U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No:	50-206/93-06
License No:	DPR-13
Licensee:	Southern California Edison Company (SCE) Irvine, California 92718
Facility:	San Onofre Nuclear Generating Station (SONGS) Unit 1
Inspection location:	San Diego County, California
Inspection duration:	On-Site March 1 - 5, 1993 and April 5 - 9, 1993 In-Office May 13, 1993

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Summary:

Areas Inspected: Special, announced inspection of occupational exposure controls. The inspection focused on a February 19, 1993, event in which a worker handled a highly radioactive object. The inspectors reviewed the pre-job briefing records, radiation exposure permit requirements, involved individuals' statements of the work evolution, and licensee evaluation of the event. Inspection procedure 83729 was used.

Results: Three apparent violations of NRC requirements were identified:

(1) The failure to perform surveys per 10 CFR 20.201(b) to assure compliance with 10 CFR 20.101 (see Section 2.c(1)).

(2) Two examples of failure to follow an REP: 1) regarding the discontinuity in health physics coverage and; 2) handling of highly radioactive material (see Section 2.c(2)).

(3) The failure to instruct workers in the precautions and procedures to minimize exposure to radioactive materials (see Section 2.c(3)).

In addition, the inspection identified weaknesses associated with a lack of planning, communication, and a formal method of reporting radiological incidents.

DETAILS

1. Persons Contacted

Licensee

*T. Adler, Unit 2/3 Health Physics Supervisor
*R. Ash-Everest, Nuclear Fuel Services Supervisor
D. Axline, On-site Nuclear Licensing Engineer
*B. Corbett, Unit 1 Health Physics Planning Supervisor
J. Darling, Licensing Engineer
*S. Enright, Radioactive Materials Control Supervisor
*M. Farr, On-site Nuclear Licensing Engineer
*J. Fee, Assistant Health Physics Manager
*E. Gatto, Health Physics Training Supervisor
*D. Herbst, Quality Assurance Manager
*J. Hammond, On-site Nuclear Licensing Supervisor
*P. Knapp, Health Physics Manager
F. Lemine, Health Physics Technician
*T. Llorens, On-site Nuclear Licensing Engineer
*J. Madigan, Health Physics Supervisor
*W. Marsh, Assistant Nuclear Regulatory Affairs Manager
*J. Reust, Unit 1 Health Physics General Foreman
*R. Rosenblum, Nuclear Regulatory Affairs Manager
*S. Schofield, Health Physics Engineering Supervisor
*M. Short, Site Technical Services Manager
W. Stroup, Refueling Engineer
*A. Tally, Unit 1 Health Physics Supervisor
T. Ushino, Health Physics Engineer
*R. Waldo, Operations Manager
*D. Warnock, Assistant Health Physics Manager
*B. Wood, ALARA Supervisor

NRC

*M. Cillis, Senior Radiation Specialist
*R. Huey, Enforcement Officer, Region V
*N. Mamish, Radiation Specialist
*J. Reese, Facilities Radiological Protection Branch Chief, Region V
*J. Russell, Resident Inspector

(*) Denotes those individuals who attended the exit meeting on April 9, 1993. The inspector met and held discussions with additional members of the licensee's staff during the inspection.

2. Occupational Exposure During Extended Outages (83729)

The inspection focused on the February 19, 1993, event in which a worker handled a highly radioactive object. The inspectors evaluated the event by interviewing involved personnel, reviewing procedures and records, and conducting facility tours.

a. Sequence of Events

(1) Event Background

Nuclear Fuel Services Personnel determined, prior to February 19, 1993, that there was interference between the upender striker plate and the upender basket. The upender basket and upender striker plate, located in the reactor refueling cavity, are part of the Unit 1 Fuel Transfer System. The job scope was to inspect the upender to find the cause of the interference, and to cut the striker plate as necessary to eliminate the interference.

(2) Scope of Tailboard (Formal Pre-job Briefing)

At approximately 5:00 p.m. PST on February 19, 1993, a Refueling Supervisor (RS) and a Refueling Engineer (RE) arrived at the Unit 1 Health Physics Control Point to attend a tailboard of the Fuel Transfer System work. The Health Physics Technician (HPT) responsible for providing health physics coverage informed the two refueling workers that he would conduct the tailboard at the Unit 1 Radiation Exposure Permit (REP) office.

During the tailboard, the HPT discussed REP No. 71494 requirements and radiological conditions - contact and 12-inch exposure rates around the upender, and contamination levels in the lower cavity. The HPT informed the workers of the high radiation exposure rates in the lower refueling cavity - a 40 Roentgen per hour (R/hr) hot spot and 800-1000 milliroentgen per hour (mR/hr) general area, both located near the center of the upender. The radiological conditions discussed were based on a survey performed on February 17, 1993, with the upender basket in the horizontal position.

