U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/88-32

Docket No. 50-293

License No. DPR-35

Licensee: Boston Edison Company
RFD #1 Rocky Hill Road
Plymouth, Massachusetts 02360

Facility Name: Pilgrim Nuclear Power Station

Inspection At: Braintree and Plymouth, Massachusetts

Inspection Conducted: September 12-16, 1988

Inspectors: cfa for T. Koshy — 10/13/88
T. Koshy, Senior Reactor Engineer — date

cfa for J. Lara — 10/13/88
J. F. Lara, Reactor Engineer — date

Approved by: C J Anderson — 10/13/88
C. J. Anderson, Chief, Plant Systems Section — date

Inspection Summary: Inspection on September 12-16, 1988 (Inspection Report No. 50-293/88-32).

Areas Inspected: Special announced inspection to review the corrective actions that resulted from IE Bulletin 85-03 that addressed improper limit switch and torque switch settings in motor operated valves. This inspection reviewed the engineering and maintenance activities to assure the operational readiness of the motor operated valves. This inspection also looked at six previous NRC findings.

Results: The licensee has addressed all the significant aspects of the bulletin. The engineering organization did not specify the special maintenance requirements for maintaining the torque and limit switches.

The engineering organization was not knowledgeable of certain of the plant maintenance activities that influence design bases. Two violations were identified based on previous findings (see Section 5.1 and 5.2). Licensee corrective actions for previous findings were thorough and complete.

DETAILS

1.0 Persons Contacted

1.1 Boston Edison Company (BECo)

R. Anderson, Plant Manager
S. L. Bibo, QA Audit Division Manager
P. T. Cafarella, Sr. Mechanical Engineer
J. Coughlin, Principal Electrical Engineer
*N. Desmond, QC Division Manager
R. V. Fairbank, NED Design Section Manager
*F. N. Famularo, QA Manager
H. D. Goettsch, Material Management Manager
*P. Hamilton, Compliance Division Manager
E. J. Janus, Sr. Electrical Engineer
R. L. Kirven, Power Systems Division Manager
*E. S. Kraft, Plant Support Manager
*F. Mogolesko, EQ Project Manager
P. J. Moraites, Maintenance Planning Division Manager
*H. Oheim, Dep. Engineering Manager
L. Perfetti, Sr. Electrical Engineer
J. Poorbaugh, Sr. QA Engineer
W. Riggs, Mechanical Division Manager
*R. E. Sherry, Maintenance Section Manager
*C. Stephenson, Sr. Compliance Engineer
*E. J. Wagner, Assistant to Vice President Nuclear

1.2 U. S. Nuclear Regulatory Commission (NRC)

C. Carpenter, Resident Inspector
T. J. Kim, Resident Inspector
J. J. Lyash, Resident Inspector
*C. Warren, Senior Resident Inspector

* Present at the exit meeting on September 16, 1988.

2.0 Purpose

The purpose of this inspection was to review the licensee's actions taken in response to IE Bulletin 85-03, motor operated valve (MOV) common mode failures during plant transients due to improper switch settings and to review the licensee's program to assure the operational readiness of the motor operated valves covered under this bulletin. This inspection also reviewed the status of several Electrical and Equipment Qualification open items.

3.0 Background

On June 9, 1985, the Davis-Besse Plant experienced a complete loss of main and auxiliary feedwater which was caused, in part, by MOV failures. This event resulted in IE Bulletin 85-03 that promulgated NRC requirements to assure the operational readiness of MOVs in the high pressure coolant injection/core spray and emergency feedwater systems. The bulletin specified that licensees take the following actions.

(a) Review and document the design basis for the operation of each valve, including the maximum differential pressure expected during normal and abnormal operation.

(b) Using the above data, establish the correct switch settings for torque, torque bypass, position limit and overload for each valve and perform the modifications as needed.

(c) Individual valves should be demonstrated to be operable by testing the valve at the maximum differential pressure based on the performance requirements. In the absence of differential pressure testing, justification should be provided.

(d) Prepare and revise procedures to ensure that correct switch settings are determined and maintained throughout the life of the plant.

(e) Submit a schedule to accomplish the above program including a final submittal with the results of (b) through (d).

Item (a) was reviewed by the NRC office of Nuclear Reactor Regulation (NRR) and the conclusions are documented in Section 4.4. The scope of this inspection was to review items (b) through (d).

4.0 Boston Edison Response to IE Bulletin 85-03 (TI 2515/73)

4.1 Status of Commitments

The licensee responded to the bulletin on December 31, 1986. This letter addressed 21 valves within the High Pressure Core Injection and Reactor Core Isolation Cooling Systems. As the Pilgrim Station was in an extended outage, the valve testing was not completed by the commitment date of November 15, 1987. The licensee requested an extension to complete this activity within 90 days after full power operation is reached (Attachment 1, Reference 2). This request was granted by the NRC on April 14, 1988. (Attachment 1, Reference 3).

Using analytical techniques, the licensee has calculated the required thrust values and tested all the required MOVS using the MOVAT test equipment. The licensee plans to reconfirm the tested valves as soon as the plant is in full power operation. A list of the valves covered in this bulletin is provided in Attachment 2.

4.2 Switch Settings

Item (b) of the bulletin requires that the correct switch settings for torque, torque bypass, position limit and overload for each valve be established. These items are addressed below.

