



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
612 EAST LAMAR BLVD, SUITE 400  
ARLINGTON, TEXAS 76011-4125

June 6, 2008

Mr. James Shetler, Assistant General Manager  
Energy Supply  
Sacramento Municipal Utility District  
6201 'S' Street  
P.O. Box 15830  
Sacramento, California 95852

SUBJECT: NRC INSPECTION REPORT 050-00312/08-001

Dear Mr. Shetler:

A Nuclear Regulatory Commission (NRC) inspection was conducted from April 14 through May 16, 2008, at your Rancho Seco Nuclear Generating Station. At the end of the site visits on April 17, 2008, and April 26, 2008, the inspectors briefed the Plant Closure and Decommissioning (Plant Manager) regarding the preliminary inspection findings. A telephonic exit briefing was conducted with the Plant Manager on May 19, 2008. The enclosed inspection report presents the scope and results of the inspection.

The inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection included reviews of your self-assessment, auditing, and corrective action programs, maintenance and surveillance activities, decommissioning performance, occupational radiation exposure, and final status surveys.

Based on the results of this inspection, the NRC has determined that a Severity Level IV violation of NRC requirements occurred involving failure to implement the Emergency Plan. This non-repetitive, licensee identified violation is being treated as a Non-Cited Violation (NCV), consistent with Section VI. A of the Enforcement Policy. This violation is described in Section 4.3 of the inspection report. If you contest the violation or significance of the NCV, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington DC 20555-0001, with copies to: (1) the Regional Administrator, Region IV; (2) the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

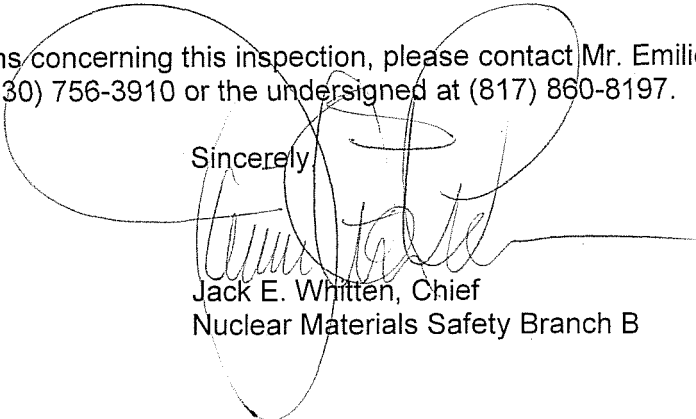
In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/Adams.html>. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the public without redaction.

Sacramento Municipal Utility District

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Should you have any questions concerning this inspection, please contact Mr. Emilio Garcia, Health Physicist, at (530) 756-3910 or the undersigned at (817) 860-8197.

Sincerely,



Jack E. Whitten, Chief  
Nuclear Materials Safety Branch B

Docket No.: 050-00312

License No.: DPR-54

Enclosures:

1. NRC Inspection Report 050-00312/08-001  
(w/Attachments 1 & 2)
2. ORISE Survey Report DCN 1695-SR-02-0

cc w/enclosure:

Thomas A. Baxter, Esq.  
Shaw, Pittman, Potts & Trowbridge  
2300 N. Street, N.W.  
Washington, DC 20037

QA/Licensing Superintendent  
Rancho Seco Nuclear Generating Station  
14440 Twin Cities Road  
Herald, CA 95638-9799

Sacramento County Board  
of Supervisors  
700 H. Street, Suite 2450  
Sacramento, CA 95814

Assistant General Counsel  
Sacramento Municipal Utility District  
6201 S Street  
P.O. Box 15830  
Sacramento, CA 95852-1830

Radiation Program Director  
California Radiologic Health Branch  
State Department of Health Services  
P.O. Box 997414 (MS 7610)  
Sacramento, CA 95899-7414

Site Document Control Supervisor  
Sacramento Municipal Utility District  
Rancho Seco Nuclear Generating Station  
14440 Twin Cities Road  
Herald, CA 95638-9799

Commissioner's Office  
California Energy Commission  
1516 Ninth Street (MS 34)  
Sacramento, CA 95814-5512

U.S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Docket No.: 050-00312  
License No.: DPR-54  
Report No.: 050-00312/08-001  
Licensee: Sacramento Municipal Utility District  
Facility: Rancho Seco Nuclear Generating Station  
Location: 14440 Twin Cities Road  
Herald, California  
Dates: April 14 through May 16, 2008  
Inspectors: Emilio M. Garcia, Health Physicist  
James L. Montgomery, Health Physicist  
Accompanied by: Thomas H. Youngblood, Jr., Health Physicist Reactor  
Decommissioning Branch, Office of Federal and State  
Materials and Environmental Management Programs  
Approved By: Jack E. Whitten, Chief  
Nuclear Materials Safety Branch B  
Attachments: Supplemental Information  
Partial List of Documents Reviewed

## EXECUTIVE SUMMARY

### Rancho Seco Nuclear Generating Station NRC Inspection Report 050-00312/08-001

This inspection was a routine, announced examination of the decommissioning activities being conducted by the licensee at the Rancho Seco Nuclear Generating Station. Areas reviewed by the NRC inspectors included self-assessment, auditing, and corrective action programs, maintenance and surveillance activities, decommissioning performance, occupational radiation exposure, and final status surveys.

#### Self-assessment, Auditing and Corrective Action

- The licensee had effectively maintained its Corrective Action Program (CAP) used to control the identification, evaluation, and resolution of problems (Section 1.1).
- Audits completed by the licensee in calendar year (CY) 2007, and those scheduled for completion in CY 2008, when completed will collectively addressed all facility activities that are required to be audited. All auditors satisfied the qualification requirements (Section 1.2).

#### Maintenance and Surveillance

- The licensee had no safety-related structures, systems or components, and the requirements of the Maintenance Rule were no longer required to be implemented at this site. The licensee had continued to maintain their schedule on other surveillances and routine tests (Section 2).

#### Decommissioning Performance and Status Review

- The licensee continued efforts to dismantle and remove contaminated components and to remediate contaminated surfaces in a safe manner. The licensee had completed final status surveys on 217 of the projected 295 survey units (Section 3).

#### Occupational Radiation Exposure

- A licensee audit of the occupational radiation exposure program was conducted by the licensee in accordance with quality assurance program requirements (Section 4.1).
- The licensee maintained an effective program for monitoring occupational radiation exposures. Occupational exposures for CY 2007 were determined by the inspectors to be below regulatory limits (Section 4.2).
- A non-cited violation related to the licensee's failure to follow the Emergency Plan was identified (Section 4.3).

### Inspection of Final Status Surveys

- The ORISE staff conducted confirmatory measurements on selected surfaces of the auxiliary building, including embedded piping. The results of the ORISE surveys conducted during this inspection will be reported at a later date (Section 5).
- The results of survey activities conducted by ORISE during the December 10 through 13, 2007, site visit were documented on a report issued on March 12, 2008. A copy of this ORISE report is attached to the inspection report as Enclosure 2. With the exceptions of the elevated direct reading measurement identified by ORISE in two locations, the ORISE surveys confirmed the accuracy of the licensee's final status survey results for the locations surveyed (Section 5).

## Report Details

### Summary of Facility Status

The Rancho Seco Nuclear Generating Station was permanently shut down in June 1989. All spent reactor fuel has been moved to an onsite Independent Spent Fuel Storage Installation (ISFSI). At the time of this inspection, the licensee was conducting decommissioning activities under the provisions of the incremental decommissioning option of Rancho Seco's Post Shutdown Decommissioning Activities Report (PSDAR) dated March 20, 1997.

Decommissioning work activities conducted by the licensee under the PSDAR included the auxiliary building, reactor building, spent fuel building, and exterior areas. All major components located in these buildings and areas had been removed, packaged, and shipped offsite for disposal. In the auxiliary building, remediation and final status survey activities were being conducted. In the reactor building, the concrete and steel removal project continued with approximately 28.6 million pounds of the concrete and steel being removed and shipped offsite. As part of planned decommissioning activities, on April 26, 2008, the reactor building polar crane was brought down by the licensee's contractor using explosives. In the fuel handling building, remediation of the surfaces continued. At the time of the inspection, the licensee had completed final status surveys of approximately 73 percent of all survey units.

#### **1 Self-assessment, Auditing, and Corrective Action (IP 40801)**

##### 1.1 Identification, Evaluation, and Resolution of Problems

###### a. Inspection Scope

The inspectors reviewed the licensee's administrative procedures that control the identification, evaluation, and resolution of problems.

###### b. Observations and Findings

The licensee's program for assessing the resolution of non-conformances, material or programmatic deficiencies, and conditions adverse to quality or safety remained as described in Section 1.2 of Inspection Report 050-00312/2006-002 and Section 1.2 of Inspection Report 050-00312/2007-002. There were no changes to the procedures of the Rancho Seco CAP since this program area was last inspected by the NRC in April 2007.

During CY 2007, 20 Potential Deviation from Quality (PDQ) reports were initiated and 11 were determined to be a Deviation from Quality (DQ). As of April 16, 2008, the inspectors noted that 13 PDQs had been initiated by the licensee during the calendar year with 6 determined to be DQs. No Corrective Action Requests or Stop Work Orders have been initiated in CY 2007 or as of the date of this inspection in CY 2008. The inspectors reviewed the list of PDQs and DQs

that remained open. There were 15 items that remained open, including 8 opened in CY 2008. The oldest item remaining open was from CY 2005. The inspectors concluded that the licensee was appropriately addressing the timely resolution of these open items.

The inspectors reviewed agendas and minutes of Commitment Management Review Group (CMRG) meetings and noted that the CMRG had met, at a minimum, monthly as required by Rancho Seco Administrative Procedure (RSAP) RSAP-0260, Commitment Management Review Group & Compliance Management Tracking Systems. The CMRG membership was composed of the individuals described in RSAP-0260. The meeting records reviewed by the inspectors indicate that the CMRG was conducting initial reviews and providing characterizations of the new PDQs. Additionally, the CMRG was assigning tasks, establishing priorities, and reviewing proposed resolutions for PDQs and other identified problems. The inspectors concluded that the licensee was effectively maintaining the Rancho Seco CAP that was established by the licensee to control the identification, evaluation, and resolution of problems.

c. Conclusion

The licensee was effectively maintaining the CAP that was established by the licensee to control the identification, evaluation, and resolution of problems.

1.2 Quality Assurance Audit Organization, Staffing, and Qualifications

a. Inspection Scope

The inspectors reviewed the licensee's process of conducting Quality Assurance (QA) audits and surveillances. Additionally, the inspectors examined the status and composition of the QA audit organization, including the staffing and qualifications of individual members.

b. Observations and Findings

The inspectors noted that the composition of the licensee's QA audit organization had not changed since the last inspection, conducted in April 2007, but some of the individual staff member in specific positions had changed. Of particular note, one of the lead auditors had left the organization and had been replaced by another full time auditor. The records reviewed by the inspectors indicated that additional auditors had been brought in as needed to conduct special audits. Records also indicated that auditors with current lead auditor certifications had led all audits.

The inspectors reviewed records of audits completed since the last inspection of this area conducted by the NRC in April 2007. The licensee had conducted 15 audits in CY 2007 and 2 audits thus far in CY 2008. One additional audit not previously scheduled was in progress during the inspection. The licensee had a total of 10 audits scheduled for CY 2008. Audits conducted in CY 2006 - 2007, and those planned for CY 2008, addressed all 34 facility activities listed in Rancho Seco Quality Manual (RSQM), Section XVIII.



In CY 2007, the licensee conducted a total of 32 audit surveillances. As of April 16, 2008, the licensee had conducted 15 surveillances thus far in CY 2008. The inspectors selected audit reports 07-A-004, 07-A-014, 08-A-007, and surveillance reports 07-S-020, 07-S-027, 07-S-029, 08-S-05, and 08-S-11 for review. The inspectors confirmed that the audits and surveillances were conducted in accordance with the RSQM. Individuals that conducted the audits and surveillances were independent of the areas being audited. The auditors when conducting audits used approved checklists. The inspectors determined that the audit team personnel were qualified, were authorized by the licensee to perform the audits or surveillances in the areas audited, and the audits and surveillances conducted by the audit team had been conducted in a timely manner.

c. Conclusion

Audits conducted in CY 2007 and those scheduled for CY 2008 addressed all facility activities required to be audited. All auditors satisfied the qualification requirements.

**2 Maintenance and Surveillance (IP 62801)**

2.1 Inspection Scope

The inspectors reviewed the status of required maintenance, surveillance, and testing. Inspectors interviewed the Maintenance Superintendent and examined selected records.

2.2 Observations and Findings

With the relocation of the spent fuel to the ISFSI, the licensee no longer had any safety-related structures, systems or components (SSC) as defined in 10 CFR 50.65(b)(1), nor any non-safety-related SSC as defined in 10 CFR 50.65(b)(2). The licensee had previously reviewed its Maintenance Rule procedure and concluded that it no longer was required to implement these activities at the site.

