UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

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Report Nos.: 50-338/89-15 and 50-339/89-15

Licensee: Virginia Electric and Power Company
Glen Allen, VA 23060

Docket Nos.: 50-338 and 50-339 License Nos.: NPF-4 and NPF-7

Facility Name: North Anna 1 and 2

Inspection Conducted: May 1-5, 1989

Inspectors: William B. Gloersen 5/31/89
W. B. Gloersen Date Signed

Roger B. Shortridge 5/31/89
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Protection Branch
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SUMMARY

Scope:

This routine, unannounced inspection of the licensee's radiation protection program consisted of a review in the areas of external and internal exposure control; control of radioactive material and contamination, surveys, and monitoring; and the program to maintain doses as low as reasonably achievable (ALARA). The inspection also involved observations of health physics job coverage during the dual unit outage.

Results:

In the areas inspected, one violation (with two examples) was identified for failure to make an adequate survey (Paragraph 3.b.). Of particular concern was the apparent lack of timely implementation of the corrective action for the violation which occurred on April 9, 1989. In general, the licensee's radiation protection program appeared to be functioning as necessary to protect the health and safety of the occupational radiation workers. However, it appears that the station's 1989 annual collective dose will significantly exceed its 1989 projected collective dose. Contributing factors to the high collective dose included (1) extended simultaneous dual unit outages; (2) large bore snubber removal; and (3) removal and replacement of steam generator tube plugs. As of April 30, 1989, the station's collective dose was approximately

824 person-rem which represented appropriately 83 percent of the 1989 budgeted collective dose (994 person-rem).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

J. Atkins, Health Physics Trainee
*M. Bowling, Assistant Station Manager, Nuclear Safety and Licensing
E. Dreyer, Supervisor, Technical Services, Health Physics
*R. Driscoll, Manager, Quality Assurance
R. Enfinger, Assistant Station Manager, Operations and Maintenance
R. Irwin, Supervisor, Operations, Health Physics
T. Johnson, ALARA Coordinator, Health Physics
*P. Kemp, Supervisor, Licensing
*J. Leberstein, Licensing Specialist, Licensing
N. Nicholson, Staff Health Physicist
J. O'Connell, Shift Supervisor, Health Physics
T. Peters, Assistant Supervisor, Dose Control and Bioassay, Health Physics
*A. Stafford, Superintendent, Health Physics
*W. Thornton, Director, Health Physics and Chemistry, Corporate
*F. Wolking, Senior Staff Health Physicist, Corporate

Other licensee employees contacted during this inspection included craftsmen, engineers, operators, mechanics, and technicians.

Nuclear Regulatory Commission

*J. Munro, Resident Inspector

*Attended exit interview

2. Organization and Management Controls (83750)

a. Organization

The licensee is required by Technical Specification (TS) 6.2 to implement the plant organization specified in TS Figures 6.2-1. The responsibilities, authority and other management controls were further outlined in Chapters 12 and 13 of the Final Safety Analysis Report (FSAR). TS 6.2 also specified the members of the Station Nuclear Safety and Operating Committee (SNSOC) and outlined its function and authority. Regulatory Guide 8.8 specified certain functions and responsibilities to be assigned to the Radiation Protection Manager and radiation protection responsibilities to be assigned to line management.

The inspector reviewed the licensee's station health physics (HP) organization. No significant changes to the organization had taken place since the last inspection other than the permanent assignment

to the position of HP Supervisor (Radiological Engineering). There appeared to be adequate management support to implement essential elements of the radiation protection program as necessary.

b. Management Controls

The inspectors reviewed various reports, including Radiation Problem Reports, Personnel Contamination Events, Station Deviation Reports, and thermoluminescent (TLD) vs. self-reading dosimeter (SRD) discrepancy reports, which would provide information on program quality. The licensee's Radiation Problem Reports (RPRs) were used to identify and document safety and radiological problems noted by HP personnel in the plant. One RPR dealt with an administrative overexposure which is discussed further in Paragraph 3.b. Most of the other problems identified in these RPRs were concerned with compliance of personnel with various procedural or radiation work permit (RWP) requirements. A few of the RPRs identified problems with advanced radiation workers collecting air samples in accordance with RWP requirements. The inspectors observed that the licensee did not have a system to track and identify trends in the RPRs. The inspectors also made the same observation regarding Personnel Contamination Events (PCEs) and TLD vs. SRD discrepancies. Additionally, the inspectors noted that the licensee collected information on maintenance rework activities; however, there was no system in place to identify or trend the rework activities that involved significant dose. The licensee agreed to review and consider developing a system to track and identify trends in the areas of RPRs, PCEs, TLD vs. SRD discrepancy reports, and maintenance rework activities. The inspectors indicated that this area of tracking and trending would be reviewed in a subsequent inspection and would be tracked by the NRC as an Inspector Follow-up Item (IFI) (50-338/89-15-01).

