May 31, 2000

Mr. R. P. Powers
Senior Vice President
Nuclear Generation Group
American Electric Power Company
500 Circle Drive
Buchanan, MI 49107-1395

SUBJECT: NRC INSPECTION REPORT 50-315/2000002(DRS); 50-316/2000002(DRS)

Dear Mr. Powers:

On May 3, 2000, the NRC completed a motor-operated valve (MOV) and inservice testing (IST) inspection at your D. C. Cook Units 1 and 2 reactor facilities. The purpose of the first part of the inspection effort was to verify that the Unit 2 MOVs have sufficient capability under design-basis conditions to perform their intended functions. The inspection addressed NRC Manual Chapter 0350 Case Specific Checklist Item No. 16, "Resolution of Operability of Motor-Operated Valves in the GL 89-10 Program." The second part of the inspection was to verify that the IST program and the associated scope of components in the program were adequate to address a portion of RAM Item R.2.1.23, LER 50-315/99032-00, "Failures to Comply with Technical Specification 4.0.5 Identified by Inservice Testing Program Assessment." The enclosed report presents the results of this inspection.

Areas examined during the inspection are identified in the report. Within these areas, the inspection consisted of a selective examination of procedures and representative records, and interviews with personnel. At the conclusion of the inspection, the findings were discussed with members of your staff at an exit meeting on May 3, 2000.

Significant progress has been made over the past year by your staff to verify the design capability of the Unit 2 MOVs included in your GL 89-10 MOV program. In general, the methodologies used to determine the design capabilities were acceptable. For certain valves, further justification for use of these methodologies will be required as part of your long term MOV program. There were several valves that had a minimal amount of positive capability margin, based on the design calculations, that will require further work on your part to ensure long-term capability. Based on this inspection we were able to verify that the GL 89-10 Unit 2 MOVs have sufficient capability under design-basis conditions to perform their intended functions. Further, we were able to conclude that the GL89-10 Unit 2 MOV program was adequate to support Unit 2 restart and closure of Case Specific Checklist Item No.16. However, further inspections of your MOV program will be required to close-out the NRC's review of the actions taken in response to GL 89-10.

Regarding the IST program, the rescoping effort has been effective in ensuring that all the components required to be tested by 10 CFR 50.55a have been identified in the program document and the appropriate testing has been assigned to verify the components' function(s). Based on results of this inspection and the surveillance testing inspection documented in Inspection Report 50-315/2000001; 50-316/2000001, the IST program was considered adequate to support Unit 2 restart.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be placed in the NRC Public Electronic Reading Room (PERR) link at the NRC homepage, http://www.nrc.gov/NRC/ADAMS/index.html.

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

/RA/

John A. Grobe, Director
Division of Reactor Safety

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

Enclosure: Inspection Report No. 50-315/2000002(DRS);
50-316/2000002(DRS)

cc w/encl: A. C. Bakken III, Site Vice President
J. Pollock, Plant Manager
M. Rencheck, Vice President, Nuclear Engineering
R. Whale, Michigan Public Service Commission
Michigan Department of Environmental Quality
Emergency Management Division
MI Department of State Police
D. Lochbaum, Union of Concerned Scientists

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U.S. NUCLEAR REGULATORY COMMISSION
REGION III

Docket Nos:	50-315, 50-316
License Nos:	DPR-58, DPR-74
Reports No:	50-315/2000002; 50-316/2000002
Licensee:	Indiana Michigan Power Company
Facility:	Donald C. Cook Nuclear Generating Plant
Location:	1 Cook Place Bridgman, MI 49106
Dates:	April 10-14, 2000
Exit Meeting:	May 3, 2000
Inspectors:	A. Dunlop, Reactor Engineer, RIII M. Holbrook, Principal Investigator, INEEL
Approved By:	G. Shear, Chief Plant Support Branch

EXECUTIVE SUMMARY

D. C. Cook Nuclear Generating Units 1 and 2
NRC Inspection Report 50-315/2000002; 50-316/2000002

Maintenance

- Based on the sample reviewed, the Inservice Testing (IST) program has an adequate basis to monitor degradation of components required to be tested per 10 CFR 50.55a. This review verified components with safety-functions were included in the IST program and adequate testing was identified to verify the safety functions of each component. Based on this inspection and the surveillance inspection documented in Inspection Report 50-315/20000001; 50-316/20000001, Restart Action Matrix (RAM) Item R.2.1.23 is considered closed. (Section M1.1.b)

Engineering

- Significant progress was made to resolve motor-operated valve (MOV) program issues and a number of improvements relating to the design-basis capability of program valves have been implemented. The licensee was able to verify that all MOVs required for Unit 2 restart met their design-basis capability requirements. Several issues were identified that required further review or justification as part of the long-term MOV program. These issues included: (1) the development of appropriate long-term actions to verify the applicability of the Electric Power Research Institute's MOV Performance Prediction Methodology to certain valves; (2) the periodic review of as-found stem friction coefficient performance to ensure that MOV program assumptions remain valid; and (3) the development of an action plan to obtain additional confirmatory data based on a range of 575/550 volt motor sizes. (Section E1.1.b.1)

- Although actions were performed to improve valve condition, approximately 22 percent of the valves had low margins based on the design calculations and valve set-up. The licensee per the MOV program would include the associated valves in the margin improvement program as part of the long-term MOV program. (Section E1.1.b.2)

- The licensee appropriately reviewed the plant's design basis and increased the Unit 2 MOV program scope. (Section E1.1.b.2)

- The licensee adequately addressed the pressure locking/thermal binding issues with Generic Letter 95-07 to support the issuance of a safety evaluation. (Section E1.1.b.3)

- Based on the installation of the equalizing line modification to the recirculation sump isolation valves to resolve the pressure locking concern, RAM Item R.2.16.1 is considered closed. (Section E1.1.b.3)

- The licensee has adequately addressed NRC concerns raised in the previous Generic Letter 89-10 inspection and incorporated the responses into the MOV program. (Section E1.1.b.4)

- Licensee self-assessments identified numerous programmatic and technical issues, a number of which were resolved prior to this inspection, although several needed further review and were being adequately tracked by the Corrective Action Program. The use of outside MOV experts provided significant insights into the MOV program. These insights included revisions to some of the methodologies and assumptions, which provided the basis used to verify MOV design capability. (Section E7.1)

- Based on the completed corrective actions and on actions committed to be completed before startup, the inspectors concluded that Case Specific Checklist Item No. 16 "Resolution of Operability of Motor-Operated Valves in the GL 89-10 Program" had been adequately addressed by the licensee. (Section E8.1)

Report Details

Summary of Plant Status

Both units were in an extended shutdown during this inspection period.