Open Torque Switch and Open Bypass Limit

This switch is normally used as a mechanical fuse to limit the mechanical thrust applied to the valve in the open direction. This switch is usually bypassed during the initial valve unseating which is the most challenging portion of the open stroke. Failure to set this switch to the required value or not bypassing this switch in the initial opening stroke, can prevent the valve from opening.

BECo has chosen to bypass the torque switch in every safety related application. This approach has some merits in that the motor can develop the maximum available torque to open the valve. This is particularly of benefit if the safety function of the valve is to open.

Close Torque Switch

The close torque switch is used to stop the motor rotation on the completion of valve travel in the close direction. Since this switch provides a normal control function and is exercised on every closure stroke, this switch setting needs more careful consideration than the open torque switch. The limiting requirement of the close torque switch is at the end of the closure stroke when the thrust requirements are the highest. The thrust at the point the torque switch trips should equal the most limiting closure thrust requirement including the thrust needed to overcome the differential pressure across the valve. Differential pressure testing using process system pumps with appropriate data gathering and diagnostic evaluation is the positive means of assuring the adequacy of the torque switch set point. Other approaches based on similarity and analysis may also be acceptable with sufficient basis.

The licensee selected the manufacturer's recommendation for thrust limits on the valve. Using the vendor's valve data and Limitorque information, the licensee calculated the required torque for closing the valve when exposed to the maximum possible differential pressure across the valve. MOVAT test equipment was utilized to confirm that required thrust is developed at the valve seat. The inspectors verified the test data on the thrust developed on the following valves.

2301-3	HPCI Turbine Steam Supply
2301-14	HPCI Minimum Flow Bypass
2301-36	HPCI Suction from Torus
1301-49	RCIC Pump Discharge

The final thrust developed on the valve seats exceeded the required thrust. The as found setpoints were in conformance with the licensee documents. In Reference 2 (Attachment 1), the licensee has committed to test the valves during power operation to confirm that torque switches are set correctly. The inspectors reviewed the valve manufacturer's data for the following valves.

2301-4	Steam Isolation
2301-5	Steam Isolation to HPCI Turbine
2301-6	HPCI Pump Suction from Condensate Storage Tank
2301-8	HPCI Pump Discharge Valve

The valve rating for thrust limit was significantly above the required thrust. No discrepancies were observed.

Close Torque Switch Bypass

The close torque switch bypass acts in the same manner as the open torque switch bypass; however, contrary to its counter part function, it normally bypasses the torque switch during the lightest duty portion of the stroke, the beginning of the closing stroke. The use of this switch is not critical; however, if utilized it should be set to operate during the initial part of the stroke, to assure that valve closure is not prevented by the torque switch.

BECo controls the torque switch operation based on the safety function. When the safety function of the valve is to close, the torque switch is bypassed for 95 percent of the stroke. This approach makes the full torque of the motor available for completing the significant part of the stroke. If the valve closure is not a safety function, the torque switch is bypassed only during the initial stroke of the valve and thereafter it remains in the circuit. No deficiencies were identified.

Open Limit Switch

This switch provides the control function for determining the upper limit of the valve stem travel in the open direction and stops the motor rotation by opening the circuit. The setting of this switch must assure adequate valve opening and should prevent back seating. Valve backseats provide a seal that is redundant to the valve packing in order to allow valve packing replacement without the need to drain down the process system. Using the motor power to backseat, can and has caused valve stem shearing and stem thread twisting. Therefore, it is important to set the open limit switch away from the back seat with enough margin to allow for motor deenergization and inertia.

BECo has set the open limit switch such that the valve does not back seat by inertia. No problem was identified with this arrangement.

Close Limit Switch

This switch is usually used with the close torque switch in series for over-torque protection. For high speed operators, where torque switches cannot react in sufficient time, the close limit switch deenergizes the motor and the remaining inertia forces seat the valve.

BECo is not utilizing the close limit switch to deenergize the motor for valves covered under this bulletin. All the valves in the scope of this bulletin are seated using the torque switches.

Open/Close Indication

A red light provides a valve open signal. This light is taken from the close rotor limit switch which is set to actuate very close to the end of valve closure. A green light provides a valve closed signal and is taken from the open rotor limit switch actuation. The green light will turn off when the MOV is in the full open position, and the red light will turn off when the MOV is in the full closed position.

Most of the PNBS MOVs are equipped with only two rotors. The precision for position indication is less significant than the torque switch bypass function. Therefore, the light indications are not exact but within 5 to 10 percent. No discrepancies were observed.

Thermal Overload Relay

Thermal overload relays are used to protect motor winding insulation from breakdown during overload conditions. Devices used appear to uniformly consist of heaters at the motor control center which trip a heat sensitive relay, the contacts of which either interrupt current to the contractor closure coil (which stops the motor) or initiates an overload alarm, or both. Where thermal overload relays stop operator mo[illegible]ation on trippi[illegible], the heaters must either be sized to prevent inadve[illegible] stopping the motor or the overload relays must be bypassed when mo[illegible]eration is important to safety. They should also be sized to protect the motor windings from thermal damage. Regulatory Guide 1.106, thermal overload protection for electric motors on motor operated valves provides guidelines on the design criteria for thermal overloads.

