APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-267/90-16 Operating License: DPR-34

Docket: 50-267

Licensee: Public Service Company of Colorado (PSC)
P.O. Box 840
Denver, Colorado 80201-0840

Facility Name: Fort St. Vrain Nuclear Generating Station (FSV)

Inspection At: FSV Site, Weld County, Platteville, Colorado

Inspection Conducted: September 28, 1990

Inspector: Blaine Murray 10/12/90
Blaine Murray, Chief, Radiological Protection and Emergency Preparedness Section — Date

Approved: Laurence A Yandell for 10/12/90
A. Bill Beach, Director, Division of Radiation Safety and Safeguards — Date

Inspection Summary

Inspection Conducted September 28, 1990 (Report 50-267/90-10)

Areas Inspected: Special, reactive, announced inspection of the radiological control problems regarding the collection and handling of five radioactive samples.

Results: Five NRC-identified apparent violations (failure to perform surveys - paragraph 3, failure to follow procedures - paragraph 5, failure to provide instructions - paragraph 6, failure to label radioactive containers - paragraph 7, and failure to provide personnel monitoring - paragraph 8) were identified. One licensee-identified violation (failure to post radiation area - paragraph 3) was identified. One open item concerning supervisory oversight is discussed in paragraph 9. No deviations were identified. Several poor radiological control practices were identified concerning the collection and handling of five radioactive sources.

DETAILS

1. Persons Contacted

PSC

*C. H. Fuller, Manager, Nuclear Production
*F. J. Borst, Manager, Nuclear Training and Support
*D. W. Evans, Manager, Operations and Maintenance
*J. M. Gramling, Supervisor, Nuclear Licensing - Operations
J. Halvorson, Special Services Licensed Operator (SSLO)
R. E. Largent, Senior Health Physics (HP) Technician
M. Porter, Senior HP Technician
G. McTiernan, Senior HP Technician
*T. E. Schleiger, Superintendent, Chemistry and Radiation Protection
*W. Woodard, Supervisor, HP

NRC

*D. L. Garrison, Acting Resident Inspector

*Denotes individuals in attendance at the exit interview on September 28, 1990.

2. Background Information

In discussions with licensee personnel on September 25, 1990, the acting resident inspector learned of a situation involving five radioactive samples obtained from a region constraint device (RCD) and two metal clad reflector elements (MCRE) that resulted in some poor radiation control practices. Based on this preliminary information, Region IV management decided to dispatch an inspector to the plant on September 28, 1990, to conduct a special reactive inspection.

On September 11, 1990, the licensee initiated work to obtain six samples from a RCD and two MCREs. After collecting the samples, they were shipped offsite for radiological analyses as part of a program to establish shipping procedures to be implemented during decommissioning activities in order to satisfy 10 CFR 61 requirements. The sampling procedure consisted of drilling into the RCD and MCREs to collect about 6 grams of metal shavings. Sample drilling activities were performed in the hot service facility (HSF) using remote controlled equipment. The RCD and MCREs were placed in the HSF by first loading the items individually into the fuel handling machine (FHM) and then lowering them into the HSF from the refueling floor. Six metal trays measuring about 12 inches x 14 inches x 4 inches were used to collect the shavings. The HSF was equipped with two area radiation monitors (ARMs) that have a local audible alarm in the HSF and an audible alarm and a strip-chart recorder in the control room. The HSF also has the capability to obtain radiation

levels on items placed in the HSF by using a Eberline RO-7 rate meter located outside the HSF near the leaded glass viewing window on Level 9. The RO-7 detectors are located in the HSF with cable attachments to the rate meter. The RO-7 detectors can be attached to a remotely operated arm that permits determining contact radiation levels or performing surveys at various distances from items placed in the HSF.

The first RCD sample was collected on September 11, 1990. Surveys performed on the RCD indicated that radiation levels measured at 6 inches were about 3.3 R/hr. The sample obtained from the RCD weighed 1.9 grams and the contact radiation level was 2 mR/hr. The sample was placed in a Ziploc plastic bag, removed from the HSF and placed in a lead shielded laboratory hood in the decontamination laundry area (old radiochemistry laboratory) on Level 3 in preparation for shipment offsite. After the first sample was collected on September 11, 1990, problems were experienced with the FHM and sampling activities were terminated until September 18, 1990, after repair of the FHM.

