U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-315/95006(DRP); 50-316/95006(DRP)

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

Licensee: Indiana Michigan Power Company
1 Riverside Plaza
Columbus, OH 43216

Facility Name: Donald C. Cook Nuclear Power Plant, Units 1 and 2

Inspection At: Donald C. Cook Site, Bridgman, MI

Inspection Conducted: March 21 through May 15, 1995

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6/8/95
Date

Inspection Summary: Inspection from March 21 through May 8, 1995 (Report Nos. 50-315/95006(DRP); 50-316/95006(DRP))

Areas Inspected: Routine, unannounced safety inspection by the resident and region-based inspectors of: action on previous inspection findings, operational safety verification, onsite event follow-up, current material condition and housekeeping, radiological controls, security, regional requests (Temporary Instruction (TI) 2515/129 - Pressure Locking of PWR Containment Sump Recirculation Gate Valves), maintenance activities, surveillance activities, and engineering technical support.

Results: Of the 10 areas inspected, 3 inspection follow-up items were identified regarding the licensee's security program (paragraph 3.e). Based on this inspection TI 2515/129 was closed.

The following is a summary of the licensee's performance during this inspection period:

Plant Operations: Overall, both Units operated uneventfully during this inspection period. Generally, operator overall performance was good. However, there were two isolated examples of operator errors which occurred during this inspection period. One operator error resulted in a balance of plant transient in which the vacuum to the operating Unit 2 "East" main feedwater (MFW) pump condenser was partially lost. The second example

occurred on Unit 1 when a non-licensed operator at the waste disposal panel failed to shut the suction valve to the reactor coolant drain tank. This error resulted in a seal water transient on the Unit 1 No. 1 reactor coolant pump. Although these errors appeared to be isolated in nature, the inspectors will continue to monitor licensee performance in this area to ensure that an adverse trend does not develop.

Maintenance and Surveillance: Overall, the quality of maintenance performed at the plant was excellent. The I&C technicians' investigation and resolution of the Unit 2 SSPS problem on April 7 was excellent. The inspectors found that the licensee could have reduced the time the residual heat removal system was out of service through closer communication between Electrical and Mechanical groups and through improved scheduling of inter-disciplinary work. However, overall management of out of service time for safety-related equipment was good.

Engineering and Technical Support: Although two major issues remained with respect to closure of GL 89-10, motor-operated valve (MOV) program, inspectors found that the licensee had made progress. Some areas of concern which remained included validation of valve factors attributable to non-differentially pressure tested valves and poor documentation available to demonstrate the design basis capability of some motor-operated valves.

Plant Support: Management of the physical security program was excellent as demonstrated by the thorough planning and implementation of the security system uninterruptible power supply replacement project, the security system/alarm station replacement project, and the development of the Plant Protection Officer Transition Plan. The licensee's controls for identifying, resolving and preventing problems in the physical security area were good. The level of management support for the security program was excellent.

DETAILS

1. Persons Contacted:

Indiana Michigan Power/Cook Nuclear Plant

#A. A. Blind, Site Vice President/Plant Manager
#K. R. Baker, Assistant Plant Manager-Operations
L. S. Gibson, Assistant Plant Manager-Technical
#J. R. Sampson, Assistant Plant Manager
*J. E. Rutkowski, Assistant Plant Manager-Support
#H. F. Runser, Operations Production Supervisor
W. J. Flaga, Maintenance Department Production Supervisor
#T. Kanger, Scheduling General Supervisor
#F. Pisarsky, Maintenance Engineer Supervisor
D. L. Noble, Radiation Protection Superintendent
T. K. Postlewait, Site Engineering Support Manager
#*J. S. Wiebe, Quality Assurance & Control Superintendent
L. H. Vanginhoven, Project Engineering Superintendent
#*W. M. Hodge, Plant Protection Superintendent
*S. R. Gane, Administrative Compliance Coordinator
*L. L. Smead, Security Operations Supervisor
*A. Hemerling, Site Manager, Stanley Smith Security
*D. Landot, General Supervisor, Information Control Section
#*R. A. West, Licensing Coordinator
#M. Depuydt, Licensing Coordinator

#Denotes those individuals attending the exit interview conducted on May 15, 1995.
*Denotes those present at the security exit conducted on March 31, 1995

The inspectors also had discussions with other licensee employees, including: members of the technical and engineering staffs, reactor and auxiliary operators, shift engineers and foremen, maintenance personnel, and contract security personnel.

