U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Inspection No. 50-387/92-24; 50-388/92-24

Docket Nos. 50-387; 50-388

License Nos. NPF-14; NPF-22

Licensee: Pennsylvania Power and Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Facility Name: Susquehanna Steam Electric Station, Units 1 & 2

Inspection At: Berwick, Pennsylvania

Inspection Conducted: September 21 - 25, 1992

Inspector: J. Noggle, Radiation Specialist
Facilities Radiation Protection Section — 10/12/92 date

Approved by: W. Pasciak, Chief, Facilities Radiation Protection Section — 10-28-92 date

Areas Inspected: Areas covered in this inspection included a review of: previously identified items and the implementation of the various radiation control programs during the performance of outage work.

Results: A generally effective radiological control program was implemented at Susquehanna Steam Electric Station during outage conditions. Progess was made in shielding optimization, obtaining primary containment positive pressure, and major improvements were noted in radiological postings in some of the major work areas. Weaknesses in Radiation Work Permits (RWPs) and some other enhancements in the operations HP area need attention.

DETAILS

1.0 Personnel Contacted

1.1 Licensee Personnel

J. Adelsberger, HP Specialist, ALARA
M. Bickell, HP Technician
T. Campbell, HP Technician
S. Cargill, HP Technician
J. Demarinos, HP Specialist, ALARA
M. Franczak, HP Assistant Foreman, Unit 2 Reactor Building
W. Gearhart, HP Specialist, ALARA
* D. Hagan, Health Physics and Effluents Management Supervisor
* D. Heffelfinger, Coordination Engineer - Nuclear Quality Assurance
K. Kiniry, HP Lead Technician, Drywell Control Point
S. Laubach, HP Lead Technician, Control Rod Drive Replacement
D. Lizbinski, HP Lead Technician, Refueling Floor
* D. McGarry, Industrial Safety Engineer
E. McIlvaine, HP Foreman, ALARA
* W. Morrissey, Radiation Operations Supervisor
D. Murphy, HP Assistant Foreman, Unit 2 Turbine Building/Balance of Plant
D. Pfendler, HP Foreman
M. Rochester, Sr. Health Physicist, Dosimetry
R. Sopko, HP Technician
* G. Stanley, Superintendent of Plant
J. Walker, HP Lead Technician, Unit 2 Reactor Building 749' Control Point
* R. Wehry, Compliance Engineer
R. White, HP Assistant Foreman, Drywell Control Point

1.2 NRC Personnel

S. Barber, Senior Resident Inspector
* D. Mannai, Resident Inspector

* Denotes those present at the exit interview on September 25, 1992.

2.0 Purpose

This inspection was an unannounced safety inspection of the Susquehanna Steam Electric Station radiation control programs. The inspection was principally focused on implementation of these programs during the performance of outage work.

3.0 Review of Previously Identified Items

3.1 (Closed) Unresolved Item (92-15-01): Unplanned Personnel Uptake During Two Condensate Demineralizer Entries.

On May 21st and then again on May 27th of 1992, workers breached two different condensate demineralizers to remove spent resins without the benefit of respiratory protection. Six individuals received measurable internal exposures from the two events with a maximum of 16 MPC-hours recorded. The licensee has completed their review of these events and the inspector has reviewed their findings and corrective actions.

Earlier this year, the licensee had successfully breached a condensate demineralizer, however, the most recent demineralizer breaches were made without respiratory protection. The safety significance of the internal exposures was relatively minor, but, several weakness were identified by the licensee. These included problems with RWP controls resulting from unspecified radiological conditions on the RWP, less than adequate supervisory oversight in the field, poor judgement in applying past historical data to predict current plant conditions, less than adequate guidance in the use of HEPA ventilation systems, and poor HP technician understanding of the work being performed.

