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Docket Nos. 50-352
50-353

Philadelphia Electric Company
ATTN: Mr. C. A. McNeill, Jr.
Executive Vice President
Nuclear
Correspondence Control Desk
P. O. Box 7520
Philadelphia, PA 19101

Gentlemen:

Subject: Combined Inspection 50-352/89-80 and 50-353/89-80

This refers to your letter dated May 8, 1989, in response to our letter dated March 23, 1989.

Thank you for informing us of the corrective and preventive actions documented in your letter. These actions will be examined during a future inspection of your licensed program.

Your cooperation with us is appreciated.

Sincerely,

Original Signed By:
P. K. Eapen
Jacque P. Durr, Chief
Engineering Branch
Division of Reactor Safety

cc w/encl:
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G. M. Leitch, Vice President - Limerick Generating Station
S. J. Kowalski, Vice President - Nuclear Engineering
D. R. Helwig, General Manager - Nuclear Servcies
M. J. McCormick, Jr., Manager - Limerick Generating Station
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PHILADELPHIA ELECTRIC COMPANY

LIMERICK GENERATING STATION
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(215) 327-1200 EXT. 2000

M. J. McCORMICK, JR., P.E.
PLANT MANAGER
LIMERICK GENERATING STATION

May 8, 1989

Docket Nos. 50-352
50-353

License No. NPF-39
Construction Permit No. CPPR-107

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

SUBJECT: Limerick Generating Station, Units 1 and 2
Response to Observed Weaknesses Noted in
Special Maintenance Team Inspection
Report No. 50-352/89-80, 50-353/89-80

NRC letter dated March 23, 1989, transmitted Special Maintenance Team Inspection Report No. 50-352/89-80, 50-353/89-80 for the Limerick Generating Station, Units 1 and 2. This letter also requested that we address the noted weaknesses contained in the report and outlined in Appendix 3. The letter requested a written response within 45 days to the noted items. Attached to this letter is our response to each observed weakness.

If you have any questions or require additional information, please do not hesitate to contact us.

Very truly yours,

M J McCormick Jr

M. J. McCormick, Jr.
Plant Manager

DBN:kap

Attachment

cc: W. T. Russell, Administrator, Region I, USNRC
T. J. Kenny, USNRC Senior Resident Inspector

Item 1

NRC Observed Weakness

Communications with offsite engineering organizations could be improved (Ref. II.4.1 {pg. 12}).

Response

Regarding the general issue of communications between the station and the offsite engineering organization, an update to the response provided to NRC Inspection Report 50-352/88-20 is provided below.

The Engineering Work Request (EWR) process, implemented at Limerick in 1989 has provided engineering support for station requests in such areas as Licensee Event Reports (LERs), Equipment Qualification (EQ) evaluations, potential reportability and operability evaluations, and specific design related questions. The EWR process is being tracked and trended along with the Non-Conformance Report (NCR) and Engineering Review Request Form (ERRF) processes using the Nuclear Engineering Task Tracking (NETT) system. Over 600 individual Limerick requests have been responded to by Engineering between January and April 1989.

The status of the tracking and trending is reported monthly in the Senior Management Report (SMR) and includes information regarding timeliness of responses, total requests processed and the current backlog of requests. This report is discussed monthly with the nuclear group vice-presidents and their direct reports.

Six dedicated engineering personnel have been located onsite and additional engineering resources are located at the Architect/Engineer's (A/E's) Pottstown, Pennsylvania office. An Engineering project management staff, located at the site, coordinates and tracks each individual request using the NETT process and ensures effective communications between the station and the offsite engineering organizations. Members of the staff attend the daily routine plant meetings (e.g. morning meeting, TRIPOD, PORC) and provide needed support. Our goal is to locate approximately ten individuals from the engineering organization at the site by the end of December 1989.

The station engineering personnel have been trained on how to properly complete an EWR to ensure that station requests for engineering support clearly identify needs and expectations. This will help provide effective use of the EWR thereby providing effective communications.

Periodic meetings between station and engineering management were held on a bi-weekly basis during the outage and are presently scheduled to continue to be held on a monthly basis after the outage. These meetings have been effective in prioritizing and resolving problems which require engineering support.