The refueling workers described the work to be performed as an inspection of the upender cable connections and cutting of the striker plate. The refueling workers stated that the striker plate would be cut using a porta-band saw. Additionally, the RS informed the HPT that the RE would be stationed in the upper refueling cavity to assist him in performing the work.

(3) Radiation Exposure Permit Requirements

The HPT and refueling workers used Radiation Exposure Permit (REP) No. 71494, "Refueling Activities in Containment/Fuel Handling Building," Revision 4, dated February 19, 1993, to perform their work. REP No. 71494 listed, in part, the following requirements:

(a) Maximum radiation limit allowed by the REP: 1500 mR/hr.

(b) Protective Clothing and Respiratory Equipment:

- Full Protective Clothing
- Plastic Protective Clothing
- Full Face Negative Pressure Respirator

(c) Dosimetry:

Thermoluminescent dosimeters (TLDs), Pocket Ion Chambers (PICs), finger ring TLDs, and an Electronic Alarming Dosimeter (PD-1) were required by REP No. 71494. The locations of the dosimetry were as follows:

Dosimetry Location	Dosimetry Type
Head	TLD & PIC
Chest	TLD & PD-1
Right Hand	Finger Ring TLD
Left Hand	Finger Ring TLD
Right Leg	TLD & PIC
Left Leg	TLD & PIC

The PD-1s were electronically set to continuously alarm at an accumulated exposure of 600 mR. If an individual's accumulated exposure exceeded 600 mR, the PD-1's alarm could only be reset by health physics personnel. In addition, the PD-1 was set to alarm at an exposure rate of 1500 mR/hr. If an individual entered an area where the radiation field was greater than 1500 mR/hr, the PD-1 would alarm until the individual left the 1500 mR/hr radiation field.

(d) This REP did not allow the following:

- Work on items with contact dose rates greater than 30 R/hr.

(e) Continuous health physics coverage was required for the following work:

- Entry into high radiation areas. An alarming dosimeter may be used in lieu of continuous coverage, except in high noise areas. If the dosimeter alarms, exit the area immediately and contact Health Physics.
- Whole body Zone III entry with plastics and respirator
- Handling and transport of Zone III materials

Zone III areas as defined in Procedure SO123-VII-7.12, "Hot Particle Control Program," Revision 5, dated January 21, 1992, are "Areas established to control the spread of

hot particle contamination. These areas are known to be contaminated with loose hot particles or are areas where loose hot particle contamination is suspected and radiological conditions make it impractical to detect them. Examples include the FHB [Fuel Handling Building] transfer machine and S/G [Steam Generator] primary channel head tents."

(4) Description of Protective Clothing, Dosimetry, and Respiratory Equipment Worn

Both refueling workers and the HPT were dressed as required by their REP. In addition, the RS and RE donned an ice vest for heat stress control. The RE placed his PD-1 on the outside of his ice vest, but inside his plastic protective clothing. The RS, however, placed his PD-1 inside his protective clothing, ice vest, and plastic protective clothing.

(5) Description of Work Area

The equipment hatch, located on the 42-foot elevation, is the normal access into containment. The 42-foot elevation, usually referred to as the refueling floor, is where the refueling bridge and the entrance to the reactor refueling cavity are located.

The reactor refueling cavity has two elevations; an Upper Cavity (UC) located at the 17-foot elevation and a Lower Cavity (LC) located at the 2-foot 7-inch elevation. Access into the UC is made via the 42-foot elevation, and access into the LC is made via the UC.

The UC had been posted as follows:

- Zone II area
- High Contamination Area

A portion of the UC, however, was posted as a Zone III area. This portion of the UC consisted of an area containing a step-off-pad at the top of the LC ladder, approximately a 8-inch-wide strip along the edge of the LC, and a triangular shaped area (at the west end of the reactor refueling cavity) large enough to accommodate one person. The step-off-pad was established for workers to remove their plastic protective clothing. The safety railing established along this UC Zone III area provided a convenient radiological and industrial safety barrier to separate the UC and LC.

As described in Section 2.a(1), the work scope to be performed in the LC included a cable connection inspection of the upender and cutting of the striker plate. The LC had been posted as

follows:

- Zone III area
- High Contamination Area
- High Radiation Area
- Very High Radiation Area

(6) Work Evolution

Upon arrival at the work area, the RE asked the Unit 1 Health Physics General Foreman (HPGF) about the correct placement of his PD-1. The HPGF instructed the RE to relocate his PD-1 to the front of his chest, outside of his plastic protective clothing. The RS was not present during this discussion; therefore, no one directed him to relocate his PD-1.