The second RCD sample and the two samples from the first MCRE were collected on September 18, 1990. These three samples remained in the HSF pending collection of the two samples from the second MCRE. Surveys performed on the first MCRE indicated a maximum radiation level of 63 R/hr measured at 6 inches. The second MCRE was placed in the HSF and surveyed. The radiation level from the second MCRE was offscale for the RO-7 detector in use (200 R/hr). The MCRE was removed from the HSF and the low range detector replaced with an extended range detector (2000 R/hr). On September 19, 1990, surveys were completed on the second MCRE which showed a maximum radiation level of 930 R/hr measured at 6 inches. During the morning, the final two samples were collected and the MCRE was removed from the HSF. In the afternoon, arrangements were made between the SSLO and the HP technician providing job coverage to remove the five samples from the HSF.

The SSLO, equipped with a Eberline RO-2 survey meter, entered the HSF for the purpose of bagging and removing the samples. The HP technician remained outside the HSF and observed the SSLO's work activities through the leaded glass window on Level 9. The SSLO entered the HSF and proceeded to pour the metal shavings from the five collection trays into separate Ziploc bags. The five smaller bags were then placed in a larger plastic bag and the SSLO hand-carried the samples down the stairs to the HSF access area on Level 8. Simultaneously, the HP technician descended from the Level 9 viewing window to meet the SSLO as he exited the HSF. As the SSLO was passing through the HSF door into the access area, a area radiation monitor (ARM) located about 10 feet from the HSF door alarmed. The access area was a temporary tent work area approximately 5 feet x 12 feet x 7 feet constructed in the personnel walk-way outside HSF door. The tent arrangement was constructed of heavy plastic sheets with a light weight commercial storm door fitted with a hasp and padlock. The steel grated walk-way floor was covered with plastic. The alarm set point for the access areas ARM was 2.5 mR/hr. The HP technician stated to the inspector that the ARM alarm was an unexpected surprise. Since the

radiation level from the first sample collected on September 11, 1990, was 2 mR/hr, the other samples were expected to be in this same general range. The HP technician stated that sample radiations levels of up to 200 mR/hr might have been expected, but certainly not at the levels determined during follow up surveys on September 20, 1990.

On hearing the ARM alarm, the HP technician immediately instructed the SSLO to drop the plastic bag containing the samples on the access area floor. Two steel plates measuring about 10 inches x 10 inches x 1 inch were present in the access area and placed on the sample bag, but the ARM continued to alarm. Several lead blankets were located and placed over the samples and the alarm stopped. The HP technician and SSLO exited the access area and locked the door. The HP technician performed surveys around the access area and determined that the radiation level at the access area door was 1 mR/hr. The HP technician descended to Level 7 and performed surveys with an extended probe survey meter to establish the radiation levels on the access area floor under the shielded samples. The maximum level beneath the samples was 300 mR/hr, and the general levels at chest height on the Level 7 walk-way were about 0.8 mR/hr. The HP technician left the HSF and informed the HP supervisor of the events involved with collecting the samples. The HP supervisor stated that since it was late afternoon, the samples should remain in the HSF access area and that they would be transferred to the decontamination laundry processing area during day shift the following day. The samples were moved to the processing area on September 20 and packaged and shipped to the offsite laboratory for analyses on September 27, 1990.

3. Surveys

The inspector reviewed radiological surveys performed in conjunction with the five samples removed from the HSF on September 19, 1990. Interviews with personnel and a review of survey records revealed conflicting survey data. The HP technician, observing work activities from the viewing window, stated that the SSLO was requested to position the RO-2 survey meter above each collection tray so that the radiation levels could be determined through the window. Under these conditions, the HP technician would be about 4-5 feet from the survey meter. The HP technician stated that the maximum radiation level observed was 500 mR/hr at contact with Sample Tray No. 4. However, the SSLO stated that with the shavings evenly distributed in the tray for Sample No. 4, he observed the radiation level to be about 2.5 R/hr measured about 6 inches above the tray. The SSLO also stated that when the No. 4 sample material was placed in the Ziploc bag, the survey meter went offscale (5 R/hr) at a distance of about 6-10 inches from the bag.

The HP technician recorded in the survey log at 1:30 p.m. on September 19, 1990, that the preliminary survey on the tray containing sample No. 4 indicated radiation levels of 500 mR/hr at contact prior to pouring the sample into the Ziploc bag. The inspector asked the SSLO if he had discussed with the HP technician that his surveys indicated radiation levels of about 2.5 R/hr before Sample No. 4 was poured into the bag and

that the meter went offscale after the sample was concentrated. The SSLO stated that his surveys were not discussed with the HP technician and that the results did not become known until the licensee started their internal review of the event after September 20, 1990.

