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U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

Gentlemen:

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
Generic Letter 89-10: Safety-Related Motor-Operated Valve Testing and Surveillance
AECM-90/0181

On December 21, 1989, Grand Gulf Nuclear Station submitted AECM-89/0217 addressing actions planned in support of the recommendations of Generic Letter 89-10 "Safety Related Motor Operated Valve Testing and Surveillance". This submittal was pursuant to the request for an initial response to the generic letter within 6 months of its issuance.

In the GGNS response it was noted that Project SMART (Systematic Motor Actuator Reliability Testing) had been initiated and the project team was developing a program plan. GGNS committed to have the plan available for review by the start of Refueling Outage 4, which began September 30, 1990.

GGNS presented the SMART Program Plan to members of your staff at a public meeting held in the White Flint NRC offices on September 5, 1990. Major provisions of the plan were discussed at some length. These discussions proved to be mutually beneficial. In general the staff expressed optimism with the Grand Gulf approach, commenting that it was evident considerable effort and careful thought had gone into development and initial implementation of the plan. The staff requested they be kept informed about development of alternatives to in-situ testing and expressed some concern in this regard.

Since this meeting the SMART Program Plan has been issued and the staff's September 20, 1990 letter summarizing the results of the September 5 meeting has been received and reviewed.

The program plan is available for review and deviates from the recommendations of the generic letter and supplement 1 only in the area of schedule. The generic letter recommends a schedule of 5 years or 3 refueling outages, whichever is longer. Grand Gulf plans to complete required actions within 6 years, spanning 4 refueling outages.

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Additional time to implement the plan is necessary due to the large GGNS MOV population and the timing of industry testing activities. However due to a prioritized approach, the plan establishes a responsible and effective method of addressing the more significant problems early in the program. Therefore even with an extended schedule, most of the generic letter concerns will be treated well within the time frame originally recommended in the generic letter. Justification for an extended schedule is included in the Attachment.

The staff's September 20 letter contained comments regarding in-situ testing and thrust verification. With respect to in-situ flow testing, GGNS intends to perform as much testing as necessary to validate MOV required thrusts but has chosen to initially test a representative sample. Evaluation of this flow data and the performance of valve similarity studies will indicate the extent to which additional in-situ flow testing is required. In an effort to address the concerns expressed by the staff, details of the in-situ flow testing and thrust verification processes along with justification for their use at GGNS are attached.

Grand Gulf recognizes the importance of ensuring MOV operability under design basis conditions and is committed to work together with the nuclear power industry to resolve this issue.

Yours truly,

JRM/WTC:mtc
Attachment

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GGNS Response to NRC Comments on Project SMART

The staff commented on Project SMART in the September 5, 1990 meeting and in its September 20 letter transmitting minutes of that meeting. Comments made are summarized as follows.

I. **In-situ Flow Testing**

Reservations were expressed in this area of the project because the Thrust Verification Program was viewed as limiting the number of full flow/differential pressure tests by grouping similar valves and performing one test to cover the group.

II. **Development of Thrust Verification Program**

It was requested that a schedule for completion of thrust verification procedures be included in the 10/1/90 submittal since the thrust verification portion of the project had not been completely developed.

III. **Justification for Schedule Extension**

Since GGNS anticipates the need for four outages to complete the generic letter baseline program justification for this extension was requested.

I. In-situ Flow Testing

A. Description

Flow testing of MOVs is recognized by GGNS as essential to establishing a required thrust with more credibility than can currently be done by calculational methods. However, in-situ flow test capabilities are very limited at BWR facilities due to system isolation restrictions in operational conditions 1, 2, and 3. In conditions 4 or 5 it is not normally possible to create design basis conditions. Even in operating conditions 1, 2, and 3 design basis conditions are usually not achievable without taking undue risk with plant systems. Compounding the problem of attaining differential pressure (DP) conditions in-situ, is the consideration of recovery requirements in the event of an MOV mispositioning incident. This scenario controls the maximum expected differential pressure (MEDP) in a significant number of cases.

Given these considerations, GGNS will of necessity be compelled to often consider alternative methods of verifying calculated required thrust. This will likely require demonstration of similarity between the tested valve and the installed valve. It is recognized that similarity is an outstanding issue within the industry but with the small amount of design basis in-situ data that can be obtained at GGNS, acceptable similarity methods must be developed and applied.

