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February 04, 2000

Mr. R. P. Powers
Senior Vice President
Nuclear Generation Group
American Electric Power Company
1 Cook Place
Bridgman, MI 49106

SUBJECT: D. C. COOK INSPECTION REPORT 50-315/99021(DRP); 50-316/99021(DRP)

Dear Mr. Powers:

This refers to the inspection conducted from November 19, 1999, through January 13, 2000, at the D. C. Cook Units 1 and 2 reactor facilities. The inspection was an examination of activities conducted under your license as they relate to compliance with the Commission rules and regulations and with the conditions of your license. Areas reviewed included Operations, Maintenance, Engineering, and Plant Support. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations of activities in progress. The inspectors also reviewed observations and findings as they related to the NRC Manual Chapter 0350 Case Specific Checklist for D. C. Cook. The enclosed report presents the results of that inspection.

We noted that you continued to make progress in resolving items in accordance with your Restart Plan. For example, you demonstrated a commitment to improving material condition during your recent electrical train maintenance outages. Additionally, management's willingness to stop work, including critical path work, to correct problems showed a self-critical approach to problem solving. The Performance Assurance Department's expansion of management's initial assessments added a proactive element to your understanding of the root causes and extent of condition.

We have observed that progress is being made in the completion of physical work to support plant restart. In observing your staff performing post-modification testing, we identified several weaknesses related to the evaluation of test results and test acceptance criteria. Although these weaknesses did not result in a significant safety impact, the inadequate implementation of test acceptance criteria and less than rigorous reviews of test results could lead to returning inoperable equipment to service. Your continued vigilance and focus and the thorough and rigorous implementation of post-maintenance and post-modification testing appears warranted.

Based on the results of this inspection, the NRC has determined that one violation of NRC requirements occurred involving the In-Service Testing Program. Specifically, low action limits for the Unit 2 West Essential Service Water pump were found to be set below the safety analysis minimum operability requirement. This was considered a failure to meet the requirements of 10 CFR Part 50, Appendix B, Criterion XI, "Test Control."

Template RGN-002

This violation is being treated as a Non-Cited Violation (NCV), consistent with Section VII.B.1.a of the Enforcement Policy. This NCV is described in the subject inspection report. If you contest the violation or severity level of this NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001, with copies to the Regional Administrator, Region III; and the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response, if you choose to provide one, will be placed in the NRC Public Document Room.

Sincerely,

John A. Grobe, Director
Division of Reactor Safety

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

Enclosure: Inspection Report 50-315/99021(DRP);
50-316/99021(DRP)

cc w/encl: A. C. Bakken III, Site Vice President
J. Pollack, Plant Manager
M. Rencheck, Vice President, Nuclear Engineering
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

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos:	50-315; 50-316
License Nos:	DPR-58; DPR-74
Report No:	50-315/99021(DRP); 50-316/99021(DRP)
Licensee:	American Electric Power Company 1 Cook Place Bridgman, MI 49106
Facility:	D. C. Cook Nuclear Generating Plant
Location:	1 Cook Place Bridgman, MI 49106
Dates:	November 19, 1999, through January 13, 2000
Inspectors:	B. L. Bartlett, Senior Resident Inspector K. A. Coyne, Resident Inspector J. D. Maynen, Resident Inspector
Approved by:	A. Vegel, Chief Reactor Projects Branch 6 Division of Reactor Projects

EXECUTIVE SUMMARY

D. C. Cook Units 1 and 2
NRC Inspection Report 50-315/99021(DRP); 50-316/99021(DRP)

This inspection included aspects of licensee operations, maintenance, engineering, and plant support. The report covers a 6-week period of resident inspection activities and includes follow-up to issues identified during previous inspection reports.

Operations

- Operators responded promptly and effectively to a partial loss of offsite power on Unit 1. Operators used their knowledge of the low heat load in the spent fuel pool, and did not start the Unit 2 spent fuel pool cooling pump until they verified that Unit 2 was not affected by the loss of power. Operators continually monitored spent fuel pool temperature during the short time that the spent fuel pool cooling system was not operating. (Section O1.2)

- The inspectors identified an error in the Outage Risk Assessment and Management logic model associated with the electrical power supply to the spent fuel pool cooling system. It was possible to calculate an acceptable risk condition with no emergency diesel generators available to support spent fuel pool cooling. Also, the licensee identified a failure to perform an Outage Risk Assessment and Management evaluation of a scheduled work activity affecting offsite power availability. Because spent fuel pool cooling requirements were met during this period, these deficiencies did not result in a significant risk impact. The licensee had implemented adequate interim compensatory measures pending long term resolution of these identified deficiencies. (Section O1.3)

Maintenance

- On December 16, 1999, a maintenance error in the switchyard by the St. Joseph Division of American Electric Power resulted in the partial loss of off-site power to Unit 1. The St. Joseph Division personnel were non-nuclear trained American Electric Power employees who were responsible for performing maintenance in the switchyard. Although the St. Joseph Division personnel were not technically contractors, the problems associated with this event were similar to previous contractor control problems. A recent NRC inspection determined that the licensee made satisfactory improvements to the contractor control program. The licensee incorporated St. Joseph Division personnel into the contractor control program. (Section M1.2)

- The inspectors identified a weakness in the licensee's process for testing molded case circuit breakers. Specifically, the applicable test procedure did not require initial overcurrent test failures to be evaluated prior to performing a second test 20 minutes later. The inspectors did not identify any actual failures of the first test which would have affected the operability of specific in-service breakers. (Section M2.1)

- The licensee effectively implemented immediate corrective actions for performance problems. In addition, the use of the stop work orders demonstrated the licensee's willingness to stop work on critical path activities to ensure that problems are corrected prior to resuming work. (Section M7.1)

- The licensee's actions to issue a stop work order and quarantine the motor-operated valve refurbishment trailer after they discovered that safety grade fastener may have been improperly stored was appropriate. The licensee's Performance Assurance department expanded the scope of the investigation and identified fastener storage problems with other onsite work groups. The widened investigation by the Performance Assurance department was appropriate and thorough. The failure to properly control safety grade fasteners did not affect the safety function of any equipment. (Section M7.2)

Engineering

- The licensee determined that the failures of several new emergency diesel generator high pressure fuel oil injection lines were due to manufacturing defects. Due to the difficulty in performing non-destructive testing of the lines, the licensee developed an alternate testing method to verify that any installed lines did not have any manufacturing defects which would lead to premature failure. The licensee conservatively declared three emergency diesel generators inoperable until susceptible lines could be verified operable using the alternate testing method. The licensee's efforts to resolve the high pressure fuel injection line leak issues were aggressive and thorough. (Section E1.1)

- The inspectors identified that the 2W Essential Service Water Pump In-Service Testing low action limit was set such that the pump could have degraded to a performance level below the required operability limit. Further, the In-Service Testing action limits established for the 1E and 2W Essential Service Water Pumps when both pumps were last required to be operable were inconsistent with the safety analysis. This constituted a failure to meet the requirements of 10 CFR Part 50, Appendix B, Criterion XI, and was identified as a non-cited violation. Also, the licensee did not consider the impact of instrument uncertainty when establishing In-Service Testing low action limits. This may have allowed pumps with operability limits more restrictive than the code allowable degradation to degrade to a level such that safety analysis requirements would not be met. (Section E2.1)

- Technical Specification 3.7.4.1 requirements may not reflect design basis assumptions concerning the operability of the opposite unit's essential service water pumps. Specifically, essential service water pumps in both units may be required to support essential service water system operability. This issue was identified as an Unresolved Item. (Section E2.1)

Report Details

Summary of Plant Status

Both Units remained defueled throughout the inspection period. The licensee began physical work in support of the Unit 1 steam generator replacement project, including installation of temporary rigging equipment and removal of portions of the steam generator enclosures. The licensee continued loading ice into the Unit 2 ice condenser and had loaded approximately half of the 1944 ice baskets by the end of the inspection period.

