U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-219/88-31

Docket No. 50-219

License No. DPR-16

Licensee: GPU Nuclear Corporation
P. O. Box 388
Forked River, New Jersey 08731

Facility Name: Oyster Creek Nuclear Generating Station

Inspection At: Forked River, New Jersey

Inspection Conducted: October 3-7, October 20, and October 31-November 4, 1988

Inspector: A. Geyer — 11/29/88
A. Geyer, Radiation Specialist, — date
Facilities Radiation Protection Section

S. Sherbini — 11/28/88
S. Sherbini, Senior Radiation Specialist — date
Facilities Radiation Protection Section

Approved by: M. Shanbaky — 11/29/88
M. M. Shanbaky, Chief, Facilities — date
Radiation Protection Section

Inspection Summary: Inspection on October 3-7, October 20, and October 31 - November 4, 1988 (Report No. 50-219/88-31)

Areas Inspected: A special, announced inspection to review the status of outstanding items, radiological controls in connection with the 12R refueling outage, and to review the circumstances connected with a radioactive spill incident and a radioiodine inhalation incident.

Results: Two apparent violations were identified: failure to perform a radiological survey in accordance with 10 CFR 20.201(b) requirements (details in section 7.0); and failure to follow procedures as required by Technical Specifications 6.11 (details section 6.0 and 7.0).

DETAILS

1.0 Personnel Contacted

1.1 Licensee Personnel

* J. Barton, Deputy Director, Oyster Creek
* J. DeBlasio, Manager, Plant Engineering
* R. Brown, Manager, Operations
T. Brownridge, Manager, Construction/ Outage manager
* B. DeMerchant, Licensing Engineer
* M. Douches, Manager QA
* E. Fitzpatrick, Director, Oyster Creek
* M. Heller, Licensing Engineer
R. Kurry, Radiological Engineer
* A. Mills, Safety and Health
W. Muehleisen, Supervisor of Support
R. Perry, Radiological Engineer
J. Renda, Group Radiological Controls Supervisor
* D. Robillard, Lead Auditor, QA
P. Scallon, Manager, Radwaste Operations
* C. Schilling, Supervisor, Mechanical Engineering
* M. Slobodien, Director, Radiological Controls
* K. Wolfe, Manager, Radiological Engineering

* Indicates attendance at the exit meetings.

1.2 NRC Personnel

J. Wechselberger, Senior Resident Inspector
* E. Collins, Resident Inspector
* D. Lew, Resident Inspector

2.0 Status of Previously Identified Items:

2.1 Potential for Contamination of the Breathing Air Supply:

This item was identified in Inspection Report No. 87-24 and reviewed again in Inspection Report No. 88-11. The issue was the quality of the breathing air supplied by a compressor located in a small sheet metal housing adjacent to the turbine building. Several industrial gas lines run through the compressor housing. These lines carry a variety of industrial gases from gas cylinders, located outside the compressor housing, to various locations inside the plant. The concern was that one or more breaks in these lines inside the compressor housing may release gases that will then be drawn into the compressor intake and possibly inhaled by workers that may be using supplied air equipment at the time. The gases in the lines include argon, nitrogen, propane, helium, acetylene, and nitrous oxide. The licensee completed a study to assess the situation. The study concluded that the gases carried by the gas lines are all non-toxic and that any danger they may pose following a break would be a result of displacing oxygen in the breathing air and creating an oxygen deficient air supply. The licensee performed calculations in which it was assumed that all the lines broke simultaneously inside the compressor housing and released all the gases contained in full gas cylinders. The calculations showed that the resulting breathing air would not contain less than 16.7% oxygen by volume (normal atmospheric air contains 20.95% oxygen by volume). The partial pressure of oxygen at this concentration in the upper portion of the lung, assuming water-saturated air, would be about 120 mm of mercury. The accepted lower limit for this value is 100 mm of mercury, below which the air is considered oxygen deficient - immediately dangerous to life and health (ANSI Z88.2-1980). Although this is not an acceptable air quality for normal operations, an accident similar to that postulated in the above calculations would not be expected to create immediately dangerous conditions, and there would be adequate time to take corrective action. The inspector stated that one of the gases, nitrous oxide, may have toxic effects at high concentrations. The licensee stated that, according to their sources of information, this gas is not a toxic substance but an asphixiant. The licensee stated that the nitrous oxide and acetylene gases were no longer being used and the cylinders supplying these gases have been removed from the gas cylinder storage area adjacent to the air compressor building. The licensee stated that they may replace these gas cylinders at a future date if the need arises. The inspector stated that in that case a determination should be made regarding the toxic properties of nitrous oxide. This item is therefore considered closed.