Designs that area being used at this time to eliminate the threat of inadvertent motor trips include: (1) removing the heaters or relay contacts from use; (2) using the relay contacts for alarm only; (3) bypassing the relay contacts during all operating modes except when a valve is being exer sed for testing; (4) bypassing the relay contacts only during the presence of an automatic safety actuation signal; and, (5) oversizing the thermal overloads.

The BECo criteria on thermal overload relay sizing was reviewed during inspections 88-27 and 88-08. The inspectors reviewed the electrical schematic diagram for the RCIC valves and concluded that thermal overloads do not serve a control function but only an alarm function. All the MOVs covered under this bulletin, including the AC operated MOVs were verified by the licensee to only alarm for a thermal overload condition.

4.3 Demonstration of Operability

This involves demonstrating the valve to be operable by testing the valve under maximum differential pressure after changing the individual valve settings as appropriate based on the design bases. In the absence of testing with full differential pressure across the valve, a justification is to be provided. The use of a MOVATS data base to set the torque switches for a particular type of valve is considered as an acceptable approach to exclude differential pressure testing, provided this type of valve has sufficient test data to establish similarity. However, a suitable test is needed to establish that the desired force is available at the valve seat for closure.

BECo has calculated the required torque switch setpoint using the Limitorque information. The licensee plans to conduct a differential pressure testing upon recovery from the outage. Currently all the MOVs covered under the bulletin have been test with the MOVAT equipment at the required torque switch setpoints.

During the inspection, the licensee was unable to produce the test records documenting the actuation of limit switches. However, the licensee maintenance procedures provide clear directions to set these switches at the desired configuration. The records on maximum thrust developed was reviewed in detail. The licensee tabulation of thrust values for all bulletin valves concluded that sufficient thrust was available at the valve seat during closing. As the open torque switch was bypassed during the safety function, this switch setting was not verified.

No discrepancies were identified.

4.4 NRC Review of the Licensee Submittal

As requested by action item e. of Bulletin 85-03, "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings," the licensee identified the selected safety-related valves, the valves' maximum differential pressures and the licensee's program to assure valve operability in their letters dated May 9 and December 31, 1986, and November 13, 1987. NRC review of these responses indicated the need for additional information. This is documented in an NRC letter to BECo dated March 25, 1988.

NRC review of the licensee's May 6, 1988, response to this request for additional information indicates that the licensee's selection of the applicable safety-related valves to be addressed and the valves' maximum differential pressures meets the requirements of the bulletin and that the program to assure valve operability requested by action item e. of the bulletin is acceptable.

The NRC review of the final response required by action item f. of the bulletin will be addressed in a future inspection report.

4.5 Maintenance and Procedures

The bulletin requires that licensees prepare or revise procedures to ensure that correct switch settings are maintained throughout the life of the plant and also to ensure that applicable industry recommendations are considered in the preparation of the procedure.

The inspectors reviewed the procedures listed in Attachment 3. The licensee had revised these procedures for maintaining the limit and torque switch settings. The torque switch setpoints for all the safety related valves are addressed in licensee drawings listed in Attachment 4.

A walkdown was conducted to inspect valve MOV maintenance activities. Where practical, the inspectors verified the grease level in the main gear case and looked for lubrication of the valve stems. These were found to be sufficiently lubricated. The licensee technicians and their staff were knowledgeable in the operation and maintenance of the valves.

The inspectors reviewed the post maintenance testing of MOVs. The licensee is currently timing the valve stroke to establish operability after minor maintenance and tightening of the packing. The licensee concurred with the inspectors observation that valve stroking does not completely establish valve operability, since valve stroking is not performed with a differential pressure across the valve. The licensee is planning to look into this matter. They plan to consider industry experience with this issue.

The inspectors observed that licensee procedures do not identify the circumstances which prompted the retesting of the valves covered under this bulletin. Certain corrective and preventive maintenance activities can influence the as-left conditions of the torque switch setting. A replacement of the torque switch or spring pack will lead to changes in the available torque for closing/opening the valve. The inspectors inquired if any of the subject valves had undergone maintenance activities that can potentially affect the torque available for valve function. The licensee review of maintenance records indicated a torque switch replacement in valve 1301-16. The inspectors questioned the licensee regarding their planned actions to

verify the capability of valve 1301-16 to perform its safety function.

The inspectors discussed the above item with the licensee management and indicated the need for the operability of valve 1301-16 to be addressed before plant restart. The maintenance department currently plans to retest this valve. The licensee committed to develop the guidelines establishing the need for retesting valves that have undergone certain maintenance activities and sensitizing the key maintenance personnel of the need for this retesting.

This is an unresolved item pending NRC review of the new test results to establish operability of valve 1301-16 and the development of specific conditions which would require retesting of valves that are covered in the bulletin. (50-293/88-32-01)

No other deficiencies were identified.

5.0 Followup Of Previous Inspection Findings

5.1 (Closed) Unresolved Item (88-08-03) Undersized Starter

During a previous special inspection of electrical power systems, NRC inspectors identified a contactor installed in MCC cubicle B1735 which was NEMA size 1 whereas the E10, Revision 12 drawing indicated a NEMA size 2. This contactor misapplication was identified as an Unresolved Item pending further NRC review of the licensee's actions to review other potential misapplications of contactors and the cause of this discrepancy.

