ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

October 25, 2006

Mr. John Hickman
Mail Stop: T-E18
Division of Waste Management
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852

SUBJECT: CONFIRMATORY SURVEY RESULTS FOR THE REACTOR BUILDING DOME UPPER STRUCTURAL SURFACES, RANCHO SECO NUCLEAR GENERATING STATION, HERALD, CALIFORNIA (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 Reactor Building Dome Upper Structural Surfaces at the Rancho Seco Nuclear Generating Station in Herald, California on June 7 and 8, 2006. These survey activities were requested and approved by the U.S. Nuclear Regulatory Commission (NRC). Enclosed are the confirmatory survey results documenting these survey activities. The survey activities included beta surface scans, direct measurements for total net beta activity, and limited gross alpha and gross beta removable activity measurements.

If you have any questions or comments, please direct them to me at 865.576.0065 or J. Scott Kirk at 865.574.0685.

Sincerely,

Wade C. Adams
Health Physicist/Project Leader
Survey Projects

WCA:ar

Enclosure

c: B. Watson, NRC/NMSS/TWFN T-7E18
E. Knox-Davin, NRC/NMSS/TWFN 8A23
E. Garcia/NRC/Region IV
E. Abelquist, ORISE
S. Kirk, ORISE
File/1695

Distribution approval and concurrence:	Initials
Technical Management Team Member	JSK
Laboratory Manager	RDC
Quality Manager	QIP

Voice: 865.576.0065 Fax: 865.241.3497 E-mail: AdamsW@orau.gov

P. O. Box 117
Oak Ridge, TN 37831

CONFIRMATORY SURVEY RESULTS FOR THE REACTOR BUILDING DOME UPPER STRUCTURAL SURFACES 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.

RSNGS was a 913-MWe pressurized water reactor (PWR) designed by Bechtel Power Corporation. The plant incorporated a pressurized water type nuclear steam supply system (NSSS) supplied by Babcock and Wilcox Company; a turbine generator and electrical systems; engineered safety features; radioactive waste systems; fuel handling systems; instrumentation and control systems; the necessary auxiliaries; and structures to house plant systems and other onsite facilities.

Due to a public vote the previous day, on June 7, 1989, RSNGS permanently shut down after approximately 14 years of operation. On August 29, 1989, SMUD formally notified the NRC of the permanent cessation of operations at the RSNGS. SMUD submitted the Post Shutdown Decommissioning Activities Report (PSDAR), in accordance with 10 CFR 50.82 (a) (4), in March 1997. In April 2006, SMUD submitted a license termination plan (LTP) that has yet to be approved by the NRC (SMUD 2006a). SMUD currently is conducting decontamination efforts and performing final status surveys (FSS) in the remaining structural surfaces and open land areas.

The NRC requested that the Oak Ridge Institute for Science and Education (ORISE) perform a confirmatory survey of the upper structural surfaces of the Reactor Building Dome at the RSNGS (Figures 1 and 2). While on site, the NRC site representative also requested that ORISE perform interlaboratory comparison analyses on several archived soil samples that would be provided by RSNGS personnel. The confirmatory surveys were performed on June 7 and 8, 2006.

PROCEDURES

Confirmatory surveys were performed in accordance with a site-specific survey plan that was submitted to and approved by the NRC (ORISE 2006a). The site-specific survey plan follows the guidance provided in the ORISE Survey Procedures and Quality Assurance Manuals (ORISE 2004 and 2005).

Reactor Dome Upper Structural Surfaces

Due to the difficulty and hazards associated with performing hand-held detector surveys of the Reactor Building Dome, SMUD opted to use the Containment Building Surface Single Nuclide Renovation/Demolition Scenario derived concentration guideline levels (DCGLs) for surfaces above the polar crane rail as described in Table 6-12 of the LTP (SMUD 2006a). In lieu of direct

surface activity measurement with hand-held radiological instrumentation, SMUD chose to perform *in situ* gamma spectroscopy measurements of the dome surfaces (SMUD 2006b). The detector geometry for the dome survey was defined as a 28 square meters (m^2) circular plane with a source to detector distance of 3 meters (m). Each individual circular plane, also designated as the field-of-view (FOV), was designated at a grid or measurement location.

SMUD used site-specific supplemental DCGLs for Co-60 and Cs-137 for determining surface release criteria (SMUD 2006a and b). ORISE judgmentally selected five grid blocks for confirmatory surveys based upon final status survey (FSS) results which approached unity.

Beta surface scans were performed using hand-held gas proportional detectors coupled to ratemeter-scalers with audible indicators. Surface scans were performed on up to 80% of the judgmentally selected grid block surfaces. Particular attention was given to cracks, joints, and horizontal surfaces in the evaluated structural surfaces where material may have accumulated.

Direct measurements for beta activity were performed at 31 (a minimum of five locations within each grid) locations on the evaluated structural surfaces which were available for confirmatory survey activities. Smear samples were collected at three direct measurement locations of elevated surface activity within Grid CRC052 to determine removable activity levels at these locations. Direct measurements locations are indicated on Figures 3 through 7.

Interlaboratory Comparison Soil Samples

At the request of the NRC site representative, ORISE was tasked with conducting an interlaboratory comparison to evaluate the quality of the licensee's radioanalytical procedures. Therefore, ORISE reviewed RSNGS characterization soil sample data and selected seven soil samples, collected and analyzed by SMUD, for interlaboratory comparison analyses. These samples were shipped by SMUD personnel and received by ORISE laboratory personnel on July 10, 2006.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Radiological data and sample media were returned to the ORISE laboratory in Oak Ridge, TN for analysis and interpretation. Radioassays were performed in accordance with the ORISE Laboratory Procedures Manual (ORISE 2006b). Soil samples were analyzed by gamma spectroscopy for the primary radionuclides-of-concern [ROC (i.e., Co-60 and Cs-137)]. However, spectra were also reviewed for additional gamma-emitting fission and activation products associated with the RSNGS and other identifiable total absorption peaks. Soil sample results were reported in units of picocuries per gram (pCi/g). Dry 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^2).

