



Susquehanna Steam Electric Station Units 1 & 2
Motor-Operated Valve Periodic Verification Program

Revision 1

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1.0 Purpose

The purpose of this document is to provide a summary of the PP&L, Inc., Susquehanna Steam Electric Station (SSES), Motor-Operated Valve (MOV) Periodic Verification Program. This summary description responds to the 180 day requirements of Generic Letter 96-05 and includes an implementation schedule as committed in PP&L, Inc.'s 60 day response (PLA-4531; 11/18/96).

This document supersedes PP&L, Inc.'s 180 day response to Generic Letter 96-05, (PLA-4578, 3/17/97) in order to reflect our level of commitment to the current Joint Owners' Group (JOG) Program on Motor-Operated Valve (MOV) Periodic Verification and to provide a general update.

2.0 Introduction

On September 18, 1996, the NRC issued Generic Letter (GL) 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related Motor-Operated Valves." GL 96-05 supersedes GL 89-10 and its supplements with regard to MOV periodic verification. GL 96-05 requests that each plant:

"establish a program, or ensure the effectiveness of its current program, to verify on a periodic basis that safety-related MOV's continue to be capable of performing their safety functions within the current licensing basis of the facility. The program should ensure that changes in required performance from degradation (such as those caused by age) can be properly identified and accounted for."

GL 96-05 requires a 60-day response indicating whether or not licensees will implement the requested actions. PP&L, Inc.'s 60 day response and commitment to the requested actions have been provided in PLA-4531.

GL 96-05 requires a 180-day response, containing a summary description of the licensee's MOV periodic verification program; which was initially provided in PLA-4578; but has been superseded by this document.

GL 96-05 requires an implementation schedule; which is provided as part of this summary description.

In July 1997, the BWR Owners' Group issued NEDC-32719, Revision 2, "BWR Owners' Group Program on Motor-Operated Valve (MOV) Periodic Verification." On October 30, 1997, the NRC issued, "Safety Evaluation on Joint Owners' Group Program on Periodic Verification of Motor-Operated Valves Described in Topical Report NEDC-32719 (Revision 2)." Both NEDC-32719, Revision 2 and the NRC safety

evaluation requested participating licensees to notify the NRC of their plan to implement the JOG program. This document responds to these requests.

3.0 Scope

The SSES periodic verification program scope is based upon, and therefore identical to, the GL 89-10 scope (gate, globe or butterfly MOVs that have active safety related open or close functions; with consideration given to test configurations).

4.0 Definitions

As-Found Test: A test performed prior to performing maintenance (and, if possible, prior to performing stem lubrication).

Cycle: Refueling Cycle (approximately two years).

Dynamic: Differential pressure and/or flow.

Margin: The difference between available thrust (or torque) capable of being delivered by the actuator and the required thrust (or torque) demanded by the valve under design basis conditions.

Available Margin: The margin available, based upon the MOV set up, to accommodate degradation.

Required Margin: The margin required to offset known degradation.

Static: No differential pressure/flow.

Three cycles: The maximum of either six years or three refueling outages. (SSES, Units 1 and 2 are both on a two-year refueling cycle).

5.0 Overview

Periodic verification, including GL 96-05 recommendations, is integrated within the SSES MOV program (which also addresses GL 89-10) and its procedures; rather than have an independent "periodic verification program."

MOVs have been set up to assure that they perform their design basis function in accordance with GL 89-10. In order for these MOV's to maintain their capability, proper preventive maintenance is performed and a periodic verification test program is established to monitor and detect degradation prior to the onset of failure. All diagnostic test information is compared to valve specific and generic degradation assumptions. Industry and SSES events are evaluated for applicability and any ramifications to the PP&L, Inc. MOV Program.