M1 Conduct of Maintenance

M1.1 Inservice Testing (IST) of Pumps and Valves (73756)

a. Inspection Scope

The inspectors reviewed documentation to determine if adequate actions were taken with respect to the IST program as part of Restart Action Matrix (RAM) Item R.2.1.23. Specifically, the inspectors reviewed the licensee's draft IST program, Revision 2. Areas reviewed during the inspection included program comments, test deferral justifications, and relief requests. The Unit 2 component cooling water (CCW) and auxiliary feedwater (AFW) systems were selected to review in detail to ensure all components required to be tested by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code) were included in the revised program and adequate testing was identified to verify the safety functions of each component. In addition, Licensee Event Report (LER) 99-032-00 was reviewed to ensure components identified in the LER were included in the IST program with the appropriate testing identified. The inspectors used NRC Inspection Procedure (IP) 73756, "Inservice Testing of Pumps and Valves," and NUREG 1482, "Guidelines for Inservice Testing at Nuclear Power Plants," as guidance during the inspection.

b. Observations and Findings

The IST program was undergoing revision due to program concerns identified by self-assessments and NRC inspections. As part of the program revision, an IST basis document was being developed. The revised program was developed to be in compliance with the requirements of the 1989 Edition of the ASME Code, Section XI. Section XI specified that testing be performed in accordance with Operation and Maintenance (OM) standards; OM-6 for pumps, OM-10 for valves, and OM-1 for pressure relief devices. The IST program document, however, included references to both the applicable sections of the 1989 Edition and to related sections of the 1995 Edition of the Code, which introduced some confusion as to the basis for the program. With the exception of one reference to the 1995 Edition (analysis allowed for pump corrective actions), for which the licensee has obtained relief, the references to the newer edition of the Code were not being used by the licensee. The references had been included based on a perception that the IST program would be upgraded to the newer Code edition in the near future. The licensee stated these references to the newer Code edition would be deleted to remove the confusion prior to approval of Revision 2 to the IST program.

b.1 IST Program Review

Overall the draft IST Program document, including program comments, test deferral justifications, and relief requests, was in accordance with 10 CFR 50.55a, the ASME Code, and NUREG-1482. Some minor issues were identified that the licensee included on Condition Report (CR) 00-05618, which is discussed in the following section of this report.

One issue that was identified concerned relief request REL-003 for the CCW to letdown heat exchanger regulating valve (CRV-470). Per the relief request, this air-operated control valve has no local or remote position indication to allow stroke-time testing as required by the Code. The licensee proposed alternate testing of full-stroke exercising the valve on a quarterly basis as part of the relief request. The inspectors noted that the relief was provisionally granted in the NRC safety evaluation, dated May 27, 1997, based on the impracticality of performing the required testing provided that the licensee develop acceptance criteria for the proposed alternate testing. This was necessary since the relief request did not propose any method to monitor the valve for degradation. The licensee indicated that the criteria developed was to ensure the valve operated smoothly with no indication of binding during the full-stroke exercising surveillance. This criteria, however, would not adequately monitor the valve for degradation and, as such, was not acceptable to meet the conditions of the relief request approval. In addition, the inspectors noted several other similar relief requests with provisional approval. The licensee indicated that the surveillance procedure was actually stroke-time testing CRV-470 by local observation of valve stem movement. Since the Code specified test was being performed, the relief request was no longer required. The licensee indicated the relief request would be withdrawn. The licensee was reviewing other provisionally granted relief requests to ensure conformance with the safety evaluation approval.

b.2 IST Scoping of Components

The inspectors' review of the revised IST program did not identify significant concerns with the scoping of components for the CCW and AFW systems or the components identified in LER 99-032-00. The review also concluded that the required testing assigned for the CCW and AFW systems' components were acceptable to test the components' safety function(s). One issue was identified concerning the AFW turbine-driven pump governor valve (open/close safety function) and the closed safety function for the AFW turbine-driven pump trip and throttle valve, which were not included in the IST program. The licensee determined these valves and/or associated safety functions were inadvertently deleted from the program. Testing of these safety functions, however, was still included in the applicable surveillance procedure. The licensee documented this issue for valve QT-506 on CR 00-05530 and for valve QT-507 on CR 00-05577. This was considered an administrative issue since the required testing was still being accomplished.

A number of other issues were identified with the IST Plan Valve Tables included in the program document for the CCW and AFW systems. These issues were documented on CR 00-05618 and included the following:

- A number of valves were identified that have a passive safety function, but were not identified in the program. The passive function, however, would not require any additional testing. The majority of these valves were associated with the CCW to the reactor coolant pump thermal barriers whose open function provide cooling to prevent a rupture of the thermal barriers.

- The program document did not clearly identify components tested as "skid-mounted" per the guidance of NUREG-1482, Section 3.4. When major components fail a surveillance test, the "skid-mounted" components should be reviewed as they may not have functioned as required.

- A number of typographical and minor errors.

c. Conclusions on the Inservice Testing Program

Based on the sample reviewed, the IST program has an adequate basis to monitor degradation of components required to be tested per 10 CFR 50.55a. This review verified components with safety-functions were included in the IST program and adequate testing was identified to verify the safety functions of each component. Based on this inspection and the surveillance inspection documented in Inspection Report 50-315/316-00001, RAM Item R.2.1.23 is considered closed.

III. Engineering

E1 Conduct of Engineering

E1.1 Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," Program Implementation (TI 2515/109)

a. Inspection Scope

This inspection evaluated the process for qualifying the design-basis capability of motor-operated valves (MOVs) for the restart of Unit 2. The inspection concentrated on MOVs based on a combination of low margin, risk importance, or other unique valve characteristics. A valve sample that included several program closure methods used by the licensee was selected to verify design-basis capability. The inspectors reviewed design-basis documents, thrust calculations, test packages, and engineering evaluations for the following MOVs:

2-CCM-430	CCW to Containment Hydrogen Skimmer Vent Fan #1 Motor Air Cooler Containment Isolation [unbalanced globe valve with rising-rotating stem]
2-CCM-454	Reactor Coolant Pumps Thermal Barrier CCW Return Header Containment Isolation [unbalanced globe valve]
2-CCM-459	CCW to Reactor Coolant Pumps Train 'B' Containment Isolation [butterfly valve]
2-ICM-251	Boron Injection Tank Train 'B' Outlet Containment Isolation [double-disc gate valve]

2-IMO-315 East Residual Heat Removal (RHR) and North Safety Injection to Reactor Coolant Loops #1 and #4 Hot Legs Shutoff [flex wedge gate valve]
2-IMO-324 West RHR Pump PP-35W Discharge Crosstie Shutoff [double-disc gate valve]
2-NMO-151 Pressurizer Power Operated Relief Valve (PORV) Block Valve [flex-wedge gate valve]
2-WMO-703 East Essential Service Water (ESW) Pump PP-7E Discharge Shutoff [butterfly valve]
2-WMO-734 East CCW Heat Exchanger HE-15E ESW Outlet Shutoff [double offset butterfly valve]

The inspectors also reviewed other licensee documentation used to justify program assumptions, such as stem friction coefficients and load sensitive behavior. Further, the inspectors reviewed the specific concerns identified during the previous GL 89-10 program inspection (Inspection Report 50-315/98020; 50-316/98020).

b. Observations and Findings on GL 89-10 Program Implementation

The licensee had made significant progress on the GL 89-10 program with respect to previous NRC MOV inspections. A majority of the MOV actuators had undergone significant refurbishment or modification as part of the process to verify the design basis capability of the valves.

b.1 MOV Sizing and Switch Settings

The licensee's MOV design-basis requirements were typically based on thrust predictions provided by the Electric Power Research Institute's (EPRI) MOV Performance Prediction Methodology (PPM). Margins were added to account for the effects of load sensitive behavior and potential stem factor degradation. Actuator output capabilities were determined using Limitorque's current guidance. The following paragraphs provide additional detail regarding the licensee's MOV switch setting methodologies.

b.1.1 Use of the Performance Prediction Methodology

The MOV switch setting calculations included results of independent PPM calculations that used the differential pressure, flow, and temperature conditions established by the design-basis review documents. Based on review of the sample valves, the licensee typically used the PPM in accordance with the guidance provided by EPRI. However, several cases were noted where use of the PPM was not directly applicable due to differences in valve design or fluid conditions. In these cases, the PPM results were considered to be "best available data" by industry standards.

