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

SEP 09 1987

Report Nos.: 50-338/87-30 and 50-339/87-30

Licensee: Virginia Electric and Power Company
Richmond, VA 23261

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

Facility Name: North Anna

Inspection Conducted: August 25-27, 1987

Inspector: B. K. Revsin 9/3/87
B. K. Revsin Date Signed

Approved by: for C. M. Hosey, Section Chief 3 September 1987
C. M. Hosey, Section Chief Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This special, unannounced inspection involved onsite inspection in the area of review of events associated with a potential exposure of the skin of the whole body of a worker in excess of the regulatory limits.

Results: Three violations - (1) failure to maintain occupational exposures to skin of the whole body below regulatory limits; (2) failure to perform adequate radiological surveys; and (3) failure to adhere to Radiation Work Permit (RWP) procedures.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*G. E. Kane, Assistant Station Manager
*A. H. Stafford, Superintendent, Health Physics
*W. T. Bartlett, Senior Staff Health Physicist, Corporate
*R. T. Johnson, Supervisor, Quality
*D. B. Roth, Nuclear Specialist
*G. Harkness, Licensing Coordinator
E. Dreyer, Senior Staff Health Physicist

Other licensee employees contacted included technicians.

Other Organizations

Numanco

Nuclear Regulatory Commission

*W. E. Holland, Senior Resident Inspector, Surry Power Station
*L. P. King, Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on August 27, 1987, with those persons indicated in Paragraph 1 above. Three apparent violations, (1) failure to maintain occupational exposures to skin of the whole body below regulatory limits; (2) failure to perform adequate radiological surveys; and (3) failure to adhere to RWP procedural requirements, were discussed in detail. The licensee acknowledged the inspection findings and took no exceptions, but stated that in the case of an exposure to a microscopic area of the skin of the whole body, they believed that a rad was not equivalent to a rem. The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

NRC concerns relative to the inspection findings were discussed by D. M. Collins of this office with A. H. Stafford in a telephone conversation on September 1, 1987. During this conversation, the NRC was informed of further corrective action taken, planned, and/or under consideration with regard to minimizing the potential for personnel exposures to high specific activity particles. These actions included: (1) reduction of action level to 5,000 cpm for reuse of protective clothing; (2) use of the low background waste sorting building for protective clothing monitoring; (3) 100 percent remonitor of vendor washed laundry;

(4) routine surveys of the laundry facility including the washers and dryers; (5) verification of methodology used by vendor to monitor laundry on September 1, 1987; (6) development of a training module for health physics technicians concerning monitoring for radioactive particles; and (7) re-evaluation of practices at the containment step-off pads with the potential of installing a PCM-1A in this location.

3. Inspector Followup on Onsite Events (93701)

a. Synopsis of the Event

During the evening of August 19, 1987, a contract health physics technician, who had been performing work in Unit 1 containment, was found to be contaminated upon exit from the Radiation Control Area (RCA). The contamination was identified as a single microscopic particle of cobalt-60 with a total activity of 1.6 microcuries. Dose to the skin of the whole body from the particle was determined to be 23.6 rem and when added to previous skin exposure for the quarter, gave a total dose of 23.828 rem to the skin of the whole body for the third quarter of 1987. Based on particle activity and residence time on the skin, the dose assigned by the licensee was confirmed in an independent assessment using the NRC acceptable computer code, VARSKIN, which is described in NUREG/CR-4418, "Dose Calculation for Contamination of the Skin Using the Computer Code VARSKIN," 1987.

b. Scenario of the Exposure Event

Through discussions with licensee representatives, interviews with involved personnel, and review of licensee records, the circumstances surrounding the August 19, 1987, contamination event were reviewed. On that date at approximately 2:00 pm, a HP technician entered containment where routine duties in support of eddy current testing for steam generator (S/G) "A" were performed. The technician exited containment at approximately 4:45 pm and exited the RCA through the Personnel Decontamination Area (PDA) which contains three Eberline PCM-1A frisking stations. The technician frisked successfully using a PCM-1A in that no contamination was detected. The lower limit of detection for the PCM-1A is 5,000 disintegrations per minute (dpm).

