April 15, 2003

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

SUBJECT: D.C. COOK NUCLEAR POWER PLANT, UNITS 1 AND 2
NRC INSPECTION REPORT 50-315/03-04(DRP); 50-316/03-04(DRP)

Dear Mr. Bakken:

The NRC conducted Supplemental Inspection Procedure 95002 “Inspection For One Degraded Cornerstone or Any Three White Inputs In A Strategic Performance Area” at your D. C. Cook Nuclear Power Plant, Units 1 and 2. The enclosed report documents the inspection findings which were discussed on March 3, 2003, with you and other members of your staff.

The NRC performed this supplemental inspection as required by the NRC Action Matrix based on our assessment of plant performance. As stated in our letter dated October 3, 2002, plant performance at D.C. Cook Unit 2 was within the Degraded Cornerstone Column of the NRC Action Matrix based on two White findings in the Mitigating Systems Cornerstone.

The first finding involved the failure to take appropriate corrective action to prevent the repetitive failure of the Unit 2 turbine-driven auxiliary feedwater (TDAFW) pump. A final significance determination and Notice of Violation for this finding were issued on May 6, 2002. The second finding involved a failed essential service water (ESW) strainer basket, caused by inadequate strainer basket installation instructions, which permitted debris to bypass the strainer and enter the essential service water system, resulting in the debris intrusion event experienced at the D.C. Cook Nuclear Power Plant on August 29, 2001. A final significance determination and Notice of Violation for this finding were issued on October 3, 2002.

This supplemental 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 purpose of this inspection was to (1) provide assurance that the root and contributing causes for both White findings and for the overall performance issues which resulted in the Degraded Cornerstone are understood; (2) independently assess the extent of condition and generic implications; and (3) provide assurance that the corrective actions are sufficient to prevent recurrence.

The NRC has concluded that your evaluation of these findings was incomplete because an adequate extent of condition review for the root and contributing causes had not yet been performed. Specifically, the extent of condition reviews for maintenance procedure adequacy and condition report evaluation and closure for equipment-related issues, which were two important causes for both of the White findings, were not adequately completed. This is considered to be a significant weakness with your evaluation and will result in both of the White findings that contributed to the Degraded Cornerstone remaining open. The NRC considered the failure to complete the extent of condition reviews to be significant because there was adequate time and opportunity available to complete the review, other corrective actions for the White findings have recently been identified by your staff as being completed incorrectly, and the NRC had previously identified a substantive cross-cutting issue in the area of problem identification and resolution at D.C. Cook. In addition, the identification of two Green findings during our independent extent of condition review confirmed the need for a thorough assessment of the extent of condition for these issues. The two White findings will remain open pending the following actions: completion of your extent of condition review; development of corrective actions to address any issues identified during the review; completion of an independent assessment of the extent of condition review; and NRC inspection of the results of your reviews.

During this inspection, two findings of very low safety significance (Green) were identified which involved violations of NRC requirements. However, because of their very low safety significance and because they have been entered into your corrective action program, the NRC is treating these issues as Non-Cited Violations, in accordance with Section VI.A.1 of the NRC Enforcement Policy. If you contest the Non-Cited Violations, you should provide a response with the basis for your denial, within 30 days of the date of this inspection report, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001; with copies to the Regional Administrator, Region III; the Director, Office of Enforcement, U. S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001; and the NRC Resident Inspector at the D. C. Cook facility.

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Sincerely,

/RA/

Geoffrey E. Grant, Director
Division of Reactor Projects

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

Enclosure: Inspection Report 50-315/03-04(DRP);
50-316/03-04(DRP)

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REGION III

Docket Nos:	50-315; 50-316
License Nos:	DPR-58; DPR-74
Report No:	50-315/03-04(DRP); 50-316/03-04(DRP)
Licensee:	Indiana Michigan Power Company
Facility:	D. C. Cook Nuclear Power Plant, Units 1 and 2
Location:	1 Cook Place Bridgman, MI 49106
Dates:	February 18 - March 3, 2003
Inspectors:	L. Kozak, Project Engineer J. Adams, Senior Resident Inspector C. Brown, Resident Inspector I. Netzel, Resident Inspector R. Lerch, Project Engineer
Approved by:	A. Vegel, Chief Branch 6 Division of Reactor Projects

SUMMARY OF FINDINGS

IR 05000315-03-04(DRP), IR 05000316-03-04(DRP), on 02/18/2003-03/03/2003, Indiana Michigan Power Company, D. C. Cook Nuclear Power Plant, Units 1 and 2. Supplemental Inspection - Mitigating Systems Cornerstone.

This report covers a supplemental inspection performed by regional-based and resident inspectors. The inspectors identified two Green findings. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter 0609, "Significance Determination Process," (SDP). 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.

Cornerstone: Mitigating Systems

The NRC performed this supplemental inspection to assess the licensee's evaluation of two White findings in the Mitigating Systems Cornerstone. The first White finding involved the failure to take appropriate corrective action to prevent the repetitive failure of the Unit 2 turbine-driven auxiliary feedwater (TDAFW) pump. The second White finding involved a failed essential service water (ESW) strainer basket, caused by inadequate strainer basket installation instructions, which permitted debris to bypass the strainer and enter the essential service water system, resulting in the debris intrusion event experienced at the D.C. Cook Nuclear Power Plant on August 29, 2001. During this supplemental inspection, a significant weakness was identified with regard to the licensee's evaluation of the findings.

The licensee's evaluation adequately assessed the root causes, and appropriate corrective actions were initially assigned. The inspectors identified that two corrective actions assigned to perform important extent of condition reviews were not adequately completed. These reviews were to determine the extent of condition of the adequacy of maintenance procedures and to determine the extent of condition of equipment-related condition reports that were inadequately evaluated or closed. The failure to adequately complete the extent of condition reviews was determined to be a significant weakness in the licensee's evaluation. As a result, the two White performance issues associated with the Degraded Cornerstone will not be closed at this time. Two additional findings of very low safety significance were identified during the inspection and are summarized below.