Inspection Report 50-315/98020; 50-316/98020 noted that licensee personnel had not formally reviewed the NRC's safety evaluation of Topical Report TR-103237, "EPRI Motor-Operated Valve Performance Prediction Program," for information that may affect the use of EPRI's PPM. Calculation MD-12-MSC-020-N, "Guidance for Addressing the Conditions and Limitations of the EPRI MOV Performance Prediction Program," was developed to establish calculation check lists that were used to ensure that each PPM

calculation addressed all applicable conditions and limitations contained in the safety evaluation. In addition, MOV Engineering Action Plan MISC 00-365 was created to identify the specific actions needed to implement the MOV program, including a plan to acquire confirmatory data to resolve conditions where the PPM was considered to provide "best available data" or cases where the safety evaluation required confirmatory test data due to limitations in the EPRI validation of the PPM. The following paragraphs identified issues in the Engineering Action Plan to be addressed in long-term to justify the applicability of the PPM to Unit 2 MOV program.

- Crane-Aloyco Solid-Wedge Gate Valves: The PPM was applied based on the similarity of the Crane-Aloyco solid-wedge gate valve design with other solid-wedge gate valves tested by EPRI. The Engineering Action Plan noted that Northeast Utilities had applied the PPM in a similar manner and had confirmed the bounding nature of the PPM through in-plant testing.

- Lunkenheimer Flex-Wedge Gate Valves: The PPM was applied based on the similarity of the Lunkenheimer flex-wedge gate valve design with the flex-wedge gate valves tested by EPRI. No additional actions were noted in the Engineering Action Plan.

- Copes-Vulcan Parallel-Disc Gate Valves: The flow isolation PPM hand calculation was applied for Anchor/Darling double-disc gate valves based on the similarity of the two different valve designs (excluding the Anchor/Darling's wedging mechanism). The Engineering Action Plan noted that several other plants were using the PPM Anchor/Darling method to establish switch settings.

- Gate Valves with Stainless Steel Guides > 100°F: The valves with stainless steel guide surfaces that operate with fluid temperatures that exceed 100°F were modeled in the PPM as carbon steel guides. EPRI was in the process of conducting friction tests to determine the applicability of the PPM for these conditions. These results would be used to prioritize the valves that were the most susceptible to galling. The licensee planned to install new discs with Stellite on the guide faces, as required, beginning with the highest risk valves.

- Balanced Disc Globe Valves with Flow Over the Seat: The licensee reviewed EPRI Topical Report TR-113558, that documented a revised method for predicting balanced disc globe valve thrust requirements for under-seat and over-seat flow conditions. The topical report stated that PPM estimates bound the results obtained from the revised method. Since the PPM was used for these valves, the licensee believed that no additional actions were necessary to justify use of the PPM for balanced disc globe valves.

- Balanced Disc Globe Valves with Steam Flow: The licensee relied on EPRI Topical Report TR-113558 (note above) as a basis for its view that the PPM was conservative for balanced disc gate valves. This conservatism was assumed to bound any uncertainty associated with steam flow. Therefore, the Engineering Action Plan did not identify any additional actions to justify use of the PPM for balanced disc globe valves that must operate in steam flow conditions.

- Unbalanced Disc Globe Valves > 150°F: A valve factor of 1.5 was used based on the results of a single globe valve test performed by EPRI as part of the PPM prototype test program. EPRI was working on a refined globe valve method that will address fluid temperatures that exceed 150°F. The Engineering Action Plan notes that EPRI's information will be reviewed to ensure that the current requirements remain conservative.

- Rising-Rotating Stem Globe Valves with Over the Seat Flow: A hand calculation, based on PPM methodologies, was performed to determine the dynamic requirements for these valves. The settings were justified based on the large margin available when compared to the valves' dynamic thrust requirements. However, a first-principles hand calculation was used to estimate the torque required to rotate the stem through the packing (which was the primary load for these valves).

- Double Offset Butterfly Valves: The licensee would take action to obtain applicable test data or hydrodynamic torque coefficients for any double offset butterfly valve that has less than a 25 percent difference between its maximum required torque and the estimated hydrodynamic torque.

- PPM Dynamic Unwedging Method: Section 1.3.6.a.2 of Attachment 3, 12 EHP 5074 MOV.001, "Motor Operated Valve Program," stated that a modified version of the PPM unwedging calculation (documented in EPRI Topical Report TR-113564) may be used. This version differed from the approved PPM unwedging calculation because: (1) static test unwedging measurements were used instead of peak closing thrust measurements; (2) no packing load adjustments were made; and (3) the 'C' coefficient applied to the dynamic load term was modified as compared to the original method documented as part of the PPM.

- Comparison of Anchor/Darling Double-Disc Gate Valve and Aloyco Split-Wedge Gate Valve PPM Results to Test Data: The Engineering Action Plan noted that in-plant dynamic testing of Anchor/Darling double-disc gate or Aloyco split-wedge gate valves was not part of the future dynamic test program. Therefore, the licensee planned to obtain confirmatory data from the MOV Joint Owners Group.

The PPM applications noted in the above paragraphs were considered by the staff to be acceptable as "best available data." The Engineering Action Plan was determined to be an acceptable vehicle for tracking the completion of long-term actions needed to resolve the PPM applicability issues. However, many issues were incorrectly identified as needing no additional actions. For example, the following issues require further actions over the long-term: (1) additional test data and/or analysis to validate use of the PPM for Lunkenheimer gate valves and Copes-Vulcan parallel disc gate valves; (2) EPRI Topical Report 113558 (revised balanced-disc globe valve methodology) and EPRI Topical Report 113564 (revised unwedging calculation) should be submitted by EPRI for NRC review or the licensee will be responsible for justifying the technical bases for this application; (3) applicable test results were needed to ensure that the packing torque calculation was conservative for rising-rotating stem globe valves; and (4) information

was needed to justify the adequacy of the 25 percent margin screening criterion applied to double offset butterfly valves. The licensee stated the intent of the Engineering Action Plan was to continue to validate the applicability issues, which was not clearly stated. The Engineering Action Plan was to be revised to appropriately state the long-term actions necessary to address the PPM applicability issues.

b.1.2 Load Sensitive Behavior and Stem Friction Coefficient

The MOV program thrust calculations used a 5.6 percent bias margin and a 26.4 percent random margin (combined with other random uncertainties using the square root sum-of-the-squares method) for load sensitive behavior. These values were based on application of PPM Method 1 for addressing load sensitive behavior. The inspectors noted that the PPM-based values were not evaluated against the available in-plant test data. In response, the licensee provided a review of historical dynamic test data that showed that the PPM load sensitive behavior assumptions were similar to the results obtained from the 16 reliable dynamic tests that were analyzed. This adequately justified use of the PPM load sensitive behavior values for Unit 2 MOVs.

