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Murray R. Edelman
SR. VICE PRESIDENT
NUCLEAR

PRIORITY ROUTING
FILE HAS

November 13, 1987
PY-CEI/OIE-0289 L

Mr. A. Bert Davis
Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Perry Nuclear Power Plant
Docket No. 50-440
Updated Information to
letter PY-CEI/OIE-0288 L

Dear Mr. Davis:

This letter provides additional information regarding the commitments made in our letter, PY-CEI/OIE-0288 L, dated November 9, 1987. Based upon the discussions held with members of you staff on November 10, 1987, enclosed is a description of committed actions, established parameters to be monitored and appropriate action statements if predetermined threshold values are exceeded.

Following receipt of your concurrence, we plan to restart the plant to complete the remaining tests in the Startup Test Program. If you have any questions, please feel free to call.

Very truly yours,

M. D. Lyster for

Murray R. Edelman
Senior Vice President
Nuclear Group

MRE:cab

Enclosure

cc: K. Connaughton
T. Colburn
Document Control Desk

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The following evaluations and actions have been or will be completed prior to plant startup:

1. As previously stated in PY-CEI/OIE-0288 L, for the dual (fast closure) solenoids, the total air pack has been replaced for the 1B21-F028D valve, and the whole dual solenoid has been replaced on the 1B21-F022D valve. Additionally, the 1B21-F022A solenoid valve has been replaced due to a frayed wire at the termination. No other solenoids showed significant degradation or required replacement. All of the other MSIV dual solenoids have been rebuilt.

2. As previously stated in PY-CEI/OIE-0288 L, the single (slow closure) solenoid was replaced on the 1B21-F028D valve since the whole air pack was replaced. Additionally, the 1B21-F028B solenoid valve has been replaced due to a frayed wire at the termination. Based on the inspection results above, no other replacements were necessary.

3. As previously stated in PY-CEI/OIE-0288 L, an evaluation has been performed of other ASCO solenoid Class 1E harsh environment applications in the plant, including those which may have been subject to the steam leak environment which affected the MSIV solenoids. The review identified two normally deenergized solenoids which were subject to the same conditions as the MSIV solenoids. Since the solenoids are in a normally deenergized state, no further action was considered necessary. The two solenoids were 1B21-F0451 (solenoid for valve 1B21-F0069) and 1M14-F0063A (solenoid for valve 1M14-F0060A). Work history review of all other applications has shown no solenoid failures, indicating the ASCO solenoid degradation appears to be limited to the MSIV solenoid valves. Further reviews are described in item 4 of the post startup actions.

   The 1M14-F0060A valve is a normally closed valve and has no safety function to mitigate an accident. It is associated with a Drywell Purge system damper that is closed during normal operation with a water seal in place for shielding purposes. The 1B21-F0069 valve is a one inch before seat drain valve that is closed at greater than 50% main steam flow (at which time the solenoid is deenergized). The valve was recently cycled on November 7, 1987 with no deficiencies identified. In addition, this valve will be cycled again during this plant startup.

4. An evaluation has been performed of other equipment in the vicinity of the 1B21-F022D, 1B21-F028D, and 1B21-F028B valves, to assess any impact that the steam leaks may have had on other components. This evaluation revealed that there were six valve actuators in the steam tunnel and two in the drywell that were in close proximity to the known steam leaks. These actuators were inspected and no steam/heat degradation was observed. Wiring, terminal blocks, torque switches, limit switches, splices, gaskets, and limit switch gear box lubricants were inspected by a team that included EQ personnel.

There was no evidence of a thermal degradation from a steam environment that would affect valve operability. It should be noted that the Limitorque actuators do not contain EPDM material. A review for qualified life adjustment will be included in the further review described in the post startup item 4. There is no short term concern of Limitorque motor operators qualified life in the drywell or steam tunnel areas.

