

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-312/88-07

Docket No. 50-312

License No. DPR-54

Licensee: Sacramento Municipal Utility District
14440 Twin Cities Road
Herald, California 95638-9799

Facility Name: Rancho Seco Nuclear Generating Station

Inspection at: Clay Station and Sacramento, California

Inspection Conducted: February 5 and 8, 1988

Inspector:

M. Cillis
M. Cillis, Senior Radiation Specialist

3/3/88
Date Signed

Approved by:

M. Cillis for / F. Wenslawski
G. P. Yuhas, Chief
Facilities Radiological Protection Section

3/3/88
Date Signed

Summary:

Inspection on February 5 and 8, 1988 (Report No. 50-312/88-07)

Areas Inspected: Special unannounced inspection by a regionally based NRC inspector in response to the licensee's February 4, 1988, report of a potential exposure to the extremity of a worker in excess of the regulatory limit. The purpose of the inspection was to determine if the licensee was dedicating sufficient resources to evaluate the potential exposure, to verify that the licensee was in the process of implementing additional measures to control potential exposures from similar radiation sources, and to perform a preliminary evaluation of the event. Inspection procedures 30703, 83729 and 93702 were addressed.

Results: The findings of this inspection will be identified as unresolved pending the completion of the licensee's investigation related to this matter.

DETAILS

1). Persons Contacted

a). Licensee

G. Carl Andognini, Chief Executive Officer, Nuclear
*J. McColligan, Director Plant Services
*F. Kellie, Radiation Protection Manager
*R. Bowser, Radiological Technical Support Superintendent
*S. Crunk, Manager, Licensing
*R. Jones, Licensing
S. Nicolls, Radiation Protection Superintendent
J. Reese, Radiation Health Superintendent
B. Rogers, Radiation Protection ALARA Specialist
P. Howard, Radiation Protection Supervisor
G. Hackett, Acting Radiation Protection Supervisor
D. Anderson, Radiation Protection Technician
*D. Le Gore, Quality Assurance Engineer
C. Helman, Radiation Protection Technician
W. Tearney, Acting Radiation Protection Supervisor

b). Contractor Personnel

(1). Applied Radiological Controls, Inc.

C. Stewart, Senior Radiation Protection Technician
D. Pilkington, Senior Radiation Protection Technician

(2). United Energy Services

R. L. Baron, Health Physicist Supervisor
A. Kamrowski, Health Physicist

* Denotes attendance at the exit interview conducted at the conclusion of the inspection.

The inspector also met and held discussions with other members of the licensee's and contractors' staff.

2. Background

On February 4, 1988, at 11:56 a.m. (PST) the licensee made a report pursuant to 10 CFR Part 50.72(b) of a potential exposure of 458 rem to the back of a worker's left knee from a microscopic particle of Cobalt-60 estimated to be 43 microcuries (μCi). In response to the notification, a Region V inspector was dispatched to the site on February 5, 1988, to perform a preliminary evaluation of the event.

The evaluation included interviews with the plant, technical (i.e. corporate) and contractor staffs, reviews of selected surveys and air sample data, licensee evaluations, selected procedures, Radiation Work

Permits (RWPs), personnel exposure and contamination reports, and statements obtained from involved licensee representatives.

The examination revealed that the Chief Executive Officer (CEO), Nuclear, had requested the plant staff to devote whatever resources and talents were necessary to assure that the evaluation of the potential exposure is completed in a timely manner. The CEO requested his staff to develop an Action Plan for performing the evaluation. He requested that the Action Plan be ready for his review by no later than February 10, 1988.

The licensee's initial response appeared to be consistent with the CEO's request. The worker's assigned skin dose had been reassessed and, as a result, had been changed from 458 rem to 523 rem. The licensee's staff stated that the 523 rem was a worst case estimate. The revised estimate of 523 rem was based on a re-review of the actual time that the worker had been in the area.

