U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-352/92-24 & 50-353/92-24

Docket No. 50-352 & 50-353

License No. NPF-39 and NPF-85

Licensee: Philadelphia Electric Company
Correspondence Control Desk
P. O. Box 195
Wayne, Pennsylvania 19087-0195

Facility Name: Limerick Generating Station, Units 1 & 2

Inspection At: Limerick, Pennsylvania

Inspection Conducted: July 27 - 31, 1992

Inspector: _____ 8/13/92
S. Sherbini, Senior Radiation Specialist date
Facilities Radiation Protection Section

Approved by: _____ 8/17/92
W. Pasciak, Chief, Facilities Radiation date
Protection Section

Areas Inspected: An announced inspection of the radiological controls program on site. Areas inspected included review of previously identified items, review of the incident involving exposure of workers to an unexpected radiation field, review of the outage report for the last Unit 1 outage, and review of the respirator maintenance and fit testing programs.

Results: Most of the previously identified items had been resolved in a satisfactory manner. Those that had not been resolved were being addressed within the framework of long-term program changes. No immediate concerns were identified in connection with the unexpected exposure incident, but the licensee's investigation of the incident and any corrective actions will be reviewed during a future inspection. The preliminary outage report was found to be of good quality and emphasized problems encountered and proposed solutions. The respirator maintenance and fit testing programs were found to be well managed and technically sound. Within the scope of this inspection, no violations were identified.

DETAILS

1.0 Personnel Contacted

1.1 Licensee Personnel

* J. Doering, Plant Manager
* J. Fongheiser, Senior Health Physicist
  V. Litton, Dosimetry Technician
* T. Mscisz, Assistant Senior Health Physicist
* J. Phillabaum, Licensing Engineer
  J. Risteter, Senior Radiological Engineer
* G. Roach, Superintendent, Plant Services
  S. Taylor, Respiratory Physicist

1.2 NRC Personnel

T. Kenny, Senior Resident Inspector

* Denotes attendance at the exit meeting on July 31, 1992.

2.0 Status of previously Identified Items

2.1 (Closed) Noncompliance NC4 (92-13-01)

This noncompliance item was opened in connection with an incident that involved inhalation of radioactive material by a radiation worker while working in the Unit 1 drywell during a recent refueling outage. The NRC inspection, as well as the licensee's own investigations, identified several failures to follow procedures in connection with the incident. The investigations also identified a failure of communications between Health Physics and the work crew involved, as well as some poor radiological practices.

The licensee took several corrective actions in an attempt to prevent recurrence. Two procedures were changed to clarify the requirements for work in the cavity and similar radiologically posted areas. Meetings were held between Health Physics and the station's radiation workers to discuss the incident and to stress the need for clear communications with HP, and also to clarify the methods to be used to ensure good communication. The licensee also committed to improving the clarity of the radiation work permits and shift turnover procedures, to widely disseminate the results of the root cause analysis of the incident, and to include a discussion of the incident in continuing training sessions. The success of these measures will be reviewed during future inspections. This item is considered closed.

2.2 A concern was raised (Inspection Report 92-07/92-08) regarding the licensee's practice of giving the worker the option of wearing whole body dosimetry inside or outside protective clothing (PC). The accuracy of the dosimetry in measuring skin dose in view of the varying amounts of absorbing layers of PC that may be placed in front of the dosimeter was questioned.

The licensee changed their procedures to address this issue. Procedure HP-603, "Guidelines for Placement of Dosimetry on Plant Personnel" was revised to require whole body thermoluminescent dosimetry (TLD), which is the dosimetry of record, to be worn outside PCs unless a respirator or face shield is used, in which case the TLD is worn inside the PCs. The basis of this policy is that, when respirators and face shields are used together with PCs, there would be no exposed skin surfaces and therefore any shallow dose received would be delivered through the protective clothing. Dosimetry inside PCs would duplicate this geometry. On the other hand, without a respirator or face shield, the skin of the face and the eyes would be exposed, in which case the dosimetry must not have any shielding layers of PCs over it. In addition to the above change, Procedure HP-510, "Selection and Use of Anti-Contamination Clothing" was changed to require that dosimetry must be secured in accordance with instructions on the radiation work permit (RWP).

The inspector stated that the above changes appeared sufficient to address the concern. However, the previous revision of HP-603 required that direct reading dosimeters (DRD) be worn outside of PCs at all times. This requirement was removed from the revised procedure, and the latest revision does not contain any guidance regarding the placement of DRDs. The licensee stated that this omission was inadvertent and that it will be corrected. The inspector also stated that the RWPs reviewed during this inspection did not satisfy the requirements of the revised Procedure HP-510 in that they did not provide guidance on the placement of dosimetry, as required by the procedure. The licensee stated that this requirement was intended only for situations where special dosimetry is to be used and not for routine situations. The licensee stated that the requirement in the procedure was poorly stated and would be changed.