The corrective actions proposed by the licensee were reviewed. These actions included the development of specific RWP guidance for condensate demineralizer initial entries, development of HEPA ventilation setup guidance, development of guidance for determining respiratory protection requirements for system breaches, and the need to increase supervisory job over-sight in the field. Two other longer term actions were proposed which included the procurement of portable CAMs for real time monitoring of airborne radioactivity, and incorporation of job planning methodology into RWPs. Most of these changes had not been completed at the time of this inspection. Based on the licensee's proposed corrective actions, this unresolved item is now considered closed. The final implementation of these corrective actions will be reviewed during future inspections.

3.2 (Closed) Inspector Followup Item (92-12-02): Lack of Shielding Optimization in the ALARA Program

There does not exist any shielding criteria or program decisional criteria for optimizing shield designs. The inspector reviewed the ALARA program efforts relative to shielding during the current outage. Although shield design optimization criteria has yet to be developed, the program has made progress to this end by proposing a 40% increase in the use of drywell shielding and the use of pre and post-shielding surveys to determine background dose rates and the practicality of the current shield configurations to reach background levels. Shield optimization designs are not currently based on person-rem evaluations at this time. The increased

shielding efforts and the continuing efforts geared toward shield evaluation warrants closure of this followup item.

3.3 (Closed) Inspector Followup Item (92-21-01): Adequacy of Radwaste Resin Sampling

During a previous inspection[1] the licensee suspended the shipment of resin bead radwastes due to a discrepancy between the calculated dose rates based on analysis of a sample versus the actual measured dose rates of the shipping container. The station procedures allow a discrepancy of up to a factor of three and NRC regulatory guidance specifies a maximum factor of 10 discrepancy. The initial sample radioactivity scaled up to represent the entire shipping container differed by a factor of 25 and after resampling proved to varied by a factor of seven. The licensee suspended the shipment until the sample discrepancy was resolved.

The inspector reviewed the licensee's investigation and corrective actions associated with the above event. The licensee's review determined that several barrels of demineralizer bottom resin had been sluiced into the resin liner prior to sluicing the general spent resin tank resins into the shipping container. The sampling techniques would not allow sampling of the bottom zone of the shipping liner as the dewatering filter material prevented it. The licensee had failed to sample the barrels of resin and incorporate it into the normal in-line composite sample.

The licensee proposed the following corrective actions to prevent reoccurrence. The licensee reviewed historical records and verified there was no change in the waste stream and that the current scaling factors used in computing radnuclide activity were still valid. The licensee revised the radwaste procedure HP-TP-800 to include specific actions to take when sample discrepancies occur in the future. The licensee is now sampling each barrel and other sources of radioactive wastes which contribute to radwaste shipments. This issue is considered closed.

4.0 ALARA Status

As of September 24, 1992, the outage had accrued 60.4 person-rem which appears to closely follows a projected ALARA goal of 255 person-rem for the outage. The total internal exposure recorded for Susquehanna for 1992 as of this inspection was 70 MPC-hours. No significant exposure overruns have been reported and several outage tasks have resulted in significant exposure savings.

Traditionally, the steam dryer has been transferred from the reactor vessel to the

[1] Inspection report no. 50-387,388/92-21

equipment storage pool in air resulting in 1.3 person-rem. This outage the work crew moved their rigging spotters away from the equipment pool resulting in 0.26 person-rem total exposure for this job. The installation of the Main Steam Line (MSL) plugs was reduced from 0.9 person-rem to 0.46 person-rem by maintaining the same rigging crew which reduced the refuel floor delays in delivering the next MSL plug to the reactor cavity crew. Also, the Reactor Water CleanUp (RWCU) pump replacement radioactive component removal activities were completed in three days slightly below estimate (5.1 person-rem versus 5.7 person-rem estimated). As mentioned in Section 3.2, additional drywell shielding was installed this outage with an extra cost of 0.45 person-rem over previous outages. The benefits of the 40% additional shielding has yet to be measured. No discrepancies were noted with regard to the ALARA program implementation.