SSES' periodic verification is implemented by the following SSES MOV Program attributes; each of which will be discussed in further detail:

1. Proper Baseline Set Up
2. Preventative Maintenance
3. Periodic Verification Testing
4. Trending and Failure Analysis
5. Joint Owners' Group (JOG) Program on Motor-Operated Valve Periodic Verification
6. Programmatic Procedures

6.0 Attribute Discussion

6.1 Proper Baseline Set Up

MOVs within the scope of GL 89-10 are set up to assure they perform their design basis functions in accordance with Generic Letter 89-10 criteria and PP&L, Inc. regulatory commitments. Set up includes design basis development, establishing correct switch settings, MOV configuration field verification, switch setting verification, stem lubrication, actuator grease inspection and baseline testing. Periodic verification testing and trending is based upon and therefore cannot begin until completion of the baseline set up.

6.2 Preventative Maintenance

Preventative maintenance is performed to assure that MOVs function as designed and includes the following:

- Gate and globe valve stem lubrication once per cycle (unless otherwise identified and dispositioned).
- Grease inspection once per cycle.
- Overhauls as required by grease inspection and resulting evaluation.

6.3 Periodic Verification Testing

Periodic verification testing is performed to assure MOVs are functioning properly, to determine margins, to identify marginal MOVs and to identify any degradation from the previous test. Periodic verification testing is typically as-left to establish margins with as-found testing (if practicable) performed in order to validate aging assumptions. Reference 6.4.3 for a discussion on periodic verification test frequencies.

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6.3.1 Rising Stem Valves

All rising stem valves (except HV-1(2)51F103B; RHR heat exchanger vent containment isolation valves) are static tested with diagnostics. HV-1(2)51F103B are flow assisted to perform their close safety function and, as permitted by GL 89-10, Supplement 6, are not included within the GL 89-10 diagnostic test program. The periodic verification test for these valves is a quarterly surveillance stroke. Closing under normal operating conditions, or even statically, requires greater actuator thrust output than for the containment isolation safety function.

A sample of two globe valves and four gate valves are dynamically tested, with diagnostics, to provide information on certain types of degradation (i.e., guide/ guide rib) that may not be detected via other means.

6.3.2 Butterfly Valves

6.3.2.1 "E" Diesel Generator ESW Butterfly Valves

As stated in our letter on the completion of the Generic Letter 89-10 Program (PLA-4410; dated 2/2/96), the ESW butterfly valves associated with the "E" Diesel Generator use surveillance testing (without diagnostics) to assure continued design basis capability. [The valves' safety function is to open/close under no differential pressure.] These valves are treated independently of the remainder of the butterfly valve testing.

6.3.2.2 Other Butterfly Valves

Presently, six butterfly valves have been baseline dynamically tested with diagnostics and 12 have been baseline dynamically tested without diagnostics.

A revised butterfly program, to be phased-in, consists of the following tests:

- Baseline dynamically testing all butterfly valves, (12 more), with diagnostics
- Periodic verification dynamic testing five valves with diagnostics

- Periodic verification static testing 13 valves with diagnostics
Until the baseline dynamic diagnostic test is performed, a valve's periodic verification test is dynamic non-diagnostic.

6.4 Trending and Failure Analysis

6.4.1 Validation of Degradation Assumptions

Each as-found SSES static and dynamic diagnostic test is evaluated to determine if degradation is occurring and its amount. Changes in thrust (or torque), for a specific valve test, which are less than test errors and uncertainties may not be considered degradation. Valve specific and generic degradation is quantified and compared to initial degradation assumptions. Assumed degradation parameters are corrected as necessary.

Applicable information from the Joint Owners' Group Program on MOV Periodic Verification (to be discussed later; 6.5) tests, and any other known tests within the industry, will also be used (as available) to validate or modify degradation assumptions.

6.4.2 Establishment of Appropriate Margins to Account for Degradation

The periodic verification program is centered around having sufficient margin to accommodate degradation. Margin assures that the MOV can continue to function, even considering assumed actuator, stem factor or valve degradation.

