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AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

MPC&D 01-052

April 9, 2001

U. S. Nuclear Regulatory Commission
Attn.: E. W. Merschoff
Harris Tower
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Docket No. 50-312
Rancho Seco Nuclear Generating Station
License No. DPR-54

RANCHO SECO ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR 2000

Dear Mr. Merschoff:

Attached is the Rancho Seco Annual Radiological Environmental Operating Report (AREOR) for 2000. This report contains the information required by the Rancho Seco Permanently Defueled Technical Specification D6.9.2.3 "Annual Radiological Environmental Operating Report."

Members of your staff with questions requiring additional information or clarification may call Steve Nichols at (916) 732-4850.

Sincerely,

Michael J Bua For S. R.

Steve Redeker
Manager, Plant Closure & Decommissioning

Cc: Document Control Desk, NRC, Washington DC
P. Harris, NRC, Rockville

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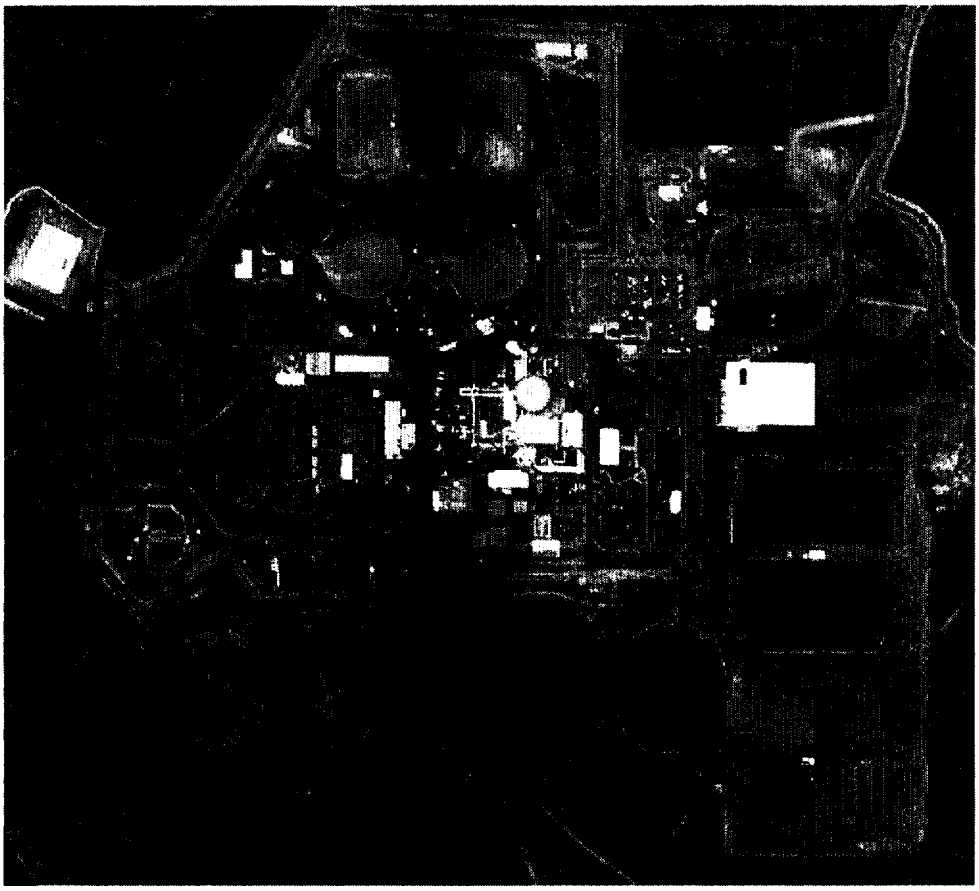
ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT



JANUARY -- DECEMBER 2000

Rancho Seco Nuclear Station
Herald, California
License Number DPR-54/ SNM-2510

2000 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

2000 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

I. EXECUTIVE SUMMARY

This report contains results from the Radiological Environmental Monitoring Program (REMP) for the Rancho Seco Nuclear Station (RSNS) compiled for the period January 1, 2000 through December 31, 2000. This program is conducted by the Radiation Protection/ Chemistry Group at RSNS and is conducted in accordance with section D6.8.3.b of the RSNS Permanently Defueled Technical Specifications.

The results of the 2000 Radiological Environmental Monitoring Program showed that the operation of RSNS had no significant radiological impact on the environment.

Currently, the Plant is (1) permanently shutdown, (2) in a SAFSTOR condition, and (3) undergoing Decommissioning. Fuel off-loading into dry storage is currently scheduled to begin in 2001 to an Independent Spent Fuel Storage Installation (ISFSI).

During the reporting period, the atmospheric, terrestrial and aquatic environs adjacent to RSNS were monitored. The sample measurements showed that the levels of radioactivity in the sampled media were consistent with previous evaluations. All positively detected results were well below the reporting levels.

Doses resulting from ambient exposure to terrestrial and atmospheric direct radiation sources were measured through the placement and retrieval of Luxel monitoring badges. Direct radiation measurements attributable to Station operations, based on control and indicator locations, were indistinguishable above background levels. Two monitoring badge locations, placed in an area near the effluents discharge creek are being used to evaluate the higher than average soil activity. This activity is a result of historic monitored liquid effluent releases during Station operation. One monitoring badge location in this area is indicating dose higher than the indicator average. The dose at this location does not exceed regulatory limits.

Isotopic identifications were consistent with known releases of radioactive material from the Station to the atmospheric and aquatic environments. As expected, algae, fish, and sediment samples obtained from the aquatic environment of the No Name, Clay, Hadselville, and Laguna Creeks contributed the majority of positive isotopic identifications. Cesium -137, Cobalt-60, and Cesium-134 were the predominant nuclides identified in the aquatic environment. Tritium activity was detected during periods of liquid effluent releases.

II. LAND USE CENSUS

The 2000 Land Use Census was conducted in accordance with the Rancho Seco Permanently Defueled Technical Specification (PDTS) section D.6.8.3.b.2 and Radiological Environmental Monitoring Program (REMP) manual section 4.0. The 2000 Land Use Census identified the continued transition to grape vineyards from pasture usage of the areas north, west, and south of the site. Evaluation of additional samples, because of this change, continued during 2000. Five well locations associated with the vineyards were sampled during 2000 and two grape samples were collected and analyzed during 2000.
This evaluation is in accordance with the requirements of 10CFR50, Appendix I, section IV.B.3. The land use census is performed on a biennial schedule and was performed during 2000 and completed in 2001. The next land use census is scheduled to be conducted in 2002 and completed in 2003.

III. RADIOLOGICAL IMPACT EVALUATION

PREDICTED POTENTIAL RADIOLOGICAL IMPACT

Gaseous Effluent Exposure Pathways

The maximum calculated annual organ dose commitment due to gaseous releases of tritium and particulate isotopes was 0.057 mRem (as calculated using the Rancho Seco Offsite Dose Calculation Manual (ODCM)). This calculated organ dose commitment was 0.38% of the associated PDTS limit (10CFR50, Appendix I guideline).

The maximum calculated annual dose commitment due to gaseous releases of noble gases was 0.00E+00 mrad, gamma air dose, and 0.00E+00 mrad, beta air dose, (as calculated using the Rancho Seco Offsite Dose Calculation Manual (ODCM)). The calculated air dose commitments were "NA" due to no calculated dose.

Liquid Effluent Exposure Pathways

During 2000, 1.83 E+07 liters of wastewater were released into "No Name" Creek from the two onsite Retention Basins. This volume of wastewater was dispersed into 1.64 E+10 liters of dilution water. The estimated error associated with determining these volumes was 5% and 20%, respectively.

The Liquid source term resulted in a calculated annual adult total body dose commitment of 0.139 mRem and a calculated child liver dose commitment of 0.276 mRem (as calculated using the ODCM). These calculated dose commitments were 4.64% and 2.76%, respectively, of the associated PDTS limits (10CFR50, Appendix I guidelines). The dose commitments reflect the age groups that could have received the highest annual dose commitment from the liquid source term. This information is summarized in Table 1.

III. RADIOLOGICAL IMPACT EVALUATION (Continued)

FUEL CYCLE DOSE EVALUATION

PDTS section D6.9.2.3 [NRC74] requires each Annual Radiological Environmental Operating Report (AREOR) to include information related to REMP manual section 5.0; Fuel Cycle Dose. The Fuel Cycle Dose Specification limits the dose or dose commitment to any real member of the public to 25 mrem to the total body or any organ, except the thyroid which is limited to 75 mrem. This specification implements requirements promulgated by the United States Environmental Protection Agency [CFRd].

Consistent with REMP manual section 5.0, no fuel cycle dose evaluation was required to be performed during 2000 since no REMP measurement exceeded the established reporting levels. Additionally, the Station effluent dose predictions did not exceed twice the dose guidelines of 10CFR50, Appendix I [CFRc]. The station operated within the Appendix I guidelines envelope for radioactive effluents (a condition supported by Program measurements); therefore, determination of an actual dose commitment delivered to a real member of the public was not required.

OBSERVED POTENTIAL RADIOLOGICAL IMPACT

Gaseous Effluent Exposure Pathways

The calculated gaseous effluent dose commitment calculation activity, of 0.057 mRem [RS00] is based on tritium activity. No particulate isotopes of Station origin were released during 2000. The observed dose commitment dose calculation, if completed, using the gross beta data (which is primarily due to naturally occurring radioisotopes) would not provide an accurate correlation with the tritium activity dose calculations. Therefore, no dose comparison was completed.

This was also confirmed during 2000, as none of the REMP quarterly composite gamma isotopic analysis results for the airborne pathway indicated the presence of nuclides of Station origin.

Direct Radiation Exposure Pathway

Based on Luxel control and indicator locations measurement results obtained during 2000, the Station proper did not contribute an observable component to the recorded direct gamma radiation field. This Luxel data supports the Gaseous Effluent Exposure Pathway conclusions and supports the conclusion that the Plant has no direct radiation effect on the environment.

Luxel monitoring badges placed near the effluent stream were used to evaluate the dose from this area. Dose levels at these locations are higher than the mean of the control and indicator locations reported. This above average dose is due to elevated soil activity due to historic liquid effluent releases.

III. RADIOLOGICAL IMPACT EVALUATION (Continued)

OBSERVED POTENTIAL RADIOLOGICAL IMPACT

Liquid Effluent Exposure Pathways

To evaluate the impact on the environment from the liquid effluent pathway, dose calculations were performed and compared with the annual dose commitment calculations reported in the January -December 2000 Rancho Seco Annual Radioactive Effluent Release Report [RS00]. The observed results presented in Table 1 were obtained using the Cs-137 activity reported for the fish samples from 2000 (Appendix F, Table F-5), default consumption quantities for fish (ODCM), and nuclide-specific dose factors [NRC77].

As in past reports, the observed potential dose commitments listed in Table 1 are subject to uncertainty, principally due to the assumption that the observed radioactivity was due to 2000 Station operations only and was not affected by radioactivity introduced into the environment prior to 2000. A major portion of the activity identified by Program measurements in 2000 is attributable to historical releases documented in previous annual reports. Additionally, the observed dose commitment calculations are based on conservative default consumption factors for fish.

The 2000 Land Use Census indicates the potential for a liquid/ fish or liquid/ irrigated vegetation pathway. This potential will continue to be evaluated and updated in the 2002 Land Use Census. This potential is based on the possibility and not actual data supporting the use of the effluent streams for a source of fish. The irrigation of the vineyards will continue to be evaluated in the 2002 Land Use Census. Conservative consumption factors for fish were used for the observed dose commitment based on this potential.

III. RADIOLOGICAL IMPACT EVALUATION (Continued)

OBSERVED POTENTIAL RADIOLOGICAL IMPACT

TABLE 1

2000 Liquid Effluent Pathway Potential Dose Comparison

POTENTIAL DOSE COMMITMENT
(Based on the maximally exposed group)

PREDICTED DOSE COMMITMENT (a) (mRem)	OBSERVED DOSE COMMITMENT (b) (c) (mRem)	PERCENT OF THE 10CFR50 APPENDIX I DOSE LIMITS
0.139 (Adult Total Body)	0.114 (Adult Total Body)	3.8 % Total Body (3 mrem guideline)
0.276 (Child-Liver)	0.182 (Teen Liver)	1.8 % Organ (10 mrem guideline)

Notes:

(a) Reported in the 2000 Annual Radiological Effluents Release Report

(b) Calculated using Cs-137 activity for fish samples (Appendix F, Table F-5).

(c) The observed dose commitments for doses reflect the age group that could have received the highest annual dose commitment from the liquid source term

IV. PROGRAM ANALYSIS RESULTS SUMMARY

This section compiles all Program data with corresponding evaluations. Each of the following five subsections presents information about each of the principal environmental exposure pathways monitored by the Program:

- ⇒ **Atmospheric** (Section IV-A)
- ⇒ **Direct Radiation** (Section IV-B)
- ⇒ **Terrestrial** (Section IV-C)
- ⇒ **Aquatic Life** (Section IV-D)
- ⇒ **Water** (Section IV-E)

Each of these sections contains a data evaluation subsection, which provides a summary of the data collected.

Table 2 is a comprehensive, all-media data summary presented in a format considered acceptable by the US Nuclear Regulatory Commission. Information contained in Table 2 was derived from data presented in Appendix F.

IV-A. ATMOSPHERIC MONITORING

DATA EVALUATION

No radionuclides attributable to the operation of Rancho Seco were observed in gamma spectrometry analyses of the quarterly composites of the particulate filters. No table is presented for this data since all the data was reported as being below the associated minimum detectable activity for the nuclides of interest.

The data indicates that there was no measurable contribution to the airborne radioactivity inventory, which could reasonably be attributable to Station operations.

The summary data for 2000 air particulate monitoring is presented in Table 2. Comprehensive data tables are given in Appendix F, Table F-1.

IV-B. DIRECT RADIATION MONITORING

DATA EVALUATION

A comparison review of all Luxel badge data for the indicator and control locations during 2000 showed that there was no observable direct radiation component due to Station operations (i.e., storage or utilization of licensed radioactive material within the restricted area.)

Two Luxel badge locations are being used to evaluate the dose in areas next to the effluent stream. The data from these locations indicates doses are within regulatory limits.

The summary data for 2000 direct radiation monitoring is presented in Table 2. Comprehensive data tables are given in Appendix F, Table F-2.

IV-C. TERRESTRIAL MONITORING

DATA EVALUATION

Garden Vegetation -- Four garden vegetation samples and two grape samples were collected and analyzed for nuclides of interest during 2000. No gamma emitting isotopes were found in any of the samples analyzed. A site boundary irrigated garden has been evaluated to be a conservative method for evaluating the liquid effluent pathway. This method meets the requirement of the Land Use Census for monitoring gardens. This site boundary garden is used for the Land Use Census. The vineyard grape samples included a control location and an indicator location. These two samples were analyzed for gamma emitting isotopes and tritium activity.

