U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Docket Nos. 50-334/92-06
Report Nos. 50-412/92-03

License Nos. DPR-66, NPF-73

Licensee: Duquesne Light Company
One Oxford Center
301 Grant Street
Pittsburgh, Pennsylvania 15279

Facility Name: Beaver Valley Power Station, Units 1 and 2

Inspection At: Shippingport, Pennsylvania

Inspection Conducted: April 13 - 17, 1992

Inspector: J. Noggle 5/8/92
J. Noggle, Radiation Specialist — date

Approved by: W. Pasciak 5-8-92
W. Pasciak, Chief, Facilities Radiation Protection Section, DRSS — date

Areas Inspected: An unannounced safety inspection of the Beaver Valley Power Station radiological controls program was conducted. This inspection focused on job coverage during outage conditions.

Results: The Beaver Valley Station radiation control program appeared to be well balanced with significant priority directed to operational health physics. Specialization of staff and the lack of staff turnover has helped contribute to a well developed, responsive and flexible organization. HP supervision was determined to work well as a team in outage planning meetings and spontaneous problem solving sessions. Good relations appeared to exist with other station departments as evidenced by observation of various outage meetings. The radiation control organization has responded to various radiological events very well while performance of normal operations was excellent. Within the scope of this inspection no violations of regulatory requirements were identified.

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DETAILS

1.0 Personnel Contacted

1.1 Licensee Personnel

A. Brunner, Operations Support Manager
*E. Cohen, Director of Unit 2 Radiological Operations
*D. Girdwood, Director of Unit 1 Radiological Operations
M. Helms, Senior Health Physics Specialist
*J. Kosmal, Manager of Health Physics
G. McFerren, Electrician Helper
J. Menzer, Refueling Supervisor
J. Noling, Diver
R. Pucci, ALARA Health Physics Specialist
R. Riley, Diver
*F. Schuster, Manager of Unit 2 Operations
*D. Spoerry, General Manager of Nuclear Operation Services
*G. Thomas, General Manager of Corporate Nuclear Services
*N. Tonet, Manager of Nuclear Safety
*R. Vento, Director of Radiological Engineering
M. Vienelli, Supervisor, Bartlett Nuclear, Inc.
J. Wilbur, Health Physics Foreman
S. Wood, Electrician Helper

1.2 NRC Personnel

* L. Rossbach, Senior Resident Inspector
* J. Jang, Senior Radiation Specialist

* Denotes attendance at the exit meeting on April 17, 1992.

Other licensee employees were contacted and interviewed during this inspection.

2.0 Purpose

The inspection was an unannounced safety inspection of the Beaver Valley Power Station radiological controls program. Areas reviewed included containment radiological controls and job coverage during outage conditions.

3.0 Organization

The station health physics organization was complemented by the addition of approximately 200 contract HP personnel consisting of 140 senior health physics technicians and supervisors. Station Senior Health Physics (HP) Specialists were temporarily promoted to the position of HP Coordinator for each work shift. Between five and eight HP Foremen per shift reported to the HP Coordinator for the following plant area responsibilities: refueling, containment, auxiliary building, inservice inspection, demobilization (for the survey and release of material), and between one and four steam generator foremen each responsible for a single steam generator during the performance of primary-side or secondary-side maintenance activities. The HP support functions including: ALARA, dosimetry, radwaste, and respiratory protection areas were staffed to provide continuous outage support. The expanded HP organization appeared to fulfill the additional outage demands. No deficiencies were noted in this area.

4.0 Contractor HP Technician Training

A new formalized contractor HP technician training course was developed and taught to the temporary HP workforce for the first time this outage. Prior to qualifying for the course the HP contractor individual must pass a screening exam which tests basic health physics knowledge. The new course, entitled Site Specific Radiation Technician Training Program (SSRTTP), was designed to supply the site specific knowledge needed to perform as an American National Standards Institute (ANSI) 18.1 - 1977 qualified radiation protection technician at Beaver Valley Station. The inspector reviewed all of the lesson plans and the process for qualifying contractor HP technicians. The course material was based on basic learning objectives and was appropriately reviewed by HP management and approved by the Nuclear Training Department. There were nine lesson plans and eight exams presented during the 50 hour course. The inspector reviewed the lesson plans and found them to be comprehensive and directed toward the practical HP methodologies at Beaver Valley Power Station. The introduction of this formalized course has replaced the previous contractor HP procedure training which consisted of a review of the applicable station HP procedures. This new SSRTTP course concentrates the procedure content and delivers the material in a logical and consistent format. It appeared to be a more formalized course than what originally was in-place at the Station and should ensure good quality and uniform training of the temporary HP work force. This training program has not been reviewed by the Institute for Nuclear Power Operations (INPO) and is not part of the INPO accredited training program at Beaver Valley Station.

After completion of the SSRTTP course, a somewhat limited reading list of various NRC notices and operational event descriptions must be completed and signed-off on a self-study basis. The final step in contractor HP technician qualification involves the completion of twelve standard Job Performance Measures (JPM) for on-the-job demonstration of skill mastery. The licensee indicated that both the required reading list and JPMs were carried over from the previous course and would be reviewed and edited as needed to complement the new training course. This will be reviewed in future inspections.