When calculating available margins, errors and uncertainties are conservatively included in the equation determining baseline required thrust/torque rather than being considered margin components. Errors and uncertainties include:

- test equipment inaccuracy
- torque switch repeatability
- spring pack torque uncertainty
- variation between static and dynamic unseating thrust
- voltage margins
- valve factor uncertainty
- load sensitive behavior bias and uncertainty

Therefore the available margin is strictly used for the purpose of offsetting degradation. In all cases, the available margin must be greater than the required margin needed to offset any known degradation.

A methodology (completely independent of the GL 89-10 methodology used to calculate required thrust/torque) has been developed solely to calculate available margin for each MOV.

6.4.3 Determining Periodic Verification Test Frequencies

6.4.3.1 Rising Stem Valves

Static Tests

Rising stem valve periodic verification static test frequencies are typically three to five cycles dependent upon margins, known degradation, safety significance and potential for aging. Test frequencies are reduced below three cycles if degradation/trending assessments indicate that greater scrutiny is required. Valves with low margin (which is dependent upon degradation, actuator capability, valve thrust/torque requirements, set up and/or conservatism) are tested each cycle unless otherwise technically justified. If valve specific degradation data is not available, the re-test frequency is not extended beyond 3 cycles unless significant available margin exists.

Dynamic Tests

Rising stem valve periodic verification dynamic test frequencies are a maximum of three cycles unless otherwise justified.

6.4.3.2 Butterfly Valves

Butterfly valve periodic verification static and dynamic test frequencies are a maximum of three cycles unless degradation/trending assessments indicate that greater scrutiny is required. [If degradation/trending assessments indicate that degradation is not occurring or is not significant, then the presently imposed three-cycle test frequency limitation may be extended (in the future) to a maximum of 10 years.] Valves with low margin (which is dependent upon degradation, actuator capability, valve torque requirements, set up and/or conservatism) are tested each cycle unless otherwise technically justified.

6.4.4 Assessment of SSES and Industry Events

A broad review of maintenance activities, diagnostic testing condition reports and industry events is performed. MOVs for which increased attention is required, due to either SSES or external experience, are identified. This may be due to a number of reasons including:

- increased required maintenance
- industry notifications
- regulatory requirements

Both MOV specific assessments and generic implications are considered.

6.4.5 Trending Report

A trending report will be issued on an annual basis documenting all assessments including determination of margins and degradation trends, adjustment of periodic verification test required frequencies and evaluation of anomalies.

6.5 Joint Owners' Group (JOG) Program on Motor-Operated Valve Periodic Verification

In July 1997, the BWR Owners' Group issued NEDC-32719, Revision 2, "BWR Owners' Group Program on Periodic Verification." This document contains MPR-1807, Revision 2, "Joint Owners' Group Program on Motor-Operated Valve (MOV) Periodic Verification."

The Joint Owners' Group (JOG) Periodic Verification Program consists of three basic elements:

1. providing an "interim" periodic test program consisting of diagnostic testing of MOVs under static (no flow) conditions,
2. conducting a dynamic test program consisting of diagnostic testing of MOVs under differential pressure and flow conditions over a 5 year period to identify potential age related increases in required thrust and torque to operate gate, globe and butterfly valves under dynamic conditions, and

3. evaluating the information from the dynamic testing program to confirm or modify the interim program assumptions.

PP&L, Inc. is participating in this industry effort and presently has representation on the steering committee. PP&L, Inc.'s rising stem valve periodic verification program is based, in part, upon the JOG program as discussed below. But, because PP&L, Inc. will have baseline dynamic diagnostic tested all butterfly valves (except the "E" Diesel Generator butterfly valves) by 12/31/99 and five of these eighteen valves will be periodic dynamic diagnostic tested at SSES, the periodic verification program for butterfly valves will be based upon the PP&L, Inc., rather than the JOG periodic verification program. Of course, if the JOG program identifies any unique degradation attributes pertinent to the SSES butterfly valves, this information will be incorporated into the PP&L, Inc. program as appropriate.