2. Action on Previous Inspection Findings: (92701)

a. (Closed) Unresolved Items 50-315/91009-01(DRS);50-316/91009-01(DRS): This unresolved item was issued due to the lack of testing data available to support the original OATIS system accuracy claims. The licensee evaluated available industry data and contracted Battelle to perform additional performance testing and validation of OATIS diagnostic equipment accuracy. Although this information was still under review by the NRC (as discussed in Section 6.c), this area will be evaluated during the GL 89-10 closeout inspection. This item is administratively closed.

b. (Closed) Unresolved Item 50-315/92008-01(DRS); 50-316/92008-01(DRS): This unresolved item pertained to the the use of "verifications" rather than "hold points" in the licensee's quality control program. In response to this concern,

the licensee strengthened the definitions of verifications and inspections, provided better examples of each, and emphasized when using a verification was not appropriate. The inspectors reviewed the actions taken in response to condition report 92-0863 and found them to be acceptable. The inspectors also reviewed procedure PMI 7090, Revision 6, and found adequate guidance on when inspections were required rather than verifications. This item is closed.

c. (Open) Unresolved Item 50-315/93006-01(DRS):50-316/93006-01(DRS): The degraded voltage calculations did not assume the worst case grid voltage as the starting point for evaluating the available voltage at motor operated valve motors. The licensee has since revised the majority of the degraded voltage calculations to use the degraded voltage relay setpoint minimum value. The remainder of the valves in the program were scheduled to be modified to improve the capability at the lower voltage. This topic is discussed in further detail in Section 6.b of this report. This item remains open pending further NRC review.

d. (Closed) Inspection Follow-up Items 50-315/93006-02(DRS);50-316/93006-02(DRS): These items were issued due to the lack of justification for valve factors, stem friction factors, load sensitive behavior, and MOV degradation. The justification of all design basis assumptions in the GL 89-10 program, including these issues, will be evaluated during the GL 89-10 closeout inspection. This item is closed.

e. (Open) Inspection Follow-up Item 50-315/93006-04(DRS); 50-316/93006-04(DRS): The licensee did not adequately justify assumptions regarding restoration of graphite foil packing gland follower nut torque to the previously tested value. Although the licensee performed testing to justify the assumption that the packing load could be restored to the previously tested value without adverse affects, the NRC continues to have reservations about this practice and was not prepared to accept this approach at this time, as discussed in Section 6.a. This item remains open pending further NRC review.

f. (Closed) Violation 50-316/94007-01(DRS): This violation concerned the failure by plant staff to perform a safety evaluation prior to permitting the Operations Department to increase the component cooling water supply temperature above the maximum value specified in the Updated Final Safety Analysis Report. In response to the violation, the licensee prepared Plant Manager Standing Order PMSO.161, "Acceptable Methods to Obtain Technical Direction for Activities Affecting Quality," Revision 0, dated January 18, 1995. The inspectors reviewed the standing order and found adequate instruction to plant personnel on when to seek technical direction as well as the required protocols. This item is closed.

g. (Closed) Inspection Follow-up Item 50-315/95005-02(DRP):50-316/95005-02(DRP):

The inspectors initiated this item to review the licensee's practice that allowed, under some circumstances, entering operational modes with associated surveillance requirements in "grace." The "grace" period was the 25 percent extension of the stated surveillance time interval allowed by TS 4.0.2. The licensee's practice appeared to conflict with TS 4.0.4, which allowed entry into a mode only if the surveillance requirements have been performed within the stated interval.

The inspectors reviewed corresponding requirements in NUREG 1431, "Standard Technical Specifications (Westinghouse)," Revision 0, which defined the "specified" frequency for surveillance requirements as including the "grace" period. In addition, NUREG 1431 allowed entry into a mode if the LCO surveillances have been met within their "specified" frequency. Therefore, the licensee's practice was acceptable, and this item is closed.

3. Plant Operations:

The licensee operated Unit 1 at full power with no significant events during the inspection period. The licensee operated Unit 2 at full power during most of this inspection period. On April 7, operators placed Unit 2 in a 6 hour Technical Specification (TS) required shutdown when the Instrumentation and Control (I&C) technicians encountered difficulty in completing a "Reactor Trip Solid State Protection System (SSPS)" surveillance within the 2 hour time limit. Unit 2 shutdown was averted when the I&C technicians successfully identified a faulty circuit card and completed the SSPS surveillance. On April 19, 1995, operators reduced power on Unit 2 to 55 percent to perform main feed pump condenser cleaning. The licensee returned the unit to full power on April 25, 1995. The licensee reduced power on Unit 2 to 55 percent again on April 28 to troubleshoot a potential problem with the "East" main feed pump overspeed trip device. No problem with the overspeed trip device was found and the licensee returned the unit to 100 percent power on May 2, 1995. Unit 2 continued full power operation for the remainder of the inspection period.

a. Operational Safety Verification: (71707)

The inspectors made the following observations with regards to operator performance during the inspection period:

1) On April 24, 1995, the plant experienced a partial loss of vacuum on the Unit 2 "East" main feedpump (MFP) condenser which was caused by operator error. The licensee was attempting to perform a gross leak check on the "West" MFP condenser following maintenance. To perform the leak check, the licensee intended to establish vacuum in the West MFP

condenser by connecting the East and West MFP condensers. The East MFP was operating at the time.