A brief description of the event is as follows:

The worker had been assigned to weld into place a drain line on the "A" Decay Heat Removal (DHR) Pump which is located on the -47' elevation of the auxiliary building. He had entered and exited the area on three separate occasions. The first entry was made between approximately 7:00 p.m. and 11:30 p.m. on February 3, 1988. A second entry was made between 1:20 a.m. and 3:30 a.m. on February 4, 1988. The final entry was made at 4:25 a.m. on February 4, 1988. The worker's final exit was made at approximately 6:40 a.m. on February 4, 1988. It was during the worker's final exit that the microscopic particle, measured at 43 μCi , was found on the backside of the knee of his left pant leg. The particle was determined to be on the inside surface of his trousers. The worker had been found to be uncontaminated during the earlier exits that were made at approximately 11:30 p.m., February 3, 1988, and at 3:30 a.m. February 4, 1988. The licensee concluded that the worker had picked up the hot particle sometime during his last entry into the work area.

3. Chronology of Events

I. Introduction

The following code will be used to identify involved individuals for the text which follows:

- ° Radiation Protection Supervisors (RPS) - 1, 2, 3, etc. (i.e. RPS-1, RPS-2)
- ° Radiation Protection Technicians (RPT) - 1, 2, 3, etc. (i.e. RPT-1, RPT-2)
- ° Worker 1, 2 or 3 (i.e. W-1, W-2, W-3)

For clarification purposes it should be noted that the worker receiving the potential high exposure will be identified as W-1 or Worker-1.

II. Sequence of Events

- a. RWP 88-075 was initiated on February 1, 1988. The RWP authorized the repair of the "A" Decay Heat Removal Pump drain line. Average contamination levels were listed as 25,000 dpm per 100 square centimeters (dpm/100 cm²) while maximum levels of contamination were greater than 1E6 dpm/100 cm². The RWP required that contaminated surfaces in the work area be covered with plastic sheeting or herculite. Protective clothing (PCs) consisted of a minimum of two pairs of coveralls, cotton and rubber gloves (two pair) and shoe covers.

Radiation levels in the area were listed as 10 mrem/hr general area with hot spot readings up to 800 mrem/hr.

The RWP required a full face respirator be worn for entry into a posted airborne area and for any operation involving decontamination, grinding, or welding.

The RWP specified that a Radiation Protection Technician would be on call and would provide zone coverage while the work was in progress.

The RWP did not require the use of process or other engineering controls as a means of limiting concentrations of radioactive materials in air or the spread of contamination.

- b. On February 2, 1988, it was determined that the drain line would have to be replaced because attempts to repair it had been unsuccessful. This was brought to the attention of RPT-1. RPT-1 notified RPS-1 of the job scope change. RPS-1 decided to wait for a change in the work request to come through before evaluating the need for changes in the RWP. Subsequently, RPS-2 working on grave shift was also made aware of the change in job scope on the morning of February 3, 1988, at approximately 1:30 a.m. RPS-2 reviewed the new work request and decided that the existing RWP was adequate. He informed the worker that presented him with the work request change that he felt the existing RWP was adequate. He did not inform anyone of his decision, but annotated the work request to require the workers to notify the radiation field office prior to starting the work.
- c. On day shift, February 3, 1988, the Radiological Protection Technical Support Superintendent became aware of the job scope change. The superintendent instructed her staff to establish "Hot Particle Zone" controls for the work in accordance with procedures in the licensee's Radiation Control Manual. The staff was asked to modify RWP-88-075 accordingly. This task was assigned to RPS-3 and to the shift ALARA Technical Analyst (ATA). The ATA and RPS-3 were not informed that RPS-2 had performed a review of the new work request and therefore, they were not aware that RPS-2 felt that the RWP was adequate (see paragraph II(b) above). RPS-3 and the ATA believed that they

could change the RWP when the revised work request came through the radiation protection (RP) field office. RWP 88-075 had not been cancelled up to this point.

- d. Maintenance workers were assigned to cut out the drain line during the afternoon of February 3, 1988. The maintenance workers did not remember if they stopped by the radiation protection field office to inform the radiation protection group of their intentions to commence the work.
- e. The valve was cut out at approximately 5:00 pm on February 3, 1988. The valve, reading 350 mrem/hr on contact and 18 mrem/hr at one foot, was placed on a piece of herculite to one side of the Decay Heat Removal Pump. One end of the herculite was pulled over the valve to cover it.
- f. Dayshift RPT-3 relieved RPT-2 at about the time the drain line was cut out. He notified the RP field office and informed the ATA and the RPS-3 that the drain line had been cut out. RPT-3 was instructed to stop the job until a "Hot Particle Zone" could be established. RPT-3 was also instructed on the types of surveys to perform and to instruct the workers accordingly.

