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Perry Nuclear Power Plant
Docket No. 50-440
Response to Request for Additional Information Regarding
the Generic Letter 96-05 Program (TAC NO. M97085)

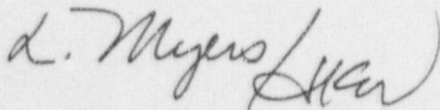
Ladies and Gentlemen:

The response to a Request for Additional Information (RAI), dated March 25, 1999, regarding the Generic Letter 96-05 Program at the Perry Nuclear Power Plant (PNPP) is contained in Attachments 1, 2 and 3.

There are no regulatory commitments contained in this letter. Any actions discussed in this document represent intended or planned actions, are described for the NRC's information, and are not regulatory commitments.

If you have questions or require additional information, please contact Mr. Henry L. Hegrat, Manager - Regulatory Affairs, at (440) 280-5606.

Very truly yours,



Attachments

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III
State of Ohio

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Response to RAI

Question 1

In NRC Inspection Report No. 50-440/96-05, the NRC staff closed its review of the motor operated valve (MOV) program implemented at Perry Nuclear Power Plant (Perry) in response to Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance." In the inspection report, the NRC staff discussed certain aspects of the licensee's MOV program to be addressed over the long term. For example, the inspectors noted that the licensee (1) agreed to modify valve 1G33-F040 during the next scheduled outage as part of Perry's margin improvement plan; (2) would continue to evaluate applicable information to confirm the valve factors applied to Anchor/Darling flex-wedge gate valves 1E22-F012 and 1E51-F059 and Borg Warner gate valve Groups 4 and 6; and (3) would monitor stem friction coefficient performance to improve the statistical basis and to confirm the stem friction coefficient assumptions applied to the closing direction thrust calculations. The licensee should describe the actions taken to address the specific long-term aspects of the MOV program at Perry noted in the NRC inspection report.

PNPP Response

(1) 1G33-F040 modification:

The overall gear ratio for 1G33-F040 was modified during the June 1996 refueling outage. The gear ratio modification enabled the overall margin of the MOV to be improved from $\approx 7\%$ to $\approx 62\%$. Based on this action, there is no further corrective actions necessary regarding GL-96-05 program requirements for this MOV, other than the normally scheduled Periodic Verification testing and Preventative Maintenance tasks to maintain the valve margin.

(2) Valve Factor (VF) confirmation:

The PNPP 96-05 Program presently uses in-house test data and intends to use the Joint Owners Group (JOG) data when the data becomes available. The JOG data will be used to confirm design assumptions made relative to Valve Factor values. For the specific cases regarding Groups # 3, 4, and 6, Attachment 2 documents the flow test data collected from those valves that are practical to Differential Pressure (DP) test. The intent is to continue this effort until sufficient data has been collected. Flow test intervals are reviewed and adjusted, based on the trend data evaluation process in accordance with FTI-F0019, "Engineering Review of MOV Test Results".

Test results from valves that can be flow tested will be used to determine the design-calculated assumptions for those valves that are not practical to flow test. The test results will be taken from valves from the same group and size. The PNPP 96-05 program, therefore, addresses long-term actions relative to GL 96-05 required to confirm the Valve Factor applied to Groups # 3, 4 and 6 valves.

(3) Stem Coefficient of Friction (COF) performance confirmation:

Stem COF is monitored whenever thrust and torque loads are available during individual MOV diagnostic testing. Test data to date supports use of the design COF value of 0.15, the value which is typically assumed in the closing direction thrust calculations. Any contradictory information obtained through the JOG program will be resolved utilizing the PNPP Corrective Action Program.

As part of overall long-term improvement relative to COF consistency, PNPP has established a program to gradually convert from using Never-Seeze as a stem lubricant to Mobilgrease 28. This process will be performed in a gradual manner such that it will allow proper monitoring and data trend analysis.