I. Operations

O1 Conduct of Operations

O1.1 General Comments

The inspectors conducted frequent observations of control room activities and equipment operation during the extended outage of both reactor units. Overall, plant operations were performed using approved operating procedures and reflected good operating practices. Noteworthy observations and findings are detailed in the report sections which follow. The inspectors were onsite monitoring plant activities during the Year 2000 rollover. No significant problems or abnormalities were observed.

O1.2 Partial Loss of Offsite Power Due to Maintenance Error

a. Inspection Scope (71707, C.3.1.a)

The inspectors reviewed the licensee's response to a loss of Unit 1 Train A Electrical Busses and spent fuel pool cooling. The maintenance aspects of this event are discussed in more detail in Section M1.2 of this report.

b.1 Observations and Findings

On December 16, 1999, workers performing corrective maintenance on the Unit 2 "A" Train reserve feed transformer (2-TR201CD), inadvertently caused an actuation of the sudden pressure relay. The sudden pressure relay provided protection for the transformer in case of a rapid pressure rise inside the transformer casing. The actuation of the 2-TR201CD sudden pressure relay resulted in the tripping of the high voltage supply breaker. The high voltage supply breaker also supplied the Unit 1 "A" Train reserve feed transformer. Unit 1 was being supplied by the reserve feed transformer; therefore, Unit 1 lost off-site power to the "A" Train electrical busses. Unit 2 was being supplied by backfeed through the main transformer; therefore, Unit 2 was not affected by the maintenance error. The loss of off-site power resulted in the loss of spent fuel pool cooling for 38 minutes.

The loss of power resulted in the automatic start of the Unit 1 CD emergency diesel generator (D/G) and load shedding of nonsafety-related Unit 1 "A" Train electrical loads

and the operating spent fuel pool cooling pump. The operating crew responded to the event using the appropriate abnormal operating procedure, 01-Operations Head Procedure (OHP) 4022.001.005, "Loss of Offsite Power With the Reactor Shutdown."

The licensee established a rapid event response team to determine the cause of the event. The team concluded that the cause was a maintenance error by American Electric Power personnel not normally assigned to D.C. Cook. The inspectors concluded that the licensee had responded promptly and effectively to the event. Additionally, the use of a rapid event response team to determine the cause of the event demonstrated the licensee's commitment to achieving improved operator performance.

The inspectors reviewed the operating logs and interviewed operations personnel about the response to the event. The inspectors had the following observations:

- The operating crew response was appropriate to the event and demonstrated a knowledge of the plant conditions.

- One Unit 1 breaker, 1-11D3 (a feeder to a nonsafety-related containment lighting transformer), failed to load shed on the loss of voltage. The failure of this breaker to trip did not significantly affect the 1 CD D/G due to low loading on the D/G. The 1-11D3 breaker spuriously tripped about four hours after the loss of voltage. The licensee wrote Condition Report 99-29272 to document the 1-11D3 breaker failure.

- The shift manager dispatched the fire brigade after the control room received a smoke detector alarm and report of smoke in the auxiliary building. The fire brigade did not detect any fires; the alarm and smoke were due to the D/G exhaust being drawn into the auxiliary building ventilation system.

- The plant lost spent fuel pool cooling for a period of 38 minutes. Cooling was restored when the operators started the Unit 2 spent fuel pool cooling pump. There was no measurable temperature rise in the spent fuel pool, which remained at 85°F. The licensee had previously calculated a spent fuel time to boil of 40 hours from 90°F.

The Unit Supervisor stated that the operating crew knew that no spent fuel pool cooling pumps were running; however, the operating crew was also aware of the low heat load in the spent fuel pool. The Unit Supervisor stated that the operating crew monitored spent fuel pool temperature while they determined that only Unit 1 was affected by the loss of off-site power. Once the operating crew had verified that Unit 2 was not affected, the Unit 2 spent fuel pool cooling pump was started and spent fuel pool cooling was restored. Off-site power was restored approximately four hours after the event, and the Unit 1 CD D/G was shut down and aligned for standby operation.

c. Conclusions

Operators responded promptly and effectively to a partial loss of offsite power on Unit 1. Operators used their knowledge of the low heat load in the spent fuel pool, and did not start the Unit 2 spent fuel pool cooling pump until they verified that Unit 2 was not affected by the loss of power. Operators continually monitored spent fuel pool temperature during the short time that the spent fuel pool cooling system was not operating.

O1.3 Problems Implementing Revised Shutdown Risk Assessment Program

a. Inspection Scope (71707, 62707)

On November 30, 1999, the licensee issued Revision 3 to PMP-4100.SDR.001, "Plant Shutdown Safety and Risk Management." This revision incorporated the use of the Outage Risk Assessment and Management (ORAM) computer program for shutdown risk management. The inspectors reviewed the implementation of the Outage Risk Assessment and Management (ORAM) system. The inspectors also reviewed ORAM logic models related to spent fuel pool cooling and electrical power safety functions.

b. Observations and Findings

The ORAM computer program used component number identifiers obtained from the work scheduling system to evaluate the shutdown risk profile. This included use of logic models to integrate component and system status to determine plant risk for eight-key safety functions, including spent fuel pool cooling and electric power availability. The ORAM program provided a more detailed and comprehensive evaluation of risk compared to the previous shutdown risk program. The revision to PMP-4100.SDR.001 also defined a new shutdown condition for the defueled condition with low spent fuel pool heat load (i.e., shutdown for greater than 1 year). The addition of this shutdown condition allowed greater operational flexibility in the defueled mode.

The inspectors identified an error in the ORAM logic model and followed up on a licensee identified problem regarding the interface between the work scheduling system and the ORAM program. These findings are discussed below:

- The detailed logic model descriptions for the ORAM computer model were contained in the "ORAM Desktop Guide." Using the Desktop Guide descriptions, the inspectors evaluated the impact of the loss of the D/Gs on the spent fuel pool cooling safety function. Section 2.6 of the ORAM Desktop Guide stated that the minimum level of defense requirements for spent fuel pool cooling under current conditions were one spent fuel pool cooling train supported by one D/G and one off-site power source.

  The inspectors noted that the associated power source safety function logic tree was inconsistent with the minimum level of defense requirements. Specifically, the electric power availability logic model may not have evaluated the number of available of D/Gs if a single offsite power supply was supporting the spent fuel cooling trains. Thus, it was possible for ORAM to calculate an acceptable risk

the minimum level of defense requirements. The licensee initiated CR 99-28422 to document and evaluate this condition. Because the spent fuel pool cooling and emergency power source safety functions satisfied the minimum level of defense requirements during this period, there was no actual risk impact associated with this logic error.

- On January 5, 2000, the licensee removed the "B" Train 4 kV electric busses and the 69 kV Emergency Power (EP) power source from service to support planned maintenance. Although, the maintenance was scheduled in the licensee's work scheduling program, the component number listed on the associated job order and clearance activities did not match a component number specifically modeled within the ORAM program. Consequently, the maintenance was not included in the ORAM input data file and the risk impact of the work activity was not initially evaluated with ORAM.

  Prior to removal of the 4 kV busses from service, the shift technical advisor (STA) manually evaluated the risk impact, and initiated CR 00-00201 to document the failure of ORAM to recognize the work activity. Because the STA was not aware of the planned loss of the EP power source during the maintenance, the risk associated by loss of EP was not evaluated. The next day, an STA identified the failure to perform a risk evaluation for the loss of the EP power source and initiated CR 00-00231. The actual risk associated with the loss of the 4 kV busses and the EP power source was later evaluated by the licensee and found to be insignificant. During the inspectors' followup to this event, the STAs and scheduling personnel informed the inspectors that only one component identifier can be associated with a clearance or job order activity. Therefore, the full risk impact of activities that affect multiple components, such as clearances, might not have been automatically evaluated by the ORAM program.

