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September 16, 1987

Docket Nos. 50-348
50-364

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

Joseph M. Farley Nuclear Plant - Units 1 and 2
I.E. Bulletin No. 85-03 Motor-Operated Valve
Common Mode Failures During Plant Transients
Due to Improper Switch Settings

By letter dated September 18, 1986, Alabama Power Company provided the results of I.E. Bulletin 85-03 Action Item (a) and the program description and schedule to accomplish Action Items (b) through (d), which included a justification for an extended bulletin schedule for Farley Nuclear Plant Units 1 and 2. In continuation of the bulletin's response review process, the Nuclear Regulatory Commission requested that Alabama Power Company submit additional information as stated in the enclosure of letter dated August 18, 1987. As per your request this additional information is attached. These responses are based upon current or proposed practices for the scoped valves and may be changed in the future as evaluations and experience require.

If you have any questions, please advise.

Respectfully submitted,

R. P. McDonald

RPM/MGE:dst-T.S.7

Attachments

cc: Mr. L. B. Long
Dr. J. N. Grace
Mr. E. A. Reeves
Mr. W. H. Bradford



IE11

ATTACHMENT

**NRC Request No. 1**

Unlisted MOV 8885 is shown normally closed in FSAR figures 6.3-1A, Rev. 2, 7/84, (Unit 1) and 6.3-1B, Rev. 2, 7/84, (Unit 2) in a discharge line of the high head safety injection pumps to the RCS cold legs. Similarly located MOVs of two other Westinghouse three-loop plants are listed for inspection in accordance with bulletin requirements. Please revise the listing to include this MOV, or justify its exclusion. As required by Action Item a of the bulletin, consider the effect of inadvertent equipment operation.

**APCo Response No. 1**

At Farley Nuclear Plant MOV 8885 is maintained in a normally closed position. Operation of this MOV is not required for the injection mode of emergency core cooling. During the recirculation mode of emergency core cooling system operation, MOV 8885 is opened to provide a redundant cold-leg recirculation flow path from the high-head safety injection pump(s) discharge to reactor core for long-term cooling. As such, MOV 8885 does not meet the high-pressure coolant injection valve selection criteria as provided in the Westinghouse Owners Group "Safety-Related MOV Program Final Report" (WOG-86-168, dated April 7, 1986) or the criteria for injection valves stated in I.E. Bulletin 85-03. Therefore, MOV 8885 was excluded from the list of high-pressure coolant injection system MOVs provided in Attachment 2 of Alabama Power Company letter dated September 18, 1986, and MOV 8885 is not within the scope of I.E. Bulletin 85-03 for Farley Nuclear Plant.

**NRC Request No. 2**

Has water hammer due to valve closure been considered in the determination of pressure differentials? If not, please explain.

**APCo Response No. 2**

Water hammer is not a concern for the valves within the scope of I.E. Bulletin 85-03. Flashing of water to steam and fast acting valves are two unique phenomena that are related to water hammer. Plant modifications and testing have demonstrated that water hammer is not a concern for the feedwater system. The feedwater piping directly connected to the steam generator has been modified to reduce the length of horizontal pipe to the inlet nozzle. Also, J-tubes have been installed into the feedwater ring to reduce the possibility of water hammer. Neither of the above phenomena are applicable to the high head-safety injection system; therefore, water hammer is not a concern.

**NRC Request No. 3**

Please justify extension of the date for completing Action Items b, c and d from 11-15-87 to April 1988 for Unit 1 and the date for completing Action Item f from 1-15-88 to June 1988 for Unit 1.

**APCo Response No. 3**

The Farley Nuclear Plant MOV Evaluation Program was initially developed in response to I. E. Bulletin 85-03 Action Items a, b, c and d and was initially described in Attachment 1, Section II, of Alabama Power Company's letter to the NRC dated September 18, 1986. Attachment 1, Sections III and IV, provided the background information and justifications for the requested schedule extension for Action Items b, c and d as the Unit 2 fifth (fourth quarter 1987) and the Unit 1 eighth (second quarter 1988) refueling outages. As shown on the preliminary schedule of the subject letter's Attachment 4, the final written summary report required by Action Item f will not be completed for both Unit 1 and Unit 2 until 60 days after completion of the Unit 1 refueling outage in the second quarter of 1988.