At approximately 5:50 pm, the HP technician re-entered containment for a continuation of previous duties in support of eddy current testing on S/G "A." The licensee explained that the staging area for the S/G "A" platform (252 foot elevation) is at the top of a short set of stairs at the 262 foot elevation. The technician remained in the staging area, sitting down and leaning against a wall until 6:30 pm, when a worker exited the platform area at which time the technician assisted the worker from his wet suit and bubble hood. At approximately 7:00 pm a decontamination crew made entry to the S/G "A" platform for routine cleaning activities. After completion of decontamination, the HP technician prepared to make entry to the S/G platform to perform a radiological survey. An additional set of

coveralls, gloves, booties, and a particulate respirator were donned by the technician in addition to the coveralls, hood, gloves, and foot apparel previously worn. At approximately 7:25 pm, entry was made to S/G "A" platform and a smear survey was performed which required 5 to 10 minutes. The technician returned to the 262 foot staging area and removed the outer layer of protective clothing, i.e., gloves, booties, hood, coveralls and respirator. A clean hood was donned.

The technician continued support duties for eddy current testing and between 7:35 pm and 7:55 pm, helped to dress out a S/G worker. At 7:55 pm, the technician was relieved from duty and at 8:00 pm exited containment. At the Unit 1 containment exit, the technician removed all protective clothing and monitored face, hands and feet for contamination using a RM-14 with HP-210 probe. No activity above background was detected. The technician returned to the PDA where portable instrumentation that had been used to provide containment coverage was returned to the checkout point and smears taken on S/G "A" platform were counted (RM-14 with HP-210 probe). Approximately 30 minutes after exiting containment, the technician entered a PCM-1A frisker station preparatory to exiting the RCA. The PCM-1A alarmed from nine zones, i.e., upper quadrants, head and thigh areas. The technician on duty at the PDA monitored the contaminated technician using a RM-14/HP-210 around the head and face areas. Low level contamination [20 to 40 counts per minute (cpm)] over background was detected, but this activity was insufficient to have caused the PCM-1A to alarm. The contract technician entered a different PCM-1A to verify operability of the first scan and the same zones alarmed as before. A third PCM-1A was tried with the same results. The PDA technician frisked the contract HP again finding activity of 20 to 40 cpm over background on hair, chin, side of face, neck, shirt and shorts.

The contract technician showered taking care to wash thoroughly with soap and water. The hair was also washed. Upon entering the PCM-1A after showering, the same zones that had alarmed before sounded again. The PDA technician frisked the contract technician once more, this time extending the survey to the back area. The RM-14 went offscale high on the 100 times scale (50,000 cpm). A microscopic particle was located and removed from the lower left shoulder blade using tape after two attempts at particle removal. Measurement of the dose rate from the particle after capture on the tape was 20-25 milliRoentgen per hour open window using an Eberline RO-2.

At 9:00 pm the contract technician again tried to exit the RCA via the PCM-1As. The PCM-1A cleared the technician indicating that the contamination had been removed.

Subsequent isotopic analysis of the particle showed the composition to be pure cobalt-60 with an activity of 1.6 microcuries. Stay time for exposure to the particle was computed from 5:50 pm, time of

second entry to containment, to 9:00 pm, when decontamination was complete, or approximately three hours and 15 minutes. A dose equivalent of 23.6 rem was assigned the individual from exposure to the particle. The individuals thermoluminescent dosimeter (TLD) was processed and the previous skin exposure for the quarter was determined to be 228 millirem to give a total quarterly skin exposure of 23.828 rem. A whole body count indicated the technician did not have an uptake of radioactivity. The contract technician was restricted from entry to the RCA for the remainder of the calendar quarter and has been assigned administrative duties.

c. Review of the Exposure Event

(1) 10 CFR 20.101(a) requires that no licensee possess, use or transfer licensed material in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from radioactive material and other sources of radiation, a total occupational dose in excess of 7.5 rem to the skin of the whole body.

10 CFR 20.4(c) states that for the purpose of 10 CFR 20, a dose of 1 rad due to X-, gamma, or beta radiation is considered to be equivalent to a dose of one rem.