As an interim compensatory measure for these identified deficiencies, operations management stated that an outage technical advisor (OTA) would perform an additional risk evaluation prior to removal of any required safety system from service. An OTA was an individual qualified as an STA or who has held a senior reactor operators license. The licensee was evaluating additional corrective actions for the shutdown risk program as part of the resolution of the associated condition reports.

c. Conclusions

The inspectors identified an error in the Outage Risk Assessment and Management logic model associated with the electrical power supply to spent fuel pool cooling. It was possible to calculate an acceptable risk condition with no emergency diesel generators available to support spent fuel pool cooling. Also, the licensee identified a failure to perform an Outage Risk Assessment and Management evaluation of a scheduled work activity affecting offsite power availability. Because spent fuel pool cooling requirements were met during this period, these deficiencies did not result in a significant risk impact. The licensee had implemented adequate interim compensatory measures pending long term resolution of these identified deficiencies.

II. Maintenance

M1 Conduct of Maintenance

M1.1 General Comments

a. Inspection Scope (62707)

The inspectors observed all or portions of the following maintenance activities and reviewed associated documentation:

- 01-OHP 4030.STP.027AB, "AB Diesel Generator Operability Test (Train B)," Revision 14
- 12-OHP 4030,STP.039, "Security Diesel Generator Operability Test," Revision 0
- Job Order (JO) C45952, Unit 2 ice basket filling and loading
- JO C49136, Recirculation sump inspection
- JO C52753, Check and correct source of security diesel fuel oil transfer pump cavitation
- JO C87362, Perform insulation testing on Unit 2 reserve feed transformer
- JO R96272, Perform tank inspection on Unit 2 component cooling water surge tank

b. Observations and Findings

The inspectors concluded that the observed work was performed in accordance with procedures, the current revision of the appropriate procedures were in use at the work sites, and proper work safety and radiological protection practices were noted. Work items were appropriately scheduled in the plan of the day.

M1.2 Improper Work Control Practices by Non-Nuclear AEP Employees

a. Inspection Scope (62707, C.4.b)

On December 16, 1999, workers performing corrective maintenance on the Unit 2 Train A reserve feed transformer (2-TR201CD), inadvertently caused a partial loss of off-site power. The inspectors interviewed members of the rapid event response team and reviewed the team's report findings. The inspectors also assessed the event as it related to NRC Restart Action Plan 0350 Item C.4.b, "Operability of Required Secondary and Support Systems." The operations aspects of this event are discussed in more detail in Section O1.2 above.

b.1 Observations and Findings

During the week of December 10, 1999, routine insulation testing was being performed by St. Joseph Division personnel on the Unit 2 "A" Train reserve feed transformer (2-TR201CD) under Job Order R87362. The St. Joseph Division personnel were non-nuclear trained American Electric Power (AEP) employees who were responsible for performing maintenance in the switchyard. Because the St. Joseph Division were AEP employees who did similar switchyard work at non-nuclear facilities, the licensee did not provide direct oversight to the work group.

During the testing, the St. Joseph Division personnel identified a damaged bushing, and the licensee expanded the scope of Job Order (JO) R87362 to add the repair. Two separate repair activities were added to JO R87362 to be performed by different work groups. However, these two activities needed to be coordinated to ensure that the sudden pressure relay was defeated prior to repairing the transformer. On December 16, 1999, only one of the two activities, repairing the transformer, was scheduled. The St. Joseph Division personnel erroneously believed that the sudden pressure relay was defeated, and began repairing the transformer. During the addition of nitrogen to the transformer, the sudden pressure relay actuated, causing the loss of "A" Train reserve feed to both units.

The licensee wrote CR 99-29277 to document the event and established a rapid event response team to investigate the event. The licensee's rapid event response team found that:

- The transformer repair work was not adequately coordinated between licensee personnel and the St. Joseph Division personnel, the maintenance was being performed without direct licensee oversight and the St. Joseph Division personnel had not been trained on the licensee's work control process.

- The corrective maintenance was added to a routine JO instead of creating a corrective maintenance JO. Therefore, the licensee did not recognize that the activity to defeat the sudden pressure relay was on hold and never scheduled.

- There was no formal maintenance procedure for performing maintenance on the transformer. The maintenance was being performed using instructions provided in JO R87362.

Following the event, the maintenance department issued a Shop Work Order (SWO) (CR 99-29312) for all activities which may impact essential off-site power supplies. The SWO required direct licensee oversight of work by the St. Joseph Division during all work activities which could impact off-site power.

The inspectors noted that this event was similar to other recent contractor control issues. The inspectors discussed this observation with senior licensee management who agreed that, although the St. Joseph Division personnel are not technically contractors, the role of the St. Joseph Division is similar to that of contract maintenance personnel. The licensee planned to implement the existing contractor control processes to work performed by the St. Joseph Division. (A recent NRC inspection determined

that the licensee made satisfactory improvements to the contractor control program.) The inspectors agreed that the licensee's action was adequate for preventing similar maintenance errors.

b.2 Review of Switchyard Maintenance Error for Restart

The inspectors assessed this event as it related to NRC Restart Action Plan 0350 Item C.4.b, "Operability of Required Secondary and Support Systems." The "A" Train reserve feed transformer provides one source of off-site power to both units' spent fuel pool cooling pumps. The inspectors concluded that the licensee's testing of the switchyard components to verify equipment performance and identify problems was being appropriately used to verify the operability of required support systems.

c. Conclusions

On December 16, 1999, a maintenance error in the switchyard by the St. Joseph Division of American Electric Power resulted in the partial loss of off-site power to Unit 1. The St. Joseph Division personnel were non-nuclear trained American Electric Power employees who were responsible for performing maintenance in the switchyard. Although the St. Joseph Division personnel were not technically contractors, the problems associated with this event were similar to previous contractor control problems. A recent NRC inspection determined that the licensee made satisfactory improvements to the contractor control program. The licensee incorporated St. Joseph Division personnel into the contractor control program.

The inspectors assessed this event as it related to NRC Restart Action Plan 0350 Item C.4.b, "Operability of Required Secondary and Support Systems." The inspectors concluded that the licensee's testing of the switchyard components to verify equipment performance and identify problems was appropriate to verify the operability of required support systems.

M2 Maintenance Procedures and Documentation

M2.1 (Closed) Inspection Followup Item 50-315/316/99020-03 (DRP): molded case circuit breaker testing.

a. Inspection Scope (62707, C.4.f)

On November 8, 1999, the inspectors observed portions of JO R84549, Clean and Inspect Motor Control Center 2-EZC-BS. Part of the JO required the licensee to test the molded case circuit breakers (MCCBs). The inspectors questioned the MCCB testing procedure methodology for performing 300 percent overcurrent tests on MCCBs. An inspection followup item was opened pending the inspectors' review. The inspectors also assessed the event as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved."

b.1 Observations and Findings

The licensee's procedure for performing overcurrent tests on MCCBs, 12 IHP 5030.EMP.006, "MCCB/TOLR [Thermal Overload Relay] Testing and Electrical Enclosure Maintenance," allowed a MCCB to remain in service following a failed test provided it passed a retest 20 minutes later. However, the procedure did not require the initial test failure to be evaluated. The inspectors reviewed documentation from previous MCCB tests and found one example, a test on a spare MCCB, where the MCCB failed the first test, but passed the second test. The inspectors did not identify any instances of an in-service breaker which failed an initial overcurrent test but remained in service after it passed a second test.