RPT-3 established the "Hot Particle Zone" without conspicuously posting the area as required by procedures AP 305-7, AP 305-8A and AP 305-9 (see paragraph 4, herein); however, he did brief the workers on his shift concerning how the zone was set up and how they were to enter and exit from the area. RPT-3 made it clear to the workers that he would monitor the area, equipment and them when they exited the work area. RPT-3 said he subsequently provided his relief, RPT-4, with the same type of briefing.

A detailed radiation and contamination survey was performed by RPT-3 at about 6:30 p.m. The survey report indicated that a "Hot Particle Zone" had been established. The report indicated that no particles were found on the workers or the tools. A bag of trash reading 1500 mrem/hr on contact was removed from the work area and taken to the waste compactor area for packaging.

The contamination survey identified one swipe reading of 240 mrad/hr which was collected underneath the piece of herculite (outer edge) that had been placed in the work area for the workers to lie on. General contamination levels in the work area ranged from 2,000 to 50,000 dpm/100 cm². There was no indication that any decontamination efforts had been made during the work that was accomplished to this point.

- g. A change of shift occurred at approximately 7:00 p.m. RPT-3 briefed RPT-4, stating that "Hot Particle Zone" controls had been established and relaying the instructions he had received from the ATA. RPT-3 informed RPT-4 that continuous coverage of the work had been established and that surveys of equipment and

personnel exiting the area were required. Workers 1, 2 and 3 showed up to continue with the replacement of the drain line.

- h. RPT-4 stated that, after being briefed by RPT-3, he provided continuous coverage until the lunch break which was taken at approximately 11:30 p.m. RPT-4 said he informed W-1, W-2 and W-3 that a "Hot Particle Zone" was in effect.

RPT-4 conducted a contamination survey of the work area and of all three workers and their tools prior to breaking for lunch. Contamination levels in the work area were lower than reported in the survey performed at 6:30 p.m. No hot particles were found on the workers or their tools. RPT-4 stated he informed the three workers they should notify him when they returned from lunch. RPT-4 said he did not brief the workers as he had been briefed by RPT-3.

- i. The three workers returned to the work site at 1:20 a.m. on February 4, 1988, to complete the installation of the drain line. The three workers exited the work area for a break at approximately 3:30 a.m. and returned to complete the installation of the drain line at about 4:25 a.m.

RPT-4 informed the inspector that he did not provide continuous coverage for the remainder of his shift, which concluded at approximately 5:00 a.m., because the workers did not inform him when they returned to the work site at about 1:20 a.m. However, the inspector noted that RPT-4 documented a radiation survey performed on the Decay Heat Removal Pump at 2:00 a.m. on the same morning and should have seen the workers in the area after they had returned at 1:20 a.m.

RPT-4 informed the inspector that the valve discussed in paragraph e., above, was seen lying adjacent to the pump; however, at this time it was not contained in any wrappings. He stated that he bagged the high reading valve and set it aside. RPT-4 felt that the valve may have been the source of the hot particle which was subsequently found on W-1.

RPT-4 was relieved by RPT-5 at approximately 5:00 a.m. RPT-4 informed the inspector that he failed to brief his relief during the turnover as he had been briefed the evening before.

The inspector was unable to determine the reason for the discrepancy in the statements obtained from RPT-4 because he had subsequently terminated his employment as a contract RPT. Discussions with the licensee's staff disclosed that they also received some conflicting statements from RPT-4 which they may not be able to clarify.

W-1 informed the inspector that he did not remember being told of the "Hot Particle Zone" or being requested to contact RPT-4 before returning to work at 1:20 a.m. The inspector did not

get the opportunity to pose the same question to Workers 2 and 3 during the inspection.

- j). Workers 1, 2 and 3 had exited the work area at 3:30 a.m. and had returned at 4:25 a.m. Worker 1 stated that he and the other two workers had performed a whole body frisk at the control point exit located on the +40' elevation of the auxiliary building. Worker 1 stated that no contamination was detected by the PCM-1B monitor during the earlier exit of 11:30 p.m. on February 3, 1988, or the 3:30 a.m. exit of February 4, 1988.

Worker 1 added that he and his coworkers were not monitored by RPT-4 prior to exiting at 3:30 a.m.

