U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket Nos:	50-254; 50-265
License Nos:	DPR-29; DPR-30
Report No:	50-254/96018; 50-265/96018
Licensee:	Commonwealth Edison Company
Facility:	Quad Cities Nuclear Power Station Units 1 and 2
Location:	22710 206th Avenue North Cordova, IL 61242
Dates:	November 18-22, 1996
Inspectors:	A. Dunlop, Regional Inspector J. Guzman, Regional Inspector M. Khanna, Mechanical Engineer, NRR M. Holbrook, Principal Investigator, INEL
Approved By:	W. J. Kropp, Chief Engineering Specialist Branch 1 Division of Reactor Safety

EXECUTIVE SUMMARY

Quad Cities Station, Units 1 & 2
NRC Inspection Report Nos. 50-254/96018(DRS); 50-265/96018(DRS)

Engineering

- Generic Letter (GL) 89-10, "Safety-Related Motor Operated Valve (MOV) Testing and Surveillance," program documentation and test data provided an adequate basis to conclude that all GL 89-10 program MOVs would perform the intended safety functions under design-basis conditions. (Section E1.1.b.1)

- The inspectors identified a program weakness where there was no formal review process for the Rising Stem MOV Data Sheets when a valve's available thrust was identified outside the design bases thrust windows. This was a generic concern for all ComEd plants. (Section E1.1.b.1.8)

- Several valve factor assumptions were not sufficiently supported for the long-term, although the values used were considered adequate for program closure and plans were in place to review these assumptions as part of the long-term MOV program. (Section E1.1.b.1.2)

- The knowledge level of MOV site engineering was considered good. There was an effective team effort between the site and corporate MOV personnel. The licensee has performed a number of good initiatives in the MOV area. (Section E1.1.b.1)

Safety Assessment/Quality Verification

- The self-assessment in the MOV area provided good technical findings and was beneficial in improving the MOV program. However, site quality verification had not completed any recent MOV program assessments since mid 1994 and none were planned. (Section E7.1)

Report Details

Summary of Plant Status

Unit 1 and Unit 2 were both operating at approximately full power this inspection period.

III. Engineering

E1 Conduct of Engineering

E1.1 Generic Letter 89-10 Program Implementation

a. Inspection Scope (TI 2515/109)

This inspection evaluated the process for qualifying the design-basis capability of motor-operated valves (MOVs) and closure of NRC's review of Generic Letter (GL) 89-10. The inspection concentrated on MOVs tested under static or low differential pressure (dp) conditions. The inspectors selected MOVs that included several program closure methods used to verify design-basis capability. The inspectors reviewed design-basis documents, thrust calculations, test packages, and engineering evaluations for the following MOVs:

1-0220-1	Main Steam Inboard Drain Isolation Valve
1-1001-21	Residual Heat Removal (RHR) Drain to Waste Surge Tank Outboard Isolation Valve
2-1001-20	RHR Drain to Waste Surge Tank Inboard Isolation Valve
2-1301-49	Reactor Core Isolation Cooling (RCIC) Feedwater Injection Isolation Valve
1-2301-5	High Pressure Coolant Injection (HPCI) Steam Supply Outboard Isolation Valve
1-2301-8	HPCI Feedwater Injection Isolation Valve
2-0202-5B	Reactor Recirculation Pump Discharge Valve
2-2301-14	HPCI Pump Minimum Flow Bypass Valve

The inspectors also reviewed other documentation used to justify program assumptions, such as stem friction coefficients and load sensitive behavior. Further, the inspectors reviewed documentation related to program issues, such as scope, periodic verification, post maintenance testing, tracking and trending, corrective actions, pressure locking/thermal binding, and program audits.

b. Observations and Findings

b.1 MOV Design-Basis Capability Verification

In general, the design-basis calculations to verify valve capability were considered adequate. Several issues were identified during the inspection and documented in the following report sections. However, program documentation and test data provided an adequate basis to conclude that all GL 89-10 program MOVs would

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b. Observations and Findings

b.1 MOV Design-Basis Capability Verification

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perform the intended safety functions under design-basis conditions. Accordingly, the NRC review of the Quad Cities' MOV program will be considered closed.