The condensers can be connected by opening 2-LPD-145W, the West MFP Condenser Air Off-take Shutoff valve. Licensee Procedure 02-OHP 4021.055.003, Attachment No. 4, Revision 5, "West Feed Pump Startup As Second Feed Pump," contained direction for operators to close 2-SMO-305, the West MFP Condenser Vacuum Breaker and then to open 2-LPD-145W. However, the operator began opening 2-LPD-145W prior to closing 2-SMO-305. The operator heard more air rushing through 2-LPD-145W than expected and immediately closed the valve. At the same time, operators in the control room received various alarms associated with loss of vacuum in the East MFP condenser. With the condensers cross-tied and a vacuum breaker open, the East MFP Condenser vacuum dropped from approximately 27.5" to 22". The operator prevented a total loss of vacuum by reclosing 2-LPD-145W. 2-SMO-305 was subsequently closed, and vacuum was successfully established in the West MFP Condenser.

The inspectors observed the operators subsequent restoration of the West MFP condenser later in the day and noted that the evolution was satisfactory. The licensee initiated Condition Report (CR) 95-0598 to investigate this evolution. The inspectors will review the licensee's completed investigation of the CR associated with this event.

2) On April 27, 1995, Unit 1 operators received a standpipe high level alarm on the No. 1 reactor coolant pump (RCP). The reactor operator (RO) requested that the non-licensed operator (NLO) in the auxiliary building reduce the pressure in the reactor coolant drain tank (RCDT) from 15 to 13 psig to lower the standpipe level. After lowering the RCDT pressure to 13 psig as requested by the RO, the NLO failed to return the suction valve, 1-DCR-205, to a closed position. Consequently, the RCDT pressure decreased to about 3 psig and the No. 1 RCP seal leakoff flow indication decreased to zero gallons-per-minute (gpm). The event was terminated several minutes later when the NLO shut 1-DCR-205 valve. The inspectors' discussion with the NLO indicated that the cause of the event appeared to be primarily attributable to personnel error by the NLO. The licensee initiated condition report (CR) 95-607 to review this event.

The inspectors discussed the incident with the reactor coolant system engineer and determined that RCDT pressure reduction to 3 psig would not cause a loss of flow past the No. 1 or 2 seals. However, the depressurization of the RCDT would cause the No. 1 seal leakoff flow indication to go to 0 gpm. The operators verified that all bearing, seal, and

leakoff temperatures were normal. Additionally, No. 1 RCP vibration levels remained normal.

b. Current Material Condition and Housekeeping: (71707)

The inspectors performed plant and selected system and component walkdowns to assess the general and specific material condition of the plant, to verify that work requests had been initiated for identified equipment problems. Walkdowns included an assessment of buildings, components, and systems: identification, tagging, accessibility, fire and security door integrity, scaffolding, radiological controls, and unusual conditions. Unusual conditions included but were not limited to water, oil, or other liquids on the floor or equipment; indications of leakage through ceiling, walls or floors; loose insulation; corrosion; excessive noise; unusual temperatures; and abnormal ventilation and lighting.

The inspectors also monitored the status of housekeeping and plant cleanliness for fire protection and protection of the safety-related equipment from intrusion of foreign matter. The inspectors observed that overall plant housekeeping and material condition was very good during the inspection period.

c. Radiological Controls: (71707)

The inspectors verified that personnel were following health physics procedures for dosimetry, protective clothing, frisking, posting, etc., and randomly examined radiation protection instrumentation for use, operability, and calibration. The inspectors did not identify any significant deficiencies in this area during the inspection period.

d. Security: (71707 & 81070)

A physical security inspection was conducted March 27-31, 1995 by a region based inspector. Inspection activities included: audits, corrective actions and management support; effectiveness of management controls; security program plans, and alarm stations and communications.

1) Plant Protection Officer Transition Plan

The licensee advised the inspectors of the intent to implement a Plant Protection Officer program that will result in a significant reduction in the number of armed security officers onsite. The change will not decrease the number of armed responders required by the security plan. The goal of the program was cost savings and improved efficiency through less ammunition usage and through security officer overtime and training reductions.