Prior to the RS's entry to the LC, the HPT conducted a pre-entry survey of the LC including the upender. Upon entry of the LC (at approximately 6:00 p.m. PST), the RS recalled the upender basket being in the vertical position. The refueling workers began setting up the work area. The RS indicated that prior to inspecting the cable connections, he placed lead blankets on the LC drain. The RE stated that while lowering a drop-light from the UC, he spotted an object inside the upender basket. The RE informed the RS about the object.

The RS looked inside the basket but could not see anything. Subsequently, the RS stated that while holding a lantern, he inserted a length of baling wire through holes on the side of the basket in an effort to view the interior of the basket. The HPT maintained that he was unaware that the RS was looking inside of the basket, but added that he might have been monitoring the radiation levels around the RS during this evolution. The RS informed the inspectors that he recalled an extendable G-M detector (teletector) beside his head while he was looking inside the upender basket.

The HPT stated that he was concerned with the LC contamination levels because they appeared to be higher than he had expected. He added that there had been a lot of crystallized boric acid around the upender on the LC floor. The HPT stated that since background radiation levels were high, it was impractical to count the contamination smears in the LC. The HPT proceeded to the UC and exited the Zone III. However, he remained in the UC in a direct line-of-sight of the RS.

Being unsuccessful in seeing inside the basket from the LC, the RS proceeded to the Zone III portion of the UC to view inside the basket. At approximately this time, the HPT stated that he informed the refueling workers he was leaving the refueling cavity to count the contamination smears, and instructed them

to stay out of the LC. The refueling workers, however, maintained that they did not recall the HPT instructing them to stay out of the LC.

While using a drop light to inspect inside the basket, the RS stated that he heard something fall onto the LC floor. Subsequently, the RS informed the RE that they needed to test the upender clearance with a dummy fuel assembly. At this point, the RS stated that he was unaware the HPT had left the refueling cavity.

As the RS was proceeding to the LC, the RE realized that the HPT was not present. The RE thought that the HPT had moved to the other side of the reactor head (which was a lower exposure area). He looked for the HPT around the reactor head; however, he was unable to find him and immediately returned to the Zone III portion of the UC.

The RS re-entered the LC and saw a metal object on the LC floor that he thought might be what he heard fall out of the upender basket. He stated that, at that time, he did not consider that it might have been a highly radioactive component since the reactor coolant system had not yet been breached. He then walked toward the object, picked it up, and walked back toward the LC ladder (approximately 12 feet) to show it to the RE. The RS indicated that while walking to the ladder, he noticed that the object was metallic and realized that it might be highly radioactive.

The refueling bridge crane operator (who had maintained continual view of the RS) saw the RS pick up the object. The refueling bridge crane operator and the RE told the RS to drop the object because it might be highly radioactive. The RS stated that he quickly dropped the object and stayed by the LC ladder.

During that time, the Unit 1 HPGF (on the 42-foot elevation) assigned to supervise activities in Unit 1 containment was attempting to get an additional survey instrument for this job. Both refueling workers began to attract the attention of the HPGF. The refueling workers informed the HPGF that an object had fallen on the LC floor. The HPGF stated that when he went to the edge of the cavity, he saw the RS in the LC about 6 feet from the object. While proceeding to the UC, the HPGF yelled and waved at the RS to move further away from the object.

At this point, the HPGF stated that he assumed the HPT had left his assignment of providing continuous coverage for the refueling workers; therefore, he instructed both workers to stay in place. The HPGF left the UC to find the HPT. Upon returning to the 42-foot elevation, the HPGF was met by the HPT. The HPGF notified the HPT that "something" had fallen

from the upender basket while he had been counting the contamination smears.

The HPGF and HPT proceeded to the UC to survey the object. The HPGF asked the RS if anybody had been near the object. He thought that the RS answered "no" by shaking his head. However, neither refueling worker recalled being asked that question. The HPGF subsequently left the refueling cavity to set up a survey instrument to measure the radiation levels around the upender from the 42-foot elevation.

Using an extendable G-M detector from the UC, the HPT was unable to reach the object on the LC floor. The RS stated that he volunteered to survey the object because the HPT had removed his respirator and could not return to the LC. The survey indicated a contact exposure rate of about 40 R/hr.

At this time, the HPGF returned to the UC and asked the RS where his PD-1 was. The RS indicated that it was under his protective clothing. The HPGF examined the RE's PD-1, and recalled that the RE's accumulated exposure had been 26 mR. The HPGF thought about getting the RS out of the reactor cavity to check his PD-1, but decided that it was not necessary.

The HPGF decided to survey the object using a different survey instrument. He requested the help of a second HPT and a second RE both located on the 42-foot elevation. A Dositec Probe Model PR-2M, a solid state detector, coupled to a Portable Remote Monitor Model PR-2 was used to perform the second survey from the 42-foot elevation. The PR-2M probe was lowered to within five to six feet from the object. The survey revealed that general area exposure rates were commensurate with pre-job surveys performed.