- k). Workers 1, 2 and 3 returned to the job site at approximately 4:25 a.m. Worker 1 stated that he completed the installation of the drain line, and approximately one half hour prior to exiting one of his coworkers left the work area to notify RPT-5 that they were exiting. They requested that RPT-5 come down and survey them and their equipment. Worker 1 stated that there was no telephone located in the work area so his coworker had to go up to the -20' elevation to make the call.

Worker 1 added that he and his coworkers cleaned up the area and after waiting for approximately 15-20 minutes for RPT-5 to show up they decided to leave.

Worker 1 said that he had seen an additional step-off-pad (SOP) in the area, but did not understand why it was there. He added that he was not made aware of any special undressing procedures that had to be followed. He also said that he exited the area as he had at 11:30 p.m. on February 3 and again at 3:30 a.m. on February 4, 1988. Worker 1 said that he left the -47' elevation with a pair of tennis shorts and tennis shoes. Upon arriving at the -20' elevation personnel frisking station he attempted to frisk himself with an Eberline, Model RM-14 frisker equipped with an HP-260 pancake probe. He said that he observed an abnormal count or high background. His coworker checked out with no abnormal measurements.

Worker 1 said that he then proceeded to the grade elevation of the auxiliary building where he attempted to frisk himself again with another RM-14 survey meter. He said that he got the same response from the meter so he decided to don his blue jeans and a shirt that were in a locker, located adjacent to the personnel frisking station. He added that his coworkers checked out clean. It should be noted that Worker 1 did not perform a whole body frisk. He had only performed a cursory check of his upper torso (above the belt line) during the frisk he performed on the -20' and grade elevations.

The inspector asked W-1 why he and his coworkers didn't attempt to call RPT-5 and/or the Shift Supervisor as required by

licensee procedure AP 305, Article 2, Line Item No. 18. The inspector added that specific instructions consistent with Line No. 18 are provided in the General Employee Training (GET) program which W-1 had last attended on March 3, 1987. The inspector also added that telephones were available on the -20' and the Grade elevations of the auxiliary building. The inspector concluded by stating that RPT-5 had no way of knowing whether W-1 may have been contaminated at that time. Worker 1 stated that they had already waited 20-30 minutes for RPT-5 to show up and since RPT-5 didn't respond to their earlier call, he decided to leave. The inspector reminded W-1 that the status had changed such that there was an indication that he may have been contaminated and therefore another call should have been made for RPT-5 or the Shift Supervisor.

Worker 1 said after leaving the grade level he proceeded to the control point exit on the +40' elevation at which point the PCM-1B Eberline gas proportional monitor began to alarm when he was 3 to 4 feet away. Workers 2 and 3 had checked out clean.

The RPTs at the control point determined after about one-half hour that Worker 1 had a particle on the inside of his trousers in the area of the knee of his left leg.

The particle, which was later identified as 43 μ Ci, Cobalt-60, was measured with an Eberline RO-2 survey meter. The readings were:

1600 mrad/hr - Beta
 27 mrem/hr - gamma
 0.6 mrem/hr @ 1 foot gamma

It should be noted that RPT-5 who came on shift at 5:00 a.m. on February 4, 1988, stated that he had not been briefed by RPT-4 about a Hot Particle Zone being in effect. He said RPS-3 mentioned that a "Hot Particle Zone" was established in the pump room and was shown a copy of the survey report documented by RPT-3 after the 6:30 p.m. survey was performed. He added that the survey report did not clearly define the hot particle zone. RPT-5 said he inspected the area at the beginning of his shift and had concluded that the "Hot Particle Zone" was not in the area where Workers 1, 2 and 3 were working; therefore, he did not provide continuous coverage for the work that was performed between 5:00 a.m. and 6:40 a.m.

RPT-5 said the Hot Particle Zone was not conspicuously posted and it wasn't made clear to him exactly where it was by RPS-3.

RPT-5 said that he did not immediately respond to the workers' request for a personnel survey because he was not aware that he was required to monitor them prior to exiting or that Worker 1 was potentially contaminated.

RPT-5 did make one entry during the shift to perform a radiation measurement at which time he adjusted some of the radiation area hot spot postings. The survey was taken with a minimum of protective clothing which consisted of shoe covers (plastic flats) and cotton and rubber gloves even though the area was classified as a "Hot Particle Zone" on the survey report taken at 6:30 p.m., February 3, 1988.