The knowledge level of MOV site engineering was considered good. There was an effective team effort between the site and corporate MOV personnel. The licensee performed a number of good initiatives in the MOV area that included motor power monitoring for magnesium rotor degradation and the testing of blowdown valves at an independent laboratory.

b.1.1 MOV Sizing and Switch Settings

Calculations utilized the industry's standard equations to determine thrust requirements for rising stem gate and globe valves. For rising stem MOVs that have been dynamically tested, measured valve factors were used. Non-dynamically tested gate valves relied on the application of test data that was obtained from testing performed at Quad Cities, other licensee facilities, and the Electric Power Research Institute (EPRI) in limited cases. Statistical methods were used to evaluate the effect of MOV performance uncertainties on the available margin. For each MOV, total uncertainty for the valve was compared to the available margin to determine the expected reliability.

b.1.2 Valve Factors (VF)

Measured VFs were used for dynamically tested rising stem MOVs. To account for measurement inaccuracies and future valve degradation, a two standard deviation (2-sigma) VF was also used by the margin analysis, based on increasing the measured VF by 28%. A VF based on 2-sigma for globe valves was determined by using the larger of a 1.2 VF, or the measured VF increased by 10%. For some non-dynamically tested gate valves, White Paper (WP) 160, "Crane Valve Factors," Revision 0, and WP 164, "Anchor/Darling Double-Disk Gate Valve Factors," Revision 1, provided the basis for the nominal and bounding VFs in the reliability margin analysis. Each WP contained regression analysis charts. No concerns were identified with respect to the use of these regression charts. There were, however, the following issues concerning selected VFs noted by the inspectors:

- WPs 160 and 164 contained special tables that were used for high temperature and steam blowdown fluid conditions. These tables were not based on the use of a regression analysis because there was insufficient data available to develop the regression curves. The inspectors had the following concerns with the use of these tables:

  (1) WP 160 Figure 5, "Seating Valve Factors (Nominal)" and Figure 6, "Flow Isolation Valve Factors (Nominal)," were used to determine VFs for Crane gate valves that would need to operate under steam blowdown conditions. The inspectors' concerns were associated with the use of flow isolation VFs obtained from Figure 6. WP 160 allowed the unrestricted use of these VFs. While the use of flow isolation VFs may be acceptable for operability assessments, the inspectors did not consider the use of VFs from Figure 6 to be acceptable for GL 89-10 program closure without specific justification

for each valve. Flow isolation VFs were typically less conservative as compared to seating VFs, and were very specific to the valve being tested. Flow isolation VFs were also subject to interpretation of test results and can be unreliable. The licensee noted that all MOVs that used flow isolation VFs have been included in the margin improvement plan which would allow the use of seating VFs. In the interim, the inspectors considered that the flow isolation VFs were not unrealistic for the valves in question and no operability concerns were identified. Based on the current thrust margins and review of the best available test data for the affected Crane valves, the inspectors considered the current settings to be adequate for program closure.

(2) WP 164 Figure 5, "Anchor/Darling Double Disk Gate Valve High Temperature Test Data," was used to support the guidance for high temperature VF determination. The Figure 5 results were taken from testing performed on a single EPRI test valve and from a single in-situ industry test. The licensee agreed that this data was insufficient to fully justify the VF guidance. The licensee further stated that the EPRI separate effects friction coefficient testing for stellite on stellite under high temperature conditions (as documented in EPRI Report TR-103119, "Friction Separate Effects Test Report") also supported the VF guidance contained in this WP. The inspectors noted that this type of laboratory testing would not reveal any concerns that may exist for Anchor/Darling double disk gate valves to exhibit nonpredictable behavior under steam blowdown conditions. Although the VFs used for the Anchor/Darling valves were considered adequate for GL 89-10 program closure, as part of the long-term MOV program, the licensee would monitor industry testing efforts on potential non-predictability concerns or obtain other additional information to justify the VF.

- The rising stem MOV data sheet (RSMDS) for MOV 1-220-1 used a 0.5 VF as the basis for the identified design-basis thrust requirements. This valve was a 3" Anchor/Darling 1500# double disk gate valve that experiences high temperature steam conditions. The VF was based on the high temperature VF guidance in WP 164, which specified the use of a VF that was 0.05 greater than the nominal VF identified in the WP table. Given the small amount of high temperature test data analyzed by WP 164, the inspectors questioned the reliability of this assumption. The licensee agreed to revise all RSMDS sheets for Anchor/Darling double-disk gate valves that must operate under high temperature fluid conditions to use the appropriate "2-Sigma VF" from the WP table.