The inspectors reviewed a printout of the Rancho Seco Computerized Surveillance Schedule dated April 15, 2008, that listed the status of surveillances and routine tests. Ten routine tests or surveillances were beyond their due dates, but none were beyond the licensee's established grace period. When questioned about the overdue tests or surveillances, the Maintenance Superintendent indicated that he did not expect any of the surveillances or tests would exceed their grace period.

2.3 Conclusion

The licensee no longer had any SSCs, and the requirements of the Maintenance Rule were no longer required to be implemented at this site. The licensee was maintaining the schedules on other surveillance and routine testing activities as required.

### **3 Decommissioning Performance and Status Review (IP 71801)**

#### **3.1 Inspection Scope**

The inspectors interviewed personnel, reviewed selected documents, and toured portions of the site to observe work activities including housekeeping, safety practices, fire protection practices, and radiological controls. An NRC inspector observed the preparations and was present during the demolition of the reactor building polar crane.

#### **3.2 Observations and Findings**

The inspectors conducted tours of the reactor, auxiliary, fuel handling, and turbine buildings and observed dismantlement and decommissioning activities in progress. Decommissioning work observed by the inspectors during the tour was conducted in a safe and orderly manner. The inspectors conducted independent radiological surveys using a Ludlum Model 2401-EC survey meter (NRC No. 21175G, calibration due date July 10, 2008). Radiological controls, including postings and barriers, were observed by the inspectors to be in place.

The reactor building concrete and steel removal project was in progress. As of April 5, 2008, the contractor had completed approximately 97 percent of the demolition. Approximately 28.7 million pounds of concrete and steel had been packaged for shipment with approximately 28.6 million pounds shipped. These shipments had been made in 146 railcars assembled into 26 rail pickups. The decommissioning project continues with the licensee's and contractor's staff working two ten-hour shifts Monday through Friday.

On Saturday, April 26, 2008, the reactor building polar crane was brought down using explosives. An NRC inspector was dispatched and was onsite during the final preparations and the detonation of the explosives. Following completion of the roll call, a count down was begun and the detonation began at about 2:20 PM P.D.T. Following the detonation, radiation monitoring teams were dispatched to various locations and after about 20 minutes an "all clear" signal was broadcasted by the licensee indicating that no radioactivity above background had been detected in either the air samples or ambient portable radiation surveys. The plant manager confirmed this information during subsequent discussions with the NRC inspector onsite during the detonation.

When questioned by the inspectors about the status of the reactor building concrete and steel removal project, the licensee indicated that the project was expected to be completed by the end of May 2008. The licensee's schedule anticipates the last of the final status surveys will be completed by the end of September 2008 and the last final status survey report will be submitted to the NRC by the end of October 2008.

In the fuel handling building, remediation continued on the building walls. When questioned about the schedule, the licensee projected that it would complete remediation of the fuel handling building by April 30, 2008.

As of April 18, 2008, the licensee had completed final status surveys on 217 of a projected 295 survey units. The number of projected survey units had changed since the last inspection as some units were split into multiple units. Based on discussions with the licensee, the 217 completed survey units constituted approximately 73.6% of the total projected survey units.

### 3.3 Conclusion

The licensee continued to dismantle and remove contaminated components and to remediate contaminated surfaces in a safe manner. Final status surveys had been completed on 217 of a projected 295 survey units.

## 4 **Occupational Radiation Exposure (IP 83750)**

### 4.1 Audits and Surveillances

#### a. Inspection Scope

The inspectors reviewed the recently conducted radiation safety audit report to verify implementation of the commitments made in Section XVIII, Audits, of the RSQM, as it relates to occupational radiation safety. The inspectors reviewed the qualification records for the individuals involved in conducting the radiation safety audit.

#### b. Observations and Findings

The inspectors reviewed the licensee's audit Report 07-A-014, Radiological Safety and Control and ALARA Program. The audit was conducted from November 21 through December 20, 2007, and the report was issued on January 9, 2008. The inspectors reviewed the audit report, confirmed that the audit was conducted according to the commitments in the RSQM, determined that the individual who conducted the audit was independent of the function being audited, and concluded that the lead auditor was qualified and authorized to perform the audit in the areas audited. The auditors used an approved checklist when conducting the audit. The inspectors observed that the audit was conducted in a timely manner.

#### c. Conclusions

A licensee audit of the occupational radiation exposure program was conducted in accordance with QA program requirements.

### 4.2 External and Internal Exposure Control and Other Radiation Protection Inspection Areas

#### a. Inspection Scope

The licensee's personnel radiation monitoring program was inspected for compliance with applicable requirements and commitments.

b. Observations and Findings

The licensee was continuing its use of Optically Stimulated Luminescent (OSL) dosimeters for evaluating beta/gamma external doses, and neutron dosimeters for neutron dose. The OSL dosimeters were provided by a vendor that was accredited under the National Voluntary Laboratory Accreditation Program for the type of dosimeters used. In addition, the licensee used Electronic Dosimeter (EDs) for controlling the day-to-day personnel exposures. The licensee continued to use a vendor-supplied computerized dose tracking system for reading the EDs and for automatically assigning the estimated dose to the individual.

The Radiological Health Supervisor stated that during CY 2007 no individual had received an internal exposure that required a committed effective dose equivalent be assigned.

During CYs 2007 and to the date of this inspection in CY2008, no individual had been classified as a declared pregnant worker, and no planned special exposures had been conducted.

The annual report for CY 2007 radiation exposures required by 10 CFR 20.2206(b) was in final preparation during the site visit. The Radiological Health Supervisor stated that the annual report will indicate, when completed, that the Total Effective Dose Equivalent (TEDE) received by each occupationally exposed individual would be below the regulatory limit of 5 rem. A review of occupational dosimetry records indicated that the highest reported TEDE in the summary report was 1.620 rem. The doses to lens of the eye, skin of the whole body, internal, and skin of the maximally exposed extremity were all below applicable 10 CFR Part 20 limits.

The required Regulatory Guide 1.16 Annual Exposure Report for CY 2007 was submitted on March 25, 2008. The report was submitted to the NRC in a timely manner before the April 30, 2008, deadline.

c. Conclusions

The licensee maintained an effective program for monitoring occupational radiation exposures. Occupational exposures for CY 2007 were noted by the inspectors to be below regulatory limits specified in 10 CFR Part 20.

4.3 Emergency Plan

a. Inspection Scope

The inspectors reviewed the circumstance related to a recent event when a Notification of an Unusual Event (NOUE) was declared by the licensee.

b. Observations and Findings

On Saturday April 5, 2008, the demolition subcontractor was using a cutting torch to remove a non-structural beam in the reactor building. Slag from the cutting

operation started a fire in combustible material concealed below concrete rubble. The fire watch detected the fire at approximately 10:20 AM PDT. At 10:30 AM PDT the on-shift ISFSI technician (the senior licensee person on site during weekends and backshift) was informed of the fire and promptly responded to the scene. The ISFSI technician took immediate action to evacuate the area, improve efforts to extinguish the fire, turned off the reactor building ventilation, and ensured that air samples were being taken to assess potential airborne radioactivity.

As a result of the fire, smoke escaped from the reactor building access hatch. The Radiation Protection Technician on-duty monitored the continuous air sampler located at the reactor building hatch for airborne radioactivity. The air samples taken at the access hatch and in other locations in the reactor building revealed no contamination above background.

Due to the difficulty encountered by ISFSI technician in observing the fire that was concealed by concrete rubble, it was not possible for the Radiation Protection Technician to determine precisely when the fire was extinguished. The licensee estimated that the fire was extinguished sometime between 11:30 AM and 12:30 PM PDT.

Due to the inability to contact offsite management, and as a result of the continuing smoke, at approximately 11:40 AM PDT, the ISFSI technician declared a NOUE in accordance with Emergency Plan Implementing Procedure (EPIP), EPIP-01 "Emergency Action." The ISFSI technician took this action on the provision included in the procedure that allows discretionary declaration of an event if the event does not fall into one of the predefined conditions.

When the NOUE was declared by the ISFI technician, communications errors occurred due the licensee's failure to use the EPIP checklist. Not using the EPIP checklist resulted in a failure of the licensee to make notifications to the County, State, and NRC within one hour of declaring a NOUE; use the licensee pager callout notification of the Rancho Seco on-call Emergency Response Organization (ERO); and make proper notification to the licensee's management.

Following the declaration of the emergency, the ISFSI technician was able to contact members of the Rancho Seco's management team and at that time a decision was made to conduct a conference call. Individuals participating in the conference call included the ISFSI Technician and Rancho Seco's on-call management and corporate safety, fire protection, security, and emergency planning staff. During the conference call, the plant status was reviewed, the need for additional actions was evaluated, weekend work in the reactor building was stopped, and a continuous fire watch posted until Monday (April 7, 2008) morning. Following the conference call, the ISFSI technician closed out the NOUE but did not use the requisite EPIP closeout checklist.

On Monday, April 7, 2008, Rancho Seco management met and determined that a NOUE had been both declared and closed out on April 5, 2008. Accordingly, on April 7, 2008, the Rancho Seco personnel notified the NRC Operations Center, as well as the State and County.

In accordance with the licensee's corrective action program two PDQs, 08-010 and 08-011, were initiated and subsequently classified as DQs. A post event critique and investigation interviews were conducted and a detailed investigation report was prepared by the licensee. On May 1, 2008, the licensee submitted a 30-day follow-up report to the NRC for the NOUE that occurred on April 5, 2008.

This report identified three fundamental issues and associated causes.

- The fire in the reactor building occurred due to inadequate housekeeping practices that allowed combustible materials to accumulate and be covered up by concrete rubble thus setting the stage for a slag-induced fire.
- Training and drills had not adequately emphasized backshift implementation of the Emergency Plan, thus once the NOUE was declared the Emergency Plan was not properly implemented.
- No formal process existed to rapidly contact management during backshifts and weekends in a non-Emergency Plan situation. The inability of the ISFSI technician to contact offsite management in a timely manner lead the individual to declare a NOUE as a discretionary measure.

The licensee's report described the corrective actions taken and those that the licensee had scheduled to be completed. Completed actions included:

1. Removing the combustible debris from hot work areas having the potential for a fire starting;
2. Reviewing the procedures, training, preventive measures and the specific documentation related to housekeeping and control of combustibles near hot work areas;
3. Providing additional training to ISFSI Technicians, emergency response organization members, and Security Shift Supervisors on the Emergency Plan, EPIPs, emergency classification, importance of clear and explicit communications, proper use of required checklists, and mandating that these individuals pass a proficiency test on the emergency plan requirements;
4. Providing additional training to ISFSI technicians on procedure compliance and the importance of following procedures; and
5. Revising the applicable procedure to direct the ISFSI technician to call for outside agency assistance for any fire that cannot be extinguished with a portable fire extinguisher. Additionally, when the procedure is revised provide training of the ISFSI technicians.

Actions to be completed included:

1. Develop backshift Emergency Plan implementation checklists, train ISFSI technicians on the proper use of the checklist, and perform an unannounced backshift drill that requires the use of the checklist;
2. Emphasize backshift Emergency Plan implementation in training and drills; and
3. Develop a formal process to notify management in a non-Emergency Plan situation and provide the requisite training to the staff.

Section 50.54(q) of Title 10 Code of Federal Regulations (CFR) requires in part that a holder of a nuclear power reactor operating license shall follow and maintain in effect emergency plans that meet the standards in Section 50.47(b) of this Title. Contrary to the above on April 5, 2008, the licensee failed to follow their Emergency Plan in that an Emergency Classification (NOUE) was declared and the offsite notifications to the County, State and NRC were not made and the licensee's on-call emergency organization was not activated. This non-repetitive, licensee identified and corrected failure satisfies the criteria as a non-cited violation (NCV 050-00312/0801-01).

c. Conclusions

A non-cited violation related to the licensee failure to follow the Emergency Plan was identified.

**5 Inspection of Final Surveys (IP 83801)**

5.1 Inspection Scope

Independent confirmatory radiological measurements were performed by ORISE on surfaces of the auxiliary building.

5.2 Observations and Findings

On April 12, 2006, the licensee submitted their License Termination Plan (LTP) to the NRC. This LTP included proposed Derived Concentration Guide Lines (DCGLs) for meeting the public dose limits after license termination. On November 27, 2007, the NRC issued License Amendment Number 133 that approved the licensee's LTP and the respective DCGLs.

Representatives from ORISE, working as the NRC's contractor, reviewed records of final status surveys taken in embedded piping and on surfaces in the auxiliary building. At the NRC's request, ORISE personnel conducted independent confirmatory radiological measurements of selected locations including embedded piping and compared their survey results with those of the licensee. The results of these surveys will be reported to the licensee at a later date under separate correspondence. The ORISE staff also collected four soil samples in the area of the basement of the auxiliary building called "pump alley." Two of the soil samples were counted by the licensee during the inspection and base on

these results the licensee decided that this area required additional remediation. After analysis of the soil samples by ORISE, the soil samples were returned to the licensee.