FINDINGS AND RESULTS

Reactor Dome Surface Activity Measurements

Beta surface scans identified several areas of elevated beta activity on the horizontally positioned metal bracket. The brackets previously connected air conditioning ductwork to the inside surface of the reactor building walls. Beta surface scans did not identify elevated beta activity on the vertical

concrete surfaces of the Reactor Building Dome walls. Total net beta activity measurements ranged from -13,000 to 410,000 dpm/100 cm^2. Removable activity measurements ranged from 9 to 26 dpm/100 cm^2 for alpha and 230 to 890 dpm/100 cm^2 for beta. Surface activity level results are presented in Table 1.

Interlaboratory Sample Analyses

Prior to shipping, SMUD re-analyzed the seven soil samples selected by ORISE. The analytical results for the comparative evaluation of the RSNGS characterization samples are provided in Table 2. The results indicate that the quality of the SMUD laboratory data, within the parameters of sample preparation and analytical procedures, were comparable with ORISE's analytical results.

COMPARISON OF CONFIRMATORY SURVEY RESULTS AGAINST THE RELEASE CRITERIA

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 DCGLs (which have yet to be approved by the NRC) based on dose modeling not to exceed 25 mrem/year total effective dose equivalent (TEDE) as presented in Section 6 of the LTP (SMUD 2006a). The DCGLs for surfaces were modified by SMUD to reflect the ratio of radionuclide concentrations in the specific survey units (SU) that were being evaluated.

The applicable surface activity guidelines from the LTP and decommissioning technical basis document (DTBD)-05-015 for the structural surfaces above the polar crane in the Reactor Building Dome are as follows (SMUD 2006a and c):

Derived Concentration Guideline Levels (dpm/100 cm^2)				
Radionuclides	**Co-60[a]**	**Cs-137[a]**	**Gross Beta[b]**	**EMC[c]**
DCGL	40,200	182,000	43,000	593,400

[a]Containment Building Surface Single Nuclide DCGL for the Renovation/Demolition Scenario as provided in Table 6-12 of the LTP.
[b]Gross beta DCGL accounts for radionuclide fractions and hard to detects as specified in the DTBD-05-015.
[c]$DCGL_{EMC}$ is the conservative value for the more restrictive Co-60 area factor of 13.8 as provided by SMUD.

All of the direct beta activity measurement results on the concrete structural surface walls (vertical surfaces) were well within the DCGLs for Co-60 and Cs-137 as provided in the LTP (SMUD 2006a). The 25 direct measurement results (on the vertical concrete walls) were also within the gross beta activity DCGL as determined by SMUD personnel using the LTP and technical basis documents (SMUD 2006a, b and c). However, the six direct beta activity measurement locations on the metal brackets that exceeded the gross beta activity DCGL were typically less than 500 cm^2. SMUD determined two area factors that were not independently verified by ORISE, one for Cs-137 which was 14.9 and one for Co-60 which was 13.8; ORISE used the lowest area factor in determining the elevated measurement comparison (EMC) criteria for a 1 m^2 area to be conservative. This corresponds to a $DCGL_{EMC}$ of 593,400 dpm/100 cm^2. All of the direct beta

surface activity measurements on the metal brackets were less than the SMUD derived $DCGL_{EMC}$ for Co-60.

SUMMARY

Beta surface scans identified several areas of elevated beta activity on the horizontal surfaces of the remaining metal brackets within the Reactor Building Dome. Direct measurements were performed at 31 locations of which six locations were on the metal brackets; the remaining locations were on the vertical concrete walls. The 25 direct measurement results on the concrete walls (vertical surfaces) were well within the individual DCGLs for Co-60 and Cs-137 and the gross beta activity DCGL for structural surfaces. As the survey results indicated, horizontal surfaces, such as on the metal brackets, exhibited elevated beta activity levels that exceeded the gross beta activity DCGL; however, these measurement locations were typically less than 500 cm^2 and were within the $DCGL_{EMC}$ release criteria. Therefore, the results of the survey activities for the upper structural surfaces of the Reactor Building Dome confirmed that the radiological conditions meet the site-specific release criteria as presented in the licensee's LTP.

ORISE performed interlaboratory comparison analyses on seven RSNGS characterization soil samples; the results indicated that the quality of the SMUD laboratory data were consistent and in agreement with ORISE's analytical results.