- The EPRI Performance Prediction Methodology (PPM) was applied to provide thrust requirements for Crane 28" flex-wedge gate MOVs 2-202-5A & 5B. Application of the PPM was documented in Calculation QDC-0202-M-0266, "EPRI PPM Calculation for Quad Cities Valves 2-202-5A/5B," that was approved November 18, 1996. The criteria used to evaluate the applicability of using the EPRI PPM, however, did not consider valve size. NRC's Safety

Evaluation (SE) of EPRI Topical Report TR-103237, "EPRI Motor-Operated Valve Performance Prediction Program," dated March 15, 1996, stated that the EPRI gate valve model was not directly applicable to the 28" Crane valves because the model was limited to gates valves that were a maximum of 18". However, due to the lack of industry information for large Crane gate valves, the inspectors considered the PPM results to be the best available data at this time. Based on the available margin and the use of PPM-based thrust requirements, the inspectors considered the current settings to be adequate for program closure. However, the licensee intended to obtain additional information (e.g., justify use of the EPRI PPM or apply other applicable industry data) to justify the VF as part of the long-term MOV program.

- WPs 160 and 164 stated that the VFs referenced in the RSMDS for non-dynamically tested MOVs in cold water applications should be approximately 0.1 greater than the nominal VFs derived from the regression charts. The use of a fixed amount above a mean value was not acceptable because of the potential for the actual VF to exceed the selected value. However, the inspector's deterministic margin review for non-dynamically tested MOVs which was based on use of bounding VFs, did not identify any operability concerns. Therefore, the RSMDS's should use the same bounding VFs as the deterministic thrust margin, unless valve-specific information was obtained. The inspectors identified this as an inconsistency in the GL 89-10 program.

b.1.3 Load Sensitive Behavior

MOVs that were dynamically tested used, in the bounding case, the measured load sensitive behavior (LSB) value plus 5% to account for diagnostic equipment uncertainty and changes over time. Non-dynamically tested MOVs relied on analysis of the LSB data, which determined the mean and the standard deviation of the available test results. Based on the use of Mobilux EP stem lubricant, the mean LSB was 7% with a 2-sigma confidence value of 20%. The inspectors found the assumptions for LSB to be adequate.

The inspectors noted that the WPs did not provide specific guidance for the selection of LSB assumptions to be used by the RSMDS for non-dynamically tested MOVs. The licensee stated that WP 107, "Guidelines for Determining Target Thrust Windows," Revision 2, will be revised to include guidance for selecting the correct LSB values from WP 124, "Rate of Loading," Revision 1. The inspectors considered this to be adequate.

b.1.4 Stem Friction Coefficient (SFC)

The margin analysis typically used a SFC of 0.20 for the bounding case. This was supported by data that showed an average SFC of 0.128 and a 95% confidence value of 0.182. The inspectors found the assumptions for SFC to be adequate.

b.1.5 Open Unseating Forces

The inspectors noted that the methods for addressing LSB did not consider the possible effects of this phenomena for a MOV's opening stroke. Under dynamic conditions, the SFC may increase as compared to what was measured under static test conditions. This would be of concern for the open direction because the determination of an available open thrust margin relied directly on the reliability of the assumed SFC. To address this concern, the licensee analyzed the SFC performance under dynamic test conditions for 12 MOVs where adequate torque data existed. This review was done to demonstrate that the open SFC assumptions in the calculations were conservative relative to the values measured during dynamic tests. The upper bound of the reviewed data increased from 0.159 (measured under static conditions at a torque switch trip) to 0.181 under open dynamic test conditions (measured at the maximum thrust point after disk unwedging). All open thrust margins were screened using an assumed SFC of 0.2 and did not identify any margin concerns for MOVs with an open safety function. The licensee stated the RSMDS will be revised to account for open LSB concerns. The inspectors considered the actions to address this concern to be adequate.

b.1.6 Torque Switch Repeatability

The application of margin for torque switch repeatability was acceptable for program review closure. Torque switch repeatability values of 5%, 10%, and 20% based on torque switch setting and actuator torque were appropriately applied following Limitorque guidance.