3. External Exposure Control and Personnel Dosimetry (83750)

a. Personnel Dosimetry

10 CFR 20.202 requires each licensee to supply appropriate personnel monitoring equipment to specific individuals and requires the use of such equipment. During a previous radiation protection inspection (50-338/89-05 and 50-339/89-05), the practice of wearing paper coveralls over the plastic bag containing an individual's SRD, which was normally worn attached to a loop on the outside of the cloth protective clothes (PCs), was identified. This practice would inhibit individuals from checking SRDs frequently in order to keep their exposures as low as reasonably achievable (ALARA). During this inspection, it was observed that the licensee had begun the practice of wearing the plastic bag containing the SRD outside the paper coveralls by piercing a small hole in the paper coverall so that the tie-ons on the plastic bag could be easily inserted through the hole and attached to the loop on the outside of the cloth PCs. During

tours of the Unit 1 containment, the inspectors observed that three individuals did not have their SRDs outside of their paper suits while entering Unit 1 containment. The licensee was made aware of this problem.

The inspectors also reviewed TLD vs. SRD correlation error reports for 1989. HP procedure HP-5.1.30, Dosimetry Processing and Dose Determination, dated December 22, 1988, described the correlation error reporting methods. The correlation error reporting criteria were as follows: (1) if either the TLD or SRD total exceed 100 millirem (mrem) and the correlation error exceeds 30 percent (%) (% correlation error = [(TLD-SRD)/TLD] x 100%), then a correlation report would be generated; and (2) if either the TLD or SRD total exceeded 300 mrem and the correlation error exceeded 30%, then the individual would not be allowed to re-enter the radiologically controlled area (RCA) until either the correlation error is resolved or until authorized by the HP Superintendent. The inspectors did not observe any "criterion 2" type correlation errors. The inspectors noted that during the month of April 1989, over 100 correlation error reports were generated. In one case, the TLD dose was approximately 47% greater than the SRD dose (191 mrem vs. 130 mrem). After it was determined that the TLD tested satisfactorily, the TLD dose was assigned t the individual. During the correlation error report review, the inspectors observed that the reports were stored in a cardboard box in no apparent chronological order. There was no attempt made to track the number or trend the type of correlation errors. These reports were usually discarded at the end of each quarter. For further information regarding the tracking and trending of these reports, the reader should refer to the Paragraph 2.b. of this report. The inspectors reviewed the quarterly collective TLD and SRD dose correlation from first quarter 1988 through first quarter 1989. During that time period, the SRD collective dose ranged from 24% to 4% greater than the TLD collective dose.

The inspectors also reviewed personnel doses for calendar year 1989 and noted that as of May 2, 1989, three individuals had accumulated over three rem. All three individuals were maintenance contractors. The highest individual dose as of May 2, 1989, was 3.862 rem. None of these individuals exceeded 3 rems for the first quarter 1989. It was determined that the licensee satisfied the requirements of 10 CFR 20.101(b) which allows the licensee to permit an individual in a restricted area to receive a total occupational dose to the whole body greater than 1.25 rems per calendar quarter, provided that the provisions in 10 CFR 20.101(b)(1), (2), and (3) are met.

b. Control of High Radiation Areas

10 CFR 20.201(b) states that each licensee shall make or cause to be made such surveys as (1) may be necessary for the licensee to comply with regulations in this part, and (2) are reasonable under the

circumstances to evaluate the extent of radiation hazards that may be present.

The inspectors reviewed licensee investigation documentation for two events that resulted in personnel receiving an inadvertent dose in excess of the administrative control values to radiation. Both of these events were identified by the licensee.