Mobilgrease 28 was first used as a valve stem lubricant at PNPP in February 1996. Overall trend data since then has indicated that MOVs using Mobilgrease 28 as a stem lubricant, some valves being located in harsh environments, have exhibited better overall consistency and improved load sensitive behavior characteristics

Question 2

The JOG program specifies that the methodology and discrimination criteria for ranking MOVs according to their safety significance are the responsibility of each participating licensee. In its letter dated March 17, 1997, the licensee stated that MOV risk ranking would be based, in part, on an expert review and Perry's Probabilistic Risk Assessment (PRA). As Perry is a boiling water reactor (BWR) nuclear plant, is the licensee applying the BWROG methodology for ranking MOVs based on their safety significance as described in BWROG Topical Report NEDC-32264 and the NRC safety evaluation dated February 27, 1996? If not, the licensee should describe the methodology used for risk ranking MOVs at Perry in more detail, including a description of (1) the process used to develop sample lists of high-risk MOVs from other BWRS; and (2) how expert panels were used to evaluate MOV risk significance.

PNPP Response

While the PNPP did not participate in the Boiling Water Reactor Owner's Group (BWROG) development of the BWROG Topical Report NEDC-32264, "Application of Probabilistic Safety Assessment to Generic Letter 87-10 Implementation," the risk ranking methodology utilized by the Probabilistic Safety Assessment (PSA) Group at PNPP is identical to that as described in the topical report. The motor operated valve risk ranking is based on Fussell-Vesley importance measures utilizing baseline failure data ($2.93 \times 10^{-3}/\text{demand}$), and sensitivity study failure data defined per NUREG/CR-4550 ($9.00 \times 10^{-3}/\text{demand}$) and NUREG/CR-5140 ($8.70 \times 10^{-2}/\text{demand}$). The resulting valve ranking was then generated corresponding to the categories as described in the topical report.

Question 3

The licensee's interim static test program allows some valves with medium and high margin to be tested on a four or six refueling outage frequency, respectively. This is consistent with the outage frequency recommended by the JOG interim static diagnostic test program. However, in the NRC safety evaluation dated October 30, 1997, on BWROG Topical Report NEDC-32719 describing the JOG program, the NRC staff stated that MOVs with scheduled test frequencies beyond 5 years will need to be grouped with other MOVs that will be tested on frequencies less than 5 years in order to validate assumptions for the longer test intervals. The NRC staff stated that this review must include both valve thrust (or torque) requirements and actuator output capability. The licensee should describe how its MOV static diagnostic-testing program will satisfy this condition of the NRC safety evaluation.

PNPP Response

PNPP is a participant plant in the JOG Periodic Verification test program. The present PNPP Periodic Verification test frequency matrix in accordance with the Motor Operated Valve (MOV) Program Plan for Generic Letter 89-10 (MPF), Attachment 12, follows the interim JOG program recommendation for static testing on medium and high margin valves, which may result in up to a 10 year frequency. With the exception of Group # 12 (two valves), Periodic Verification testing has been conducted on at least one representative valve from each Group. Testing on one of the two Group # 12 valves (most likely 1C41-F001B) will be conducted during Cycle 8. A Group by Group breakdown for the valves tested to date as they relate to Periodic Verification is included in Attachment 3.

Based on the overall actions taken and the program already in place, with the exception of Group #12 as stated above, PNPP meets the NRC safety evaluation report requirements on the BWROG Topical Report NEDC-32719, regarding frequency test intervals exceeding a five year span.

Question 4

The JOG program focuses on the potential age-related increase in the thrust or torque required to operate valves under their design-basis conditions. In the NRC safety evaluation dated October 30, 1997, on the JOG program, the NRC staff specified that licensees are responsible for addressing the thrust or torque delivered by the MOV motor actuator and its potential degradation. The licensee should describe the plan at Perry for ensuring adequate ac and dc MOV motor actuator output capability, including consideration of recent guidance in Limitorque Technical Update 98-01 and its Supplement 1.