3.0 Radioactive Spill in the New Radwaste Building Yard:

A spill of radioactive liquid occurred in the yard to the east of the New Radwaste Building (NRW) on September 23, 1988. The spill was discovered when workers attempting to exit the radiological controls area showed radioactive contamination on their shoes. The licensee surveyed various areas of the NRW where these workers had been and eventually located the contamination in the yard. By the time it was discovered, the liquid had dried and the contaminated area was delineated using survey instruments. The highest contamination level was 600 mrad/hr beta, 8 mR/hr gamma. The contaminated area was irregular in shape and was confined within a rectangular surface of approximately 400 square feet.

The licensee's reconstruction of the events that led to the contamination are as follows. Contractor workers were performing decontamination work inside the NRW. The hydrolazing equipment used for this work was located in the yard east of the NRW. A hose used to supply demineralized water ran from the hydrolazing unit, across the yard, and into the building through a truck bay. Because of the length of hose required, the hose was made up of several 50' sections coupled together by quick disconnect couplings. On Thursday, September 22, the workers were decontaminating an evaporator skid (evaporator B). The skid formed a catch basin under the evaporator and was highly contaminated. The decontamination procedure was to pump water into the basin, form a slurry and then pump it out. On that day, water was pumped into the basin to a depth of about 8". The water was then to be pumped out to a nearby contaminated fluid drain using a submersible pump. The pump malfunctioned, however, and the water was not pumped out that day. The workers stated that they left the end of the filling hose dangling a few inches above the water in the catch basin. The hose at that time was full of demineralized water.

On the following morning, Friday 23, the contractor workers needed the hydrolazer for work in another building. A worker uncoupled the hose at one of the couplings located in the yard. The uncoupled section of hose running from the yard to the NRW remained in place. The worker noticed some water flow out of the disconnected section of hose and assumed that it was demineralized water. The licensee postulates that the open ended hose must have created a siphon action that drew contaminated water from the evaporator catch basin and spilled it into the NRW yard. The licensee questioned workers who had passed through the yard during the period in question but no one remembered seeing any water in the yard. The licensee stated that this was probably due to the fact that it was raining during that weekend and so the yard was wet anyway. The shape of the spill supports the licensee's hypothesis: it spreads away from the open end of the hose. The licensee also analyzed the contaminant in the yard and a sample from the catch basin and found similar radioisotopic compositions. The hose was also found to be contaminated internally.

On Monday 24, two contractor workers reconnected the hose segments in the yard. They were the first people to show up with shoe contamination connected with the spill. On Tuesday, two other individuals who had toured the yard area showed up with shoe contamination. A radiological controls technician backtracked with them the path they took and they all came back with shoe contamination. The contaminated area was then identified and delineated. A storm drain located in the yard close to the contaminated area was sampled but was found to be uncontaminated. The contaminated area was vacuumed to remove loose dust and then painted over with waterproof, stripable sealer to ensure that the contamination did not spread. The licensee plans to divide the area into small sections in a grid fashion and perform a detailed survey of the grid points. Each element of the grid will be exposed and decontaminated. Decontamination will probably be by steam vacuuming. The licensee also generated a human performance evaluation report in which the events and causes were examined, and recommendations were made to prevent similar incidents. The recommendations included relocating the hydrolazing equipment to avoid long runs of hose, providing the evaporator catch basin with a means to drain accumulated fluids, and changing the applicable procedures to address the possible formation of siphons and to require operational testing of equipment before use in radiation or contamination areas.