According to NEMA standards, size 1 contactors can be used with 460 volt motors having ratings not exceeding 10 HP and size 2 contactors with 460 volt motors having ratings not exceeding 25 HP. The load served by unit B1735 is a 20 HP motor for drywell unit cooler V-AC-206A1. Accordingly, a NEMA size 2 contactor is required for this application. This MCC was procured by Bechtel Engineering via a purchase order for BECo. A size 2 starter was ordered. However, a size 1 starter was supplied by the manufacturer.

PNPS QA Manual Section 7 requires that a receipt inspection of purcha[illegible]uipment be performed according to approved procurement docume[illegible] Failure to use correctly sized motor starters as specified by design drawings constitutes a violation of 10 CFR 50 Appendix B Criterion VII which requires that measures be established to assure that purchased equipment conforms to procurement documents. This is a violation (50-293/88-32-02).

Subsequent to this NRC finding, the licensee initiated a Potential Condition Adverse to Quality (PCAQ) #NED-88-022 which documented the discrepancy between field conditions and as-built drawings. BECo's Nuclear Engineering Department (NED) addressed this discrepancy and

documented its evaluation in ERM 88-647. The apparent cause for the deficiency is that a size 1 starter was improperly shipped from the manufacturer Nelson Electric. An extensive document search by the licensee of the corresponding MCC procurement documents and receiving records indicated that the MCC purchase order required a size 2 starter but a size 1 starter was erroneously shipped by Nelson Electric. A test data sheet for MCC cubicle B1735, dated April 7, 1972, indicated that a size 1 starter was installed in the cubicle at that time. The licensee, therefore, determined that Nelson Electric incorrectly supplied a size 1 starter and receiving inspections by Bechtel did not note this error.

NED issued Field Revision Notice (FRN) 87-80-46 to replace the size 1 starter in MCC cubicle B1735. A walkdown was performed of the remaining safety-related MCCs to ensure that the as-built conditions agree with the design documents. No additional discrepancies were identified. NED has informed Nelson Electric of the deficiency in the procurement process which contributed to the problem.

In addition to the field walkdown of as-built starter sizes to the design documents, NED reviewed the current motor sizes on the safety-related MCCs to verify that the existing starters are sized properly. As a result of this review, five (5) additional starters were changed from a size 1 to size 2. These changes were due to past PDCs that made minor changes in the motor sizes that were being fed from the MCCs. These changes in motor sizes were marginal. However, they were necessary to conform with the industry standards for sizing motor starters.

The NRC inspectors reviewed the licensee's evaluation of the undersized contactor during this inspection period. The licensee initiated adequate corrective actions and evaluated the circumstances to determine if other similar misapplications were present in safety-related Motor Control Centers.

Based on the licensee's corrective actions to prevent reoccurrence and results, this violation is considered closed.

5.2 (Closed) Unresolved Item (87-53-01.1) Licensee Actions to Improve Ability to Respond to Future LOOP Events: During the Augmented Inspection Team (AIT) review of the November 12, 1987 loss of off-site power (LOOP) event at PNPS, the licensee identified several actions that would be implemented to improve the stations ability to respond to future LOOP events. These actions included (1) installation of a station blackout diesel generator (SBDG); (2) installation of a backup instrument air supply; and, (3) installation of additional instruments to analyze switchyard transients.

Review of the above actions and inspector observations are described below.

1. Installation of Station Blackout Diesel Generator.

   As part of the PNPS Safety Enhancement Program (SEP), the licensee has installed an additional Standby Diesel Generator (SBDG). This non-safety related DG will provide a source of on-site power to the 4.16 kV safety buses A5 and A6. This DG supplies power to the buses through bus A8 concurrent with a failure of either one or both Emergency Diesel Generators (EDG). The SBDG, rated at 2000 Kw, can provide sufficient power for one ECCS pump and its associated support systems required for a LOOP event. Two 20,000 gallon fuel oil tanks provide sufficient supply to run the SBDG for one week. The NRC inspector reviewed PNPS Procedure No. 2.2.146 "Station Blackout Diesel Generator" Revision 1. The station procedure addresses the initial lineup, standby status, operation and restoration of the SBDG. The licensee has completed installation and pre-operational testing of the SBDG. The inspector performed a walkdown of the SBDG during this inspection and observed the diesel and associated equipment to be well-maintained and ready for operation.

2. Installation of Back-up Instrument Air Supply.

   During the LOOP event, the licensee determined that an additional, independent back-up air supply was needed to enhance the existing Instrument Air System. The back-up air system can provide an additional source of air during times when the existing system is not available due to maintenance. A portable Atlas Cupco 900 SCFM compressor is staged outside the Turbine Building truck lock to provide the emergency back-up air supply. The compressor can be connected to the instrument air header through a permanent connection between air compressor K-111 and air receiver T-154. The back-up instrument air supply will be connected to the permanent tie-in connection via a 4" flexible air hose. The back-up air supply connection will be isolated during normal operation. The NRC inspector reviewed the following PNPS Procedures:

   2.2.36 "Instrument Air Systems" Revision 17
   5.3.8 "Loss of Instrument Air" Revision 11

   The above procedures provide instructions for the operation of the portable air compressor and the systematic isolation of portions of the air system to mitigate the effects of a loss of instrument air event. At the time of this inspection, the licensee had completed installation of the back-up air system but had not performed a pre-operational test of the system. The licensee is tracking this test. The test is scheduled to be complete prior to restart.