Potentially reportable issues identified by the offsite engineering organization are communicated to the station regulatory personnel by way of a Reportability Evaluation Form (REF). Station management can then evaluate the need for compensatory or other required actions, to make any required notifications, and to request additional engineering support utilizing the EWR process. This mechanism has provided effective communications between the offsite engineering organization and station personnel such that potential reportability/equipment operability concerns are raised to station operations personnel in a timely manner.

Some examples of recent effective engineering support and communication between the offsite engineering organization and station personnel especially in the area of maintenance include 1) investigation and evaluation of the jet pump riser nozzle crack and design of modifications to install crack monitoring equipment, 2) development of the test procedure and design of the required modifications for the main turbine torsional testing, 3) investigation and evaluation of indications on the Low Pressure Turbine blades, 4) design of a modification to relocate the Suppression Pool Temperature Monitoring System (SPTMS) temperature probes, 5) the project task force which is reviewing and resolving problems identified during the review of the 10CFR50 Appendix R related fire protection issues, and 6) the establishment of periodic Service Water System Reliability Group meetings involving engineering and station personnel.

In conclusion there is clear evidence that there are improved communications between the offsite engineering organizations and the station staff.

Item 2

NRC Observed Weakness:

The operability of the HPCI room unit coolers was a concern in view of the ESW piping corrosion and no periodic performance test for these coolers. (Ref. II.4.2 {pg. 14})

Response

During the Unit 1 Second Refueling Outage the NRC inspector observed several activities related to Emergency Service Water (ESW) system valve and pipe replacements including the High Pressure Coolant Injection (HPCI) system room unit cooler supply piping. This planned modification work was being done to increase supply piping sizes to several ESW components to allow for aging degradation of this piping. During this pipe replacement, significant pipe corrosion was observed in the removed piping. The NRC inspector questioned the future operability of the HPCI room unit coolers in light of the observed corrosion.

During the pipe replacement work, pipe friction coefficients were estimated and incorporated into a computerized ESW system flow network model. Engineering and the Architect/Engineer analyzed the ESW model using the new data and new piping sizes and determined that a successful two unit ESW flow balance could be achieved.

The two unit flow balances were performed during the Unit 1 Second Refueling/Unit 2 Tie-In Outage and proved ESW is capable of providing adequate flows to all components in both units including the HPCI room coolers for all six acceptance criteria modes. An additional mode proved both ESW loops could independently support eight diesel generators while providing the required flows to both units' safety related heat exchangers.

To ensure the ESW system will continue to meet its required demands and support operability, several actions have been and will be taken. A solution to the general ESW piping corrosion issue is described under item 3 of this attachment. Quarterly flow balancing of the ESW system will be performed and piping and components will be periodically inspected. In addition, the Technical Specification required quarterly ESW pump performance test will be performed and pump capacity performance will be monitored and evaluated. A further description of the quarterly flow balancing and component inspection program is described below.

Routine ESW flow balances tests RT-1-011-251-0 and RT-1-011-252-0 will be performed quarterly. The procedures were based on the flow balances performed as part of the two unit flow balance test program. They have been specifically designed to closely monitor ESW components with marginal performances observed in the two unit flow balance test program. Every quarter, potential 'problem' components will be tested. Included in this category will be all Residual Heat Removal (RHR) system pump seal coolers, RHR motor oil coolers, the Unit 1 HPCI room coolers, and the Unit 2 Reactor Core Isolation Cooling (RCIC) system room coolers. These components are more likely to become 'problem' components because of their piping configurations. The remaining components will be tested a minimum of once during each cycle as part of the scheduled quarterly tests. Acoustic flow monitors will be used to verify the accuracy of the procedure. Acoustic flow testing will be performed on any component with unusually high differential pressure (DP) readings and on coolers with a past history of fouling. This redundant verification will ensure that we maintain a close watch on potential problems.

Every refueling outage, Maintenance will perform visual inspections of ESW and Service Water pipe and components via the Preventive Maintenance Program. Once again, ESW components identified to have a potential problem such as RHR seal coolers, Unit 1 HPCI room coolers and Unit 2 RCIC room coolers will be inspected each refueling outage. In addition, any component that experienced poor performance in the quarterly flow balances will be inspected. The piping associated with the inspected coolers will also be inspected. Flow balances will establish a constant reference point of ESW flow versus total system dynamic head. Each quarter this will be compared with past results and the data obtained will be used to monitor pipe fouling. Low DP readings on heat exchangers during the flow balances could also indicate low flow conditions due to flow restrictions. The computerized ESW system flow network model will be utilized in the ESW monitoring program. The monitoring program will enable us to predict system performance and potential problems. The monitoring program will be continually evaluated and modified as necessary to ensure continued system operability.