5.0 Radiological Controls

The inspector toured the radiological controlled areas of Susquehanna Units 1 and 2 and reviewed the following elements of the licensee's radiological control program:

- posting, barricading and access control, as appropriate, to radiation, high radiation, and airborne radioactivity areas;
- personnel adherence to radiation protection procedures, radiation work permits, and good radiological control practices;
- use of personnel contamination control devices;
- adequacy of airborne radioactivity sampling and analysis to plan for and support ongoing work;
- installation, use and periodic operability verification of engineering controls to minimize airborne radioactivity;
- adequacy of radiological surveys to support pre-planning of work and on-going work.

The review was with respect to criteria contained in applicable licensee procedures, Technical Specifications, 10 CFR 19 - Notices, Instructions And Reports To Workers: Inspection And Investigation, and 10 CFR 20 - Standards For Protection Against Radiation.

5.1 Drywell HP Work Coverage and Controls

5.1.1 Drywell Postings

The licensee indicated that the outage work inside the drywell represents more than one-half of all outage exposures therefore this area received commensurate inspection attention. The Drywell HP Control Point, was supervised by an HP Assistant Foreman and seven HP technicians with at least one HP technician dressed in

protective clothing and assigned to a roving drywell watch of jobs in progress. The Drywell HP Control Point had a two-way radio system to communicate with the drywell HP rover, which was an important link to relay job briefing information to the HP inside the drywell and to pass on current drywell radiological information to the control point desk. Sufficient survey routines were established with three Continuous Air Monitors (CAMs) located inside the drywell and one CAM located outside the drywell near the Control Point. In addition to the CAMs, low volume air samplers were located one on each principal drywell elevation to permit regular grab samples to be taken when work was in progress. Each worker entering the drywell was issued an Alarming Pocket Dosimeter (APD) generally set to alarm at 100 mRem and upon entering a 100 mR/hr dose rate field. In general, the HP personnel and instrument resources devoted to this work area were very good and appropriate for the plant radiological conditions.

Partly due to the valve upgrade program of live-loaded packing of valves, the drywell contamination levels were found to be relatively low after an operating fuel cycle. Post-shielded dose rates were generally 10 - 50 mR/hr with much higher dose rates found within the vicinity of reactor vessel nozzle penetrations. All high radiation areas and other radiological hazards were posted as required. The licensee involved HP supervision in frequent drywell monitoring and sufficient HP technician presence was noted in the drywell during the inspection. The direct HP job coverage of drywell work was provided by a rotational HP "rover". The role of the HP "rover" was not well defined by the licensee in regards to providing intermittent HP job coverages. The rover was primarily used to provide current status of the drywell to the lead HP technician stationed outside of the drywell.

5.1.2 Drywell Shielding

The inspector noted some improvement in the drywell shielding since the last outage inspection. Many of the higher dose rate sources appeared to have additional shielding resulting in typically 50 mR/hr radiation fields versus a typical 80 mR/hr post-shield result from previous outages. According to the licensee, 23 tons of lead blanket shielding were installed in the drywell this outage compared to 16 tons normally. The recirculation riser shields were increased by 3 tons (600 pounds each). A new shield curtain was installed on the lowest drywell elevation shielding the 'B' recirculation pump and associated valves. Other drywell shields were also improved. The effectiveness of the shield improvements will be measured by the licensee after the outage and documented in an outage ALARA report. These shield enhancements were considered good ALARA initiatives.

5.1.3 Drywell Ventilation

During the outage a newly installed 6,000 ft^3 HEPA ventilation unit was tested for effectiveness in providing a negative pressure atmosphere to the drywell with respect to the reactor building. This was a permanent station modification undergoing initial functional testing. The air outside of the open equipment hatch was found to flow into the drywell as planned, but the personnel airlock air flow patterns were both into and out of the drywell in stratified layers. Local HEPA ventilation exhausts inside the drywell were adjusted to improve this situation. The licensee was thorough in implementing the new air evacuation system which corrected a long standing drywell ventilation imbalance.