4. Controlling Documents

a. Procedures

The following procedures from the licensee's Radiation Control Manual were reviewed:

<u>Procedure No.</u>	<u>Title</u>	<u>Revision</u>	<u>Date</u>
AP.305	Radiation Control Manual	Rev. 20	10-31-87
RP.305-4	Radiation Work Permits	Rev. 0	12-09-87
RP.305-7	Area Definitions and Posting	Rev. 0	12-29-87
RP.305-8A	Routine and Radiation Work Permit Surveys	Rev. 0	12-02-87
RP.305-9	Contamination Limits and Control for Plant Surfaces	Rev. 0	12-22-87

b. Observations

- (1) AP-305-4, paragraphs 6.2.8, 6.2.10 and 6.2.10.9 and AP 305-9, paragraph 6.2.3.1 state in part:

Paragraph AP 305-4

"6.2.8 Using the job description, radiological conditions, as determined from the survey, and the ALARA Group recommendations, determine the requirements for protective clothing, engineering controls, respiratory protective equipment and dosimetry (refer to Enclosure 8.4 for Protective Clothing Selection Guidelines)."

"6.2.10 In determining the protective clothing requirements and any special instructions pertinent to the work being done, the following items should be considered...."

"6.2.10.9 If planned work involves the opening of a system, it may be necessary to wait until the system is opened to determine maximum contamination or airborne radioactivity levels. Full protective clothing and full face respirator are the minimum requirements for

opening a primary system because of concern for beta dose and hot particles, unless containments isolate the worker from the open system."

AP 305-9

"6.2.3.1 For jobs with high potential for spreading contamination it may require use of containments, tents or work enclosures, and HEPA filters (per RP.305-31). Normally, the group performing the work will be responsible for setting up a containment, which is then inspected by RP personnel. General use HEPA filters units are available from RP. Special applications like asbestos work or RCP pump replacement may require a dedicated HEPA provided by the work group in accordance with RP guidelines."

Finding: The use of engineering controls as is recommended by 10 CFR Part 20.103(b)(1) and the above licensee procedures for minimizing airborne radioactivity levels were not prescribed for the initial and subsequent work that was accomplished during the repair and/or removal of the drain line. The licensee does maintain a supply of controlled vacuum cleaners and portable exhaust units equipped with HEPA filters which, if utilized, could have prevented the spread of contamination and/or hot particles.

Finding: RWP 88-075 did not provide precautions to indicate the potential for Hot Particles when the system was opened (see paragraph 6.2.10.9)

(2) AP 305-8A, Section 5 states in part:

"5.0 PRECAUTIONS

"5.1 Hot particles represent a significant problem in detection and control. When found or suspected; immediately notify the Rad OPS Supervisor and perform the following:

"5.1.1 The area will be posted per RP.305.7 and access controlled by RWP.

"5.1.2 Hot particles will be bagged and submitted for isotopic analysis, unless otherwise directed by RP Supervision.

"5.1.3 Large areas (maslin) contamination surveys should be conducted on surfaces in the area of discovery.

"5.1.4 All protective clothing used in the area will be segregated, and surveyed in detail for additional hot particles prior to being sent out for laundry.""

AP 305-7, Section 6.7 states in part:

"6.7 Hot Particle Zone

- "6.7.1 Hot Particle Zones must be conspicuously posted as a Contaminated Area per 6.6 and with a Hot Particle Zone sign.
- "6.7.2 Entry into a Hot Particle zone requires an RWP and continuous Radiation Protection coverage.
- "6.7.3 Double Step-Off Pads are required to be established at the exits from these areas.
- "6.7.4 Personnel exiting these areas are required to be surveyed to ensure they are free of hot particles."

and AP 309, Section 6.7 states in part:

"6.7 Hot Particle Control Requirements

When hot particles are found or suspected, an RP Tech will:

- "6.7.1 Post the area, report to RP Supervision and control access by RWP.
- "6.7.2 Bag and label the hot particle(s) in accordance with RP.305.9A, and submit for isotopic analysis unless otherwise directed by RP Supervision.
- "6.7.3 The RP Tech will escort the hot particle(s), unless directed otherwise by RP Supervision.
- "6.7.4 Conduct large area (maslin) contamination surveys on surfaces in the area of discovery and the transfer routes.
- "6.7.5 Segregate all protective clothing used in the area. Notify Radwaste Supervision. Survey in detail for additional hot particles prior to sending out for laundry.
- "6.7.6 Store and dispose of hot particles as directed by Radwaste Supervision."