The results of survey activities conducted by ORISE staff during December 10 through 13, 2007, inspection were documented in a report issued on March 12, 2008. A copy of that report is attached. With the exceptions of the elevated direct reading measurement that occurred in Room 18 of the Auxiliary Building and also in a small area near where the Regenerate Holdup Tank, the surveys taken by ORISE confirmed the accuracy of the licensee's final status surveys for the locations surveyed. These elevated readings were discussed in Section 5 of Inspection Report number 050-00312/07-006.

### 5.3 Conclusion

The ORISE staff conducted confirmatory measurements on selected surfaces of the auxiliary building, including embedded piping. The results of the ORISE surveys conducted during this inspection will be reported at a later date.

The results of survey activities conducted by ORISE during the December 10 through 13, 2007, site visit were documented on a report issued on March 12, 2008. A copy of this ORISE report attached as Enclosure 2. With the exceptions of the elevated direct reading measurement identified by ORISE in two locations, the ORISE surveys confirmed the accuracy of the licensee's final status survey results for the locations surveyed.

## 6 **Exit Meeting Summary**

At the end of the site visits on April 17, 2008 and April 26, 2008, the inspectors briefed the Plant Closure and Decommissioning Manager (Plant Manager) and other members of licensee staff regarding the preliminary inspection findings. A telephonic exit briefing was conducted with the Plant Manager on May 19, 2008. The licensee did not identify any information provided to, or reviewed by, the inspectors as proprietary.



## PARTIAL LIST OF PERSONS CONTACTED

### Sacramento Municipal Utility District

J Astronom, ISFSI Technician  
M. Bua, Radiation Protection/Chemistry Superintendent  
W. Hawley, Dismantlement Superintendent - Operations  
L. Hoist, Nuclear Document Control Supervisor  
R. Jones, Supervising Quality Engineer  
D. Koontz, ISFSI Supervisor  
S. Redeker, Manager, Plant Closure and Decommissioning (Plant Manager)  
J. Roberts, Maintenance Superintendent  
E. Ronningen, Dismantlement Superintendent – Radiological  
D. Ward, Quality Assurance Auditor

## INSPECTION PROCEDURES USED

IP 40801	Self-assessment, Auditing, and Corrective Action
IP 62801	Maintenance and Surveillance
IP 71801	Decommissioning Performance and Status Review
IP 83750	Occupational Radiation Exposure
IP 83801	Inspections of Final Surveys

## ITEMS OPENED, CLOSED, AND DISCUSSED

### Opened

050-00312/0801-01 NCV	Failure to follow their Emergency Plan in that an Emergency Classification was declared and the offsite notifications to the County, State and NRC were not made and the on-call emergency organization was not activated.
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### Closed

050-00312/0801-01 NCV	Failure to follow their Emergency Plan in that an Emergency Classification was declared and the offsite notifications to the County, State and NRC were not made and the on-call emergency organization was not activated.
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### Discussed

None

## LIST OF ACRONYMS

CFR	Code of Federal Regulations
CMRG	Commitment Management Review Group
CY	Calendar Year
DCGLs	Derived Concentration Guide Lines
DQ	Deviation from Quality
ED	Electronic Dosimeter
EPIP	Emergency Plan Implementing Procedure
ERO	Emergency Response Organization
IP	Inspection Procedure
ISFSI	Independent Spent Fuel Storage Installation
LTP	License Termination Plan
NCV	Non-Cited Violation
ORISE	Oak Ridge Institute for Science Education
OSL	Optically Stimulated Luminescent dosimeters
PDQ	Potential Deviation from Quality
PSDAR	Post Shutdown Decommissioning Activities Report
QA	Quality Assurance
RSAP	Rancho Seco Administrative Procedure
RSQM	Rancho Seco Quality Manual
SSC	Structures, Systems Or Components
TEDE	Total Effective Dose Equivalent

## PARTIAL LIST OF DOCUMENTS REVIEWED

### Audits and Surveillance's

- Audit Log, 2007.
- Audit Log, 2008 as of April 16, 2008.
- Audit File, Audit 07-A-004, Emergency Preparedness Program, performed May 2-22, 2007.
- Audit File, Audit 07-A-014, Radiological Safety and Control; ALARA, performed November 21 through December 20, 2007.
- Audit File, Audit 08-A-007, Process Control Program + Packaging & Transportation of Radioactive Waste, performed March 11-20, 2008.
- Surveillance Log, 2007.
- Surveillance Log, 2008 through April 16, 2008.
- Surveillance report 07-S-020, approved August 21, 2007.
- Surveillance report 07-S-027, approved November 28, 2007.
- Surveillance report 07-S-029, approved December 10, 2007.
- Surveillance report 08-S-005, approved February 14, 2008.
- Surveillance report 08-S-011, approved March 13, 2008.

### Correspondences and Memorandums

- Correspondence dated May 1, 2008, from Steve Redeker, Manager, Plant Closure and Decommissioning to U. S. Nuclear Regulatory Commission, Attention John Hickman, subject Special Report Regarding a Fire in the Rancho Seco Reactor Building.

### Reports

- Master Surveillance Schedule by Due Date, dated April 15, 2008.
- Master Routine Tests Schedule by Department, dated April 15, 2008.



OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

March 12, 2008

Mr. John Hickman  
Mail Stop: T-8F5  
Office of Federal and State Materials  
and Environmental Management Programs  
U.S. Nuclear Regulatory Commission  
11545 Rockville Pike  
Rockville, MD 20852

**SUBJECT: INTERIM LETTER REPORT—CONFIRMATORY SURVEY RESULTS FOR  
ACTIVITIES PERFORMED IN DECEMBER 2007; RANCHO SECO  
NUCLEAR GENERATING STATION, HERALD, CALIFORNIA  
DCN 1695-SR-02-0  
(DOCKET NO. 50-312, RFTA NO. 06-003)**

Dear Mr. Hickman:

The Oak Ridge Institute for Science and Education (ORISE) performed confirmatory survey activities on the Auxiliary Building structural surfaces (Rooms 18, 50 and 53 and Vaults 30, 31, 34 and 35), portions of the Acid Waste Piping system, and two exterior soil areas [Outfall Area and the Regenerant Hold-Up Tank (RHUT) Auxiliary Building Soil Area] at the Rancho Seco Nuclear Generating Station in Herald, California on December 10 through 13, 2007. These survey activities were requested and approved by the U.S. Nuclear Regulatory Commission (NRC). Enclosed is an interim letter report that summarizes ORISE's survey procedures and preliminary results of the confirmatory survey. The surveys included beta and gamma surface scans, direct measurements for total net beta activity, and smears for removable alpha and beta activity within the Auxiliary Building; embedded piping gamma scans within the Auxiliary Building; and limited gamma scans and the collection of soil samples in the Outfall and RHUT Auxiliary Boiler Land Areas.

If you have any questions, please direct them to me at 865.576.0065 or Sarah Roberts at 865.241.8893.

Sincerely,

Wade C. Adams  
ORISE Health Physicist/Project Leader  
Survey Projects

WCA:bf

Enclosure

- c: T. Carter, NRC/FSME/DWMEP/DD/SP T-8F5
- E. Knox-Davin, NRC/FSME/TWFN 8A23
- E. Garcia, NRC/Region IV
- E. Bailey, ORISE
- T. Youngblood, NRC/FSME/DWMEP/TWFN 8 F5
- E. Abelquist, ORISE
- S. Roberts, ORISE
- W. Riley, ORISE
- File 1695

Distribution approval and concurrence:	Initials
Technical Management Team Member	JJR
Laboratory Manager	RRC
Quality Manager	CTP

P. O. Box 117  
Oak Ridge, TN 37831

Voice: 865.576.0065

Fax: 865.241.3497

E-mail: [Wade.Adams@orau.org](mailto:Wade.Adams@orau.org)

Enclosure 2

**INTERIM LETTER REPORT  
CONFIRMATORY SURVEY RESULTS  
FOR ACTIVITIES PERFORMED IN DECEMBER 2007  
RANCHO SECO NUCLEAR GENERATING STATION  
HERALD, CALIFORNIA**

## **INTRODUCTION**

The Sacramento Municipal Utility District (SMUD) operated the Rancho Seco Nuclear Generating Station (RSNGS) from 1976 to 1989 under Atomic Energy Commission Docket Number 50-312 and License Number DPR-54. In August 1989, SMUD notified the U.S. Nuclear Regulatory Commission (NRC) that they shut down RSNGS permanently. In May 1991, SMUD submitted the Rancho Seco Decommissioning Plan which was approved by the NRC in March 1995. SMUD began decommissioning activities in February 1997 and completed transfer of all the spent nuclear fuel in August 2002 (SMUD 2006a).

In April 2006, SMUD submitted a license termination plan (LTP) that was recently approved by the NRC on November 26, 2007 (SMUD 2006a and NRC 2007). SMUD currently is conducting decontamination efforts and performing final status surveys (FSS) on the remaining structural surfaces and in open land areas.

The NRC requested that the Independent Environmental Assessment and Verification (IEAV) Program of the Oak Ridge Institute for Science and Education (ORISE) perform confirmatory surveys of structural surfaces and the Acid Waste System drains in the Auxiliary Building at the RSNGS (Figures 1 and 2). While on site, the NRC site representative also requested that ORISE perform cursory gamma surface scans and collect soil samples at the Outfall Area and the Regenerant Hold-Up Tank Auxiliary Boiler Land Area (RHUT Area). The confirmatory surveys were performed during the period of December 10 through 13, 2007.

## **PROCEDURES**

Confirmatory surveys were performed in accordance with a site-specific survey plan that was submitted to and approved by the NRC (ORISE 2007a). The site-specific survey plan follows the guidance provided in the IEAV Survey Procedures and Quality Program Manuals (ORISE 2007b and ORAU 2007).

In the Auxiliary Building, ORISE judgmentally selected four of the eight vaults (Figures 3 through 5), three rooms (Figures 6 through 8), two Acid Waste System drains (Figures 9 and 10), and various pipe penetrations for confirmatory surveys based upon preliminary FSS results. At the request of the NRC site representative, ORISE also performed limited radiological surveys of the Outfall and RHUT Areas (Figures 11 and 12).

## **SURFACE SCANS**

### **Auxiliary Building Structural Surfaces**

Gamma surface scans were performed using sodium iodide, thallium-activated [NaI(Tl)] gamma scintillation detectors coupled to ratemeters with audible indicators. Beta surface scans were performed using large area gas proportional, hand-held gas proportional, and Geiger-Muller (GM)

detectors coupled to ratemeter-scalers with audible indicators. Particular attention was given to cracks, joints, embedded piping openings and horizontal surfaces in the evaluated structural surfaces where material may have accumulated.

### **Drains and Pipe Penetrations**

Limited qualitative gamma scans were performed in portions of two 2" inner diameter (ID) Acid Waste Systems drain lines on the -20 foot level elevation and in numerous pipe penetrations within the vaults and rooms that were part of these survey activities. ORISE recorded the gamma scan range for the Acid Waste System drains and the pipe penetrations. Gamma scans were performed using a cesium iodide, thallium-activated [CsI(Tl)] gamma scintillation detector coupled to a ratemeter with an audible indicator.

### **Outfall and RHUT Areas**

Gamma scans of the soils within the excavated Outfall Area and immediately adjacent to the excavated area and within the RHUT Area were performed using a NaI(Tl) gamma scintillation detector coupled to a ratemeter with an audible indicator.

## **SURFACE ACTIVITY MEASUREMENTS**

Based on beta and gamma surface scan results, direct measurements for beta activity were performed at 26 judgmentally-selected locations on the evaluated structural surfaces within the Auxiliary Building which were available for confirmatory survey activities. Direct measurements were performed using hand-held gas proportional detectors coupled to ratemeters-scalers. A smear sample for determining removable gross alpha and gross beta activity levels was collected from each direct measurement location. Direct measurement and smear locations are indicated on Figures 4 through 8.

## **SOIL SAMPLING**

Based on gamma scan results, ORISE judgmentally collected two soil samples from the Outfall Area; one sample to the east and one sample to the west, both immediately adjacent to the remediated portion of the Outfall Area. Also based on ORISE gamma scan results, ORISE asked SMUD personnel to collect a soil sample from an area of elevated gamma radiation (suspected to possibly be a discrete particle) in the RHUT Area and to provide analytical results to ORISE.

## **SAMPLE ANALYSIS AND DATA INTERPRETATION**

Radiological data and sample media were returned to the ORISE laboratory in Oak Ridge, Tennessee for analysis and interpretation. Radioassays were performed in accordance with the ORISE Laboratory Procedures Manual (ORISE 2007c). The soil samples were analyzed by gamma spectroscopy for the primary radionuclides-of-concern (ROC), Co-60 and Cs-137. However, spectra were also reviewed for additional gamma-emitting fission and activation products associated with the RSNRS and other identifiable total absorption peaks. The soil sample results were reported in units of picocuries per gram (pCi/g). Smear samples were analyzed for gross alpha and gross beta activity using a low-background gas proportional counter. Smear results and direct measurements for total surface activity were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm<sup>2</sup>). Since a pipe detector efficiency was not required,

embedded piping scan data were reported in units of counts per minute (cpm) to compare with SMUD's gross gamma cpm results.