The licensee developed a transition plan which included visits to other utility sites that have implemented similar watchmen programs and open discussion meetings with the security officers. The testing of potential candidates for the armed Plant Protection Officer positions was tentatively scheduled from June 1 to July 1, 1995 with selection of personnel to be completed by July 15, 1995. The licensee stated that the transition period should be completed by August 15, 1995.

The licensee stated that on initial review of current security plan commitments indicated that a security plan change would not be required because the current plan includes watchmen.

Inspectors review of the licensee's implementation of the transition program is an inspection follow-up item. (IFI 50-315/95006-01; 50-316/95006-01)(DRSS))

2) Security Program Plans

The inspectors reviewed the licensee's approved security plan and one concern was noted with paragraph 6.6.2.1. The current security plan required concurrence for certain commands in the security computer. The revision stated that the system "may be configured to require or not require concurrence for command functions." (Ref 10 CFR 73.55 (e)(1)).

The licensee stated that in practice, concurrence was required for certain command functions and acknowledged that the revision provided a general description of system capability. The inspectors' review of the licensee's revision of the description to reflect a commitment to the concurrence function is an inspection follow-up item. (50-315/95006-02;50-316/95006-02(DRSS))

3) Alarm Stations

The licensee completed installation of a new security computer system/ central alarm station within a new structure. The upgrades were extensive. Initial system startup date was January 9, 1995.

The inspectors observed CAS operations and interviewed console operators regarding the reliability of the new system. Minor "debugging" type problems with the system continue to be resolved by the licensee working with the vendor. Overall system performance appeared good. Site acceptance testing was scheduled to begin May 22, 1995 and was scheduled to be completed June 2, 1995. The inspectors' review of the licensee's completion of the transition phase

is an inspection follow-up item. (IFI 315/95006-03;50-316/95006-03(DRSS))

Each week during routine activities or tours, the inspectors monitored the licensee's security program to ensure that observed actions were being implemented according to the approved security plan. The inspectors noted that persons within the protected area displayed proper photo-identification badges and those individuals requiring escorts were properly escorted. The inspectors also verified that checked vital areas were locked and alarmed. Additionally, the inspectors also observed that personnel and packages entering the protected area were searched by appropriate equipment or by hand.

Three inspection follow-up items were identified. No violations, deviations, or unresolved items were identified.

4. Regional Requests: (92701)

(Closed) Pressure Locking of PWR Containment Sump Recirculation Gate Valves (TI 2515/129):

The licensee's short-term actions to address potential pressure locking of containment sump recirculation valves, 1(2)ICM-305 and 1(2)ICM-306, were addressed per TI 2515/129, "Pressure Locking of PWR Containment Sump Recirculation Gate Valves." Pressure locking may occur in flexible-wedge and parallel-wedge (double disk) gate valves when fluid becomes pressurized within the valve bonnet, and the actuator was not capable of overcoming the additional thrust requirements resulting from the differential pressure created across both disks by the pressurized fluid. Containment sump recirculation valves may experience pressure locking during a postulated design-basis loss-of-coolant-accident (LOCA) and fail in the closed position. The inspectors reviewed the calculations and assumptions and determined that the containment sump recirculation valves were capable of operating under pressure locking conditions.

The recirculation valves were assumed to have water-filled bonnets. The licensee determined that the heat up of water in the recirculation valve bonnets due to high containment sump temperatures was limited due to procedural actions taken in 1(2) EHP 4030 STP.203, Appendix A. In these procedures, the operators filled the 17.5' section of pipe that sloped upward from the valve to the containment sump. This resulted in a stagnant body of water that would insulate the recirculation valves from the higher containment temperatures experienced during a LOCA. The inspectors reviewed these procedures and verified that these actions had been taken.

From this configuration, the licensee calculated the heat transfer over a four hour period, which would conservatively bound the required operation time of these valves, and determined that the temperature rise

due to conduction from the containment sump would be approximately 0.2°F. The inspectors reviewed the heat transfer calculation and found it to be acceptable. In addition, the ambient heat transfer was considered and it was determined that the bonnet water temperature rise due to the ambient temperature would be approximately 4.2°F.

From the cumulative bonnet water temperature rise (4.4°F), the bonnet pressure was calculated to increase to approximately 300 psia. Using this information, and the methodology described in NUREG/CR-5807, "Improvements in MOV Design and Prediction Models for Nuclear Power Plants," the licensee determined that the total disk drag force under these conditions was approximately 49,800 pounds. The licensee estimated the unwedging load by obtaining the unwedging ratio from a similar valve and applying this ratio to the known wedging thrust. Based on the summation of these forces, these MOVs would not have sufficient capability to overcome the pressure locking condition, when the worst case assumptions are applied.