3. Installation of additional instruments to analyze switchyard transients.

As part of the SEP, the licensee identified the need for improvement in the recording of switchyard parameters to increase the ability to reconstruct and analyze transient events. The licensee proceeded to install an Automatic Transient Recording System (ATRS). The system will enable the licensee to evaluate and analyze transients such as those experienced during the LOOP event of 1987. Installation of the ATRS is complete and is in operation.

During review of the above items, no deficiencies were identified This item is considered closed.

5.3 (Closed) Unresolved Item (87-36-02) Operation of MOVs at High Voltage: During a previous NRC inspection the NRC questioned the licensee on the effect of having 520 volts on 480 volt buses. The inspector was concerned regarding the effect of high voltage on MOV operating times, plant instrumentation, and calibration of protective relays and breakers.

The NRC inspector reviewed the licensee's evaluation of the NRC's concerns. Results of the review are described below.

1. Effect of High Voltage on MOV Operating Time.

   Elevated AC voltages have negligible effect on motor RPM and therefore will not significantly affect valve stroke time. An increase in operating voltage (110%) results in a decrease in the slip and a negligible increase in RPM of about 1%. Therefore, if an induction motor is operating at rated voltage or at an overvoltage of 110%, there is no significant change in its RPM. The valve stroke time can therefore be expected to remain the same at either operating voltage. Since the operating time of the MOVs is relatively short, any increase in motor heating will not exceed the motor's temperature rise capability.

2. Effect of High Voltage on Plant Instrumentation.

   The 120 volt AC control circuitry has a 120 ± 10% (132 v max) voltage rating. Using a 480/120 AC bus voltage ratio, and extrapolating to a higher voltage of 520 volts at the MCC buses, corresponds to a voltage of 130 volts at the instrumentation buses. This is a conservative assumption in that the instrumentation buses would probably have a lower voltage than 130 volts due to the 480/120 volt transformer impedance and circuitry load losses. Typical 120 V instrument relays have ratings of 120 V ± 10%. Therefore, the maximum rated voltage allowed (132 V) is higher than the expected worst case voltage of 130 volts at the instrumentation buses.

3. Effect of High Voltage on Protective Relay/Breaker Calibration
Operation of protective relays and breakers is not affected by higher voltages.

Since overcurrent is the principal parameter in overload/fault current protection systems, protective equipment function is independent of system voltage.

No deficiencies were identified during this review. This item is closed.

5.4 (Closed) Violation (88-08-01) Failure To Perform Periodic Calibration/Testing of DC Circuit Breakers: This violation pertains to the failure of the licensee to perform periodic calibration/testing of DC circuit breakers as required by PNPS Technical Specification 6.8A. During a previous NRC inspection (88-23), the NRC staff reviewed the licensee's response to the notice of violation.

The licensee developed a testing program for a representative sample of all types of safety-related DC breakers installed at PNPS. Testing included breakers of varying ratings and types. A sample of 44 breakers were tested. During the previous NRC inspection, the NRC staff reviewed the licensee's technical analysis and basis used to achieve the breaker test acceptance criteria.

During this inspection, the NRC inspector reviewed the dc breaker test results to verify that all the tested breakers met the acceptance criteria. All tested breakers met the acceptance criteria. No deficiencies were identified during the review.

The licensee previously committed to develop and implement a long-term dc breaker surveillance program. The licensee has committed to implement this program by October 1, 1988.

Based on the above test results, this violation is considered closed.

5.5 (Closed) Unresolved Item (88-23-01) Unidentifiable Wiring in Limitorque Motor Operators:

During a previous NRC inspection (88-23), NRC inspectors reviewed the licensee's corrective actions in response to Information Notice 86-03 regarding the unqualified internal wiring in Limitorque valves. Results of the review indicated that the licensee's corrective actions to address the qualifications of Limitorque internal wiring was insufficient in that the inspectors observed three unidentifiable wires in valves located inside containment. The presence of unidentifiable wiring was documented as an Unresolved Item (88-23-01) pending licensee evaluation of the causes of the discrepancy and the corrective actions.

In the previous inspection, the NRC inspectors observed a red jumper wire on the terminal block inside the Limitorque compartment of valve MO-202-5A which could not be identified. The licensee presented documents which traced the wire to Gauge 12 SIS GE Vulkene Supreme. Inspection of valve MO-202-5B revealed jumper wires located on the terminal block and limit switch fingerboard which could not be identified. These jumper wires were required to be either qualified Vulkene Supreme SIS or qualified Rockbestos Firewall SIS. However, at the time of the NRC inspection these wires could not be established as qualified and their traceability could not be confirmed.

Subsequent licensee inspections of MOVs listed in the EQ Master List (EQML) revealed that Rockbestos Firewall EP wire was installed in six (6) MOVs. Rockbestos Firewall EP has limited qualification inside the drywell to a peak temperature of 150 F or less. This peak temperature is below the peak temperature for which the MOVs are required to operate during accident conditions. Four (4) of the six valves identified with this type of wire are located inside the drywell. The six valves are listed below:

*MO-220-1
MO-1001-23B
MO-1001-26B
*MO-1001-63
*MO-1301-16
*MO-2301-4

*Denotes valves located inside the drywell.