A. **Inspector Identified Findings**

- Green. The licensee failed to take adequate corrective action to revise procedure 12-MHP-5021-056-007, "Turbine-driven Auxiliary Feedwater Pump Trip and Throttle Valve Linkage Adjustment" to include the manufacturer's recommendations regarding the set-up of the turbine trip throttle valve.

This finding was determined to be a Non-Cited Violation of 10 CFR 50 Appendix B Criterion XVI, “Corrective Action”. This finding was of very low safety significance because the inadequate corrective action in revising the procedure did not affect the operability or availability of the auxiliary feedwater system.

- Green. The licensee failed to take corrective action to ensure that only turbine trip throttle valve latch hooks with the correct geometry would be installed in the turbine-driven auxiliary feedwater pumps after determining that the incorrect part had been supplied by the manufacturer.

  This finding was determined to be a Non-Cited Violation of 10 CFR 50 Appendix B Criterion XVI, “Corrective Action”. This finding was of very low safety significance because failure to take corrective action did not result in parts of incorrect geometry being installed in the auxiliary feedwater system and therefore did not affect the operability or availability of the system.

Report Details

01 Inspection Scope

This supplemental inspection, performed in accordance with Inspection Procedure 95002, "Inspection for One Degraded Cornerstone or Any Three White Inputs in a Strategic Performance Area," was conducted as a result of D.C. Cook Unit 2 having a Degraded Cornerstone in Mitigating Systems. The inspection objectives were to provide assurance that the root and contributing causes were understood for the individual and collective performance issues, to independently assess the extent of condition for the individual and collective issues, and to provide assurance that the corrective actions were sufficient to address the causes and prevent recurrence.

D.C. Cook Unit 2 entered the Degraded Cornerstone column of the NRC's Action Matrix in the second quarter of 2002 as a result of two findings of low to moderate or "White" safety significance in the Mitigating Systems Cornerstone. The first White finding was initially identified in the first quarter of 2002 and was documented in Inspection Report 50-315/02-02; 50-316/02-02. This finding involved the failure to take appropriate corrective action to prevent the repetitive failure of the Unit 2 turbine-driven auxiliary feedwater (TDAFW) pump. The root causes of the repetitive failures of the pump were attributed to incorrect geometry of the Trip Throttle Valve (TTV) hook and latch mechanism and an incorrect procedure change. A final significance determination and Notice of Violation for this finding was issued on May 6, 2002. A supplemental inspection was performed in July 2002 in accordance with Inspection Procedure 95001, "Inspection for One or Two White Inputs to a Strategic Performance Area" and was documented in Inspection Report 50-315/02-05; 50-316/02-05. This inspection found that the licensee had performed a thorough root cause evaluation and that the corrective actions identified were reasonable. No additional findings were identified.

The second White finding was initially identified in the second quarter of 2002 and was documented in Inspection Report 50-315/01-17; 50-316/01-17. This finding involved a failed essential service water (ESW) strainer basket, caused by inadequate strainer basket installation instructions, which permitted debris to bypass the strainer and enter the essential service water system, resulting in the debris intrusion event experienced at the D.C. Cook Nuclear Power Plant on August 29, 2001. A final significance determination and Notice of Violation for this finding was issued on October 3, 2002.

The scope of this supplemental inspection included the root cause evaluation, extent of condition, and corrective actions for the second White finding and for the collective or common issues identified for both the White findings. The licensee's evaluation of the first White finding was documented in Condition Report (CR) 02018064 titled, "Unit 2 Turbine Driven Auxiliary Feed Pump Trip Throttle Valve Failure". The licensee's evaluation of the second White finding was documented in Condition Report (CR) 01242013 titled, "ESW Strainer Basket Damage", and the common cause evaluation of the two findings was documented in CR 02277047, titled "Common Cause Investigation for Mitigating Systems Degraded Cornerstone".

In addition to the detailed review of the licensee's evaluation, the inspectors performed an independent extent of the condition review for the individual and collective causes identified.

02 Evaluation of Inspection Requirements

02.01 *Problem Identification*

a. *Determine that the evaluation identifies who (i.e., licensee, self revealing, or NRC), and under what conditions the issue was identified.*

Both of the White findings were identified through self-revealing events. CR 01242013 for the ESW silt intrusion event adequately documents the sequence of events and the conditions of the plant both before the event and during recovery from the event. The NRC conducted a special inspection at the time of the event which also documented the event and plant conditions. The special inspection is documented in Inspection Report 50-315/01-17; 50-316/01-17, dated June 10, 2002. The review of problem identification for the TDAFW pump finding was conducted during the IP 95001 inspection and was documented in Inspection Report 50-315/02-05; 50-316/02-05. No additional issues regarding problem identification were found during this supplemental inspection.

b. *Determine that the evaluation documents how long the issue existed, and prior opportunities for identification.*

Regarding the ESW basket strainer finding, the licensee's evaluation determined that the basket had existed in a failed condition for an extended period of time. Based on maintenance records, the licensee concluded that the basket was initially damaged during installation in 1989. Further degradation occurred over time. A metallurgical analysis also indicated that poor fabrication of the basket was a contributor to its failure.

The licensee's evaluation identified several missed opportunities for identification of the strainer damage prior to the event. Several heat exchanger inspections performed under Generic Letter (GL) 89-13 indicated that large debris (greater than 1/8 inch debris) was present in the heat exchangers. Two condition reports had been written in 1999 (CR 99-0730 and CR 99-25442). One CR was closed with no investigation and the second CR was still open. No evaluation had been performed to identify the source of the large debris.

Additionally, the licensee found that an NRC service water system inspection in 1995 recommended the development of maintenance procedures and periodic inspections for the ESW basket strainers. These recommendations were never implemented. These issues were again identified in 1999 during the Expanded System Readiness Review (ESRR) prior to restart. In 1999, strainer basket inspections were completed; however, the procedure at the time did not require removal of the strainer basket cover. Therefore, the failed condition of the strainer basket could not be detected.