5.2 Reactor Building Basement

The Reactor Building 645 ft. HP Control Point provided the job coverage for all work at this elevation. The inspector reviewed all work areas, radiological surveys, and air sample logs maintained at the Control Point. Generally work areas appeared to be well maintained and weekly routine surveys were complete and of good quality. The radiological hazards were generally low (<2 mR/hr in most areas) with exception of the Residual Heat Removal (RHR) pump rooms where contamination levels occasionally reached respirator required levels and dose rates were between 10 and 200 mR/hr. These areas were posted appropriately. The RWPs were also reviewed and the inspector noted that they were all general condition RWPs with radiological controls to be determined by the HP technician. The HP control point log book was reviewed next and found that it was not used to record any of the job specific HP radiological control decisions or any radiological information. This control point relied on only verbal turnover between HP technicians. This does not provide the supervising HP foremen the benefit of an effective review of HP controls as these HP supervisors regularly review the control log books during their tours of the station.

5.3 Reactor Building 749 Ft

The inspector toured the Reactor Water Clean Up (RWCU) pump rooms and associated work areas and reviewed the HP Control Point surveys, air sample logs, and RWPs. All surveys and air samples appeared to be complete. The surveys indicated generally low contamination areas and general dose rates of 2 - 8 mR/hr with two high radiation areas associated with the RWCU Heat Exchangers and RWCU pipe penetration areas ranging from 35 up to 150 mR/hr. These areas were properly posted and controlled. The RWPs were predominantly non-prescriptive and the HP requirements were to be determined by the HP technician. A few RWPs listed one or two instructions, but even those RWPs were weak. Effective HP job

coverage relied solely on the abilities and judgement of the individual HP technicians.

The RWCU pump rooms had been cleared of all old RWCU pumps and related piping in preparation for new pumps of a seal-less design. The pumps and related piping demolition was completed in three days while accruing 5.1 person-rem versus a 5.7 person-rem estimate. Appropriate ALARA considerations were followed including the identification of the highest radiation level pipes and removing them from the pump rooms first. Also the radwaste handling and storage strategy was predetermined which resulted in efficient removal of the high radiation wastes.

5.4 Reactor Building Refueling Floor, 818 Ft

The inspector reviewed on-going refueling activities, refuel floor radiological conditions, surveys, and RWPs. The refueling floor was well laid out for contamination control purposes and contamination limits approaching clean area limits were usually maintained. The reactor pressure vessel (RPV) head insulation, the RPV head, and drywell head were all stored on the refueling floor during the outage and their inside surfaces represented high contamination hazards, however these sources were isolated from the refuel floor by using plastic curtains. Dose rates on the refuel floor were also low; typically less than 2 mR/hr and between 2 and 5 mR/hr around the reactor cavity rail during refueling operations. In summary, the radiological hazards were low and the radiological sources appeared to be well controlled. Unlike the other HP Control Points, the RWPs were generally well written with some specific HP requirements listed on each permit. During the inspection, a turbine building effluent air monitor alarmed indicating increased levels of iodine and noble gas in the turbine building exhaust stack. The HP technician notified chemistry to verify the reading but failed to alert the turbine building HP control points for the possibility of increased air activity. The station effluent monitors were controlled by the chemistry department and HP technicians were not trained in their use.