On April 9, 1989, a crew of mechanics were assigned to replace the packing in two valves (2-RC-81 and 2-RC-101) located in different areas in the Unit 2 "C" loop room. RWP-89-1786 indicated radiation levels of 300 t. 600 mR/hr general area (12 inches) and a 2,000 mR/hr hot spot on contact with valve 2-RC-81. In addition, a full set of protective clothing was required with full face respirator, TLD and SRDs affixed on the workers' head, hands and elbows. Contamination levels were up to 78, 00 dpm/100 $cm^2$ and the workers were required to wear wet suits to protect against hot particle absorption. One mechanic unbolted the packing gland on 2-RC-101 in approximately eight minutes and received 30 mrem on his "head SRD." The same mechanic unbolted the packing gland on 2-RC-81 in approximately eight minutes and received 65 mrem to the head dosimeter. Only the head dosimeter was monitored by the HP technician because all other dosimetry was worn under the wet suits. Based on these operations, the HP technician calculated stay times for the other workers at approximately 12 minutes. A second mechanic removed the packing from both valves in 10 minutes and picked up less radiation than the first worker.

The HP technician then allowed two mechanics to install the packing on both valves at the same time. The licensee's report stated that this diluted the HP technician's coverage of work on valve 2-RC-81. The mechanic, in repairing 2-RC-81, had to lie down on the grating to properly install the packing, whereas the two mechanics that previously worked the valve remained in the squatting position during the repair.

The final worker, who received the unplanned exposure, was tasked with final assembly of the packing gland and torquing of the packing nuts in accordance with approved procedures. To gain the required position, this mechanic also laid on the grating with his right elbow near the plane of highest radiation. The Virginia Electric and Power quarterly whole body exposure control point of 750 mrem was exceeded when the mechanic received 545 mrem for this job. The individual had received 300 mrem prior to the operation which, when added to this operation, resulted in 845 mrem for the quarter. In discussions with the inspectors, licensee representatives stated that the exact time spent by the mechanic in the area was not determined but difficulties were experienced in installation of the split ring on the gland and in installation of the strongback during repacking and torquing.

Licensee representatives identified in the investigation the following points:

(1) The HP contractor technician did not fully understand the administrative controls on exposure imposed by the licensee.

(2) Zone coverage of jobs with high potential for unplanned exposure should not be encouraged by workers and that HP technicians should not direct their attention away from the worker in these circumstances.

(3) The source term was not fully understood as related to the workers body configuration with respect to the job.

(4) The HP covering the job did not have sufficient dosimetry to comfortably cover the job and did not halt work to obtain needed equipment.

Licensee representatives concluded as a result of the investigation that the focus of the workers was on completing the job quickly, that the HP contract technician was not prepared to cover the job, covered too much work at once, and did not devote enough attention to the job. In addition, the pre-job survey did not precisely determine the dose rates.

According to the licensee, the root cause of the event was lack of understanding the source term. The short term corrective action was to discuss the administrative exposure limits and emphasize closer control on work activities with the technician. Long term corrective action stated that administrative control values will be discussed with all contract HP technicians.

The inspectors were not able to obtain training material from the licensee that verified that the long term corrective action had been performed. The inspectors, in interviews with a licensee HP supervisor, determined that only the HP personnel involved in the event had received any type of briefing regarding corrective actions, not all contract personnel as stated in the deviation report. During the inspection, the inspectors informed licensee management that the corrective actions did not address all problems identified during the event and that, as a result, the corrective action identified was not adequate to prevent recurrence, nor was the long term corrective action completed as stated. The inspector informed the licensee that this would be considered as a licensee-identified violation (LIV) but would not be cited. Upon evaluation at Region II, this event was reclassified as the first example of an apparent violation of 10 CFR 20.201(b) and TS 6.8.1 (50-338, 339/89-15-02).

The second unplanned exposure occurred on May 1, 1989, and involved a maintenance foreman who received 1,640 mrem to his left thigh during the repair of the fuel transfer cart in the Unit 1

transfer canal. Day and night shift crews of mechanics made several entries on RWP-89-2-2074 to replace bushings on eight of the sixteen wheels on the transfer cart. The RWP listed general area dose rates as 200 to 14,000 mR/hr. and a contact, hot spot reading of 80 R/hr. Contamination levels were listed as up to 1,000,000 dpm/100 $cm^2$ and the area was considered a hot particle area so disposable coveralls (paper suits) were required. Full face respirators and multibadging was also required. An entry to repair the transfer cart at 0300 hours on May 1, 1989, was planned and a preshift briefing was conducted. During the briefing, the HP technicians and workers discussed a 200 R/hr. hot spot and general area radiation levels of 20 to 25 R/hr at one foot. During this and previous entries, a teledose system was used. The worker wore an electronic integrating dosimeter that sent a readout signal to a receiver/monitor at a remote location from the job site. Head set communications between the workers and personnel at the monitor were planned.