The Farley Nuclear Plant MOV Evaluation Program has been further defined over the last eleven months based on additional industry experiences and ongoing engineering evaluations. The present scope of the program for each unit includes fifteen valves in the auxiliary feedwater system and twenty-two valves in the emergency core cooling system high-head injection flow path. Some of the significant activities integrated into the program are summarized as follows.

- Review and evaluation of MOV design bases (including the FSAR, ERPs, vendor drawings, engineering specifications, and setpoint documents) to establish the design differential pressure and stroke time.

- Performance of engineering thrust calculations and stress evaluations to determine required MOV operating torque values.

- Determination of a setpoint for each MOV limit switch rotor by considering valve design and limit switch functions.

- Development of a refined methodology for sizing MOV thermal overloads based on industry reports and operating experience.

- Incorporation of all pertinent information/data in a new MOV setpoint document.

- Review of industry-identified MOV issues (i.e., IENs, SERs, SOERs, vendor bulletin's etc...) by an MOV Task Force to ensure that issues are incorporated into the program for resolution.

- Revision of MOV maintenance procedures based on current industry practices, task force recommendations, engineering evaluations, and updated vendor information.

- Update Limitorque technical manuals and bulletins including the incorporation of a new replacement part listing for each actuator size.

- Incorporation of design changes to support the separation of MOV limit switch functions and setpoints (i.e., remote position indication and torque switch bypass).

- Procurement of new MOV test equipment from MOVATS for MOV calibration and diagnostic analysis.

- Training of APCo personnel to operate new MOV test equipment and to perform signature analysis.

- Development of new procedures to support the use of the new MOV test equipment.

- Establishment of an adequate MOV spare parts inventory.

- Determination of an MOV differential pressure testing methodology to validate designer/vendor thrust calculations.

- Development of MOV differential pressure test procedures to support conduct of differential pressure testing.

- Finalize scope of bulletin MOV maintenance and testing activities and integrate into the Unit 1 and 2 refueling outage schedules.

- Contracting of MOVATS specialists to support the planned MOV actuator maintenance and testing activities.

The activities described above could not be completed prior to the Unit 2 fifth refueling outage. Furthermore, several of these activities are ongoing and Alabama Power Company expeditors have been actively involved in procurement of Limitorque replacement and spare parts and vendor thrust calculation data for over three months. Over the past nine months efforts to obtain MOV setpoint data have been hindered by competition among the different nuclear plants for both designer and vendor resources, resulting in scheduling delays that could not be avoided.

Before Farley Nuclear Plant implements any new or refined MOV switch setting policy or performs any MOV differential pressure testing, the activities described above must be satisfactorily completed to the maximum extent possible and each MOV maintenance, calibration, and testing activity must be well-defined and factored into the refueling outage schedule. Because other industry-identified MOV issues (e.g., environmental qualification, pressure locking and thermal binding, symptomatic repairs, etc.) could impact Alabama Power Company's response to I.E. Bulletin 85-03, a comprehensive approach continues to be taken to control expenditures and to minimize duplication of engineering and maintenance work efforts. While this approach may have contributed to the necessary schedule extension, it is the most prudent approach to resolve the various MOV issues including I.E. Bulletin 85-03.

Alabama Power Company has responded to the bulletin's requirements in a timely manner. The implementation of the Farley Nuclear Plant MOV Evaluation Program's maintenance, calibration, and testing activities must be well-defined and factored into outage schedules of sufficient duration to accommodate these activities. As such, I.E. Bulletin Action Items b, c and d can not be completed until the Unit 2 fifth and the Unit 1 eighth refueling outages. Therefore, Alabama Power Company continues to request the bulletin extensions described above for Farley Nuclear Plant Units 1 and 2.

**NRC Request No. 4**

Please expand the proposed program for Action Items b, c and d of the bulletin to include the following details as a minimum:

(a) justification of a possible alternative to testing at maximum differential pressure at the plant, and

(b) description of a method possibly needed to extrapolate valve stem thrust measured at less than maximum differential pressure.