The licensee stated that from their evaluation of the event, they had concluded that the origin of the particle was most probably from the protective clothing via the laundry for contaminated PCs. The licensee emphasized that a dose assignment of 23.6 rem from exposure to the particle was conservative in that stay time was computed from the beginning of the technician's second entry into containment at 1750 hours. Stay time was verified from printouts from the Security computer which records all entries/exits from containment. The licensee stated for this type of exposure they believed that the rad to rem equivalency established by 10 CFR 20.4(c) may not be adequate to describe skin exposures from microscopic, high activity particles. The licensee indicated that they would continue to review the technical aspects of these types of personnel exposures.

Failure to maintain quarterly occupational exposures to individuals in restricted areas to less than 7.5 rem to the skin of the whole body was identified as an apparent violation of 10 CFR 20.101(a) (50-338, 339/87-30-01).

(2) The inspector reviewed RWP No. 87-2312, Perform Eddy Current Testing in A, B, and C S/Gs, August 14-27, 1987. Among other protective clothing and equipment required by the RWP, a plastic suit and a fresh air hood were specified. Although the HP technician had signed into containment on this RWP, discussions with the technician and licensee records confirmed that 2 cloth

coveralls rather than 1 cloth coverall and 1 plastic suit had been worn. Additionally, a particulate respirator had been worn instead of a fresh air hood.

Technical Specification 6.8.1.a requires that written procedures be established, implemented, and maintained covering procedures recommended in Appendix A of Regulatory Guide 1.33, Revision 2, February 1978.

Regulatory Guide 1.33, Appendix A, Paragraph 7.e requires radiation protection procedures covering access control to radiation areas including a Radiation Work Permit (RWP) System.

Procedure HP-5.3.10, RWP Program, August 21, 1986, Paragraph 4.3.1 states that RWPs shall only provide the radiological controls required in support of specific conditions relating to the specific work activity and area or purpose of entry.

RWP No. 87-2312, Perform Eddy Current Testing in A, G, and C S/Gs, August 14-27, 1987, requires that in addition to other protective clothing requirements, a plastic suit and a fresh air hood will be worn.

During an interview, the technician who had been contaminated, stated that while the work crew dressed according to the RWP, it was not always necessary for the HP technician to be dressed similarly even though all personnel were working under the same RWP. The technician stated that it was not uncommon for the HPs at the station to dress differently from the work crew according to their own judgement. During discussions the inspector learned that the licensee was aware that HP (both contract and house technicians) often failed to meet RWP protective clothing requirements, and was also aware that the Station RWP program contained no mechanism for providing certain groups or individuals exceptions to compliance with RWP requirements. Indeed Procedure HP-5.3.10, Paragraph 1.0 states that the RWP program controls personnel entries into and work in radiation areas or areas containing radioactive material.

Failure to adhere to protective clothing requirements specified on RWP No. 87-2312 was identified as an apparent violation of Technical Specification 6.8.1.a (50-338, 339/87-30-02).

(3) 10 CFR 20.201(b) states that each licensee shall make or cause to be made such surveys as may be necessary for the licensee to comply with the regulations and are reasonable under the circumstances to evaluate the extent of radiation hazards that may be present.

10 CFR 20.201(a) defines survey to mean an evaluation of the radiation hazards incident to the production, use, release,

disposal or presence of radioactive materials or other sources of radiation under a specific set of conditions, and, when appropriate, includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

During discussions with the individual who had been contaminated with the radioactive particle and through review of licensee records, it was determined that when the technician had exited containment, the personal survey performed by the individual was not a whole body frisk as was required, but had included only hands, feet and face. The individual stated that due to the high background radiation level (600 cpm) at the containment exit, low levels of contamination were undetectable and therefore whole body frisking was better relegated to the exit of the RCA where the PCM-1A frisker stations were available and background radiation levels much lower. However, when the technician reached the PDA containing the PCM-1A frisker booths, personal monitoring was not performed until approximately 30 minutes had elapsed. Instead, the technician counted the smears that had been taken while on the S/G "A" platform. A second 30 minutes elapsed before the contamination was located and successfully removed so that decontamination was achieved approximately one hour after exiting containment.