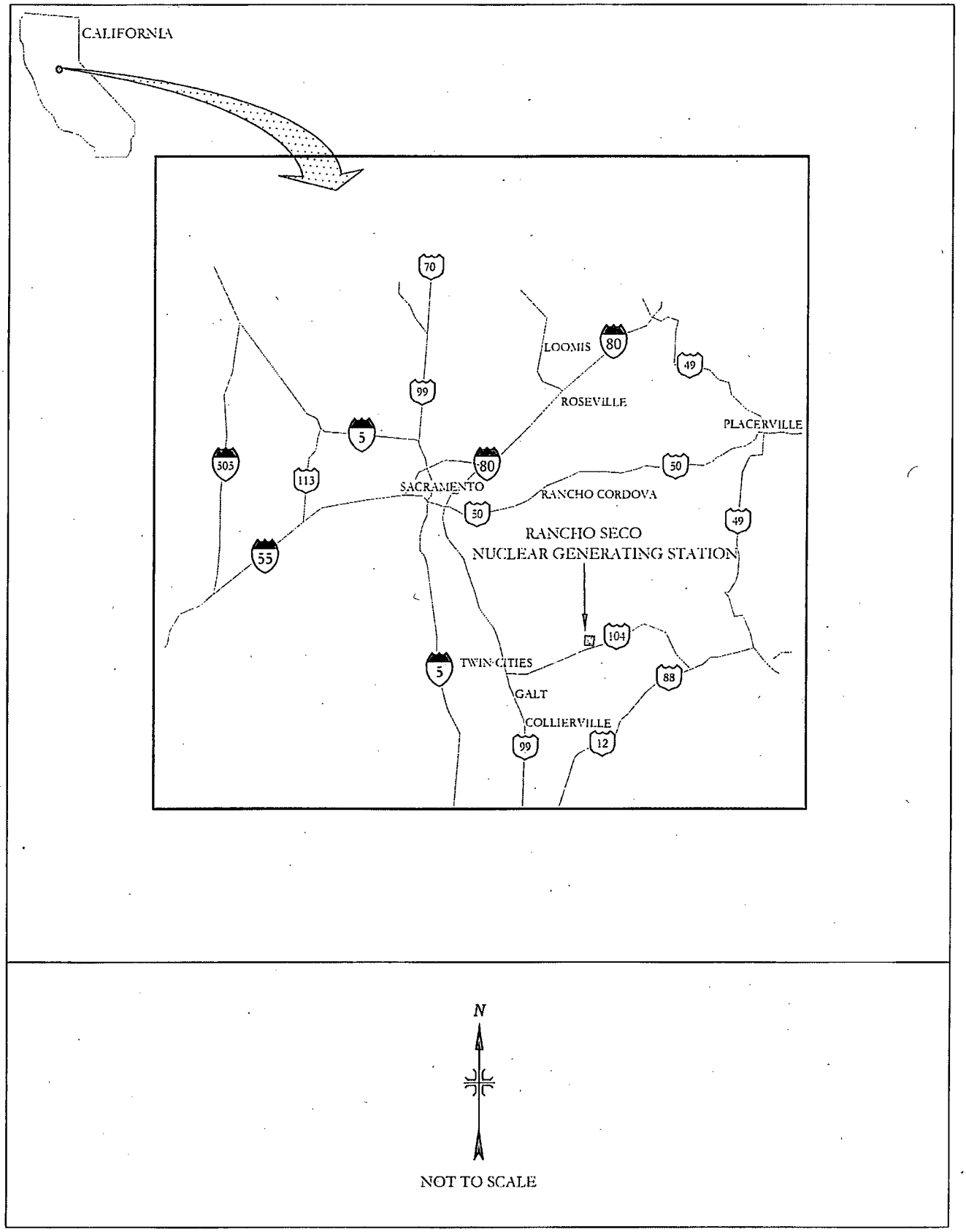

FIGURE 1: Location of Rancho Seco Nuclear Generating Station, Herald, California

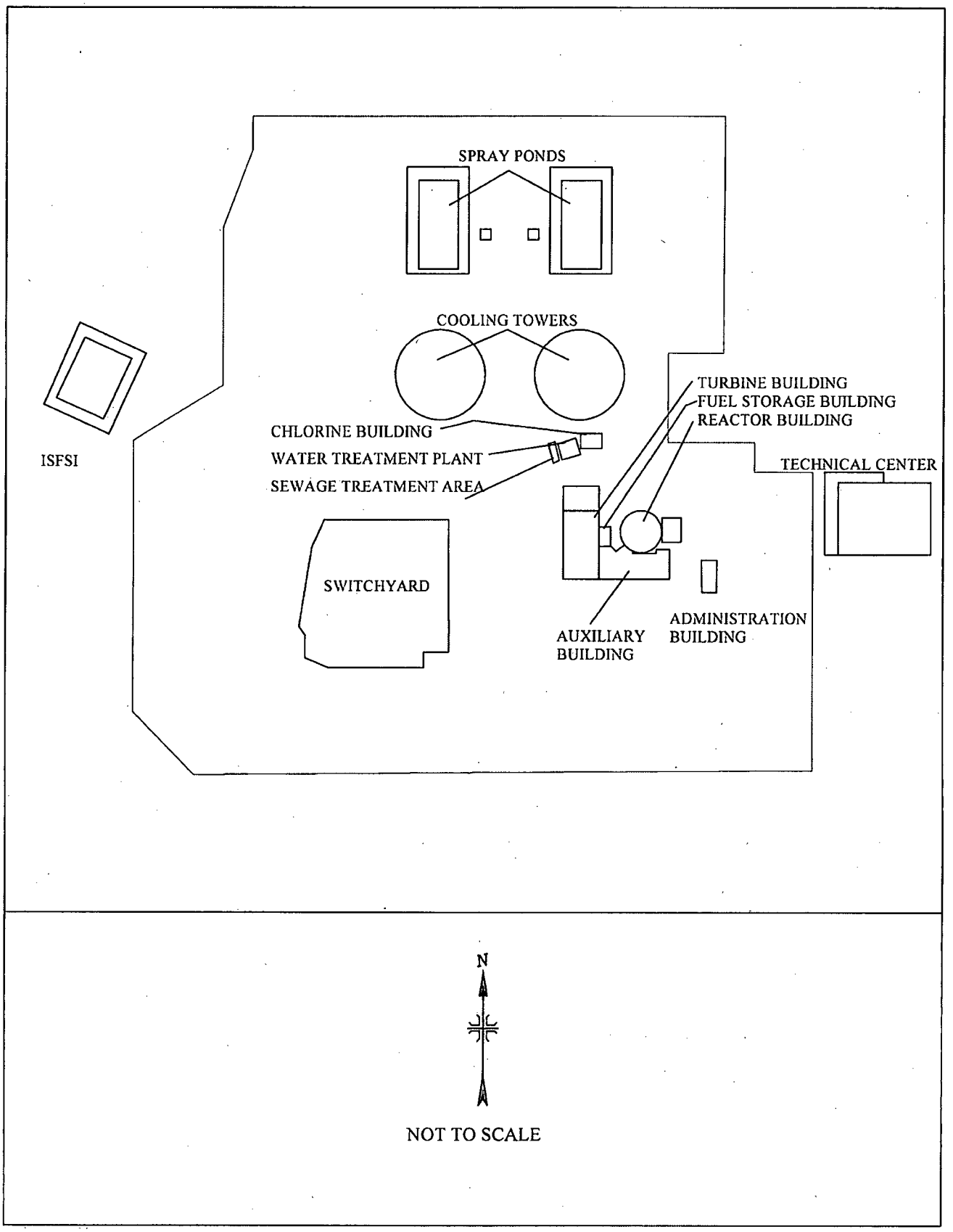

FIGURE 2: Plot Plan of the Industrial Area at Rancho Seco Nuclear Generating Station