## **FINDINGS AND RESULTS**

### **AUXILIARY BUILDING STRUCTURAL SURFACES**

The scan percent coverage and room area classifications are provided in Table 1. Beta surface scans determined that localized areas of residual elevated beta-gamma surface activity were present on floor and lower wall surfaces within the evaluated survey units (SUs). With the exception of direct measurement Location 14 in Room 18, residual surface activity was limited to small areas that were interspersed throughout the rooms. Due to the elevated beta and gamma surface activity levels determined at Location 14, SMUD and NRC personnel were notified and SMUD personnel remediated the location.

Beta measurements were performed at locations of residual elevated beta-gamma surface activity detected during surface scans. With one exception, total net beta activity measurements ranged from 130 to 16,000 dpm/100 cm<sup>2</sup>. The one exception was at Location 14 in Room 18, which had a total net beta activity of 110,000 dpm/100 cm<sup>2</sup>. It was determined that the residual beta activity was due to a discrete particle (0.22 pCi/g of Cs-137 and 0.0008 pCi/g of Co-60)<sup>1</sup>; the discrete particle was removed and the post-remedial total net beta activity was 1,100 dpm/100 cm<sup>2</sup>. Removable gross alpha and gross beta activity ranged from 0 to 5 and -3 to 8 dpm/100 cm<sup>2</sup>. Surface activity and removable activity level results are presented in Table 2.

### **DRAINS AND PIPE PENETRATIONS**

A comparison of ORISE and SMUD gamma scan results for the Acid Waste System Drain Line 4-2-15 indicated elevated gamma radiation levels at approximately the same length/depth and levels as reported by SMUD personnel in the preliminary final status survey (FSS) data packages. However, gamma scans of Acid Waste System Drain Line 4-1-12, Segment 1 (originally numbered incorrectly by SMUD as Drain Line 4-1-13) indicated a large discrepancy between ORISE and SMUD data in the gamma scan range for the 0 to 8 foot portion of the pipe. SMUD's results, although more conservative than ORISE's results, were thirteen times higher than the ORISE results. The reason for this discrepancy is unclear and ORISE recommends further evaluation of this drain line during a future confirmatory survey trip. The ORISE confirmatory and SMUD gamma scan ranges are provided in Table 3.

Gamma scans of numerous pipe penetrations within the evaluated SUs indicated that gamma radiation levels ranged from 200 to 1,200 cpm. For comparison, the CsI(Tl) detector background range for the conduits along the east side of the Turbine Building at the +40 level elevation ranged from 200 to 800 cpm. The ORISE gamma scan ranges for the pipe penetrations are also provided in Table 3.

### **OUTFALL AND RHUT AREAS**

Gamma scans of the remediated portion of the Outfall Area and the immediately adjacent areas detected residual elevated gamma radiation levels to the west and east of the remediated portion of

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<sup>1</sup> Electronic mail from G. Pillsbury (SMUD) to W. Adams (ORISE); January 14, 2008.

the Outfall Area. A soil sample was collected from each of these locations. The radionuclide concentrations for the two soil samples collected immediately adjacent to the remediated portion of the Outfall Area ranged from 0.32 to 0.49 pCi/g for Co-60 and 34.9 to 47.1 pCi/g for Cs-137. The confirmatory radionuclide concentrations for the soil samples are provided in Table 4.

Gamma scans of the RHUT Area indicated that the vast majority of the surface soil was at background levels. The one exception was along the west perimeter of the area where a small location indicated elevated gamma radiation levels at approximately 40 times the average background. SMUD and NRC personnel were notified of this finding and SMUD personnel remediated the location and collected a soil sample. SMUD analyzed the RHUT soil sample and determined that the sample contained 66 pCi/g of Co-60. The sample was further divided and SMUD isolated a discrete particle that was counted as a point source and reported the particle activity as 0.485  $\mu$ Ci of Co-60; the recount of the soil sample (minus the discrete particle) indicated background levels.<sup>2</sup>

## COMPARISON OF SURVEY RESULTS WITH GUIDELINES

### STRUCTURAL SURFACE ACTIVITY LEVELS

The major contaminants identified by SMUD at RSNGS are beta-gamma emitters—fission and activation products—resulting from reactor operation. Cesium-137 and Co-60 have been identified during characterization as the predominant radionuclides present on structural surfaces. SMUD developed site-specific derived concentration guideline levels (DCGLs), which were recently approved by the NRC, based on a dose modeling to future occupants not to exceed 25 mrem/year total effective dose equivalent (TEDE) as presented in Section 6 of the LTP (SMUD 2006a and NRC 2007). The DCGLs for surfaces were modified by SMUD to reflect the ratio of radionuclide concentrations (account for the presence of unmeasured contaminants based on contaminant ratios) in the specific SUs that were being evaluated. The applicable surface activity guidelines for the evaluated structural surfaces for these surveys are provided in Table 5. These DCGLs were provided in the preliminary FSS data packages for each evaluated SU and were derived from the LTP and decommissioning technical basis document (DTBD)-05-015 (SMUD 2006a and b).

Confirmatory survey data for Auxiliary Building structural surfaces were compared with the site-specific DCGL for the evaluated Auxiliary Building SUs. One of the 26 direct beta activity measurement results on the concrete structural surfaces exceeded the Gross Beta DCGL of 43,000 dpm/100 cm<sup>2</sup>. Using the gross activity DCGL as determined in DTBD-05-015 (SMUD 2006b) and the area factor determined for each SU, SMUD calculated Design DCGL elevated measurement comparison (DCGL<sub>EMC</sub>) values which are also provided in Table 5. All confirmatory direct surface activity measurements on the Auxiliary Building structural surfaces in the evaluated SUs were within the site-specific SU DCGL<sub>EMC</sub> as provided by SMUD in the preliminary FSS data packages. However, it was determined that the elevated beta surface activity at Location 14 in Room 18 was from a discrete Cs-137 and Co-60 particle; hence, the particle was remediated by SMUD personnel while ORISE was on site and a confirmatory, post-remediation direct measurement was performed with the results being well within the gross activity DCGL.

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<sup>2</sup> Electronic mail from E. Ronningen (SMUD) to W. Adams (ORISE), RE: RHUT Area Contamination; December 20, 2007.



## **DRAIN LINES AND PIPE PENETRATIONS**

Co-60 is the primary ROC within the embedded piping. SMUD has established a dose-based restriction for embedded piping not to exceed 25 mrem/year that assumes a building occupancy scenario within rooms where embedded piping is present. The corresponding modeled DCGL is 100,000 dpm/100 cm<sup>2</sup>. SMUD's grouting action level for embedded piping is 21,000 dpm/100 cm<sup>2</sup> (SMUD 2007).

ORISE's confirmatory drain line and pipe penetration results were not directly compared to the embedded piping DCGL; instead, since ORISE and SMUD used the same Ludlum Model 44-159 CsI(Tl) detector, ORISE compared gross gamma scan readings with either SMUD's preliminary FSS data package gamma scan results for each surveyed pipe at various depths or with background levels as determined during a previous ORISE confirmatory survey (ORISE 2007d).

Confirmatory survey data for the Acid Waste System drain lines were compared with the preliminary FSS data package gross gamma cpm results. The confirmatory gamma scan results indicated that ORISE gross gamma radiation levels within the drain line pipes were consistent with the SMUD preliminary FSS data package results for Drain Line 4-2-15. SMUD's gross gamma cpm results for Drain Line 4-1-12, Segment 1 were thirteen times higher than the ORISE gross gamma cpm results; the results for this drain line need to be re-evaluated during the next ORISE confirmatory survey. Gamma scans of the other evaluated Auxiliary Building pipe penetrations that were part of these survey activities did not detect gamma radiation levels in excess of the detector background.

## **SOIL SAMPLES**

Table 6-5 (Table 6) from the LTP provides the single nuclide DCGL's for soil at RSNRS. The DCGL<sub>w</sub> is 12.6 pCi/g for Co-60 and 52.8 pCi/g for Cs-137 (SMUD 2006a). The Outfall Area soil sample concentrations were below the respective single radionuclide DCGLs. The soil sample collected by SMUD personnel from the location of elevated residual gamma radiation detected by ORISE personnel in the RHUT Area was analyzed by SMUD; SMUD's analyses indicated that the sample (containing 66 pCi/g of Co-60) exceeded the DCGL for Co-60. The sample was further divided and a discrete particle containing 0.485 µCi of Co-60 was identified by SMUD.

## **SUMMARY**

During the period of December 10 through 13, 2007, ORISE performed confirmatory radiological survey activities which included beta and gamma surface scans, beta activity direct measurements, and removable gross alpha and gross beta activity measurements on structural surfaces within the Auxiliary Building; gamma scans within Auxiliary Building embedded piping; and, gamma scans and the collection of soil samples from the Outfall and RHUT Areas.

Beta and gamma surface scans identified several areas of elevated beta surface activity on the structural surfaces of the evaluated SUs with the Auxiliary Building. With one exception, additional investigation of these locations indicated that the majority of the elevated surface activity levels were attributable to localized areas of residual beta-gamma radiation within the matrix of the concrete media. In general, the elevated surface activity was limited to small areas that were interspersed throughout the rooms. The one exception was a discrete particle of Cs-137 and Co-60 that was found in Room 18. Direct measurements were performed at 26 locations. As mentioned above,

only one direct measurement exceeded the site-specific gross beta DCGL but all were within the DCGL<sub>EMC</sub> criteria. A review of the preliminary FSS data package for Room 18 indicated that SMUD personnel did not identify the elevated residual beta and gamma radiation levels from Location 14 in Room 18. Therefore, the results of the confirmatory survey activities for the evaluated structural surfaces of Room 18 in the Auxiliary Building did not confirm the radiological status of the SU as presented in the licensee's preliminary Room 18 FSS data package. SMUD personnel were notified and are investigating the confirmatory finding in Room 18. The confirmatory survey results for Rooms 50 and 53 are in agreement with the radiological status of these SUs as presented in the licensee's preliminary FSS data packages.

Gamma surface scans of the evaluated Auxiliary Building pipe penetrations did not indicate any areas of elevated gamma radiation levels; the scan results within Acid Waste System Drain Line 4-2-15 were consistent with the results presented in the preliminary FSS data packages for that drain. However, the gamma scan results for Acid Waste System Drain Line 4-1-12, Segment 1 were not in agreement with the preliminary FSS results. Further investigations by SMUD indicated that Drain Line 4-1-13 had been removed and the preliminary FSS results for Drain Line 4-1-12, Segment 1 were erroneously reported as the results for 4-1-13 (Refer to Figure 9). Due to this discrepancy, SMUD re-surveyed Segments 1 and 2 of Drain Line 4-1-12 and provided preliminary results to ORISE on February 12, 2008.<sup>3</sup> SMUD's gamma scan range for the 0 to 8 foot length of Segment 1 is thirteen times higher and not in agreement with ORISE's gamma scan results (Table 3). Based on the discrepancy between the ORISE confirmatory and SMUD FSS gamma scan ranges and the confusion with the incorrect numbering of the drain line, ORISE recommends that a side-by-side instrument comparison be performed in this drain line during a subsequent confirmatory survey trip.

The soil sample results from the Outfall Area were below the individual radionuclide DCGLs and meet the soil release criteria. The SMUD radiological analyses of the soil sample from the RHUT area exceeded the soil DCGL for Co-60. SMUD personnel are performing further investigations within the RHUT Area.

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<sup>3</sup> Electronic mail from E. Ronningen (SMUD) to W. Adams (ORISE), RE: Survey of Acid Waste Line 4-1-12; February 12, 2008.