The HP contract technician and crew entered the area and the HP technician took surveys when the mechanic was in position to repair the transfer cart. The technician identified highly localized, non-uniform dose rates and made the worker reorient his body to the job as dose rates to the head were unacceptable. The HP technician resurveyed around the perimeter of the worker's body and noted that dose rates were acceptable. Since the cable was not long enough for the headset/monitor connection, headset communication between the worker (251 foot (ft) elevation) and teledose/monitor (292 ft elevation) was not possible. Hence, the headset was placed at the 262 ft elevation. The HP technician left the transfer canal and proceeded to the 262 ft elevation to don the headset for communicating with the 292 ft elevation. During transit to the 262 ft elevation, the teledose/monitor received an alarm. The HP technician that had not yet reached the 262 ft elevation was dispatched to remove the worker from the transfer cart work area. The licensee estimated that approximately 40 seconds had elapsed when the HP technician left the job site and returned to retrieve the worker. The licensee established that, during this time, the worker shifted the position of his body to the job causing the teledose to receive an alarm at a 275 mrem set point. However, the foreman, during an informal mockup later to determine his position to the source, stated that when he shifted his position just before the teledose alarmed, he still maintained the original orientation to the job.

The HP contract technician returned to the transfer canal job site for a follow-up survey and located an 800 R/hr hot spot contact reading in the fuel basket. The teledose units were source checked and verified operable before and after the job and two follow-up surveys were conducted to verify the 800 R/hr reading. The first follow-up survey did not identify the source but the second survey did.

The licensee's evaluation of the event identified the following as contributing factors:

(1) Poor job planning

(a) Poor communications between maintenance and HP led to poor understanding of job site activities and radiological conditions.

(b) Inadequate survey of the fuel transfer cart and fuel basket because of incomplete understanding of the exact job site. A survey for the transfer canal blank flange elevation was used for the RWP.

(c) No craft procedure was available for the high dose, high radiological risk environment.

(d) No evaluation of the worker's position relative to the source was made during the planning stage. In this case of non-uniform, highly localized doses, an evaluation of right-handed versus left-handed orientations would have had a significant ALARA impact.

(e) Poor work practices compromised the integrity of mechanical components. Shift turnover between maintenance crews information appeared to be poorly documented.

(2) Delayed worker response to the alarming teledose unit. The worker did not immediately step away from the job site when the teledose alarmed.

(3) Poor communication system between the HP technicians and the workers

(4) Scheduling constraints to complete the job in a timely fashion.

The licensee made recommendations to prevent recurrence in the investigative report; however the inspectors noted that the report was not clear in identifying details for all contributing factors listed. The inspectors noted that the licensee had not identified short term or long term corrective actions and that the investigative report had not been finalized at the time of the inspection.

The inspectors informed licensee representatives and licensee management during the exit interview that the second unplanned exposure, where the mechanic received a dose of 1,640 mrem to his left thigh, was considered to have safety significance and had the potential for an exposure above regulatory limits. Also, it was apparent that the quick recovery of the individual from the work area when the teledose alarmed resulted in not exceeding a regulatory dose limit.

During the inspection, the inspectors identified the following similarities in both events to licensee representatives and informed the licensee that adequate and timely corrective action may have prevented the second administrative overexposure event:

(1) Radiation surveys performed for the RWP and by the contract health physics technicians during the job were inadequate to identify the extent of the radiation hazards present.

(2) Poor communications identified in both events.

(3) Attention of the HP technician covering the job was not always directed at the job/worker.

(4) On both jobs, a change in the individual's orientation to the source was considered a factor.

(5) Inadequate dosimetry in the first event and inadequate response by the worker to dosimetry in the second event. The inspectors noted that for both jobs disposable coveralls or wet suits covered dosimetry that should have been exposed and visible to the worker or HP technician covering the job. This was previously pointed out to the licensee in inspection report 50-338, 339/89-05.

The inspectors informed licensee management that failure of HP personnel to perform a radiation survey sufficient to identify the extent of the radiation hazard present was the second example of an apparent violation of 10 CFR 20.201(b) and TS 6.8.1 (50-338, 339/89-15-02).

c. Radiation Work Permits

The inspectors observed work being performed under the control of RWPs and verified that the applicable requirements of the RWPs were met.

d. Control of Radiation Areas

During tours of RCAs, the inspectors reviewed the licensee's posting and control of radiation, airborne radioactivity, contaminated and radioactive material areas. The inspectors performed independent radiological surveys throughout the RCA of the plant and verified that the radiation levels were consistent with area postings. The inspectors identified a reading of 90 mR/hr. at 12 inches from the Evaporator Demineralizer, lower level of the Auxiliary Building. HP department personnel verified the reading. Since the demineralizer was in operation, HP conservatively posted the area as a high radiation area.