The licensee characterized these missed opportunities as a contributing cause to the ESW event for the failure to effectively use internal operating experience that had

identified the need for periodic strainer maintenance and maintenance procedures. A corrective action was developed to review the CRs generated during the ESRR that were associated with equipment performance or reliability problems to determine the extent of condition for inadequate evaluation or corrective action. The inspectors identified that this extent of condition action was not adequately completed. Further discussion of this finding is in Section 02.02.d.

The TDAFW pump finding was reviewed in the IP 95001 inspection. No additional issues were identified during this inspection. The inspectors concluded that the licensee had adequately documented how long the conditions potentially existed and addressed prior opportunities to detect the problems.

c. *Determine that the evaluation documents the plant specific risk consequences (as applicable) and compliance concerns associated with the issue(s) both individually and collectively.*

The licensee's common cause evaluation of the two findings stated that the actual safety significance of the two events was low because the affected systems were not being challenged to perform their safety functions at the time the events occurred. The evaluation further stated that the potential significance was greater.

The NRC's evaluation of the TDAFW pump finding is documented in the IP 95001 inspection report. The NRC's preliminary assessment of the ESW basket strainer finding was initially determined to be a finding of substantial importance to safety or Yellow. A regulatory conference was held on July 25, 2002 and a phase 3 significance assessment was conducted. The final significance determination letter was issued on October 3, 2002 and determined that the finding was White. With the final significance determination, the NRC issued a Notice of Violation for inadequate maintenance installation instructions for ESW strainer basket installation. The licensee's failure to have adequate installation instructions was a violation of 10 CFR 50 Appendix B, Criterion V, "Instructions, Procedures, Drawings". This compliance concern was adequately addressed in the root cause evaluation for the ESW Strainer Basket Damage event.

02.02 *Root Cause and Extent of Condition Evaluation*

a. *Determine that the problem was evaluated using a systematic method(s) to identify root cause(s) and contributing cause(s).*

The licensee developed a detailed timeline of events associated with the ESW strainer basket damage root cause evaluation. To identify the cause of the basket damage, the licensee conducted a support/refute analysis to review and assess the potential causes. A metallurgical analysis of the basket strainer was also performed. The root cause evaluation was not conducted using a formal technique. The licensee indicated that barrier analysis was the technique used but was not documented.

The root cause was determined to be incorrect installation of a strainer basket during basket replacement activities that occurred in the 1989 time frame. The failure to adjust the height of the basket to align the top edge of the basket with the lip of the

strainer body allowed the basket to be placed in compression when the approximately 700 pound strainer lid was reinstalled. The compressive force exerted by the lid caused the basket mesh to tear in the area of the weld on the basket's vertical support bracket and was the initiating event for the resultant damage and eventual failure of the basket. Weaknesses in the preventive maintenance program and strainer inspection procedure permitted the failed condition of the basket to go undetected for an extended period of time. The failure of the basket, combined with the design of the ESW system and the way in which it was operated, led to the silt intrusion event. The silt intrusion was a common mode failure mechanism that affected all four emergency diesel generators (EDGs).

The common cause evaluation was performed using cause and effect diagrams for the two White findings. Two common causes were identified. The first common cause was inadequate technical understanding and guidance to the organization of equipment/sub-component set-up requirements. The second common cause was the failure to follow-up on identified performance issues.

The TDAFW pump finding was reviewed during the IP 95001 inspection. No additional issues were identified during this inspection. Overall, the inspectors concluded that the licensee had used reasonable methods to identify the root, contributing and common causes.

b. *Determine that the root cause evaluation was conducted to a level of detail commensurate with the significance of the problem.*

Overall, the root cause evaluation for the ESW strainer basket damage and the common cause evaluation for the degraded cornerstone were conducted to an adequate level of detail. The inspectors noted that neither maintenance training or maintenance practices were explicitly evaluated as a barrier in either the ESW root cause or the common cause evaluation but that several corrective actions were to provide additional training to maintenance and engineering personnel. The licensee indicated that they had considered maintenance training and maintenance practices but determined that these were not contributing causes to the findings. While performing the independent extent of condition review, the inspectors observed ESW strainer basket maintenance. During these observations, the inspectors noted several poor maintenance practices, including observing a worker that had climbed into the basket during removal and observing maintenance steps performed out of sequence. The inspectors concluded that the root causes and contributing causes identified by the licensee were appropriate but could not eliminate maintenance practices or maintenance training deficiencies as a contributing cause because of the noted maintenance observations and the lack of a specific evaluation of these barriers in the ESW root cause or common cause analyses.

c. *Determine that the root cause evaluation included a consideration of prior occurrences of the problem and knowledge of prior operating experience.*

The ESW strainer basket damage root cause evaluation considered prior operating experience, both internally and externally. The licensee identified one similar issue regarding strainer bypass in a 1996 licensee event report for another facility. However, no review of this event had been performed at D.C. Cook and none was required by the

licensee's operating experience program. The internal operating experience review focused on the missed prior opportunities to identify the strainer bypass. The missed opportunities included the condition reports written after large debris was found during heat exchanger inspections and condition reports that were initiated regarding the lack of periodic inspections and maintenance procedures for the ESW strainer baskets. These issues had been documented in the licensee's corrective action program but neither the evaluations or the prescribed actions led to the identification of the failed strainer. No operating experience evaluation was necessary for the common cause evaluation. The inspectors concluded that the licensee had adequately considered operating experience in their review of the ESW strainer basket root cause evaluation.

d. *Determine that the root cause evaluation included consideration of potential common causes(s) and extent of condition of the problem.*

The inspectors determined that the licensee had not yet completed the extent of condition review for the root cause and for an important contributing cause of the ESW strainer basket damage finding. The root cause involved inadequate installation instructions, which was also the NRC finding and basis for the violation. The extent of condition review was specified to conduct an assessment of safety-related maintenance procedures to determine if they contained adequate technical guidance. The important contributing cause involved the failure to use internal operating experience in the forms of self-assessments and CRs that had identified the need for periodic maintenance of the ESW strainers and maintenance procedures several times since 1995. For both of these issues, an extent of condition evaluation was to be performed and was assigned a corrective action in the ESW strainer basket root cause evaluation. However, both of the actions were closed, although the specified action was not taken.