5. The historical readings of the existing permanent steam tunnel and drywell temperature elements in the vicinity of the MSIVs have been reviewed, and a baseline has been determined for each element (see Attachment 1). Until the temporary temperature monitoring baseline values have been determined, the existing permanent temperature elements will be used. It has been determined that a 10% rise above these baseline values may be indicative of a localized steam leak and would require investigation. This value was conservatively selected since it is approximately one half of the temperature rise expected for the Technical Specification trip value for leak detection. It is sufficiently conservative for the interim period until the MSIV area and surface temporary temperature element readings have been fully baselined. This temperature rise would have indicated the steam leaks which impacted the inboard MSIV (24 degrees F differential temperature) A lower threshold temperature rise could result in unnecessary actions or reduction in power operation due to minor temperature fluctuations.

(5a.) A procedure will be established specifying necessary actions to be taken upon exceeding the interim temperature values. The interim temperature thresholds are, area temperature plus a 10% rise or a selected 225 degrees F for the temporary temperature elements in the area surrounding the MSIVs for both the steam tunnel and drywell. The Senior NRC Resident Inspector will be notified if any of the following corrective actions are to be taken:

- o Reduce power, as necessary, to perform a visual inspection to determine the equipment affected.
- o Immediately repair the leakage or shield the adjacent Class 1E components to limit the impact until a repair is possible.
- o Note components being affected and assess the thermal impact (EQ). Evaluate and determine the necessary time frame for taking additional action, such as increasing surveillance frequency or changing replacement interval.

- o At least 1 temporary temperature element in the area of each MSIV will be maintained in service in Operating Conditions 1, 2 and 3. If all temporary temperature elements fail for a specific MSIV, the adjacent temperature elements will be utilized in an interim period not to exceed 7 days. In the interim a correlation will be established between the adjacent temperature elements and the specific MSIV without individual monitoring. After 7 days, reactor power will be reduced in order to repair/replace the failed element within 24 hours or the plant will be placed in Hot Shutdown within 12 hours and Cold Shutdown within the following 24 hours.

- o If the local temperature monitoring in the area of an MSIV exceeds 284 degrees F, the affected MSIV will be declared inoperable in accordance with Technical Specification 3.6.4.a or cycled daily consistent with the EQ test parameters. This remains in effect until the additional environmental testing is completed (see Attachment 2).

6. Additional steam tunnel temporary temperature monitoring has been installed on the preselected sample points in the MSIV area including on the dual and the test solenoid bodies. Baseline data will be obtained on the temporary temperature elements in the steam tunnel during the next full operating period of sufficient duration to allow temperatures to stabilize. From our experience, this will be several days after the plant is at full power. Until the baseline data is established, a value of 225 degrees F will be utilized for the temporary temperature elements in the areas surrounding the MSIV to initiate the actions described in 5a. Inspections will be performed during startup to assure that the initial temperature reading are not being effected by steam leaks. Once it has been determined that the readings have stabilized, the procedure outlined in item (5a) above will be revised to use the temporary temperature elements in lieu of the permanent elements. The temporary temperature monitoring program will continue until the final analysis results of the environmental testing (see Attachment 2) is fully evaluated. At this time, possible design improvements will be evaluated and a determination will be made on future actions, including replacement frequencies or correlation to permanent area temperature elements. The NRC will be notified prior to removal of the temporary temperature elements.

   Nine drywell temporary temperature elements have been installed with at least one on each of the dual solenoids on the inboard MSIVs, typical of what was done with the temporary steam tunnel temperature elements. A baseline will be established after the startup following the outage as described above for the temporary steam tunnel temperature elements. These baseline values will then be incorporated into the program, along with the respective acceptance criteria. In the interim, a selected threshold of 225 degrees F will be used for temperature elements in the area surrounding the inboard MSIVs to initiate the actions described in 5a.

7. A test has been performed which verified that air does not flow between the air compressor reduction gear vents and the air compressor intake. Consequently, it was determined that there was no need for any equipment modification, or change in the intake filter replacement frequency.

Following startup, these additional evaluations and actions will be performed:

1. To further substantiate the high temperature root cause, laboratory analyses will be performed to confirm the failure mechanism of the EPDM degradation. A review of industry experiences and discussions with various industry sources will continue to be conducted in order to input into our analysis plan. Our preliminary analysis plan, which included these industry contacts, is completed, and a summary is provided in Attachment 2.