Item 3

NRC Observed Weakness:

A comprehensive solution to the ESW piping corrosion issue was not yet well defined. (Ref. II.4.2 {pg. 15})

Response

Based on observations of service water system components prior to commercial operation of Unit 1, a service water/circulating water (cooling tower) chemical treatment program was developed. The program was developed to limit corrosion, deposition and microbiological fouling in circulating water, service water and portions of ESW. This treatment system was installed and made operational shortly after commercial operation (after receipt of the required NPDES permit from the Pennsylvania Department of Environmental Resources). Provisions for corrosion rate monitoring, using corrosion coupons, were included in the scope of this installation. It was recognized that, although reductions in corrosion rates were expected, further corrosion protection could be achieved with clean pipe surfaces. We therefore began to investigate cleaning alternatives in parallel with instituting the corrosion treatment program and periodically monitoring the effectiveness of the program using the corrosion coupons, an instantaneous corrosion monitor, and individual component inspections (conducted as components are isolated and opened due to maintenance activities).

Due to the amount of piping involved in these systems, and the isolation/availability constraints and outage schedule limitations associated with mechanical cleaning, chemical cleaning techniques were pursued. A chemical cleaning technique was identified and testing was conducted, using samples of service water piping removed from Limerick. Although this two step chemical cleaning process (deposit softening followed by mild acid wash) was demonstrated to be effective in a similar application at another utility, it was not effective in removing Limerick's deposits. Investigations into chemical cleaning techniques continued into cycle 2 for Unit 1. An alternate cleaning program has been identified similar to the previously tested two step program, which based on recent successful application in a similar application has proven effective. We plan to test this program using ESW piping samples removed during the second Refueling Outage.

In addition, during a design review prior to the Unit 1 First Refueling Outage, we recognized that due to normal aging (corrosion degradation) of the pipe, there would not be sufficient system flows to support 2 unit operations and some ESW supply piping would need to be replaced. During the First Refueling Outage, sections of piping in the 'A' loop of ESW were replaced with larger diameter piping. Inspection and testing of the piping replaced during this outage indicated that a corrosion problem existed in small ESW lines, specifically the one-inch diameter piping to the RHR pump seal coolers and RHR motor oil coolers, but was not evident in the larger diameter piping inspected or replaced.

During the Second Refueling Outage, sections of piping of the 'B' loop of ESW were replaced for the aging concern described above. The new piping was passivated with a high concentration of corrosion inhibition chemicals prior to wetting. Passivation is a chemical treatment applied to the inner metal surface of the piping to inhibit corrosion. The removed sections of pipe contain similar amounts of corrosion as contained in the 'A' loop piping removed 18 months earlier with the exception of the HPCI room unit cooler piping. The 'A' loop piping replaced during the first refueling outage was inspected and found to contain a very small amount of corrosion after 18 months of service. Evaluation of the corrosion monitoring data and the observations made during the second Refueling Outage indicate that the corrosion rate within the ESW piping has been reduced. Samples of the deposits obtained from the ESW piping were analyzed and the results indicate that the fouling problem is caused by general iron corrosion products and not from silt/mud deposition, microbiological fouling or microbiologically influenced corrosion.

Based upon the chemical analysis results, ESW system inspections, and several tests involving the service water system (which normally supplies the ESW piping and components), we have determined the causes of the ESW system fouling to be the following:

1. Ineffective layup practices during plant construction and testing phase which resulted in prolonged periods of exposure of the piping to raw water in stagnant or intermittent flow conditions. This resulted in high corrosion rates and deposition/accumulation of the corrosion products on the pipe surface.

2. An effective cleaning program was not identified and implemented coincident with the chemical treatment program. This limited the effectiveness of the chemical treatment.

3. Although the cooling tower corrosion treatment program does provide some corrosion protection of ESW, isolation of certain ESW components and low or intermittent flow conditions when in standby mode further limit this protection.

Chemical treatment of the service water and ESW systems has been recently upgraded to provide enhanced dispersant and anti-corrosion chemicals. Initial results of this upgraded treatment program indicate even lower corrosion rates than achieved during the previous treatment program. A study is in progress to determine the feasibility of a targeted biocide and corrosion inhibitor program to address the corrosion problems during stagnant/intermittent operating conditions present in the ESW and Residual Heat Removal Service Water (RHRSW) systems. A Service Water System Reliability

Group, composed of onsite and offsite engineering and technical personnel, was initiated in December, 1988, to identify and address specific Service Water and ESW problems.