The inadequate extent of condition assessment for maintenance procedures was identified by the licensee during the Degraded Cornerstone Common Cause Assessment. The report for the Degraded Cornerstone Common Cause Assessment stated that the individual event investigations made an adequate determination of the extent of condition but that the Degraded Cornerstone Assessment Team had initiated additional actions to address weaknesses. The failure to adequately review other maintenance procedures was one of the identified weaknesses. The Common Cause Assessment stated that the original corrective action to perform the extent of condition was credited in both the TDAFW pump and ESW basket strainer root cause evaluations and that the action had been closed inappropriately to a Category "X" CR. Category "X" CRs are for enhancements and do not address conditions adverse to quality such as deficient maintenance procedures. The Category "X" CR was closed without a specific review of any maintenance procedures. The closure documentation credited the routine biennial review required for all procedures. The licensee generated a new corrective action to prevent recurrence to perform the maintenance procedure review. These efforts were ongoing at the time of the inspection with a due date of April 4, 2003.

The licensee had also identified the inadequate extent of condition review for the failure to use internal operating experience. This action was specified to review equipment-related CRs generated during the ESRR to verify adequate evaluation and closure. The original action had been closed based on a search of CRs that contained the phases "single failure" or "common cause" in the identification block. A sample of those CRs

was reviewed and a conclusion drawn that there were no further cases of single or common mode failures at D.C. Cook. This action was closed in February 2002. The licensee identified that the action taken did not match the specified required action which was to perform an extent of condition review to determine if other CRs had been closed with an inadequate evaluation or no action. A CR was initiated in February 2003 to document this issue. This review had not been completed at the time of the inspection and no due date had been assigned.

An extent of condition evaluation for the ESW strainer basket damage and bypass condition was performed around the time of the event to physically inspect other ESW strainers and other systems, including the non-essential service water (NESW) strainers and portions of the auxiliary feedwater system which contain strainers. The inspectors determined that these actions were completed. Also, the licensee reviewed a 1999 Single Failure Analysis to determine if any other systems had a single failure or common cause vulnerability similar to what occurred when the ESW basket failed and affected multiple systems. The inspectors performed an independent review of this extent of condition which is discussed in Section 02.04. A physical extent of condition review was also conducted for the first White finding involving the TDAFW pump. At the time the issue occurred, the licensee verified that the condition did not exist on other similar pumps.

The failure to complete an adequate extent of condition review was determined to be a significant weakness in the licensee's evaluation of the Degraded Cornerstone issues. The weakness was determined to be significant because of the overall importance of determining the full extent of condition of the problems, adequate time was available to conduct a thorough evaluation, and the NRC's independent inspection results confirmed the need for a thorough extent of condition evaluation. As a result, the findings will remain open until the licensee completes the evaluation and the NRC re-inspects the results of the licensee's review.

02.03 *Corrective Actions*

a. *Determine that appropriate corrective action(s) are specified for each root/contributing cause or that there is an evaluation that no actions are necessary.*

The inspectors reviewed the specified corrective actions for the ESW strainer basket root cause and the Degraded Cornerstone Common Cause Assessment and determined that the actions were appropriate for the identified causes. However, implementation of some corrective actions was poor. Several important actions specified for the ESW root cause were not implemented as intended. Most notably, the extent of condition actions discussed in Section 02.02.d were not adequately completed. The licensee had recently identified several other corrective actions that were not implemented correctly but had been closed as completed. Other examples included the failure to update training on the critical characteristics of the TDAFW pump TTV geometry and the failure to continue trending ESW system parameters.

The proposed corrective actions for the first White finding involving the TDAFW pump were reviewed during the 95001 inspection and were determined to be reasonable. Full implementation of the corrective actions was not verified at the time of the inspection.

During the independent extent of condition review of this 95002 inspection, the NRC identified two findings involving the adequacy of corrective actions associated with this finding. These current findings involved inadequate corrective action for the procedure change to the AFW TTV set-up procedure and the failure to take corrective action for known parts deficiencies associated with the trip hook. The findings are discussed in detail in Section 02.04.

The inspectors did not specifically review the completion of corrective actions specified for the Degraded Cornerstone Common Cause Assessment since a number of these actions were not yet complete. However, the inspectors did note that several of the corrective actions specified limited the action to be taken to a subset of plant systems designated as "ROP" systems. The subset of systems did not include all mitigating systems or even all risk-significant systems and therefore implementing these actions for only specific systems would not necessarily prevent repetition of a degraded cornerstone. The licensee indicated that a review of the implementation of these corrective actions for only "ROP" systems would be completed.

b. *Determine that the corrective actions have been prioritized with consideration of the risk significance and regulatory compliance.*

The inspectors reviewed the due dates that were initially assigned to the corrective actions identified and concluded that the assigned priorities were appropriate. However, as noted previously, in one case an important corrective action to review maintenance procedure adequacy as part of an extent of condition review was inappropriately closed to a Category "X" or enhancement CR. This re-prioritization was not consistent with the significance of the original CR which was a Category 1 or with the overall importance of determining the extent of condition of the root cause for this finding.

The inspectors also encountered several instances where there was difficulty in reviewing corrective actions identified in CRs to determine if they were adequately implemented. Corrective actions were often closed to other condition reports, such as occurred with the closure of the extent of condition review to a Category "X" CR. The repetitive closure of CRs to other CRs left a difficult trail to determine if the action was actually taken. The inspectors also identified examples where the characterization of the corrective action changed as the action was transferred to another CR.

c. *Determine that a schedule has been established for implementing and completing the corrective actions.*

For those corrective actions that had not yet been completed, the licensee had developed due dates for completing the corrective actions. One exception was the newly generated CR to complete the extent of condition for the review of equipment-related CRs to assess if they were properly evaluated and corrected. This action had not yet been assigned a due date at the time of the inspection.

d. *Determine that quantitative or qualitative measures of success have been developed for determining the effectiveness of the corrective actions to prevent recurrence*.