**FIGURES**

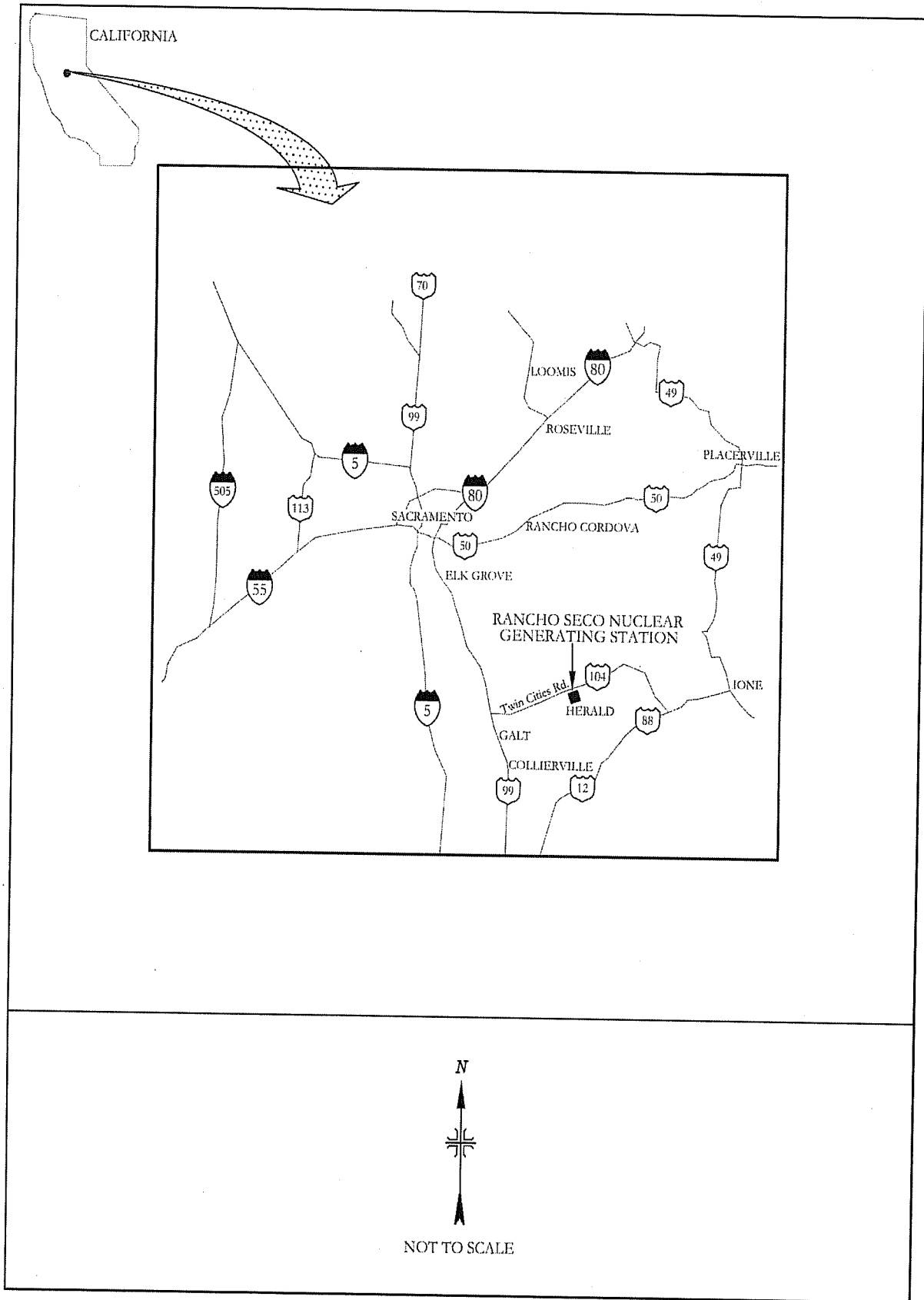


Figure 1: Location of Rancho Seco Nuclear Generating Station, Herald, California

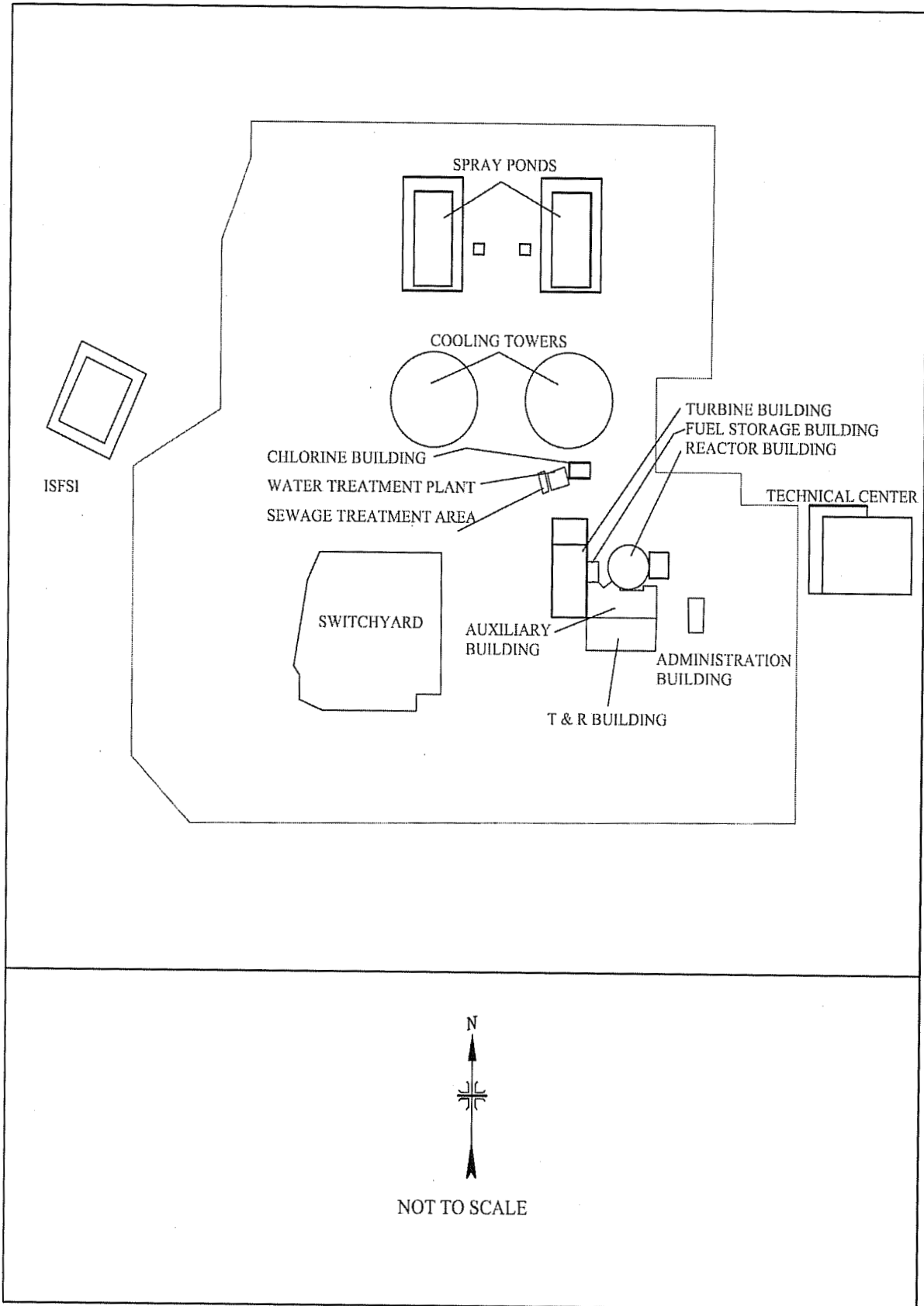


Figure 2: Plot Plan of the Industrial Area at Rancho Seco Nuclear Generating Station

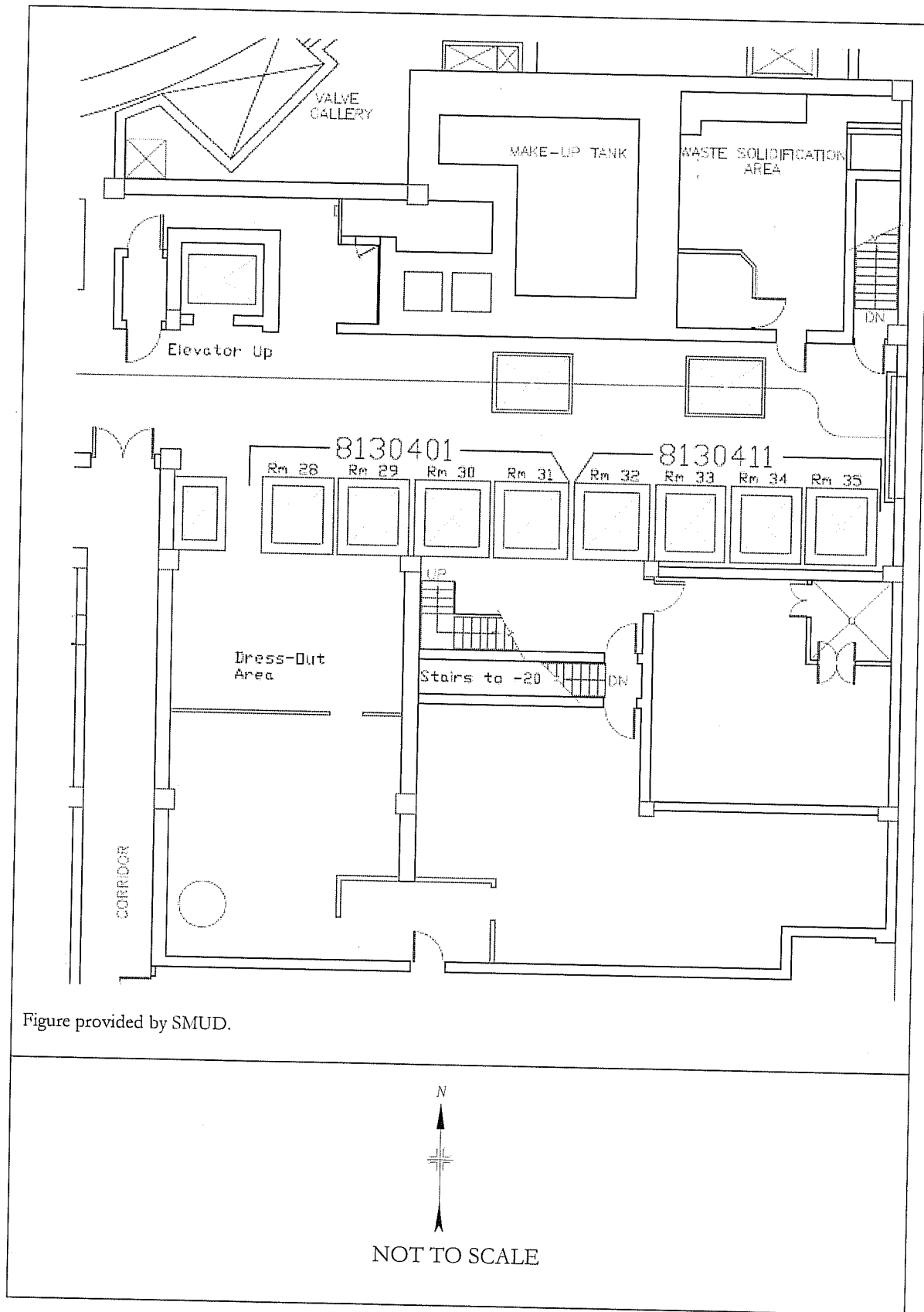


Figure provided by SMUD.

**Figure 3: Plot Plan of Auxiliary Building Vaults – Survey Units F8130401 and F8130411**

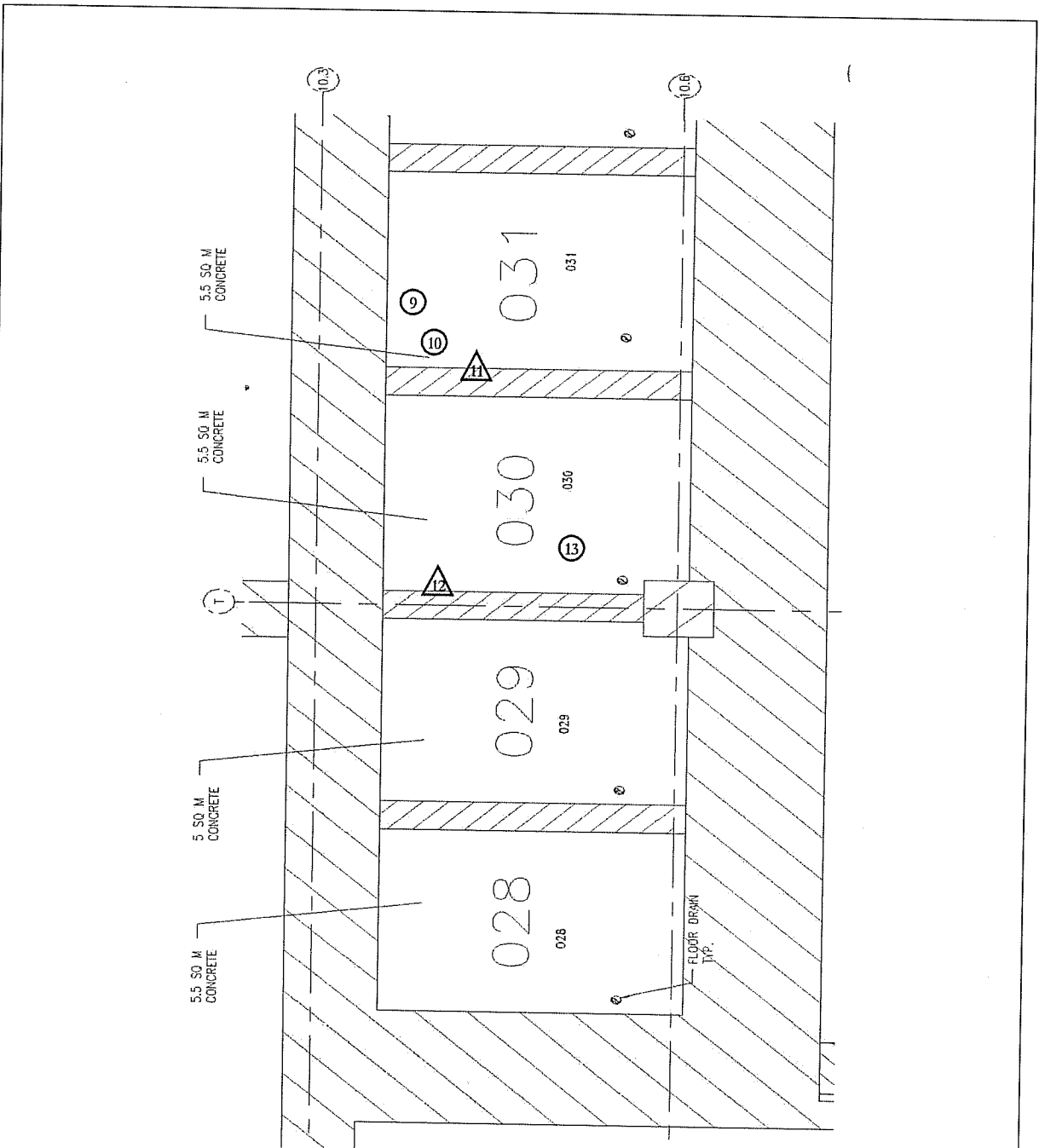


Figure provided by SMUD.