5.5 Turbine Building Condenser Bay, 656 Ft

The inspector reviewed the HP Control Point surveys and log book records and determined that appropriate survey routines were being kept and were of good quality. Although radiation levels in the turbine building were low, there were high contamination levels inside the three main condenser hotwells (30,000 dpm/100 cm^2 up to 40 mrad/hr/100 cm^2). The inspector reviewed all of the RWPs controlled by this HP Control Point and noted that they were all generic without specific requirements. RWP no. 92-601 was written for work inside the condensers and hotwells and had no specific requirements associated with the work in these high radiological hazard work areas. As the ALARA person-rem estimate did not require a pre-job ALARA review to be performed, therefore the work in the condenser

hotwells did not receive this review. The inspector toured the setup for work in the hotwells and noted a containment tent had been erected in front of the hotwell entrance, waterproof protective clothing and filter respirators were being verbally prescribed for the hotwell clean-out work. Additionally, as the licensee expected a couple of 500 mR/hr barrels of radwaste to be collected, arrangements had been made with the effluents management group to expeditiously remove the wastes when collected. A self contained breathing apparatus was available in the area if required. All of these arrangements had been well setup, but none were required except by the decision of the HP technician at the control point on shift at the time. The inspector found no discrepancies with regard to the layout for the hotwell cleanout work, however the RWP and the ALARA review did not capture any of the job setup needs.

5.6 Turbine Building Turbine Deck, 729 Ft

The HP Control Point appeared to maintain good control of on-going activities and the surveys proved that adequate radiological control measures were taken commensurate with the radiological hazards. Turbine stop and control valves exhibited very high contamination levels, otherwise all of the turbine areas were close to clean contamination levels and less than 1.5 mR/hr dose rate fields. The station utilized a plexi-glass sand blasting enclosure to control the high contamination generating activities associated with sand blasting of contaminated turbine components. The highest airborne contamination samples for the outage were routinely measured inside the sand blasting enclosure when work was in progress. The inspector questioned the HP Control Point Lead HP Technician if the sandblasting workers that work in air supplied suits were part of the licensee's random bioassay sampling program. The inspector learned that they were not and that the assignment for random bioassay sampling would normally be done by the Dosimetry Health Physicist through a review of MPC-hour records and not based on the exposure to airborne radiological hazards in the plant. The inspector questioned the adequacy of this practice in verifying the effectiveness of the respiratory protection program. The licensee agreed to review this plant practice.

5.7 Personnel Contamination Reports (PCRs)

The inspector reviewed the PCRs written during the current outage. There were 26 non-Radon PCRs documented during the first 3 weeks of the outage. A total of 296 PCRs have been documented for the year which included a spring 1992 refueling and maintenance outage at Unit 1. No significant trends or underlying root cause or any apparent lack of licensee control was suggested by these incidents. These appear to be a reasonable number of incidents when compared to other stations.

6.0 Radiation Work Permits

In response to the condensate demineralizer breach incidents mentioned in Section 3.1, the licensee has begun a study of various RWP formats and has not finalized the needed changes. The licensee indicated the intent to make the RWP easier for the worker to read and to provide work steps in the RWP to allow the HP technician to anticipate the radiological work requirements. During this inspection, these changes had not been implemented. Therefore, the inspector's observations were reflective of the old RWP approach and consideration has been allowed for the final development and implementation of the new RWP format.

The inspector noted that most of the outage RWPs were written before the outage without the benefit of survey information and without knowledge of the radiological hazards of the work environment except for historical accounts. Therefore, most of the RWPs were written in a non-specific generic format often devoid of any specific HP controls or requirements. As an example, the most commonly encountered RWP reviewed by the inspector required an HP briefing, the use of single protective clothing for work, and waterproof protective clothing if the worker might encounter liquids. Further, HP technician monitoring requirements, special dosimetry requirements, and any respiratory requirements were to be determined based on HP procedure limits. This generic RWP format was used quite extensively during this outage. The inspector pointed out weaknesses with the widespread use of generic RWPs and some of the problems that can result from their use. The licensee stated they would review these weaknesses and resolve them by revising the RWP format. The licensee stated that RWPs will no longer be issued without the radiological hazards being established first.

7.0 Exit Meeting

The inspector met with licensee representatives at the conclusion of the inspection, on September 25, 1992. The inspector reviewed the purpose and scope of the inspection and discussed the findings.