



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

ENCLOSURE 1

SUPPLEMENTAL SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PUMP AND VALVE INSERVICE TESTING PROGRAM

METROPOLITAN EDISON COMPANY  
JERSEY CENTRAL POWER AND LIGHT COMPANY  
PENNSYLVANIA ELECTRIC COMPANY  
GPU NUCLEAR CORPORATION

THREE MILE ISLAND NUCLEAR STATION, UNIT 1

Docket No. 50-289

1.0 INTRODUCTION

10 CFR 50.55a(g) requires that water-cooled nuclear reactor facilities have an inservice testing (IST) program for pumps and valves to meet the requirements of applicable edition of Section XI of the ASME Boiler and Pressure Vessel Code. The IST program for Three Mile Island, Unit 1 (TMI-1) was submitted to the NRC and was reviewed by the staff. The results of the staff review were provided to the licensee in the safety evaluation reports (SERs) dated October 3, 1986 and March 19, 1987.

Subsequent to the SER's issuance, additional information was provided by the licensee for resolving open items. At about the same time, Region I (RI) identified in Inspection Report 50-289 87-10 that the check valves (EG-V10) located upstream of the diesel generator air start receivers should have been but were not included in the licensee's IST program. The staff reviewed the additional information and concluded that the valves did perform a safety function and should be included in the IST program. The review results were provided in the SSER dated March 31, 1988.

The licensee disagreed with the staff review results on the EG-V10 check valves and the denial of the relief request for extending disassembly intervals for valves DH-V14, BS-V52, BS-V30, and MS-V9. By letters dated June 7, 1988 and April 17, 1989, the licensee submitted additional information to substantiate their disagreement and requested re-review of these two issues.

This SSER provides the staff evaluation of the information submitted in the above two letters.

2.0 EVALUATION

2.1 Check Valves EG-V10 A/A, A/B, B/A and B/B (EG-V10)

These check valves are located on the inlet to each of the four air receivers that are used to start the emergency diesel generators. The air receivers are maintained at a pressure between 225 psig and 250 psig and are under daily observation of a plant operator. Low receiver air pressure (150 psig) is alarmed and the instrument that provides the low air pressure signal is calibrated annually to ensure its reliability.

These valves were not originally included in the IST program and the March 19, 1987 SER was silent on its exclusion. However, a staff re-review of these valves concluded that they perform a safety-related function to seat and prevent loss of air pressure when the compressor is unloaded after the charging or recharging cycle. As a result, the staff concluded in its March 31, 1988 SSER that these valves must be put into the IST program. In response to the licensee request to re-review the issue, the staff has reviewed the design of the air receivers and the function of these valves. The staff's review indicates that the valves do not necessarily provide a safety function in the event that they fail to seat but that failure of the valves to open would inhibit charging of the downstream air receivers. A review of the receiver's pressure boundary also indicates that check valves EG-V10 are just one of many potential leak paths of the receiver system. Testing just one of many leak paths at a two-year interval is impractical and inadequate, and provides little assurance that the air receiver will remain under the required pressure. A continuous pressure monitoring system is installed and an alarm is provided to detect low receiver air pressure. The reliability of the air receiver system is further enhanced by a daily recording and verification of receiver air pressure.

On April 27, 1988, the licensee conducted a test to demonstrate that EG-V10 could be removed from the system because the design of the compressor discharge to the air receiver was verified to be essentially leak tight. However, the licensee chose to retain these valves in the system because they provided certain operational conveniences.

Based on the above discussion, the staff finds that EG-V10 may be removed from the system. If they are retained in the system, they are performing safety-related functions in the open position because failures of these valves to open will impair the function of the air receivers. Therefore these valves should be included in the IST Program. However, the staff finds that the installed continuous pressure monitoring system and daily verification of receiver air pressure is a better and more effective means of testing than the less frequent Section XI's test, (i. e., full flow/back flow/leak test), because it provides timely detection of these valves' failure and other failures associated with the air receiver system. Per 50.55a(a)(3)(i), even though these valves are required to be included in the IST program, they need not be tested per Section XI requirements because a better alternative is provided resulting in an acceptable level of quality and safety.

## 2.2 Check Valves DH-V14 A/B

Since full flow testing cannot be performed on these valves, the SER dated March 19, 1989 requires that the operability of these valves be demonstrated by sample disassembly on a refueling outage interval. In its letter dated November 3, 1987, the licensee requested the sample disassembly be extended to a 10-year interval/frequency. In the March 31, 1988 SSER, the staff restated its requirement that the sample disassembly and inspection be performed on a refueling interval.

By letters dated June 7, 1988 and April 17, 1988, the licensee submitted additional information and requested re-review of the request for extending the disassembly interval to every 10 years.

In addition to reviewing the additional information in the above two letters, the staff has re-evaluated the partial flow tests of these check valves, and finds that the partial flow tests may provide an acceptance basis for extending the internal inspection interval if they are conducted, monitored and analyzed in a certain specific manner.