<p>MEASUREMENT/SAMPLE LOCATION</p> <p>⊙ # Single Point – Floor</p> <p>△ # Single Point – Lower Wall</p>	<p>N </p> <p>NOT TO SCALE</p>
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Figure 4: Survey Unit F8130401, Vaults 30 and 31 – Direct Measurement and Sample Locations

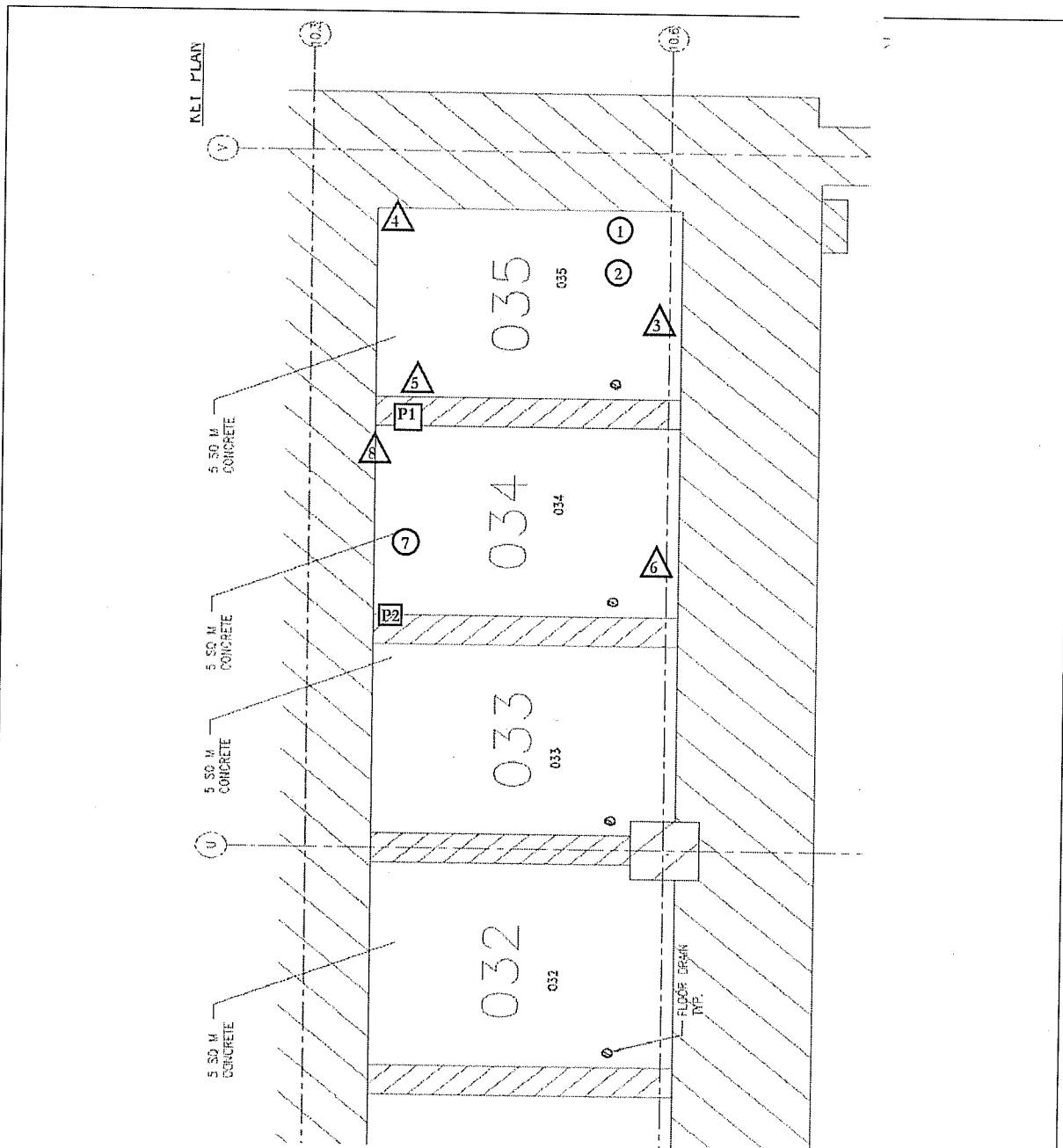
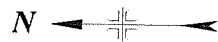


Figure provided by SMUD.

MEASUREMENT/SAMPLE  
LOCATION

- ⊕ Single Point – Floor
- △ Single Point – Lower Wall
- ▲ Single Point – Upper Surfaces
- ▣ P# Pipe Penetration



NOT TO SCALE

Figure 5: Survey Unit F8130411, Vaults 34 and 35 – Direct Measurement and Sample Locations



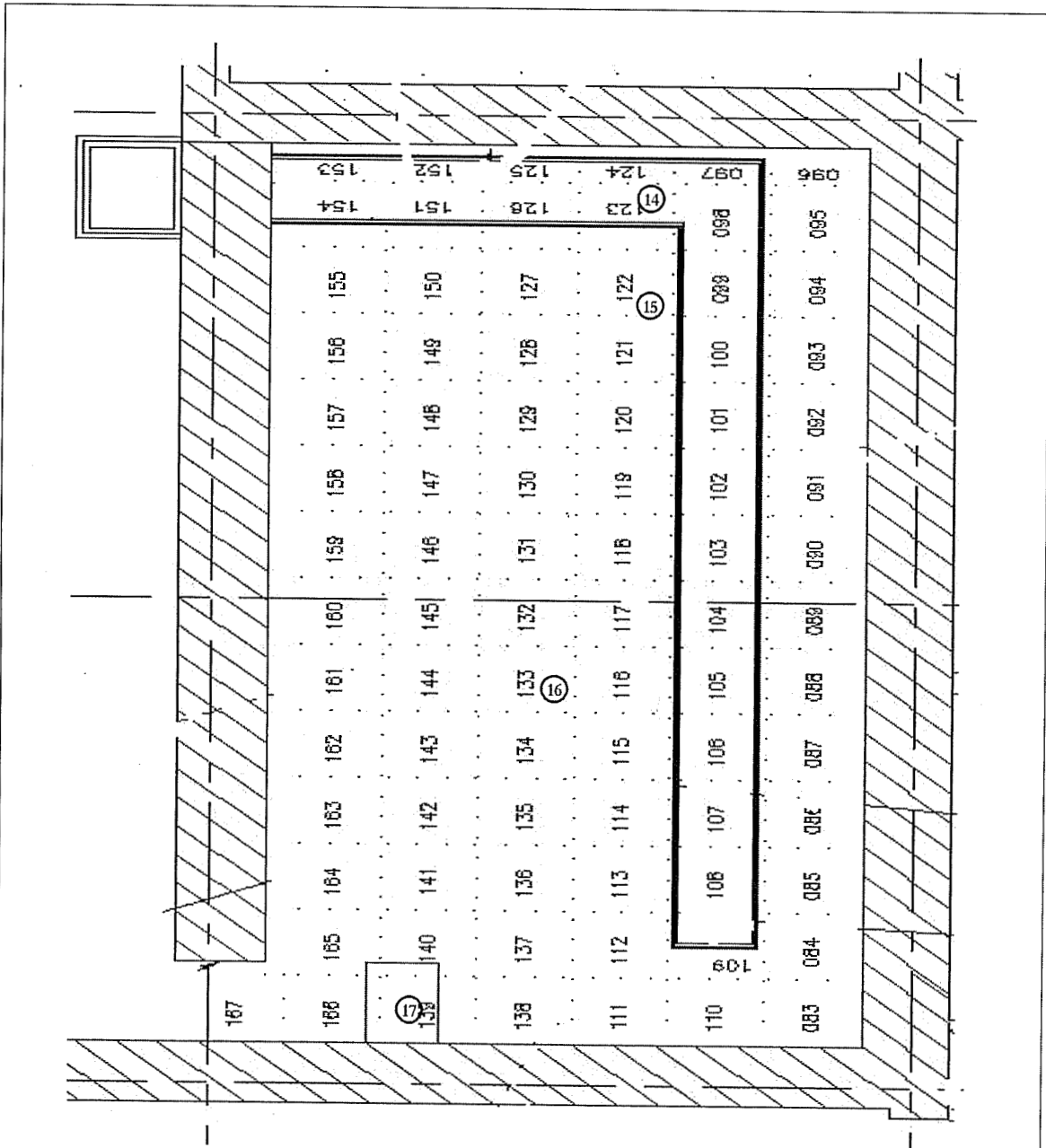


Figure Provided by SMUD

Figure 6: Survey Unit F8130201, Room 18 – Direct Measurement and Sample Locations



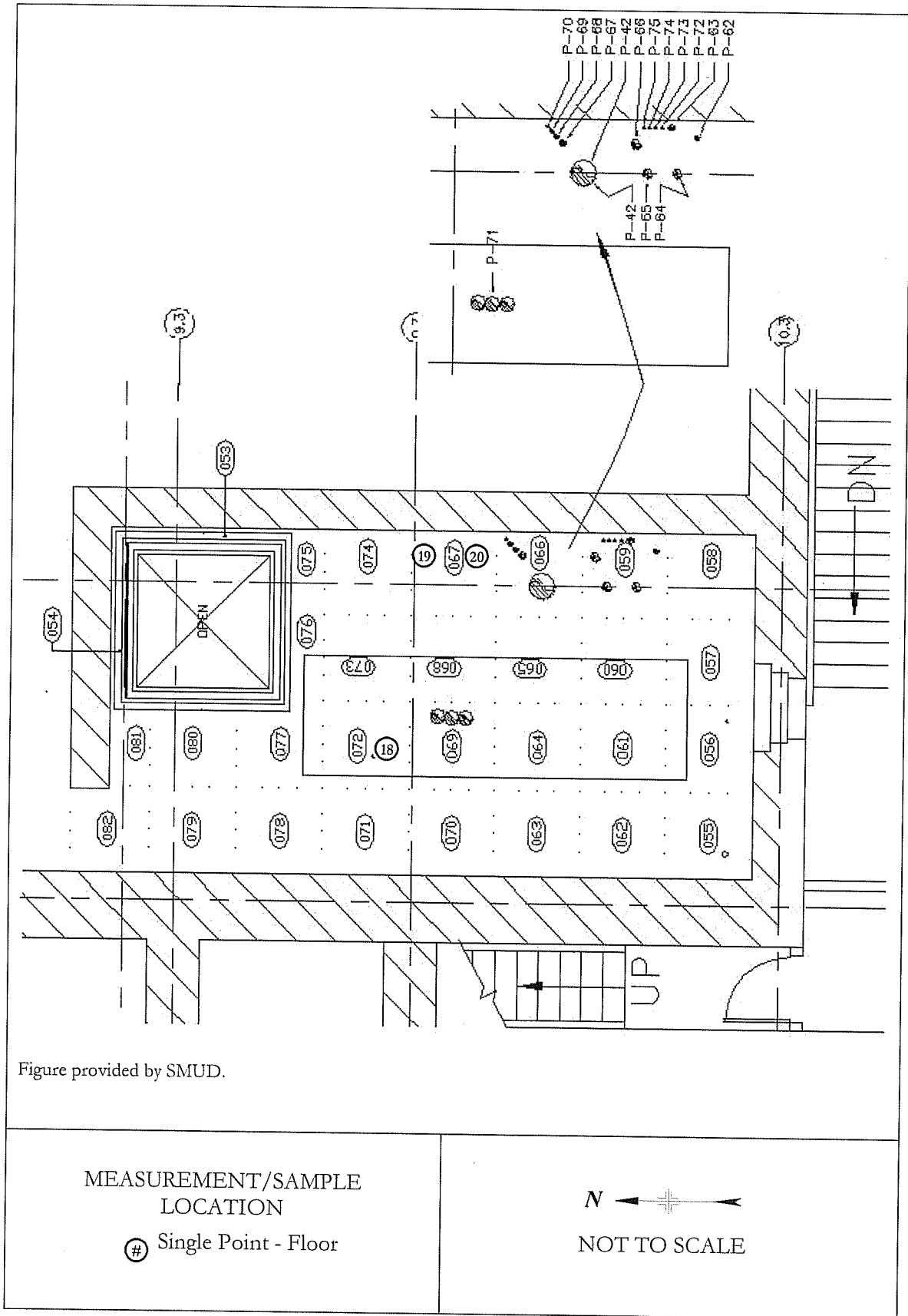


Figure 8: Survey Unit F8130781, Room 53 – Direct Measurement and Sample Locations