5.0 Containment HP Job Coverage

The inspector toured the radiological controlled areas of Beaver Valley Units 1 and 2 during outage conditions 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 Diving In The Reactor Cavity

The inspector witnessed the execution of an unplanned work evolution requiring under water diving into a forty-five foot deep containment refueling cavity to replace a blind flange onto the fuel transfer tube to allow drain down of the reactor cavity. This task required the application of complex radiological and safety controls and provided the inspector with insights into the strength of the licensee's radiological control program. On short notice, the licensee was able to obtain quick response from a non-nuclear experienced diving company. The inspector witnessed the final planning meeting which included the HP and ALARA briefings. The divers and dive tenders were given minimal employee training and were provided escorts on site. Although the work task was relatively straightforward, the radiological requirements were complex due to the contaminated water environment and the high dose rate gradient that exists in a water medium. Underwater surveys of the fuel transfer canal were performed by two different methods. First, a radiation monitor (AR-20) was dropped into the cavity at various depths throughout the refueling canal area. The second method involved the lowering of a 'tree' of Thermoluminescent Dosimeters (TLDs) down into the work area for a timed exposure. This redundancy of measurement not only allowed confirmation of readings but also correlated the radiation monitor readings with final Record TLD results. The surveys confirmed the presence of > 1 R/hr (up to 100 R/hr) on the fuel upender device which was approximately twenty feet from the diver's work area which was surveyed to be between 50 and 100 mR/hr. The licensee constructed a vertical wall barricade consisting of scaffolding and netting to prevent the diver from entering the high exposure area associated with the upender. Due to the high dose rate gradient in the canal, multiple whole body and extremity dosimeters were assigned to the diver in order to determine the correct record dose. For exposure control of the dive in progress, the licensee attached a radiation detector with a remote readout to the diver's waist and utilized an underwater television camera to maintain continuous monitoring of the diver's location during the dive. The inspector determined that sufficient surveys and precautions were taken to control and minimize the exposure to the diver.

At the end of the diving evolution, the dive tenders and HP technicians helped the diver out of his dry suit. The initial dive resulted in heat stress to the diver and contamination of the diver and the inside of his suit. Streamlining the protective clothing, and utilizing ice packs helped relieve the stress caused by the 84° F water. Operations also worked to achieve lower water temperatures after the first dive. The monitoring and control of water temperature could have been improved.

Given the nuclear inexperience of the divers and tenders, contamination control techniques should have been previously explained and rehearsed to avoid contaminating the diver and the inside of his suit. After several dives the contamination control methodology was developed and appeared to work with better success. Overall, the safety significance of contamination control in this instance was low. The more safety significant aspects of the diving operation were well defined and controlled, such as dedicated air supply source, stand-by backup diver, continuous voice and dose rate contact with the diver. While the job was carried out with some problems occurring, the more significant safety precautions were understood and complied with.

5.2 Removal Of A High Radiation Source

As mentioned in the previous section, a high radiation source measured at 100 R/hr was found on the reactor cavity upender. Concern was raised regarding cavity dose rates after cavity drain down and the possibility of other like sources. The licensee managed to coordinate the use of an under water vacuum system to attempt a remote cleanup of the upender. This was successfully accomplished. The under water vacuum filter was measured at 40 R/hr and was transferred by remote handling into a cask in accordance with ALARA. Precautions were taken during drain down to monitor for any other unusual high radiation sources. None were found. The successful handling of this unexpected event was very well done.

5.3 Steam Generator Work

Steam generator associated work represented the largest exposure cost for the outage equal to approximately 32% of the outage exposure. This work had been completed at the time of the inspection, however the radiological controls were reviewed through meetings with the licensee and through the review of records. The inspector reviewed the outage HP coverage of steam generator eddy current inspection work. The total personnel exposure received was 29 person-rem. There were 24 manned steam generator entries resulting in 3.5 person-rem. Steam generator platform exposures accounted for 25.5 person-rem (or seven times the total steam generator entry dose). Maximum dose to an individual was 1500 mrem. The inspector reviewed Radiation Work Permit A-92-178 for 'A' steam generator eddy current inspection work, and determined that appropriate radiological controls were stipulated which included: multiple dosimetry, air supplied suit, negative pressure ventilation on the steam generator, continuous air sampling and HP coverage while work was being performed. Three pages of detailed HP instructions were included with this RWP specifying various radiological control details which was considered excellent.

The associated ALARA Review Package (No. 92-2-11-00) was also reviewed. This review specified various engineering controls associated with the steam generator work which included a steam generator channel head bowl flush, the erection of temporary shielding at the cubicle entrance, and a shield house staged below the platform area. Audio headsets and video cameras were specified to reduce the need for work crew presence near the open steam generator. A containment tent was specified for contamination control purposes. Finally, an ALARA pre-job briefing was required to ensure all work crew members were aware of the radiological control requirements of the job. The ALARA controls were considered very good.