The thrust calculations used a 0.20 stem friction coefficient assumption. A statistical review of static stem friction coefficient test results obtained from 22 Unit 2 MOVs found that a value of 0.1658 was adequate to provide a 95 percent confidence level bound (using a Student's-t statistical method) for MOV performance under static test conditions. The licensee also combined its in-plant static test data with EPRI's stem friction coefficient analysis results and determined that an expected stem friction coefficient upper bound for limit-controlled MOVs under dynamic conditions would be 0.1899. This result left residual margin to account for potential stem lubricant degradation.

For torque-seated valves, the combined error analysis included an additional five percent bias margin to account for potential stem lube degradation. Trending MOV performance over time and assessing the impact of degradations will be important to maintaining MOV design-basis capability. The licensee tracking and trending program did not specifically address whether as-found stem friction coefficient performance would be periodically reviewed to ensure that MOV program assumptions remain valid.

b.1.3 Actuator Capability

Limitorque Corporation issued Technical Update 98-01 including Supplement 1, which provided guidance for determining the output of alternating current (ac) Limitorque motor actuators. This guidance stipulated the use of actuator pullout efficiencies and an application factor of 0.90. Special configurations needing additional analysis were also identified: (1) 25 ft-lb, 3600 rpm, frame 56 motors; (2) 60 ft-lb, 1800 rpm, frame 56 motors; (3) SMB-1 actuators with a 66:1 worm gear ratio; and (4) all motors that operate at less than 70 percent of rated voltage. The inspectors noted that the Limitorque Technical Update 98-01 guidance was a standard part of the MOV program.

The Commonwealth Edison (ComEd) ac motor capability method (described in ComEd White Paper 125) has been applied to several Unit 2 MOV thrust calculations. However, this method was not directly applicable because D. C. Cook has 575/550 volt ac motors

instead of the 460 volt ac motors tested by ComEd. The licensee modified the ComEd methodology to account for the voltage differences and compared the results to some limited testing of 40 ft-lb 575 volt motors conducted by ComEd. The licensee was satisfied that this comparison to a single motor size was sufficient to justify use of the modified ComEd methodology. However, industry testing has shown that the tested output of 460 volt ac motors varies greatly, relative to their name plate rated values, when comparing the performance of different motor sizes. Therefore, the inspectors determined that the model comparison to test results obtained from a single motor size would not adequately justify the model for a range of 575/550 volt motor sizes.

b.1.4 Degraded Voltage

Based on guidance from NRR as documented in previous MOV inspection reports, MOV design-basis calculations were to be based on the second level undervoltage relay setpoint. In recent public meetings with the NRC (March 24, 2000 and April 17, 2000), the licensee has indicated that the licensing basis for adequate operation of safety-related equipment under degraded voltage was not the second level undervoltage relay setpoint as is the case for the majority of nuclear power plants. The licensing basis was the result of a grid study (loss of nearby generating unit, loss of critical transmission grid element, both D. C. Cook units down, and transmission system heavily loaded) and load flow analysis for limiting accident conditions. This study determined that the safety-related bus voltage would remain above 93.8 percent of 4160 volts. The NRC requested the licensee to document both the short term and planned long term enhancements to the electrical distribution system. This was accomplished in a letter dated May 4, 2000.

The starting point used by the licensee in the degraded voltage calculations for the MOVs was the 93.8 percent versus the second level undervoltage relay setpoint. Based on discussions with NRR projects and electrical branches, it was verified that this would be an acceptable starting point for the calculations based on actions completed and planned by the licensee. As such, the MOV design bases was verified using the 93.8 percent bus voltage.

b.1.5 Operability of the Unit 2 MOVs

Based on the inspectors request for the valve matrix, which identified assumptions and resultant set-up margins for the Unit 2 MOVs, the licensee identified one valve (2-IMO-910) with negative margin. Even though this valve had been reviewed for turnover to operations, this deficiency was not identified. Based on discussions with the licensee, it appeared there was a lack of understanding in the importance of meeting acceptance criteria for the running loads for the valve after a packing adjustment. This confusion was based on the valve being limit seated versus torque seated. The licensee initiated CR 99-05815 to address this issue. Subsequent action taken by the licensee was to re-stroke the valve to wear-in the packing to reduce the running load. The new running load was then incorporated into the design-basis calculation, which resolved the immediate concern of negative margin and established a positive design margin. Generic corrective actions were still under review for the CR at the end of the inspection.

In addition to evaluating the methodologies used to verify design basis capability, the inspectors reviewed the set-up margins associated with the 114 MOVs required to be operable for the restart of Unit 2. The review indicated that the licensee was able to verify that all MOVs required for the Unit 2 restart had a positive design margin. As indicated in section E1.1.b.2.2 of this report, a number of valves were considered marginal and were to be included in the margin improvement program.

c.1 Conclusions on MOV Sizing and Switch Settings

Significant progress was made to resolve MOV program issues and a number of improvements relating to the design-basis capability of program valves have been implemented. The licensee was able to verify that all MOVs required for Unit 2 restart met their design-basis capability requirements. Several issues were identified that required further review or justification as part of the long-term MOV program. These issues included: (1) the development of appropriate long-term actions to verify the applicability of the EPRI MOV PPM to certain valves; (2) the periodic review of as-found stem friction coefficient performance to ensure that MOV program assumptions remain valid; and (3) the development of an action plan to obtain additional confirmatory data based on a range of 575/550 volt motor sizes.

b.2 Miscellaneous Program Issues

b.2.1 Program Scope Changes

A total of three valves were added to the program for Unit 2 since the 1998 GL 89-10 inspection. The valves were added based on a re-validation of the GL 89-10 MOV program scope. The following valves were added to the program:

2-ICM-129	Reactor Coolant Loop #2 Hot Leg to Residual Heat Removal (RHR) Pumps Suction Containment Isolation
2-IMO-128	Reactor Coolant Loop #2 Hot Leg to RHR Pumps Suction Shutoff
2-IMO-390	Refueling Water Storage Tank-33 Supply to RHR Pumps Suction Shutoff

The first two valves were added due to their automatic function to close to protect the low pressure RHR piping when the plant is on shutdown cooling, while the third valve was added based on operator action to close the valve during the recirculation phase in order to isolate the recirculation sump from the refueling water storage tank. With the addition of these valves, the program scope for Unit 2 increased to 113 MOVs: 56 gates, 24 globes, and 33 quarter-turn (butterfly) valves.

In GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," the NRC staff recommended that licensee programs consider safety-related MOVs that were assumed to be capable of returning to their safety position when placed in a position that prevented their safety system (or train) from performing its safety function; and the system (or train) was not declared inoperable when the MOVs were in their non-safety position. The licensee indicated that these MOVs were either included in the program or the applicable Limiting Condition for Operation of the Technical Specifications was entered when MOVs were placed in their non-safety position.

b.2.2 Marginal Valves

The inspectors noted during the inspection that 22 percent of MOVs in the GL 89-10 program were considered marginal based on design-basis calculations. These valves were considered operable, however, potential future changes to accepted assumptions could affect the operability of these MOVs. The majority of these MOVs were set up using the EPRI PPM, which was generally considered conservative. The general industry practice considered marginal valves to have less than a five percent margin when set-up with the PPM or less than a 10 percent margin when set-up was based on other methodologies. The licensee's program was based on establishing a minimum 10 percent margin using design values for each MOV in the program. Valves that did not meet this criteria would be included in the margin improvement program. Based on the licensee's guidance, 25 MOVs required margin improvement. No specific actions to address these low margin valves had been planned or scheduled at the time of the inspection.

c.2 Conclusions on Miscellaneous Program Issues

Although actions were performed to improve valve condition, approximately 22 percent of the valves had low margins based on the design calculations and valve set-up. The licensee per the MOV program would include the associated valves in the margin improvement program as part of the long-term MOV program. The licensee appropriately reviewed the plant's design basis and increased the Unit 2 MOV program scope.

b.3 Pressure Locking/Thermal Binding Issues

b.3.1 Response to Generic Letter 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves"

The licensee recently submitted a revised letter addressing their response to GL 95-07. Based on NRR’s review of the submittal, four issues were identified that were addressed during the inspection to facilitate the issuance of a safety evaluation. These questions and responses were as follows:

1. What was the basis for the PORV block valves not being susceptible to thermal binding?

   Licensee calculation MD-2-PZR-010-N concluded that the block valves would not experience a significant temperature change following their closure, which would be necessary for thermal binding to occur. This was based on the upper portion of the valve's wedge being exposed to steam even with the valve in the closed position, as a loop seal would not form by the valve wedge due to the piping arrangement from the pressurizer.

2. What calculation methodology was used to demonstrate that the actuators were capable of producing adequate thrust under postulated thermal-binding conditions for the RHR/safety injection to reactor coolant system hot leg isolation valves (½-IMO-315 and ½-IMO-325)?

Licensee calculation MD-2-RHR-023-N concluded that there would not be a significant temperature difference between the inside and outside of the valves to cause thermal binding.

3. What calculation methodology was used to demonstrate the actuators were capable of producing adequate thrust under postulated pressure-locking conditions for refueling water storage tank to chemical to volume control tank charging pumps suction header valves (½-IMO-910 and ½-IMO-911)?

   Licensee calculation MD-2-RHR-904-N utilized the ComEd methodology for assessing the pressure locking potential for these valves. This pressure locking methodology was previously approved by the NRC where a licensee complies with the identified restrictions issued by ComEd, which the licensee was able to document.

4. What modifications were performed to address pressure locking concerns with the following valves: ½-IMO-330, ½-IMO-331, ½-NMO-151, ½-NMO-152, and ½-NMO-153?

   Design change package 2-DCP-181 was completed and turned over to operations, with the exception of completing the post modification test. This modification drilled either a 1/8 inch diameter hole (2-IMO-330 and 2-IMO-331), or a 1/4 inch diameter hole (2-NMO-151, 2-NMO-152, and 2-NMO-153) in the upstream valve disc to address the pressure locking concern.

The inspectors reviewed the associated information in the licensee's response and confirmed that the issues had been adequately addressed. These responses will assist NRR in issuance of the safety evaluation on GL 95-07.

b.3.2 Restart Action Matrix (RAM) Item R.2.16.1

The licensee issued LER 315/99-031-00 based on a pressure locking concern with the recirculation sump to RHR/charging pumps suction isolation valves, ½-ICM-305 and ½-ICM-306. The licensee modified the Unit 2 valves by installing equalizing lines on the valves' bonnet per design change package 2-DCP-4371. This modification would relieve pressure in the valves' bonnet to the sump during a pressure locking scenario. Calculation results verified these valves would perform their function under design-basis conditions. Although the modification has been installed, the valves have not undergone post-modification testing or been turned over to the operations staff at the end of the inspection. These remaining activities were being adequately tracked by the licensee for resolution.

c.3 Conclusions on Pressure Locking/Thermal Binding Issues

The licensee adequately addressed the pressure locking/thermal binding issues with GL 95-07 to support the issuance of a safety evaluation. Based on the installation of the equalizing line modification to the recirculation sump isolation valves to resolve the pressure locking concern, RAM Item R.2.16.1 is considered closed.

b.4 Previous Inspection Issues

b.4.1 Direct Current (dc) Motors

The performance under load differs between MOVs with dc motors from MOVs with ac motors. The speed of a dc motor gradually slows as load increases, while the speed of an ac motor may remain more constant under typical load conditions. Therefore, estimating the time it would take a dc MOV to perform its valve stroke under design-basis conditions would be important if it was relied upon by the plant's safety analysis or Technical Specifications to complete a safety function within a given period of time. Inspection Report 50-315/ 98020; 50-316/98020 noted that this analysis was not conducted for MOVs with dc motors. In response, the licensee estimated the stroke times for the seven Unit 2 dc MOVs that have stroke time limitations. This analysis assumed a load profile that: (1) was constant for the first 75 percent of the closing stroke (representing packing and stem rejection loads); and (2) increased linearly to the estimated maximum force value over the last 25 percent of the valve stroke. Force requirements were converted to torque requirements assuming a stem friction coefficient of 0.20. The dc motor model used the vendor motor curves and included consideration of degraded voltage, circuit resistance, motor resistance, and elevated ambient temperatures. No concerns were noted regarding this methodology.

b.4.2 PORV Design-Basis Open Differential Pressure

Inspection Report 50-315/ 98020; 50-316/98020 noted that the worst-case opening differential pressure for the PORV block valves was 0.0 psid. The inspectors found that the PORV block valves' open scenarios were not properly analyzed and a complete review of necessary emergency and abnormal operating procedures was not performed. Subsequently, the PORV block valve opening scenarios were reviewed and the current calculations used a worst-case open differential pressure of 2680 psid. Therefore, this issue has been resolved.

b.4.3 Program Documentation

Inspection Report 50-315/98020; 50-316/98020 noted there were several programs, procedures, and calculations that were not up-to-date or formally approved by the licensee. This issue has been resolved as the licensee has implemented approved program documents and has processes in place to ensure calculations, both internally and externally prepared, were reviewed and approved and maintained up-to-date. Therefore, this issue has been resolved.

b.4.4 Butterfly Valve Testing

Inspection Report 50-315/98020; 50-316/98020 noted numerous concerns with the verification of the design-basis for butterfly valves. The majority of these issues, however, were no longer applicable due to the licensee's use of the EPRI PPM to verify design-basis capability. An issue that required resolution was the design control violation, as discussed in section E8.4 of this report, concerning the structural capabilities of butterfly MOVs. The licensee performed the required structural capability

calculations and incorporated the results into the individual valve design calculations. No concerns were noted regarding this methodology.