At this point, the HPGF decided that the RS could return to the upender area to complete his work because the object was at least six feet away from the striker plate. While the RS was cutting the striker plate, the HPGF surveyed the object more thoroughly. The PR-2M survey detector revealed a contact exposure rate of 120 R/hr.

The RS completed the cutting of the striker plate, adjusted the turnbuckles on the upender, and cycled the upender basket to ensure that clearance was sufficient.

Upon exit of the radiation controlled area, a Unit 1 control point worker noted that the RS's chest PD-1 had accumulated, only 181 mrem, but had exceeded the pre-set exposure rate alarm (set at 1500 mR/hr). Following a discussion among control point personnel, an HPT informed the HPGF that the RS's PD-1 had alarmed.

The HPGF stated that he remembered the RS looking into the upender, and thought that the RS might have exceeded his exposure rate limit at that point. Thus, he informed the control point HPT to allow the RS to exit the Unit 1 control point. The RS informed the inspectors that he did not recall hearing the alarm in the LC and added that, at this point, he still had not told any one he had picked up the object.

Upon exit of the Unit 1 control point, an RE who had been stationed on the 42-foot elevation informed the RS that the object had been measured at 120 R/hr.

(7) Subsequent Events

A tailboard was held at approximately 7:00 a.m. PST on February 20, 1993, to resolve a problem involving the upender counter weight and to recover the object still lying on the LC floor.

At approximately 8:30 a.m. PST, the RS returned to the LC to perform the additional work on the upender. During the same time, health physics surveyed the object using an extendable G-M detector. The exposure rate measurements revealed radiation exposure levels of 400 R/hr, 10 R/hr, and 1 R/hr (at contact, 1 foot, and 1 meter respectively). Using remote handling tools, the object was subsequently placed into a small drum, shielded with lead blankets, and stored in the High Radiation Storage Vault.

At approximately 11:30 a.m. PST, the Health Physics Planning Supervisor (HPPS) informed the RS that the contact exposure rate of the object had been measured at 400 R/hr. At that point, the RS stated that he had picked up the object while working in the LC on February 19, 1993, and suggested that his dosimeters be processed. The HPPS immediately requested the RS's TLDs be pulled for processing, and placed a temporary restriction on his access to the radiation controlled area.

On February 22, 1993, health physics management was notified and a Division Investigation Report (DIR) was initiated.

b. Licensee Evaluation of the Event

The inspectors reviewed the licensee's DIR completed on March 23, 1993. The licensee had performed the following:

(1) On February 22, 1993, the licensee processed all TLDs worn by the RS. The finger ring TLDs were mailed to a vendor for processing. The TLD results were as follows:

Dosimetry Location	TLD Results (mrem)	PIC/PD-1
Head	126	140
Chest	156	181
Right Hand (Finger Ring TLD)	856	N/A
Left Hand (Finger Ring TLD)	373	N/A
Right Leg	157	180
Left Leg	150	160

(2) Conducted twenty five separate interviews with the involved individuals between February 22, 1993 and March 9, 1993, to determine the circumstances that led to the unplanned exposure.

(3) Obtained the RS's PD-1 data from the Nuclear Information Services Division on February 23, 1993. The licensee stated that the PD-1 alarmed for 33 seconds.

(4) Performed operability tests of the RS's PD-1 on February 24, 1993. The tests indicated that the PD-1 had been functioning normally.

(5) Performed a mock-up of the event on March 2, 1993, to determine the approximate length of time the RS handled the foreign object. The time-motion study indicated that the RS held the object for approximately 8 seconds.

(6) Performed direct TLD measurements of the object to estimate its contact dose rate. Because contact dose rates were measured at 540 rem/hr and 209 rem/hr, the licensee concluded that the highest dose rate of the object was extremely localized. The licensee determined that a more elaborate study was needed to calculate the contact dose rate of the object.

The licensee performed a "Dose versus Distance" study to conservatively estimate the extremity dose received by the RS. TLD measurements of the object were taken at seven distances - 0.5", 1.0", 1.5", 3.0", 6.0", 12.0", and 24". After processing the dosimeters, the results of the TLD measurements were entered into 1) the computer code "Microshield" to calculate the object's strength (i.e., object's radioactivity), and 2) the computer code "Tablecurve" to extrapolate the contact dose rate of the object.

In calculating the object's contact dose rate, the licensee assumed that the distance from the center of the object to the skin of the worker was approximately two millimeters. This distance equalled the thickness of the three protective gloves worn by the RS in the LC. Based on the computer codes used and the assumptions made, the object's contact dose rate was conservatively calculated to be approximately 1188 rem/hr.