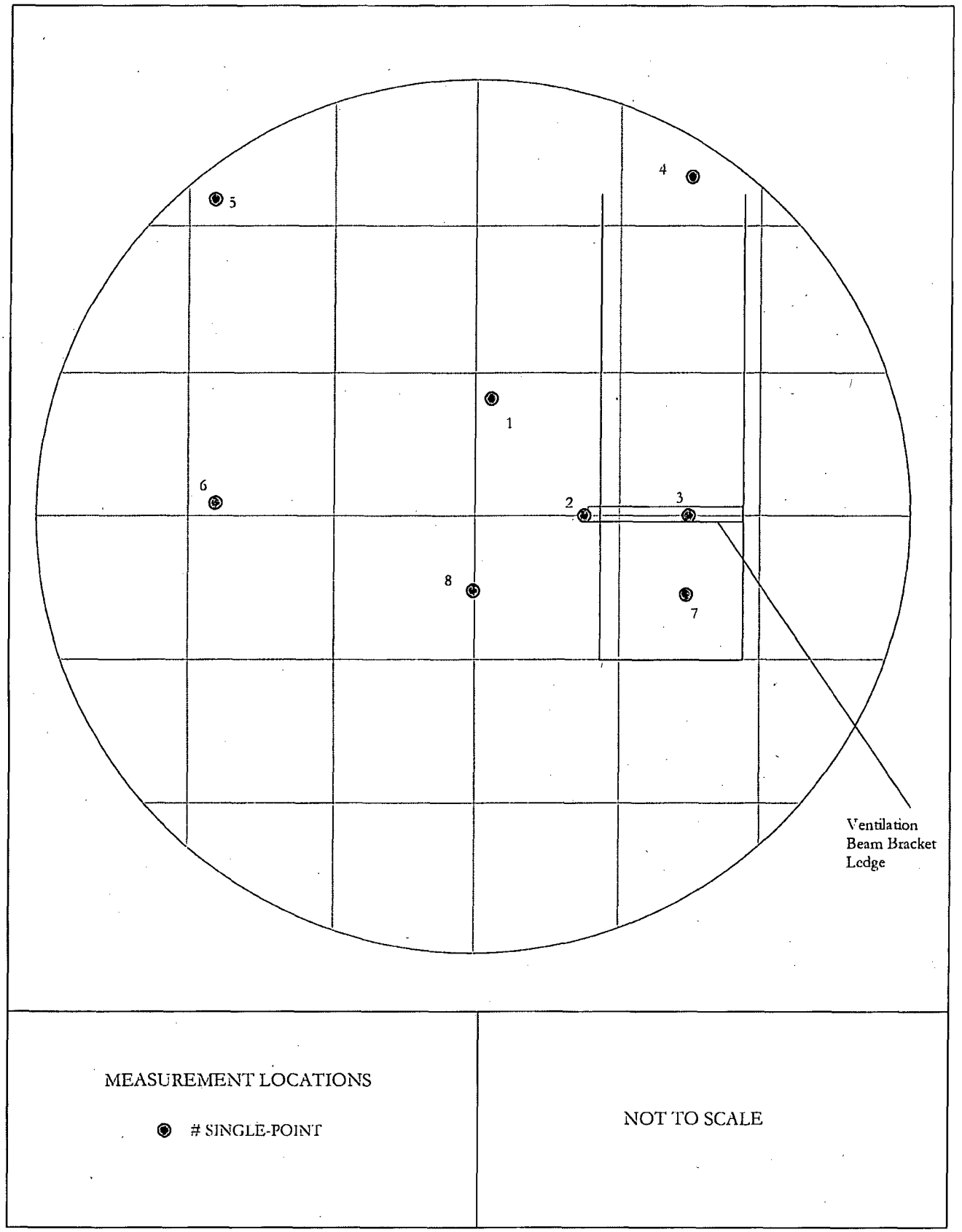

FIGURE 3: Reactor Dome CRC052 - Measurement Locations

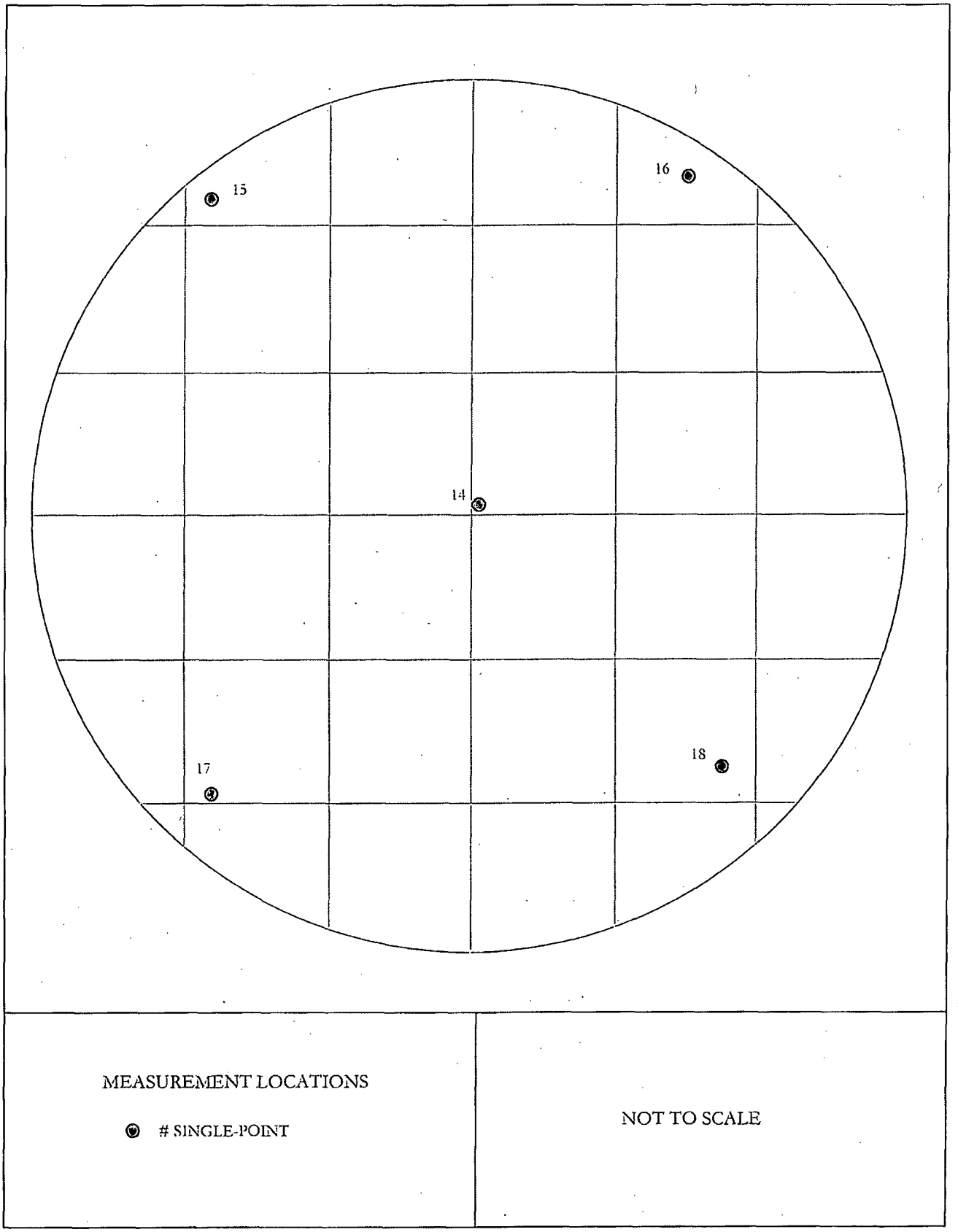

FIGURE 4: Reactor Dome CRC076 - Measurement Locations

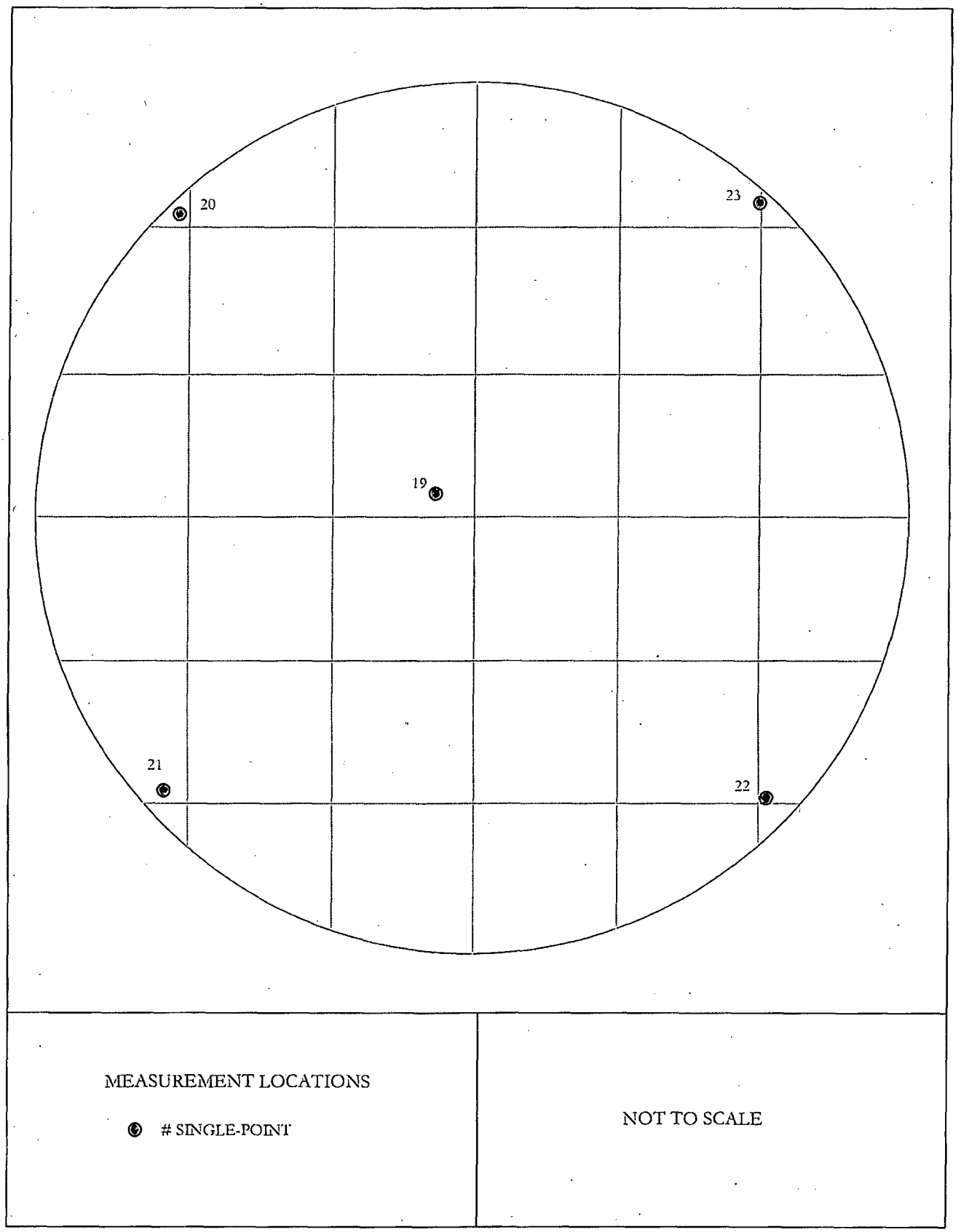

FIGURE 5: Reactor Dome CRC089- Measurement Locations

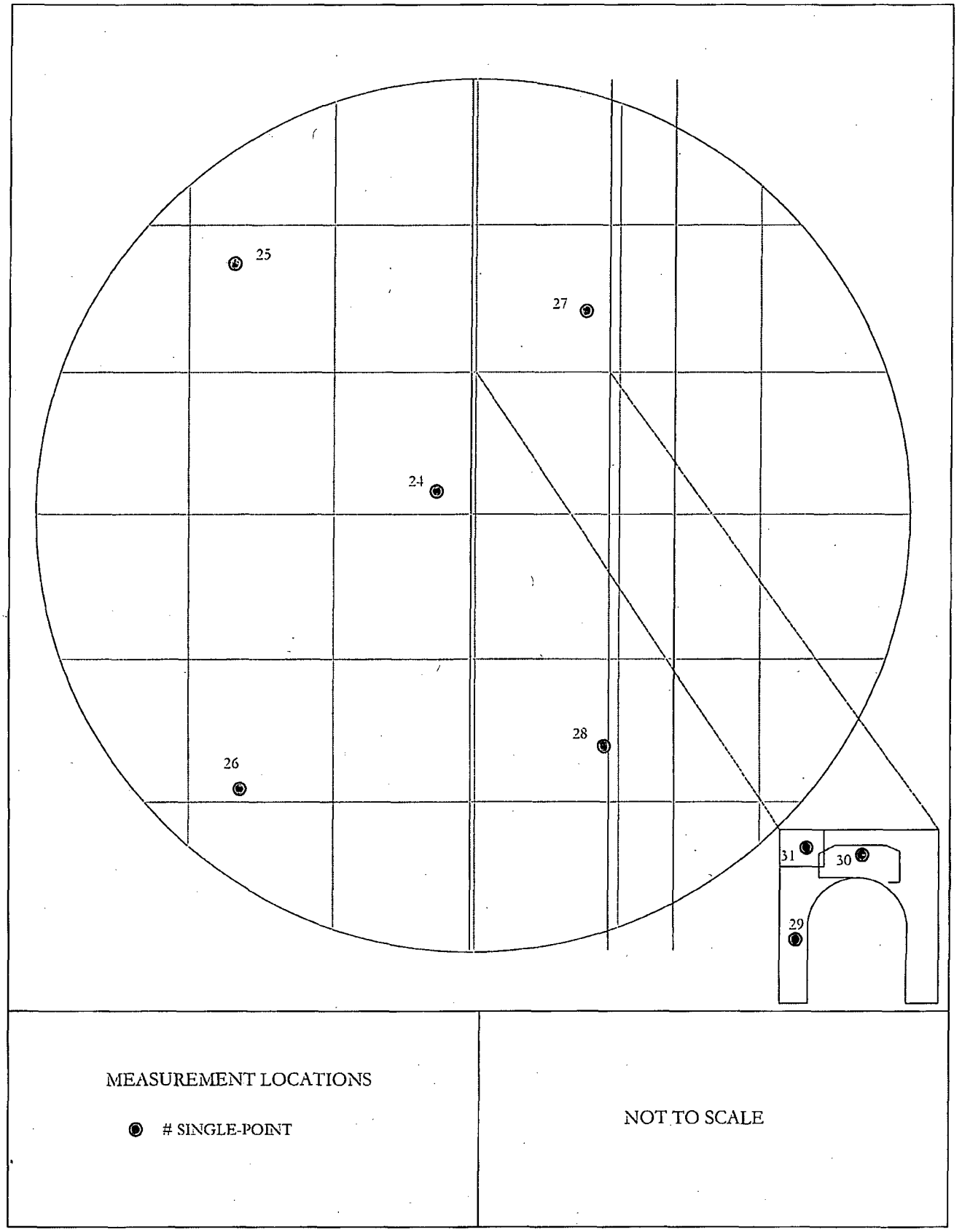

FIGURE 6: Reactor Dome CRC114 - Measurement Locations

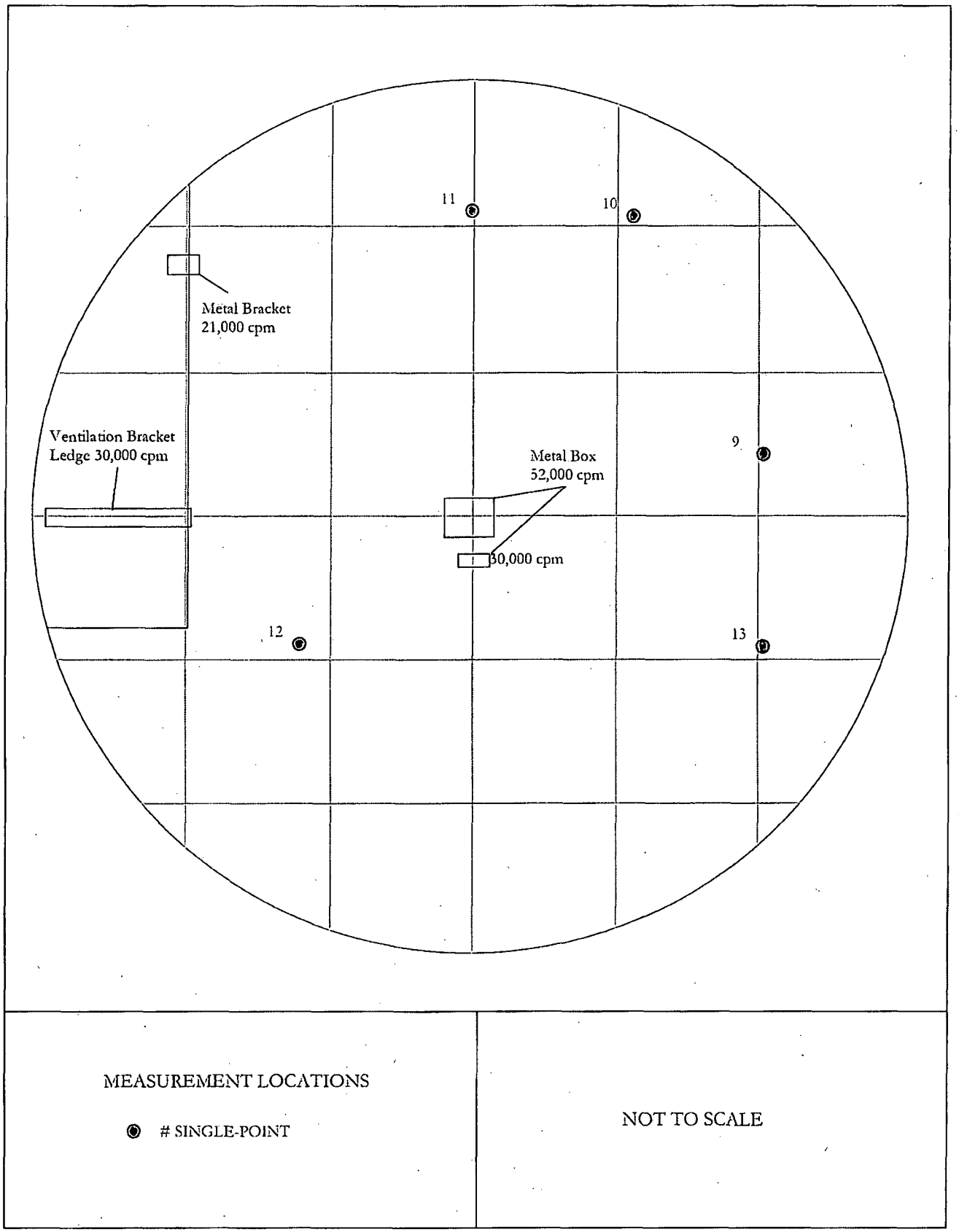

FIGURE 7: Reactor Dome CRC168 - Measurement Locations

TABLE 1

SURFACE ACTIVITY LEVELS