The licensee's effectiveness review plan for the Degraded Cornerstone Common Cause Assessment was to perform a self-assessment to review the corrective action closures and to review all rework items within the assessment period. The review would look for indication of a lack of procedural guidance or accurate vendor information that contributed to the rework event. The acceptance criteria specified was zero rework items on critical components due to a lack of accurate information, faulty parts or inadequate cause analysis. A second criterion was to have no significant events leading to a "White" finding in the Mitigating Systems Cornerstone. The inspectors reviewed these criteria and concluded that the specified review for effectiveness was adequately defined.

02.04 *Independent Review of Extent of Condition*

The inspectors performed an independent extent of condition review in two areas. The first area was to review maintenance procedures for technical adequacy and accuracy. The second area of independent review was to determine if another shared system at the plant was operated or maintained in a manner that would render the system susceptible to a common mode or single failure as occurred with the failure of the ESW strainer basket which affected multiple systems and trains.

The inspectors reviewed selected maintenance procedures to verify that: 1) the procedures were reviewed and approved in accordance with Technical Specifications and regulatory requirements, 2) the technical adequacy of procedures was consistent with desired actions and modes of operation, 3) the usability of procedure content and format by determining the degree to which accepted human factors principles have been incorporated, and 4) temporary changes were made in accordance with plant administrative procedures and Technical Specification requirements.

The inspectors performed a focused inspection of the component cooling water (CCW) system and the control air system to independently assess the validity of the licensee's conclusions regarding extent of condition issues. The inspectors reviewed the system configuration as specified in the design basis documentation and compared that configuration to the configuration specified in the plant's normal, abnormal, and emergency procedures. The inspectors evaluated changes in the system's configuration with respect to different operating modes and plant conditions. The inspectors reviewed each system's design for susceptibilities to a single failure induced common mode failure. The observations and findings of these two independent extent of condition reviews are described below.

Maintenance Procedure Independent Extent of Condition Review

The inspectors reviewed selected maintenance procedures for the AFW, ESW, and emergency diesel generator (EDG) systems. The procedure for the AFW TTV set-up contained several discrepancies when compared to the manufacturer's technical information that was obtained by the licensee after the repetitive failures of the TDAFW pump occurred. This issue is described in more detail below and was determined to

constitute inadequate corrective action for the AFW TTV issue. In addition, the inspectors had observations of deficiencies with the ESW strainer basket maintenance procedures and EDG governor maintenance procedures. The ESW strainer basket maintenance procedure deficiencies were minor in nature and the EDG procedure deficiencies had also been previously identified by the licensee. However, overall, the inspectors noted deficiencies with procedures in all three of the maintenance areas reviewed. These results could not be compared to the licensee's extent of condition review since it was incomplete; however, the findings and observations confirmed the need for a thorough and complete extent of condition review in this area.

On January 18, 2002, the TDAFW pump tripped rendering the pump inoperable. This trip was the third spurious trip of the pump. The previous two occurred in June 2000 and August 2001. The licensee's root cause investigation determined that incorrect geometry of the TTV latch hook was the cause for the spurious trips. Corrective actions included revising the maintenance procedure and machining the TTV latch hook to correct the geometry.

The inspectors reviewed all of the changes that had been made to Revision 2 (Change 1 through 8) of Procedure 12-MHP-5021-056-007, "TDAFP Trip and Throttle Valve Linkage Adjustment," to ensure that the technical information was correct. Changes 1 through 6 were consistent with the manufacturer's technical information; however, Change 7, issued February 5, 2002, after the licensee had completed the root cause investigation for the TDAFW pump issue and obtained technical information regarding the geometry of the TTV from the manufacturer, was not. The several changes accomplished by Change 7 and 8 were inconsistent with the manufacturer's information. Specifically, Change 7 provided for five changes, the most significant of which moved the location of a horizontal clearance measurement such that it prevented complete latching of the latch hook to the latching up lever. Change 8, issued a day later, was required to change the "Acceptance Criteria" so that work per Change 7 could be accomplished.

The inspectors noted that Acceptance Criteria "A" of Step 8 of the procedure could not be met per the manufacturer's recommendations. The criteria was, "Trip hook and latching-up lever fully engaged." The manufacturer's requirement that the end of the latching-up lever contact the latch hook throat could not be met due to the horizontal clearance introduced by Change 7. The reason given for the change was, "As requested by System Engineering based on procedure walk through." The licensee staff had based the changes on engineering judgement and had not documented the basis for the decisions regarding the procedure changes. After discussion with the inspectors, the licensee staff agreed that the procedure was incorrect as written and that the changes were not technically justified when compared to the manufacturer's recommendations. The inspectors further noted that these changes had been reviewed and approved despite inadequate documentation of the basis for the change.

On February 20, 2003, to address the procedure issues, the licensee initiated CR 03051126, "Maintenance Procedure 12-MHP-5021-056-007, "TDAFP Trip and Throttle Valve Linkage Adjustment," needs revised. Also, there is a generic concern with the process for technically justifying changes to maintenance procedures." An excerpt from CR 03051126 follows:

an error introduced by changes in the maintenance procedures for both Units' Turbine Driven Auxiliary Feedwater pumps (TDAFPs, ½-PP-4) trip and throttle valve (TTV, ½-QT-506) trip linkages. The maintenance procedure changes were part of the response to previous problems with the TTV latch engagement, which resulted in several TDAFWP trips during 2000 through early 2002 (see CRs 01362027, 01222001, 02018064).