4. Internal Exposure Control and Assessment (83750)

a. Engineering Controls

10 CFR 20.103(b) requires the licensee to use process or other engineering controls to the extent practical to limit concentrations of radioactive material in air to levels below those specified in 10 CFR Part 20, Appendix B, Table 1, Column 1.

During tours of the Auxiliary Building and the Unit 1 Containment, the inspector observed various engineering controls to limit the concentration of airborne radioactive material. These included the use of ventilation systems equipped with high efficiency particulate air (HEPA) filters and containment enclosures. The licensee used tent enclosures and vendor supplied sealed chambers to decontaminate various tools and items of equipment and to perform maintenance on some contaminated items.

b. Internal Assessment

The licensee's whole body counting equipment consisted of two Nuclear Data "bed" geometry systems (ND100 and ND6620) which were located in the dose control and bioassay field office located outside of the protected area. The inspectors reviewed selected whole body count results for calendar year 1989, and observed that no administrative limits had been exceeded. The licensee's administrative limit, as defined in HP-5.2 B.11, Bioassay Data Evaluation and Follow-up, dated October 1, 1985, is a body burden of 5% of the maximum permissible body burden (MPBB). The inspectors also reviewed selected airborne radioactivity area entry logs for calendar year 1989, and noted that on March 13, 1989, 15 individuals were apparently exposed to greater than 2 MPC-hrs in one day while working on lifting the Unit 2 upper internals. However, no individual during that time period had been exposed to 10 MPC-hrs in any seven days. The MPC-hr assignments were based on calculations derived from an air sample collected in the area of the 291 ft level on the refueling floor and not in the breathing air zone. The licensee recognized this problem, collected additional air samples, obtained whole body counts on all individuals involved with the upper internals lift, and discussed with technicians the proper technique in collecting a breathing zone air sample. The additional air samples that were collected were below 10% of MPC except for one air sample which was 38% of MPC. As mentioned earlier, all whole body counts of the individuals were less than the minimum detectable activity of the counting system.

Additionally, the inspectors reviewed Deviation Report #87-1073 which described an event involving a greater than 40 MPC-hours inhalation of Co-58 and Co-60. The report provided a description of the incident, description of the location and circumstances, chronology of events, cause of the incident, radiological evaluation, and the corrective actions. The event occurred on September 17, 1987, when a

contract Senior HP Technician was instructed to survey the intake of the Process Vent Filter (1-GW-FL-1B) housing, located on the 274 ft level of the Auxiliary Building for a radiation hot spot causing approximately 700 mR/hr. contact dose rate. The technician's goal was to locate and possibly remove the radioactive material causing the hot spot. Based on survey results, it was assumed that the hot spot was a point source, possibly a small piece of resin.

The technician was able to localize a spot inside the housing reading 800 mR/hr (contact) using a closed window on an RO-2. To reach the spot and read the meter with a flashlight, the technician had to lean inside the filter housing. The technician attempted to wipe away the material causing the hot spot with masslinn. Upon finding that the masslinn cloth was covered with fine black dust reading 1200 (open) and 150 (closed) mR/hr on an RO-2, the technician suspected an intake of radioactive material. The technician frisked his nose and mouth area and observed 200 counts above background. A whole body count was subsequently performed and an intake of 255 nanocuries (nCi) Co-58 and 66.6 nCi Co-60 was confirmed. The technician was barred from entering the RCA, scheduled for daily whole body counts, and requested to supply a urine sample. Based on a 96 hour retention period after the intake, the technician was assigned the following bioassay results:

| | |
|---|---|
| 0.71% | MPBB |
| 6.74% | maximum permissible organ burden (MPOB) |
| 41.38 | MPC-hours |

The activity was eliminated from the body with an average effective halflife of 3.7 days. On September 25, 1987, whole body count results indicated less than 5% MPOB. On October 1, 1987, the technician's whole body count result showed less than 1% MPOB. The presence of Co-58 and Co-60 was confirmed by gamma isotopic analysis of the masslin. Mn-54 and Nb-59 were also present; however, the quantities present were less than 3% of the total. The Co-58/Co-60 ratio as determined by the whole body count results agreed favorably with the gamma isotopic results. The urinalysis results generally agreed with the whole body count results.