10 CFR Part 50, Appendix B, Criterion XI, required, in part, that test results be documented and evaluated to assure that test requirements have been satisfied. The licensee's procedure, 12 IHP 5030.EMP.006, "MCCB/TOLR Testing and Electrical Enclosure Maintenance," was inconsistent with Criterion XI in that after comparing the test results with the acceptance criteria, Step 7.2.6 of the test procedure stated that if the test results were not satisfactory, then the MCCB could be retested 20 minutes later without evaluating the initial test failure. The procedure directed the MCCB to be removed from service only if it failed the second test. However, all of the MCCBs in service in the plant had passed their initial overcurrent tests; therefore, the inspectors concluded that the licensee had complied with 10 CFR Part 50, Appendix B, Criterion XI, in this case because there were no initial test failures which needed to be evaluated.

The inspectors discussed these observations with members of the licensee's engineering department. The licensee wrote Condition Report 99-27129 to document the inspectors' questions, and placed the MCCB test procedure on hold pending a revision to remove the allowance for a retest without evaluating an initial test failure.

b.2 Review of MCCB Testing for Restart

The inspectors assessed this event as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved." The inspectors noted that the MCCB testing was being done as part of a larger licensee project to clean and inspect all of the motor control centers. The motor control center cleaning project was being conducted to identify and correct longstanding material condition issues in the plant's electrical distribution systems.

c. Conclusions

The inspectors identified a weakness in the licensee's process for testing molded case circuit breakers. Specifically, the applicable test procedure did not require initial overcurrent test failures to be evaluated prior to performing a second test 20 minutes later. The inspectors did not identify any actual failures of the first test which would have possibly affected the operability of specific in-service breakers.

The inspectors assessed this event as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved." The inspectors noted that the molded case circuit breaker testing was being done as part of a larger licensee project

to clean and inspect all of the motor control centers. The inspectors concluded that the motor control center cleaning project demonstrated the licensee's commitment to resolving significant hardware issues with the electrical distribution systems in the plant.

M7 Quality Assurance in Maintenance Activities

M7.1 Licensee Stop Work Orders

a. Inspection Scope (62707, C.3.1.a, C.4.f)

During this inspection period, several stop work orders (SWOs) were issued to various work groups in order to correct performance issues. The inspectors assessed the licensee's actions regarding the stop work orders. Additionally, the inspectors evaluated the individual SWOs as they related to NRC Restart Action Plan 0350 Item C.3.1.a, "Demonstrated Commitment to Achieving Improved Performance Through the Results of the Programmatic Readiness Assessment," and NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved."

b.1 Observations and Findings

During this inspection period, the following SWOs were issued:

- On December 2, 1999, the Operations department issued a SWO on critical path ice condenser loading activities after problems were identified with foreign material control and ice chemistry. The SWO was documented in CR 99-28313.

- On December 17, 1999, the Maintenance department issued a SWO for all work activities which may impact essential off-site power supplied to the plant after a maintenance error resulted in a partial loss of off-site power. This issue is discussed in additional detail in Sections O1.2 and M1.2 of this report. The SWO was documented in CR 99-29312.

- On December 18, 1999, the Engineering department issued a SWO on critical path motor operated valve (MOV) refurbishments after deficiencies in the control of safety grade material were identified. This issue is discussed in additional detail below. The SWO was documented in CR 99-29471.

- On January 11, 2000, the Maintenance department issued a SWO on the questionable use of parts from plant equipment. The SWO was documented in CR 00-0673.

The inspectors determined that the licensee was appropriately using SWOs to implement corrective actions. Each SWO required a specific action plan to be completed in order to lift the SWO and allow work to resume. In addition, the inspectors noted that the licensee demonstrated a willingness to stop critical path work in order to address problems. The SWO on MOV refurbishments was particularly noteworthy in that the licensee's Performance Assurance (PA) department expanded the scope of the investigation to include other work groups.

b.2 Review of Stop Work Orders for Restart

The inspectors assessed the use of SWOs as they related to NRC Restart Action Plan 0350 Item C.3.1.a, "Demonstrated Commitment to Achieving Improved Performance Through the Results of the Programmatic Readiness Assessment." The inspectors noted that both the licensee's willingness to stop critical path work with a SWO and the establishment of action plans to lift each SWO demonstrated a commitment to improving work performance.

The inspectors also assessed the MOV refurbishment project as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved." The inspectors noted that the MOV refurbishment project was part of a larger project intended to correct deficiencies in the maintenance and material condition of MOVs. The MOV project demonstrated the licensee's commitment to resolving longstanding hardware issues.

c. Conclusions

The licensee effectively implemented immediate corrective actions for performance problems. In addition, the use of the stop work orders demonstrated the licensee's willingness to stop work on critical path activities to ensure that the problems are corrected prior to resuming work.

The inspectors assessed the use of SWOs as they related to NRC Restart Action Plan 0350 Item C.3.1.a, "Demonstrated Commitment to Achieving Improved Performance Through the Results of the Programmatic Readiness Assessment." The inspectors noted that both the licensee's willingness to stop critical path work with a SWO and the establishment of action plans to lift each SWO demonstrated a commitment to improving work performance.

The inspectors assessed the MOV refurbishment project as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved." The inspectors noted that the MOV refurbishment project was part of a larger project intended to correct deficiencies in the maintenance and material condition of MOVs. The MOV project demonstrated the licensee's commitment to resolving longstanding hardware issues.

M7.2 Performance Assurance Involvement in MOV Refurbishment Stop Work Order

a. Inspection Scope (62707)

On December 18, 1999, the Engineering department issued a SWO on critical path MOV refurbishments after deficiencies in the control of safety grade material were identified. The licensee's Performance Assurance (PA) department investigated the circumstances surrounding the issuance of the SWO. The inspectors followed up on the stop work order and the PA investigation.

b. Observations and Findings

On December 18, 1999, the licensee's maintenance department quarantined the MOV refurbishment trailer after they discovered that safety grade fasteners may have been improperly stored. The trailer had been used by a contractor work group for refurbishing MOV actuators. The licensee evaluated the use of the safety grade fasteners in the MOVs and determined that only safety grade fasteners were installed in safety-related MOVs. However, the licensee could not determine which specific safety grade fasteners were installed in which specific MOVs.

The licensee later determined that the non-traceable fasteners did not result in a loss of any MOV functionality. The licensee amended the work packages to include an engineering evaluation of the installed fasteners. In December 1999, the SWO was incrementally lifted after the action plan to train the MOV workers in the proper control of safety grade parts was completed.

After the original SWO was issued to the MOV refurbishment group, the licensee's PA organization widened the root cause investigation to include other on-site organizations. The PA department identified safety grade material control deficiencies with the air-operated valve project team and the licensee's instrumentation and controls shop. However, similar to the MOV findings discussed above, the licensee determined that the improperly controlled safety grade parts did not affect the safety function of any equipment. These groups were also trained on the procedural requirements for safety grade parts control. The inspectors noted that the licensee's PA department had appropriately expanded the inspection scope in order to identify and correct a wider problem than the safety grade fasteners storage problem in the MOV refurbishment trailer.

c. Conclusions

The licensee's actions to issue a stop work order and quarantine the motor-operated valve refurbishment trailer after they discovered that safety grade fasteners may have been improperly stored was appropriate. The licensee's Performance Assurance department expanded the scope of the investigation and identified other on-site work groups with similar problems. The widened investigation by the Performance Assurance department was appropriate and thorough. The failure to properly control safety grade fasteners did not affect the safety function of any equipment.

III. Engineering

E1 Conduct of Engineering

E1.1 High Pressure Fuel Injection Line Failures on Emergency Diesel Generators

a. Inspection Scope (37551, C.4.f)

In November 1999, the Unit 2 AB D/G experienced a number of high pressure fuel injection line failures. The inspectors followed up on the licensee's response to the fuel line failures. The inspectors also assessed the failures as they related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved."

b.1 Observations and Findings

In mid-1997, the licensee replaced the Unit 2 AB D/G carbon steel high pressure fuel oil injection lines with stainless steel lines due to concerns about line failures. The stainless steel lines had a larger inner diameter than the original carbon steel lines, but the D/G drawings indicated that the larger diameter lines were acceptable. The line replacement decreased the engine performance and increased the fuel oil consumption. The high pressure fuel injection line changes were discussed in a previous NRC Inspection Report 50-315/316/97024.