Finding: Continuous coverage as required by AP 305-7 was not provided after the "Hot Particle" program had been established at the request of the ATA.

Although the area was designated as a Hot Particle Zone, RPT-3 stated that it was not conspicuously posted with barriers and signs to clearly define it to personnel working in the area.

The examination disclosed that personnel working on the same shift as RPT-3 were briefed on the requirements for working in the "Hot Particle Zone"; however, the examination also disclosed that RPT-4 failed to properly brief Workers 1, 2, or 3 and RPT-5 on the "Hot Particle Zone" and how to control activities in the area. Workers 1, 2, and 3 informed the inspector that they exited from the area as they normally would; however, if so instructed they would have removed the first pair of protective clothing at the first step off pad (SOP) and the second set at the second SOP.

RPT-5 also stated that he was not sure where the "Hot Particle Zone" was because it wasn't conspicuously posted.

RPT-4 informed the inspector that he failed to give the workers and RPT-5 a good briefing.

The hot swipe (i.e. 240 mrad) obtained by RPT-3 was not bagged and submitted for isotopic analysis as required by AP 305-8A and AP 305-9.

Personnel and equipment were not surveyed after 11:15 p.m. February 3, 1988. The only surveys performed after 11:15 p.m. were a hot spot survey at 2:00 a.m. and a general area survey at approximately 5:30 a.m. February 4, 1988.

- (3) The inspector noted that the procedures related to the "Hot Particle Zone" control program do not provide instructions concerning the criteria to be applied by RPTs for suspecting when they have a Hot Particle problem. The inspector asked RPSs 1, 2, 3 and 4 and RPTs 1, 2, 3, 4 & 5 if they knew how to determine if there was a Hot Particle problem. One RPT stated that he had received some training at another utility company related to Hot Particles and fuel fragments. The others did not know exactly how to make the determination (see Report Section 5).
- (4) Paragraph 6.2.2.1.3 of AP 305-8A prescribes the frequency for performing routine and RWP surveys. Paragraph 6.2.2.1.3.2 of the procedure requires that surveys be performed to monitor changing conditions. Paragraph 6.2.3 of the procedure states in part that for some evolutions, this may mean performing several surveys in one day.

Finding: A review of surveys for the work performed between 5:00 p.m. February 3, 1988, and 7:40 a.m. February 4, 1988, revealed that surveys taken after 11:15 p.m., February 3, 1988 did not include contamination surveys of the work area or of the equipment and personnel and therefore could not have

identified whether the contamination or Hot Particle problems identified from the earlier surveys had changed.

5. Training and Implementation of Information Notices (INs)

The inspector examined the current status of RPTs and workers training related to the following areas:

- ° General Employee's Training (GET)
- ° IN 87-39, "Control of Hot Particle Contamination at Nuclear Power Plants"
- ° IN 86-23, "Excessive Skin Exposures due to Contamination with Hot Particles"

The Radiation Protection Manager provided the inspector with copies of correspondence providing information on the licensee's plans for the implementation of IN 87-39 and 86-23.

Through discussions and a review of training attendance records, the inspector determined that the Hot Particle training for RPTs was not scheduled for completion until June 1988. Only a portion of the training had been provided. The RPM stated there had been numerous meetings discussing the implementation of IN 87-39 and 86-23. He added that it was decided to provide the training of workers and RPTs in stages. The first stage was attended by all RPTs except for RPT-4; however, the inspector verified that RPT-4 had read all controlling documents related to the "Hot Particle Zone" control program.

Discussions held with the Training Supervisor revealed that the Hot Particle Training Program was phased into GET on October 10, 1987. The phase-in has been gradual and has been updated on two or three occasions since then. The most recent update of the GET program was made on February 1, 1988. Worker 1 had not attended GET since March 3, 1987; therefore, he had no exposure to the hot particle training program provided in the GET program. One of the two workers that worked with Worker 1 had attended a later GET class that was presented on January 5, 1988. This class provided attendees with a general overview of IN 87-39 concerns. The class did not discuss "Hot Particle Zone" control.

The Radiation Protection Manager stated that a SMUD staff member had attended workshops conducted by counterpart utility companies located in Region V area and that he has dispatched a staff member to a Region V utility company following this event. The RPM added that the utility company had an established hot particle program which will be considered for use at SMUD. The RPM went on to state that the hot particle training program would now be scheduled for completion at an earlier date than was originally scheduled.