Soil (discharge canal) -- Eight soil samples were collected and analyzed for nuclides of interest from the effluent discharge canal and downstream creeks during 2000. Cs-137 (7 samples, 61 to 1259 pCi/kg, 313 pCi/kg mean) and Co-60 (2 samples, 13 to 43 pCi/kg, 28 pCi/kg mean) was detected by the analyses. The remaining nuclide identifications were numerically below the required LLD-equivalent activity concentration. The presence of the identified nuclides is attributed to historical Station operations. Sampling at these locations is within an approximately 10 m^2 area. Random sampling in this area provides data to evaluate isotopic concentrations in the sample location. Due to the random nature of the samples, the data does not provide adequate statistical information to evaluate individual isotopic decay or overall migration information. Soil sampling at these locations is not required by the REMP (administratively controlled).

Soil (storm drain outfall) -- Thirty soil samples were collected from fifteen storm drain out-fall locations during 2000. These out-falls are located along the perimeter of the Industrial Area Boundary (Restricted Area) and the ISFSI. Gamma spectrometry analysis of these samples revealed the presence of Cs-137 (16 samples, 21 to 418 pCi/kg, 70 pCi/kg mean). Sampling at these locations is in the area of the storm drain discharge. Soil sampling at these locations is not required by the REMP (administratively controlled).

IV-C. TERRESTRIAL MONITORING (Continued)

DATA EVALUATION

Soil (depression area) -- Fourteen (14) soil samples at seven locations were collected in 2000. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (14 samples, 133 to 40700 pCi/kg, 9319 pCi/kg mean), Co-60 (8 samples, 30 to 1180 pCi/kg, 404 pCi/kg mean), and Cs-134 (6 samples, 38 to 147 pCi/kg, 79 pCi/kg mean. Sampling at these locations is within an approximately 3 m^2 area. As stated for the soil locations along the effluent discharge, random sampling in this area provides data to evaluate isotopic concentrations in the individual sample location(s). Due to the random nature of the samples, the data does not provide adequate statistical information to evaluate individual isotopic decay or overall migration information. Soil sampling at these locations is not required by the REMP (administratively controlled).

The summary data for 2000 terrestrial monitoring is presented in Table 2. Comprehensive data tables are given in the following Appendix F tables:

⇒ **F-3** (Garden Vegetables)

⇒ **F-4** (Soil and Sediment).

IV-D. AQUATIC LIFE MONITORING

DATA EVALUATION

Fish - Two fish samples were collected during 2000 and analyzed for nuclides of interest by gamma spectrometry. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (2 samples, 59 to 94 pCi/kg, 76 pCi/kg mean).

Sediment - 23 samples of sediment were collected from the discharge canal and the Clay/ Hadselville/ Laguna Creeks during 2000. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (21 samples, 11 to 9000 pCi/kg, 946 pCi/kg mean), Co-60 (4 samples, 6 to 176 pCi/kg, 95 pCi/kg mean), Cs-134 (2 samples, 30 to 41 pCi/kg, 36 pCi/kg mean), and Mn-54 (2 samples, 1 to 5 pCi/kg, 3 pCi/kg mean).

The presence of nuclides of interest in sediments is attributed to historical permitted liquid effluent discharges. The presence of Mn-54 is considered an anomaly due to the half-life of Mn-54. The analysis laboratory (Eberline Services) reanalyzed and confirmed the results for the Mn-54 data.

IV-E. WATER MONITORING

DATA EVALUATION

Algae - Eleven samples of algae were collected from the discharge canal and the Clay/ Hadselville/ Laguna creeks during 2000. Cs-137 (6 samples, 12 to 52 pCi/kg, 31 pCi/kg mean) and Co-60 (2 samples, 5 to 7 pCi/kg, 6 pCi/kg mean) was detected by gamma spectrometry analysis.

The identification of nuclides of interest in the algae samples is attributed to permitted historical liquid effluent discharges.

Well Water - 34 well water samples, from nine locations, were collected at indicator and control locations around the site during 2000. Tritium and gamma spectrometry analysis of the samples indicated results less than LLD. Gross beta activity levels for all samples were within regulatory limits. Three additional locations (total of four locations for the vineyards) were administratively added in 2000 for the observed transition to commercial grape vineyards around the site.

Runoff Water – 30 runoff water samples were collected at the site boundary during 2000. No nuclides of interest were identified by gamma spectrometry. One tritium analysis, during the third quarter, immediately after a liquid effluent release from the South Retention Basin, indicated a positive tritium result (5190 pCi/L).

Surface Water - Five locations (3 indicator and 2 control) were included in the surface water monitoring Program. Composite samplers located at the Plant intake (Folsom South Canal) and effluent discharge (Restricted Area/ Industrial Area Boundary) provide monthly composite samples. During 2000, 64 samples were collected and analyzed for nuclides of interest. No gamma-emitting nuclides were detected in any of the samples analyzed. Tritium activity was detected in samples collected during the third and fourth quarters of 2000 during planned liquid effluent releases from the South Retention Basin. Tritium activity was measured at 510 pCi/L from the composite sampler at the effluent discharge and 260 pCi/L from the grab sample taken at the Site Boundary.

Drinking Water - Water supplied from the site well is distributed in a potable water supply system for Station personnel consumption and use. On a monthly frequency, a sample of this water was collected and analyzed for nuclides of interest. A sample from the Rancho Seco Reservoir Well is collected as a control location. Cs-137 activity (45 pCi/L) was detected in the sample collected on January 25, 2000 from the Site sampling location. The Gross Beta analysis for this sample was 3.6 pCi/L. The location was re-sampled on March 13, 2000 and did not indicate Cs-137 activity. The next monthly sample did not detect Cs-137 activity at this location, as did all of the subsequent samples collected for 2000. The analysis vendor was contacted for reanalysis of the sample, but was unable to complete the analysis due to inadequate sample volume remaining. Gross Beta analysis for all samples showed activity within regulatory limits.

Rainwater - On a seasonal basis, rainwater is collected at an off site location. The sample is analyzed for gamma emitting isotopes and tritium. During 2000, 16 samples were collected at this location. No isotopes of interest were detected in these samples. Rainwater samples are not required to be collected by the REMP (administratively controlled).

IV-E. WATER MONITORING

DATA EVALUATION (continued)

The summary data for the water monitoring program is shown in Table 2. Comprehensive data tables are given in the following Appendix F Tables:

- ⇒ **F-4** Soil and Sediment
- ⇒ **F-6** Algae
- ⇒ **F-7** Well Water
- ⇒ **F-8** Runoff Water
- ⇒ **F-9** Surface Water
- ⇒ **F-10** Drinking Water
- ⇒ **F-11** Rain Water

TABLE 2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

TABLE 2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility **Rancho Seco Nuclear Station** Docket No. **DPR-54/ SNM-2510**

Location of Facility **Sacramento, California** (County, State). Reporting Period **January - December 2000**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)[b]	All Indicator Locations Mean (f)[b] Range	Location with Highest Annual Mean Name / Distance & Direction / Mean (f)[b] Range	Control locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Air Particulates (pCi/M^3)	Gross β (208)	0.01	0.022 (104/104) (0.009- 0.069)	RAS0.1CO 0.1 miles 45° 0.023 (52/52) (0.010-0.065)	0.022 (104/104) (0.009-0.063)	0
	γ-spec (4)					
	^{137}Cs	0.01	<LLD	<LLD	<LLD	
	^{134}Cs	0.01	<LLD	<LLD	<LLD	
Direct Radiation (mRem/qtr.)	Luxel badge (139)	1 mRem (badge sensitivity)	18 (116-116) (13-46)	RTL0.4NO 0.4 miles 270° 37 (4/4) (29-46)	17 (23/23) (13-21)	0
Garden Vegetables (pCi/kg)	γ-spec (6)					
	^{60}Co	60	<LLD	<LLD	<LLD	0
	^{137}Cs	60	<LLD	<LLD	<LLD	0
	^{134}Cs	60	<LLD	<LLD	<LLD	0
	Tritium (2)	1000	<LLD	<LLD	<LLD	0

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

[b] LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCES", for information on determining LLD and Minimum Detectable Activity (MDA).

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(County, State)

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Soil Discharge Canal (pCi/kg)	γ-spec (8)					
	^{60}Co	150	28 (2/8) (13-43)	RSL1.5NO 43 (1/2) 1.5 miles 270° (NA)	NA	0
	^{137}Cs	150	313 (7/8) (61-1259)	RSL1.5NO 672 (2/2) 1.5 miles 270° (84-1259)	NA	0
	^{134}Cs	150	<LLD	<LLD	NA	0
Soil Storm Drain (pCi/kg)	γ-spec (30)					
	^{60}Co	150	<LLD	<LLD	NA	0
	^{137}Cs	150	70 (16/30) (21-418)	RSL0.2HO 231 (2/2) 0.2 miles 158° (44-418)	NA	0
	^{134}Cs	150	<LLD	<LLD	NA	0

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

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Soil Depression Area (pCi/kg)	γ-spec (14)					
	^{60}Co	150	404 (8/14) (30-1180)	RSL0.4MP1 0.4 miles 248° 979 (2/2) (778-1180)	NA	0
	^{137}Cs	150	9319 (14/14) (133-40700)	RSL0.4MP1 0.4 miles 248° 34825 (2/2) (28950-40700)	NA	0
	^{134}Cs	150	79 (6/14) (38-147)	RSL0.4MP1 0.4 miles 248° 123 (2/2) (99-147)	NA	0
Sediment (pCi/kg)	γ-spec (23)					
	^{60}Co	150	95 (4/23) (6-176)	RMS0.7NO 0.7 miles 270° 173 (2/4) (169-176)	NA	0
	^{137}Cs	150	946 (21/23) (11-9000)	RMS0.7NO 0.7 miles 270° 4419 (4/4) (73-9000)	NA	0
	^{134}Cs	150	36 (2/23) (30-40)	RMS0.7NO 0.7 miles 270° 36 (2/4) (30-41)	NA	0
	^{54}Mn	150	3 (2/23) (1-5)	RMS1.8NO 1.8 miles 270° 5 (1/4) NA		

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

[b] LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCES", for information on determining LLD and Minimum Detectable Activity (MDA).

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Fish (pCi/kg)	γ-spec (2)					
	^{54}Mn	130	<LLD	<LLD	NA	0
	^{60}Co	130	<LLD	<LLD	NA	0
	^{65}Zn	260	<LLD	<LLD	NA	0
	^{137}Cs	130	76 (2/2) (59-94)	RFS0.6MO 0.6 miles 248° 76 (2/2) (59-94)	NA	0
	^{134}Cs	130	<LLD	<LLD	NA	0
Algae (pCi/kg)	γ-spec (11)					
	^{60}Co	150	6 (2-11) (5-7)	RAG1.8NO 1.8 miles 270° 7 (1/11) (NA)	NA	0
	^{137}Cs	150	31 (6-11) (12-52)	RAG1.8NO 1.8 miles 270° 52 (1/11) (NA)	NA	0
	^{134}Cs	150	<LLD	<LLD	NA	0

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

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Well Water (pCi/L)	Gross β (34)	4	3.9 (9/34) (2.4-6.9)	RWW0.3EO 0.3 miles 90° 6.9 (1/4) (NA)	<LLD	0
	Tritium (34)	1000	<LLD	<LLD	<LLD	0
	γ-spec (34)					
	^{54}Mn	15	<LLD	<LLD	<LLD	0
	^{60}Co	15	<LLD	<LLD	<LLD	0
	^{65}Zn	30	<LLD	<LLD	<LLD	0
	^{137}Cs	10	<LLD	<LLD	<LLD	0
	^{134}Cs	10	<LLD	<LLD	<LLD	0
Runoff Water (pCi/L)	Tritium (30)	2000	5190 (1/30) (NA)	RRW0.6MO 0.6 miles 248° 5190 (1/30) (NA)	NA	0
	γ-spec (30)					
	^{54}Mn	15	<LLD	<LLD	NA	0
	^{60}Co	15	<LLD	<LLD	NA	0
	^{65}Zn	30	<LLD	<LLD	NA	0
	^{137}Cs	18	<LLD	<LLD	NA	0
	^{134}Cs	15	<LLD	<LLD	NA	0

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

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Name of Facility **Rancho Seco Nuclear Station** Docket No. **DPR-54/ SNM-2510**

Location of Facility **Sacramento, California** (County, State). Reporting Period **January - December 2000**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) [b]	All Indicator Locations Mean (f)[b] Range	Location with Highest Annual Mean Name / Distance & Direction / Mean (f)[b] Range	Control locations Mean (f)[a] Range	Number of Nonroutine Reported Measurements
Surface Water (pCi/L)	Tritium (64)	2000	385 (2/52) (260-510)	RSW0.3MO 0.3 miles 248° 510 (1/12) (NA)	<LLD	0
	γ-spec (64)					
	^{54}Mn	15	<LLD	<LLD	<LLD	0
	^{60}Co	15	<LLD	<LLD	<LLD	0
	^{65}Zn	30	<LLD	<LLD	<LLD	0
	^{137}Cs	18	<LLD	<LLD	<LLD	0
	^{134}Cs	15	<LLD	<LLD	<LLD	0
Drinking Water (pCi/L)	Gross β (24)	4	3.5 (8/13) (2.6-4.1)	RDW0.1GO 0.1 miles 135° 3.5 (8/13) (2.6-4.1)	2.8 (8/12) (2-3.5)	0
	Tritium (24)	1000			<LLD	0
	γ-spec (24)					
	^{54}Mn	15	<LLD	<LLD	<LLD	0
	^{60}Co	15	<LLD	<LLD	<LLD	0
	^{65}Zn	30	<LLD	<LLD	<LLD	0
	^{137}Cs	10	45(1/13) (NA)	RDW0.1GO 0.1 miles 135° 45 (1/13) (NA)	<LLD	0
	^{134}Cs	10	<LLD	<LLD	<LLD	0

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

[b] LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCES", for information on determining LLD and Minimum Detectable Activity (MDA).

TABLE 2

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility **Rancho Seco Nuclear Station** Docket No. **DPR-54/ SNM-2510**

Location of Facility **Sacramento, California** (County, State). Reporting Period **January - December 2000**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) [b]	All Indicator Locations Mean (f)[b] Range	Location with Highest Annual Mean Name / Distance & Direction / Mean (f) [b] Range	Control locations Mean (f) [a] Range	Number of Nonroutine Reported Measurements
Rain Water (pCi/L)	Tritium (16)	2000	<LLD	<LLD	NA	0
	γ-spec (16)					
	^{54}Mn	15	<LLD	<LLD	NA	0
	^{60}Co	15	<LLD	<LLD	NA	0
	^{65}Zn	30	<LLD	<LLD	NA	0
	^{137}Cs	18	<LLD	<LLD	NA	0
	^{134}Cs	15	<LLD	<LLD	NA	0

[a] Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

[b] LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCES", for information on determining LLD and Minimum Detectable Activity (MDA).

V. REFERENCES

CFRa — Code of Federal Regulations, 1999, "National Primary Drinking Water Regulations," Title 40, Part 141.