Each of the referenced CRs was written after a spurious TDAFW pump trip. The procedure changes were required as a corrective action by the root cause evaluation for CR 02018064, "Recurring Trips of the Unit 2 TDAFP Trip and Throttle Valve (TTV)." The inspectors determined that the failure to take effective corrective actions to prevent recurrence of a known quality problem, specifically not adequately and accurately changing a known deficient procedure (12-MHP-5021-056-007, Revision 2, Change 6) was a violation of regulatory requirements.

10 CFR 50, Appendix B, Criterion XVI, "Corrective Action," stated, in part, that in the case of significant conditions adverse to quality, measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The inspectors determined that a corrective action from the root cause for CR 02018064, "Recurring Trips of the Unit 2 TDAFP Trip and Throttle Valve (TTV)," was to revise Procedure 12-MHP-5021-056-007, "TDAFP Trip and Throttle Valve Linkage Adjustment," Revision 2, Change 6. However, the licensee failed to either revise the procedure in accordance with the manufacturer's recommendations or to document the basis for the changes in Change 7 and 8 in order to prevent the installation of an improper geometry latch hook. This issue was entered into the licensee's corrective action program and is identified as a **Non-Cited Violation (NCV) 50-315/03-04-01; 50-316/03-04-01.** This finding was assessed using the significance determination process (SDP) and determined to be of very low safety significance (Green) because the inadequate corrective actions in revising the procedure did not affect the operability or availability of the auxiliary feedwater system.

During the discussions about the TTV latch hook, the licensee staff stated that the TTV parts were received "rough" and required machining; however, the licensee indicated that the parts were purchased from a qualified vendor and therefore did not require a special receipt inspection. To assess the adequacy of the quality of the spare latch hooks, the inspectors reviewed receipt inspection requirements. The inspectors confirmed that the replacement latch hooks, ordered in August 2001, had required and had been receipt inspected but only for shipping damage, not for physical characteristics or geometry. This was due to the latch hooks being supplied by an approved quality supplier per the quality supplier list (QSL) who provided a certificate of compliance for the hooks. The inspectors reviewed the ordering information for the discrepant latch hook (originally ordered in 1985) and the replacement latch hooks and found that there was no substantial difference in the ordering specifications. The 1985 supplier had been a qualified supplier and had provided a certificate of compliance with the original latch hook with the incorrect geometry.

The licensee received the critical parameters for the TTV latch hook mechanism geometry from the vendor on December, 13, 2001, and used the information for Design Information Transmittal (DIT) No. DIT-S-01037-01 to correctly machine the latch hook for the repairs conducted in 2002; however, the licensee did not take action to ensure that only replacement latch hooks with the correct geometry would be installed in the future. The system engineer indicated that the maintenance procedure had sufficient instructions to ensure the correct geometry of the latch hook. Specifically, Revision 2, Change Sheet 7 to the procedure had added a note stating, "The design of the parts (geometry) establishes proper orientation between the trip hook and latching up lever." However, the inspectors determined that no step in the procedure checked the latch hook geometry and that it was possible to attain all of the fit-up acceptance criteria for the latch hook with a hook of the wrong geometry, which had occurred after the August 2001 TDAFW pump trip.

On February 28, 2003, in response to the inspectors finding, the licensee initiated CR 03059025, "The spare trip hooks for the TDAFP trip & throttle valves (1- and 2-QT-506) appear to have been dedicated to less-than-adequate critical characteristics," to address the inadequate corrective action to prevent recurrence (CATPR) for the TTV latch hook geometry. The inspectors determined that the failure to take effective actions to prevent recurrence of a known quality problem, specifically the receipt and installation of improper geometry TTV latch hooks, constituted a violation of regulatory requirements.

10 CFR 50, Appendix B, Criterion XVI, "Corrective Action," stated, in part, that in the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The inspectors determined that the licensee had identified the cause for repetitive spurious TDAFW pump trips in CR 02018064, "Recurring Trips of the Unit 2 TDAFP Trip and Throttle Valve (TTV)." However, no corrective action had been taken to ensure that only TTV latch hooks with the correct geometry would be installed in the TDAFW pumps. This issue was entered into the licensee's corrective action program and is identified as a **Non-Cited Violation (NCV) 50-315/03-04-02; 50-316/03-04-02.** This finding was assessed using the SDP as having very low safety significance (Green) because the failure to take corrective action did not result in parts of incorrect geometry being installed in the auxiliary feedwater system and therefore did not affect the operability or availability of the system.

System Common Mode or Single Failure Independent Extent of Condition Review

The licensee's root cause evaluation for the emergency service water silt intrusion event (CR 01242013) identified that the emergency service water supply configuration to the Unit 1 and Unit 2 emergency diesel generators was vulnerable to a single failure and common mode failure. The emergency service water configuration was part of the original design basis. In 1999, as part of a restart issue resolution arising from concerns about the plant's conformance to single failure criterion, the licensee performed a single failure analysis of safety-related systems (NED-1999-00002-REP). This analysis included the emergency diesel generators and emergency service water systems. The analysis failed to identify a strainer bypass as a potential failure mode. The licensee initiated a corrective action (CRA 01242013-56) to review the 1999 single failure

analysis of systems to assure system configurations reflect conservatively bounded actual configuration and that failure modes are assumed consistent with the requirements of the licensee's procedure for the application and use of single failure criteria. The results of the licensee's review did not identify any other instances where an event like the emergency service water debris intrusion has the potential to affect the operability of both trains of a safety system.

The inspectors conducted a detailed assessment of the CCW system for potential single failures that could result in the common mode failure of both trains. The inspectors started their assessment with the system in its normal configuration as described in the plant's design basis. The inspectors then selected CCW system procedures that resulted in changes in system configuration and assessed each change for vulnerability to a credible common mode failure mechanism. Of particular interest to inspectors were the configuration changes associated with the CCW miscellaneous service header since it is common to both trains. The inspectors assessed procedures for the line up of the spare CCW pump, the restoration of CCW during an Appendix R event, the restoration of CCW following a loss of CCW, and emergency operating procedure directed manipulations of the CCW system. The inspectors did not identify any credible single failure induced common mode failure mechanisms associated with configuration changes contained in system operating procedures for the CCW system.