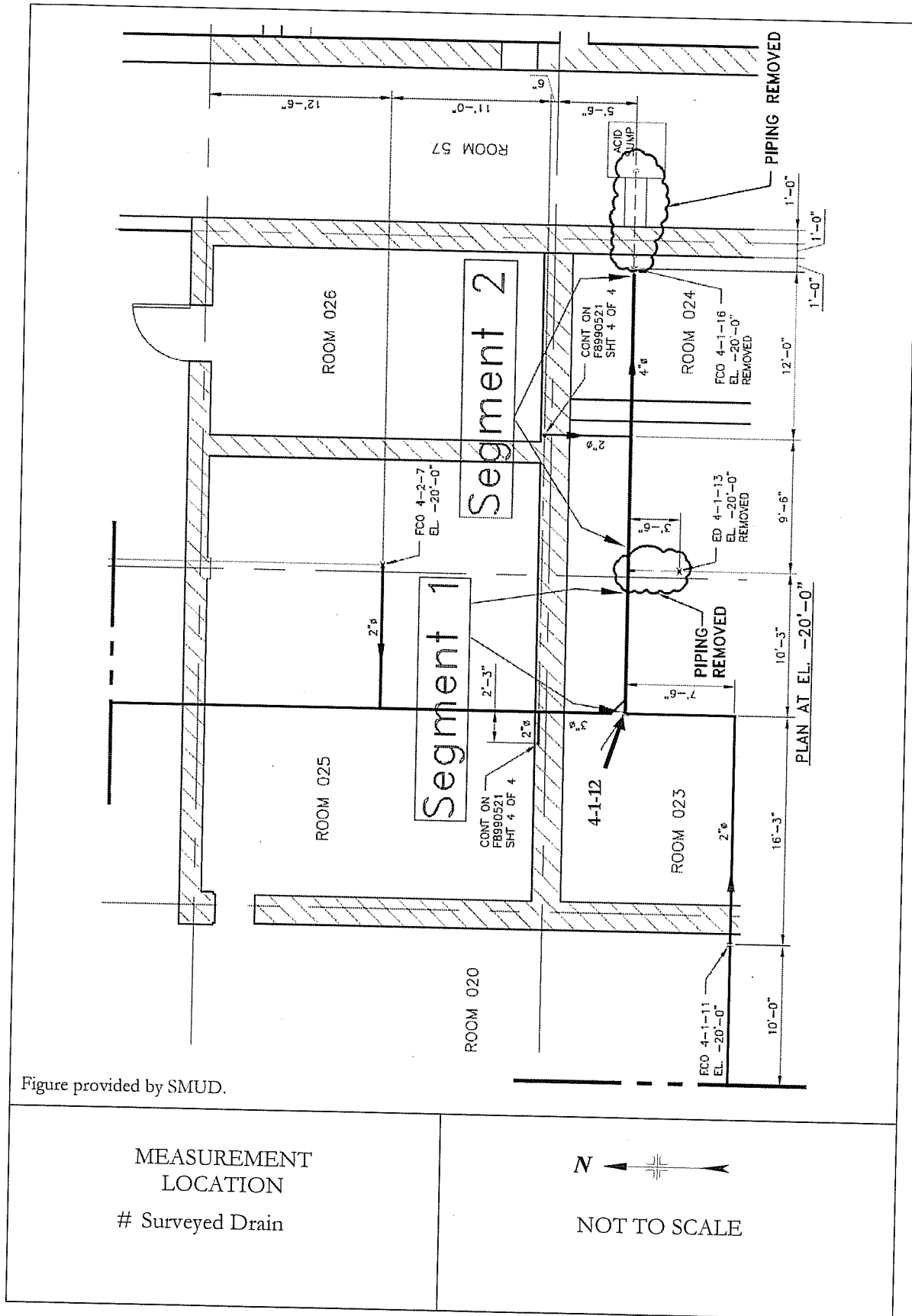


Figure 9: Survey Unit F8990521, Acid Waste Drains – Surveyed Drain 4-1-12, Segment 1

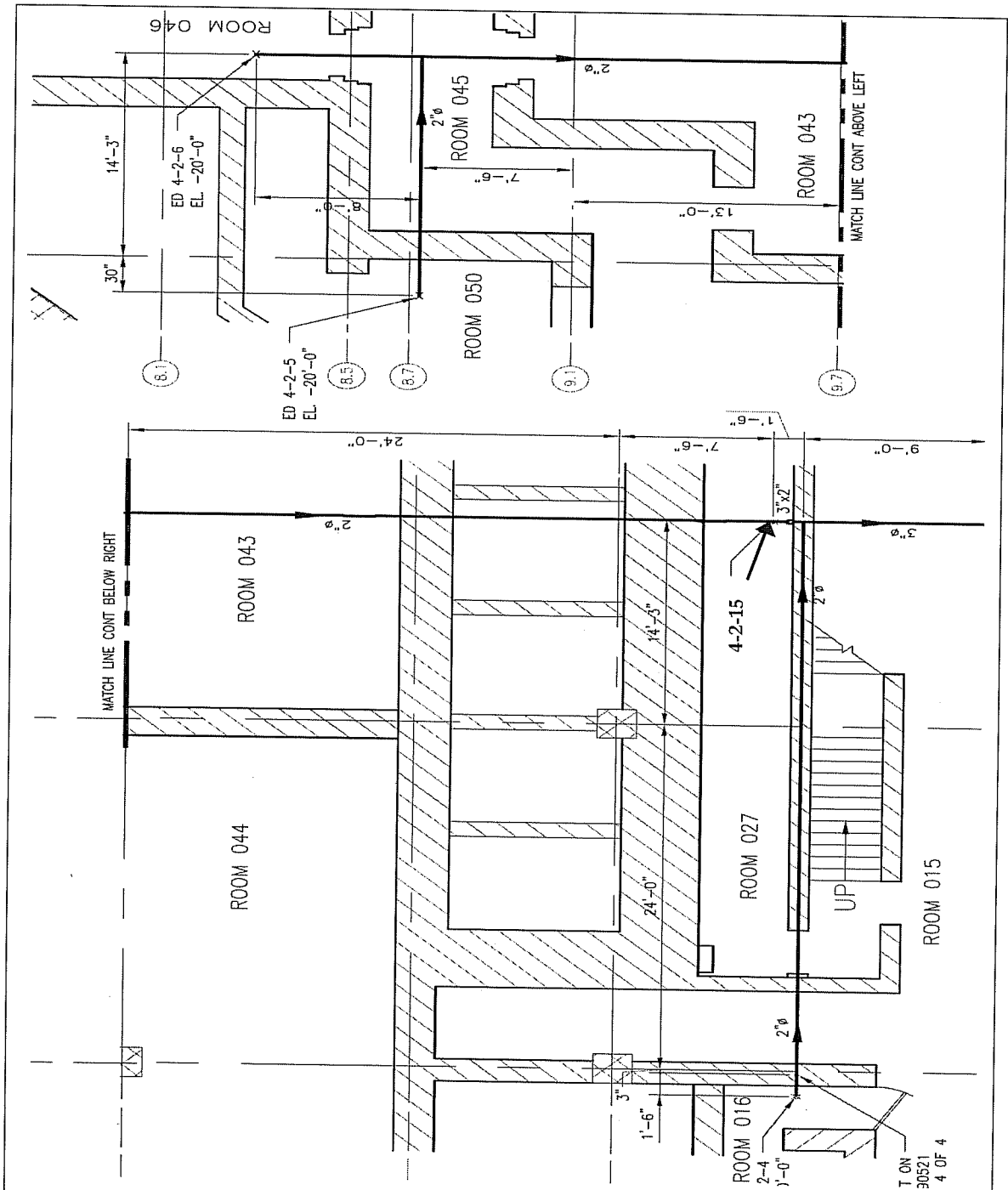


Figure provided by SMUD.

<p>MEASUREMENT LOCATION</p> <p># Surveyed Drain</p>	<p>N </p> <p>NOT TO SCALE</p>
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Figure 10: Survey Unit F8990521, Acid Waste Drains – Surveyed Drain 4-2-15