Although the procedures, job supervision, planning and implementation of this operation were weak, the licensee's response to the incident was found to be good. Implementation of corrective actions will be reviewed during a future inspection.

4.0 Control of Locked High Radiation Area Doors:

A review of the licensee's Radiological Incident Reports (RIR) for 1987 and 1988 showed a higher than expected incidence of locked high radiation area doors were found unlocked (10 in 1987 and 3 in 1988). The inspector reviewed the procedures and logs for maintaining accountability and control over locked areas and found them to be adequate. The licensee stated that training was being augmented to emphasize the necessity for checking doors after exiting to ensure they are locked, and also to emphasize other important aspects of maintaining control of the locked areas and the keys to these areas. Review of the incidents described in the RIRs suggests factors other than trainir that may be con uting to the problem. These are:

- The locks on some of the doors appear to be in various states of disrepair and the door frames in some cases appear to have distorted, causing a need for some vigilance to ensure that the door is actually locked. allenging the door upon locking it would reveal such problems, but apparently many workers do not challenge the doors after locking them. The licensee stated that there was a proposal to upgrade these doors but that it was not implemented. The licensee also stated that they will review the matter and take appropriate action to improve door maintenance.

- Some incidents of doors left unlocked are to-date unexplained, based on statements that the worker who last used the area ensured that the door was locked. In a recent incident, the previous users stated that they had made sure that the door was locked, and this was witnessed by several individuals who attested to this. Nevertheless, that door was later found to be unlocked and held adjar by a piece of equipment. The key to this door had not been issued since the door was last locked and checked.

The inspector stated that there is a possibility that there may be unauthorized keys. The licensee stated that this was an unlikely explanation and that there is no reason to suspect the use of unauthorized keys. The licensee stated that they will be alert to any evidence of unauthorized keys and will take appropriate action if such evidence is found.

The licensee's actions to correct the situation regarding the mechanical condition of locked high radiation area doors and control of keys to those doors will be reviewed during future inspections.

5.0 Drywell Access During Fuel Movement:

The Nuclear Regulatory Commission (NRC) issued a Temporary Instruction (TI), number 2500/23, to evaluate BWR licensee radiological controls for the drywell during spent fuel movements.

A review of the drywell design and the fuel movement procedure used by the licensee showed that there are several configurations of the fuel that could lead to high exposure rates in the drywell. These configurations are as follows:

- A fuel bundle lying anywhere on the drywell bulkhead, which forms the floor of the refueling cavity, anywhere between the reactor vessel flange and the cavity wall. This represents a fuel drop accident. Such an accident would occur if the fuel bundle was dropped from the grapple used to move the fuel to or from the core or for fuel shuffle. In this configuration, there would be very little shielding between the bundle and spaces within the drywell. Calculations by the licensee and the vendor show that the exposure rates for this configuration would be of the order of several thousand R/hr 10' below the bundle, and several hundred R/hr 40' below it.

- A fuel bundle held vertically in the grapple but moved beyond the boundary of the reactor vessel and suspended over the drywell bulkhead. The exposure rate in this configuration was estimated to be about 10 R/hr at the top of the bioshield (85' elevation) when the fuel is suspended at the height normally used during transfer to the fuel storage pool.

- A fuel bundle in the vessel close to the wall of the vessel and above the 84' elevation. In this case there is little water between the bundle and the vessel wall. The bioshield ends at the 84' elevation, and the space in the drywell above that level is not shielded from the vessel. The exposure rates in this space would be high as the fuel bundle was moved past that area, particularly past the main steam nozzles at the 89′ elevation. The exposure rates under these conditions were estimated by the licensee to be in the order of several thousand R/hr.