Detailed surveys were performed on each sample bag during the day shift on September 20, 1990, as part of the work involved with moving the samples from the access area to the Level 3 processing area. The results are listed below: (all readings in mR/hr except for the contact reading on Sample No. 4)

Sample	Item	Contact	6"	18"	Weight (grams)
2	ROD	10	1.2	0.4	1.04
3	MCRE	120	8	1.2	2.66
4	MCRE	15.8 R/hr	1200	220	5.1
5	MCRE	300	15	2	2.79
6	MCRE	90	8	1	3.61

NOTE: Dose to hand at top of Ziploc bag for Sample No. 4 = 2000 mR/hr.

The above results were obtained with a RO-2 survey meter. The inspector determined that the surveys were performed with the beta window closed. The licensee also stated that they had performed a beta/gamma ratio study on the samples and determined that the beta to gamma ratio was 4:1. The licensee had completed a preliminary analyses and identified Co-60 and Mn-54 as two primary radionuclides present in the sample material. Therefore, the combined contact dose for the samples would be:

Sample	mRad/hr (except for Samples No. 4 and 5 which are Rad/hr)
2	40
3	480
4	63 Rads/hr
5	1.2 Rads/hr
6	360

Dose to hand at top of bag = 8 Rads/hr

Airborne surveys were not performed to determine the need for respiratory equipment before allowing the SSLO to enter the HSF on the afternoon of September 19, 1990. Surveys conducted on September 18, 1990, indicated that the maximum surface contamination level was 729,726 disintegration per minute (dpm)/1000 cm^2 and the airborne concentration was 3.67 E-10 uCi/cc. However, airborne surveys were not performed before allowing the SSLO in the HSF on September 19, 1990, (1) to determine how airborne conditions might have changed as a result of the drilling activities on the morning of September 19 and (2) to establish the breathing zone concentrations present while the SSLO was pouring the sample material from the trays into the Ziploc bags.

Proper radiation control job coverage would have required that the HP technician make the initial entry into the HSF after sample drilling was completed and the RCD and MCREs removed to determine radiological conditions such as airborne concentrations, general direct radiation levels, and specific radiation levels associated with each sample collection tray. 10 CFR 20.201(b) requires that each licensee shall make or cause to be made such surveys as may be necessary to evaluate the extent of radiation hazards that may be present. The failure to conduct direct radiation and airborne surveys before allowing the SSLO to work in the HSF is an apparent violation of 10 CFR 20.201(b) (267/9016-01).

At about 1:00 a.m. on September 20, 1990, the shift HP technician, while performing routine survey duties, identified an area on Level 7 walk-way beneath the HSF access area that was 10 mR/hr. This area was immediately posted and a rope barricade established. The HP technician completed a "Health Physics Irregularity Report," Report 90-11 which provided a description of the event and the corrective actions. This was the same area previously identified as having radiations levels of about 0.8 mR/hr based on surveys performed the afternoon of September 19, 1990, under the shielded RCD and MCRE samples. The licensee estimated that this uncontrolled radiation area existed for about 9 hours before it was identified on September 20, 1990. The licensee's evaluation indicated that the maximum exposure received by an individual in this area would have been less than 90 mR. The inspector reviewed the personnel traffic patterns and work activities for the 9 hours the uncontrolled radiation area was present and concluded that the likely maximum exposure to an individual would have been less than 5 mR. 10 CFR 20.202(b)(2) identifies a radiation area as any area accessible to personnel where radiation levels exists where the whole body could receive a dose in excess of 5 mR in 1 hour or 100 mR in 5 consecutive days. 10 CFR 20.203(b) requires that each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words, "Caution - Radiation Area." The failure to post the radiation area on Level 7 beneath the HSF access area is an apparent violation of 10 CFR 20.203(b). However, the licensee's corrective actions satisfied the criteria in 10 CFR 2, Appendix C, Section V.G.1. for self-identified problems. Accordingly, NRC decided to exercise its discretion and classify this matter as a licensee identified violation.

No deviations were identified.

4. Personnel Exposure

The inspector reviewed the personnel monitoring and whole body counting results for the SSLO that removed the RCD and MCRE samples from the HSF on September 19, 1990, to determine compliance with 10 CFR 20.101 and 20.103. The SSLO was wearing a self-reading pocket dosimeter and a beta-gamma film badge equipped with a 30 mg/cm^2 beta window on his chest when he entered the HSF.