Surveys were performed inside each steam generator channel head utilizing two independent methods. A conventional radiation survey instrument was used and a timed exposure of a series of TLDs was performed which allowed dose rate comparisons to be made between the instrument readings and final record TLD results. Good correlation was verified. This attention to detail to surveys was considered a significant program strength.

For critical exposure control timekeeping of the steam generator entries an RCM Form 5.3 was a requirement for access to the platform or steam generator. HP supervison issues the RCM Form 5.3 marking the dosimetry requirements and indicates the allowable remaining exposure for the individual. The back of the form is a well laid out worksheet which allows the job coverage HP technician to make appropriate stay time calculations. This appears to be a very effective tool for the performance of a critical exposure control function.

The staged layout for the primary steam generator work included a containment tent around each generator with a 2,000 CFM High Efficiency Particulate Activity (HEPA) filter unit providing air evacuation from the tent and simultaneously pulling a vacuum on the steam generator. The steam generator containment continued down the stairs to the undress/step-off-pad area. Underneath the steam generator platform tent was a lead shielded work area to support steam generator maintenance activities which reduced dose rates by half (to 15 mR/hr). In addition, the end of the containment tent was also shielded to 15 mR/hr providing a low dose area for steam generator workers. During manned steam generator work, one HP technician was normally stationed inside the shielded portion of the steam generator containment tent and one HP technician was stationed outside the biological shield wall at a video and communications monitoring station. During normal robotic steam generator maintenance activities, there was no one stationed inside the biological shield wall. Manned steam generator entries were only required for placement and removal of nozzle covers and platform attendance was only required for installing and removing the robotic equipment and for changing eddy current probes or other tooling from the robot arm. The inspector was satisfied that steam generator maintenance associated exposure was minimized.

5.4 ALARA STATUS

As of April 17, 1992, with most of the exposure intensive outage work completed, the Beaver Valley Unit 2 third refueling outage had accrued 194 person-rem versus a final outage estimate goal of 300 person-rem. During this refueling outage, two significant ALARA initiatives were implemented. An ALARA course for first line supervisors was presented to outage supervision. This four hour course explained the station ALARA methods and philosophy encouraging greater station participation in the ALARA program. The reaching outside of the HP organization for ALARA program participation is viewed as a significant strength of the ALARA Program. The second significant ALARA initiative involved the use of closed circuit television systems throughout containment providing remote supervision and HP surveillance of several areas to include: steam generators, reactor coolant pumps, pressurizer cubicle, reactor cavity, refueling floor, and several other containment work locations. Several work evolutions were videotaped for future use as training and job briefing aids. This innovation has allowed an increase of work surveillance by HP and supervision while curbing the amount of in-field inspection activity and resultant doses.

6.0 Unplanned Exposure Event

On March 26, 1992, the licensee discovered that containment air-lock operators were periodically using an unmarked contaminated plastic bucket as a seat. To maintain containment integrity during fuel movement, the air-lock doors were maintained shut and were operated only by designated personnel. Twenty-two inner air-lock operators were involved in using the bucket as a seat over an 81 hour period. Radiation readings were found to be approximately 200 mR/hr on contact with the bottom of the bucket and 2.2 mR/hr at 36 inches. The licensee's dose assessment indicated the highest exposure received by an individual air-lock operator was 666 mrem (whole body). No regulatory limits were exceeded based on the licensee's dose estimates. The calculated total exposure for all personnel involved was 5.97 person-rem. The bucket has been removed and placed in a proper storage location. Inventories and surveys performed by the licensee indicated that there were no other items of this nature. The inspector reviewed the incident to determine whether the licensee demonstrated any lack of control of radioactive sources, or any fault to monitor exposures properly or failure to inform the worker of radiological hazards in the work place. The source of the bucket had not been determined. It apparently originated at least one year previously as deduced by extrapolating the percentage of nuclides present at the time of the incident back in time to when a normal radionuclide percentage would have existed based on half-life determinations. The source of the bucket was not determined and therefore the root cause of this incident remains unknown. The inspector reviewed Incident Report 2-92-17 and was satisfied that acceptable corrective actions were taken including incorporating this event into station training and requiring radiation control personnel to read the Incident Report. The inspector was satisfied that a detailed investigation and appropriate dose assessments were made. Also, all of the affected individuals were appropriately counseled regarding the dose assessments and were given an opportunity to voice various concerns to the licensee. The inspector interviewed two of the air-lock operators to determine the acceptability of the licensee's response to the workers. Apparently all of the worker's questions were answered and there were several requests for dose assessment documentation and these requests were fulfilled by the licensee.

The existence of the unknown and unposted radiation source appeared to be a unique event with no apparent breakdown of normal radiological controls. Workers were informed of the radiological hazard incident after the investigation was completed and worker's questions were answered. The inspector determined the licensee to be responsive with respect to this incident.

7.0 Exit Meeting

The inspector met with licensee representatives at the end of the inspection, on April 17, 1992. The inspector reviewed the purpose and scope of the inspection and discussed the findings.