. A fuel element moving past the feedwater nozzles at the 74′ elevation. The exposure rates due to streaming through the nozzle and past the doors provided in the bioshield at these locations was estimated by the licensee to be of the order of 10 R/hr.

The above exposure rates assume a 5-day decay period. Longer decay periods would result in lower exposure rates.

One of the options to preclude inadvertent exposures as a result of the occurrence of one of the above configurations is to restrict or forbid access to the drywell during fuel movements, or at least restrict access to the upper levels of the drywell. The licensee stated that this would pose a problem because of the urgency of some required inspection work to check for cracking on the feedwater and control rod drive return water nozzles. These nozzles are located at the 74′ elevation. Discussions with the licensee previous to this inspection had concluded with the understanding that the only alternative to restricting drywell access was to provide physical barriers that would preclude a fuel drop accident in any location that would cause high dose rates in the drywell, and also to provide administrative controls to protect workers from unnecessary exposure in the event of occurrence of any of the less serious configurations discussed above. The licensee proposed the following measures:

1. A physical barrier or fence would be constructed around the perimeter of the reactor vessel to prevent fuel elements being moved beyond the boundary of the vessel, even by accident. The barrier will consist of stanchions made of 8" aluminum pipes 12′ high fit over reactor vessel studs. The stanchions will be spaced closely together in some sections, the spacing being close enough to prevent fuel bundles from passing in between. At other locations the spacing will be further apart, and in this case 1/4" steel cab[illegible] will be stretched between stanchions at three heights. The fence will extend from the transfer canal in both directions to about three quarters of the way around the vessel. There will be no fence at the far end of the vessel. The licensee has decided to install stops on the rails of the fuel handling bridge to prevent it from moving beyond the fence boundary.

2. The fuel movement procedures will be changed. The current method is to raise the fuel bundle to transfer height and then move it to the centerline of the vessel for transfer to the fuel storage pool. The proposed method would involve raising the fuel bundle only high enough

to clear the top of the core, center the element for transfer, and then raise the element to transfer height. This method provides for water shielding as the fuel bundle is raised past the vessel nozzles and above the bioshield. The operators would also be trained in the new method.

3. Work on the feedwater nozzles would not go on simultaneously with fuel movements in the cavity. During such movements the workers would not be allowed access to areas not shielded from the vessel by the bioshield.

4. A Radiological Controls Technician (RCT) would be present at the feedwater nozzles whenever workers are present and fuel is being moved to ensure that they observe appropriate precautions and applicable radiological safety procedures.

5. Six area monitors would be in use. Two of these will be remote reading and alarming, with the readouts and alarms at the drywell control point and the detectors in the upper levels of the drywell (75' elevation inside the bioshield). The other monitors would be placed one at each of the feedwater nozzles and would have local readouts and alarms. The monitor setpoints would be checked daily and the monitor functions checked every shift.

6. All workers entering the drywell will receive special instructions on the hazards, the warning alarms, and emergency exit procedures. A video tape was prepared for this purpose.

7. All persons entering the drywell will be equipped with alarming dosimeters.

8. Radio communications will be established between the RCTs at the drywell control point, inside the drywell, and on the refueling floor.

9. No work is to be allowed above the feedwater nozzles (75' elevation) during defueling or refueling. No work will be allowed above the 51' elevation without permission from the Group Radiological Controls Supervisor (GRCS). No work will be allowed inside the bioshield penetrations during fuel movement.

The inspector reviewed the above preparations with the licensee. The following were noted:

1. The design of the fence provided to the NRC was initially limited to plan and elevation sketches of the proposed fence. The inspector requested numerical analysis to demonstrate that the proposed fence would be strong enough for its intended function. The licensee then

performed a stress analysis that showed that the fence would be strong enough. However, review of that analysis showed that the forces used to calculate the stresses on the fence were not carefully considered and that the assumed forces did not in fact represent the forces to be expected when a fuel bundle reached, and then pushed against, the fence. An independent analysis by the inspector showed, however, that the actual forces to be expected are not likely to be very different from those assumed by the licensee.