The inspectors reviewed the licensee's evaluation of the event and the corrective actions taken to assure against recurrence as required by 10 CFR 20.103(b)(2). The corrective actions included incorporation of the lessons learned from the event into the site specific training for contract HP technicians. Some of the lessons learned included recognizing a non-routine task for which a special RWP is necessary, recognizing a situation where the creation of airborne activity is likely and respiratory protection will always be required, and emphasizing to contract HP supervisory personnel the need to request special RWP's for non-routine tasks. The HP technician and his immediate supervisor were formally counseled with regard to appropriate use of RWPs and procedure compliance. The

corrective actions and evaluation appeared adequate to meet the requirements of 10 CFR 20.103(b)(2).

No violations or deviations were identified.

5. Control of Radioactive Material and Contamination, Surveys, and Monitorings (83750)

a. Area and Personnel Contamination

The licensee maintains approximately 105,000 square feet ($ft^2$), excluding containment, as radiologically controlled. In 1988, nine percent or approximately 9,800 $ft^2$ was contaminated. Since the beginning of the outage, the contaminated area of the plant had increased to approximately 15,000 ft. Licensee representatives stated that most of the increase in contaminated area was due to laydown and storage areas for outage related equipment.

The inspectors reviewed Personnel Contamination Events (PCEs) for 1989 and the current refueling outage. Licensee representatives stated that the goal for 1989 was less than 400 PCEs. Through May 2, 1989, the licensee documented 281 PCEs. As a measure to reduce the number of PCEs, the licensee has recently instituted a program to prohibit anyone from entering the RCA who had an instance of contamination on the skin or clothing until the individual attended a one-on-one coaching session with the Plant Manager or Superintendent of HP.

The inspectors noted during the PCE review that the root causes of many of the PCEs were not always listed or were not defined sufficiently to trend performance in this area. Licensee representatives stated that HP was responsible for documenting PCEs, but the reports were forwarded to the Human Performance Evaluation Section (HPES) for evaluation. Licensee representatives were not knowledgeable of any adverse trends regarding PCEs other than the number of PCEs to date. When interviewed, HPES personnel stated that no provisions had been made to evaluate adverse trends. The inspectors discussed with licensee management the decline of the previous trending program and stated that important performance information was not available. In the past, the licensee tracked and trended PCEs to the extent that details, such as, the number of PCEs involving the various types of poor radiological work practices and contamination events that occurred in clean areas of the RCA were identified. As a result, corrective actions were developed for the identified adverse trends. Licensee management stated that they would review the reestablishment of trending PCEs (see Paragraph 2.b).

b. Monitoring

The inspectors observed that HP technicians were involved in the cleanup and close out of Unit 2 prior to returning the unit to power. The inspectors interviewed HP personnel to determine the extent of HP involvement in responsibilities for cleanliness (housekeeping) of the RCA. Most of the approximately six to eight HP technicians interviewed stated that they spent significant amounts of time in cleaning up areas. The technicians indicated that they were being held responsible for overall housekeeping in the RCA. An HP representative stated that when areas became too cluttered with tools and waste during the job that a hold was placed on the operation until the area was cleaned. However, this practice became a frequent occurrence and pressures to complete work on schedule from management resulted in decreasing the holds placed on jobs/areas. The HP representative indicated that HP technicians were too involved in housekeeping and that job coverage was being diluted. As an example, the foreman stated that one of his technicians spent two hours on job coverage and ten hours on housekeeping in one shift. The inspectors asked security to provide an access tape of selected mechanical maintenance foremen entering containment during the outage as an indicator of their involvement with the problem of cleanup during and after operations. The inspectors reviewed the data and noted out of the six maintenance foremen listed, only two had been in either Unit 1 or Unit 2 containment during the outage (approximately 30-40 days). Based on the inspectors review of the data and interviews with HP personnel, the inspectors discussed with licensee management the potential for diluting HP technician radiological coverage of work in progress. The inspectors stated that no events were yet identified that had resulted in inadequate radiological coverage due to housekeeping responsibilities. Licensee management stated that they were aware of HP being under pressure due to the outage, but were not aware of problems in the area of housekeeping.

c. Radiation Detection and Survey Instrumentation

During area tours, the inspectors observed the use of survey instruments by HP personnel. The inspectors examined calibration stickers on radiation protection instruments in use and at various areas throughout the plant. Instrument use appeared to be in accordance with standard practice and all instruments examined had been calibrated.