BECo procedure NOP 84A9, "Equipment Qualification Program," Revised February 12, 1988, describes in part the controls for demonstrating and documenting the qualification of equipment and the maintaining of EQ Document Files. 10 CFR 50.49(f) requires that each component be environmentally qualified based on testing with identical or similar equipment under expected worst case environmental conditions to show that the equipment to be qualified is acceptable. Failure to install qualified wires in MOVs for use inside the drywell and failure to establish qualification of all MOV wires at the time of the NRC inspection constitutes a violation of 10 CFR 50.49(f). This is a violation (50-293/88-32-03).

The NRC inspectors reviewed the licensee's corrective actions in resolving the NRC inspectors' findings and their subsequent inspection findings. Licensee actions and inspectors' observations are described below.

Licensee actions included initiating a Potential Condition Adverse to Quality (PCAQ) report #NED 88-085 which resulted in the development of an inspection program covering all 70 EQ Limitorque MOVs. Inspection attributes included detailed wiring requirements to

confirm qualification and identification of wiring requiring replacement. All suspect wires were required to be replaced with Rockbestos Firewall SIS, traceable to BECo qualification reports. During the inspection of the EQ valves, the licensee observed the jumper wires identified during the previous NRC inspection as well as other wiring deficiencies. Licensee findings are as follows:

1. The licensee observed the two jumper wires installed in valve MO-202-5B which could not be identified at the time of the previous NRC inspection. The unidentifiable white wire was removed for inspection. Examination of the removed jumper was made together with other removed similar white jumper wires installed by Limitorque. These wires were all similar in size, color, and texture. Some of these wires had partial markings which are part of the marking found on Rockbestos Firewall SIS qualified wire. Rockbestos indicated that they manufactured qualified Firewall SIS wire with white insulation. Rockbestos informed BECo that based on the comparison of the installed wire to marked qualified wires, they concluded that the found jumpers are Rockbestos Firewall SIS qualified wire.

   The unidentifiable gray wire with red line also was replaced. Inspection and comparison of wires with this color to identified marked wires established that this wire was qualified Vulkene Supreme SIS. During the course of licensee's inspection, suspect jumper wires with the following colors were observed: red/pink, gray with red line, gray with black line, orange. These wires were later identified to be either qualified Rockbestos Firewall SIS or qualified Vulkene Supreme SIS.

2. Black colored wires were observed in six MOVs. Some of these wires were readily identified as Rockbestos Firewall EP. The licensee reviewed Equipment Qualification Evaluation Sheets to determine whether these wires were qualified for its as-found application. Review of these documents as well as Maintenance Requests, Material Receipt Inspection Reports, and QC Inspection Reports verified that these wires were Rockbestos Firewall EP. However, Rockbestos Firewall EP wire has limited environmental qualification. It is qualified for EQ applications outside the drywell. Four of the six MOVs having this limited type of wire are located inside the drywell. The NRC inspectors reviewed WYLE Laboratories Nuclear Environmental Qualification Report No. 47066-CAB-20 which established the qualification for Rockbestos Firewall EP wire for use at PNPS. This report established its qualification for outside the drywell.

All of the above suspect wires were replaced with qualified Rockbestos Firewall SIS during the licensee's inspection.

The NRC inspectors reviewed licensee documents to determine when the Rockbestos EP wires were installed within the drywell MOVs and

whether these wires were ever in use. Review of several Maintenance Requests and QC inspection reports indicated that these wires were installed during the present plant outage and therefore were not in service during plant operation. Documents reviewed are listed in Attachment 5.

The licensee implemented a plan to determine the extent of the use of Rockbestos Firewall EP wire. A review of all Safety Related (Q) purchase orders (PO) indicated that only two Q Purchase Orders had been placed with Rockbestos for the subject wire. These two POs were made by BECo and were Nos. 37291 and 56791. Review of these POs indicted that this type wire was used for fire protection tasks, which are non EQ applications, and for the upgrade of MOVs. Wire used for MOV applications, from PO No. 37291, was withdrawn from the warehouse during or after the September 1987 time frame. (Review of MRs for the four drywell valves also traced the installed wire to this purchase order.) A search of the cable and raceway program by cable code and a review of the master list equipment, to determine if "EP" wire was installed in other EQ applications other than MOVs, indicated that no Rockbestos Firewall EP wire was used as a cable in any EQ application. In addition, jumper wires of this type are not used within the drywell for EQ application.

The NRC inspectors reviewed PNPS Procedure No. 1.5.3.1, "Maintenance Work Plan" which establishes the measures to be used for the preparation, review, approval, and issuance of a Maintenance Work Plan. This procedure has been revised to include further instructions and requirements for the review of EQ work activities. EQ work activities are reviewed by engineering in the planning package and the EQ requirements will be documented in EQ Supplement Sheet(s).

The licensee reviewed the inadequacy of QC inspections during the installation of the unqualified wires in MOVs. Review indicated that when QC inspectors are observing the work activity, they do not verify the wires to the source to confirm if these wires are indeed the correct wires in accordance with EQ requirements. QC inspectors are now instructed as to the types of environmentally qualified wires available and to visually verify all installed components to the source document and that they are in conformance.

During this inspection period, the NRC inspectors reviewed the licensee's extensive effort to remove all the potential concerns on unqualified wiring in EQ equipments. The corrective action addressing the unidentified wires was determined to be adequate. Licensee actions to prevent reoccurrence, including engineering review of EQ work activities and additional training of QC inspectors, were also determined to be adequate.

Based on the above licensee's corrective actions and subsequent NRC review, this violation is considered closed.