2. The detectors used for the alarming area monitors in the drywell are of the GM type. This type of detector is subject to saturation effects that may disable their function in case of sudden exposure to high radiation fields. The inspector stated that this may be a problem for the proposed and existing area monitors. The licensee, after consultation with the monitor vendor, concluded that this would be a problem. They will therefore modify the circuitry of the monitor systems, in accordance with vendor instructions, to provide a latching feature. This feature would cause the alarms to activate and sound until manually disabled despite detector saturation.

3. The licensee is planning to test the extent to which the alarms from the area monitors will be heard throughout the drywell.

4. Stops are to be installed on the fuel transfer bridge rails to limit motion of the bridge in the southern direction (the direction away from the fuel storage pool).

At the time of this inspection, the fence had been installed and fuel transfer to the spent fuel pool had started. However, after approximately 50 fuel bundles had been transferred, the licensee discovered that, as a result of miscommunication between different departments on site, the stops on the bridge rails had not been installed. The licensee suspended fuel movements until stops were installed. A notice was issued suspending work in the upper levels of the drywell during fuel movements. Defueling was then resumed and the licensee continued to investigate the reasons for the failure to install the rail stops as planned.

6.0 Iodine Inhalation Incident

This incident occurred following removal of the reactor head from the vessel and storing it in the laydown area on the refueling floor. Before removal of the head, a mechanical vacuum pump was used to purge the gases inside the vessel. The pump was run for several days, turned off two days before head lift, and then turned back on a few hours before head lift. The iodine level in the coolant was 8E-3 uCi/ml. The head was cracked open on Saturday afternoon (3:10 on October 15). All workers on the refueling floor and in the cavity at that time were in respirators equipped with cartridges. The cavity was ventilated using hoses connected to two HEPA units located on the refueling floor (119') and venting to the building's ventilation system. The head was lifted and placed on its pedestal on the 119' at about 1600 on Saturday. A total of about 10 workers were involved in this operation: four were in the cavity, a crane operator, three radiological controls technicians (RCT) and other workers on the refueling floor. Most of the workers left the floor after the head was placed on the pedestal. Some remained to clean up and take samples. At about 2000 on Saturday, the next group of workers entered the refueling floor. Respirators were not required at this point. At 2030, the Group Radiological Controls Supervisor (GRCS) was notified that the iodine samples from the refueling floor showed 1.26 MPC fraction of iodine. He asked for confirming samples. At 2330 he was notified that the samples showed 4-6 MPC fraction on the refueling floor and 5.83 MPC fraction in the cavity. The GRCS then ordered evacuation of the refueling floor. Samples taken at other parts of the reactor building did not show significant airborne activities. The airborne activity on the following day, Sunday, dropped to about 0.7 MPC fraction iodine. People were allowed on the floor but limited to less than 2 MPCH. They wore respirators with cartridges, and the work performed during these entries was to pull the dryer out of the vessel and place it in the storage pool. By Monday, the iodine level had dropped to 0.5-0.8 MPC fraction, and workers were allowed on the floor for normal work routine but were required to wear respirators with cartridges, unless the stay time was short (less than 0.5 hour). By Wednesday, the iodine level had dropped to below 0.25 MPC fraction and the requirement for respirators was lifted.

Air samples taken shortly before, during, and shortly after the head lift included five low volume samples, two high volume samples, and three breathing zone samples. In addition, continuous air monitors (CAM) were in use on the refueling floor. The CAM showed an increase in reading when the reactor head was cracked open, and continued to increase throughout the operation up to the point of placing the head on its pedestal. The readings increased from 1800 cpm to 4000 cpm by 1600, and went back to 2500 cpm by 1930. The rise in readings was monitored on the strip chart and was interpreted by the radiological controls technician assigned to that area as being caused by short-lived noble gas decay products.