PNPP Response

- (1) Long term actuator degradation resulting in torque and thrust load output to the valve:

Long term actuator performance is maintained by means of two programs. These are the PNPP Preventive Maintenance program and the PNPP Periodic Verification test program. Details of the programs follow.

a. Preventive Maintenance

Each 96-05 Program MOV is periodically inspected and maintained through the PNPP Preventive Maintenance (PM) program. In general, the program requires maintenance and inspection on the actuator that includes:

- Internal gearbox(s) grease sample inspection and inventory level.
- Valve stem cleaning and lubrication.
- Limit switch compartment cleaning and inspection.
- Switch contact cleaning / inspection.
- Wiring inspection.
- General overall bolt and fasteners inspection / tightness.
- Motor insulation resistance testing.

The PNPP Preventive Maintenance program ensures that the actuator is maintained properly. The PNPP Corrective Action Program would address degradation.

b. Periodic Verification

Each 96-05 Program MOV is periodically tested at the frequencies established by the GL 96-05 Periodic Verification (PV) test program. Testing is performed and flow data is evaluated. Critical parameters of the test results are then trended. General trending parameters monitored are as follows (as available):

- Torque and thrust values (i.e. at unseat, average run, seat contact, control switch trip, maximum, DP test flow cutoff).
- Motor Current (i.e. at unseat, average run, control switch trip, maximum).
- Spring pack (i.e. at unseat, average run, control switch trip, maximum).
- Motor power (i.e. at maximum loads)
- Stem friction factor
- Valve Factor
- Stroke time
- Rate of loading
- Margin.

Based on the overall periodic testing and data trending as specified above, any potential degradation of the actuator's capability would be identified. The PNPP Corrective Action Program would address corrective actions.

(2) Limitorque Technical Update 98-01 and actuator AC / DC motor output capability issues.

a. AC Motors

Limitorque Technical Update 98-01 and Supplement 1 identified concerns associated with Limitorque actuator capability using AC motors. The two main issues were AC motor curve performance (i.e., use of Application Factor) and actuator gearbox efficiency (i.e., use of Pullout Efficiency). The two concerns are addressed as follows:

Application Factor

In accordance with Limitorque Technical Update 98-01 and Supplement 1, it is recommended that an Application Factor of 0.9 be used in all cases when determining output torque, unless an alternate engineering justified method can be used. Previously, Limitorque endorsed the use of a 1.0 Application Factor under certain circumstances.

PNPP has opted to use an alternate, industry accepted engineering method, where feasible. The Commonwealth Edison AC motor output calculation methodology was selected and is used at PNPP. The NRC staff has previously reviewed this methodology and determined it to be an acceptable alternative. The Commonwealth Edison method does not require the use of the Limitorque Application Factor or the Limitorque equation methodology.

The Commonwealth Edison testing methodology development process was unable to test every type and size Limitorque AC motor. Therefore, Commonwealth Edison test data is not available for nine PNPP valve AC motors, four motor types. For the nine AC motors not covered by the Commonwealth Edison method, PNPP utilizes the Limitorque Technical Update 98-01 methodology, including the use of a 0.9 Application Factor.

When the Commonwealth Edison methodology was initially adopted by PNPP in 1996 as part of the GL 89-10 program, there were several valves identified that required minor torque switch re-adjustments in order to meet the new requirements. Since then, the necessary adjustments have been completed. In addition, there was one case (MOV 1E22-F012) where a torque switch adjustment would have resulted in a margin that was lower than desired. In that case, a gear ratio change modification was implemented to allow for improved overall capability margin.

Gear Box Efficiency

Limitorque Technical Update 98-01 and Supplement 1, requires the use of GearBox Pullout Efficiency. PNPP has used Pullout Efficiency in accordance with "Limitorque SEL 7", also known as "The Select Guide", since 1996. However, Technical Update 98-01 indicates that in SMB-1 units with 66:1 worm gear ratio, the stated Pullout Efficiency values per the "Limitorque SEL 7" Table may not be conservative. A review at PNPP indicated that the four 96-05 Program valves listed below utilize this actuator.