REACTOR DOME UPPER STRUCTURAL SURFACES
RANCHO SECO NUCLEAR GENERATING STATION
HERALD, CALIFORNIA

Location/Grid Block[a]	Total Beta Activity[b] (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
		Alpha	Beta
Grid CRC052			
1	79,000	9	230
2	150,000	16	330
3	410,000	26	890
4	-6,800	--	--
5	-5,900	--	--
6	-13,000	--	--
7	-2,800	--	--
8	-370	--	--
Grid CRC168			
9	7,500	--	--
10	360	--	--
11	890	--	--
12	2,700	--	--
13	27,000	--	--
Grid CRC076			
14	13,000	--	--
15	12,000	--	--
16	12,000	--	--
17	-590	--	--
18	12,000	--	--
Grid CRC089			
19	4,500	--	--
20	2,700	--	--
21	12,000	--	--
22	-1,800	--	--
23	-820	--	--

TABLE 1 (continued)

SURFACE ACTIVITY LEVELS
REACTOR DOME UPPER STRUCTURAL SURFACES
RANCHO SECO NUCLEAR GENERATING STATION
HERALD, CALIFORNIA

Location/Grid Block[a]	Total Beta Activity[b] (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
		Alpha	Beta
Grid CRC114			
24	4,000	--	--
25	9,900	--	--
26	6,400	--	--
27	2,500	--	--
28	2,500	--	--
Metal Overhang in CRC114			
29	75,000	--	--
30	210,000	--	--
31	280,000	--	--

[a]Refer to Figures 3 through 7.
[b]The LTP Surface Single Nuclide DCGL values are 182,000 dpm/100 cm^2 for Cs-137 and 40,200 dpm/100 cm^2 for Co-60 and the Gross Beta DCGL is 43,000 dpm/100 cm^2. With a SMUD area factor of 13.8 for Co-60, the $DCGL_{EMC}$ is 593,400 dpm/100 cm^2; all of the elevated beta activity measurement locations from 1 through 28 were less than 500 cm^2. Measurement locations 29 though 31 were on a metal overhang with approximately 1 m^2 area; the average for the 1 m^2 area would be less than the $DCGL_{EMC}$.