All the air samples that were taken up to 1600 on Saturday showed no significant airborne radioactivity. These included seven of the total of ten samples taken. The three remaining samples were either started or turned off after 1600, and all showed significant iodine concentrations. These samples were as follows:

Low Volume, in cavity:

started	1340
stopped	1720
analyzed	1819

activity 0.393 MPC fraction iodine

Low Volume, at HP desk on 119':

started	1600
stopped	1635
analyzed	2007
activity	0.320 MPC fraction iodine

Low Volume, in cavity:

started	1720
stopped	1946
analyzed	2047
activity	1.26 MPC fraction iodine

The first two samples, analyzed at 1819 and 2007, showed iodine activities above 0.25 MPC fraction. This level is a procedural action level that requires notification of the GRCS (Procedure 9300-ADM-4212.02). Neither of the two results were reported. The failure to report these results is a violation of procedural requirements (88-31-01).

A review of the sample analysis times reveals another problem with the manner in which surveys of airborne conditions are conducted. Samples are apparently not counted in accordance with any specified priority that reflects their importance in making decisions regarding airborne hazards. The first sample shown above was analyzed an hour after collection, the second sample four hours after collection, and the third sample an hour after collection. At the time of resumption of work on the refueling floor on Saturday at 2000, the GRCS in charge did not have the results of any of the samples taken after removing the head. Also, although the GRCS was notified of significant airborne iodine at 2030 and he asked for samples to confirm this result, the confirming analysis was not reported to him until about 2330, three hours later. The tendency of the licensee to place insufficient emphasis on the air sampling program's role in airborne hazard survey prior to entry or during job evolution, if necessary, was identified previously by the NRC in connection with a reactor vessel head lift that took place during a previous outage. In that case, as in the present one, an airborne iodine problem developed following head removal. The weakness in using the air sample program to obtain timely information on airborne hazards was pointed out at that time. The licensee stated that the current incident was not identical to the previous one but acknowledged that there were similarities that warranted a review of the air sampling program and the need to assign priorities to sample analysis. The inspector also stated that the method currently in use to document air sample analyses makes retrieving past results from the records often difficult and uncertain, and in some instances impossible. The licensee stated that the system will be reviewed and necessary improvements made.

All personnel who entered the refueling floor on Saturday evening were counted on the whole body counter. The highest activity found was 95 nCi of iodine. The highest assigned intake was 16.74 MPCH.

7.0 Drywell Worker Contamination Incident

This incident occurred on October 22. The contamination occurred while pinning hangers in support of shielding installation on the 51′ elevation in the drywell. Two contractor workers were involved, and the contamination was mainly around the chin area. Whole body counting showed body burdens of Co-60 of 4.3% and 2.0% of the maximum permissible body burden.

The work was being performed on an RWP that was written for installation and removal of shielding on all elevations of the drywell (RWP #880883). A full scale pre-job briefing was held the day before the incident. It was attended by the workers, their supervisors, radiological engineering, and radiological controls supervisors. The briefing was directed mainly toward work to be performed that day, which was to pin hangers on the 13′ elevation of the drywell. The next day's work on the 51′ elevation was also discussed. There was known to be high levels of removable contamination at the work site on the 13′ elevation, and the workers were put in powered air purifying respirators. The contamination levels at the work site on the 51′ elevation were not known at the time. It was therefore decided that a survey be done at that location and that a decision be made according to the results of the survey. One of the options to take in case of high contamination levels was to mist and wipe down the hangers to be worked on as an alternative to using respirators.

On the day of the incident, the workers went to do the work on the 51′ elevation after a short briefing by radiological controls. The required surveys had not been done, and the workers were equipped with only face masks. The workers thus performed work in an unsurveyed area that was suspected to be contaminated. This is a violation of the survey requirements specified in 10 CFR Part 20 (88-31-02).