Using the calculated 1188 rem/hr contact dose rate and the eight seconds in which the RS held the object, the licensee assigned the RS a calculated extremity dose of 2640 mrem. The total quarterly extremity dose assigned to the RS (i.e., 3300 mrem) was considerably lower than the quarterly regulatory limit of 18750 mrem. His total whole body dose for the same period was 157 mrem.

The inspectors noted that the total quarterly extremity dose received by the worker was well within the regulatory limits. Additionally, the inspectors noted that the licensee's calculations were very conservative. Specifically, the assumption of a distance of two millimeters from the center of the object to the skin of the worker was quite conservative, in that protective gloves used by workers are never skin tight. Air gaps between three layers of gloves typically total a few millimeters.

(7) Performed spectroscopy measurements using a multi-channel analyzer to characterize the radiation spectrum. The analysis indicated that the radioactivity associated with the object was primarily due to activation products (i.e., ^{60}Cobalt and ^{54}Manganese).

c. NRC Evaluation of the Event

The inspectors attended the mock-up of the event, and examined the pre-job surveys, REP No. 71494 requirements, workers' statements, and licensee evaluation of the event. In review of the sequence of events, the inspectors noted several instances in which the licensee did not appear to be in compliance with NRC requirements and Technical Specifications.

(1) Radiological Surveys

The inspector reviewed NRC Information Notice (IN) No. 90-47, "Unplanned Radiation Exposures to Personnel Extremities Due to Improper Handling of Potentially Highly Radioactive Sources," dated July 27, 1990. The IN discussed several instances in which workers picked up highly radioactive sources resulting in unplanned radiation exposures to the extremities.

The licensee provided the inspectors with a Memorandum, "High Extremity Exposure Due to Improper Handling of Potentially Radioactive Objects," dated October 20, 1990. The memorandum, addressed to all site personnel from the Health Physics Manager, had cautioned workers not to pick up unidentified objects originating from the reactor cavity.

In discussion with the inspectors, the RS stated that he had been trained in the past not to pick up unidentified objects, and admitted that he should not have picked up the object

before a survey was performed. However, the RS added that he did not think the object could have been highly radioactive since the reactor coolant system had not yet been breached.

(a) Regulatory Criteria: 10 CFR 20.201(b) requires that each licensee shall make or cause to be made such surveys as (1) may be necessary to comply with the regulations in this part, and (2) are reasonable under the circumstances to evaluate the extent of the radiation hazards that may be present. As defined in 10 CFR 20.201(a), "survey" means 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.

(b) NRC Conclusion: The inspectors concluded that the licensee's failure to perform a survey, prior to the worker's handling of the object, constituted an apparent violation of 10 CFR 20.201(b) (50-206/93-06-01). During a telephone discussion on March 9, 1993, the licensee acknowledged the inspectors' observation.

(2) REP Requirements

As described in Section 2.a(6), the HPT stated that he informed the refueling workers he was leaving the refueling cavity to count the contamination smears, and instructed the workers not to enter the LC. The refueling workers maintained that they did not recall the HPT instructing them to stay out of the LC.

In discussion with the inspectors, the HPT indicated that he knew that he should not have left the reactor refueling cavity, but added that he was very concerned with the apparent contamination levels in the LC.

While the RS acknowledged that he should not have returned to the LC if there was not continuous health physics coverage, the RS maintained that he had not known the HPT had left the area.

The inspectors questioned licensee staff about their definition of "Continuous Coverage." Licensee staff indicated that continuous coverage meant "Line-of-Sight Coverage," and added "to keep an HPT in a high radiation area, in some cases, might not be consistent with As Low As Reasonably Achievable (ALARA) principles." However, in this case, they agreed that the continuous coverage requirement had been violated.

The inspectors noted that although the HPT should not have left the RS in the Zone III area of the UC, the radiological hazards associated with that location were minimal.

(a) Regulatory Criteria: Technical Specification (TS) 6.8.1 requires that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Appendix "A" of Regulatory Guide (RG) 1.33, Revision 2, February 1978.

RG 1.33, Appendix A lists, in part, the following procedures:

7. Procedures for Control of Radioactivity (For limiting materials released to environment and limiting personnel exposure)

e. Radiation Protection Procedures

(1) Access Control to Radiation Areas including a Radiation Work Permit System

Licensee Procedure SO123-VII-9.9, "Radiation Exposure Permit Program," Revision 11, dated September 10, 1992, Section 6.3.2 states that "All personnel covered by a Radiation Exposure Permit shall follow the requirements specified in the Radiation Exposure Permit."