CFRb — Code of Federal Regulations, 1999, "Standards for Protection Against Radiation," Title 10, Part 20.

CFRc — Code of Federal Regulations, 1999, "Domestic Licensing of Production and Utilization Facilities," Title 10, Part 50.

CFRd — Code of Federal Regulations, 1999, "Environmental Radiation Protection Standards for Nuclear Power Operations," Title 40, Part 190.

NRC74 — United States Nuclear Regulatory Commission, 1974, "Permanently Defueled Technical Specifications for the Rancho Seco Nuclear Station," Appendix A to Facility License No. DPR-54 (as amended).

NRC77 — United States Nuclear Regulatory Commission, 1977, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I," Regulatory Guide 1.109, Revision 1.

NRC79a — United States Nuclear Regulatory Commission, 1979, "An Acceptable Radiological Environmental Monitoring Program," Branch Technical Position, Revision 1.

NRC79b — United States Nuclear Regulatory Commission, 1979, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," Regulatory Guide 4.15, Revision 1.

NRC92 — United States Nuclear Regulatory Commission, "Air Sampling in the Workplace", Regulatory Guide 8.25, June 1992

NUREG79 — United States Nuclear Regulatory Commission, 1979, "Radiological Effluent Technical Specifications for PWRs," NUREG-0472, Revision 2.

NUREG80a — United States Nuclear Regulatory Commission, 1980, "Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard (40CFR190)," NUREG-0543.

RS00 — Rancho Seco Nuclear Station, 2000, "Annual Radioactive Effluent Release Report, January -December 2000," Sacramento Municipal Utility District report.

VI. APPENDICES

APPENDIX A

2000 LAND USE CENSUS RESULTS

In compliance with the Rancho Seco Permanently Defueled Technical Specifications, section D6.8.3.b.2 and the REMP Manual, section 4.0, "Land Use Census", a land use census was completed on February 27,2001. The primary method of conducting the survey was to use an aerial survey that was conducted during June 2000. Evaluating the aerial photographs continues to provide an effective method of determining locations and distances of the nearest residences. In conjunction with the aerial survey, a Global Positioning System (GPS) was used to verify distances and locations of residences. When the review of the survey photos indicated that an actual on-scene survey was needed to verify the use of identified structures; a visual observation was made. The aerial photos also provided a method to identify any changes in the agricultural, commercial, or industrial use of the land surrounding the site. The use of conservative dose factors for the purpose of projected dose calculations still requires that we evaluate the use of the area surrounding the site. The information that is presented is to verify this assumption and validate the process.

The land use census covered an area bounded by each of the sixteen meteorological sectors out to a two-mile radius from the Reactor Building.

The 2000 Land Use Census did not identify any changes in the use of the unrestricted areas that would require modifications in the Radiological Environmental Monitoring Program for evaluating doses to individuals from principal pathways of exposure. This evaluation and determination are in accordance with the requirements of 10CFR50, Appendix I, section IV.B.3.

The Land Use Census is completed on a biennial schedule. Aerial surveys will be conducted during 2002 and the Irrigation reports covering 2001 and 2002 will be requested during the last quarter of 2001 and 2002. This information will be used to complete the 2002 census scheduled to be completed in 2003.

A. RESIDENT EXPOSURE PATHWAY SUMMARY

Inhalation, Ground Plane and Water Consumption

The 2000 census determined that seven of the 16 radial sectors have residences that are within the 2-mile (3219 meters) Land Use Census radius. The closest residence in each of the seven sectors is identified below:

Sector	Distance (meters)	Ranking (Nearest to Farthest)
A	>3219	NA
B	>3219	NA
C	1432*	3
D	1175*	1
E	>3219	NA
F	>3219	NA
G	2381*	6
H	>3219	NA
J	>3219	NA
K	2320*	5
L	1207*	2
M	2028*	4
N	3181	7
P	>3219	NA
Q	>3219	NA
R	>3219	NA

It is expected that all seven residences use well water for consumption and other domestic purposes.

*Distance updated using GPS.

B. DEPOSITION EXPOSURE PATHWAY SUMMARY

Beef Consumption

Based on conservative dose calculation parameters in use, the following is a summary for the 2000 land use census of the potential deposition exposure pathways at the locations listed below:

Sector	Distance (meters)	Consumption Pathway	Comment
A	433	Beef	Unrestricted Area Boundary
B	430	Beef	Unrestricted Area Boundary
C	531*	Beef	Unrestricted Area Boundary
D	451*	Beef	Unrestricted Area Boundary
E	483*	Beef	Unrestricted Area Boundary
F	499*	Beef	Unrestricted Area Boundary
G	579*	Beef	Unrestricted Area Boundary
H	198	Beef	Unrestricted Area Boundary
J	195	Beef	Unrestricted Area Boundary
K	195	Beef	Unrestricted Area Boundary
L	286	Beef	Unrestricted Area Boundary
M	404	Beef	Unrestricted Area Boundary
N	514*	Beef	Unrestricted Area Boundary
P	708*	Beef	Unrestricted Area Boundary
Q	579*	Beef	Unrestricted Area Boundary
R	448	Beef	Unrestricted Area Boundary

Because of the extremely small amount of radioactive gaseous effluent released from the site, Deposition Exposure Pathway changes were considered inconsequential. The changes indicated in the beef consumption table do not necessitate modification of ODCM or REMP practices.

*Distance updated using GPS

C. IRRIGATED CROP EXPOSURE PATHWAY SUMMARY

Laguna Creek

The 2000 Land Use Census determined that irrigation water is used by three organizations. Rancho Seco Nuclear Station, through a contract with Rossini Farming Co. monitors water usage from the Site Boundary for irrigation purposes. Clay Irrigation District is the next user downstream that provides irrigation water. Galt Irrigation District provides irrigation water downstream of the Clay Irrigation District. The following is a summary of the Irrigation Reports collected during the 2000 Land Use Census.

Rossini Farming Co. Usage

Date	Meter Reading	Comment
January 14, 1999 to August 25, 1999	1.787	Initial reading at start of contract
December 2, 1999	67.002	
December 30, 1999	101.571	
March 6, 2000 to December 7, 2000	124.682	

Total usage: 122.895 Acre-feet (40,057,010.78 gallons)

Clay Irrigation District

Resident	Year	Acre-feet	Usage
Gary Silva	1999	4513	Pasturage
Gary Silva	2000	4390	Pasturage

The amount of water used is based on discussions with the resident (Gary Silva) that he uses 1/3 of the discharge from Rancho Seco and Galt Irrigation District uses the remaining 2/3 of the total discharge.

C. IRRIGATED CROP EXPOSURE PATHWAY SUMMARY (Continued)

Laguna Creek

Galt Irrigation District

1999/ 2000 Irrigation Report

Meter No.	Acre Feet Water 1999	Acreage Irrigated 1999	Crop 1999	Acre Feet Water 2000	Acreage Irrigated 2000	Crop 2000
Creek meter	165	55	Pasture	165	55	Pasture
251	470.544	156	Sudan	0		
588	176.112	20	Clover	24.933	20	Clover
494	194.931	60	Corn	16.919	60	Corn
500	254.55	50	Sudan	224.282	100	Sudan
254	368.499	50	Sudan	412.553	110	Clover
255	402.045	135	Sudan	413.433	140	Pasture
253	383.545	130	Pasture	384.175	140	Pasture
250	27.24	90	Clover	92.37	170	Sudan
247	0	0				
256	332.055	100	Sudan	275	100	Sudan
136	177.883	60	Corn	175.437	60	Corn
461	48.406	30	Alfalfa	48.406	40	Corn
315	210.432	50	Sudan	63.862	50	Sudan
Total	3211.242	986		2296.37	1201	

Based on direct observation cattle consume water from the Clay, Hadselville, and Laguna Creeks.

D. OTHER EXPOSURE PATHWAYS

The 2000 Land Use Census confirmed previous knowledge that the Clay/Laguna Creeks are utilized by the general public for aquatic life consumption purposes. Past census evaluations have been unsuccessful in determining the usage/ occupancy factors for their consumption. Therefore, insufficient data existed to justify ODCM usage factor modification.

E. REMP EVALUATION

An objective of the 2000 Land Use Census was to compare census and current REMP Manual locations to ensure consistency exists between monitoring activities and actual land utilization. The following discussion is a summary of the comparison evaluation for each of the four exposure pathways.

Resident Exposure Pathway

The inhalation and ground plane exposure pathways, the principal components of the Resident Exposure Pathway, are monitored directly and indirectly by Luxel dosimetry, air, and soil sampling and analysis. Well water was monitored at nine locations.

Since the existing REMP was more conservative with respect to Resident Exposure Pathway monitoring, no changes were required.

Deposition Exposure Pathway

The Deposition Exposure Pathway (Section B) is monitored directly within the Station Site Boundary through garden vegetation sampling and analysis. The potential for a deposition pathway has been evaluated by the ODCM and REMP programs and found to have little potential for the current plant status. Since the current REMP was representative and conservative with respect to Deposition Exposure Pathway monitoring, no changes were required.

Irrigated Crop Exposure Pathway

The REMP was effective in monitoring the identified irrigated crop exposure pathways. This conclusion was because the REMP included irrigated vegetation sampling. The commercial grape vineyards use well water for the primary source of irrigation and the Clay/ Laguna Creeks for a supplemental source as needed.

REMP surface water surveillance activities monitor irrigation water radiological quality. Current ODCM calculations are conservative since dilution effects are not included when predicting potential dose delivered through downstream pathways.

No REMP changes were required to monitor the irrigated crop exposure pathway.

E. REMP EVALUATION (continued)

Other Exposure Pathways

Existing aquatic life, surface water and sediment sampling and analysis practices are effective in monitoring potential observable effects associated with recreational activities occurring at the Clay Creek, Hadselville Creek, Laguna Creek, Folsom South Canal and Rancho Seco Lake. With respect to availability and quantity of food sources, the other identified consumption activities were considered inconsequential for pathway monitoring purposes.

No REMP changes were required to monitor other exposure pathways.

F. ODCM EVALUATION

Based on 2000 Land Use Census findings, the following potential exposure pathways exist at the indicated locations:

GASEOUS EFFLUENT

Exposure Pathway	Location	Comment
Inhalation	1175 meters ENE	Resident location having the highest dispersion parameter
Ground Plane	1175 meters ENE	Resident location having the highest deposition parameter

LIQUID EFFLUENT

Exposure Pathway	Location	Comment
Freshwater Fish	Clay Creek	Recreation beyond the Site Boundary
Swimming	Clay Creek	Recreation beyond the Site Boundary
Shoreline Deposits	Clay Creek	Recreation beyond the Site Boundary
Irrigated vegetation	Clay Creek	Potential for residences beyond the site boundary
Irrigated forage	Clay Creek	Cattle grazing beyond the Site Boundary
Drinking Water	Clay Creek	Cattle drinking water beyond the Site Boundary

F. ODCM EVALUATION (continued)

The GASEOUS EFFLUENT locations for inhalation and ground plane used by the ODCM are conservative since they are located at the Station Site Boundary.

Specifying the Laguna Creek location also provides additional conservatism since the beneficial effects of downstream dilution are not considered when specifying effluent release restrictions.

As required by the 2000 Land Use Census the above information for exposure pathways and locations was submitted for incorporation in the ODCM for use during 2001.

APPENDIX B

SAMPLE SITE DESCRIPTIONS AND MAPS

This appendix provides descriptive information about the sampling locations and maps of all the locations for the Radiological Environmental Monitoring Program sites.

Table B-1 provides information on sample type, identification codes, and map location references. The sample identification code is an alphanumeric string beginning with the prefix "R" (for Rancho Seco Nuclear Station) followed by two letters to identify the sample media:

AS	Air	SL	Soil
RW	Runoff Water	FS	Fish
SW	Surface Water	LV	Garden Vegetable
DW	Drinking Water	AG	Algae
WW	Well Water	TL	Direct Gamma Radiation (Luxel)
MS	Mud and Silt	RN	Rainwater

The numeric designations, which follow the letter designations, indicate the straight-line distance (in miles) from the center of the Reactor Building to the monitoring site.

The next letter designates the sector in which the monitoring location is located. The letters A through R are used for sector designators. The letters I and O are not used to prevent confusion with the numbers one and zero in the ID codes.

Sector Letter	Degrees Azimuth	Compass Point
A	348.75 to 11.25	N
B	11.25 to 33.75	NNE
C	33.75 to 56.25	NE
D	56.25 to 78.75	ENE
E	78.75 to 101.25	E
F	101.25 to 123.75	ESE
G	123.75 to 146.25	SE
H	146.25 to 168.75	SSE
J	168.75 to 191.25	S
K	191.25 to 213.75	SSW
L	213.75 to 236.25	SW
M	236.25 to 258.75	WSW
N	258.75 to 281.25	W
P	281.25 to 303.75	WNW
Q	303.75 to 326.25	NW
R	326.25 to 348.75	NNW

SAMPLE SITE DESCRIPTIONS AND MAPS
(continued)

The final letter designation indicates if the location is part of the operational REMP program ("O") or post-operational REMP program ("P").

Table B-1 Lists each location referencing the sample type and the location ID code to the map site number on one of the four Radiological Environmental Monitoring Site Maps included in this Appendix.

Figure B-1 **Site Location Map**: Shows the locations of the sample locations on and/or near the Site (including Storm Drain locations).

Figure B-2 **1 Mile Radius map**: Sampling locations within one mile of the Reactor Building centerline are shown on this map.

Figure B-3 **5 Mile Radius map**: Sampling locations between one and five miles from the Reactor Building centerline are shown on this map.

Figure B-4 **25 Mile Radius map**: Sampling locations between five to 25 miles from the Reactor Building centerline are shown on this map.