The licensee determined that margin would be available if the coefficient of friction (COF) assumed in the actuator capability calculation was reduced from 0.15 to about 0.135. To support the use of a lower COF, the licensee referenced in-plant test data of other stub-thread valves which demonstrated that the as-left COFs were lower than 0.10. The licensee asserted that the clean, benign environment around these MOVs would reduce the potential of stem lubrication degradation and concluded that these valves possessed adequate capability to respond to a pressure locking event.

The inspectors reviewed the calculations and assumptions and concurred in the licensee's determination that the containment sump recirculation valves were capable of operating, even under pressure locking conditions. Although some conservatism in the analysis was removed by reducing the assumed COF, the inspectors concluded that the overall analysis was still conservative. For the purposes of TI 2515/129, the licensee's actions were acceptable; however, long-term solutions for these and other valves deemed susceptible to pressure locking will need to be evaluated in accordance with an upcoming Generic Letter on this issue.

No violations or deviations were identified.

5. Maintenance/Surveillance: (62703 & 61726)

a. Maintenance Activities: (62703)

Routinely, station maintenance activities were observed and/or reviewed to determine compliance with approved procedures, regulatory guides, industry codes, industry standards, and Technical Specifications (TS).

The following items were also considered during this review: Limiting Conditions for Operation requirements met while

components or systems were removed from service; approvals obtained prior to initiating work; functional testing and/or calibrations performed prior to returning components or systems to service; maintenance of quality control records; and activities accomplished by qualified personnel. Portions of the following Job Order (JO) activities were observed and reviewed:

JO R0018237, "Drain and Refill West RHR (residual heat removal) Motor Bearing Reservoir"

JO R0024639, "Inspect and Lube Reachrod Valve, 2-PW-282W"

JO R0034455: "Perform Diagnostic Testing of 2-IMO-320"

JO C0028833, "Investigate and Repair 1-Airlock-C612"

JO C0028836, "Equalize Charge 2-Batt-CD Cell #38"

JO C0026397, "Replace IMO-211 Torque Switch"

JO R0029406, "As Found Testing on IMO-211"

The inspectors observed portions of the preventive maintenance and motor-operated valve (MOV) diagnostic testing performed on the West RHR pump suction valve, 2-IMO-320, and found that the quality of work performed by the electricians was good.

The inspectors found that the licensee could have reduced the LCO time for the West RHR system through improved scheduling of work activities and closer coordination of work between electrical and mechanical disciplines. Having completed preventive maintenance on IMO-320 early, the electricians were ready to perform as-left testing of IMO-320 at about 2:30 PM instead of the initially scheduled time of 4:30 PM. However, when the electricians began the as-left diagnostic testing, the lead electricians realized that the mechanics still had to perform packing adjustment on 2-IMO-320. Because the packing adjustment would affect the diagnostic test, and because the mechanics who had the morning shift were about to turn over to the afternoon mechanics, the decision was made to defer the as-left diagnostic to the afternoon electricians. However, the inspectors determined that the licensee still exited the LCO within the initially scheduled time of 19.5 hours.

b. <u>Surveillance Activities:</u> (61726)

During the inspection period, the inspectors observed technical specification required surveillance testing and verified that testing was performed in accordance with adequate procedures, instrumentation was calibrated, results conformed with technical specifications and procedure requirements and were reviewed, and any deficiencies identified during the testing were properly

resolved. The inspectors also witnessed portions of the following surveillances:

*02-IHP-6030-IMP.449, "Power range Nuclear Instrumentation Calibration N41," Revision 0

*02-OHP-4021.055.005, "East Feed Pump Turbine Miscellaneous Trip Test (Attachment no. 1)," Revision 5

*02-OHP-4030.STP.017E, "East Motor Driven Auxiliary Feedwater System Test," Revision 5

*12IHP4030.STP.600, "AB, CD and N-Train Battery Weekly Surveillance and Maintenance," Revision 1

*02-OHP4030.STP.51S, "South Safety Injection Pump System Test," Revision 5

On April 7, 1995, the Instrumentation and Control (I&C) technicians were unable to satisfactorily complete the Memories Selector Switch portion, section 7.4.20, of the "Reactor Trip Solid State Protection System (SSPS) Logic and Reactor Trip Breaker Train "B" Surveillance Test," **2IHP4030.STP.511, Revision 2. The I&C technicians found that one of the source range nuclear instrument block functions tested unsatisfactorily. Because of the time required to investigate the problem and make repairs, Unit 2 entered a 6 hour Technical Specification (TS) mandated shutdown requirement to hot standby at 3:06 PM as required by ACTION 1 associated with TS 3.3.1.1. Power was not actually reduced because the cause of the problem was identified early into the 6 hour shutdown period.