**APCo Response No. 4**

(a) A possible alternative to testing at maximum differential pressure could include, but not necessarily be limited to, any of the following:

- no differential pressure testing when sufficient industry data is available to validate a given thrust equation for specific MOV;

- testing at a reduced pressure because system equipment is not capable of developing design differential pressures; or

- testing at a reduced pressure (or not testing at all) to preclude the possibility of damaging installed plant equipment.

(b) While the extrapolation of valve stem thrust measured at less than maximum differential pressure is not always necessary, it can be obtained by projecting the measured thrust as a linear function at the maximum differential pressure.

To support Alabama Power Company's above response to 4 (a) and 4 (b), the following information is provided. Requests (a) and (b) above both pertain to I.E. Bulletin 85-03 Action Item c, in part. In response to this bulletin item, demonstration of valve operability by testing each valve at its maximum differential pressure, Alabama Power Company requested that Bechtel, Westinghouse, and MOVATS provide engineering support to determine the best differential pressure testing methodology and/or alternative. To date MOVATS has evaluated specific Farley Nuclear Plant valve data and calculated thrust

values for all thirty-seven (37) bulletin valves using the MOVATS empirical equations. Westinghouse and MOVATS reviewed various thrust calculation methodologies applicable to the Westinghouse scope of valves. Bechtel, Westinghouse and Farley Staff representatives have developed MOV differential pressure testing matrices that define the MOVs which must be tested and include the recommended system conditions and flow paths required to support MOV differential pressure testing. The Farley Staff has drafted MOV differential test procedures. The assumptions outlined below are a part of the bases for MOV differential pressure testing at Farley Nuclear Plant; therefore, these assumptions can be used to address this NRC request for additional details.

1. Installed plant instrumentation (pressure, flow, etc...) or temporary instrumentation used to support differential pressure testing should have an accuracy of ± 2% or better and a range that is approximately 1.25 x the expected reading.

2. A gate valve can be tested with pressure on either side of the gate (disc) because the FNP subject types of gate valves are of the bi-directional design.

3. Existing MOVATS data demonstrates that loading factors due to increasing differential pressure are a linear function. (This assumption is planned to be substantiated during the performance of differential pressure testing for a subset of the Farley Auxiliary Feedwater system valves.)

4. Differential pressure testing should be performed at maximum system operating pressure whenever possible to ensure that the entire operating range of a given MOV has been encompassed by the measurement of valve actuator thrust at or near the valve's required design differential pressure (i.e., the design differential pressure may be higher than the maximum system operating pressure).

5. Installed plant instrumentation (pressure, flow, etc...) or temporary instrumentation (test gauges) should be installed as close to the subject MOV as possible.

6. Test pressures referenced in the test matrix or in a test procedure are approximate values used to establish initial conditions in support of MOV differential pressure testing and to estimate expected system parameters during testing. For purposes of MOV thrust calculation methodology validation, the actual pressure values indicated by plant instrumentation and/or test gauges as recorded in the procedure just prior to valve stroking and subsequent to valve stroking will be used.

7. To validate a thrust calculation equation:

    a. Perform an MOV differential pressure test and measure actual system differential pressure, MOV actuator thrust, and MOV motor load normally in both the open and closed directions.

b. Use actual pressure data as input to the given equation and calculate the thrust.

c. Compare actual measured thrust to the calculated thrust.

d. If measured thrust is less than calculated, the equation is shown to be conservative.

e. If measured thrust approximates the calculated thrust by ± 10%, then the equation is shown to be representative.

f. If measured thrust is greater than calculated, an engineering review is required.

g. Four (4) identical valves of the same size and manufacturer must be differential pressure tested with conservative or representative results to verify a given thrust calculation methodology for a specific valve stroke direction.

h. Twenty (20) similar valves (e.g., flex wedge gate valves) of different sizes and manufacturers must be differential pressure tested with conservative or representative results to verify a given thrust calculation methodology for a specific valve stroke direction.

8. For purposes of calculating thrust, the system pressure factor is assumed to be the same as the highest recorded upstream pressure during testing when a given thrust equation is validated with actual differential pressure test data.

9. When thrust values are calculated to determine the minimum and maximum torque switch settings, the system pressure factor is assumed to be the same as the maximum design differential pressure (i.e., since the design differential pressure for MOV 8107 is 2750 psid, the maximum system pressure is assumed to be 2750 psi).