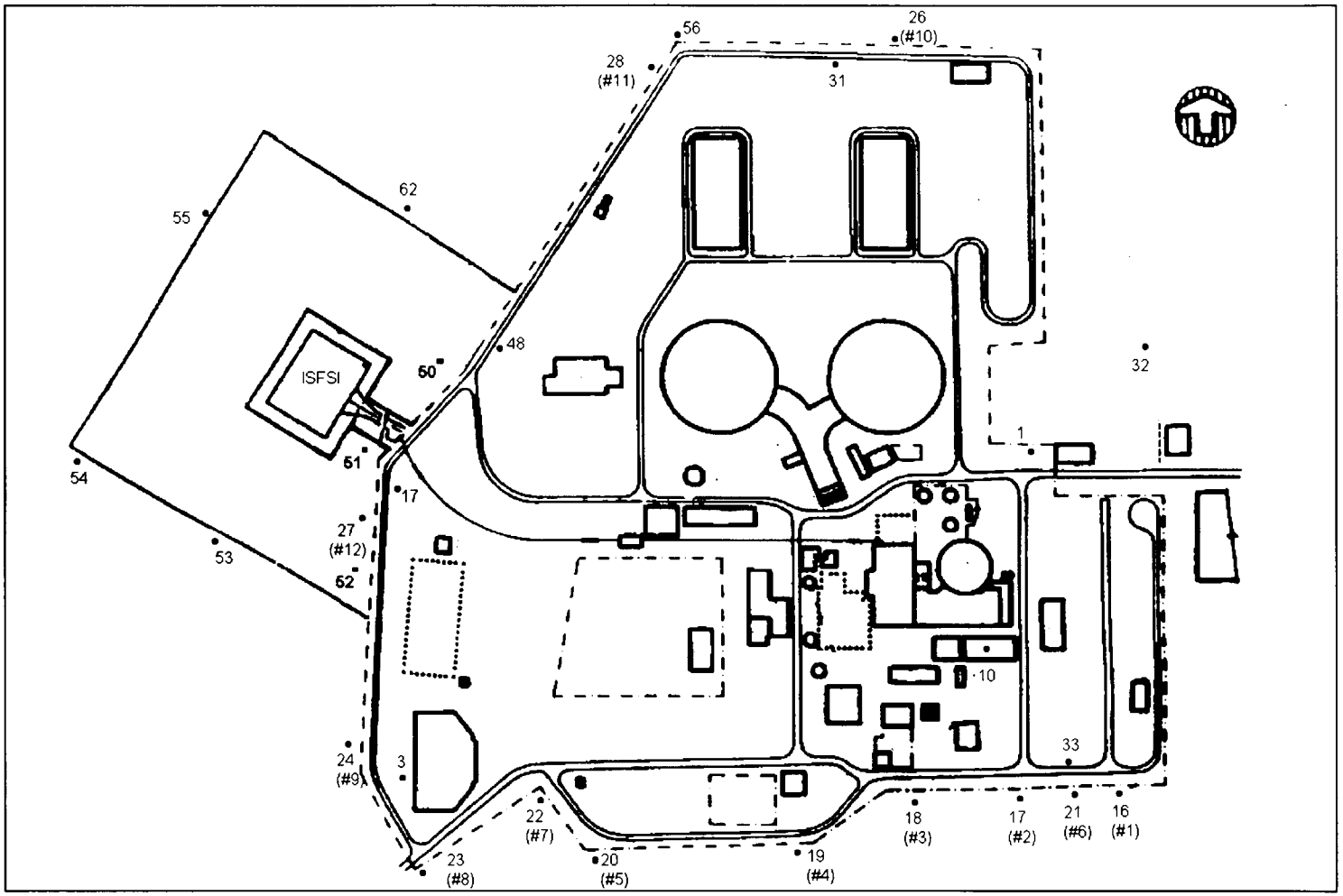

Figure B-1 Radiological Environmental Sampling Locations on and near the Site
(Storm Drain location numbers are in parenthesis)

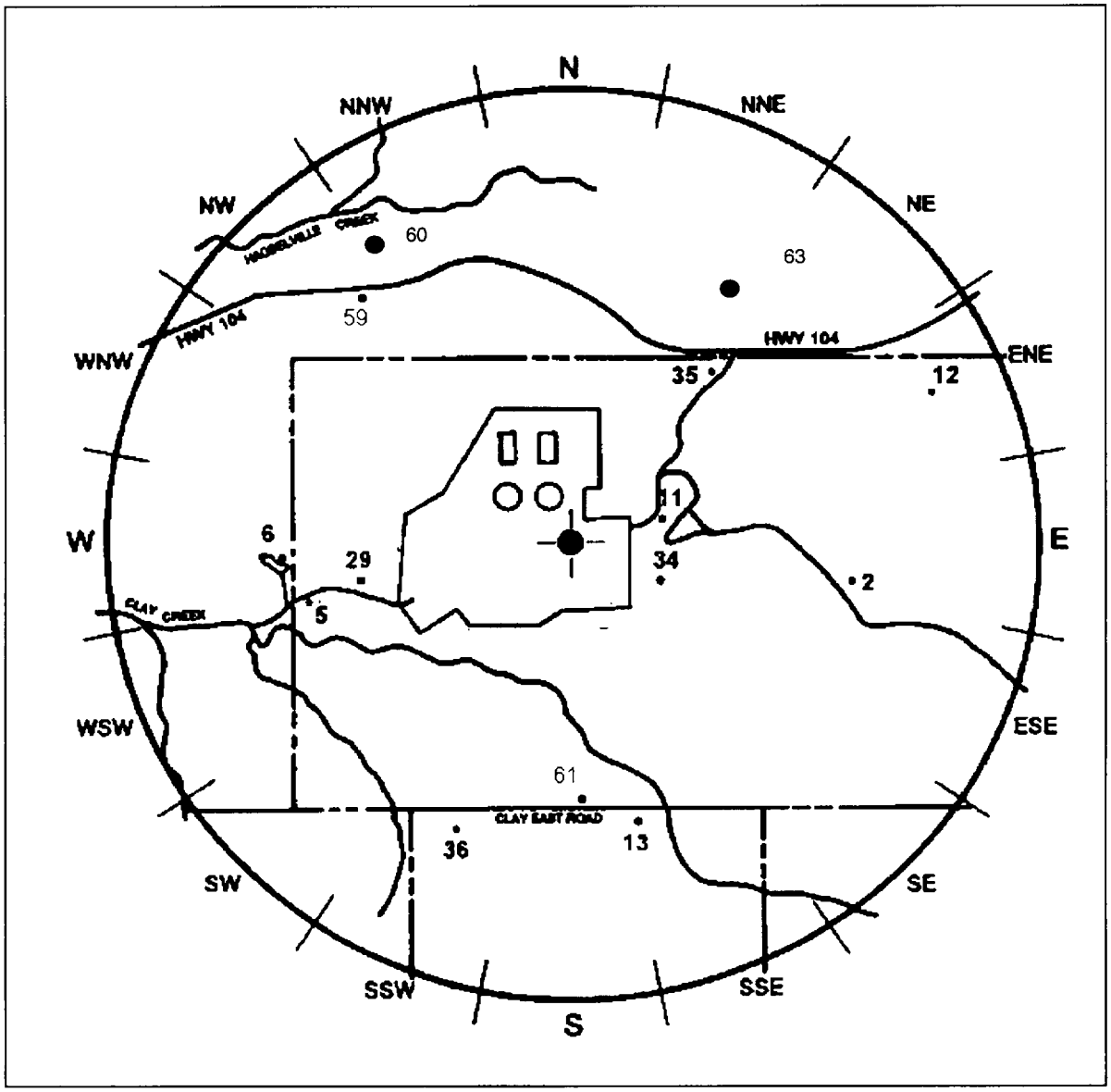

Figure B-2 Radiological Environmental Sampling Locations within 1 mile from the Reactor Building

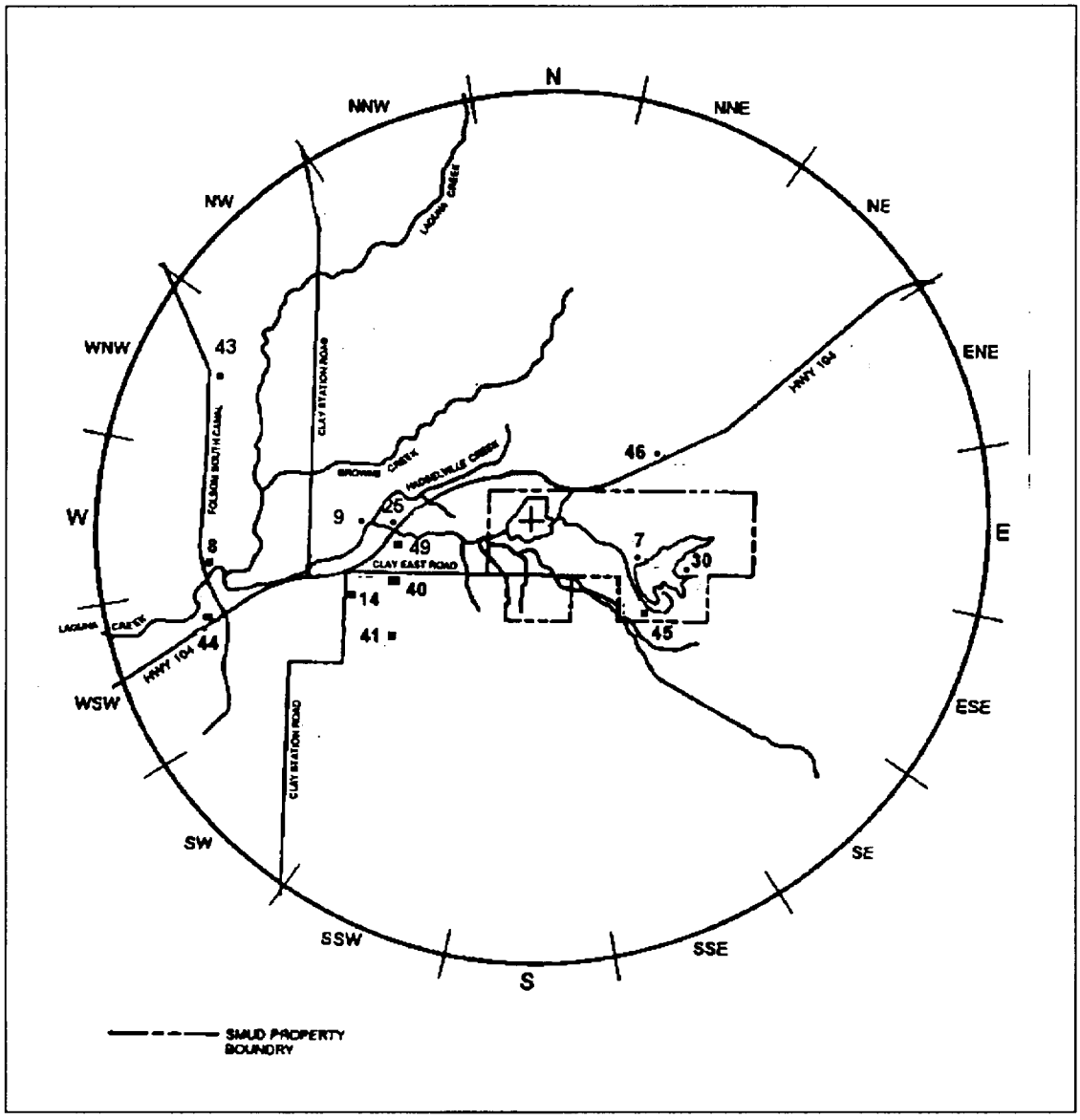

Figure B-3 Radiological Environmental Sampling Locations from 1 to 5 miles from the Reactor Building

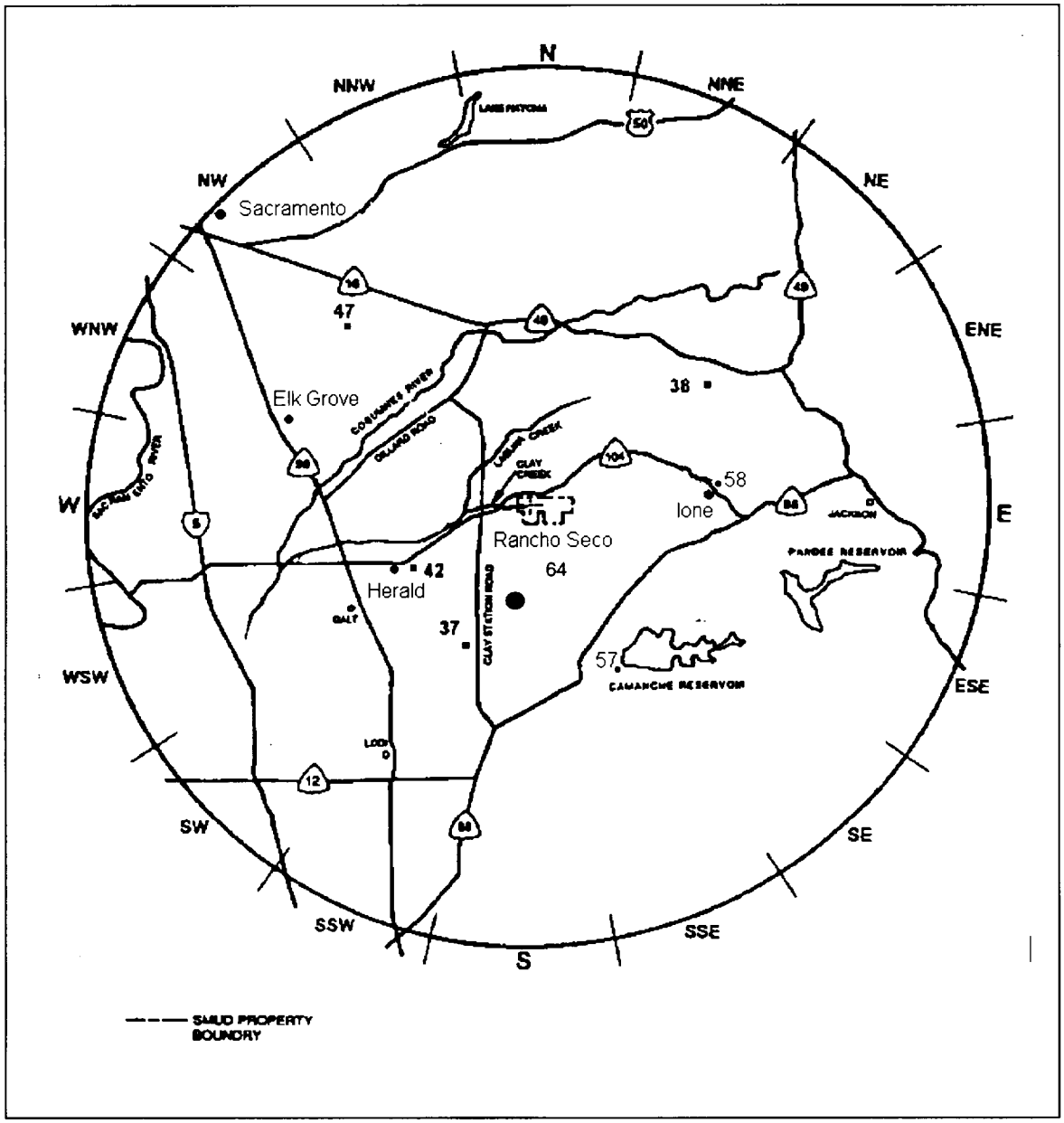

Figure B-4 Radiological Environmental Sampling Locations 5 to 25 miles from the Reactor Building