All MOVs in the program are considered for in-situ flow testing in accordance with procedure 17-S-03-16 and justification is provided in those cases where flow testing is not performed. Because most in-situ flow testing is possible only at reduced DP's and/or flows, it is considered prudent at this time to flow test an initial sample of approximately 40 valves that represent a significant percentage of valve types in the total project valve population. The Project SMART Thrust Verification Program will consider the extent of flow testing performed and review documented justifications to determine if additional flow testing should be considered. In-situ capabilities will be reviewed for any additional flow test needs but where not practicable, alternatives will be considered. This sampling/similarity concept is believed to be technically justifiable for GGNS for reasons discussed in section I.B below. The attached logic diagram shows the process as currently envisioned.

B. Justification of a Sampling/Similarity Approach

The concept of a sampling approach followed by careful evaluation and selective additional in-situ or laboratory testing is being considered due to very limited ability to perform flow testing at or near MEDP in the plant. However the potential for successful results to this approach appears high because of the relatively small percentage of large gate valves, the predictability associated with William Powell gate valves, and the ability of existing hardware to support use of a bounding valve factor. These factors are briefly discussed in the following:

1. Small Population of Large Gate Valves

Gate valves larger than 4" in diameter make up approximately 25% of the expected population of valves covered by the project. These would be the valves considered at the most risk based on size and type only. NPRDS data substantiates this assessment, indicating the majority of MOV demand failures at GGNS since 1985 occurred on valves in this group.

Other valve types are not considered to have the same level of demand uncertainty as that associated with gate valves. This is illustrated by the performance of the 105 Yarway globe valves, 2" in diameter or less, that are addressed by the program. To date only 1 MOV demand failure has occurred for these valves at GGNS.

2. William Powell Gates

Nearly all gate valves included in the program were manufactured by the William Powell Co. These were among the better and more predictable performers in the INEL test program. This is evident based on preliminary EPRI assessments of the INEL work. It was concluded that the Powell valve showed only minor evidence of anomalous behavior in the test data and had no major damage. In addition, the valve consistently maintained relatively low valve factors, compared to other valves showing anomalous behavior.

3. Valve Factors for Gate Valves

Design basis reviews were conducted using .5 as a valve factor when calculating required thrust for gate valves. In most cases existing MOV hardware is adequate to support this upgrade. The recent results of testing at INEL indicates this factor may bound most operating conditions in commonly used gate valves in the industry. Where existing hardware cannot support a .5 valve factor, the possibility of hardware upgrades is being considered.

EPRI's preliminary assessment of the INEL test data seemed to indicate that Powell gate valves typically showed valve factors below .5. The resultant margin in GGNS MOVs would tend to compensate for uncertainties present when demonstrating similarity between a test valve and an installed valve.

Based on the above considerations, a sampling/similarity type approach appears to be feasible for many GGNS MOVs due to the small percentage of larger gate valves and the near absence of demand failures for other valve types in the program. Additionally, the above shows that a significant number of gate valves at GGNS have substantial margin and seem likely to be predictable performers based on preliminary EPRI assessments of INEL test results.

C. Key Thrust Verification Program Elements

The success of the Thrust Verification Program in Project SMART will depend on several key factors. They are, access to large blocks of experience data, personnel with broad-based global valve testing experience, detailed consideration of data applicability beyond valve type, size, and manufacturer, and careful monitoring and use of the EPRI GL 89-10 test program.

1. Experience data of a quality to be useful in addressing generic letter issues is presently scarce in the United States. However this type of data has been generated on behalf of the global nuclear power industry. Efforts will be made to use these sources. In this respect, we were encouraged to hear at our September 5, 1990 meeting that the NRC intends to make publicly available, British testing results on globe valves.

2. Personnel with broad experience in the collection and interpretation of the type data needed are essential to ensure that prudent choices are made with respect to similarity and cross valve applicability of data. This type experience is available within the global nuclear community and GGNS plans to solicit these services.

3. Demonstration of similarity between valves for the purpose of applying type test data must consider more than valve type, size, and manufacturer. Recent testing by Duke Power Company, as documented in IN 89-61, "Failure of Borg-Warner Gate Valves to Close Against Differential Pressure", has confirmed results of previous European-based testing in this regard.

4. EPRI is currently undertaking a test program that will attempt to address the outstanding technical issues of valve factor and the rate-of-loading effect. Also a significant amount of full flow testing is planned that may be directly applicable to GGNS.

D. Conclusion

Based on the above discussion, the GGNS sampling/similarity approach to flow testing, supplemented and guided by the Thrust Verification Program, represents a prudent action plan to obtain flow data where the ability to acquire in-situ data is limited. If carefully monitored and conservatively applied, it will empirically confirm the applicability of calculated required thrusts.