In order to reduce fuel oil consumption and restore engine performance, the licensee decided to restore the fuel injection system to the original configuration. On November 1, 1999, the licensee replaced the stainless steel lines with new carbon steel lines of the original inner diameter as part of a scheduled maintenance overhaul of the Unit 2 AB D/G. Several attempted post-maintenance tests of the Unit 2 AB D/G were stopped after the new high pressure fuel injection lines developed through wall leaks. After each attempted test, the failed line was replaced with another new carbon steel line. The licensee analyzed the leak failures and determined that the through-wall leaks were caused by fatigue failures which propagated from existing flaws on the inner bore surface. The licensee also determined that the flaws on the new lines were most likely due to manufacturing defects.

The nature of the carbon steel line manufacturing process increased the likelihood of flaws to appear on the inner bore surface. The licensee developed an alternate testing method due to the difficulty in performing non-destructive testing of the lines. The licensee performed the alternate testing method to verify that any installed lines did not have any manufacturing defects which would lead to premature failure.

After reviewing the high pressure fuel injection line failure analysis, the licensee determined that any manufacturing flaws would result in a through-wall leak within 1 million cycles (approximately 65 hours of run time). The licensee evaluated the other D/G fuel lines and found that two of the three D/Gs each had a replacement high pressure fuel injection line with less than 65 hours of run time. Based on this

information, the operators declared the Unit 2 D/Gs and the Unit 1 AB D/G inoperable until all of the high pressure fuel injection lines could accumulate at least 65 hours of run time.

Originally, the licensee intended to run the three affected D/Gs for 72 hours to ensure that all of the high pressure fuel injection lines had greater than 65 hours of run time. However, senior licensee management determined that the safety-related D/Gs should not be run simply to accumulate run time on the fuel lines. The licensee contracted with an off-site testing facility to replicate the high pressure fuel injection line service conditions and run each of the new lines for 72 hours. Once each D/G's susceptible lines had been tested satisfactorily and re-installed, the D/Gs were declared operable.

b.2 Review of High Pressure Fuel Injection Line Failures for Restart

The inspectors assessed this event as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved." The inspectors noted that the licensee's efforts to identify and correct the cause of the D/G high pressure fuel injection lines were thorough. Because the manufacturing defects cannot be easily identified through non-destructive testing methods, the licensee developed a test methodology to identify defective lines and replace them.

c. Conclusions

The licensee determined that the failures of several new emergency diesel generator high pressure fuel oil injection lines were due to manufacturing defects. Due to the difficulty in performing non-destructive testing of the lines, the licensee developed an alternate testing method to verify that any installed lines did not have any manufacturing defects which would lead to premature failure. The licensee conservatively declared three emergency diesel generators inoperable until susceptible lines could be verified operable using the alternate testing method. The inspectors concluded that the licensee's efforts to resolve the high pressure fuel injection line leak issues were aggressive and thorough.

The inspectors assessed this event as it related to NRC Restart Action Plan 0350 Item C.4.f, "Significant Hardware Issues Resolved." The inspectors concluded that the resolution of the D/G high pressure fuel injection line demonstrated the licensee's commitment to resolving significant hardware issues with the emergency electrical distribution systems in the plant.

E2.1 Review of Post Modification Testing of Essential Service Water Pump

a. Inspection Scope (61726, 37551, C.4.a, C.4.e)

In November 1999, the inspectors observed the post modification testing (PMT) of the 2 West (2W) ESW pump following completion of DCP-666, "Replace Pump Bowl (Casing) Assembly." The PMT was conducted in accordance with Procedure 2-Engineering Head Procedure (EHP) SP.DCP.666, "Essential Service Water Pump Performance Test." The test acceptance criteria used pump performance curves obtained from engineering Procedure 12-EHP 5070 ISI.017R, "Section XI

Centrifugal Pump Performance Verification," which was also used in the licensee's In-Service Testing (IST) program for safety-related centrifugal pumps. Because the licensee confirmed ESW pump operability through periodic IST, the inspectors also reviewed the basis for the quarterly IST acceptance criteria. Additionally, the inspectors reviewed Technical Specification (TS) 3.7.4.1, "Essential Service Water System," for consistency with design basis calculations.

The inspectors assessed the observations and findings developed during this review as they related to the Manual Chapter 0350, Guidelines for Restart Approval, Item C.4.a, "Operability of TS Systems" and Item C.4.e, "Adequacy of Surveillance Tests/Test Program."

b. Observations and Findings

The inspectors reviewed various aspects of the IST program associated with the ESW pumps. This review included pump minimum operability requirements, treatment of instrument uncertainty, surveillance procedure adequacy, design basis assumptions, and TS requirements. Significant observations and findings related to this review are detailed below.

b.1. IST Pump Action Limit Set Below Minimum Operability Limit

The inspectors compared ESW pump acceptance criteria to the associated safety analysis to verify that periodic pump testing ensured that operability assumptions were met. Technical Specification 4.0.5.a requires, in part, that In-Service Testing of American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps be done in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda. For the third 10-year interval, the licensee committed to perform In-Service Testing in accordance with Part 6 of OMa-1988, "In-Service Testing of Pumps in Light-Water Reactor Power Plants." Procedure 1[2]-OHP 4030.STP.022E[W], "Essential Service Water System Test," was used demonstrate the operability of the ESW system.

Calculation NEMP940921AF, "CCW Hx [heat exchanger] Flow Multiplier," Revision 1, established the minimum design basis operability limit for the ESW pumps. Based on this calculation, the minimum operability for the 1 East (1E) and 2 West (2W) ESW pumps at their specified IST reference flows were 69.5 and 61.8 pounds-force per square inch differential (psid), respectively. The low action limit for 2W ESW pump was established at 60.7 psid, or 1.1 psid below the minimum operability limit. Therefore, the 2W ESW pump low action limit could have allowed the pump to degrade to a performance level below the minimum operability limit required by the ESW system safety analysis. At the time of the inspection, both units were in a defueled condition and ESW pump TS operability was not required. However, the ESW pumps provided support for spent fuel pool cooling. Based on a review of recent surveillance data, the inspectors determined that all ESW pumps were performing at a level above the minimum operability limit.

The ESW pumps were last required to be operable per the TSs prior to the dual unit shutdown of September 1997. The inspectors reviewed surveillance data obtained prior

to the shutdown to determine if appropriate low action IST limits had been established at that time. The inspectors identified the following examples of non-conservative low action limits:

- The low action limit acceptance criteria for the July 18, 1997, performance of 01 OHP 4030.STP.022E for the 1E ESW pump was 69.2 psid. The minimum operability limit at the associated reference flowrate was 69.5 psid.

- The low action limit acceptance criteria for the August 19, 1997, performance of 02 OHP 4030.STP.022W for the 2W ESW pump was 69.1 psid. The minimum operability limit at the 2W ESW pump IST reference flow was 69.5 psid. The reference flow for the 2W pump was later increased and the low action limit was lowered to 60.7 psid following a pump rebuild.

10 CFR Part 50, Appendix B, Criterion XI, "Test Control," requires, in part, that a test program be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. Contrary to Criterion XI, the acceptance limits established for the 1E ESW pump in 01 OHP 4030.STP.022E and the 2W ESW pump in 02 OHP 4030.STP.022W did not incorporate the operability limits of the associated design calculation. This Severity Level IV violation is being treated as a Non-Cited Violation (NCV), consistent with Appendix C of the NRC Enforcement Policy. This violation is in the licensee's corrective action program as CR 99-21087 and CR 99-29349 (NCV 50-315/316/99021-01).