Table B-1
Radiological Environmental Monitoring Sites and Map Locations

Sample Type	ID Code	Class	Map Location No.	Collection Frequency	Description. of Location	Miles	Sector
AIR	RAS0.1CO	IND.	1	Weekly	On Site-PAP BLDG.	0.1	C
AIR	RAS0.7EO	IND.	2	Weekly	Meteorological Tower	0.7	E
AIR	RAS0.3MO	IND.	3	Weekly	Effluent Discharge	0.3	M
AIR	RAS1.8FP	CON	30	Weekly	Rancho Seco Reservoir Well Enclosure	1.8	F
RUNOFF WATER	RRW0.6MO	IND.	5	Biweekly	Site Boundary	0.6	M
SURFACE WATER	RSW0.7NO	IND.	6	Monthly	Water Sump	0.7	N
SURFACE WATER	RSW1.3FO	CON	7	Monthly	Rancho Seco Reservoir	1.3	F
SURFACE WATER	RSW3.7NO	CON	8	Monthly Composite	ISCO Composite Sampler at Folsom South Canal	3.7	N
SURFACE WATER	RSW0.3MO	IND.	3	Monthly Composite	ISCO Composite Sampler at Effluent Discharge	0.3	M
SURFACE WATER	RSW1.8NO	IND.	9	Monthly	Confluence of Clay and Hadselville Creeks	1.8	N
DRINKING WATER	RDW0.1GO	IND.	10	Monthly	Rancho Seco Site	0.1	G
DRINKING WATER	RDW1.8FP	CON	30	Monthly	Rancho Seco Lake Well	1.8	F
WELL WATER	RWW0.3EO	IND.	11	Quarterly	Site Well	0.3	E
WELL WATER	RWW0.8DO	CON	12	Quarterly	Marciel Ranch	0.8	D
WELL WATER	RWW0.8LO	IND.	13	Quarterly	Clay Cattle Feedlot	0.8	L
WELL WATER	RWW3.7MO	IND.	8	Quarterly	Silva Feed Lot Well	3.7	M
WELL WATER	RWW2.1M0	IND.	14	Quarterly	Clay Area Well (Tipling's)	2.2	M
WELL WATER	RWW1.5MP	IND.	49	Quarterly	Vineyard Well (west)	1.5	M
WELL WATER	RWW0.6RP	IND	59	Quarterly	Vineyard Well (south of Hwy 104)	0.6	R
WELL WATER	RWW0.7RP	IND	60	Quarterly	Vineyard Well North west of Site	0.7	R
WELL WATER	RWW0.9CP	IND	63	Quarterly	Vineyard Well Sample North East of Site	0.9	C
RAIN WATER	RRN0.8DO	IND.	2	Seasonal	Meteorological Tower	0.8	D

Table B-1
(Continued)

Radiological Environmental Monitoring Sites and Map Locations

Sample Type	ID Code	Class	Map location No.	Collection Frequency	Description. of Location	Miles	Sector
MUD AND SILT	RMS0.3MO	IND.	3	Quarterly	Effluent Discharge	0.3	M
MUD AND SILT	RMS0.6MO	IND.	5	Quarterly	Site Boundary	0.6	M
MUD AND SILT	RMS0.7NO	IND.	6	Quarterly	Water Sump	0.7	N
MUD AND SILT	RMS1.8NO	IND.	9	Quarterly	Confluence of Clay and Hadselville Creeks	1.8	N
MUD AND SILT	RMS3.7NO	IND.	8	Quarterly	Laguna Creek at Folsom South Canal	3.7	N
FISH	RFS0.3MO	IND.	3	Semi-Annual	Effluent Discharge	0.3	M
FISH	RFS0.6MO	IND.	5	Semi-Annual	Site Boundary	0.6	M
FISH	RFS0.7NO	IND.	6	Semi-Annual	Water Sump	0.7	N
FISH	RFS1.5FO	CON	7	Semi-Annual	Rancho Seco Reservoir	1.5	F
FISH	RFS1.8NO	IND.	9	Semi-Annual	Confluence of Clay and Hadselville Creeks	1.8	N
ALGAE	RAG0.3MO	IND.	3	Semi-Annual	Effluent Discharge	0.3	M
ALGAE	RAG0.6MO	IND.	5	Semi-Annual	Site Boundary	0.6	M
ALGAE	RAG0.7NO	IND.	6	Semi-Annual	Water Sump	0.7	N
ALGAE	RAG1.8NO	IND.	9	Semi-Annual	Confluence of Clay and Hadselville Creek	1.8	N
ALGAE	RAG3.7NO	IND.	8	Semi-Annual	Hadselville Creek at Folsom South Canal	3.7	N
ALGAE	RAG1.3FO	IND	7	Semi-Annual	Reservoir north	1.3	F
ALGAE	RAG2.2NO	IND	9	Semi-Annual	Hadselville/ Clay Creeks	2.2	N
SOIL	RSL0.2HO1	IND.	16	Semi-Annual	Storm Drain No. 1	0.2	H
SOIL	RSL0.2HO2	IND.	17	Semi-Annual	Storm Drain No. 2	0.2	H
SOIL	RSL0.2JO	IND.	18	Semi-Annual	Storm Drain No. 3	0.2	J
SOIL	RSL0.2KO	IND.	19	Semi-Annual	Storm Drain No. 4	0.2	K
SOIL	RSL0.3LO	IND.	20	Semi-Annual	Storm Drain No. 5	0.3	L
SOIL	RSL0.2HO	IND.	21	Semi-Annual	Storm Drain No. 6	0.2	H
SOIL	RSL0.3MO7	IND.	22	Semi-Annual	Storm Drain No. 7	0.3	M
SOIL	RSL0.3MO8	IND.	23	Semi-Annual	Storm Drain No. 8	0.3	M
SOIL	RSL0.3MO9	IND.	24	Semi-Annual	Storm Drain No. 9	0.3	M
SOIL	RSL0.3A0	IND.	26	Semi-Annual	Storm Drain No. 10	0.3	B
SOIL	RSL0.3NO	IND.	27	Semi-Annual	Storm Drain No. 12	0.3	N
SOIL	RSL0.3Q0	IND.	28	Semi-Annual	Storm Drain No. 11	0.3	Q

Table B-1
(Continued)

Radiological Environmental Monitoring Sites and Map Locations

Sample Type	ID Code	Class	Map Location No.	Collection Frequency	Description of Location	Miles	Sector
SOIL	RSL0.6MO	IND.	5	Semi-Annual	Site Boundary	0.6	M
SOIL	RSL0.7NO	IND.	6	Semi-Annual	Water Sump	0.7	N
SOIL	RSL1.5NO	IND.	25	Semi-Annual	Silva Property	1.5	N
SOIL	RSL1.8NO	IND.	9	Semi-Annual	Confluence of Clay and Hadselville Creek	1.8	N
SOIL	RSL0.4MP1	IND.	29	Semi-Annual	Depression Area	0.4	M
SOIL	RSL0.4MP2	IND.	29	Semi-Annual	Depression Area	0.4	M
SOIL	RSL0.4MP3	IND.	29	Semi-Annual	Depression Area	0.4	M
SOIL	RSL0.3NP1	IND.	50	Semi-Annual	ISFSI north drainage	0.3	N
SOIL	RSL0.3NP2	IND.	51	Semi-Annual	ISFSI south drainage		
SOIL	RSL0.3NP3	IND.	52	Semi-Annual	ISFSI combined drainage		
SOIL	RSL0.5MPAK	IND.	5	Semi-Annual	Site Boundary	0.5	M
SOIL	RSL0.5MPAL	IND.	5	Semi-Annual	Site Boundary	0.5	M
SOIL	RSL0.5MPAM	IND.	5	Semi-Annual	Site Boundary	0.5	M
SOIL	RSL0.5MPAN	IND.	5	Semi-Annual	Site Boundary	0.5	M
GARDEN VEGETABLES	RLV0.6MO	IND.	5	Semi-Annual	Site Boundary Garden irrigated with No-Name Creek water	0.6	M
GARDEN VEGETABLES	RLVXX.XX	CON	NA	Semi-Annual	Truck Garden which provides local produce from the local area	NA	NA
VINEYARD	RLV0.7NO	IND	6	Seasonal	Vineyard Sample West of Site	0.6	N
VINEYARD	RLV6.6KP	CON	64	Seasonal	Vineyard Sample Southwest of Site	6.6	K

Table B-1
(Continued)
Radiological Environmental Monitoring Sites and Map Locations

Sample Type	ID Code	Class	Map Location No.	Collection Frequency	Description of Location	Miles	Sector
Luxel	RTL0.3RO	IND.	31	Quarterly	NNW @ Perimeter Fence N/O Spray Ponds; #1	0.3	R
Luxel	RTL0.3C0	IND.	32	Quarterly	NE Perimeter Fence/ parking lot NE corner; #2	0.3	C
Luxel	RTL0.3NO	IND.	17	Quarterly	W Perimeter Fence road/ pole/ top of hill; #3	0.3	N
Luxel	RTL0.3LO	IND.	20	Quarterly	SW Perimeter Fence road near RS lake filters; #4	0.3	L
Luxel	RTL0.3HO	IND.	33	Quarterly	Perimeter Fence/ S/O of Admin. Bldg.; #5	0.3	H
Luxel	RTL0.4F0	IND.	34	Quarterly	Photovoltaic Facility/ North Fence (NRC); #6	0.4	F
Luxel	RTL0.5CO	IND.	35	Quarterly	Rt. 104 entrance to Rancho Seco; #7	0.5	C
Luxel	RTL0.6KO	IND.	36	Quarterly	Tokay Substation; #11	0.8	K
Luxel	RTL10.0HP	CON	57	Quarterly	Fish Hatchery at Comanche Lake, #15	10.0	H
Luxel	RTL2.7MO	IND.	14	Quarterly	In Clay at Tipling's Residence 11633 Clay Station Rd; #16	2.1	M
Luxel	RTL8.2KO	IND.	37	Quarterly	Elliott Cemetery Near Angelo Dairy; #17	8.2	K
Luxel	RTL7.8CO	IND.	38	Quarterly	Sam Jaber Residence/ 601 Carbondale Rd/ Ione; #18	7.8	C
Luxel	RTL0.7GO	IND.	30	Quarterly	Well pump fence @ reservoir; #43	1.7	G
Luxel	RTL1.5MO	IND.	40	Quarterly	Clay East & Kirkwood (NRC); #20	1.5	M
Luxel	RTL3.9KO	IND.	41	Quarterly	SSW of Site on Borden Rd; #26	3.9	K
Luxel	RTL7.4MO	IND.	42	Quarterly	Herald Fire Station #87/ 12746 Ivie Rd; #30	7.4	M
Luxel	RTL3.7NO	IND.	43	Quarterly	Folsom South Canal near Hobday Rd; #31	3.7	N
Luxel	RTL3.8MO	IND.	44	Quarterly	BLM entrance to Folsom South Canal Pumping Station; #33	3.8	M
Luxel	RTL1.9NO	IND.	9	Quarterly	Hadselville Cr. & Clay Cr.; #35	1.9	N
Luxel	RTL1.8F0	IND.	45	Quarterly	Rancho Seco Lake Maintenance Building, #19	1.8	F
Luxel	RTL1.4DO	IND.	46	Quarterly	0.9 Miles E/O Site on Twin Cities Road/ Rt. 104; #46	1.4	D
Luxel	RTL10.0EP	CON	58	Quarterly	Preston School entrance on pole, #51	10.0	E
Luxel	RTL8.0PO	IND.	47	Quarterly	Dillard School; #55	8.0	P
Luxel	RTL0.8DO	IND.	12	Quarterly	Marciel Ranch; 14626 Twin Cities Rd; #63	0.8	D
Luxel	RTL0.6MO	IND.	5	Quarterly	Site Boundary Irrigated Garden; #65	0.6	M
Luxel	RTL0.4NO	IND.	29	Quarterly	Depression @ Clay Creek; #66	0.4	N

Table B-1
(Continued)
Radiological Environmental Monitoring Sites and Map Locations

Sample Type	ID Code	Class	Map Location No.	Collection Frequency	Description of Location	Miles	Sector
Luxel	RTL0.4NO1	IND.	29	Quarterly	Soil Pile @ Clay Creek; #67	0.4	N
Luxel	RTL0.3PO	IND.	48	Quarterly	West Fence; #68	0.3	P
Luxel	RTL0.3NP	IND.	53	Quarterly	West Garden, #88	0.3	N
Luxel	RTL0.4NP	IND.	54	Quarterly	Southwest ISFSI, #89	0.4	N
Luxel	RTL0.5PP	IND.	55	Quarterly	Northwest ISFSI, #90	0.5	P
Luxel	RTL0.3QP	IND.	56	Quarterly	Northeast ISFSI, #91	0.3	Q
Luxel	RTL0.7QP	IND.	59	Quarterly	Highway 104 at the rail spur on pole, #92	0.7	Q
Luxel	RTL0.7JP	IND.	61	Quarterly	Clay East Road on pole south of site boundary, #93	0.7	J
Luxel	RTL0.4PP	IND.	62	Quarterly	ISFSI ALARA fence north side, #94	0.4	P

APPENDIX C

QUALITY CONTROL SAMPLE ANALYSIS RESULTS

QUALITY ASSURANCE AND CONTROL

Implementation of the Radiological Environmental Monitoring Program (REMP) consists of a number of discrete steps including:

- ⇒ Sample collection,
- ⇒ Packaging,
- ⇒ Shipment and receipt,
- ⇒ Measurements of radioactivity,
- ⇒ Data evaluation, and
- ⇒ Reporting.

These program elements are performed according to approved, written procedures to assure the validity of REMP results. This section discusses the internal quality control measurements made by the analysis laboratory, Eberline Services (formerly Thermo Nutech), and the results of their participation in the Interlaboratory Comparison Program implemented by the National Institute of Standards Testing (NIST). The Interlaboratory Comparison Program and the analysis laboratories Quality Assurance Programs provide information on the validity (accuracy and precision) of the REMP implementation steps listed above.

Because REMP measurement validity is important for evaluating protection of the health and safety of the public, RSNS has established an Environmental Quality Assurance Program (EQAP) for radiological environmental measurements. The Environmental QA Program implements the guidance provided in Regulatory Guide 4.15, (NRC79a).

INTERLABORATORY COMPARISON PROGRAM

Eberline Services participates in the Interlaboratory Comparison Program (ICP). The ICP is a radiological analysis quality control program implemented by NIST and provided by vendor laboratories. Eberline Services participates in an ICP provided by the Department of Energy (DOE). Participation in an ICP is a requirement of the Permanently Defueled Technical Specification (section D6.8.3.b.3). It provides for an independent check of the proficiency of the laboratory. It also provides information on the precision and accuracy of measurements of radioactive material in REMP samples by Eberline Services. The extent of Eberline Services participation in this program includes all of the environmental radioactivity determinations that are related to the analyses required by the REMP manual.

INTERLABORATORY COMPARISON PROGRAM (continued)

The Intercomparison Program consists of a variety of sample media spiked with known quantities of specific radioactive materials at levels normally found in environmental samples. These levels are generally quite low. Most samples require long counting times to determine if any activity is present, and the results may have large deviations from the mean. When the samples are distributed, there is an implied precision requirement given in terms of the analysis requested to be performed. After the labs provide the results of their analyses, the laboratories provide a statistical summary of all the results by the participating laboratory. This report includes the acceptance control limits, the mean of all laboratories and the standard deviation of the results by all labs, among other statistics.