6. Program for Maintaining Exposure As Low As Reasonably Achievable (ALARA) (83750)

10 CFR 20.1(c) states that persons engaged in activities under licenses issued by the NRC should make every reasonable effort to maintain radiation exposures ALARA. The recommended elements of an ALARA program are contained in Regulatory Guides 8.8, Information Relevant to Ensuring that Occupational Radiation Exposure at Nuclear Stations will be ALARA;

and 8.10, Operating Philosophy for Maintaining Occupational Radiation Exposures ALARA.

a. Goals and Objectives

During this inspection, Unit 1 was in day 70 of its outage while Unit 2 was in the last week of its outage. The estimated 1989 collective dose goal for the station was set at 994 person-rem or 497 person-rem per reactor. As of April 30, 1989, the station's collective dose was 824 person-rem. The inspectors reviewed the estimated and actual collective dose data for both Unit 1 and Unit 2 refueling outages. The total estimated collective dose for the Unit 1 outage was set at 569 person-rem while the estimate for Unit 2 was set at 678 person-rem. As of May 4, 1989, the actual collective dose for the Unit 1 outage was 159 person-rem and 628 person-rem for Unit 2. It should be noted that the station's annual goal was estimated to be exceeded by 253 person-rem (1,247 person-rem [station outage estimate] - 994 person-rem [station goal]) due to additional scope and unplanned work. Some of the additional scope included in-service inspections, steam generator tube plug removal and replacement, replacement of Unit 2 reactor head, and removal and replacement of small bore snubbers.

b. ALARA Suggestion Program

The inspectors observed that ALARA suggestions were encouraged and solicited from all plant employees. The licensee provides cash incentives on a quarterly basis to the individual who submits the best ALARA suggestion that is adopted for action. Based on a selective review of ALARA suggestions for the last several years, it was quite apparent that the licensee's ALARA suggestion program was effective in soliciting suggestions. The following provides a summary from 1983 to 1989 of ALARA suggestions received and accepted:

| | ALARA Suggestions | |
|---|---|---|
| Year | Received | Accepted |
| 1983 | 55 | 34 |
| 1984 | 55 | 7 |
| 1985 | 23 | 5 |
| 1986 | 40 | 15 |
| 1987 | 32 | 12 |
| 1988 | 75 | 24 |
| 1989 (to 4/13/89) | 19 | 4 |

The inspectors observed that, for the years 1983 to 1987, there were approximately 20 ALARA suggestions that are still incomplete. It should be pointed out that many of those suggestions required engineering reviews and/or significant resources to complete. The licensee was actively tracking the incomplete ALARA suggestions via the Monthly Station ALARA Committee Meeting Minutes and had

established a goal for 1989 to eliminate the 1983 through 1987 ALARA suggestion backlog.

c. High Dose Jobs

The inspectors reviewed the estimated and actual collective dose data for the various jobs with the potential for high dose for both Units 1 and 2. The inspector discussed these jobs with the Site ALARA Coordinator. Additionally, the inspectors compared the average collective dose for the outage high-dose jobs listed in Table 3-3 of NUREG/CR-4254, Occupational Dose Reduction and ALARA at Nuclear Power Plants: Study on High-Dose Jobs, Radwaste Handling, and ALARA Incentives, with currently available Unit 2 outage data. Some of the job categories could not be compared directly since the licensee classified some jobs differently. The following table lists the job title and average collective dose for Westinghouse Pressurized Water Reactors as summarized in NUREG/CR-4254 and compares them to the licensee's actual collective dose used for the 1989 Unit 2 refueling outage:

Table 1

| Job Title | Collective Dose (man-rem) NUREG/CR-4254 | North Anna (U2/1989) |
|---|---|---|
| 1. Snubber, Hanger, and Anchor Bolt Inspection and Repair | 110 | 23 |
| 2. Steam Generator Eddy Current Testing | 50 | 65 |
| 3. Reactor Disassembly/ Assembly | 48 | 30 |
| 4. Steam Generator Tube Plugging | 47 | 13 |
| 5. In-Service Inspection | 46 | 55 |
| 6. Plant Decontamination | 45 | 13 (as of 5/3/89) |
| 7. Primary Valve Maintenance and Repair | 30 | 46 |
| 8. Scaffold Installation/ Removal | 30 | 8 (as of 5/3/89) |
| 9. Reactor Coolant Pump Seal Replacement | 17 | 4 |
| 10. Steam Generator Manway Removal/Replacement | 16 | 3 |
| 11. Secondary Side Steam Generator Inspection/ Repair | 11 | 11 |
| 12. Fuel Shuffle/Sipping and Inspection | 9 | 3 |

| | | |
|---|---|---|
| 13. Operations--Surveillance, Routines, and Valve Lineups | 7 | 16 (as of 5/3/89) |
| 14. Cavity Decontamination | 6 | 8 |
| 15. Radwaste System Repair, Operation, and Maintenance | 5 | 5 (as of 5/3/89) |
| 16. Residual Heat Removal System Repair and Maintenance | 3 | 2 |