2.3 Review of Procedure HP-621, "Use of Special Purpose Dosimetry", had indicated that the manner in which whole body dose was to be assessed when using multiple dosimetry was not clearly specified. The procedure was revised to indicated that whole body dose would be assessed by using the highest dosimeter reading for each entry in which multiple dosimetry was used.

2.4 A concern was raised regarding the use of yellow catch containments for leaks from both clean and contaminated systems. The licensee stated that they had attempted in the past to use green containments on clean systems but that the attempt had failed because various groups on site continued to use yellow containments on clean systems. To address the concern, the licensee revised Procedure RW-604, "Control of Temporary Collection Systems" to require more consistent radiological markings on the yellow containments now in use to ensure that contaminated containments are clearly identified as such.

2.5 A concern was raised that health physics (HP) supervisors had no clearly defined continuing training requirements. Procedure HP-100, "Health Physics Department Selection, Training, and Qualification" was revised to incorporate such a program. HP supervisors are now required to attend the same continuing training provided to the HP technicians they supervise. In addition, HP supervisors participate in "self--assessment" sessions. These sessions are held several times per year and last about 4-5 hours, and are attended by the HP technicians and run by the supervisors. Discussions on a selected topic are conducted during these sessions, the object being to review the chosen subject area and find ways to improve performance in that area. A recent topic for one of these sessions was HP performance and problem areas during the previous refueling outage.

2.6 Concerns were raised regarding the manner in which the licensee was tracking the average beta energy in the plant for use in dosimetry and survey instrument calibrations, and also the manner in which the presence (or absence) of alpha contamination was being monitored. The licensee stated that they were reviewing all the various programs and data sources involved in these activities in an attempt to integrate the process to ensure that all available data is reviewed by the appropriate personnel and also to ensure that sampling and analysis are done in a technically sound manner. The licensee stated that this project was progressing but was not complete at the time of the inspection. This area will therefore be reviewed during a future inspection.

2.7 A concern was raised that the licensee did not have a clearly defined method to assess the dose resulting from immersion of personnel in clouds to noble gases. The licensee stated that their corporate dosimetry section has commissioned a study of the response of their personnel dosimetry system to such clouds of noble gases. The results of this study and its implementation will be reviewed during a future inspection.

3.0 Presence of An Unexpected Radiation Field in Work Area

This situation occurred during maintenance on a valve in the drywell while the reactor was at about 6% power during startup after the recent refueling outage. The valve in question is on the main steam sampling line and it had failed shut. The problem was identified as an electrical one and two workers had been sent in to attempt to repair it. A prejob ALARA briefing was held to plan the work and review the radiological conditions in the area. Surveys of the work area just before the start of work showed neutron dose rates of 200-500 mrem/hr and gamma rates of 0.08 - 30 R/hr. The two workers signed in on the Radiation Work Permit (RWP) on July 9, 1992 at about 8:10 am and signed out at 8:40 am. They were accompanied all the time by an HP technician. They all wore PCs, neutron and gamma dosimetry, and alarming dosimeters. They also had a confined space alarm since the work was in a confined space. The RWP had initially specified a dose limit for the job of 500 mrem and the alarm setting on the dosimeters was specified to be set at 375 mrem. However, the ALARA engineers who reviewed the job package before entry felt that the alarm setting may be too high considering the work environment and specified a setting of 60 mrem. This was the setting used during the entry. The engineers felt that the lower settings would allow for exposure to the neutron fields in the area because the alarming dosimeters were not sensitive to these fields.

According to the licensee's investigations, the HP technician stated that some time after start of work, he heard an alarm that he believed to have been the confined space alarm. He then noticed a flashing indicator light on one of the worker's alarming dosimeters. The HP technician surveyed the work area but found no unexpected readings. He also checked the worker's 0-200 mR self reading dosimeter (SRD) and did not find any unusual readings. The HP technician concluded that the alarm must be malfunctioning, but he continued to survey the work area. He soon found a small region that caused his survey instrument to go off scale. At this point he asked the workers to clear the area. The SRD readings at exit were 25 and 45 mR for the two workers. Subsequent surveys of the area located a narrow beam a few inches in diameter that came from an instrument line penetration. The beam did not show any neutron dose rates above those existing in the general work area, but it did show higher gamma readings than expected in the work area, reaching about 1-1.5 R/hr.

The licensee conducted a time and motion study of the worker's activities to determine the amount of time spent in the beam. Based on this study, the highest exposed worker was assigned a gamma dose of 220 mrem. The neutron dosimetry

was processed and showed a dose of 70 mrem, giving a total whole body dose to the highest exposed worker of 300 mrem. The licensee also issued a radiological incident report based on the incident's potential for high worker exposures. An independent safety group will investigate the incident and all planning and survey activities connected with it. The inspector stated that there were no immediate concerns in connection with the incident. However, the results of the investigation and the corrective actions taken based on the findings will be reviewed during a future inspection. In particular, the licensee's corrective actions to improve the staff's ability to identify small area radiation beams will be reviewed.