b.4.5 Valve Factors

Inspection Report 50-315/98020; 50-316/98020 noted numerous concerns with the justifications for the valve factors assumed in the design-basis calculations. The majority of these issues, however, were no longer applicable due to the licensee's use of the EPRI PPM to verify design-basis capability. In cases where the PPM was not applicable, the licensee provided adequate justification for the valve factors assumed in the design-basis calculations. Therefore, this issue has been resolved.

b.4.6 Industry Information

Inspection Report 50-315/98020; 50-316/98020 noted concerns that industry information was not proactively being obtained, reviewed for applicability, and implemented into the MOV program. The licensee performed a thorough review of industry information concerning MOVs to ensure it had been adequately addressed in the MOV program. Therefore, this issue has been resolved.

c.4 Conclusions on Previous Inspection Issues

The licensee has adequately addressed NRC concerns raised in the previous GL 89-10 inspection and incorporated the responses into the MOV program.

E7 Quality Assurance in Engineering Activities

E7.1 Licensee Self-Assessment Activities

a. Scope

The inspectors reviewed three MOV self-assessments performed by consultants during the past year as part of the corrective actions for Restart Action Plan No. 16.

b. Observations and Findings

The three assessments were conducted over a one year period to ensure that the MOV program was progressing in the right direction. Numerous issues were identified during the assessments. These included both programmatic concerns and specific concerns with methodologies and assumptions used in verifying the design basis capability of the MOVs. Programmatic issues identified during the first assessment included: (1) the MOV team had a weak understanding of the MOV design bases; (2) staff training and awareness of MOV regulatory issues did not meet expectations; and (3) no integrated plan or schedule to resolve the large scope of MOV work. Although the last two assessments were conducted in the last four months, significant concerns were still identified with methodologies and assumptions used in verifying the design basis capability of the MOVs. These programmatic and specific concerns were adequately addressed to put in place an MOV program that would ensure the design capability of

the MOVs. Some issues will require further review and justification before final resolution.

c. Conclusions

The self-assessment identified numerous programmatic and technical issues, a number of which were resolved prior to this inspection, although several needed further review and were being adequately tracked by the Corrective Action Program. The use of outside MOV experts provided significant insights into the MOV program. These insights included revisions to some of the methodologies and assumptions, which provided the basis used to verify MOV design capability.

E8 Miscellaneous Engineering Issues

E8.1 Case Specific Checklist Item No. 16, Resolution of Operability of Motor-Operated Valves in the GL 89-10 Program

a. Inspection Scope

The NRC designated inadequate design control pertaining to MOVs as Case Specific Checklist Item No. 16. Inspectors reviewed licensee root causes and corrective actions taken for this item as documented in Restart Action Plan Item No. 16, Revision 0, "Resolution of Operability of Motor-Operated Valves in the GL 89-10 Program." In addition, the inspectors interviewed members of the MOV staff to understand and assess the effectiveness of the corrective actions for this issue.

b. Observations and Findings

As a result of a previous NRC MOV inspection (Inspection Report 50-315/98020; 50-316/98020) and plant shutdown, the licensee developed Restart Action Plan Item No. 16 that identified a number of corrective actions necessary to establish an adequate MOV program to meet the guidance of GL 89-10. These actions included the following major areas:

- Perform MOV program self-assessment
- Review and closure of existing MOV program CRs and remaining System Index Database (SIDS)
- Review and integrate industry information
- Perform review of previous MOV test data
- Address program management identified deficiencies
- Determine MOV material condition
- Perform modifications to existing equipment
- Reconstitute MOV design basis
- Perform required testing
- Perform root cause analysis and identify any additional corrective actions
- Verify operability concerns resolved for Unit 2 MOVs prior to restart

The root cause analysis, initiated as part of CR 99-06150, identified the causes behind the failure of the MOV program. The root causes identified in the analysis included the following:

- Inadequate assessment of challenges by management
- Inadequate business plan
- Inadequate program development and management
- inadequate staffing of MOV program
- Inadequate organization structure and function
- Inadequate knowledge and skills of engineers supporting MOV program
- Weak engineering support

The inspectors verified that the licensee had adequately assessed the failure of the MOV program and identified the appropriate actions necessary to resolve these concerns. With the root cause analysis and restart action plan as a basis, a significant amount of effort was put into the MOV program to address the causes and establish an adequate MOV program. Some of the specific actions accomplished for each Unit 2 MOV in GL 89-10 program included refurbishment/modifications of the MOV/actuator, establishment of design basis calculations, and performance of static diagnostic testing of each MOV. These actions ensured that each valve was properly set-up with sufficient capability to perform their function under design basis conditions.

The majority of the restart action plan had been completed, although only a few of the 11 major areas were signed off as being complete at the end of the inspection due to a couple of valves that were still going through the process. As discussed in previous sections of the report, the licensee has established an adequate MOV program and verified that the Unit 2 valves have sufficient design capabilities for the restart of the plant. The resolution of some long-term actions and completion of the design capability calculation for Unit 1 need to be reviewed before the NRC will close-out the review of the GL 89-10 MOV program.

c. Conclusions

Based on the completed corrective actions reviewed and on actions committed to be completed before startup, the inspectors concluded that Case Specific Checklist Item No. 16 had been adequately addressed by the licensee and recommends that this item be closed.

E8.2 (Open) Licensee Event Report (50-315/99-031-00): Valves Required to Operate Post-Accident Could Fail to Open Due to Pressure Locking/Thermal Binding. Based on the actions documented in Section E1.1.b.3.2 of this report, the actions necessary to resolve this issue for Unit 2 have been implemented or planned. However, since the actions have not yet been addressed for Unit 1 and a supplemental LER was scheduled to be issued, this item will remain open.

E8.3 (Open) Licensee Event Report (50-315/99-032-00): Failures to Comply with Technical Specification 4.0.5 Identified by Inservice Testing Program Assessment. As discussed in section M1.1 of this report, the scope and adequacy of the required testing was reviewed and determined to be acceptable. The corrective actions for this LER have

other additional actions that were not competed at the time of the inspection and will be reviewed during a subsequent inspection. This item will remain open.

E8.4 (Closed) Non-Cited Violation (50-315/316-98020-01): Failure to perform design-basis calculations for the structural capability of butterfly valves. Based on the actions documented in section E1.1.b of this report, this item is closed.