Results from the pocket dosimeter read on the afternoon of September 19, 1990, indicated the SSLO received 3 mR to the whole body. The film badge was collected and sent to the vendor for special processing. The vendor processed the film badge and reported via telephone on September 26, 1990, that the badge indicated less than 10 mR exposure. During the interview with the inspector, the SSLO described his activities while in the HSF and stated that the total time spent in the facility was 10-15 minutes. He stated that when he observed that the survey meter went off-scale while surveying Sample No. 4, he immediately threw the bag on the floor and left it there until the other four samples were placed in the large plastic bag. He estimated that the total time Sample No. 4 was within 18 inches of his body was between 30 seconds and 1 minute. The 30 seconds - 1 minute estimate included the time spent pouring the sample shavings into the Ziploc bag and hand carrying the bag containing all five samples to the HSF access area.

The inspector reviewed the survey data to estimate the dose to the SSLO's hands. The licensee had completed a time and motion study and concluded that the SSLO received an extremity dose of about 680 mRads. The inspector reviewed the licensee's calculations and found them to be conservative based on the time estimates provided by the SSLO.

The SSLO was whole body counted on September 24, 1990. The results indicated that body burdens were below the instrument's lower limits of detection (less than 0.1 percent of the maximum permissible body burden).

No violation or deviations were identified.

5. Radiation Work Permit (RWP)

The inspector reviewed the RWP used for the RCD and MCRE sample collection. A specific RWP was not issued for the sample collection work and the one used (Special RWP No. 11377) contained only limited information. For example, the RWP was issued for the period September 13-20, 1990, and was titled, "Manipulator Testing and Modify RCD." The RWP appeared to be for general work in the HSF with no specific reference to sample collection activities. The only radiological data on the RWP was the results of smear surveys taken on September 6, 1990, and September 18, 1990, along with an airborne sample collected on September 18, 1990. The RWP stated that no finger rings or respiratory protection equipment were required. The RWP also indicated that HP coverage was only required for the start of the job. The inspector noted that continuous HP coverage should have been required for the job.

The HP technician that wrote and approved RWP No. 11377 was not the same HP technician that provided HP coverage during the RCD and MCRE sample collection. Under the RWP special instruction section, no information was included concerning sample collection activities.

Protective clothing requirements appeared adequate and the RWP required a whole body count upon leaving the area.

The inspector reviewed licensee Procedures HPP-125, "Establishing and Posting Controlled Areas" and NPAP-10, "Radiation Work Permit Program" and noted the following examples where procedures were not followed:

- Procedure HPP-125, Section 4.3, titled, "Hot Service Facility Control" Subsection 4.3.5, states, "Write a Radiation Work Permit (RWP) for the job to be performed in the HSF."

- Procedure NPAP-10, Section 3.2.2, states "A Special RWP is normally issued for a specific task for a period not to exceeded 1 week.

- Section 4.2.3 states "During work in a area controlled by an RWP, health physics personnel shall: (b) conduct radiation, contamination, and airborne radioactivity surveys as necessary to determine changing radiological conditions."

Technical Specification (TS) 7.4.d states, "Procedures for personnel radiation protection shall be prepared consistent with the requirements of 10 CFR Part 20, and shall be approved, maintained, and adhered to for all operations involving personnel radiation exposure." The failure to adhere to Procedures HPP-125 and NPAP-10 is considered an apparent violation of TS 7.4.d. (267/9016-02).

No deviations were identified.

6. Planning, Training, and Instructions

The inspector reviewed the planning, training, and instructions associated with the RCD and MCRE sampling activities. The inspector determined, by interviews with the personnel involved, that no formal planning, briefings, or instructions had been included in preparation for collecting the samples. The HP technician that provided job coverage stated that during the week of September 17-21, 1990, she was assigned the duties of refueling floor HP technician. The responsibility for providing job coverage for the sample collection was considered part of the routine work duties.

The HP technician and health physics supervisor both stated that no formal briefing or discussions were held to review such items as allowing the SSLO to enter the HSF without HP escort, use of shielded transfer containers or sample tongs, action to take if unexpected radiation levels were encountered, or conditions where the samples should not be removed from the HSF.