The I&C technicians were successful in investigating the problem and found that the problem was with a failed "A406" universal logic card. The I&C technicians replaced the card and satisfactorily re-performed the surveillance in its entirety. The operators exited the 6 hour shutdown action statement at 4:01 PM when bypass breaker "B" was opened. The operators initiated condition report 95-0527 to document the problem with the SSPS system.

No violations or deviations were identified.

6. Engineering & Technical Support: (37700)

The inspectors monitored engineering and technical support activities at the site including any support from the corporate office. The purpose was to assess the adequacy of these functions in contributing to other functions such as operations, maintenance, testing, training, fire protection, and configuration management.

a. Packing Gland Nut Torque Restoration Study

As discussed in previous NRC Inspection Report 50-315/93006; 50-316/93006(DRS), an inspection follow-up item was issued due to the licensee's inadequately justified assumptions regarding restoration of graphite foil packing gland follower nut torque to the previously tested value.

To address this concern, the licensee performed a lab study on a test valve to validate this position. Although this testing demonstrated that, under some conditions, retorquing of the packing would not adversely impact the stem packing load, there were still situations where this practice could inadvertently increase the stem packing load. Due to this concern, the NRC had reservations about the retorquing of packing without subsequent diagnostic testing and was not prepared to accept this approach. The industry, through the MUG Packing Committee, reviewed the history of this issue and expressed similar reservations about this practice.

One approach that would be acceptable would be to perform in-situ packing adjustments, per the applicable procedures, with subsequent diagnostic testing to verify that packing loads had not increased beyond the original tested value. If sufficient testing data were collected to support this engineering position, then the NRC would consider this position to be suitably justified. This area will be reviewed again prior to program closure.

b. Degraded Voltage

As discussed in previous NRC Inspection Report 50-315/93006; 50-316/93006(DRS), the licensee's degraded voltage calculations did not assume the worst case grid voltage as the starting point for evaluating the available voltage at motor operated valve motors. Instead, the licensee's degraded voltage calculations used a minimum expected grid voltage study that was based on a 5-year grid history. The licensee has since revised the majority of the degraded voltage calculations to use the degraded voltage relay setpoint minimum value. The remainder of the valves in the program were scheduled to be modified to improve the capability at the lower voltage. Currently, eleven MOVs still rely on this 5-year study. Eight of these valves were located in the auxiliary feedwater (AFW) system and three of these valves were located in the steam supply to the AFW steam supply system.

The inspector determined that the proposed actions to modify these valves in the upcoming refueling outages were acceptable; however, the existing capability of these valves was not evaluated. The valve capabilities and progress on the proposed actions will be reviewed prior to program closure.

c. Diagnostic Equipment Error (OATIS)

In response to the lack of OATIS system accuracy validation testing, identified in Inspection Report No. 91009, American Electric Power (AEP) contracted Battelle to perform additional performance testing and validation of OATIS diagnostic equipment accuracy. This study concluded that the diagnostic errors for static testing were +/-26% and -3% to +26% under dynamic conditions, for the stems tested.

Based on the inspector's limited review of these evaluations, it appeared that the OATIS data could be effectively used to demonstrate the operability of the specific valves tested. However, given these errors, it would be difficult to use this information to accurately determine the validity of design-basis assumptions such as valve factor and COF. Consequently, for those MOVs tested with OATIS diagnostic equipment, validation of the design-basis capability may require the use of more accurate VF and COF data (best available data) from other similar valves to determine the thrust and torque requirements and capabilities (i.e., grouping). In addition, appropriate OATIS errors would need to be applied to the thrust and torque windows to ensure that these MOVs would be capable of meeting those requirements. The NRC will review the Battelle study, and the overall consolidation and implementation of the study results to the GL 89-10 program prior to program closure.

d. Valve Testing Packages

The inspector reviewed the static and dynamic tests for three valves. Based on this sample, the inspector identified several areas of concern, including the evaluation and documentation of testing data, the feedback of testing data, and the application of diagnostic equipment errors.