5.6 (Closed) Unresolved Item (87-27-05) Motor Operated Valve Preventive and Corrective Maintenance Program. This item deals with the following items:

- Lack of Torque switch setpoint and controls;
- Inadequate use of Torque switch in closing circuit;
- The setpoint of Torque bypass limit switch and the validity of stroke timing;
- Lack of instructions to prevent back seating;
- Maintenance bypassing the torque switch for testing;
- Unbalanced Torque switches and lack of procedural control on balancing torque switches;
- Spring Pack packed with grease;
- Improper splice on MOV-1001-7C and MOV-1001-7C.

Based on the extensive problems identified in MOV maintenance area, the licensee used a Limitorque contractor and performed a complete overhaul of all the safety-related and some of the non-safety related valves. This work was done according to the revised BECo procedures. The inspectors reviewed the summary document "PNPS Motor Operated Valve Program RF07", dated May 9, 1988. The work involved the following specific activities.

1. One and ten minute meggar test of motor

2. Limit Switch Compartment inspection:

   - condition of all gaskets and seals for compartment cover and switches;

   - condition of switch contacts and phenolics;
   - switch materials (EQ grade as applicable);
   - condition of limit switch grease
   - condition of lugs and wiring (replacement as required for EQ valves);
   - torquing of terminations;
   - review of elementary drawings for torque switch bypass;

3. Worm and Spring pack inspection

4. Torque Switch Checkout

   - contact and phenolic inspections;
   - torque switch balancing;
   - adjustment of spring cartridge cap collar (if applicable);
   - verification of permanent open torque switch bypass; (if applicable);
   - switch functional check: feed to open/close permissive;

- switch setting: per manufacturers recommendations or past MOVATS;
- electrical stroke test to verify positive closure.

5. T-drain blockage (EQ valves inside containment)

6. Condition and level of main and clutch housing grease

7. Hold down bolt torquing (tightness check)

8. Staking of stem nut locknut (rising stem, non-rotating only)

9. Stem lubrication and thread condition

10. General inspection for external gasket and seal leakage

The licensee procedures were proven to be sufficient to maintain the MOVs during this work. Torque switch setpoints are currently controlled through the drawings listed in Attachment 4. Based on the inspectors observation of the valves discussed in Section 4, this item is closed.

The inspectors reviewed a Limitorque contractor report (PNPS Motor Operated Valve Program RF07) that addressed several valve conditions which rendered the valve inoperable due to spring pack problems, some valves that contained improper splices and unqualified material in environmentally qualified MOVs. It was determined that the corrective actions are complete.

6.0 Unresolved Items

Unresolved items are matter for which more information is required in order to ascertain whether they are acceptable, violations, or deviations. One unresolved item is discussed in Section 4.5 of this report.

7.0 Exit Interview

At the conclusion of the inspection on September 16, 1988, the inspectors met with the licensee representatives denoted in Section 1.0. The inspectors summarized the scope and findings of the inspection at that time.

No written material was provided to the licensee by the inspectors.

ATTACHMENT 1

REFERENCES

1. Licensee letter from James M. Lydon to Thomas E. Murley, NRC, dated December 31, 1986.

2. Licensee letter from R. G. Bird to Document Control Desk, NRC, dated November 13, 1987.

3. NRC letter from Daniel McDonald, Project Manager to Ralph E. Bird, Boston Edison Company, dated April 14, 1988.

MOV DATA SUMMARY

HPCI System Valve	Size(in) Rating(lb)	Limitorque Operator	Valve Function	Design Basis ΔP (PSI)	Max Operating ΔP(PSI) Open/Close	Torque Switch Jumpered
MO-2301-3 Velan - Gate	10x8 600	SMB-1	Steam Admission Valve	1150	1104/1104	Open
MO-2301-4 Velan - Gate	10x8 900	SMB-2	Steam Line Isolation Valve	1150	1104/1104	Open
MO-2301-5 Velan - Gate	10x8 600	SMB-1	Steam Line Isolation Valve	1150	1104/1104	Open
MO-2301-6 Powell - Gate	16 150	SMB-0	Condensate Storage Tank Suction Valve	60	25/38	Open
MO-2301-8 Anchor - Gate	14x10 900	SMB-1	Injection Valve	1500	1230/1302	Open
MO-2301-9 Anchor - Gate	14x10 900	SMB-1	Injection Test Valve	1500	1230/1302	Open
MO-2301-10 Velan - Globe	10 900	SMB-2	CST Test Return Valve	1500	1290/1337	Open
MO-2301-14 Velan - Globe	4 900	SMB-0	Minimum Flow Bypass Isolation Valve	1500	1327/1355	Open
MO-2301-35 Powell - Gate	16 150	SMB-0	Suppression Pool Suction Isolation Valve	60	26[3]/26	Open
MO-2301-36 Anchor - Gate	16 150	SMB-00	Suppression Pool Suction Isolation Valve	60	27[3]/27	Open

[1] Values are for both open and close positions.
[2] Calculated maximum operating pressures based on BWR Owner's Group Report.
[3] For additional conservatism, increasing pressure due to check valve leakage will be assumed resulting in a suction line pressure of 97 psi. Realizing this possibility, the suction line relief valve will be set lower, or the valves/operators will be readjusted for 100 psi differential.