The inspector confirmed through discussions with licensee representatives that the background radiation levels at the containment exit were often high, i.e., greater than 1000 cpm. In a large measure this was due to the amount of used, contaminated PCs in the area. All PCs from containment work were collected in this area. Once the bag lined drums were filled, the bags were taken out of the drums and stored in the area, making it possible for large amounts of used PCs to be present which caused highly variable background radiation levels for the personnel monitors (friskers). In addition, the friskers were not shielded, and the practice of constructing frisking booths with lead blankets had not been adopted at the facility. The inspector stated that failure of the technician to perform a whole body frisk at the exit to containment as required appeared to be a contributing factor to the total dose determined to have been delivered to the skin of the whole body in that an hour elapsed between containment exit and decontamination. This amounted to greater than seven rem of the dose equivalent the technician was determined to have received.

Failure to perform adequate personal surveys was identified as an apparent violation of 10 CFR 20.201(b) (50-338, 339/87-30-03).

On August 26, 1987, for a fifteen minute period, the inspector observed personnel frisking at the containment step-off pads.

Of the 10 persons exiting from Unit 1 and Unit 2 containment, seven failed to perform whole body frisks. This was identified as an additional example of the apparent violation of 10 CFR 20.201(b) (50-338, 339/87-30-03).

After the August 19, 1987, skin exposure event, the licensee amended all RWPs dealing with S/G work to require workers after exiting containment to immediately proceed to the PDA and monitor at the PCM-1A. The licensee also amended all RWPs for work on the S/G platform area to require plastic suits for all entries to the platform regardless of the work to be performed.

(4) The contaminated laundry facility was observed and found to utilize a wet wash and a dry cycle. After cleaning, the protective clothing is monitored with a RM-14/HP-210 probe both inside and out and protective clothing with contamination greater than 10,000 cpm (i.e., 100,000 dpm) is discarded. The inspector observed the laundry facility and noted that the limited space was not conductive to a thorough PC frisk, and depending on the amounts of both dirty and cleaned PCs in the facility, the background radiation levels could be sufficiently high as to preclude thorough PC surveys.

The licensee stated that PCs were also cleaned by a vendor, and that the action point used by the vendor for discarding PCs was 7,500 cpm. The licensee stated that when cleaned PCs were returned from the vendor, some portion of the PCs were monitored to confirm that they met the licensee's action level. The licensee stated that in general, approximately one drum out of 25 to 35 was monitored. The licensee also stated that they had never verified that the vendor had the capability to meet the licensee's action point.

After the skin exposure event described above, the licensee randomly removed 15 items of PC from the men's and women's change rooms and surveyed them for contamination. These garments were available for use by workers. Of the 15 items, one spot of contamination was found to read 634,000 dpm, and numerous other spots were found but were below the licensee's action point of 100,000 dpm. The licensee surveyed a total of 50 items of protective clothing and concluded that the sample was adequate for a conclusion to be reached that further exposures from particles trapped on PCs was unlikely. The inspector discussed with the licensee the fact that the data did not appear to support that view in that from a total of 51 items of protective clothing, 1 particle had caused an apparent overexposure to the skin of the whole body, while a second particle was found with sufficient activity to result in a similar event should an individual be contaminated sufficiently long. The inspector discussed with licensee representatives whether more aggressive actions were required to bring the probability of recurrence of such events to a minimum.

The licensee stated that in the future, laundry would be removed from the laundry room to a recently constructed low level waste sorting building and would be thoroughly monitored using large tables which would permit a more careful survey. Also the background radiation levels would be lower and more controllable. Additionally, the licensee had purchased a trash bag monitor and a conveyer belt driven trash monitor for the facility which the licensee postulated may be diverted from monitoring trash to monitoring PCs. At the time of the inspection this was not a definitive decision, and neither of the two monitors were yet operational. The licensee was continuing to evaluate further corrective actions.

No violations or deviations were identified.

ENCLOSURE 2

Proposed Meeting Agenda

Virginia Electric and Power Company Meeting with NRC
September 24, 1987

I.	Opening Remarks	NRC
II.	Issues of Concern	VEPCO
	A. Circumstances Surrounding an Occupational Dose to the Skin of Whole Body in Excess of 7.5 Rem	
	B. Adequacy of Radiation Work Permit Program for Controlling Radiologically Hazardous Work	
	C. Personnel Self-Monitoring Practices	
III.	Closing Remarks	NRC