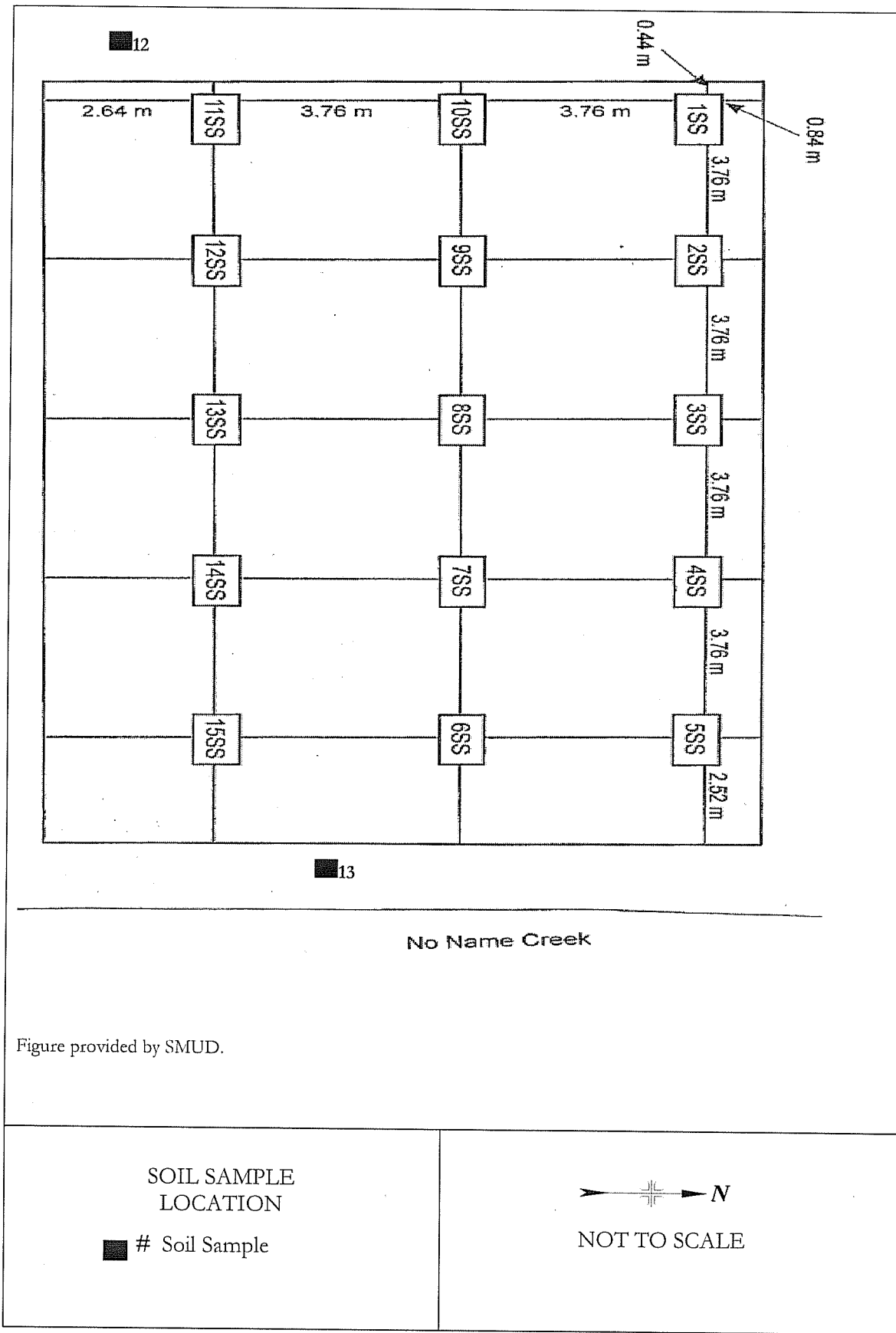


Figure 11: Outfall Area – Soil Sample Locations

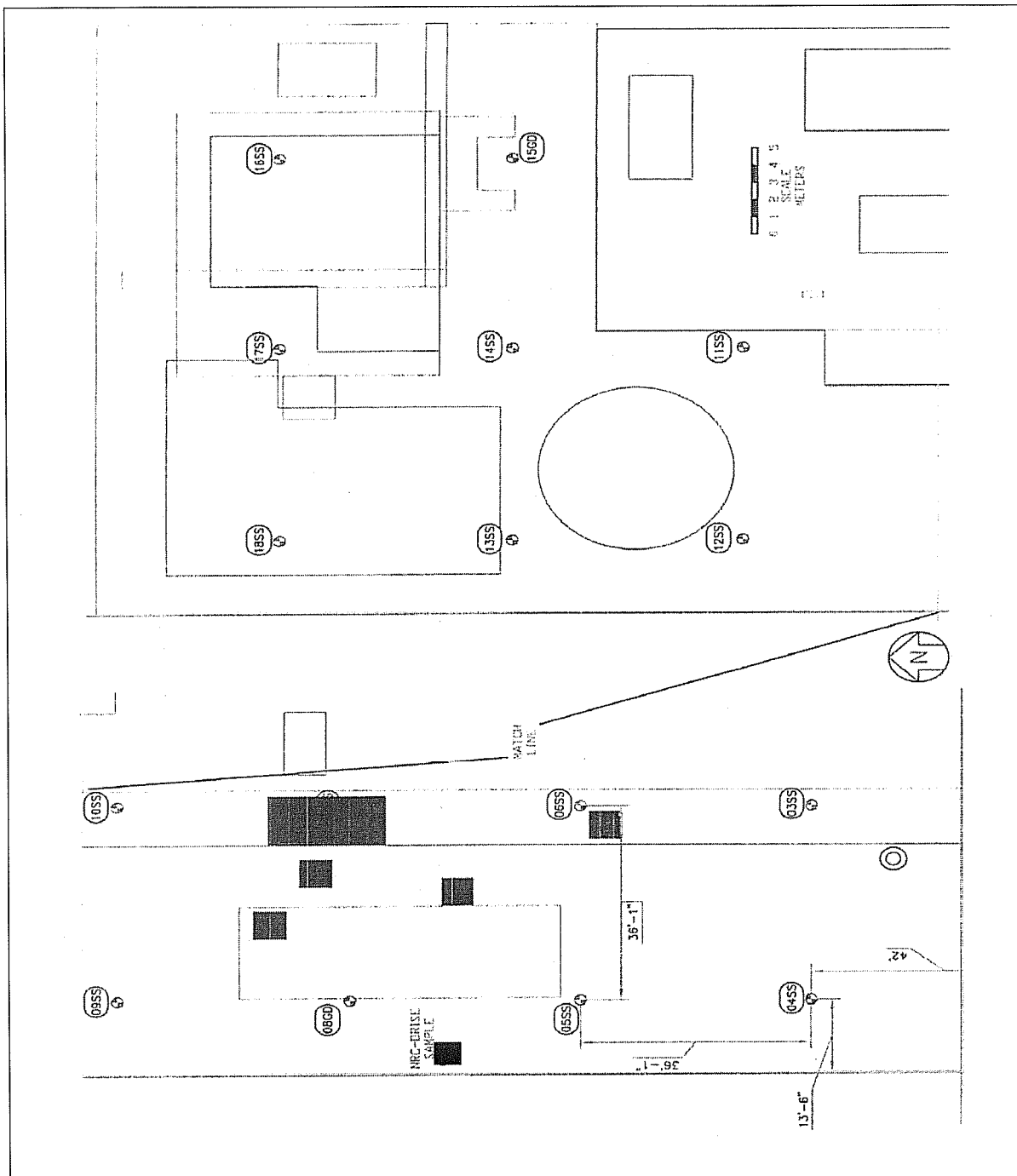


Figure provided by SMUD.

<p style="text-align: center;">SOIL SAMPLE LOCATION</p> <p style="text-align: center;"> <span style="display: inline-block; width: 15px; height: 15px; background-color: black; margin-right: 5px;"></span> Soil Sample         </p>	<p style="text-align: center;"> </p> <p style="text-align: center;">NOT TO SCALE</p>
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**Figure 12: RHUT Auxiliary Boiler Land Area – Soil Sample Locations**

## TABLES



TABLE 1

SURVEY UNIT CLASSIFICATION AND SCAN COVERAGE  
 FOR SURVEYED ROOMS IN THE AUXILIARY BUILDING  
 RANCHO SECO NUCLEAR GENERATING STATION  
 HERALD, CALIFORNIA

Auxiliary Building Survey Unit/Room <sup>a</sup>	Class	Percent Scan Coverage			
		Gamma Floor/Lower Wall	Beta Floor	Beta Lower Wall	Beta Upper Surfaces
Vault 30	1	--- <sup>b</sup>	100	75	5
Vault 31	1	---	100	75	5
Vault 34	1	---	100	75	---
Vault 35	1	---	100	70	---
18 FL and LW	1	100	75	50	---
18 US	2	---	---	---	---
50 FL and LW	1	100	70	50	---
50 US	2	---	---	---	---
53 FL and LW	1	100	75	50	---
53 US	2	---	---	---	---

<sup>a</sup>Refer to Figures 4 through 8. FL = floor, LW = lower wall and US = upper surfaces.

<sup>b</sup>Scans not performed.

TABLE 2

**SURFACE ACTIVITY LEVELS  
AUXILIARY BUILDING STRUCTURAL SURFACES  
RANCHO SECO NUCLEAR GENERATING STATION  
HERALD, CALIFORNIA**

Room/ Location <sup>a</sup>	Surface <sup>b</sup>	Total Beta Activity (dpm/100 cm <sup>2</sup> ) <sup>c</sup>	Removable Activity (dpm/100 cm <sup>2</sup> )		Activity Meets Gross Beta DCGL <sup>d</sup>
			Alpha	Beta	
<b>Vault 30</b>					
12	LW	740	1	2	YES
13	FL	4,700	0	-1	YES
<b>Vault 31</b>					
9	FL	16,000	0	8	YES
10	FL	4,300	1	1	YES
11	LW	2,600	0	1	YES
<b>Vault 34</b>					
6	LW	6,000	0	-1	YES
7	FL	6,100	0	7	YES
8	US	260	0	-3	YES
<b>Vault 35</b>					
1	FL	1,200	1	6	YES
2	FL	4,100	0	-1	YES
3	LW	2,400	0	3	YES
4	US	130	3	2	YES
5	US	170	0	3	YES
<b>Room 18</b>					
14 Before <sup>e</sup>	FL	110,000	---	---	NO <sup>e</sup>
14 After	FL	1,100	0	2	YES
15	FL	3,400	1	3	YES
16	FL	4,200	0	6	YES
17	FL	12,000	0	2	YES
<b>Room 50</b>					
21	FL	12,000	0	5	YES
22	FL	14,000	0	6	YES
23	FL	5,700	0	3	YES
24	FL	10,000	0	8	YES
25	FL	15,000	0	6	YES
26	FL	14,000	0	8	YES

TABLE 2 (continued)

**SURFACE ACTIVITY LEVELS  
AUXILIARY BUILDING STRUCTURAL SURFACES  
RANCHO SECO NUCLEAR GENERATING STATION  
HERALD, CALIFORNIA**

Room/ Location <sup>a</sup>	Surface <sup>b</sup>	Total Beta Activity (dpm/100 cm <sup>2</sup> ) <sup>c</sup>	Removable Activity (dpm/100 cm <sup>2</sup> )		Activity Meets Gross Beta DCGL <sup>d</sup>
			Alpha	Beta	
<b>Room 53</b>					
18	FL	5,400	0	4	YES
19	FL	3,700	5	1	YES
20	FL	2,500	3	6	YES

<sup>a</sup>Refer to Figures 3 through 8.

<sup>b</sup>Structural surfaces; FL = floor, LW = lower wall and US = upper surfaces.

<sup>c</sup>Direct measurement results rounded to two significant digits.

<sup>d</sup>DCGL values are provided in Table 5.

<sup>e</sup>Location 14 was determined to be a discrete particle that was remediated by SMUD. After remediation, the direct measurement was below the gross beta DCGL.

<sup>f</sup>Smear sample not collected.

TABLE 3

**AUXILIARY BUILDING ACID WASTE SYSTEM DRAINS  
AND PIPE PENETRATIONS  
CONFIRMATORY GAMMA SCAN RANGES  
RANCHO SECO NUCLEAR GENERATING STATION  
HERALD, CALIFORNIA**

Drain Line Location	Diameter (inches)	Scan Length (feet)	Gamma Scan Range (cpm)	
			ORISE	SMUD
<b>Turbine Building Backgrounds<sup>a</sup></b>				
Conduit, East Side 1	4	1	300 to 600	--- <sup>b</sup>
Conduit, East Side 2	4	1	300 to 600	---
Conduit, East Side 3	4	1	200 to 600	---
Conduit, East Side 4	4	1	300 to 600	---
Penetration, East Side	4	1	300 to 600	---
Exciter Pad East	4	12	200 to 800	---
Exciter Pad West	4	12	200 to 800	---
Background Range	---	---	200 to 800	---
<b>Auxiliary Building Pipe Penetrations<sup>c</sup></b>				
Vault 30	2 to 3	5	400 to 900	NA <sup>d</sup>
Vault 34	2 to 3	5	600 to 1,200	NA
Room 18	2 to 14	3 to 5	200 to 800	NA
Room 53	2 to 4	2 to 3	200 to 600	NA
<b>Auxiliary Building Acid Waste Drains<sup>e</sup></b>				
4-1-12, Segment 1 <sup>f</sup>	2	0 to 8	400 to 1,400	510 to 19,000
4-2-15	2	0	900	990
		1	600	520
		2	800	660
		3	3,200	7,700
		4	5,000	16,000
		4.5	20,000	3,000

<sup>a</sup>Turbine Building embedded piping backgrounds were determined within Turbine Building conduits. This data was collected during a previous ORISE survey (ORISE 2007d).

<sup>b</sup>Measurements not performed by SMUD within the Turbine Building conduits.

<sup>c</sup>Figure not provided. Each room had numerous pipe penetrations and a portion of those penetrations were scanned.

<sup>d</sup>Not applicable. ORISE compared the pipe penetration scan results to background.

<sup>e</sup>Refer to Figures 9 and 10. SMUD data was provided in to ORISE in a preliminary FSS data package. ORISE and SMUD results were rounded to two significant digits.

<sup>f</sup>SMUD originally numbered incorrectly Acid Waste Drain Line 4-1-12, Segment 1 as 4-1-13. Due to discrepancies in the survey data, ORISE recommends further evaluation of this drain line and the instrumentation used to collect the preliminary FSS data.

**TABLE 4**  
**RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES**  
**RANCHO SECO NUCLEAR GENERATING STATION**  
**HERALD, CALIFORNIA**

Radionuclide Concentrations in Soil Samples (pCi/g)		
Outfall Location <sup>a</sup>	Co-60	Cs-137
12	$0.32 \pm 0.06^b$	$34.9 \pm 1.1$
13	$0.49 \pm 0.08$	$47.1 \pm 1.6$

<sup>a</sup>Refer to Figure 11.

<sup>b</sup>Uncertainties represent the 95% confidence level based on total propagated uncertainties.

**TABLE 5**  
**DERIVED CONCENTRATION GUIDELINE LEVELS AND ELEVATED**  
**MEASUREMENT COMPARISONS FOR SURVEYED ROOMS**  
**IN THE AUXILIARY BUILDING**  
**RANCHO SECO NUCLEAR GENERATING STATION**  
**HERALD, CALIFORNIA**

Auxiliary Building Survey Unit/Room <sup>a</sup>	Class	Gross Beta DCGL <sup>b</sup> (dpm/100 cm <sup>2</sup> )	Design DCGL <sub>EMC</sub> <sup>c</sup> (dpm/100 cm <sup>2</sup> )
Vault 30	1	43,000	163,400
Vault 31	1	43,000	163,400
Vault 34	1	43,000	154,800
Vault 35	1	43,000	154,800
18 FL and LW	1	43,000	137,600
18 US	2	43,000	NA <sup>d</sup>
50 FL and LW	1	43,000	206,400
50 US	2	43,000	NA
53 FL and LW	1	43,000	172,000
53 US	2	43,000	NA

<sup>a</sup>Refer to Figures 3 through 8. FL = floor, LW = lower wall and US = upper surfaces.

<sup>b</sup>Gross beta DCGL accounts for radionuclide fractions and hard to detects as specified in the DTBD-05-15.

<sup>c</sup>DCGL<sub>EMC</sub> provided by SMUD and accounted for area factors determined for each specific survey unit.

<sup>d</sup>DCGL<sub>EMC</sub> not required for Class 2 survey units.

TABLE 6

DERIVED CONCENTRATION GUIDELINE LEVELS FOR SOIL SAMPLES  
 RANCHO SECO NUCLEAR GENERATING STATION  
 HERALD, CALIFORNIA

Single Nuclide DCGL <sub>w</sub> Values for Detectable Radionuclides <sup>a</sup>		
Radionuclide	Peak of the Mean Dose (mrem/y per pCi/g)	DCGL <sub>w</sub> (pCi/g)
C-14	2.93E-06	8.33E+06
Co-60	1.93E+00	1.26E+01
Ni-63	1.60E-06	1.52E+07
Sr-90	3.76E-03	6.49E+03
Cs-134	1.09E+00	2.24E+01
Cs-137	4.62E-01	5.28E+01

<sup>a</sup>Table 6-5 from the License Termination Plan (SMUD 2006a).

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