4.0 Outage Performance:

The licensee's outage report for the 1R04 refueling outage indicated that the cumulative radiation exposure for the outage was about 260 man-rem, about 1.8 times the estimate of 140 man-rem established before the outage. The outage report was not complete at the time of the inspection, but an incomplete draft report was available for review. According to this draft report, the exposure estimates were exceeded by most work groups involved in the outage. Some, including Nuclear Quality Assurance, Radwaste, Maintenance, I&C, and Health Physics, exceeded their estimates by substantial margins. Other groups, such as Chemistry and Security, showed lower cumulative exposures than estimated. The number of personnel contaminations that occurred during the outage, about 170, also substantially exceeded the estimate of 80 for the outage. The preliminary report provided some discussion of the problems that developed during the various phases of the outage, but the report did not contain a clear discussion of the reasons for the substantially higher than expected radiation exposures, nor were there clear proposals for corrective actions prior to the next outage. As mentioned above, however, the report reviewed during this inspection was preliminary and incomplete. The parts reviewed were found to be well written and to concentrate on problem areas and proposed corrective actions. The complete report will be reviewed during a future inspection. The licensee stated that they believed based on their informal analyses that there were two main reasons for the higher than expected exposures. One was an expanded outage work scope substantially above that contemplated at the start of the outage. The second reason was a significant number of scheduling and implementation weaknesses in connection with small, low exposure jobs. The licensee pointed out that many of the high exposure jobs did not significantly exceed their estimated exposures. However, the preliminary outage report did not contain sufficient

detail to evaluate these conclusions, and such assessments, as well as reviews of plans to correct identified weaknesses, will be made during a future inspection.

5.0 Respirator Maintenance and Fit Testing:

The respirator maintenance and fit testing programs were reviewed during this inspection. Although the licensee does have the capability to perform maintenance on their respiratory equipment, respirators are sent to an off-site vendor for cleaning and maintenance. Reusable respirator filters are also tested by the vendor. Used respirators are placed in receptacles with used protective clothing at the exit points from the work areas and sent to the vendor. The vendor cleans the respirators and performs any necessary maintenance on them, seals them in plastic bags, and returns them to the licensee. The serial numbers of returned respirators are entered into a computer data base to indicate that they were ready to be issued. Workers requesting a respirator must sign a form indicating that they have read and understood the station rules regarding use of respirators. The worker's respirator qualifications, such as current medical, training, and fit testing, are also verified prior to issue of the respirator.

The licensee stated that about 10% of the respirators returned from the vendor are visually inspected and leak tested at the licensee's facility as a quality assurance (QA) measure. The tested respirators are also smeared and frisked for loose and fixed contamination to ensure that contamination levels do not exceed the licensee's acceptance criteria. A similar fraction of the returned filters are also tested for leakage and resistance. The licensee conducts periodic audits of the vendor's laundry and maintenance facilities as part of their QA program. A program is also conducted to verify the effectiveness of respiratory protection. The program involves periodically checking for internal contamination in about 10% of personnel who wore respirators during recent jobs. A whole body counter is used for the purpose.

The QA program for receipt of respirators from the vendor is described in Procedure HP-514, " Acceptance Criteria for Respiratory Protective Equipment Received From Offsite Cleaning Facilities". A review of the procedure showed that it was well written but did not contain the requirement to leak test a fraction of the returned respirators and filters. The licensee revised the procedure before the end of the inspection to include these requirements.

Observation of fit testing of workers showed that the testing was being performed in accordance with procedures and currently accepted industry good practices. Proper quality control was also being conducted on the testing machines. Two makes of facepiece were being used in fit testing, and different pass/fail criteria were being applied to each make. For the MSA facepiece, an overall fit factor of 500 was required to pass the test. For the Scott facepiece, at least 100 was required on each of the eight individual component tests used during the fit test. The licensee stated that the MSA facepiece is used in the negative pressure mode and therefore a fit factor of at least 10 times the protection factor allowed for this type of respirator was being used. The Scott facepiece, however, is used only in the positive pressure mode. According to accepted current practice, positive pressure respirators do not require fit testing. The licensee stated that they perform the fit test on the Scott facepiece to assist in proper selection of facepiece size for the individual worker. This practice is considered acceptable and no concerns were identified in this area.

6.0 Exit meeting

The inspector met with licensee representatives at the end of the inspection on July 31, 1992. The inspector reviewed the purpose and scope of the inspection and discussed the inspection findings.