These actions will provide the comprehensive solution to the ESW piping corrosion issue.

Item 4

NRC Observed Weakness:

Deletion of QC witness points in certain maintenance procedures without specific guidance (Ref. II.4.4 {pg. 18}).

Response:

The weakness identified as the process for deleting QC witness points was recognized by NQA during the NRC inspection and appropriate corrective measures were taken at that time. As stated in the Inspection Report, the problem stemmed from the efforts to increase accountability for quality at the worker level and sharpen the focus of QC on the more critical aspects of the work activities. Without formal guidance to accomplish this, QC witness points were inconsistently applied and, in some instances, appropriate QC witness points had been deleted from certain procedures along with those that were unnecessary. During the NRC inspection, a review was initiated by the QC Division which determined that of approximately 700 Maintenance Procedures, seventy-seven (77) were revised without the specific guidance being in place. These seventy seven procedures were reviewed and eleven (11) required revision to reinstate the appropriate QC witness points which were inadvertently deleted. The eleven procedures including the emergency diesel engine and motor control center preventive maintenance procedures identified by the NRC inspector were appropriately revised prior to performance of any work activities utilizing them.

As committed to during the inspection, formal guidance for determining QC points for specific work activities has been proceduralized. Maintenance Guideline No. 28, titled "Identification of Quality Control Witness Points" and a supplement to the QC Inspection Program Procedure, Supplement NQA-4-S1A, "Determination of QC Action Points", provide the formal guidance to the maintenance procedure writer and QC procedure reviewer for determining when QC witness points are to be included in the electrical and mechanical preventive maintenance procedures. Supplement NQA-4-S1A is expected to be formally issued by June 30, 1989.

Item 5

NRC Observed Weakness:

Low Level QA/QC involvement in the ESW piping corrosion issue. (Ref. II.4.4 {pg. 19})

Response

The ESW piping system corrosion problem had been previously identified during flow balancing of the ESW system during pre-operational testing. A flow network analysis was performed to aid in flow balancing and modifications were initiated to ensure that no unacceptable flow restrictions existed as the ESW piping aged. These modifications were identified and substantiated by written Safety Evaluations and Plant Operating Review Committee reviews.

During the course of on-going ESW piping modifications, QC inspection personnel questioned the acceptability of the ESW piping corrosion. However, in the absence of specific cleanliness acceptance criteria in the governing specification, and in light of the on-going modifications, flow network analysis and engineering study, NQA management and QC supervision felt that the ESW corrosion problem was adequately identified and controlled and concluded that it was not necessary to issue nonconformance reports.

In order to avoid recurrence in situations where the involvement of the appropriate personnel would not be as evident, supplement to NQA-QC inspection procedures are being developed to more clearly define cleanliness acceptance criteria for plant operating systems. These criteria will include loss of cross-sectional area that could impair or prohibit mechanical piping system components such as check valves, coolers or heat exchangers from performing their intended function. The supplemental inspection procedures are expected to be issued by June 2, 1989. These criteria will be used to determine the acceptability of internal cleanliness conditions of plant piping systems and if not met will be the basis for issuance of Equipment Trouble Tags (ETT's) or Nonconformance Reports (NCR's) in accordance with procedure NQA-24 "Control of Hardware Non-Conformances" (now NGAP NA-03N001).

In addition, a committee has been appointed by the NQA-General Manager to revise NQA-24 (NGAP NA-03N001) to ensure that ambiguity will not exist in the procedure regarding nonconforming conditions and the issuance of NCR's. The procedure revision is expected to be completed by September 30, 1989.

These, or any other nonconformances that are found to be repetitive, shall be considered a significant nonconformance in accordance NQA-24. As such, a Corrective Action Request shall be initiated to management attention in accordance with existing procedure NQA-25, "Corrective Actions," to request a root cause analysis and to determine corrective action to prevent recurrence.

Item 6

NRC Observed Weakness:

The lack of preparation of a Maintenance Procedure to support lapping operations for D/G crankshaft bearings. (Ref. III.5.0 {pg. 25}).