The check valves DH-V14 are located between the Borated Water Storage Tank (BWST) and both suction of the Decay Heat Removal (DHR) pumps and the Reactor Building Spray (RBS) pumps. These valves are tested via DHR pumps every refueling outage at a flowrate of 2/3 of the maximum design flow. They are also tested quarterly via RBS pumps at a flowrate of approximately 1/4 of maximum design flow. The safety function of these check valves is to open and supply flow to DHR and RBS pumps. A partially open valve would increase the friction pressure drop to the pump inlet and may cause undesirable losses of the net positive suction head (NPSH) available. Inadequate NPSH can cause pump damage. A review of TMI system diagrams indicates that the valves DH-V14 are the only active components whose performance may vary from test to test. Thus, monitoring the pump inlet pressure provides useful information on check valve performance. The staff considers that the partial flow tests conducted, monitored and evaluated as follows:

- a. Establish a base line flowrate when the check valves are known to be in a good working condition and record from the test as reference values the flowrate and corresponding pump inlet pressure.
- b. Perform future tests at the same flow rate and measure and evaluate pump inlet pressure for indication of valve degradation.
- c. Evaluate what the pump inlet pressure would be at the maximum design flowrate and verify that the NPSH available would be greater than the NPSH required at this flowrate.

Even though the staff finds that the partial flow test, if conducted as stated above, provides almost as good an indication of valve degradation as would be obtained from full flow test requirements, the staff continues to believe that the disassembly/inspection is the most positive means to determine the conditions and integrity of valve internals. Therefore a disassembly program must continue. However, presuming a better monitored partial flow test as described in a., b. and c. above, and after review of inspection results from previous disassembly of these check valves, the staff finds that some extension of the current required inspection interval may be acceptable.

Extending the sample disassembly interval to every ten years as proposed by the licensee is unacceptable because the second valve might not be inspected until 20 years after it has been in service. Since most plants have not been operating more than 20 years, the staff finds that the 20-year interval is too long and cannot be justified by the plant operating history. Based on the 10-year requirement of major inservice inspection activities and inspection results of these valves after more than 10 years in service, the staff finds that disassembly and inspection of both valves every 10 years is a more reasonable and acceptable interval in addition to the periodic partial flow test.

### 2.3 Check Valves

BS-V52 A/B  
BS-V30 A/B  
MS-V9 A/B

Since full flow tests can not be performed on the above valves, the March 19, 1987 SER and March 31, 1988 SSER require that the sample disassembly and inspection of those valves be performed on a refueling outage frequency. In letters dated June 7, 1988 and April 17, 1989, the licensee submitted additional information and requested that NRC reconsider the disassembly frequency.

The review of the additional information indicates that the usage factor of the above valves is low and therefore fatigue and wear are not serious concerns of these valves. The primary concerns of these valves would be corrosion, erosion, locking devices, or missing parts. A review of past inspection data and photographs show that the valves were found in good condition after more than 10 years in service. There were no missing parts, no unusual corrosion, no unusual wear nor other abnormal conditions that would prevent these valves from performing their safety-related functions. The staff finds that for a group of two valves, the originally required inspection interval, i.e., every refueling outage, would be excessive especially in view of the pitfalls of no effective post maintenance test (IWV-3200) after major disassembly of these valves. Based on the recently issued Generic Letter 89-04, the staff finds that the disassembly interval may be extended from every refueling outage to every other refueling outage. The revised frequency will result in each valve being inspected approximately every six years.

The licensee's requested inspection interval of every 10 years would result in the second valve of the group not being inspected for as long as 20 years after it has been in service. A 20 year interval is too long and cannot be justified by the plant operating history. Therefore the licensee's request is denied and an inspection interval of one valve in each set every other refueling outage shall be implemented.

### 3.0 Conclusion

Based upon the above discussion, the staff concludes:

- 1) If the EG-V10 valves are retained in the air receiver system, they are required to be included in the IST Program but relief may be granted from the Section XI leak tests because the performance of these valves is monitored by a effective alternative and is acceptable pursuant to 10 CFR 50.55a(a)(3)(i).
  
- 2) Relief may be granted to use partial flow testing of DH-V14 A/B is acceptable in lieu of the full flow test requirement of IWV-3522, provided it is performed, monitored and analyzed in a repeatable manner as described above and complemented by periodic internal inspections. The licensee's relief request for extending the inspection frequency to every 10 years is denied, but an adoption of the monitored partial flow tests and a review of past inspection results of these valves justify an extension to a maximum of a 10-year interval for inspecting both of these valves.
  
- 3) The licensee's relief request for extending the inspection frequency to every 10 years for valves BS-V52 A/B, BS-V30 A/B and MS-V9 A/B is denied. However, based on the Generic Letter 89-04 and a review of past inspection results of these valves, the staff finds that relief may be granted from the full flow test requirements of IWV-3522 provided the inspection interval is no longer than one valve in each set every other refueling outage.

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