PP&L, Inc.'s commitment, for rising stem valves, to the three JOG program elements is discussed below:

1. "Interim" periodic static diagnostic MOV test program

PP&L, Inc.'s static diagnostic test program is similar in philosophy to the JOG's "Interim" periodic static diagnostic MOV test program in that it is meant to provide confirmation that each MOV is set up in a manner that ensures positive margin for operability. The risk ranking is in agreement with the methods described in NEDC-32264-A, Class 2, Revision 2, "Application of Probabilistic Safety Assessment to Generic Letter 89-10 Implementation." The PP&L, Inc. equations to establish margins are similar to JOG's in that there must be sufficient margin to accommodate degradation. But the PP&L, Inc. equations differ from those of JOG's in that actuator degradation (in addition to valve degradation) is not built in to the equations establishing available margins. Rather, the available margin is compared to the required margin (representative of expected actuator and valve degradation). Finally, PP&L, Inc.'s test frequencies are similar to JOG's in that the static testing is carried out at a frequency that depends on the importance (risk contribution) and the margin of the valve. In addition, PP&L, Inc. considers any known degradation and the valve's potential for aging. But establishment of the frequencies differs in that for the PP&L, Inc. program:

- A conservative 25% available margin (minimum) is required to extend test intervals beyond three cycles if valve degradation is unknown.

- Margins used to establish static retest frequencies take into account the margins in the baseline set-up. For instance, valves with extremely conservative valve factors need not account for additional degradation margins.
- Valves with low margin are assigned a one-cycle retest frequency (unless otherwise justified) regardless of risk ranking.

2. Dynamic diagnostic MOV test program

PP&L, Inc. is conducting dynamic tests for JOG valves in accordance with the requirements of the JOG dynamic diagnostic test program, including selection of valves to be tested, performance of the tests and documentation of results. The test intervals may extend slightly beyond the five years requested by JOG due to refueling outage constraints. PP&L, Inc. is presently testing four rising stem valves in support of the JOG program.

3. Validating or modifying the "Interim" periodic static diagnostic MOV test program

The JOG dynamic diagnostic MOV test program, in addition to testing performed at SSES and any known dynamic diagnostic testing throughout the industry, will be used to validate the PP&L, Inc. degradation assumptions as defined in item 1 above. The schedule for this validation is discussed in section 7.0.

6.6 Programmatic Procedures

The following documents delineate the SSES MOV Program periodic verification requirements:

- NDAP-QA-0017; "Motor-Operated Valve Program"
- E-220911; "Motor-Operated Valve Program Summary and Drawing Index"
- MDS-08; "Periodic Performance Assessment of Motor-Operated Valves"
- MT-EO-021; "VOTES-MOV Diagnostic Testing"

7.0 Implementation Schedule

Although PP&L, Inc. has already been performing periodic verification as an integral part of the SSES MOV Program, periodic verification as discussed within this summary description will be implemented as follows:

- The MOV program document (NDAP-QA-0017), which delineates periodic verification requirements, has been issued.
- Unit 1 periodic verification testing began following the ninth refueling outage.
- Unit 2 periodic verification testing began following the eighth refueling outage. |
- Periodic verification for each valve began after the baseline set up was complete |
- Butterfly valve periodic verification by static testing with diagnostics, rather than dynamic testing without diagnostics, will be phased in and complete by 12/31/99.
- Trending reports will be issued on an annual basis, with the first report issued in 1997.
- Validation of degradation assumptions is a continual effort performed as diagnostic test information is received. The information from the JOG dynamic diagnostic MOV test program will be incorporated into the PP&L, Inc. MOV program in accordance with the JOG schedule. It is expected that the entire validation effort be complete and incorporated into the PP&L, Inc. MOV program by the later of 12/31/02 or the JOG schedule. |