Licensee Radiation Exposure Permit (REP) No. 71494, "Refueling Activities in Containment/Fuel Handling Building," Revision 4, dated February 19, 1993, Section VI lists, in part, the following special instructions:

2. Continuous health physics coverage is required for the following work:

a. Whole body Zone III entry with plastics and respirator

(b) NRC Conclusion: The inspectors concluded that the licensee's failure to adhere to REP No. 71494 requirements, in that an HPT did not provide continuous coverage and in that a worker returned to the LC without continuous health physics coverage, constituted an apparent violation of TS 6.8.1 (50-206/93-06-02). The licensee acknowledged the inspectors' observation.

(3) REP Limitations

The inspectors noted that REP No. 71494 did not allow work on items with contact dose rates greater than 30 rem/hr. However, as described in Section 2.a(6), the RS returned to the LC and picked up a foreign object that was subsequently calculated at 1188 rem/hr.

(a) Regulatory Criteria: Technical Specification (TS) 6.8.1 requires that written procedures shall be established, implemented, and maintained covering the applicable procedures recommended in Appendix "A" of Regulatory Guide (RG) 1.33, Revision 2, February 1978.

RG 1.33, Appendix A lists, in part, the following procedures:

7. Procedures for Control of Radioactivity (For limiting materials released to environment and limiting personnel exposure)

e. Radiation Protection Procedures

(1) Access Control to Radiation Areas including a Radiation Work Permit System

Licensee Procedure SO123-VII-9.9, "Radiation Exposure Permit Program," Revision 11, dated September 10, 1992, Section 6.3.2 states that "All personnel covered by a Radiation Exposure Permit shall follow the requirements specified in the Radiation Exposure Permit."

Licensee Radiation Exposure Permit (REP) No. 71494, "Refueling Activities in Containment/Fuel Handling Building," Revision 4, dated February 19, 1993, Section VI lists, in part, the following special instructions:

1. This REP does not allow the following:

a. Work on items with contact dose rates greater than 30 rem/hr

(b) NRC Conclusion: The inspectors concluded that the licensee's failure to adhere to REP No. 71494 requirements, in that a worker handled an object having contact dose rates greater than 30 rem/hr, constituted a second apparent violation of TS 6.8.1 (50-206/93-06-03). The licensee acknowledged the inspectors' observation.

(4) External Exposure Controls

As indicated in Section 2.a(4), the refueling supervisor placed his PD-1 inside his protective clothing, ice vest, and plastic protective clothing. The PD-1 alarmed during the work evolution for 33 seconds. The RS maintained, however, that he never heard the PD-1 alarm, and added that the reactor cavity was relatively noisy. Licensee tests of the PD-1 confirmed that the PD-1 had been properly functioning.

The inspectors noted that the RS's comment (regarding the reactor cavity being relatively noisy) was inconsistent with the RS's earlier statement that he heard the object fall on the LC floor. The inspectors were not able to test the noise level of the LC because the reactor cavity was flooded and fuel transfer was in progress.

On March 2, 1993, the inspectors raised questions regarding the lack of more timely corrective actions to prevent recurrence of similar events (i.e., improper placement of PD-1s). Licensee staff indicated that their investigation had not been completed and added that corrective actions would be initiated following the completion of the DIR.

(a) Use of PD-1s in Work Area: On March 3, 1993, the inspectors reviewed events described in NRC report No. 50-362/92-05, dated February 22, 1992. The report had noted that licensee procedures did not address the use of PD-1s in areas of high ambient noise level. Additionally, concerns were raised regarding the PD-1 alarms being muffled by a variety of factors.

The report added that the Unit 2/3 Health Physics Supervisor informed the inspector that actions would be taken to ensure that exposure controls for personnel issued alarming dosimeters under the TS 6.12.1.b exemption were adequate.

In response to the inspector's concerns, the licensee implemented changes to Procedure SO123-VII-5.2.17, "SAIC PD-1 Dosimeter and PDR-1 Reader Operation, Calibration, and Maintenance." SO123-VII-5.2.17 was modified to include the following statement:

> "In high noise areas, the audible alarm might not be heard; an earphone adapter or continuous Health Physics coverage may be required."

The inspectors noted that licensee procedures addressed the use of PD-1s in high noise areas, but did not contain specific instructions relating to the proper placement of PD-1s. In discussion with the inspectors, the licensee indicated that workers were verbally informed during their training sessions on the proper placement of their PD-1s.

(b) PD-1 Lesson Plan: The inspectors reviewed SONGS Lesson Plan No. DOS-PD1, "SAIC PD-1 Electronic Dosimeter," dated November 4, 1992. The lesson plan states that:

> "The PD-1 dosimeter should be worn on the upper torso near the thermoluminescent dosimeter (TLD). When protective clothing is used the PD-1 is to be

attached in accordance with the REP or special instructions from Health Physics."