The inspectors provided a specific focus on the CCW surge tank since it is common to both CCW trains. The inspectors reviewed licensee procedures for the inspection of the surge tank interior, results of the inspection, and discussed American Society of Mechanical Engineers (ASME) code inspection requirements with Region III inspectors knowledgeable of those requirements. The inspectors determined that the licensee's inspection of the surge tank exceeded the ASME code requirements. The licensee's inspection results did not identify any condition that would be indicative of CCW surge tank failure. The inspectors concluded that the CCW surge tank, as maintained by the licensee, was not a credible single failure that could potentially result in a common mode failure of both CCW trains.

The inspectors also performed an assessment of a loss of control air (instrument air) on a number of important systems including the emergency service water system, reactor protection system, component cooling water system, coolant charging system, auxiliary feedwater system, safety injection system, residual heat removal system, emergency alternating current power system, reactor coolant system, main feedwater, and non-essential service water. The inspectors verified that the loss of control air would not result in a common mode failure of both trains of a safety system or in the case of the non-safety systems, prevent or complicate the completion of safety functions by safety systems. The inspectors did not identify any credible common mode failures during this assessment.

03 MANAGEMENT MEETINGS

Exit Meeting Summary

The inspection results were presented to Mr. A. C. Bakken and other members of licensee management at the conclusion of the inspection on March 3, 2003. The licensee acknowledged the findings presented.

Key Points of Contact

Licensee

A. Bakken, Senior Vice President, Nuclear Generation
M. Finissi, Plant Manager
J. Gebbie, System Engineering Manager
S. Greenlee, Nuclear Technical Services Director
J. Nadeau, Corrective Action Department
D. Naughton, Plant Engineering
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B. McIntyre, Regulatory Affairs
R. Meister, Regulatory Affairs
T. Noonan, Performance Assurance
B. O'Rourke, Regulatory Affairs
S. Papageorgiou, Maintenance
J. Pollock, Site Vice President
M. Scarpello, Regulatory Affairs
M. Skow, Performance Assurance

NRC

B. Kemker, Senior Resident Inspector
T. Vegel, Chief, Reactor Projects Branch 6

List of Items Opened, Closed, and Discussed

Open

NCV 50-315/03-04-01; 50-316/03-04-01	Failure to take adequate corrective action to revise procedure 12-MHP-5021-056-007
NCv 50-315/03-04-02; 50-316/03-04-02	Failure to take corrective action to ensure that only turbine trip throttle valve latch hooks with the correct geometry would be installed in the turbine-driven auxiliary feedwater pumps

Closed

NCV 50-315/03-04-01; 50-316/03-04-01	Failure to take adequate corrective action to revise procedure 12-MHP-5021-056-007
NCv 50-315/03-04-02; 50-316/03-04-02	Failure to take corrective action to ensure that only turbine trip throttle valve latch hooks with the correct geometry would be installed in the turbine-driven auxiliary feedwater pumps

Discussed

None

LIST OF DOCUMENTS REVIEWED

Condition Reports

CR 97-03151 During review of flow rate for CCW pump found CCW system not reviewed for potential pump dead-heading, CCW pumps experience pump/pump interaction/CCW trains are cross-tied, NRC B88-04
CR 98-05206 Drawing Discrepancy Between Vendor Drawing and Ops for CCW Surge Tank, Re: 12-5414-6 and OP 1-5135-37 Vendor Drawing 7108 Rev 4
CR 98-05208 FAR: CCW Surge Tank As-Built Does Not Provide Two Redundant 2000 Gallon Compartments as Originally Required by Letter and Calculation
CR 98-05876 DBD/FDB/ Installed/IST Program Discrepancy: ½ CRV485 Valve Type
CR 99-02280 The Component Cooling Water (CCW) pump autostart and low discharge pressure alarm setpoints may not be set to design conditions
CR 99-07943 Extended System Readiness Review (ESRR) Item. Interior of Surge Tank Must Be Inspected
CR 99-08127 CCW System is Vulnerable to Single Failure During the Recirculation Phase if a Leak Were to Develop in the Miscellaneous Header
CR 01242013 Silt/Mud intrusion into U1 and U2 ESW systems renders CCW and EDG inoperable
CR 01245030 Deficient strainer condition allowed large size material intrusion into the Essential Service Water System
CR 02018064 Recurring Trips of the TDAFP Trip and Throttle Valve (TTV)
CR 02148014 [Unit 1] CD Diesel has a minor oscillation in both the frequency and voltage when the diesel is unloaded
CR 02277047 Common Cause Investigation for Mitigating Systems Degraded Cornerstone
CR 02306005 CD EDG exhibited 150 kW oscillations at full load during surveillance testing
CR 02347032 TDAFP maintenance procedures require revision for procedural compliance
CR 0302207 Gap Between Strainer Basket and Door and Strainer Basket, Debris Found in Basket
CR 03049059 Place numerous maintenance procedures on Administrative Hold until a review has been completed
CR 03051018 Biennial procedure reviews that have NRC Commitment correctly implemented; however, have been identified as missing or not correctly referencing CMS (NRC Commitment(s)) IAW PMP-2010-PRC-001
CR 03051125 CRA-02277047-15 (Cat 1) Implementation did not meet the action prescribed
CR 03051126 Maintenance Procedure 12-MHP-5021-056-007, “TDAFP Trip and Throttle Valve Linkage Adjustment,” needs revised. Also, there is a generic concern with the process for technically justifying changes to maintenance procedures
CR 03055133 The NRC identified a problem with 12-MHP-019-003, Essential Service Water Strainer Maintenance. The procedure could not be performed as written
CR 03055129 2-OME-34W, Both East and West strainer basket “as-found” gap dimensions between the cover and the strainer basket assembly were unacceptable and the rubber seal ring was found partially separated from the discs
CR 03055128 The Woodward Electronic Governor Module (EGM) currently installed in 2CD EDG (Serial No. 2673299) may have been subjected to the same fault conditions as the one that was removed in January 2003 (Serial No. 2673904)