If the results of a determination by Eberline Services in the ICP is outside the specified control limits or do not pass the outliers test, Eberline Services must investigate and, if a problem is identified, take corrective action to prevent problem recurrence.

During 2000, Eberline Services analyzed 12 ICP samples related to the current REMP program. All sample results reported by Eberline Services were within the control limits.

The Eberline Services measurement results are presented in Table C-1 along with the acceptable values for each test.

INTRALABORATORY QUALITY ASSURANCE PROGRAM

Eberline Services by contract also operate an Intralaboratory Comparison Program (Quality Assurance Program) to maintain an acceptable quality level on a routine basis.

As part of their Quality Assurance Program, the laboratory performs background counts, an analysis of spiked samples, and duplicate sample counts for every ten Rancho Seco REMP samples analyzed. These quality control procedures are performed for all analyses except gamma spectrometry, for which weekly energy and efficiency checks are performed. Personnel not directly involved with the analysis prepare the spiked and duplicate samples. Spiked samples, as well as the radioactive sources used for the gamma spectrometer checks, are traceable to the National Institute for Standards and Technology (NIST).

RANCHO SECO AUDIT AND SURVEILLANCE RESULTS

The Rancho Seco Quality Program requires periodic audits of REMP activities, including Eberline Services. Contract laboratory performance is evaluated by the Rancho Seco QA Department.

CONCLUSIONS

The Intralaboratory and Interlaboratory results provided Eberline Services indicate that Eberline Services performance was acceptable.

DIRECT RADIATION (Luxel) COMPARISON PROGRAM

The monitoring badge vendor Landauer (Luxel) participated in a blind spike comparison-testing program. Landauer participated in a biennial program provided by the Idaho National Environmental Laboratory (INEL). A review of Landauer's results of the participation in this testing program indicates that Landauer has satisfactorily completed all of the required tests for the types of environmental radiation monitored at RSNS.

This comparison program satisfies the requirement of the REMP manual section 6.0.

TABLE C-1

2000 INTERLABORATORY COMPARISON PROGRAM

Statistical Report Summary Data for Responding Lab

Sample Type	Sample Date	Assay Type	DOE Result	Eberline Services Result	Control Limits Reported/ Range
Air Filter	6/00	Co-60	5.320±0.260	5.084 ± 0.206	0.75-1.32
Air Filter	6/00	Cs-137	6.100 ± 0.300	5.878 ± 0.211	0.73-1.37
Air Filter	6/00	Gross Beta	2.420 ±0.200	2.285 ±0.114	0.72-1.67
Air Filter	6/00	Mn-54	27.200±0.800	25.910±0.340	None reported
Soil	6/00	Cs-137	339.000 ±9.300	298.400 ±3.700	0.83-1.32
Vegetation	6/00	Co-60	52.800 ±1.000	49.500 ±.3.200	0.69-1.46
Vegetation	6/00	Cs-137	1380.000 ±20.000	1225.000 ±8.000	0.80-1.40
Water	6/00	Co-60	48.900 ±1.800	53.180 ±1.150	0.80-1.20
Water	6/00	Cs-137	103.000 ±4.000	112.800 ±1.400	0.80-1.26
Water	6/00	Gross Beta	690.000 ±70.000	727.000 ±20.000	0.55-1.54
Water	6/00	Tritium	79.400 ±2.500	83.479 ±8.559	0.71-1.79

TABLE C-1
(cont.)
2000 INTERLABORATORY COMPARISON PROGRAM
Statistical Report Summary Data for Responding Lab
(Thermo NUtech.)

Sample Type	Sample Date	Assay Type	DOE Result	Eberline Services Result	Control Limits Reported/ Range
Mixed Analyte	11/00	Cs-134	1047	1096	732.90-1361.10
	11/00	Cs-137	930	897.5	651.00-1209.00
	11/00	Co-60	1180	1180	826.00-1534.00
	11/00	Mn-54	1023	1044	716.10-1329.90

APPENDIX D

SAMPLE COLLECTION AND ANALYSIS METHODS

For each of the sample media collected, the method of collection is documented in Rancho Seco Nuclear Station procedures. Detailed analysis methods are documented in procedures controlled by the contract laboratory, Thermo NUtech. A brief description of these collection and analysis methods is included in this Appendix.

Sample Media	Collection/Analysis Method
AIR	An air sampler continuously moves air through a filter paper designed to capture particulates by filter paper impaction. The air samplers are equipped with a flow device and elapsed time meter, which, together are used to calculate the volume of air that has passed through the filter paper. The filter paper is exchanged weekly. At least one day is allowed to elapse between sample collection and counting to reduce the interference of naturally occurring radon and thorium daughters on the sample analysis. The filter paper is assayed for gross beta radioactivity by placing the filter on a stainless steel planchet and counted with an internal gas flow proportional counter. The individual particulate filter papers are saved over a calendar quarter and the composite collection is assayed for gamma isotopic radioactivity by gamma spectroscopy.
DIRECT RADIATION	Monitoring badges (Luxels), are located within a ten (10) mile radius of the site. The badges within a five (5) mile radius are considered indicator badges. Two (2) badges are placed at each monitoring location to assure adequate data recovery and to improve measurement statistics. The badge field exposure cycle is approximately ninety (90) days. At the end of the field exposure cycle, the badges are exchanged and returned to the contract laboratory for processing.

Sample Media	Collection/Analysis Method
SOIL & SEDIMENT	Samples of sediment and soil are collected from the top three inches (approx 15 cm) of the sampled material. Sediment samples are obtained approximately two feet from the shoreline. Each sample is assayed directly for gamma isotopic radioactivity by gamma spectroscopy.
GARDEN PRODUCE	Samples of vegetables are collected semi-annually from a garden, which is maintained at the Station Site Boundary. Control location samples are collected from a local commercial vendor. The vegetables are assayed directly for gamma isotopic radioactivity by gamma spectroscopy. During 2000 samples were also collected from the vineyards near the site and at a vineyard control location (seasonal).
FISH	Fish are collected semi-annually from the Clay Creek system. The dissected (edible) portion of each sample is assayed directly for gamma isotopic radioactivity by gamma spectroscopy.
ALGAE	Samples of algae in the Clay Creek system are collected semi-annually and assayed directly for gamma isotopic radioactivity by gamma spectroscopy.
WATER	1 liter grab samples of water from locations in the liquid effluent pathway and groundwater are collected as follows: • Surface water and Drinking water are collected monthly • Runoff water is collected biweekly • Well water is collected quarterly. At two locations, samples are obtained to provide a monthly composite sample. All samples are assayed for tritium by liquid scintillation counting and for gamma isotopic radioactivity by gamma spectroscopy. Drinking and Well water samples are analyzed for Gross Beta activity.
RAIN WATER	Samples of rainwater are collected on a seasonal basis. All samples are assayed for tritium by liquid scintillation and for gamma isotopic radioactivity by gamma spectroscopy.

APPENDIX E

ENVIRONMENTAL MONITORING PROGRAM DESIGN

PROGRAM BASIS

The Sacramento Municipal Utility District conducts a continuous Radiological Environmental Monitoring Program (REMP) at the Rancho Seco Nuclear Station to assess the impact of Station operation on the surrounding environment. The current Post-Operation REMP is a continuation of a similar program initiated prior to and during operation of the Station. Samples of the surrounding environment are collected on a routine basis and analyzed to determine the amount of radiation and radioactive materials present in the exposure pathways.

During 2000 the program was directed and executed by the Radiation Protection/ Chemistry Superintendent. The Technical Staff and the Chem./Rad Decommissioning Technicians perform sample collection. The Radiological Health Supervisor performs data review and Program maintenance. The Program is operated with primary accountability and cognizance of the Manager, Plant Closure and Decommissioning.

The Program is designed consistent with Title 10, Code of Federal Regulations, Part 50, Appendix I - Section IV, B.2, B.3 and C, and Appendix A, "General Design Criteria for Nuclear Power Plants," Criterion 64. The program also complies with Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation," Section 1302. These federal requirements are cited in the Rancho Seco Permanently Defueled Technical Specifications and the REMP manual. REMP requirements are implemented through the review, approval and routine use of several documents, namely the REMP Manual, Offsite Dose Calculation Manual, Surveillance Procedures and Health Physics Implementing Procedures.

The programmatic elements of the REMP are based on regulatory requirements and associated guidelines. The objectives of the Program are to:

1. Provide the technological basis and the instruction for monitoring the environs for radioactivity sources. The radioactive sources, which contribute to detectable radioactivity in the local environs, are comprised of:

   ⇒ Naturally occurring background,
   ⇒ Releases during normal operations,
   ⇒ World-wide weapons testing, and
   ⇒ Major global nuclear accidents

PROGRAM BASIS
(Continued)

2. Provide the means to verify the effectiveness of the Rancho Seco Nuclear Station Radiological Effluents Control Program.

3. Meet the minimum detectable limits for radioisotopes in environmental samples.

4. Provide quantitative measurements in the gaseous, liquid and direct radiation exposure pathways for radionuclides.

5. Provide indications of the largest potential radiation exposure for individuals as a result of radionuclides in the principal exposure pathways.

The Program is developed and conducted using recognized standards and practices NRC79a, NRC79b, NUREG79, and NUREG80a.

REMP CHANGES

The Permanently Defueled Technical Specifications administrative requirements for the REMP program were not revised during 2000. The REMP manual was revised during 2000:

1. Include in Section 1, ISFSI Technical Specification bases for dose limits, administrative controls, and pathway analysis.

2. Editorial change to revise reference to "thermoluminesence dosimeter" to "monitoring device". This was overlooked in the last revision as a generic change.

3. Added ISFSI Technical Specification to Section 9 as a reference.

4. Increased number of monitoring badges from 24 to 25, in Table 1, Item 2, Direct Radiation, to reflect addition of ISFSI monitoring badges added in an earlier revision.

EXPOSURE PATHWAYS

The fundamental parameters, which have been defined prior to monitoring the environs, are:

1. Identification of the effluent release pathways

2. Identification of the human exposure pathways

3. Identification of the land use parameters by the population within a two-mile radius of the plant site.

Each of these three parameters is discussed below.

EXPOSURE PATHWAYS

Effluent Release Pathways

There are three principal pathways, which may result in human exposure to radiation and radioactive material originating from Station operation:

1. Gaseous effluents
2. Liquid effluents and
3. Direct radiation from these effluents and onsite sources.

Gaseous Effluents

Gaseous ventilation and process effluents are released, through particulate filtration units to the environment from the Reactor Building and Auxiliary Building stacks.

In the gaseous pathway, airborne radioactive materials can be inhaled or ingested by humans. Animals can inhale or ingest radioactive material present in the atmosphere, which are retained in animal food products (meat or milk). Radioactive materials, which are carried by air currents, can also be deposited on vegetation or water sources, which are in turn directly consumed by humans or animals.

Liquid Effluents

In the liquid exposure pathway, humans can ingest radioactive materials in surface waters directly or indirectly through the consumption of aquatic foods such as fish and shellfish. Humans can consume vegetation, which is irrigated with Clay Creek water, which may contain radioactive material. Another exposure pathway from liquid effluents results from the consumption of animal products such as meat and milk from animals, which have fed upon irrigated vegetation and/ or consumed Clay Creek water.

Direct Radiation

In the direct radiation pathway, potential radiation exposure may occur from radioactive material storage vessels, which are contained within the site boundary such as the Borated Water Storage Tank. People can potentially be exposed to direct radiation from gaseous effluents or from ground deposition of particulates deposited on the ground from gaseous or liquid effluents. When the fuel off-load is completed, the ISFSI will become part of the direct radiation pathway.

LAND USE CENSUS

On a biennial basis, a land use census is conducted within a two-mile radius to identify any changes in the human exposure pathways. The Land Use Census is used to determine the changes needed for REMP monitoring activities. The results of the land use census conducted during 2000 are presented in Appendix A of this Report. The next scheduled land use census will be conducted in 2002 and reported in the 2002 AREOR. From data obtained from the Land Use Census, exposure pathways are analyzed through a systematic process, which identifies a sample medium, or organism that is found to potentially contribute to an individual's radiation exposure. Usage and bioaccumulation factors (NRC77) are then specified which represent the magnitude of radioactive material transfer through the food chain to a receptor. The analysis of the effluent and exposure pathways enables monitoring sites to be identified as "indicator" (for sites at which the potential effects of Station effluents would be readily detected) or "control" (for those sites which are not expected to be influenced by Station operation). The analysis results of samples obtained at indicator and control sites are routinely compared to identify potential exposures above background levels.

MONITORING LOCATION SELECTION

The REMP maintains the monitoring sites required by the REMP manual, Table 6. This program is supplemented with additional samples to compensate for changes in the radiological environment surrounding Rancho Seco. The United States Nuclear Regulatory Commission and the California Department of Health Services also selected some of the monitoring sites as part of their monitoring programs. Indicator sites are placed in areas, which would be most sensitive to the effects of Station effluents such as downwind, or downstream areas near the Station. If radioactive material is detected above background at any of these indicator sites, observed potential exposure and dose to humans can be estimated to verify the effectiveness of the Offsite Dose Calculation Manual in predicting potential exposures or doses. It is important to note that the detection of radioactive material in indicator samples does not necessarily mean that its presence can be attributed to Rancho Seco operations. Moreover, especially with liquid effluent pathway samples, the detection of radioactive material is difficult to interpret since it is unknown when the material was deposited. In many instances, the observed radioactive material could correctly be ascribed to historical (pre-2000) depositions.

Control locations provide data that should not be influenced by the operation of Rancho Seco. These locations are selected based upon distance from the Station in the upwind or upstream direction of the effluent release pathways. Samples obtained from control locations should, upon analysis, reveal information about the presence and distribution of naturally occurring and man-made radioactive materials. Data from these locations are used to aid in the discrimination between the effects of Rancho Seco releases and other natural phenomena or accidental releases, which may result in human exposure.

MONITORING LOCATION SELECTION
(continued)

Gaseous effluent indicator monitoring sites are generally placed in areas, which receive prevailing winds crossing the Rancho Seco site. Liquid radioactive effluents are discharged in batches from two onsite Retention Basins into "No Name" Creek located southwest of the Station. Dilution water, obtained from the Folsom South Canal, is discharged into "No Name" Creek to give reasonable assurance of compliance with the 10CFR50, Appendix I dose guidelines. "No Name" Creek flows southerly into the Clay Creek. Without this dilution water flow, the Clay Creek would be in a dry state for most of the year.

Beyond the Site Boundary at a point north of Highway 104, the Clay Creek empties into the Hadselville Creek. Hadselville Creek then empties into the Laguna Creek at a point west of North Clay Station Road near the Folsom South Canal. Finally, Laguna Creek flows into the Cosumnes River at a point located approximately 20 straight-line miles west of Rancho Seco. Since this stream system is the only routine release pathway for liquid radioactive and non-radioactive effluents from the Station, the liquid exposure pathway indicator sites are located along these creeks and nearby land.