   We have completed an initial evaluation of industry experience. The initial industry review did not change our preliminary conclusion that the root cause of the problem was primarily localized elevated temperatures near the ASCO solenoid valves. The visual inspection of the EPDM did not exhibit the normal signs of hydrocarbon degradation (stickiness, sponginess, or swelling), however, we have not eliminated the potential of hydrocarbons having a deleterious effect. We plan to use data obtained from other plant experiences as described in IEN 86-57, along with our own analysis, to confirm the root cause.

   Our preliminary schedule is to have initial infrared analysis for hydrocarbon degradation by the end of January 1988 with the remaining results and analyses by end of the first quarter 1988. Any further analyses required will be determined at that time. We plan to use a local research laboratory, as our primary analyses contractor. Results will be provided to the NRC. With respect to environmental testing, a test plan will be provided to the NRC by November 23, 1987. Interim test results will be provided to the NRC as they become available during the 92 day test duration.

   Following completion of the analysis program, possible design improvements, will be evaluated and a determination will be made on future actions, including replacement frequencies.

2. Presently, in order to minimize the potential for introducing hydrocarbons to the air system, a preventive maintenance requirement will be established for periodic replacement of the instrument air system prefilters. The maintenance frequency will be consistent with replacement of the instrument air system after filters. Additionally, a generic precaution will be added into air system work orders regarding the use of thread lubricants and sealants. If the outcome of the chemical analyses indicates the presence of hydrocarbons, we will immediately implement an appropriate

hydrocarbon sample and analysis program for the instrument air system. This will include weekly sampling of the supply lines to the MSIV's at the containment penetration connection as well as other main J-headers throughout the air supply system. The Senior NRC Resident Inspector will be notified upon implementation of this action.

Dew point and particulate sampling of the instrument air system will continue in accordance with the existing plant administrative procedure. Any unacceptable results will be evaluated and system blowdowns will be conducted until satisfactory results are obtained.

3. Until the first refueling outage, the fast closure dual solenoids will be checked for proper operation during the monthly slow closure check. The existing monthly surveillance instruction will be revised prior to startup to reflect the following test procedure. The test will be performed by fully closing each MSIV individually utilizing the test solenoid, followed by taking the control switch to close. Performance of this test will verify the proper operation of the dual solenoid, since the MSIV will only remain closed if the dual solenoid deenergizes and properly repositions. If any MSIV should reopen during the test, indicating failure of a dual solenoid, the associated MSIV will be declared inoperable and the plant will be placed in Hot Shutdown within 12 hours and Cold Shutdown within the following 24 hours. The NRC will be notified upon discovery of such a failure.

   Also during this time frame the MSIVs will be cycled individually on a quarterly basis regardless of plant operating conditions, and the fast closure time verified. As a result of a failure of this quarterly test due to temperature related problem with a dual solenoid, or other air pack component, the plant will be shutdown and the NRC will be notified as described above. The monthly test described above, will not be performed during those months when the quarterly fast closure test is performed.

   Prior to exceeding a six month period an inspection will be performed during an outage of opportunity, on the dual solenoid experiencing the highest temperature profile. This inspection will verify no degradation of the solenoid valve internals. If accelerated heat degradation is observed, a complete investigation will be initiated and the NRC notified.

4. A review has been completed of all known steam leaks in the plant which could have affected Class 1E equipment. For all of the potentially affected equipment identified, there is no configuration where elastomer compression set or degradation could result in the equipment not being able to perform its intended function. However, these components will be evaluated to determine if there has been any affect on their long term qualified life based on the environment under which they were subjected. The results of this evaluation will be completed and submitted to the NRC by November 30, 1987. A further review will be conducted for potentially high temperature area environments of all Class 1E solenoids and other equipment with EPDM subcomponents where elastomer compression set or degradation could result in equipment not being able to perform its intended function. This review will be completed by the end of the first quarter 1988.