CR 03056056 2-OME-34W, The backwash inlet piping spray tube was not installed in the proper orientation on both East and West Strainer basket
CR 03056051 2-ESW-102W Dedicated replacement valve not configured per design requirements
CR 03057040 Screening committee request to generate a roll-up CR for Maintenance Procedure issues identified in the 95002 inspection
CR 03058047 The "Detailed Description of Condition" for CR 03055129 was confusing with respect to as-found measurements and what was acceptable and what was unacceptable
CR 03058051 Procedure 12-MHP-5021-001-009 had steps left blank and line through when the step should have been N/A'd per PMP-2010-PRC-003
CR 03059025 The spare trip hooks for the TDAFP trip & throttle valves (1- and 2-QT-506) appear to have been dedicated to less-than-adequate critical characteristics

Procedures

Procedure PMI-7033	Application and Use of Single Failure, Revision 1
Procedure 01-OHP-4025.R-3	Restore CCW, Revision 2A
Procedure 01-OHP-4021-016-002	Interchanging the Spare Component Cooling Water Pump with the East or West Component Cooling Water Pump, Revision 11
Procedure 01-OHP-4022-016-004	Loss of Component Cooling Water, Revision 7
Procedure 01-OHP-4023-ES-1.3	Transfer to Cold Leg Recirculation, Revision 7
Procedure PMP-5030-001-007	Steel Tank Inspection Program, Revision 0
Procedure 02-OHP-4022-064-001	Control Air Malfunction, Revision 4
Procedure PMP-7030-CAP-001	Corrective Action Program Process Flow, Revision 14, Change 0
Procedure 12MHP5021.056.007	Turbine Driven Auxiliary Feed Pump Trip and Throttle Valve Linkage Adjustment, Revision 2, Changes 5 - 8
Procedure 12MHP5021.019.003	Essential Service Water Strainer Maintenance, Revisions 0, 0a, 1-5, and associated changes
Procedure 12MHP5021.032.037	Emergency Diesel Engine Woodward Governor Removal and Installation,"Revision 2, Change 2
Procedure 2MHP5021.032.049	Emergency Diesel Generator Throttle Control Cylinder Maintenance, Revisions 0 and 1
Procedure 01-OHP-4030-STP-027	CD Diesel Generator Operability Test (Train A), Revision 19b, Change1
Procedure 12-IHP-6030-IMP-075	Emergency Diesel Generator Tuning and Adjustment, Revision 0, Change 1 and 2, Revision 0a
Procedure 12-MHP-5021-032-017	Emergency Diesel Engine Main Bearing Removal, Inspection, and Installation, Revision 4, Change 1

Flow Diagrams

D. C. Cook Flow Diagrams for the Component Cooling Water System
D. C. Cook Flow Diagrams for the Essential Service Water System
D. C. Cook Flow Diagrams for the Auxiliary Feedwater System
D. C. Cook Flow Diagrams for the Compressed Air System
D. C. Cook Flow Diagrams for the Chemical and Volume Control System

D. C. Cook Flow Diagrams for the Safety Injection System
D. C. Cook Flow Diagrams for the Residual Heat Removal System
D. C. Cook Flow Diagrams for the Non-Essential Service Water System
D. C. Cook Flow Diagrams for the Feedwater System

Miscellaneous Documents

Updated Final Safety Analysis Report (UFSAR) Section 6.1, Application of ESF [Emergency Safety Feature] Design Criteria, Revision 18

UFSAR Section 9.5, Component Cooling Water System, Revision 18

UFSAR Table 9.5-4, Component Cooling Water Malfunction Analysis, Revision 17

UFSAR Section 14.3, Reactor Coolant Pipe Rupture (Loss of Coolant Accident), Revision 18

Design Basis Document DB-12-CCW, Design Basis Document for the Component Cooling Water System, Revision 1

Calculation MD-12-CCW-010-N, Setpoint for SV-71, CCW Thermal Relief Valve on the Spent Fuel Pool Cooling Heat Exchangers, Revision 0

Limited Design Change Package 2-LDCP-4682, Setpoint Change for SV-71, Revision 0

Routine Task 00018371, Perform Inspection of Tank 2-TK-37

Routine Task 00022267, Perform Inspection of Tank 1-TK-37

Structural Inspection Guideline and Report for Pressurized Steel Storage Tank, 2-TK-37 CCW Surge Tank, Performed December 21, 1999

NED-1999-00002-REP, Single Failure Evaluation of Selected Systems, Revision 0

Regulatory Guide 1.33, “Quality Assurance Program Requirements,” Revision 2, February 1978

ANSI N18.7 - 1976, “Administrative Controls for Power Plants”

10 CFR 50,59, “Changes, tests, and experiments”

SA-2002-TRN-007, “Maintenance Training Programs Comprehensive Self-Assessment,” Condition Report Tracking Number: 02350008, December 16 - 20, 2002

AEP Design Information Transmittal (DIT) No. DIT-S-01037-01, dated February 5, 2002

VTM-DRCO-0001, “Vendor Technical Manual for Terry Turbine Auxiliary Feed Pump Turbine,” Revision 5

VTM-TATE-0001, “Vendor Technical Manual for Tate Andale Strainers,” Revision 3

JO R0232469 - Disassemble/Inspect 2-ESW-102W (86-03), Repair as Necessary

JO R0088750-01, U2 ESW Strainer & Valve PMs

List of Acronyms

ASME	American Society of Mechanical Engineers
CCW	component cooling water
CR	condition report
EDG	emergency diesel generator
ESRR	expanded system readiness review
ESW	essential service water
GL	generic letter
NCV	non-cited violation
NRC	Nuclear Regulatory Commission
SDP	significance determination process
TDAFW	turbine-driven auxiliary feedwater
TTV	trip throttle valve