The direct radiation pathway is monitored principally through a network of monitoring badges at sites distributed in sectors centered on the Station. The badges are located primarily at the site, residential, and recreational areas around the Rancho Seco location. This design provides the capability to easily detect Station-induced direct radiation contributions to the observed terrestrial and cosmic direct radiation background.

Some badges have been sited in special locations to record direct radiation resulting from known depositions of radioactive material and to provide pre-operational data for the Interim Spent Fuel Storage Installation (ISFSI).

Appendix B contains a detailed description and illustration of the REMP sample and monitoring locations.

SAMPLE MEDIA

Samples are collected from predetermined monitoring sites at a specified frequency. The sample media chosen is a function of the type of monitoring desired and coincides with one of the following exposure pathways:

- o Atmospheric
- o Direct radiation
- o Terrestrial
- o Aquatic life
- o Water

Atmospheric monitoring is accomplished by filtering a volume of air using a mechanical air pump to collect particulates with a particulate filter paper. Four air sampler locations are used to collect weekly air samples. Two locations (Meteorological Tower and Rancho Seco Reservoir) are control locations and the remaining two locations are indicator locations on the plant site.

Direct radiation monitoring is achieved by placing monitoring badges at aboveground sites. The monitoring badges respond to, and record the amount of, gamma radiation exposure. The source of this gamma radiation exposure is varied and includes potential Station effluents, naturally occurring terrestrial, and cosmogonic radionuclides. The monitoring badges are also influenced by seasonal and global (fallout) radiation sources.

There are 35 sites, which are monitored within a 10-mile radius of the Station. The monitoring badges are placed at the Station Industrial Area Boundary, near the property boundary, locations of interest such as nearby residences, and at control locations located beyond five miles of the Station.

Terrestrial monitoring is accomplished by obtaining samples of sediment, soil, and garden vegetation to measure the quantity of radioactive material deposited from gaseous and liquid effluents. There are five mud and silt, 27 soil, and 4 garden vegetation locations. Two vineyard sample locations were administrated added during 1999.

Aquatic monitoring includes the sampling of fish and algae. Algae is an excellent concentrator of radioactivity contained in water and is sampled to provide an early indication of increased liquid radioactive material concentration. There are four fish and five algae sample locations.

SAMPLE MEDIA
(continued)

Water monitoring includes samples of surface, runoff, drinking, and well sources from locations in the liquid effluent pathway and from area wells. The six surface water sampling locations monitor site supply water (Folsom South Canal), runoff water and water discharged from the Station. Drinking water is sampled from six groundwater wells and two drinking water taps. Two new well locations were administrated added in 2000 to monitor the vineyard wells. These locations were added to reflect the change in agricultural use of the surrounding area. Rainwater is also collected at one location on a seasonal basis.

SAMPLE ANALYSIS & DATA HANDLING

The laboratory, which provides radio-analytical services for the Program, is Eberline Services located in Richmond, California. Sample analysis results submitted by Eberline Services are reviewed for accuracy and completeness and then entered into a computerized database for evaluation and trending.

Data comparisons are made between individual control and indicator sample sites to isolate potential Station influences on the measurement results.

The summarized results of the 2000 Radiological Environmental Monitoring Program are presented in Table 2.

Individual (raw data) results are presented in Appendix F, Tables F-1 through F-11.

REGULATORY REPORTING LEVELS

Sample analysis data is reviewed and evaluated by the Radiological Health Supervisor as the results are received. All sample analysis results are reviewed for correct sensitivity and anomalies.

The activity concentration values listed in Table E-1 are the environmental Fuel Cycle Dose quantities that, if exceeded, require a Special Report to be submitted to the USNRC. In accordance with the REMP Manual (Section 5, Fuel Cycle Dose), the Special Report must include an evaluation of any release conditions, environmental factors or other aspects, which caused the reporting limits to be exceeded.

REGULATORY REPORTING LEVELS
(continued)

In addition to the Fuel Cycle Dose reporting requirements, a Special Report is required to be submitted to the USNRC when more than one of the radionuclides in Table E-1 are detected in the sampling medium and the summed ratio of detected activity concentration to the respective Reporting Level concentration is greater than, or equal to, unity (1). When radionuclides other than those listed in Table E-1 are detected which are a result of Station effluents, a Special Report is required to be submitted if the potential annual dose commitment exceeds the 10 CFR 50, Appendix I guidelines.

No reports of the types described above were required to be submitted during 2000.

SENSITIVITY OF THE REMP MEASUREMENT PROCESS

All Program measurements must be performed at a sensitivity, which meets USNRC requirements. This sensitivity is determined "before the fact" (*a priori*) for each radionuclide of interest and sample analysis type. Typical controllable sensitivity parameters include:

⇒ Sample volume or mass

⇒ Sampling efficiency

⇒ Time from sample collection to measurement

⇒ Instrument detection efficiency for the nuclides (energies) of interest

⇒ Background radiation levels

⇒ Chemical recovery factors

By adjusting and controlling each of these parameters to maximize measurement process efficiency, a maximum sensitivity level (activity concentration) can be specified for each nuclide of interest and analysis type while maintaining an economic measurement process. The maximum sensitivities in the REMP are specified by the USNRC in the REMP Manual approved for Rancho Seco. These sensitivities are referred to as "LLD's", an acronym for "Lower Limit of Detection". LLD's are specified on an "*a priori*" basis and apply to routine measurement process capabilities when no other interfering radioactivity is present. The word "routine" is emphasized since occasional circumstances, such as limited sample mass, elevated levels of background radiation and interfering nuclides can contribute to sensitivity degradation.

Such occurrences are normally noted and reported during the conduct of REMP activities.

SENSITIVITY OF THE REMP MEASUREMENT PROCESS
(continued)

Meeting the LLD requirements is a quality control function shared by both REMP and the analytical laboratory personnel. Once the laboratory establishes values for the controllable parameters for each analysis type, sample chain of custody controls ensure that these parameters are upheld. If all parameters are upheld, then compliance with the LLD requirements has been demonstrated. The specific LLD values for Program measurements are included in Table E-2.

Since most of the samples analyzed result in the detection decision "activity not identified", a Minimum Detectable Activity (MDA) concentration value is calculated and reported. This value can be thought of as the LLD-at-the-time-of-counting since it is calculated using an equation, which is similar to the one, used to establish LLD parameters. The biggest difference is that actual (not "*a priori*") parameters are used, including interference from natural radioactive material in the sample. It is important to note that MDA's are reported only for those measurements where the "activity not identified" decision has already been made.

MDA values are used primarily to identify changes in the measurement process and to convey more information about the measurement itself. Without the use of the MDA concept, most Program measurements would be reported simply as "<LLD". With MDA used, Program measurements are reported as "< xxx " where "xxx" is the calculated MDA concentration.

TABLE E-1

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pCi/L)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Food Products (pCi/kg, wet)
H-3	20000[a]			
Mn-54	1000		30000	
Co-60	300		10000	
Zn-65	300		20000	
Cs-134	30	10	1000	1000
Cs-137	50	20	2000	2000
Gross Beta	40 [b]	2 [c]		

Notes:

[a] For drinking water samples, this is a 40 CFR Part 141 value

[b] Gross Beta activity in water of ten times the yearly mean of the control samples is indicated as the level that gamma isotopic analysis should be performed on the individual sample (NRC79a). Gamma isotopic analysis on each water sample is required by the REMP and therefore this requirement does not apply.

[c] Gross Beta activity is air of ten times the yearly mean of the control samples is indicated as the level that gamma isotopic analysis should be performed on the individual sample. The value indicated is Site specific.

TABLE E-2

MAXIMUM (REQUIRED) LLD VALUES FOR ENVIRONMENTAL SAMPLES[ac] (NRC79A)

Analysis (d)	Water (pCi/L)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Food Products (pCi/kg, dry)	Sediment (pCi/kg, dry)
Gross Beta	4[b]	0.01			
H-3	2000 (1000, [b])				
Mn-54	15		130		
Co-60	15		130		150[e]
Zn-65	30		260		
Cs-134	15 (10[b])	0.01[d]	130	60	150
Cs-137	18 (10[b])	0.01[d]	130	60	150

Notes:

(a) Analysis requirements are those recommended in the BTP [NRC79A] and RETS [NUREG79].

(b) LLD for water samples utilized for human consumption only [NUREG79].

(c) Other peaks, which are measurable and identifiable, together with the nuclides in Table E-2, shall be identified and reported.

(d) Composite analysis LLD is shown; individual sample LLD is 0.05 pCi/m^3 (Site-specific value).

(e) LLD for Mud and Silt Co-60 is not required by RETS [NUREG79]. This value is consistent with the RETS required value for Cs-134 and Cs-137.

APPENDIX F

2000 SAMPLE ANALYSIS RAW DATA TABLES

TABLE F-1
2000 WEEKLY AIR SAMPLE SUMMARY

Gross Beta Activity in Air Particulates
(pCi/m^3)

Collected Date	RAS01CO	2 sigma	RAS03MO	2 sigma	RAS07EO	2 sigma	RAS18FP	2 sigma
1/3/2000	0.065	0.002	0.069	0.003	0.059	0.002	0.063	0.002
1/11/2000	0.044	0.002	0.042	0.002	0.042	0.002	0.043	0.002
1/18/2000	0.023	0.001	0.025	0.001	0.023	0.002	0.024	0.002
1/25/2000	0.012	0.001	0.011	0.001	0.012	0.001	0.012	0.001
2/1/2000	0.019	0.001	0.019	0.001	0.033	0.002	0.018	0.001
2/8/2000	0.019	0.001	0.018	0.001	0.019	0.001	0.019	0.001
2/15/2000	0.014	0.001	0.013	0.001	0.014	0.001	0.014	0.001
2/22/2000	0.012	0.001	0.013	0.001	0.012	0.001	0.011	0.001
2/29/2000	0.010	0.001	0.010	0.001	0.010	0.001	0.010	0.001
3/6/2000	0.014	0.001	0.013	0.001	0.013	0.001	0.013	0.001
3/14/2000	0.013	0.001	0.012	0.001	0.013	0.001	0.011	0.001
3/21/2000	0.014	0.001	0.013	0.001	0.012	0.001	0.013	0.001
3/28/2000	0.016	0.001	0.015	0.001	0.015	0.001	0.015	0.001
4/4/2000	0.021	0.001	0.022	0.001	0.022	0.001	0.021	0.001
4/11/2000	0.017	0.001	0.018	0.001	0.018	0.001	0.017	0.001
4/18/2000	0.014	0.001	0.013	0.001	0.011	0.001	0.012	0.001
4/25/2000	0.014	0.001	0.013	0.001	0.012	0.001	0.012	0.001
5/2/2000	0.017	0.001	0.014	0.001	0.014	0.001	0.013	0.001
5/8/2000	0.013	0.001	0.011	0.001	0.011	0.001	0.011	0.001
5/16/2000	0.011	0.001	0.009	0.001	0.009	0.001	0.010	0.001
5/23/2000	0.025	0.002	0.028	0.002	0.027	0.003	0.026	0.002
5/30/2000	0.015	0.001	0.012	0.001	0.012	0.001	0.013	0.001
6/6/2000	0.022	0.001	0.019	0.001	0.018	0.001	0.018	0.001
6/12/2000	0.012	0.001	0.010	0.001	0.010	0.001	0.010	0.001
6/20/2000	0.017	0.001	0.015	0.001	0.015	0.001	0.015	0.001
6/26/2000	0.019	0.002	0.017	0.001	0.016	0.001	0.016	0.001

TABLE F-1
2000 WEEKLY AIR SAMPLE SUMMARY
(continued)

Gross Beta Activity in Air Particulates
(pCi/m^3)

Collected Date	RAS01CO	2 sigma	RAS03MO	2 sigma	RAS07EO	2 sigma	RAS18FP	2 sigma
7/5/2000	0.017	0.001	0.014	0.001	0.013	0.001	0.013	0.001
7/10/2000	0.013	0.001	0.015	0.001	0.013	0.001	0.011	0.001
7/18/2000	0.013	0.001	0.013	0.001	0.014	0.001	0.015	0.001
7/24/2000	0.017	0.002	0.017	0.001	0.701	0.100	0.018	0.001
8/1/2000	0.017	0.001	0.016	0.001	0.392	0.065	0.016	0.001
8/8/2000	0.020	0.002	0.020	0.001	0.018	0.001	0.019	0.001
8/15/2000	0.016	0.001	0.018	0.001	0.015	0.001	0.018	0.001
8/21/2000	0.021	0.003	0.018	0.001	0.018	0.002	0.018	0.001
8/29/2000	0.017	0.001	0.016	0.001	0.018	0.001	0.016	0.001
9/5/2000	0.016	0.001	0.015	0.001	0.016	0.001	0.016	0.001
9/12/2000	0.029	0.001	0.026	0.001	0.030	0.002	0.026	0.001
9/19/2000	0.027	0.001	0.024	0.001	0.026	0.001	0.026	0.001
9/26/2000	0.025	0.001	0.023	0.001	0.025	0.001	0.024	0.001
10/2/2000	0.038	0.001	0.037	0.001	0.040	0.001	0.038	0.001
10/10/2000	0.022	0.002	0.023	0.001	0.025	0.002	0.022	0.001
10/17/2000	0.024	0.001	0.024	0.003	0.025	0.001	0.025	0.001
10/24/2000	0.030	0.002	0.029	0.003	0.033	0.001	0.029	0.001
10/31/2000	0.015	0.001	0.013	0.001	0.015	0.001	0.013	0.001
11/7/2000	0.026	0.002	0.029	0.004	0.026	0.002	0.021	0.001
11/14/2000	0.019	0.001	0.018	0.001	0.021	0.001	0.018	0.002
11/20/2000	0.045	0.010	0.035	0.004	0.037	0.001	0.033	0.002
11/27/2000	0.064	0.002	0.058	0.002	0.061	0.002	0.056	0.002
12/5/2000	0.049	0.002	0.046	0.002	0.045	0.002	0.043	0.002
12/12/2000	0.060	0.004	0.057	0.002	0.061	0.002	0.056	0.002
12/19/2000	0.021	0.001	0.019	0.001	0.020	0.001	0.019	0.001
12/26/2000	0.040	0.002	0.037	0.002	0.042	0.002	0.037	0.002

Table F-2

2000 Luxel Summary (Direct Radiation)

Quarterly
(mRem)