V. Management Meetings

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at the conclusion of the inspection on May 3, 2000. The licensee acknowledged the findings presented at the exit. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Arnold, MOV Engineer
C. Bakken, Site Vice President, Operations
M. Bennett, Licensing Engineer
K. Chivers, MOV Engineer
R. Crane, Regulatory Affairs Inspection Supervisor
C. Cynoski, Performance Assurance
R. Ebright, MOV Project Manager
D. Farley, MOV Maintenance Manager
M. Finissi, Director, Plant Engineering
A. Gort, MOV Engineer
S. Greenlee, Director, Design Engineering
B. Kalinowski, Manager, Engineering Programs
J. Kinsey, MOV Engineering Manager
W. Kropp, Director, Performance Assurance
Z. LaPlante, Performance Assurance Manager
B. Lord, MOV Engineer
J. Molden, Director Maintenance
M. Moran, Director, Business Services
T. Noonan, Restart Director
J. Pollack, Plant Manager
R. Powers, Senior Vice President
M. Rencheck, Vice President, Engineering
S. Smith, Director, Maintenance
D. Tateosian, MOV Engineer
T. Taylor, Licensing Engineer
B. Withrow, MOV Program Manager
W. Wolfe, MOV Maintenance Supervisor
R. Womack, Engineering Program Supervisor

INSPECTION PROCEDURES USED

TI 2515/109: Safety-Related Motor-Operated Valve (MOV) Testing and Surveillance
IP 73756: Inservice Testing of Pumps and Valves

ITEMS OPENED, CLOSED, and DISCUSSED

Opened

None

Closed

Case Specific Checklist Item 16		Resolution of Operability of Motor-Operated Valves in the GL 89-10 Program
RAM R.2.16.1		LER 50-315/99031-00, "Valves Required to Operate Post-Accident Could Fail to Open Due to Pressure Locking/Thermal Binding"
RAM R.2.1.23		LER 50-315/99032-00, "Failures to Comply with Technical Specification 4.0.5 Identified by Inservice Testing Program Assessment"
50-315/316-98020-01	NCV	Failure to perform design-basis calculations for the structural capability of butterfly valves

Discussed

50-315/99032-00	LER	Failures to Comply with Technical Specification 4.0.5 Identified by Inservice Testing Program Assessment
50-315/99031-00	LER	Valves Required to Operate Post-Accident Could Fail to Open Due to Pressure Locking/Thermal Binding

LIST OF ACRONYMS USED

ac	Alternating Current
AFW	Auxiliary Feedwater
ASME	American Society of Mechanical Engineers
ComEd	Commonwealth Edison
CFR	Code of Federal Regulations
CR	Condition Report
CCW	Component Cooling Water
dc	Direct Current
EPRI	Electric Power Research Institute
ESW	Emergency Service Water
ft-lbs	Foot-Pounds
GL	Generic Letter
INEEL	Idaho National Engineering and Environmental Laboratory
IP	Inspection Procedure
IST	Inservice Testing
LER	Licensee Event Report
MOV	Motor-Operated Valve
NCV	Non-cited Violation
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
OM	Operations and Maintenance
PORV	Power-Operated Relief Valve
PPM	Performance Prediction Methodology
psid	Pounds per Square Inch Differential
RAM	Restart Action Matrix
RHR	Residual Hear Removal
rpm	Revolutions per Minute
TI	Temporary Instruction

LIST OF DOCUMENTS REVIEWED

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

Procedures

12-EHP-5074.MOV.001	Motor-Operated Valve Program, Revision 0, 3/23/00
12-EHP-5074.MOV.002	Motor-Operated Valve Setpoint Control, Revision 0, 3/29/00
12IHP5030.EMP.002	MOV Diagnostic Testing, Revision 11, 3/15/00
PMI-5074	Motor-Operated Valve Program, Revision 0, 10/6/99
02-OHP 4030.STP.017T	Turbine Driven Auxiliary Feedwater System Test, Revision 13, 5/15/98
02-OHP 4030.STP.017TV	Turbine Driven Auxiliary Feedwater Pump Trip and Throttle Valve Operability Test, Revision 8, 1/29/99
02-OHP 4030.STP.020E	East Component Cooling Water Loop Surveillance, Revision 8

Self-Assessments

RST-1999-005-ENP	D. C. Cook MOV Program Assessment Report, R. Gambrill, 2/17/99
FO-00-C-295	Performance Assurance Field Observation, 4/4/00
SA-1999-017-ENP	Assessment of Cook MOV Program, MPR Associates, 2/10/00
SA-2000-ENP-023	Motor Operated Valve Program Implementation, 2/16/00 - 3/31/00

Letters

Licensee to NRC	Response to Generic Letter (GL) 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," 4/3/00
Licensee to NRC	Actions Being Taken to Complete Generic Letter 89-10 and Generic Letter 96-05 Implementation, 1/11/00
NRC to Licensee	Evaluation of Third 10-Year Interval for the Pump and Valve Inservice Testing Program for D. C. Cook Nuclear Plant, Units 1 and 2, 5/27/97
NRC to Licensee	Evaluation of Relief Requests for the Pump and Valve Inservice Testing Program, 12/29/98
NRC to Licensee	Summary of March 24, 2000, Public Meeting Regarding Motor Operated Valve Operability with Degraded Voltage at the D. C. Cook Nuclear Plant, 4/28/00
NRC to Licensee	Summary of April 17, 2000, Public Meeting Regarding Under Voltage Protection, 4/20/00
Licensee to NRC	Short Term and Planned Long Term Enhancements to the Electrical Distribution System, 5/4/00

Miscellaneous Information

Valve Matrix for Generic Letter 89-10 MOVs
Pump and Valve Inservice Test Program, Third Ten Year Interval, Revision 2, 9/30/99 (DRAFT)
MISC 00-365, MOV Engineering Action Plan, 4/9/00.
Internal Memorandum, MOV Field Work - Stop Work Order MT-99-08, 10/21/99
Root Cause Analysis for CR 99-06150, Motor Operated Valve Program, 9/9/99

Restart Action Plans

No. 16 Resolution of Operability of Motor Operated Valves in the GL 89-10 Program, Revision 0

Design Change Packages

2-DCP-181 Pressure Locking Modification for Valves 2-IMO-330/331 and 2-NMO151/152/153, Revision 0, 11/4/99

Job Orders

Job Order R0083803	2-CCM-459 As-Left Diagnostic Test, 9/13/99.
Job Order R0036402	Perform 2-ICM-251 As-Left Diagnostic Test, 2/1/00.
Job Order R0033666	Perform As-Left Diagnostic Testing @ 2-IMO-315, 11/8/99.
Job Order R0038194	Perform As-Left Diagnostic Testing @ 2-IMO-324, 8/21/99.
Job Order R0063148	Perform As-Left Diagnostic Testing @ 2-CCM-430, 9/25/99.
Job Order R0063156	Perform As-Left Diagnostic Testing @ 2-CCM-454, 1/21/00.
Job Order R0059739	Perform As-Left Diagnostic Testing @ 2-WMO-703, 11/13/99.
Job Order R0086397	Perform As-Left Diagnostic Testing @ 2-WMO-734, 11/11/99.