TEMPERATURE MONITORING FOR DETECTION OF STEAM LEAKS

	TEMPERATURE SENSOR NUMBER	NORMAL OPERATIONAL BASELINE TEMPERATURE	ACTION PLAN IMPLEMENTATION TEMPERATURE
UPPER DRYWELL AREA	D23-K102 A D23-K102 B M13-R110-2 M13-R110-16	140° F 140° F 150° F 135° F	154° F 154° F 165° F 148° F
MIDDLE DRYWELL AREA	D23-K112 A D23-K112 B M13-R110-3 M13-R110-4 M13-R110-14 M13-R110-15	135° F 131° F 136° F 124° F 136° F 127° F	148° F 144° F 150° F 136° F 150° F 140° F
LOWER DRYWELL AREA	D23-K122 A D23-K122 B M13-R110-5 M13-R110-7 M13-R110-8 M13-R110-11 M13-R110-12	130° F 128° F 114° F 122° F 122° F 110° F 127° F	143° F 141° F 125° F 134° F 134° F 121° F 140° F
STEAM TUNNEL AREA MONITORS	E31-N604 A E31-N604 B E31-N604 C E31-N604 D	125° F 134° F 130° F 128° F	138° F 147° F 143° F 141° F
STEAM TUNNEL DELTA - T MONITORS	E31-N605 A E31-N605 B E31-N605 C E31-N605 D	80° F 80° F 82° F 82° F	88° F 88° F 90° F 90° F

Attachment 2.

ANALYSIS PLAN FOR EPDM SOLENOID COMPONENTS

I. INTRODUCTION

To determine the cause for failure of solenoid pilot valves which resulted in the slow closing of MSIV'S, two approaches will be taken. Both approaches involve analyses of the EPDM elastomer gasket material. The physical properties of the elastomeric material which was in service will be compared to new material to observe degradation, loss of material, deformation, anomolies in surface characteristics, and reduced performance. In addition, the gasket material will be subjected to chemical analyses to discover changes from original material at the molecular level. Data obtained from the analysis regimen along with data from a similar failure experienced at Brunswick in 1985 will be used to determine cause.

II. PERSONNEL CONTACTED

Interviews with the Harris Research Personnel and NRR provided information regarding analyses performed and resulting postulations. PNPP analyses will include methods to confirm or deny these failure postulates. The full Brunswick Failure Analysis Report has been sent and will be used as guidance. A meeting with Ricerca, Inc. Personnel regarding this failure analysis program resulted in the following proposed course of testing.

III. ANALYSIS PROGRAM

A. Samples

1. Unused Elastomer Gasket material
2. Used Elastomer from pilot solenoids which did not fail.
3. Used, degraded Elastomer Material from failed pilot solenoids.
4. Pilot Solenoid valve bodies with elastomer residue.

Attachment 2.

B. Physical Testing
   1. Profilimetric analysis to compare indentations in EPDM discs (sample nos. 3, and 2)
   2. Optical Microscopy to determine the presence of foreign material, or loss of material from surfaces.
   3. Hardness testing to compare with original specifications.
   4. Compression set to compare with unused material and note performance degradation.

C. Chemical Testing
   1. Infrared survey to determine carbonile content. This will provide information about mode of attack (organic acids from the presence of hydrocarbons) and extent of oxidation.
   2. Scanning Electron Microscopy/X-Ray dispersion Spectrometry to confirm or negate copper-catalyzed accelerated oxidation. (Which was a postulated Failure Mode at Brunswick)

D. Environmental Testing

Six new dual coil solenoids will be sent to a laboratory for additional environmental testing. The solenoids will be placed in three separate environmental chambers (two per chamber) at various elevated temperatures in an energized condition. The solenoids will remain energized for predetermined times in an attempt to determine the temperature and continuously energized time at which the solenoids do not perform their function.

IV. SUMMARY

The above analyses and their results will provide evidence of failure mode and will describe any further confirming analyses which may be needed. In addition, recommendations will be made in order to preclude recurrence.