The SSLO stated that no special instructions or prejob training were provided regarding expected radiation levels, sample handling techniques to minimize exposures, or actions to take if problems developed. The inspector questioned the SSLO if he had received training to qualify him to perform radiation surveys. The SSLO stated that he was familiar with the general operating characteristics of the survey meter, but had not

worked as a HP technician nor received special HP training on how to perform proper surveys.

10 CFR 19.12 requires that all individuals working in a restricted area shall be kept informed in precautions or procedures to minimize exposure. The extent of these instructions shall be commensurate with potential radiological health problems in the restricted area. The failure to provide proper instruction to the SSLO that entered the HSF to retrieve the RCD and MCRE samples is considered an apparent violation of 10 CFR 19.12 (267/9016-03).

7. Containers and Labelling

The licensee stated that neither the five Ziploc bags nor the larger bag containing all five bags were labelled to identify them as containing radioactive material while they were in the HSF access area between the afternoon of September 19, 1990, and September 20, 1990. In addition, no labelling was placed on the lead blankets that provided shielding for the samples to alert personnel that radioactive material was present under the blankets. While the samples were in the HSF access area, the door was maintained locked and posted as a high radiation area requiring HP approval before entry.

There were three keys for the lock to the access area door. The superintendent of chemistry and radiation protection and the health physics supervisor each had a key. The third key was kept in a locked cabinet in the HP count room. The licensee stated that about 20 individuals had keys to the lock on the cabinet in the HP count room. The possibility of an uninformed individual entering the HSF while the samples were there was unlikely; however, in the event that someone did enter the access area, it was possible that they could have come in contact with the bags without knowing they contained high levels of radioactive materials.

10 CFR 20.203(f)(2) requires that each container of licensed material shall bear a durable, clearly visible label identifying the radioactive contents. The label shall bear the radioactive caution symbol and warning. The label shall also provide sufficient information to permit individuals handling working in the vicinity to take precautions to avoid or minimize exposures. The licensee had established the following requirements in Procedure HPP-630, "Radioactive Material Control and Handling":

- Section 4.3, "Use of Radioactive Material Identification Tag," Section 4.3.1 states "Identify all radioactive material, or their containers, with a Radioactive Materials Identification (RMI) Tag."

- Section 4.3.5 states "Record information on the tag as necessary.

- Section 4.3.5 states "Record information in the Radioactivity Accountability log."

- Section 4.3.6 states "Attach the hard copy of the tag to the material or container to be tagged."

The failure to identify the RCD and MCRE sample bags as containing radioactive material is considered an apparent violation of 10 CFR 20.203(f)(2) (267/9016-04).

No deviations were identified.

8. Personnel Monitoring

The inspector determine that extremity monitoring had not been provided to the SSLO that handled the radioactive RCD and MCRE samples on September 19, 1990. The SSLO was involved with transferring the radioactive metal shavings from the collection trays into plastic bags and then hand carrying the unshielded bags to the HSF access area. The sample bags contained radioactive material with contact radiation levels of about 65 Rads/hr.

10 CFR 20.202 requires that each licensee shall supply appropriate personnel monitoring equipment to each individual who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (a) of 10 CFR 20.101. The failure to provide extremity monitoring to the SSLO that entered the HSF on September 19, 1990, is considered an apparent violation of 10 CFR 20.202(a)(1) (267/9016-05).

9. Supervisory Oversight

The inspector reviewed the amount of time HP department supervisors spend in the plant overseeing ongoing work activities. The health physics supervisor stated that because of the heavy paper workload, he only spends about a ½ hour per day in the plant observing radiation protection job coverage. The licensee stated that this is an area that needs to be evaluated in order to improve supervisory briefings, coordination, and onsite job coverage. This matter is considered an Open Item pending further review by the inspector (267/9016-06).

10. Processing and Shipping Samples

The inspector reviewed the work performed between September 20-27, 1990, concerning the processing, packaging, and shipping of samples to an offsite laboratory for analyses. This work was covered under Special RWP 11387 titled, "Preparation RCD/Metal Clad Samples," approved September 20, 1990. The RWP appeared to contain the necessary information including contact radiation levels and extremity monitoring. Personnel monitoring results indicated that the maximum exposure received by workers

involved with the processing, packaging, shipping of the samples was 45 mR to the whole body.

No violations or deviations were identified.

11. Exit Interview

The inspector met with the acting resident inspector and the licensee representatives denoted in paragraph 1 at the conclusion of the inspection on September 28, 1990, and summarized the scope and findings as presented in this report. The licensee did not identify as proprietary any of the materials provided to, or reviewed by, the inspector during the inspection.