The following high-dose jobs performed by the licensee on Unit 2 were not included in the jobs listed in Table 1: (1) Design Change Package - Large Bore Snubber Removal (82 man-rem [actual]) and (2) Removal of Steam Generator Tube Plugs (93 man-rem [actual]).

The licensee was actively tracking the collective doses for all jobs and had the capability to track which jobs were over the projected amounts. The licensee also tracked collective dose by department (Health Physics, Maintenance, Operations, Nuclear Site Services, Instrumentation/Chemistry, Power Engineering, and Quality Assurance/Quality Control). The jobs which contributed to precluding the licensee from meeting its goal included: eddy current testing activities; replacement of Unit 2 reactor head; removal/replacement of small bore snubbers; and steam generator tube mechanical plug removal.

The inspectors also reviewed the licensee's criteria for pre-job and post-job ALARA reviews. These criteria were specified in HP-5.4.30, ALARA Pre-job and Post-job Reviews, April 9, 1987. The pre-job review criteria were as follows:

(a) less than 1 man-rem: normal RWP preparation

(b) greater than or equal to 1 man-rem: pre-job ALARA review performed under ALARA Coordinator prior to RWP issue

(c) greater than or equal to 10 man-rem: above requirements and approval by station ALARA Committee

(d) greater than or equal to 50 man-rem: above requirements and approval by both Station Manager and ALARA Coordinating Committee

The post-job review criteria were as follows:

(a) less than 1 man-rem: normal job close out process

(b) Perform a post-job review and in addition meet with cognizant job supervisor when:

(1) greater than or equal to 1 man-rem and exceeded projected man-rem by 125%

(2) greater than or equal to 10 man-rem

(3) * RWP required two or more RWP ALARA evaluations

(4) * As ALARA Coordinator deems necessary

In addition,

(5) greater than or equal to 25 man-rem: The station ALARA Coordinator shall (1) prepare brief job summary and post-job critique with responsible job supervisor and (2) schedule Station ALARA Committee (SAC) review and approval of post-job review and critique report. The SAC shall (1) review post-job summary and critique; (2) review applicable ALARA evaluation documents; (3) make comments and recommendations as required; and (4) obtain approval by SAC Chairman.

It was apparent that the licensee had a very good program established for performing the necessary review of jobs involving significant dose. During this inspection, it was observed that only one post-job review (replace flange gasket on Unit 2-RC-RO-2) had been completed. Approximately 20 jobs requiring post-job reviews were remaining. It should be noted that the station was in a dual unit outage and, therefore, approximately twice the number of post-job reviews would be required. The inspectors noted the potential backlog problem, and indicated to the licensee that this area would be reviewed during subsequent inspections.

No violations or deviations were identified.

7. Exit Interview

The inspectors met with licensee representatives (denoted in Paragraph 1) at the conclusion of the inspection on May 5, 1989. The inspectors summarized the scope and findings of the inspection, including the violation and IFI. The inspectors also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary. Dissenting comments were not received from the licensee.

During the exit interview, an apparent LIV dealing with an inadequate survey resulting in unplanned dose to a worker was discussed. Based upon careful consideration and evaluation of the adequacy and timeliness of the licensee's corrective action for failure to make an adequate survey to prevent recurrence of an event similar to the first event in which an individual exceeded the station's quarterly whole body dose control value,

it was determined that the LIV would be considered as another example of an apparent violation of 10 CFR 20.201(b). NRC management considered the corrective action for the first example of exceeding the administrative control value to be neither timely nor comprehensive. Licensee management was notified of this decision by telephone on May 16, 1989 (Paragraph 3.b.).

| Item Number | Description and Reference |
|---|---|
| 50-338/89-15-01 | IFI - Develop system to track and identify trends in the areas of: RPRs, PCEs, TLD/SRD discrepancies, and maintenance rework activities (Paragraph 2.b). |
| 50-338, 339/89-15-02 | VIO - Failure to perform adequate radiation surveys necessary to prevent individuals from receiving an exposure to radiation above the station administrative control value (two examples) (Paragraph 3.b). |