II. Development of Thrust Verification Program

The Thrust Verification concept is fully developed within the GGNS Program Plan for Project SMART. The process is shown in the attached flow chart and was discussed above. As stated at the September 5 meeting, a detailed action plan for each valve cannot be developed until valve grouping is researched, in-situ testing capabilities evaluated, and availability of test data is identified. It is anticipated that additional valve testing expertise will be solicited in this regard.

It is estimated that this work can begin by the first quarter of 1991 and that valve specific action plans will be available by January of 1992. These dates are preliminary and subject to change at this time but actual dates will be supportive of the overall GGNS completion schedule. The NRC Project Manager will be notified when action plans with assigned completion dates are in place.

III. Justification for Schedule Extension

A. Large MOV Population

Grand Gulf has a safety related MOV population of 294 including MOVs with active and passive safety functions. Of this number, 6 Residual Heat Removal valves associated with the steam condensing mode have been eliminated from the program since their use is not permitted at GGNS. Another 10 valves in the Standby Gas Treatment System and the Control Room Air Conditioning System have been eliminated, as permitted by Supplement 1, since these are MOV's in ductwork systems. Considering these deletions the current program scope addresses 278 valves. An additional 26 valves with passive safety functions are under consideration for implementation of administrative controls that would eliminate them from the program. Therefore the total scope of valves in the program is not expected to fall below 252. This number is well in excess of the 150 valves assumed when the generic letter schedule was issued.

B. Limited On-Line Testing Capability

A limited number of valves can be tested during regular system preventive maintenance while the plant is on line.

In some instances the required safety system downtime to perform testing would considerably exceed that required for regular system maintenance outages. This would not be consistent with the goal of minimizing safety system down time.

C. Rework

Experience indicates that about 20% of the valves included in the program will require switches to be set more than one time within the baseline program due to ongoing maintenance needs such as packing work and valve seat relap that sometimes occurs more frequently than every 5 years. In addition, the potential for parts upgrades due to obsolescence, industry failures, EQ upgrades, etc., always exists. Many of these upgrades could be considered to invalidate the original baseline test. Also, due to the two phased approach being taken where switch setting is done in parallel with flow testing and industry research, it is likely that some rework of switch settings will be required as the amount of empirical data increases. These factors will all work together to effectively expand the total number of switches that will be required to be set to complete the baseline program.

Assuming a program scope of 252 valves and a rework scope of 20% this would require over 100 valves to be set in each of the next three outages. This figure has never been approached to date in normal plant refueling outages within the industry. Even with a 4 outage schedule, 75 valves would be required every outage which still represents a formidable challenge.

D. EPRI Test Program Schedule

Grand Gulf is a participant in industry sponsored research presently being performed at EPRI. This effort is not currently projected for completion prior to 1993, the same year in which the third GGNS outage (RF06) is scheduled to occur. Additional time beyond the completion date of the test program must be allowed to implement any EPRI recommendations made.

E. Prioritized Approach

Based on design basis review work performed to date, a cognizance of past European testing experience, and the recent INEL test results, it is evident that consideration of valve safety significance, design margin, and performance history would aid in focusing attention on valves with the most immediate needs. These considerations make it prudent to prioritize valves included in the generic letter scope so that resources can be directed to the more critical valves as early in the program as practicable. To facilitate this approach eight parameters are being considered to assess valve priority:

Safety Significance

1. NUREG 1150 Risk Importance - considers the relative contribution to probability for core damage when safety systems are lost due to equipment failures including some of the more important MOVs.

2. Safety Function - considers whether the valve's primary safety function is to shutdown the reactor, mitigate accident consequences, or to maintain pressure integrity.

Design Margin

3. Differential Pressure Factor - considers the newly calculated maximum expected differential pressure against the original design differential pressure.

4. Thrust Factor - considers the minimum required thrust against the more limiting of maximum allowable thrust or the maximum available thrust.

5. Friction Factor - considers the highest valve factor in gate valves that can be used (up to .5) without the need for a hardware change.

Performance History

6. Valve Type - accounts for the performance differences observed industry-wide between gate, globe and butterfly valves.

7. Valve Size - considers smaller valves less likely to show non-linear behavior.

8. GGNS Performance History - considers the historical performance of GGNS-specific valves.

F. Conclusion

Together, the above considerations form a justifiable basis for a 6 year schedule, spanning 4 refueling outages, to implement the requirements of the generic letter. The prioritized approach strongly supports the intent of the generic letter in that it provides for addressing those valves needing attention most, within the 3 outage, 5 year schedule of the generic letter.

THRUST VERIFICATION DECISION CHART