1) Evaluation and Documentation of Testing Data

The inspector expressed concerns about the lack of documented evaluations of testing data. For example, the open differential pressure (DP) test evaluation sheet for 1-ICM-321 (tested on 3/30/94) did not evaluate the open test data because the test was performed at less than 80% of the design basis DP, and it was concluded that this test data was inconclusive. An informal written evaluation to justify the design basis capability of the valve to open under design basis conditions was provided to the inspector. The inspector reviewed the evaluation and concluded that it provided reasonable assurance of valve operability. The licensee indicated that evaluations of this nature were being documented and included in the program closure document.

In addition, 1-ICM-321 was over-thrusted. The inspector reviewed Condition Report (CR) 94-0520, written to evaluate the over-thrusted condition, and found the CR to be thorough. However, in spite of the over-thrust, there was no documented evaluation to determine if the valve was potentially overtorqued. Although the licensee provided information to demonstrate that the valve had not been overtorqued, the testing procedures and test acceptance criteria did not require evaluation of overtorque. After discussions with the cognizant individuals, it appeared that these evaluations had been performed; however, these evaluations were not documented. This was due primarily to the reliance on a spreadsheet to evaluate the testing data. This information was then used to determine the operability of the valves prior to returning them to service. The use of this spreadsheet was demonstrated to the inspector, and it appeared to sufficiently address the necessary acceptance criteria (e.g., overtorque).

The inspector concluded that, although the required evaluations appear to have been performed, the documentation of these evaluations was a weakness.

2) Feedback of Testing Data

The inspector noted several instances where testing data was not compared to revised design calculations. For example, 1-IMO-256, was DP tested in 1992 (using OATIS). The OATIS unseating load of 14.69 kips was extrapolated to the design-basis DP resulting in a calculated design-basis opening thrust of 17.30 kips. This extrapolated opening thrust was compared to the minimum available thrust at degraded voltage conditions of 19.00 kips, calculated by procedure DCCPV12MV001N, "GL 89-10 Thrust Calcs," revision 6, Attachment 4, and it was determined that the valve would have enough capability to open under design basis conditions. However, when the thrust window calculation was revised (revision 7), the minimum available thrust at degraded voltage conditions was recalculated to be only 16.01 kips. Based on the inspector's review of this test package and the current thrust window, the inspector questioned the ability of the valve to open under design-basis, degraded voltage conditions.

To determine the valve capability, the licensee used the DP test thrust and torque obtained at torque switch trip (TST) in the closing direction to back out a stem coefficient of friction (COF) of 0.04. This was then used to determine the thrust available to open the valve under degraded voltage conditions. The licensee determined that a COF of up to 0.13 would provide sufficient thrust to unseat the valve at degraded voltage conditions. The inspector questioned the

accuracy of the 0.04 stem COF since this value was much lower than typically observed in industry. The inspector concluded that the stem COF was not reliable due to the large potential errors associated with this diagnostic equipment. Based on the Battelle testing, the OATIS thrust data could have been 26% higher than the actual thrust. Given this error and the test data, the COF for this MOV could have been as high as 0.10. Although this was still less than the average COF of approximately 0.11 for similar valve stems and stem lubricant, based on in-plant VOTES test data, it was evident that the available margin may be significantly less than initially calculated.

Since margin was available, even with the application of the OATIS errors to the test data, the inspector was not concerned about immediate operability; however, the use of similar arguments without consideration of possible factors that might influence the data in a nonconservative direction is of concern. The licensee indicated that the use of OATIS test data in this manner was limited to the evaluation performed for 1-IMO-256 and that OATIS data was not typically used in the determination of "best available data," such as valve factors or stem COF.

For 1-ICM-321, a discrepancy was noted between the valve factor (VF) used to calculate the thrust window and the measured VF. Although the valve was set to operate within a thrust window based on an assumed VF of 0.6, the closing VF was later calculated to be 0.91. If the valve had been set up near the bottom of the thrust window, the increased VF could have increased the minimum required thrust (MRT) to the point where the valve may not have had enough margin to operate under design basis conditions. The thrust window was not recalculated and the impact of the higher valve factor was not evaluated. Although the inspector was not concerned about the operability of this particular valve, the inspector was concerned about the potential for this lack of feedback to exist for other valves.

In response to the inspector's overall concerns in this area, and in other areas, the licensee provided draft 89-10 closure summary reports prepared by VECTRA to demonstrate the ongoing efforts to incorporate and evaluate test data and design data. From the sample of test packages reviewed, it appeared that the historical feedback of testing information was weak. This area will be reviewed prior to program closure.

3) <u>Diagnostic Equipment Error - VOTES</u>

The inspector determined that the application of VOTES diagnostic errors to the thrust windows was acceptable.