The inspectors noted, however, that REP No. 71494 did not give workers any instructions regarding the placement of PD-1s. Additionally, the RS informed the inspectors that he did not recall being instructed or trained on the proper placement of PD-1s. In discussion with licensee staff, the inspectors pointed out that REP No. 71494 lacked specific instructions such as PD-1 placement and precautions not to pick up foreign objects.

(c) Additional Related Observations: On March 3, 1993, the RE indicated that he had worked in the LC on February 18, 1993. Upon exit of the Unit 1 control point, an HPT informed him that his PD-1 had alarmed on a high exposure rate (greater than 500 mR/hr). The RE stated that he told the control point HPT he had not heard the PD-1 alarm.

The HPT questioned the RE about the placement of his PD-1. The RE informed the HPT that he had placed it under his ice vest. The HPT advised him to place it on the outside of his ice vest to hear the alarm if it sounds.

Health physics supervisors and managers indicated that they had not been notified of this discrepancy. The inspectors informed the licensee that a Radiological Incident Report (RIR) should have been initiated as provided for by SO123-VII-9.3, "Reporting Radiological Incidents," Revision 5, dated April 2, 1991.

Licensee staff indicated that Procedure SO123-VII-9.3 was intended to be used for willful violations. The licensee added that since the February 18, 1993, event was not deliberate, an RIR was not issued.

On March 3, 1993, the inspectors raised additional concerns regarding the lack of more timely corrective actions in relation to the placement of PD-1s. The inspectors informed licensee staff that they had not taken measures to prevent similar events from recurrence.

On March 4, 1993, the licensee issued Memorandum "PD-1 Use When Worn With Protective Clothing," alerting health physics operational personnel of the above problems and directing them to be certain PD-1s were positioned such that:

- Their alarm can be clearly heard under the worst conditions that can exist.

- Their liquid crystal display can be seen by the worker and health physics personnel who may wish to check them.

(d) Regulatory Criteria: 10 CFR 19.12 requires, in part, that "all individuals working in a restricted area shall be kept informed of the radiation in such portions of the restricted area ... be instructed in the precautions and procedures to minimize exposure to radioactive materials, in the purpose and functions of protective devices employed, and in the applicable provisions of the commission's regulations and licenses."

(e) NRC Conclusion: The inspectors concluded that the licensee's failure to instruct workers on the purpose and functions of protective devices to minimize exposure to radioactive materials constituted an apparent violation of 10 CFR 19.12 (50-206/93-06-04). The licensee acknowledged the inspectors' observation.

(5) Additional NRC Evaluations

The inspectors raised additional concerns relating to planning and communication, procedural guidance, documentation, and actions of licensee personnel.

(a) Planning and Communication

The inspectors noticed several cases in which the Fuel Transfer System work could have been better planned and communicated by both the refueling workers and HP personnel. Specifically, the inspectors noted the following cases in which the lack of planning and communication were evident:

(i) As indicated in Section 2.a(2), the tailboard performed by the HPT discussed radiological conditions in the LC - the 40 R/hr hot spot and the 800 - 1000 mR/hr general area around the center of the upender. This information was based on a survey performed on February 17, 1993, with the upender basket in the horizontal position. A survey performed on February 18, 1993, with the upender in the vertical position, identified a 250 R/hr hot spot at the bottom of the upender basket.

Upon entering the LC, the RS maintained that the upender basket was in the vertical position. The inspectors noted that, based on the surveys reviewed and discussions with HPTs, the location of the hot spot had been changing every time a survey had been performed. The inspectors further noted that the

licensee did not inform the refueling workers of the 250 R/hr hot spot during the formal tailboard.

The licensee indicated that the RE was informed on February 18, 1993, of the 250 R/hr hot spot, and that the RS was informed during one of the informal tailboards on February 19, 1993, of the same hot spot. However, the inspectors noted that this information was not explicitly discussed during the formal tailboard.

(ii) The refueling workers failed to clearly identify the scope of their work to the HPT. The HPT stated that the refueling workers informed him that the job scope was limited to a cable connection inspection and a cutting of the striker plate.

However, as indicated in Section 2.a(6), the work scope included work evolutions such as cycling the upender, turn buckle adjustment, and lowering a drop-light into the fuel basket to verify no debris was causing the clearance problem. The inspector noted that these items were clearly outlined in Maintenance Order No. 91012102001 and an electronic mail message from a refueling engineer to the RS.

The RS stated that he presented a list of the job scope description but HP personnel did not recall receiving the list.

(iii) The licensee missed two prior opportunities to correct an identified deficiency (i.e. placement of the PD-1s). First, HP failed to effectively correct and communicate the deficiencies identified in Report No. 92-05. Second, HP failed to communicate the February 18, 1993, event to HP supervision via an RIR, allowing a second chance to rectify the weakness to pass unnoticed.