In addition to the failure to perform the required surveys, the workers were sent into the drywell with improper dosimetry. The RWP required a low range and a high range self reading dosimeter. At least one of the workers had two low range and no high range dosimeters. Both low range dosimeters were found to be offscale at the end of the job. The dose was assigned on the basis of the alarming dosimeter worn by the worker. The failure to provide proper dosimetry as required by the RWP constitutes a violation of procedural requirements (88-31-01).

Review of the circumstances surrounding this incident shows that the probable cause was a failure to carry out the surveys and other measures discussed during the pre-job briefing. It is not clear based on available information why this happened. The radiological controls technicians who briefed the workers on the day of the incident did not appear to have been aware of the exact location of the job and of the details of the previous day's briefing. The workers themselves did not appear to have been aware of the conditions at the work site, including the need to crawl under pipes and other equipment to accomplish the job. The details and reasons for these failings were being investigated by the licensee at the end of this inspection. The results of this investigation will therefore be reviewed in a future inspection.

8.0 ALARA

The licensee published in August 1988 a report entitled "Exposure Reduction Plan - OCNGS" in which measures to reduce exposure at the site are identified, discussed, and prioratized. Estimated man-rem savings are also given for each item proposed. The report estimates that the proposed measures should result in a two-year rolling average of 730 man-rem per year during 1990-1992, with a reduction to 450 man-rem possible if further action is taken. The proposed actions were divided into source term reduction and work planning and practices categories. They include the following:

Source Term Reduction:

1. Chemical decontamination of the recirculation system.
2. Improvement in the efficiency of the condensate polisher for removal of radioactive contaminants from the coolant.
3. Use of Control Rod Drive (CRD) shields.
4. Increasing the flow rate through the Reactor Water Cleanup System (RWCU).
5. Installation of shields on the reactor cavity floor. These shields have been installed this outage (12R) and the licensee estimates that they have resulted in a reduction of exposure rates for cavity work by up to 50%.
6. Chemical decontamination and shielding of the Drywell Equipment Drain Tank. The tank has been hydrolazed frequently, and was shielded in 12R using lead blankets.
7. Installation of flush connections on the Scram Dump system. This is to be completed in 12R.

8. General decontamination or shielding of systems in the drywell to reduce the dose rates at all levels. The licensee estimates that up to 70% of outage accumulated exposures are received in the drywell. General area exposure rates in the drywell are currently 50 - 100 mR/hr. Extensive temporary shielding is being installed during 12R.

9. Use of low cobalt alloys for replacement parts, including replacement and newly installed valves.

10. Use of improved valve packing systems to reduce leakage and prolong intervals between maintenance work.

11. Review of the layout of the Reactor Water Cleanup System. This system has traditionally been a source of significant exposure. Relocation of some of its components and improvements in design and reliability is expected to reduce exposures related to this system.

Changes in Work Practices:

1. Improvement in job planning by improving timeliness and increasing the level of attention to detail in the planning stage. There appears to have been some improvement in this area in 12R, but there has been considerable exposure incurred so far in 12R because of jobs not working out as planned.

2. Installation of permanent scaffolding in the drywell. This job has traditionally consumed a substantial fraction of outage exposures. Much of the scaffolding being installed in 12R will permanent.

3. Installation of a new personnel access hatch for the drywell. This would substantially reduce the need for extended movement in the drywell to reach work locations from the current access hatch.

4. Expansion in the use of mockups. This is being augmented in 12R.

5. In-place testing of safety valves on steam lines rather than the current practice of removing the valves for testing.

6. Installation of a new, wide range neutron monitoring system. The new system is expected to substantially reduce exposure incurred during the frequent maintenance required by the current system.

7. Improvements in worker training. An environmental chamber to simulate work conditions is being used in 12R to familiarize workers with the expected work environment, particularly when in protective clothing.