The licensee had previously identified the failure to appropriately set the low action limit for the 1E ESW pump in CR 99-01635 on January 27, 1999. However, this CR identified that only the 1E ESW had a low action limit set below the minimum operability requirement. Prior to the initiation of this CR, the reference flow and low action limit for the 2W pump had been revised. The condition evaluation for this CR failed to identify that the revised low action limit for the 2W ESW pump was also established below the minimum operability limit. The corrective action for this CR included a revision to the Unit 1 technical data book to increase the 1E ESW pump low action limit to 70.0 psid.

As discussed in Section E2.1.b.4, the licensee initiated CR 99-21087 to identify that there was no programmatic method to compare minimum pump operability limits to IST testing acceptance criteria. Although CR 99-21087 did not identify any specific cases where a pump low action limit was set below the minimum operability limit, it did document that there was a potential to allow a pump to degrade to a level allowed by the ASME code but below the minimum operability limit in the associated system safety analysis. The corrective actions for the CR included evaluation of every pump tested in the IST program to determine if design requirements were satisfied. During discussions with the inspectors, members of licensee engineering management stated that the failure to appropriately establish the IST low action limit for the 2W ESW pump would have been identified during this review.

The requirement to establish action limits consistent with design requirements has been promulgated by the NRC in a number of publications available to the licensee.

Discussions of the application of minimum pump operability limits to the IST program were contained in the following documents:

- NUREG-1482, published in April 1995, provided guidelines and recommendations for developing and implementing IST programs. NUREG-1482, Section 5.6, "Operability Limits of Pumps," stated that operability limits of pumps "must always meet, or be consistent with, licensing assumptions in a plant's safety analysis." Section 9.8.3.4 of the Updated Final Safety Analysis Report (UFSAR) stated that the ESW pumps are tested in accordance with ASME OM standards and NUREG-1482, "Guidelines for In-Service Testing at Nuclear Power Plants."

- On December 30, 1997, the NRC issued Information Notice 97-90, "Use of Non-Conservative Acceptance Criteria in Safety-Related Pump Surveillance Tests." This notice discussed the use of In-Service Testing acceptance criteria that might have allowed safety-related pumps to degrade below the performance assumed in the accident analysis. Specifically, the notice stated that if the minimum design performance stated in design-basis documentation is more restrictive than the ASME code acceptance criteria, then the test acceptance criteria must be adjusted to avoid actual pump performance being allowed to degrade below the minimum acceptable design performance. This Information Notice also referred to a previous violation (50-315/96013-02(DRS); 50-316/96013-02(DRS)) at D.C. Cook where the IST low action limits for the centrifugal charging pumps were established below the minimum operability limit.

Although this issue had been disseminated to the industry, the failure of the licensee to be responsive to industry information was identified by the licensee's expanded system readiness reviews and has been discussed in earlier NRC inspection reports (See NRC Inspection Reports 50-315/316/99001 and /99003). Additionally, the plant corrective action system had been judged to be inadequate and has been the focus of significant licensee attention to improve the program.

b.2 Failure to Account for Instrument Uncertainty During Operability Tests

The inspectors reviewed the ESW pump low action limits to determine if instrument uncertainties were appropriately considered. Although the adjustment of IST acceptance limits for instrument uncertainty was not required by the ASME code, periodic IST was used to verify pump operability. Therefore, the IST acceptance criteria must be set to the more restrictive of either: (1) the allowable ASME code degradation from the reference differential pressure or (2) the minimum safety analysis operability limit including consideration for test instrument uncertainty. If pump minimum operability limits were more restrictive than the allowable ASME code degradation (i.e., the pump was design limited), instrument uncertainty must have been considered to ensure that the pump actually performed above the minimum operability limit. This issue was further discussed in NUREG-1482, Section 5.10, "Adjustments for Instrument Inaccuracies."

The ESW pump surveillance procedure acceptance criteria did not account for instrument inaccuracies for design limited pumps. Because the 2W ESW pump had a

minimum operability limit more restrictive than the full code allowable degradation limit, it was a design limited pump. Therefore, the acceptance criteria for the 2W ESW pump surveillance test was required to account for instrument uncertainty to ensure minimum operability requirements were met.

Case Specific Checklist Item 3C, "Failure to Consider Instrument Uncertainties, Setpoints, and/or other Instrument Biases," will be addressed in NRC Inspection Report 50-315/316/99032. However, the application of instrument uncertainty within the licensee's IST program was outside the scope of NRC Inspection Report 50-315/316/99032. In responding to the Case Specific Checklist item, the licensee reviewed the ESW quarterly IST surveillance procedure, 01[02]-OHP 4030.STP.022E[W]. The inspector reviewed the licensee's instrument uncertainty evaluation of the ESW pump test procedure. The licensee's review was limited to ensuring that test instruments were identified for the critical parameter list and that instruments met ASME code requirements for IST. This review did not evaluate the impact of instrument uncertainty on test acceptance criteria when the minimum pump operability requirements were more limiting than the ASME code allowable degradation.

The licensee documented the failure to account for the effect of instrument uncertainty on minimum pump operability requirements in CR 99-21087 and CR 99-29349. During their initial review of the CR 99-21087, the inspectors concluded that the failure to account for instrument uncertainty in the IST program was only generally addressed. The licensee subsequently revised the corrective actions in the CR to include specific actions to add instrument uncertainty margin to pump low action limits as required.

b.3 Surveillance Test Procedure Inadequacies

During a review of completed IST surveillance procedures for the ESW pumps, the inspectors identified the inappropriate use of a test reference flow band and a minor calculation error associated with the computation of total pump head. These observations are detailed below:

- The inspectors identified that during a performance of 02-OHP 4030.STP.022W for the 2W ESW pump on August 19, 1997, the inappropriate use of the reference flow band could have potentially masked pump degradation. The surveillance test acceptance criteria was based on a reference flow of 7000 gallons per minute (gpm) and the procedure specified a flow rate band of 6900 gpm to 7100 gpm. The purpose of providing the flow band around the reference flow was to provide an allowance for expected instrument variation during the test. The operators initially performed the test at a flow rate of 7100 gpm and obtained a pump differential pressure between the IST alert level and the low action level. The operators then repeated the test at 6900 gpm and obtained an acceptable differential pressure. After the inspector identified this condition, the licensee initiated CR 99-29359 to document the inappropriate use of the test control flow band. Subsequent to this test, the 2W pump was rebuilt and the pump differential pressure was determined to be above the minimum operability limit during later inservice tests.

- The inspectors identified a minor error in the pump differential pressure calculation in Procedure 01[02]-OHP 4030.STP.022E[W]. After establishing the reference pump flow, the operators determined the ESW pump differential pressure based on pump discharge pressure and forebay level. The elevation difference between the pump discharge pressure gage and the forebay level represented additional pump head that was added to the pump discharge pressure to obtain the total pump developed head. The inspector measured the gage elevations and concluded that the gages (1-WPI-711, 1-WPI-712, 2-WPI-713, and 2-WPI-714) were located 1 foot below the elevation stated in the procedure. This elevation error introduced a non-conservativism of approximately 0.4 psid in the calculation of ESW pump differential pressure. The licensee reviewed past ESW pump data and determined that the 0.4 psid reduction in developed pump differential pressure would not have made an ESW pump inoperable. The licensee documented this condition in CR 00-00458.