1E12-F004A 1E12-F004B 1E12-F105 1E21-F001

For the above MOVs (i.e., SMB-1 with 66:1 worm gear ratio), additional information has been requested from Limitorque for the specific efficiency value applicable. In the interim, until vendor information becomes available, PNPP has taken the following actions to account for this concern:

- a. Calculations for these four valves have been updated to add an additional "Adjustment Factor" of 0.9 as a conservative measure.
- b. The valves were reviewed to ensure adequate thrust margin existed. The review indicated that the safety function is to close under the design basis differential pressure of zero (0) psid. As such, these valves currently exhibit thrust margins greater than 100%. This provides assurance that even if a very conservative gearbox efficiency were provided by Limitorque, sufficient margin would exist to envelop it.

Based on the above actions already taken, the Application Factor issue and the GearBox Efficiency issue, relative to the Limitorque Technical Update 98-01 and Supplement 1, have been addressed at PNPP.

b. DC Motors

DC MOV Actuator capability is calculated in accordance with Attachment 1 of "Limitorque Maintenance Update" dated 8/17/88. DC motor capability is calculated by using: (1) pullout efficiency, (2) an application factor of 0.9, (3) a "reduction factor" of 0.9 for motor performance curve correction, and (4) motor winding resistance losses for motor temperature rise.

The BWR Owner's Group is working with MPR Associates to develop a methodology for DC MOV torque capability and stroke time determination. PNPP intends on being a participant member in this BWR Owner's Group effort. Appropriate action will be taken, if required, when the final results are published and endorsed by Limitorque. PNPP DC MOVs have adequate capability to perform their design basis function as required by the 96-05 program.

VERIFICATION FLOW TEST RESULTS

Group # 3

1E22-F012	Original flow test 6/18/94, Confirmation flow test 5/16/97,	VF - (Open: 0.377, VF - (Open: 0.312,	Close: N/A) Close: N/A)
1E51-F059	Original flow test 4/09/96, Confirmation flow test: 07/09/96, Confirmation flow test: 01/24/99,	VF - (Open: N/A, VF - (Open: 0.413, VF - (Open: 0.412,	Close: 0.277) Close: 0.424) Close: 0.440)

Group # 4

1E12-F064A	Original flow test 3/31/94, Confirmation flow test 6/25/98,	VF - (Open: 0.300, VF - (Open: 0.639,	Close: 0.378) Close: 0.723)
1E12-F064B	Original flow test 5/08/94, Confirmation flow test 7/30/98,	VF - (Open: 0.266, VF - (Open: 0.508,	Close: 0.279) Close: 0.554)
1E12-F064C	Original flow test 5/18/94, Confirmation flow test 2/10/98,	VF - (Open: 0.314, VF - (Open: 0.527,	Close: 0.382) Close: 0.588)
1E21-F011	Original flow test 10/28/93, Confirmation flow test 10/03/97,	VF - (Open: 0.626, VF - (Open: 0.465,	Close: 0.719) Close: 0.590)

Group # 6

1C11-F083	Original flow test 3/14/96, Confirmation flow test N/A.	VF - (Open: 0.693,	Close: 0.623)
1E12-F042B	Original flow test 5/15/94, Confirmation flow test N/A.	VF - (Open: 0.273,	Close: 0.373)