TABLE 2

RADIONUCLIDE CONCENTRATIONS
INTERLABORATORY COMPARISON SOIL SAMPLES
RANCHO SECO NUCLEAR GENERATING STATION
HERALD, CALIFORNIA

Sample Identification		Radionuclide	Radionuclide Concentration (pCi/g)				
			ORISE			SMUD[a]	
ORISE	SMUD					Previous	Current
1695S0001	XB8100030DS01A	Mn-54	-0.15	±	0.15[b]	--[c]	--
		Co-60	1.45	±	0.14	1.69	2.52
		Cs-134	0.05	±	0.07	--	--
		Cs-137	46.6	±	1.6	61.2	86.4
		Eu-152	0.03	±	0.20	--	--
		Eu-154	0.06	±	0.16	--	--
1695S0002	SA8100000DS01A	Mn-54	1.2	±	2.5	--	--
		Co-60	2.86	±	0.16	2.9	3.19
		Cs-134	0.13	±	0.08	--	--
		Cs-137	113.1	±	3.7	115	122
		Eu-152	0.15	±	0.24	--	--
		Eu-154	0.08	±	0.16	--	--
1695S0003	SA837001DS01	Mn-54	-0.02	±	0.05	--	--
		Co-60	2.75	±	0.12	5.63	2.83
		Cs-134	0.01	±	0.02	--	--
		Cs-137	24.30	±	0.76	20.2	20.4
		Eu-152	0.04	±	0.09	--	--
		Eu-154	0.04	±	0.08	--	--
1695S0004	SB837001DS12	Mn-54	0.13	±	0.16	--	--
		Co-60	0.06	±	0.07	0.05	0.06
		Cs-134	0.12	±	0.09	--	--
		Cs-137	48.1	±	1.6	31.1	33.5
		Eu-152	-0.15	±	0.18	--	--
		Eu-154	-0.03	±	0.12	--	--
1695S0005	CC8430020S001SS	Mn-54	0.00	±	0.01	--	--
		Co-60	0.37	±	0.05	0.34	0.34
		Cs-134	0.01	±	0.02	--	--
		Cs-137	4.46	±	0.18	4.25	4.11
		Eu-152	0.02	±	0.06	--	--
		Eu-154	-0.03	±	0.09	--	--

TABLE 2 (continued)

RADIONUCLIDE CONCENTRATIONS
INTERLABORATORY COMPARISON SOIL SAMPLES
RANCHO SECO NUCLEAR GENERATING STATION
HERALD, CALIFORNIA

Sample Identification		Radionuclide	Radionuclide Concentration (pCi/g)				
			ORISE			SMUD[a]	
ORISE	SMUD					Previous	Current
1695S0006	CC8430020S005SS	Mn-54	-0.11	±	0.19	--	--
		Co-60	0.04	±	0.03	0.09	0.06
		Cs-134	0.04	±	0.03	--	--
		Cs-137	1.95	±	0.10	2.01	2.03
		Eu-152	0.00	±	0.06	--	--
		Eu-154	0.02	±	0.09	--	--
1695S0007	8100010SFPCP	Mn-54	0.05	±	0.07	--	--
		Co-60	0.07	±	0.02	0.12	0.05
		Cs-134	0.02	±	0.03	--	--
		Cs-137	2.09	±	0.09	1.42	1.6
		Eu-152	0.01	±	0.03	--	--
		Eu-154	-0.03	±	0.05	--	--

[a]Co-60 and Cs-137 concentrations provided by SMUD personnel. Previous concentrations were performed during characterization surveys. Current concentration are when the site re-analyzes the samples prior to submitting them to ORISE.
[b]Uncertainties represent the 95% confidence level based on total propagated uncertainties.
[c]Radionuclide concentrations were not provided.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Survey Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; September 2, 2004.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; July 28, 2005.

Oak Ridge Institute for Science and Education. Proposed Confirmatory Survey Plan for the Remaining Structural Surfaces, Embedded Piping, Standing Water and Open Land Area Survey Units, Rancho Seco Nuclear Generating Station, Herald California [Docket No. 50-312; RFTA No. 06-003]. Oak Ridge, Tennessee; June 2, 2006a.

Oak Ridge Institute for Science and Education. Laboratory Procedures Manual for Independent Environmental Assessment and Verification Program. Oak Ridge, Tennessee; April 18, 2006b.

Sacramento Municipal Utility District (SMUD). License Termination Plan, Rancho Seco Nuclear Generating Station, Herald, California; April 2006a.

Sacramento Municipal Utility District. Decommissioning Technical Basis Document: Use of In Situ Gamma Spectroscopy for Final Site Survey. DTBD-06-003, Revision 0. Rancho Seco Nuclear Generating Station, Herald, California; May 24, 2006b.

Sacramento Municipal Utility District. Decommissioning Technical Basis Document: Structure Nuclide Fraction and DCGLs. DTBD-05-015, Revision 0. Rancho Seco Nuclear Generating Station, Herald, California; June 2, 2006c.