  10 CFR Part 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," requires, in part, that procedures include appropriate quantitative acceptance criteria. Contrary to Criterion V, the ESW In-Service Testing Procedure, 01[02]-OHP 4030.STP.022E[W], did not provide appropriate acceptance criteria in that the calculation used to determine total pump differential pressure used an incorrect value for the elevation pump discharge pressure. Because the condition did not result in the inoperability of an ESW pump, the safety significance of the failure to provide appropriate acceptance criteria was minimal. Therefore, this failure constituted a violation of minor significance and is not subject to formal enforcement action.

b.4 Minimum Operability Limits Not Appropriately Reflected in IST Acceptance Criteria

Attachment 2 to 12-EHP 5070 ISI.017R provided a collection of head and flow performance curves for centrifugal pumps tested by the In-Service Testing program. The purpose of this procedure was to ensure that pump design limits were considered when pump reference values and acceptance criteria were changed. Step 7.3.1 of 12-EHP 5070 ISI.017R stated that pump IST low action limits must not be less than the minimum required net total head for the system as shown in Attachment 2 pump performance curves. In August 1999, the licensee identified that the minimum operability limits in Attachment 2 were not programmatically required to be updated when design assumptions changed. The licensee documented this concern in CR 99-21087.

In addition to a graphical representation of the minimum required pump total head, Attachment 2 provided a quadratic curve fitting equation for each performance curve. The inspectors noted that pump performance requirements derived from the use of the curve fitting equation did not bound design calculation assumptions or established IST action limits. During discussions with the inspectors, licensee management stated that the use of curve fitting equations for the minimum pump operability limits was inappropriate and the placement of the equations on the performance curve was misleading. On January 6, 2000, the licensee placed the 12-EHP 5070.ISI.017R, Attachment 2, performance curves on administrative hold pending validation of the

operability limits. The licensee planned to complete this evaluation as part of the corrective action for CR 99-21087.

b.5 Evaluation of the Effect of Degraded Voltage and Frequency on ESW Pump Operability

Although IST pump testing generally has been run at nominal bus voltage and frequency conditions, under accident conditions, the electrical power supply to the ESW pump motors may become degraded. For example, TS 4.8.1.1.2 for emergency diesel generator surveillance testing allowed a frequency band of 60+/- 1.2 Hz and a voltage range of 4160+/- 420 volts. Less than nominal voltage and frequency conditions for the ESW pump motor may have resulted in a reduced ESW pump speed. Therefore, the power supply to the ESW pump motors under worst case conditions could have resulted in a reduced ESW pump head and flow capability. Licensee engineering management stated that this effect was not considered when establishing operability limits for the ESW pumps. The licensee also stated that they believed that the reduction in motor speed associated with degraded voltage conditions would be a minor effect (e.g., approximately 2 - 4 RPM or less than a 1 percent degradation in total head) and would not significantly alter the ESW pump operability limit. The licensee has documented this concern in CR 99-29349 and stated they will also evaluate the effect of degraded voltage and frequency conditions during the closure of CR 99-21087.

b.6 Review of TS Operability Requirements for ESW System

During a review of the ESW system safety analysis calculation, NEMP940921AF, the inspectors noted that the ESW system was modeled with two ESW pumps supplying cooling water to a single cross connected system header. Based on this configuration, an ESW pump located in the opposite unit would be required to meet the design basis safety analysis. This configuration is consistent with Section 9.8.3.2 of the UFSAR, which stated that two ESW pumps are sufficient to supply all service water requirements for unit operation, shutdown, refueling, or post accident operation. Technical Specification 3.7.4.1.a required at least two independent ESW loops to be operable, but was not specific about what constituted an operable ESW loop. The inspectors questioned if the flowpath from the opposite unit ESW pumps was required to be operable to support ESW system operability. Although TS 3.7.4.1.b required at least one essential service water flow path from the opposite unit to be available for 10 CFR Part 50, Appendix R considerations, the requirements TS 3.7.4.1.a may not have been consistent with design basis assumptions. Based on the inspectors' questions, the licensee initiated CR 00-00641 on January 13, 2000. After additional review, the licensee identified two additional CRs related to this issue:

- CR 99-08588, initiated on April 17, 1999, which identified that UFSAR Table 9.8-6 may have had a conflict concerning the number of required ESW pumps for a design basis accident.

- CR 99-17580, initiated on July 1, 1999, which identified an industry issue related to TS requirements for a multi-unit site with a shared service water system.

Pending further review of the ESW system licensing basis and operational requirements, this issue is identified as Unresolved Item (URI) 50-315/316/99021-02 (DRP).

b.7 Review of Inspection Findings and Physical Readiness of Plant for Restart

The inspectors assessed the observations and findings developed during this review as they relate to the Manual Chapter 0350, Guidelines for Restart Approval, Item C.4.a, "Operability of TS Systems" and Item C.4.e, "Adequacy of surveillance tests/test program." Although the inspectors determined that the IST surveillance low action limit for the 2W ESW was established less conservatively than the minimum operability limit, the licensee has planned on reverifying the action limits for all inservice tested centrifugal pumps prior to restart. This review should provide reasonable assurance that IST action limits have been established consistently with minimum operability requirements. The inspectors identified a minor calculation error associated with the ESW In-Service Testing surveillance procedure and the inappropriate execution of the surveillance with regard to the use of the specified flow range. These issues have been documented in the licensee's corrective action system.

c. Conclusions

The inspectors identified that the 2W Essential Service Water Pump In-Service Testing low action limit was set such that the pump could have degraded to a performance level below the required operability limit. Further, the In-Service Testing action limits established for the 1E and 2W Essential Service Water Pumps when both pumps were last required to be operable were inconsistent with the safety analysis. This constituted a failure to meet the requirements of 10 CFR Part 50, Appendix B, Criterion XI and was identified as a non-cited violation. Also, the licensee did not consider the impact of instrument uncertainty when establishing In-Service Testing low action limits. This may have allowed pumps with operability limits more restrictive than the code allowable degradation to degrade to a level such that safety analysis requirements would not be met.

In addition, TS 3.7.4.1 requirements may not reflect design basis assumptions concerning the operability of the opposite unit's essential service water pumps. Specifically, essential service water pumps in both units may be required to support essential service water system operability. This issue was identified as an Unresolved Item.

E8 Miscellaneous Engineering Issues

E8.1 Inspectors Review of Restart Action Matrix Items

In a letter dated July 30, 1998, the NRC informed the licensee that an oversight panel had been established in accordance with NRC Manual Chapter (MC) 0350, and a checklist was enclosed which specified activities which the NRC considered necessary to be addressed prior to restart. In accordance with MC 0350, an inspection plan was developed to evaluate the effectiveness of the licensee's actions to correct the items listed on the Case Specific Checklist. In addition, the NRC Inspection Manual 0350

Panel initiated a Restart Action Matrix to document all items that needed review prior to restart.

The NRC MC 0350 oversight panel assessed the RAM items on the basis of importance, from "risk significant" to "little or no risk significance" and established criteria for inspection of the RAM items based on the relative risk. For low-risk significant items, the panel criteria required that: (1) the licensee had written a condition report to track the issue addressed by the RAM item, and (2) the licensee appropriately tracked the item as required for restart. The inspectors reviewed the following low-risk items and concluded that the licensee's actions met the requirements of the MC 0350 oversight panel restart criteria.

- (Closed) RAM Item R.2.1.11, URI 50-315/316/98009-016: Performance testing of the D/G heat exchangers was not able to detect degradation, as required by the licensee's Generic Letter (GL) 89-13 testing program. The inspectors reviewed RAM closure item R.2.1.11 in accordance with the criteria discussed earlier in this section. The original unresolved item is quoted below:

  "Heat exchanger performance trending included the EDG [Emergency Diesel Generator] jacket water, lube oil and aftercoolers. ESW outlet temperatures were recorded and trends were charted over several tests. The trends indicated that the temperature profiles were relatively constant over the testing period. However, the AE team identified that the heat exchanger outlet temperature was automatically regulated by a flow control valve. Therefore, the trending data only indicated that the flow control valves were operating correctly."