b.1.7 Margin Assessment

A method for margin assessment was developed that looked at the specific testing of a given MOV and used statistical methods to account for all uncertainties associated with MOV performance. Each source of uncertainty was evaluated based on whether the uncertainty was bias error, a random error, or a combination of both. Using this concept, a nominal scenario was developed based on bias errors, and a bounding scenario based on random errors for each MOV. Each source of random error was individually evaluated to determine its effect on the margin associated with the nominal scenario. These individual results were then combined using the square root sum of the squares method to arrive at a margin needed for a 2-sigma confidence level. This result was compared to the MOV's nominal margin, and a reliability value was determined. This reliability value was combined with the valve's safety significance. As discussed in GL 91-18, "Information to Licensees Regarding Two NRC Inspection Manual Sections on Resolution of Degraded and Nonconforming Conditions and on Operability,' the safety-related component (in this case, MOV) must be capable of performing its specified function. GL 91-18 also states that probabilistic risk assessments and probabilities of the occurrence of accidents or external events were not acceptable for making operability decisions

For completing the response to GL 89-10, thrust margins also were calculated for MOVs using a more deterministic method. These calculations were adjusted to account for diagnostic equipment uncertainty, torque switch repeatability, and load

sensitive behavior. Based on these calculations, MOVs with less than 10% thrust margins were reviewed. No operability concerns were identified. Several of these MOVs were already scheduled for margin improvements. However, the following MOVs were identified as having low thrust margins, but were not included in the margin improvement plan.

2-1301-21	1-1001-23A	1-2301-4	2-2301-4
2-2301-5	1-2301-8	2-1001-7D	

The licensee reviewed the affected valves and has incorporated these MOVs into the margin improvement program. No other concerns were noted.

b.1.8 Rising Stem MOV Data Sheets (RSMDS)

The following two issues were identified concerning the RSMDS:

- During review of MOV 1-220-1, the inspectors noted that the thrust available at a torque switch trip was above the maximum allowed thrust stated in the most recent RSMDS. This occurred when the RSMDS was recently updated to reflect the current program assumptions (e.g., VF). The licensee had performed an evaluation based on the margin assessment program to determine if there was an operability concern. Based on this evaluation, no operability concerns were identified.

  The inspectors were concerned that this condition did not initiate a formal operability review. Based on this concern, the licensee initiated problem identification form (PIF) 96-3296 to review this issue for all program MOVs. This review identified 45 MOVs that were outside the current optimal thrust windows. No operability concerns were identified with these valves based on deterministic margins or the margin assessment program. To resolve this concern in the future, the licensee stated that the MOV program will be revised to ensure that this type of review will be adequately documented when an RSMDS thrust window was revised. The inspectors identified this as a generic concern for all ComEd plants, which will be resolved by a revision to the corporate white paper.

- The recent self-assessment report identified that there was no requirement to feedback test information into the RSMDS in a timely manner. In response, licensee personnel initiated a VOTES procedure change to ensure those test results that exceed the current RSMDS assumptions will require the generation of a revised RSMDS. The inspectors considered this procedure change to be adequate.

b.2 Program Scope Changes

Forty-four valves were removed from the program since the Part 2 inspection. Thirty were removed based on the valves not having an active safety-function. The remaining 14 valves were in an air duct system and not required to be in the program scope based on Supplement 1 to GL 89-10. With the removal of these valves, the program scope for both units consisted of 160 MOVs consisting of 118

gate and 42 globe valves. From this scope, 58 valves were able to be dynamically tested.

b.3 Periodic Verification of Design-Basis Capability

Based on existing margin reliability and risk evaluations, the licensee planned to statically test as follows:

- 2 MOVs every refueling outage
- 91 MOVs every three refueling cycles
- 67 MOVs every six refueling outages.

Test frequencies and methods were based on risk considerations, design function reliability, and motor gearing capability margin reliability to provide assurance of MOV operability over the test interval. The testing plans included static testing with and without the VOTES torque cartridge, dynamic testing, and future use of motor power monitoring testing. Currently, nine valves were scheduled for dynamic testing as part of the periodic verification program.

The NRC staff will review the periodic verification program in greater detail following the submittal in response to GL 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves," including the intent to test some valves every six refueling outages where GL 96-05 discussed testing every five years. As stated in GL 89-05, the licensee should consider the benefits (such as identification of decreased thrust output and increased thrust requirements) and potential adverse effects (such as accelerated aging or valve damage) when determining the appropriate type of periodic verification testing for each program MOV.

b.4 Post-Maintenance Verification/Testing (PMT)