8. Installation of new control rod drive modules of improved design, low cobalt content, longer life span, and better reliability instead of rebuilding old ones.

9. Improvements in access control of the Radiological Controls Area (RCA) to eliminate unnecessary entries, improve control over inspection and tour entries, and increase the efficiency of work per entry.

10. Increased use of closed circuit TV cameras.

11. Improvements in the maintenance frequency of components by review of maintenance and exposure histories and replacement of components requiring frequent maintenance by more reliable ones.

12. Expansion in the use of low dose rate waiting areas.

13. Implementation of administrative changes that are designed to improve work efficiency. These would include: review the radiological consequences of decisions, expedite purchase of ALARA items, establish a site ALARA committee with significant powers, improve and clarify accountability for job exposures, improve post-job ALARA reviews, include ALARA incentives in contracts with vendors, review high radiation area entry procedures, develop a system to track component failure rates and associated exposures, and other measures.

The exposure goal for the current (12R) outage was set at 900 man-rem. The estimate for this outage, including the short 11U outage, is in the range of 700 - 1130 man-rem. As of November 17, the accumulated exposure for 12R was 622 man-rem. It is unlikely that the 12R exposure will meet the goal of 900 man-rem, but it is not clear at this point how it will compare with the upper limit of the estimated exposure. Two significant difficulties were encountered at the time of this inspection that resulted in unexpected delays and exposures. The refueling cavity was painted with a waterproofing, stripable layer to protect the rest of the system from water leaks when the cavity is flooded. The painted surfaces were found to have unacceptable defects and the layer had to be removed and re-applied. The second difficulty was encountered when it was attempted to install the equipment to be used to inspect the feedwater nozzles. The equipment was to be installed at the 74' elevation in the drywell after cutting out sections of the mirror insulation at these locations. The machines brought in to cut the insulation could not be used because of dimensional incompatibilities, causing delays and unplanned exposures.

Although the licensee has implemented, or is implementing, many of the proposed ALARA measures, most of these are still in the study phase and are to be implemented during future outages. The decisions to implement these measures and implementation progress, will be reviewed during future inspections.

9.0 Tours of the Facility

Several inspection tours were conducted in and out of the RCA. The newly constructed respirator maintenance and issue facility was found to be well maintained and well run. Control of respirator issue and verification of qualifications was good. The supplied air respirator facility, however, was found to be small and cluttered, but the work was apparently being adequately conducted. The newly constructed drywell access facility is operational and provides much better control of drywell work, including dressout and pre-job briefings. This access point also provides a much shorter and more direct access to the drywell than was previously the case.

A new, fixed, air purification system was installed in the air compressor building behind the turbine building. The purifier replaces the portable units used previously. Housekeeping in the compressor room was found to have deteriorated; the room was being used as a kind of interim storage area, and debris and cans of paint were on the floor, as well as a fair amount of oily fluid that apparently dripped from the compressor equipment.

Postings and signs within the RCA were found to be adequate. Plexiglass sheets were being used to demarcate highly contaminated areas in an effort to prevent people from reaching across the rope barriers normally used. Protective clothing bins at dressout areas were well stocked and orderly. Housekeeping was found to be somewhat poorer than in the past, with several instances noted of protective clothing on the floor close to roped-off contamination areas, and one instance of a respirator on the floor near a step-off pad because a used respirator receptacle was not provided. Copies of RWPs were readily available at the control points, and logging into and out of the dose tracking system was efficiently performed by the technicians at the control points.

The refueling floor during this outage was not released for street clothes access as has been the practice in the past. The licensee stated that, at least during the initial phases of the outage, this was more efficient than constantly trying to decontaminate the area while a lot of work was being done. Although access control to the refueling floor was generally good, the protective clothing requirements for access to that area were not always strictly observed and enforced.

10. Exit Meeting

The inspector met with licensee representatives at the end of the inspection on October 7, October 20, and November 4. The inspector explained the purpose, scope, and findings of the inspection.