6. Other Licensee Actions/Observations

a. Other Licensee Actions

The inspector noted that the licensee had taken or were taking the following actions:

- ° The involved worker was sent to University of California Medical Center for an examination by a Nuclear Physicist and physician.
- ° Arrangements were made for obtaining bioassay samples from the worker and to schedule the worker for a whole body count.
- ° The hot particle and the worker's protective clothing were saved. The licensee's staff planned to survey the worker's PCs to see if any useful information can be obtained. They also intend to send the Hot Particle to an offsite laboratory for an independent analysis. The staff also plans to evaluate where the particle was on the worker's jeans (i.e. inside or outside).
- ° A Standard Test Procedure (STP) was being developed to run a mockup of the event. The purpose of the mockup will be to determine when the Hot Particle was transferred to the worker's trousers. The licensee staff indicated there was the possibility that the Hot Particle was lodged on the worker's shoe when he exited the work area at 6:40 a.m. on the day of the event. The staff added that the worker may have transferred the hot particle from his shoe when he put on his trousers while on the Grade Level. The Hot Particle will be used in an attempt to duplicate the abnormal readings experienced by Worker 1 when he frisked himself on the -20' and Grade level of the auxiliary building. The coworkers that exited with Worker 1 will be asked to witness the tests to ascertain whether the background levels experienced by Worker 1 are identical to those of February 4, 1988.
- ° Interviews with the involved workers were ongoing at the time of this inspection. Statements obtained from individuals were being reviewed for conflicting data.
- ° Worker 1's thermoluminescent dosimeter (TLD) was processed. The TLD showed that the worker received a whole body dose of 105 mrem. This was consistent with the dose measured by the individuals pocket ionization chamber (PIC), which showed 100 mrem. No shallow dose (beta) was reported.
- ° Detailed followup surveys (i.e. radiation and contamination) of the workers' exit route and clothing lockers were performed. No abnormal measurements were reported.

b. Other Observations

- ° A review of security records and dosimetry records for the period of February 1, 1988, through February 4, 1988, disclosed that the Radiation Protection Superintendent and staff of three RPSs identified in this report had not visited the job site.
- ° Internal communication for involved personnel within the Radiation Protection group was poor. There was inattention to detail. The inspector expressed some concern about the decision reached by RPS-2 when he determined that RWP 88-075 was adequate after the job scope had changed. The decision was not consistent with the guidelines in AP 305-4, paragraph 6.2.10.9 and what was subsequently decided by the Radiological Protection Technical Support Superintendent (see paragraph 3(c)).

This matter (Report Sections 2-6) is considered unresolved (88-07-01). Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, violations or deviations.

7. Exit Interview

The inspector met with the licensee representatives (denoted in paragraph 1) at the conclusion of the inspection on February 8, 1988. The scope and findings of the inspection were summarized. The inspector stated that the single, most significant contributing factor associated with the event was failure to comply with controlling procedures, particularly AP 305-7.

The inspector said it may never be determined with any degree of certainty how and when the hot particle was deposited on the worker because Worker 1 failed to comply with the instructions every worker receives as part of GET and as required by AP 305, Article 2, Line Item 18. The inspector added that factors contributing to the event were:

- a. Failure of RPT-4 to perform his job and adequately brief the workers and RPT-5 that a "Hot Particle Zone" had been established.
- b. Failure to complete the Hot Particle Training program for workers and RPTs.

The inspector added that there were missed opportunities that could have mitigated the event, such as:

- ° Failure to cancel RWP 88-075 when it was first learned that the scope of the job was to change. The Radiation Protection staff was made aware of the change two days before the event occurred.
- ° Failure to provide appropriate supervision.

- The poor communications within the Radiation Protection group.
- Worker 1's failure to call for radiation protection assistance at the -20' or the grade elevation of the auxiliary building.
- Failure of worker 1 to perform an adequate whole body frisk on the -20' and grade elevations.
- RPT-5's failure to respond to the call for a survey in a timely manner.

The inspector concluded by stating that the findings of this inspection will be identified as unresolved pending the completion of the licensee's evaluation and submittal of their 30 day 10 CFR Part 20.405 report.

The inspector added that a special inspection will be scheduled upon receipt of the 10 CFR Part 20.405 report.