Calculations

MD-2-CCW-101-N	Analysis of Thrust and Torque Limits for MOV 2-CCM-430/432, Revision 2, 3/26/00.
MD-2-CCW-105-N	Analysis of Thrust and Torque Limits for Motor Operated Valves 2-CCM-453/454, Revision, 2/29/00.
MD-2-CCW-109-N	Analysis of Thrust and Torque Limits for MOV 2-CCM-458/459, Revision 1, 2/29/00.
MD-12-CCW-007-N	Maximum Differential Pressure During Operation of CCW Valves ½-CMO-410 - 416, 419, 420 & 429, and ½-CMO-430 - 433, 451 - 454, 458 & 459, Revision 2, 2/24/00.
MD-12-CCW-089-N	GL 89-10 MOV Program Pressures, Temperatures, Flows for Component Cooling Water Valves ½-CCM-430, 431, 432, 433, 451, 452, 453, 454, 458 & 459, ½-CCM-410, 411, 412, 413,414, 415, 416, 419, 420 & 429, Revision 1, 2/24/00.
MD-12-CCW-800-N	Evaluation of Stem Thrust Requirements for 2-CCM-430/431/432/433, Revision, 2/29/00.
MD-12-CCW-814-N	EPRI PPM Prediction for 2-CCM-451, 2-CCM-452, 2-CCM-458, and 2-CCM-459, Revision 1, 3/24/00.
MD-2-ESW-021-N	Analysis of Thrust and Torque Limits for MOVs 2-WMO-703 & 704, Revision 3, 3/16/00.
MD-2-ESW-031-N	Analysis of Thrust and Torque Limits for MOVs 2-WMO-734/738, Revision 1, 2/25/00.
MD-2-ESW-070-N	EPRI PPM for 2-WMO-734 and 2-WMO-738, Revision 1, 3/24/00.
MD-12-ESW-045-N	GL 89-10 MOV Program Essential Service Water Differential Pressure Calculation, Revision 3, 3/28/00.
MD-12-ESW-072-N	EPRI PPM Prediction for 2-WMO-703, 2-WMO-704, 2-WMO-706 and 2-WMO-708, Revision 1, 3/24/00.
MD-2-MSC-053-N	D.C. Cook Unit 2 GL 89-10 Scope, Revision 0, 12/18/99.

MD-12-MSC-020-N	Guidance for Addressing the Conditions and Limitations of the EPRI MOV Performance Prediction Program, Revision 1, 1/26/00.
MD-12-MSC-036-N	MOV Parameter Calculation, Units ½, Valves IMO-225/226, IMO-210/211, IMO-220/221, IMO-910/911, ICM-250/251, QCM-250/350, QMO-451/452, Revision 2, 3/10/00.
MD-12-MSC-037-N	MOV Parameter Calculation, Flow Rates, Temperatures and Pressures for Valves ESW and NESW 1-WMO-701, 702, 705, 707, 711, 713, 715, 717, 721, 723, 725, 727, 731, 733, 735, and 737, 2-WMO-703, 704, 706, 708, 712, 714, 716, 718, 722, 724, 726, 728, 732, 734, 736, and 738. ½-WMO-744, 754, 903, 906, Revision 2, 2/3/00.
MD-12-MSC-039-N	MOV Parameter Calculation for Valves IMO-202, 204, 212, 222, 215, 225, IMO-270, 275, 315, 325, 330, 331, ICM-260, 265,& NMO-151, 152, 153, Revision 3, 3/16/00.
MD-12-MSC-056-N	MOV Parameter Calculation, Flow Rates and Pressures for Valves ½ IMO-261, 390, 310/320, 312/322, 314/324, 340/350, Revision 1, 3/2/00.
MD-2-PZR-004-N	Analysis of Thrust and Torque Limits for MOVs 2-NMO-151/152/153, Revision 1, 3/27/00.
MD-2-PZR-010-N	Investigation of the Temperature Change in the PORV Block Valves 2-NMO-151, 152,153 Going from an Open to a Close Position, Revision 0, 4/13/00
MD-2-RCS-002-N	Evaluation of Stem Thrust Requirements for 2-NMO-151, -152, -153 Using the EPRI Performance Prediction Methodology, Revision 0, 3/2700.
MD-2-RH-023-N	Analysis of Thrust and Torque Limits for Motor Operated Valve 2-IMO-315/316/325/326, Revision 2, 3/27/00.
MD-2-RH-027-N	Analysis of Thrust and Torque Limits for MOV 2-IMO-324, Revision 0, 3/4/00.
MD-2-RH-103-N	PPM Calculation to Determine the Minimum Required Opening and Closing Thrusts for MOVs 2-ICM-250 and 2-ICM-251, in Accordance with AEP Contract C-2434 and its Amendments in Effect, Revision 0, 3/20/00.
MD-2-RH-114-N	Analysis of Thrust and Torque Limits for MOVs 2-ICM-250 251, Revision 1, 3/20/00.
MD-2-RH-207-N	EPRI PPM Stem Thrust Requirements for 2-IMO-315 and 2-IMO-315, Revision 0, 3/4/00.
MD-2-RH-904-N	Pressure Locking Analysis for Valves 2-IMO-910 and 2-IMO-911, Revision 1, 3/26/00
MD-12-RH-040-N	Maximum Differential Pressure During Operation of RHR Valves 1-IMO-312, 1-IMO-314, 1-IMO-320, 1-IMO-322, 1-IMO-340, 1-IMO-350, 2-IMO-312, 2-IMO-314, 2-IMO-320, 2-IMO-322, 2-IMO-340, 2-IMO-350, Revision 2, 3/2/00.
MD-12-RH-109-N	PPM Calculation to Determine the Minimum Required Opening and Closing Thrusts for MOV ½-IMO-314 and ½-IMO-324, Revision 0, 3/4/00.
MD-12-RH-130-N	Differential Pressure Calculation for Valves ½-IMO-255, ½-IMO-256, ½-ICM-250, ICM-251, Revision 1, 3/10/00.
MD-12-RH-132-N	Maximum Differential Pressure During Operation of Hot Leg Injection Valves 1 IMO-315, 1 IM-325, 2-IMO-315 & 2 IMO-325, Revision 1, 2/29/00.

Condition Reports

99-02114, 99-04091, 99-06150, 99-06319, 99-08820, 99-10454, 99-14511, 99-15648, 99-17787, 99-17789, 99-17791, 99-17796, 99-17797, 99-17798, 99-19032, 99-19428, 99-20295, 99-20670, 99-22041, 99-23451, 99-24069, 99-24448, 99-24464, 99-24627, 99-24773, 99-24879, 99-25303, 99-25136, 99-25185, 99-25189, 99-25303, 99-25357, 99-25635, 99-25798, 99-26032, 99-26046, 99-26225, 99-26325, 99-26416, 99-28631, 99-29471, 00-02243, 00-02244, 00-02245, 00-02247, 00-02248, 00-02249, 00-02250, 00-02251, 00-02253, 00-02254, 00-02256, 00-02257, 00-02317, 00-02319, 00-02320, 00-02321, 00-02978, 00-03435, 00-03761, 00-03766, 00-03873, 00-04092, 00-04447, 00-04463, 00-04473, 00-04992, 00-04447, 00-04463, 00-04909, 00-05026, 00-05029, 00-05030, 00-05031, 00-05032, 00-05034, 00-05038, 00-05040, 00-05041, 00-05098, 00-05258, 00-05259, 00-05260, 00-05261, 00-05264, 00-05304, 00-05521, 00-05529, 00-05530, 00-05531, 00-05532, 00-05577, 00-05618, 00-05815