  In response to this unresolved item the licensee opened condition reports, CR 97-2339, CR 97-3523, CR 98-5574, and CR 99-7866. The licensee corrective action review board split the issue into the specific question on the D/G heat exchangers and the programmatic issue on GL 89-13 testing in general.

  During the outage the licensee opened up, inspected, and cleaned all heat exchangers on the D/Gs, including those with service water as a cooling medium. Based upon the GL option of either testing or inspecting and cleaning, the licensee decided that rather than correct the GL 89-13 problems prior to restart that inspection and cleaning would ensure heat exchanger operability for restart. The CRs for both the specific D/G heat exchanger issue and the general 89-13 issue were moved to after restart.

  The inspectors reviewed the records documenting the inspection and cleaning of the heat exchangers and verified that the D/G heat exchangers had been cleaned. The inspectors determined that the licensee took appropriate corrective actions to ensure the operability of D/G heat exchangers cooled by service water. However, the GL 89-13 programmatic issues were in the process of being corrected by the licensee. Consequently, the inspectors concluded that sufficient corrective actions had been taken to support plant restart, but future

inspections need to be conducted to verify that long term corrective actions to resolve GL 89-13 programmatic weaknesses were adequate. This RAM item will be closed. The inspector's review of the licensee's long term corrective actions to resolve GL 89-13 weaknesses will be tracked as IFI 50-315/316/99021-03.

- (Closed) RAM Item R.2.3.32, Unresolved Item 50-315/316/98009-17: Inadequate justification to return the Unit 2 250 VDC battery Train CD to an operable status. The licensee documented this item in CR 97-3520. This item is closed.

- (Closed) RAM Item R.2.4.26, Violation 50-315/316/98152-01342: Change to CCW operating procedure was not recognized as a change to the intent of the procedure. This item had previously been identified as Escalated Enforcement Item 50-315/316/98009-32. The licensee documented this item in CR 97-2340 and included it in the root cause evaluation of CR 98-5339. This item is closed.

- (Closed) RAM Item R.2.9.4, Inspection Follow-up Item 50-315/316/98007-11: Unable to identify any NRC correspondence that specifically approved the licensee position. The licensee documented this item in CR 98-06369. This item is closed.

IV. Plant Support

R1 Radiation Protection and Chemistry Controls (71750)

During normal resident inspection activities, routine observations were conducted in the area of radiation protection and chemistry controls using Inspection Procedure 71750. No uncontrolled releases of radioactive material were identified.

S1 Conduct of Security and Safeguards Activities (71750)

During normal resident inspection activities, routine observations were conducted in the area of security and safeguards activities using Inspection Procedure 71750. No discrepancies were noted.

F1 Control of Fire Protection Activities (71750)

During normal resident inspection activities, routine observations were conducted in the area of fire protection activities using Inspection Procedure 71750. No discrepancies were noted.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of the licensee management at the conclusion of the inspection on January 13, 2000. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

X2 Summary of MC 0350 Restart Action Matrix Items

The inspectors reviewed selected items from the NRC Inspection Manual Chapter 0350 Restart Action Matrix (RAM). The following list indicates NRC RAM Items which are discussed in the report:

- Item R.2.1.11, "Performance Testing of the D/G Heat Exchangers Was Not Able to Detect Degradation, As Required by the Licensee's GL 89-13 Testing Program," is discussed in Section E8.1. This item is closed.

- Item R.2.3.32, "Inadequate Justification to Return the Unit 2 250 VDC Battery Train CD to an Operable Status," is discussed in Section E8.1. This item is closed.

- Item R.2.4.26, "Change to CCW Operating Procedure Was Not Recognized as a Change to the Intent of the Procedure," is discussed in Section E8.1. This item is closed.

- Item R.2.9.4, "Unable to Identify Any NRC Correspondence That Specifically Approved the Licensee Position," is discussed in Section E8.1. This item is closed.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

#C. Bakken, Site Vice President
#L. Bush, Assistant Operations Manager
#R. Gaston, Compliance Manager
#S. Greenlee, Director, Design Engineering
#R. Godley, Director, Regulatory Affairs
#R. Kalinowski, Acting Manager, Engineering Programs
#W. Kropp, Director, Performance Assurance
#M. Marano, Director, Business Services
#T. Noonan, Restart Director
#T. O'Leary, Radiation Protection, Chemistry, and Environmental Manager
#J. Pollack, Plant Manager
#R. Powers, Senior Vice President
#T. Quaka, Nuclear Safety Assessment
#M. Rencheck, Vice President, Nuclear Engineering
#B. Wallace, Training Manager
#R. Womack, Engineering Supervisor

# Denotes those present at the January 13, 2000, exit meeting.

INSPECTION PROCEDURES USED

IP 37551:	Onsite Engineering
IP 61726:	Surveillance Observations
IP 62707:	Maintenance Observation
IP 71707:	Plant Operations
IP 71750:	Plant Support Activities

NRC MANUAL CHAPTER 0350 ITEMS DISCUSSED

- Item C.3.1.a, "Demonstrated Commitment to Achieving Improved Performance Through the Results of the Programmatic Readiness Assessment"
- Item C.4.a, "Operability of TS Systems"
- Item C.4.b, "Operability of Required Secondary and Support Systems"
- Item C.4.e, "Adequacy of Surveillance Tests/Test Program"
- Item C.4.f, "Significant Hardware Issues Resolved"

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-315/316/99021-01	NCV	In-Service Testing low action limits set lower than minimum operability limit
50-315/316/99021-02	URI	Review of TS requirements for ESW operability during design basis accident
50-315/316/99021-03	IFI	Verify adequacy of long term corrective actions to resolve GL 89-13 programmatic weaknesses for performance testing of the D/G heat exchangers

Closed

50-315/316/98007-11	IFI	Unable to identify any NRC correspondence that specifically approved the licensee position
50-315/316/98009-17	URI	Inadequate justification to return the Unit 2 250 VDC battery train CD to an operable status
50-315/316/98152-01342 (50-315/316/98009-32)	VIO	Change to CCW operating procedure was not recognized as a change to the intent of the procedure
50-315/316/99020-01	IFI	Molded case circuit breaker overcurrent testing
50-315/316/99021-01	NCV	In-Service Testing low action limits set lower than minimum operability limit

Discussed

50-315/316/98009-16	URI	Performance testing of the D/G heat exchangers was not able to detect degradation, as required by the licensee's Generic Letter 89-13 testing program

LIST OF ACRONYMS

AR	Action Request
ASME	American Society of Mechanical Engineers
C	Clarence
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CR	Condition Report
D/G	Diesel Generator
DHSO	Department Head Standing Order
DRP	Division of Reactor Projects
EP	69kV Emergency Power
EMP	Electrical Maintenance Procedure
ESRR	Expanded System Readiness Review
ESW	Essential Service Water
IHP	Instrument Head Procedure
IMP	Instrument Maintenance Procedure
IST	In-Service Testing
JO	Job Order
MC	Manual Chapter
MCCB	Molded Case Circuit Breaker
MHP	Maintenance Head Procedure
MOV	Motor Operated Valve
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
NRR	Nuclear Reactor Regulation
OHI	Operations Head Instruction
OHP	Operations Head Procedure
ORAM	Outage Risk Assessment and Management
OSO	Operations Standing Order
OTA	Outage Technical Advisor
PA	Performance Assurance
PMI	Plant Manager's Instruction
PMP	Plant Manager's Procedure
PMSO	Plant Manager's Standing Order
PMT	Post Modification Testing
PDR	Public Document Room
RAM	Restart Action Matrix
RCS	Reactor Coolant System
RHR	Residual Heat Removal
SRO	Senior Reactor Operator
STA	Shift Technical Advisor
STP	Surveillance Test Procedure
SWO	Stop Work Order
TS	Technical Specification
VIO	Violation