Response:

The need for a bearing journal lapping procedure was previously identified during the construction phase of Limerick Unit 2. Bearing inspections were scheduled to be performed on all four Unit 1 emergency diesel generators (D/G's) during the Unit 1 second refueling outage and during this inspection, journal lapping is not normally required. In addition, there were no vibration problems indicating that the journal bearings would need replacing and journal lapping was not expected to be necessary during the second refueling outage. Therefore, incorporation of journal lapping instructions into permanent procedures was determined to be of a lower priority than revision and enhancement of other procedures required to support the Unit 1 Refuel Outage. During the overhaul of the D12 D/G, journal lapping was identified to be required and a lapping procedure was generated shortly thereafter.

Journal lapping instructions are expected to be incorporated into the appropriate permanent Maintenance Procedure(s) prior to July 31, 1989.

Item 7

NRC Observed Weakness:

Slow implementation of the PRA into the prioritization of maintenance work. (Ref. III.5.0 {pg. 27})

Response:

Several factors inhibited early extensive use of the Probabilistic Risk Assignment (PRA) in the maintenance process and at Limerick in general. These included:

1) The lack of a comprehensive, living PRA that reflected the as-built plant, and,

2) The lack of a user friendly PRA tool that would simplify and expedite use of the PRA.

The following describes actions taken over the past few years to eliminate these factors:

1) The PRA originally performed in 1980 was reviewed during the plant licensing process and updated in September 1982. Before widespread use could be made of the PRA, the system models had to be revised to reflect as-built designs. Also, station operating procedures, that were non-existent in 1982, had to be incorporated. The PRA was updated in August 1986 to reflect Unit 1 as-built design and most of the emergency operating procedures (i.e. the Transient Response Implementation Plan (TRIP) procedures). A second update was completed in November 1988 that completed the incorporation of the TRIP procedures and reflected two unit operation. Completion of this update addresses the first factor providing Limerick with a comprehensive, living PRA that reflects the as-built plant and supports applications.

2) PRA applications in the past were limited due to the available computer software that was difficult and cumbersome to use. In 1987, the Nuclear Engineering Department PRA Branch purchased a personal computer (PC) workstation that streamlined the process of modifying and using the PRA. The conversion of the PRA to the workstation model was completed by November 1988. The PRA work station was used to develop the PRA parameters (i.e. what systems and equipment are PRA important and how they affect Core Damage Frequency) to be utilized by the station PRA programs and will be used by engineering to answer specific PRA based questions from the station. The PRA workstation addresses the second factor; it is the tool that was needed to simplify PRA use and provide better responsiveness to PRA requests.

With the above described improvements completed in November of 1988, Limerick has been able to develop several programs involving the PRA. Specific to the prioritization of maintenance work, these programs include Administrative Guidelines (AG) AG-42, "PRA Applications in Plant Maintenance" and AG-43, "Guideline for the Performance of System Outages." Following extensive training of Limerick personnel, these programs became effective in January 1989 and have since then been implemented.

Item 8

NRC Observed Weakness:

The lack of adherence to an administrative procedure (A-26) resulted in traceability problems of mechanical tools. (Ref. III.7.0 {pg. 36})

Response:

This problem had been identified prior to the inspection and the Maintenance Request Form (MRF) had been changed in late 1988 to allow recording of up to 15 tools versus 5 allowed on the old form. On February 9, 1989, the next day following identification of the problem by the NRC inspector, a meeting was held with the maintenance department personnel. The importance of recording all tools used during maintenance activities on the MRF was stressed in the meeting. Continuing training for Maintenance personnel will address the need to include calibrated tool serial numbers on the MRF in order to provide traceability.

A review of all out of tolerance (OOT) tools is being performed. Prior to January 1, 1988, Quality Assurance (QA) personnel recorded all calibrated tools used on safety related equipment in parallel to the work activity. A similar traceability problem is not likely to have occurred prior to January 1, 1988 nor after the meeting held on February 9, 1989 and therefore the review will encompass the OOT reports from the calibration facility received from January 1, 1988 to February 15, 1989. This review will compare the OOT tool reports, the tool usage log and the referenced MRF's to ensure that the OOT tools are properly identified on the MRF and that the affect of the OOT tools have been evaluated. This review includes the nine MRF's identified during the NRC inspection. Any deficiencies identified during this review will be evaluated and corrected. In addition, a maintenance guideline is being prepared for the control of calibrated tools. All corrective actions are expected to be completed by September 1, 1989.