PMT requirements documented in WP-135, "GL 89-10, Post Maintenance Verification Recommendations," Revision 0, QCAP 0400-16, "MOV Management Program, Attachment F," Revision 1, and QCAP 2200-09, "Post Maintenance Testing Guide," Revision 3, were acceptable for program closure. The guidance and requirements specified were consistent with the licensee's commitments to GL 89-10 and appropriately established static and/or dynamic test requirements following valve and actuator maintenance and modifications including packing adjustments.

b.5 MOV Trending and Corrective Actions

The inspectors determined that the trending program appeared capable of tracking and evaluating data to maintain MOV design-basis capability. The tracking and trending of MOV failures were controlled by WP-000, "MOV Program Technical Guidance," Revision 3, and the QCAP 400-16. However, the inspectors noted that the data was maintained in numerous databases. These databases contained the following information:

- Major MOV failure which required a root causes determination.
- Minor failures such as packing leaks.
- Baseline diagnostic test results that would be used to evaluate valve performance during the periodic verification program.
- MOV problems stemming from the plant-wide PIF system, as well as the licensee and industry failures.

Although the MOV staff was aware of the information available in the databases which was reviewed periodically, the inspectors were concerned that, contrary to recommendation "H" of the GL, frequency of review of the information was not specified. In response, the MOV management program was revised to require a review of this information every fuel cycle.

The inspectors reviewed selected MOV-related PIFs generated since the Part 2 inspection and determined those MOV failures and subsequent corrective actions had been adequate. The licensee was thorough in the identification of MOV failures. Subsequent root cause determinations and corrective actions appeared effective to preclude repetition of the failures.

b.6 Pressure Locking and Thermal Binding (PL/TB)

The inspectors reviewed the licensee's responses to GL 95-07, "Pressure Locking/Thermal Binding of Safety-Related Power-Operated Gate Valves." In a submittal dated February 13, 1996, 12 valves were identified as susceptible to PL. The licensee indicated that based on the calculations and the modifications completed to date, the valves have sufficient capability to perform the open design basis function. Currently, 11 valves had holes drilled in the discs and the licensee intended to drill a hole in the disc of the remaining valve, 2-1001-29A, during the March 1997 Unit 2 refueling outage. The inspectors reviewed the operability determination for the 2-1001-29A valve and did not identify any concerns.

The inspectors also reviewed several additional issues such as; the potential susceptibility to thermal binding of valves 1(2)-2391-3 (HPCI Turbine Steam Supply), thermal binding of MOVs due to stem growth, and the basis for the temperature criterion that was used for evaluating if valves were susceptible to thermal binding. In most cases these issues appeared to be adequately addressed, however, these issues will continue to be reviewed and closed-out under the guidance of GL 95-07.

c. Conclusions

All significant issues related to the MOV program have been resolved; therefore, the GL 89-10 program review will be closed. Program documentation and test data provided an adequate basis to conclude that all GL 89-10 program MOVs would perform the intended safety functions under worst-case design-basis conditions.

Significant issues identified during the inspection that were adequately addressed included the following:

- Several VF assumptions were not sufficiently supported for the long term.
- There were several marginal valves identified that were not included in the margin improvement program to increase the valves capability.
- The licensee's methods for addressing LSB did not consider the possible effects of this phenomena for a MOV's opening stroke.
- There was no formal review process when a valve's available thrust was identified outside the RSMDS design bases thrust windows.

E7 Quality Assurance in Engineering Activities

E7.1 Licensee Self-Assessment Activities

The inspectors reviewed a recent MOV self-assessment that identified a number of good technical issues. The use of outside MOV experts was considered beneficial to providing additional insights into improving the MOV program. Although the technical self-assessment in preparation for the inspection was excellent, the NRC noted that the site quality verification (SQV) had not completed any recent assessments of the MOV program. No SQV audit had occurred since mid 1994 and none were planned. In response, the licensee stated that an audit would be performed during the upcoming Unit 2 outage covering MOV testing, maintenance, and engineering. In addition, recurring MOV program reviews would be pursued as part of the SQV program.

E8 Miscellaneous Engineering Issues

E8.1 (Closed) Inspection Followup Item 50-254/265-93013-01(DRS): Generic program assumptions for valve factors, stem friction coefficients, and load sensitive behavior were not sufficiently justified. Further, a draft white paper was inappropriately used to assess low margin MOVs. Based on the results of this inspection, as documented by the preceding report sections, the inspectors considered this item closed.