PERIODIC VERIFICATION BY VALVE GROUP

- Group # 1: The group consists of two Anchor Darling 150# Gate valves. One representative valve (1E22-F015) has been tested to meet Periodic Verification validation intent.
- Group # 2: The group consists of one Anchor Darling 655# Gate valve. Valve (1E22-F004) has been tested to meet Periodic Verification validation intent.
- Group # 3: The group consists of two Anchor Darling 900# Gate valves. Both valves (1E22-F012, 1E51-F059) have been tested to meet Periodic Verification validation intent.
- Group # 4: The group consists of 25 Borg Warner 300# Gate valves. Ten representative valves (1G61-F030, 1E21-F011, 1E12-F064A, 1E12-F064B, 1E12-F064C, 1E12-F028A, 1E12-F028B, 1E12-F537A, 1E12-F537B, 1E51-F068) have been tested to meet Periodic Verification validation intent.
- Group # 5: The group consists of two Borg Warner 900# Gate valves. Both valves (1E12-F008, 1E12-F09) have been tested to meet Periodic Verification validation intent.
- Group # 6: The group consists of 18 Borg Warner 1500# Gate valves. Fifteen representative valves (1C11-F083, 1B21-F016, 1B21-F019, 1G33-F053, 1G33-F054, 1E51-013, 1G33-F001, 1G33-F004, 1G33-F039, 1G33-F040, 1E51-F063, 1E51-F064, 1E12-F042A, 1E12-F042B, 1E12-F042C) have been tested to meet Periodic Verification validation intent.
- Group # 7: No valves listed under Group # 7.
- Group # 8: All MOVs under Group # 8 no longer apply. E32 system was deleted during RFO-7.
- Group # 9: The group consists of three Anchor Darling 900# Globe valves. All three valves (1E22-F010, 1E22-F011, 1E22-F023) have been tested to meet Periodic Verification validation intent.
- Group # 10: The group consists of Anchor Darling 300# Globe valves. All four valves (1E21-F012, 1E12-F021, 1E12-F024A, 1E12-F024B) have been tested to meet Periodic Verification validation intent.
- Group # 10A: The group consists of four Anchor Darling 300# Globe valves (CCI Cage/Plug modification). All four valves (1E12-F003A, 1E12-F003B, 1E12-F048A, 1E12-F048B) have been tested to meet Periodic Verification validation intent.
- Group # 11: The group consists of two Borg Warner 1500# Globe valves. Both valves (1E51-F022, 1E51-F045) have been tested to meet Periodic Verification validation intent.
- Group # 12: The group consists of two Rockwell 150# Globe valves. Neither valve has been Periodic Verification tested to date. Baseline testing was performed on 12-13-95 for 1C41-F001A and 6-15-94 for 1C41-F001B.
- Group # 13: The group consists of thirteen Rockwell 1500# Globe valves. Three representative valves (1E51-F076, 1E51-F019, 1P52-F646) have been tested to meet Periodic Verification validation intent. Note that two of the thirteen valves listed (1E32-F006, 1E32-F007) no longer apply as a result of the E32 system being deleted during RFO-7.

Group # 14: No valves listed under Group # 14.

Group # 15: The group consists of seven Contromatics 150# (stainless steel disk and body) Butterfly valves. Four representative valves (1G43-F030A, 1G43-F030B, 1G43-F040A, 1G43-F040B) have been tested to meet Periodic Verification validation intent.

Group # 16: The group consists of twenty-seven Contromatics 150# (carbon steel disk and body) Butterfly valves. Twenty three representative valves (1P50-F060, 1P50-F140, 1P50-F150, 1P45-F140, 0P42-F150A, 0P42-F150B, 0P42-F295A, 0P42-F295B, 0P42-F300A, 0P42-F300B, 0P42-F325A, 0P42-F325B, 1P43-F355, 1P43-F400, 1P43-F410, 1G42-F010, 1G42-F020, 1P11-F060, 1P43-F055, 1P43-F140, 1P43-F215, 1P45-F130A, 1P45-F130B) have been tested to meet Periodic Verification validation intent.

Group # 17: The group consists of four Henry Pratt 150# (seal on disk) Butterfly valves. One representative valve (1M17-F025) has been tested to meet Periodic Verification validation intent.

Group # 18: The group consists of two Henry Pratt 150# (seal on body) Butterfly valves. Both valves (0P41-F420, 0P41-F430) have been tested to meet Periodic Verification validation intent.