MOV DATA SUMMARY (Cont'd)

RCIC System Valve	Size(in) Rating(lb)	Limitorque Operator	Valve Function	Design Basis ΔP (PSI)	Max Operating[2] ΔP(PSI) Open/Close	Torque Switch Jumpered
MO-1301-16 Velan - Gate	3 600	SMB-00	Steam Line Isolation Valve	1250	1104/1104	Open
MO-1301-17 Velan - Gate	3 600	SMB-000	Steam Line Isolation Valve	1250	1104/1104	Open
MO-1301-22 Powell - Gate	6 150	SMB-000	Condensate Storage Tank Suction Valve	60	25/36	Open
MO-1301-25 Velan - Gate	6 150	SMB-000	Suppression Pool Suction Isolation Valve	60	27[3]/27	Open
MO-1301-26 Powell - Gate	6 150	SMB-000	Suppression Pool Suction Isolation Valve	60	26[3]/26	Open
MO-1301-48 Powell - Gate	4 900	SMB-00	Injection Test Valve	1500	1238/1345	Open
MO-1301-49 Powell - Gate	4 900	SMB-00	Injection Valve	1400	1238/1345	Open
MO-1301-53 Powell - Globe	4 900	SMB-0	CST Test Return Valve	1400	1301/1358	Open
MO-1301-60 Powell - Globe	2 600	SMB-00	Minimum Flow Bypass Isolation Valve	1500	1340/1377	Open
MO-1301-61 Powell - Globe	3 600	SMB-00	Steam Admission Valve	1150	1104/1104	Open
MO-1301-62 Powell - Globe	2 600	SMB-000	Cooling Water to Turbine Accessories	75	60[4]/28	Open

[1] Values are for both open and close positions.
[2] Calculated maximum operating pressures based on BWR Owner's Group Report.
[3] For additional conservatism, increasing pressure due to check valve leakage will be assumed resulting in a suction line pressure of 95 psi. Realizing this possibility, the suction line relief valve will be set lower or the valves/operators will be readjusted for 100 psi differential.
[4] This value is based on demonstrated operability during pump surveillance testing, and a control valve located upstream.

ATTACHMENT 3

MOV PROCEDURES

3.M.1-11.1	EQ Maintenance Repair/Replacement, Revision 10
3.M.4-10	Valve Maintenance, Revision 10
8.Q.3-8	Limitorque Type SB/SMB Valve Operator EQ Maintenance, Revision 5
3.M.3-24.1	Limitorque Type SMB Valve Operator Removal, Revision 5
3.M.3-24.2	Limitorque Type SMB-000/00 Motor Operator Overhaul, Revision 3
3.M.3-24.3	Limitorque Type SMB-0 Through-3 Motor Operator Overhaul, Revision 2
3.M.3-24.4	Limitorque Type SMB-5 Motor Operator Overhaul, Revision 1
3.M.3-24.5	Limitorque Type SB/SMB Electrical Checkout and Adjustment, Revision 10
3.M.3-24.6	Limitorque Type SMB Valve Operator Installation, Revision 4
3.M.3-24.7	Limitorque Type SB-00 Through SB-3 Valve Operator Disassembly/Removal, Revision 1
3.M.3-24.8	Limitorque Type SB-00 Through SB-3 Valve Operator Reassembly/Installation

ATTACHMENT 4

DRAWINGS

M-MOV 1	Motor Operated Valves Information Table	Revision E-1
M-MOV 2	Motor Operated Valves Information Table	Revision E-0
M-MOV 3	Motor Operated Valves Information Table	Revision E-1
M-MOV 4	Motor Operated Valves Information Table	Revision E-0
M-MOV 5	Motor Operated Valves Information Table	Revision E-1
M-MOV 6	Motor Operated Valves Information Table	Revision E-0

ATTACHMENT 5

DOCUMENTS REVIEWED

PNPS Report No. 88XE-2ER-Q, "Assessment And Confirmation Of Environmentally Qualified Limitorque Motor Operator Internal Wiring."

BECo Nuclear Organization Procedure 84A9, "Equipment Qualification Program."

BECo NED Memorandum 88-447, "Limitorque EQ Master List Motor Operator Environmental Qualification Inspection 3 Requirements."

WYLE Laboratories NEQ Report 47066-CAB-20, "Qualification Verification Report On Rockbestos Firewall EP Cable For Use In Pilgrim 1 Nuclear Power Station."

PCAQ #NED 88-085.

Engineering Service Request (ESR) 88-516, "PCAQ NED 88-085, IEN 86-03, EQ Limitorque File."

ESR Response Memorandum (ERM) 88-675.

BECo NED Telecon record with Rockbestos Company, Dated July 20, 1988.

Maintenance Requests:

-86-10-121	-88-23-76
-88-10-22	-88-23-81
-88-13-54	-88-23-84
-88-23-66	

BECo NED Document No. NED 88-516, "Maintenance Work Package Review Feedback."

Equipment Qualification Evaluation Sheets:

- -Cable-Rockbestos Firewall EP (O.C.)
- -MO-220-1
- -MO-1001-63
- -MO-1301-16
- -MO-2301-4

Material Receipt Inspection Report No. 81-758.

BECo Purchase Order No. 37291.

QC Inspection Report No. IR 87-1-59A.

BECo Deficiency Report No. 1800.

PNPS Procedure No. 1.5.3.1, "Maintenance Work Plan."

QC Instruction No. 5.01, "Quality Control Review of PNPS Maintenance Requests and Maintenance Work Plan Packages."