The inspectors concluded that while the work scope discussed during the formal tailboard was limited, the details of the work scope were fully discussed during the informal and formal tailboards.

(b) Procedural Guidance

During interviews with licensee personnel, the inspectors noted that the HP personnel understanding of the continuous coverage definition was inconsistent. For example:

- The refueling workers indicated that continuous coverage meant continuous presence of an HPT for the duration of the job.

- During interviews with licensee staff, the HPT stated that since he was "In-Voice Contact," he felt he had been providing continuous coverage. However, in discussion with the inspectors, the HPT indicated that he should not have left the reactor refueling cavity.

- The HP management indicated that continuous coverage meant "Line-of-Sight Coverage," but added that, "to keep an HPT in a high radiation area, in some cases, might not be consistent with As Low As Reasonably Achievable (ALARA) principles."

The inspectors were unable to find a definition of continuous coverage in licensee procedures or REPs. However, the HP Handbook, given to workers during their site training access, defined continuous coverage as follows:

> "Continuous coverage is defined as the HP technician having HP present at all times during the work evolution, or using remote video/audio gear to monitor him/her at all times. If the REP requires continuous coverage, and continuous coverage is not provided, exit the work area and contact HP."

(c) Documentation

(i) First Incident: The inspectors noted that Section 6.2.1 of Procedure SO123-VII-9.3, "Reporting Radiological Incidents," Revision 5, dated April 2, 1993, states the following:

> "Incidents involving external exposures in excess of administrative or regulatory limits and incorrect use of, tampering with, or damage to dosimetry devices will be documented on form HP(123) 15, External Dosimetry Investigation Form, in accordance with Reference 2.3.2."

The inspectors noted that the licensee did not document the February 18, 1993, event in which the RE incorrectly used his dosimetry device (i.e., placed his PD-1 under his plastic protective clothing and ice vest). The inspectors informed licensee staff that this was a missed opportunity to correct an identified deficiency. The inspectors added that, if

the incident on February 18, 1993, had been documented, it might have prevented the event on February 19, 1993.

(ii) Second Incident: The inspectors noted that Section 6.3.1 of Procedure SO123-VII-9.3, states the following:

> "Most violations of Health Physics procedures are inadvertent and, therefore, the issuing of Form HP(123) 286 for these cases is at the discretion of the Health Physics Supervisors. The determination of whether an ROR [Radiological Observation Report] [is] to be issued should be based upon the severity of the infraction, the effectiveness of the counseling subsequent to the infraction, and any other pertinent factors which may be involved."

The inspectors noted that the licensee did not initiate an ROR relating to the February 19, 1993, apparent violations of health physics procedures (e.g., apparent REP violations). The inspectors informed licensee staff that this was a second example of a failure to document an event in which workers had not complied with their REP. The licensee indicated that a DIR, a more thorough and a higher level investigative report, had been initiated.

The inspectors stated that if the RS had not admitted to picking up the object, a DIR and an ROR would not have been initiated. Furthermore, the RS's return to the LC without continuous HP coverage and the HPT's decision to leave the reactor cavity, both apparent REP violations, would have passed unnoticed.

Licensee staff indicated that Procedure SO123-VII-9.3 was intended to be used for deliberate violations, and added that they did not have a method for formally notifying supervision of discrepancies and weaknesses in HP programs. However, the licensee stated that a formal system of communicating programmatic weaknesses would be developed.

The inspectors concluded that the licensee's lack of a formal communication tool was a weakness that contributed to the failure to identify and correct HP deficiencies.

(d) Actions of Licensee Personnel

The inspectors raised some concerns regarding the actions of licensee personnel as follows:

- The HPT's decision to leave the LC, a very high radiation area, to count some smears
- The RS's decision to return to the LC without continuous HP coverage and to pick up the object
- The HPGF not taking proper steps to thoroughly evaluate the circumstances prior to allowing resumption of work

The licensee acknowledged the inspectors' observations regarding the HPT's and RS's actions, but indicated some disagreement with the inspectors.

The HPGF indicated that he thought the HPT had left his assignment of providing coverage. Additionally, he stated that he temporarily stopped work, investigated the radiological conditions, and decided that it was safe for the RS to complete his work.

The inspectors concluded that better planning, communication, and procedural guidance might have prevented this event. These matters addressed in the DIR as corrective actions will be further examined in a future inspection (50-206/93-06-05).

Three apparent violations of NRC requirements and one inspection followup item were identified.

3. Exit Interview

The inspectors met with members of licensee management at the conclusion of the inspection on April 9, 1993. The scope and findings of the inspection were summarized. The licensee acknowledged the inspectors' observations.