However, the application of other sources of VOTES error was not well justified. In the tests reviewed, the inspector noted that the pullout thrust was not extrapolated to account for diagnostic errors associated with data outside of the VOTES Force Sensor (VFS) calibration range. Upon further review and discussions with licensee personnel, it was discovered that in past testing this data was not used due to the high errors associated with calibrating the VFS under minimal tension. Instead of increasing the tension in the stem during the calibration stroke (which would decrease the required extrapolation) as described in the vendor's guidance, alternate means of justification were used.

Previously, the maximum pullout current was compared to the extrapolated, degraded-voltage inrush current to determine if the pullout current required was higher than the available motor current at degraded voltage. The licensee has since determined that this methodology was not acceptable and was in the process of reevaluating past test data. In future tests, thrust and torque will be measured using VOTES and a thrust measurement device (TMD), where possible, to determine opening thrust based on displacement of the LVDT. The adequacy of the licensee's evaluations of past testing data and the application of diagnostic error will be reviewed prior to program closure.

e. Best Available Data/Grouping

The inspector reviewed the August 24 and December 30, 1994, "Best Available Data" evaluations. These evaluations were written to collect and to present available testing information and corresponding assumptions for load sensitive behavior (rate of loading), stem/stem-nut coefficient of friction (COF), aging effects, lubrication degradation, and valve factor.

Although the basis for the assumed load sensitive behavior of 15% and the basis for the assumed coefficient of friction value of .15 were not reviewed, it appeared that these values were generally consistent with plant and industry data. The inspector also noted that a 5% margin was assumed to account for COF degradation, spring pack relaxation effects, and other possible aging related degradation. The justification for these assumptions will be reviewed prior to program closure.

The inspector reviewed the data used to justify the application of tested valve factors and industry data to non-DP tested valves (or to DP tested valves with unreliable test data). In some cases, such as the Walworth 8" flexible wedge gate valves, the licensee performed VOTES testing on all four of these valves, took the most conservative valve factor measured (0.56), and revised the assumed valve factor for these valves to 0.60.

However, the majority of the assumed valve factors were based on limited (useful) in-plant testing data. D.C. Cook performed a commendable amount of DP testing. Unfortunately, due to limitations of the OATIS diagnostic testing equipment, the valve factors for the majority of the DP tests were not able to be determined or were questionable. This necessitated the extensive use of industry testing data and the application of limited (useful) in-plant test data to a large number of other valves. In many cases, the inspector found the justification for the selected valve factors to be weak or inadequate.

One example was the 0.30 valve factor used for all Anchor-Darling (A/D) parallel seat gate valves, based on EPRI testing data and in-plant testing data. Of the fourteen DP tests performed on valves of this type, nine of the OATIS tests could not be used to determine the valve factor and three of the OATIS tested valve factors were of questionable accuracy, based on the limitations of the diagnostic equipment. This left two VOTES tests, which supported the use of the 0.30 valve factor; however, the EPRI testing data did not support the use of a 0.30 valve factor for all sizes, pressure classes, and applications of A/D parallel seat gate valves.

Other examples included the use of industry data taken from NRC inspection reports, such as the use of data from 6" solid wedge Crane valves on 12" Crane-Aloyco split wedge gate valves and the application of ComEd testing data for A/D valves to Lunkenheimer valves of a higher pressure class. In addition, although ComEd white papers were used to select fairly conservative valve factors for a number of A/D flexible wedge gate valves, no documentation was available to justify the acceptability of the ComEd test data to the specific valves.

In most cases, it appeared that the licensee attempted to select the most conservative valve factors based on the available industry information. In spite of the poor justification of the selected valve factors, the apparent conservatism in the selected values should bound the actual valve factors. However, for the purposes of design-basis verification and program closure, these assumptions must be appropriately justified. The justification for the application of valve factors to non-DP tested valves, and the justification for the use of "best available data," in general, to validate design-basis capability will be reviewed prior to program closure.

No violations or deviations were identified.

7. <u>Inspection Follow-up Items:</u>

Inspection follow-up items are matters which have been discussed with the licensee involving action on the part of the NRC or the licensee or

both. Inspection follow-up items disclosed during the inspection are discussed in paragraphs 3.e.1, 3.e.2, and 3.e.3.

8. Meetings and Other Activities:

a. Exit Interview (30703)

The inspectors met with the licensee representatives denoted in paragraph 1 at the conclusion of the inspection on May 15, 1995. The inspectors summarized the scope and results of the inspection and discussed the likely content of this inspection report. The licensee acknowledged the information and did not indicate that any information disclosed during the inspection could be considered proprietary in nature.