E8.2 (Closed) Unresolved Item 50-254/265-94004-39(DRS): Acceptability of continued use of magnesium alloy rotors in MOVs due to susceptibility to corrosion from high-temperature and high-humidity environment. The inspectors reviewed corrective actions taken to address this issue, which included replacement of all pure magnesium rotors with 10/90 aluminum/magnesium alloy rotors. During resolution of this issue, the licensee engineering staff helped developed an innovative non-destructive, non-intrusive method to check for motor rotor corrosion via monitoring of motor power and evaluation of motor slip and line frequency relationships. The motor power monitoring was being completed on all MOV VOTES diagnostic tests to continue monitoring for potential corrosion, with particular focuses on the high-temperature and high humidity environment containment MOVs. This item is closed.

E9 Updated Final Safety Analysis Report (UFSAR) Commitments

E9.1 Review of UFSAR Commitments

The inspectors reviewed the applicable sections of the UFSAR that related to the inspection areas discussed in this report. The inspectors verified that the UFSAR wording was consistent with the observed plant practices, procedures and/or parameters, with the following exceptions.

- UFSAR Table 6.2-7 lists MOVs 1(2)-1301-60 (RCIC minimum flow bypass valves) as primary containment isolation valves. Contrary to this, the design basis document DBD-QC-004 and the MOV design basis document, #20897-DB-QDC-1301, both state that the valves have no design basis safety function. The MOV program stated the valves did have safety functions and had been dynamically tested at more than 100% dp. The valves had a substantial capability margin in the open and close direction. Therefore, the generation of a PIF to re-review the design basis requirements for these valves was considered acceptable.

- UFSAR Section 6.3.2.2.4.2 discussed the closure of the preselected recirculation loop equalizing valves to separate the loops causing the maximum differential pressure across the two loops. This logic was required such that RHR would be injected in the unbroken recirculation loop. Normal valve alignment, however, has three of the four equalizing valves shut so that the recirculation loops were not interconnected. As such, closure of the fourth equalizing valve would not cause the loops to separate as this was the normal lineup. The licensee initiated a PIF to review the UFSAR wording.

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 November 22, 1996. The licensee acknowledged the findings presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

*P. Aitken, Acting Engineering Manager
*J. Arnold, SSE MOV Coordinator
*R. Baumer, Regulatory Affairs
*B. Bunte, Corporate MOV Peer Group
*C. Conner, Site Support Engineering (SSE)
*B. Fairbanks, Assistant Vice-President for Administration
*F. Famulari, Site Quality Verification
*P. Gebhardt, SSE MOV Engineer
*D. Lamb, SSE Valve Group
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M. Browning, MOV Engineer
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INSPECTION PROCEDURE USED

TI 2515/109 Safety-Related Motor-Operated Valve (MOV) Testing and Surveillance

ITEMS OPENED and CLOSED

Closed

50-254/93013-01(DRS): IFI Concerns with generic program assumptions
50-265/93013-01(DRS):

50-254/94004-39(DRS): URI Acceptability of magnesium alloy rotors in MOVs
50-265/94004-39(DRS):

LIST OF ACRONYMS USED

BOP	Balance-of-Plant
COF	Coefficient of Friction
ComEd	Commonwealth Edison Company
dp	Differential Pressure
EPRI	Electric Power Research Institute
GL	Generic Letter
HPCI	High Pressure Coolant Injection
IFI	Inspection Followup Item
IN	Information Notice
INEL	Idaho National Engineering Laboratory
LPCI	Low Pressure Coolant Injection
LSB	Load Sensitive Behavior
MOV	Motor Operated Valve
MUG	Motor Operated Valve Users Group
NRC	Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
PDR	Public Document Room
PIF	Problem Identification Form
PL/TB	Pressure Locking and Thermal Binding
PMT	Post Maintenance Testing
PPM	Performance Prediction Methodology
PRA	Probabilistic Risk Assessment
PV	Periodic Verification
QCAP	Quad Cities Administrative Procedure
RCIC	Reactor Core Isolation Cooling
RHR	Residual Heat Removal
ROL	Rate of Loading
RSMDS	Rising Stem MOV Data Sheets
RWCU	Reactor Water Cleanup
RWST	Refueling Water Storage Tank
SE	Safety Evaluation
SFC	Stem Friction Coefficient
SQV	Site Quality Verification
SSE	Site Support Engineering
TI	Temporary Instruction
TS	Technical Specification
UFSAR	Updated Final Safety Analysis Report
URI	Unresolved Item
VF	Valve Factor
VOTES	Valve Operational Test Equipment System
WP	White Paper