ID	Type	2000-1	2000-2	2000-3	2000-4
RTL0.3RO	INDICATOR	16.0	18.0	19.0	20.0
RTL0.3CO	INDICATOR	17.0	16.0	16.0	23.0
RTL0.3NO	INDICATOR	16.0	20.0	17.0	23.0
RTL0.3LO	INDICATOR	17.0	17.0	17.0	19.0
RTL0.3HO	INDICATOR	16.0	18.0	18.0	21.0
RTL0.4FO	INDICATOR	14.0	17.0	15.0	18.0
RTL0.5CO	INDICATOR	16.0	17.0	19.0	23.0
RTL0.6KO	INDICATOR	15.0	17.0	15.0	20.0
RTL10.0HP	CONTROL	17.0	17.0	14.0	21.0
RTL2.7MO	INDICATOR	15.0	15.0	17.0	15.0
RTL8.2KO	CONTROL	18.0	23.0	19.0	22.0
RTL7.8CO	CONTROL	13.0	14.0	13.0	16.0
RTL1.8FO	INDICATOR	13.0	14.0	13.0	14.0
RTL1.5MO	INDICATOR	16.0	17.0	15.0	20.0
RTL3.9KO	INDICATOR	13.0	16.0	16.0	19.0
RTL7.4MO	CONTROL	0.0	19.0	14.0	20.0
RTL3.7NO	INDICATOR	16.0	18.0	18.0	16.0
RTL3.8MO	INDICATOR	16.0	17.0	17.0	16.0
RTL1.9NO	INDICATOR	15.0	22.0	17.0	21.0
RTL1.7FO	INDICATOR	15.0	17.0	16.0	17.0
RTL1.4DO	INDICATOR	18.0	19.0	19.0	19.0
RTL10.0EP	CONTROL	13.0	15.0	18.0	17.0
RTL8.0PO	CONTROL	16.0	16.0	18.0	18.0
RTL0.8DO	INDICATOR	17.0	18.0	18.0	19.0
RTL0.6MO	INDICATOR	14.0	15.0	17.0	16.0
RTL0.4NO	INDICATOR	29.0	35.0	46.0	36.0
RTL0.4NO1	INDICATOR	17.0	18.0	21.0	19.0
RTL0.3PO	INDICATOR	17.0	19.0	14.0	20.0
RTL0.3NP	INDICATOR	16.0	19.0	15.0	16.0
RTL0.4NP	INDICATOR	14.0	18.0	16.0	20.0
RTL0.5NP	INDICATOR	17.0	20.0	15.0	21.0
RTL0.3QP	INDICATOR	14.0	17.0	17.0	17.0
RTL0.7QP	INDICATOR	15.0	17.0	14.0	17.0
RTL0.7JO	INDICATOR	14.0	17.0	14.0	17.0
RTL0.4PP	INDICATOR	15.0	21.0	19.0	21.0

Table F-3

2000 Garden Vegetables
Semi-annual
(pCi/kg, wet)

Sample ID	Collect date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137	Tritium
RLV0.6MO	3/23/2000	<26	<18	<47	<25	<16	
RLV18.0KO	3/23/2000	<16	<18	<34	<18	<16	
RLV0.6MO	7/10/2000	<6.1	<7.0	<15	<16	<6.3	
RLV18.0KO	7/10/2000	<28	<29	<70	<28	<24	
RLV6.6KP	8/29/2000	<8.90	<9.21	<20.5	<17.8	<9.77	<93
RLV0.7NO	8/29/2000	<11.3	<13.0	<30.4	<13.7	<11.9	<98

Table F-4

2000 SEDIMENT
Quarterly
(pCi/kg)

Sample ID	Collect Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RMS1.8NO	2/8/2000	<7.0	<8.0	<21	<10	62.0
RMS3.7NO	2/8/2000	<15	<15	<38	<19	<14
RMS0.6MO	2/8/2000	<10	<10	<28	<13	126
RMS0.7NO	2/8/2000	<20	169	<50	30.0	9000
RMS0.6MOQ	2/8/2000	<9.0	<9.0	<22	<11	275
RMS0.3MO	2/15/2000	<25	29.0	<62	<35	517
RMS0.7NO	5/23/2000	<27	176	<64	41.0	8380
RMS1.8NO	5/23/2000	5.00	<7.0	<14	<7.0	179
RMS3.7NO	5/23/2000	<8.0	<5.0	<23	<10	53
RMS0.6MOQ	5/23/2000	<4.0	<5.0	<12	<8.0	49.0
RMS0.3MO	5/23/2000	<5.0	<7.0	<15	<10	115
RMS0.6MO	5/23/2000	<4.0	<5.0	<12	<6.0	38.0
RMS0.6MOQ	8/21/2000		<17	<42	<21	176
RMS0.3MO	8/21/2000		<29	<75	<33	145
RMS0.7NO	8/21/2000		<34	<81	<49	221
RMS0.6MO	8/21/2000		<29	<59	<32	158
RMS1.8NO	8/21/2000		<22	<49	<30	92.8
RMS3.7NO	8/21/2000		<33	<67	<39	<30
RMS0.6MO	11/7/2000	1.12	<2.3	<2.3	<1.8	26.2
RMS0.7NO	11/7/2000	<1.9	<2.1	<4.5	<2.8	72.9
RMS0.3MO	11/7/2000	<2.6	5.47	<8.0	<3.4	172
RMS1.8NO	11/7/2000	<1.7	<1.9	<4.9	<2.5	45.6
RMS3.7NO	11/7/2000	<2.8	<3.1	<7.8	<3.5	10.9

TABLE F-4
(continued)

2000 SOIL AND SEDIMENT

Effluent Creek Soil
Semi-Annual
(pCi/kg)

Sample ID	Description	Collection Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSL0.6MO	Site Boundary	4/26/2000	<7	13	<15	<6	276
RSL0.6MO	Site Boundary	11/1/2000	<10	<7	<23	<8	198
RSL0.7NO	Water Sump	4/26/2000	<9	<7	<21	<7	150
RSL0.7NO	Water Sump	11/1/2000	<10	<9	<20	<7	61
RSL1.5NO	Silva Property	4/26/2000	<9	43	<26	<10	1259
RSL1.5NO	Silva Property	11/1/2000	<18	<17	<39	<12	84
RSL1.8NO	Hadselville/ Clay Creeks	4/26/2000	<10	<9	<21	<8	<9
RSL1.8NO	Hadselville/ Clay Creeks	11/1/2000	<14	<13	<38	<12	164

TABLE F-4
(continued)
2000 SOIL AND SEDIMENT

Site Boundary Soil/ Depression Areas Soil
Semi-Annual
(pCi/kg)

Sample ID	Description	Collection Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSL0.5MPAK	Site Boundary	4/26/2000	<12	<15	<26	<13	339
RSL0.5MPAK	Site Boundary	11/7/2000	<7	<7	<17	<6	133
RSL0.5MPAL	Site Boundary	11/7/2000	<8	<7	<19	<8	243
RSL0.5MPAL	Site Boundary	4/26/2000	<10	<11	<23	<9	198
RSL0.5MPAM	Site Boundary	11/7/2000	<11	171	<23	<11	1574
RSL0.5MPAM	Site Boundary	4/26/2000	<12	181	<25	<13	3248
RSL0.5MPAN	Site Boundary	4/26/2000	<8	<7	<17	<6	138
RSL0.5MPAN	Site Boundary	11/7/2000	<11	<12	<21	<8	171
RSL0.4MP1	Depression	4/26/2000	<19	1180	<54	147	40700
RSL0.4MP1	Depression	11/6/2000	<19	778	<46	99	28950
RSL0.4MP2	Depression	4/26/2000	<23	494	<58	76	24690
RSL0.4MP2	Depression	11/6/2000	<14	364	<38	62	17820
RSL0.4MP3	Depression	11/7/2000	<11	37	<21	38	7421
RSL0.4MP3	Depression	4/26/2000	<8	30	<17	53	4838

TABLE F-4
(continued)

2000 SOIL AND SEDIMENT
Storm Drain Soil
Semi-Annual
(pCi/kg)

Sample ID	Description	Collection Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSL0.3NP1	ISFSI #1	4/26/2000	<9	<9	<22	<7	<9
RSL0.3NP1	ISFSI #1	11/6/2000	<9	<8	<19	<8	<10
RSL0.3NP2	ISFSI #2	4/26/2000	<8	<7	<19	<7	<8
RSL0.3NP2	ISFSI #2	11/6/2000	<9	<8	<19	<7	<10
RSL0.3NP3	ISFSI #3	11/6/2000	<7	<6	<18	<5	<8
RSL0.3NP3	ISFSI #3	4/26/2000	<9	<9	<19	<6	<8
RSL0.2HO1	Storm Drain #1	11/2/2000	<17	<17	<35	<13	47
RSL0.2HO1	Storm Drain #1	4/26/2000	<8	<7	<14	<6	<8
RSL0.2HO2	Storm Drain #2	11/2/2000	<13	<17	<28	<10	104
RSL0.2HO2	Storm Drain #2	4/26/2000	<8	<13	<20	<7	78
RSL0.2JO	Storm Drain #3	4/26/2000	<8	<9	<21	<7	<10
RSL0.2JO	Storm Drain #3	11/1/2000	<9	<9	<18	<6	21
RSL0.2KO	Storm Drain #4	11/2/2000	<8	<8	<18	<6	43
RSL0.2KO	Storm Drain #4	4/26/2000	<8	<10	<21	<7	60
RSL0.3LO	Storm Drain #5	4/26/2000	<7	<6	<16	<6	<9
RSL0.3LO	Storm Drain #5	11/2/2000	<8	<7	<20	<6	26
RSL0.2HO	Storm Drain #6	4/26/2000	<10	<8	<21	<8	44
RSL0.2HO	Storm Drain #6	11/1/2000	<11	<14	<27	<10	418
RSL0.3MO7	Storm Drain #7	4/26/2000	<8	<7	<20	<6	23
RSL0.3MO7	Storm Drain #7	11/2/2000	<9	<10	<22	<7	35
RSL0.3MO8	Storm Drain #8	4/26/2000	<10	<8	<20	<8	59
RSL0.3MO8	Storm Drain #8	11/2/2000	<8	<8	<19	<7	<9
RSL0.3MO9	Storm Drain #9	4/26/2000	<9	<8	<19	<7	27
RSL0.3MO9	Storm Drain #9	11/6/2000	<10	<11	<21	<8	45
RSL0.3AO	Storm Drain #10	11/2/2000	<8	<7	<21	<6	25
RSL0.3AO	Storm Drain #10	4/26/2000	<7	<7	<19	<5	<8
RSL0.3QO	Storm Drain #11	4/26/2000	<8	<8	<21	<6	<9
RSL0.3QO	Storm Drain #11	11/6/2000	<11	<10	<24	<8	59
RSL0.3NO	Storm Drain #12	11/2/2000	<7	<8	<19	<7	<9
RSL0.3NO	Storm Drain #12	4/26/2000	<9	<8	<22	<8	<9

TABLE F-5

2000 FISH
Semi-Annual
(pCi/kg, wet)

Sample ID	Collect Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RFS0.6MO (1)	6/6/2000	<12	<16	<40	<15	94
RFS0.6MO (1)	11/16/2000	<11	<10	<22	<14	58.5

Note: (1)=Predator Species

TABLE F-6

2000 ALGAE
Semi-annual
(pCi/kg, wet)

Sample ID	Collect Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RAG1.3FO	7/18/2000	<4.7	<5.0	<11	<6.3	<9.2
RAG0.3MO	7/18/2000	<5.4	<6.0	<13	<12	19.1
RAG2.2NO	7/18/2000	<7.1	<8.5	<18	<9.3	<13
RAG1.8NO	7/18/2000	<4.6	<6.2	<11	<6.0	<19.5
RAG3.7NO	7/18/2000	<9.6	<11	<25	<21	11.6
RAG0.6MO	7/18/2000	<8.7	<10	<21	<11	29.8
RAG0.7NO	7/18/2000	<5.7	5.20	<7.8	<4.0	29.5
RAG1.3FO	8/29/2000	<5.66	<6.52	<12.7	<11.0	<8.93
RAG3.7NO	8/29/2000	<5.54	<5.18	<12.1	<8.65	<5.81
RAG1.8NO	8/29/2000	<2.71	6.56	<6.23	<3.67	52.2
RAG0.7NO	8/29/2000	<5.33	<6.19	<11.6	<6.31	45.5

TABLE F-7

2000 WELL WATER

Quarterly
(pCi/L)

Sample ID	Collect Date	Gross beta	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RWW1.5RP	1/25/2000	<2.8	<201	<3.69	<4.61	<9.05	<4.97	<3.99
RWW0.6RP	1/25/2000	3.5	<201	<8.34	<10.7	<20.3	<10.3	<8.42
RWW0.6RP	3/1/2000	<3.71	<202	<6.42	<7.38	<12.4	<7.40	<6.44
RWW1.5RP	3/1/2000	<3.17	<201	<5.45	<7.06	<15.6	<7.35	<5.53
RWW3.7MO	3/7/2000	<2.80	<208	<11.8	<14.2	<26.4	<12.8	<11.5
RWW2.1MO	3/7/2000	<3.18	<207	<43.8	<39.8	<97.8	<52.5	<43.0
RWW0.8LO	3/7/2000	<3.51	<212	<5.03	<6.19	<14.6	<6.80	<5.07
RWW0.8DO	3/7/2000	<3.06	<200	<3.99	<4.64	<8.52	<5.06	<4.14
RWW0.3EO	3/7/2000	<3.72	<199	<9.13	<10.9	<19.4	<10.1	<9.66
RWW1.5RP	3/28/2000	<2.4	<210	<7.2	<7.9	<15	<9.6	<7.5
RWW0.6RP	3/28/2000	2.38	<210	<3.3	<4.1	<7.2	<4.3	<3.5
RWW1.5MP	6/6/2000	<3.1	<190	<3.9	<5.2	<11	<13	<4.1
RWW0.3EO	6/6/2000	6.85	<190	<4.2	<5.1	<12	<9.3	<4.5
RWW0.6RP	6/6/2000	3.29	<190	<8.5	<8.2	<19	<11	<8.4
RWW2.1MO	6/6/2000	<3.0	<190	<9.2	<11	<21	<10	<7.4
RWW0.8LO	6/6/2000	<1.8	<190	<8.8	<11	<20	<10	<9.3
RWW0.8DO	6/6/2000	3.3	<190	<4.0	<4.4	<9.4	<5.3	<4.4
RWW3.7MO	6/6/2000	<3.2	<190	<7.6	<9.1	<17	<8.3	<7.7
RWW1.5MP	9/5/2000	<1.8	<430	<14	<15	<31	<18	<14
RWW0.6RP	9/5/2000	2.35	<440	<6.9	<6.9	<14	<7.5	<7.2
RWW2.1MO	9/5/2000	<2.4	<430	<14	<15	<28	<19	<14
RWW0.8LO	9/5/2000	<1.8	<440	<9.7	<11	<22	<14	<11
RWW0.8DO	9/5/2000	<2.1	<430	<4.6	<4.5	<8.6	<5.5	<4.1
RWW3.7MO	9/5/2000	<1.8	<440	<6.0	<5.6	<12	<6.0	<5.7
RWW0.3EO	9/5/2000	<2.3	<440	<14	<14	<28	<18	<14
RWW1.5MP	11/27/2000	<2.6	<190	<7.9	<9.9	<20	<10	<8.4
RWW2.1MO	11/27/2000	<2.0	<190	<6.7	<16	<17	<9.2	<7.6
RWW0.7RP	11/28/2000	2.84	<190	<5.5	<5.3	<11	<6.9	<6.1
RWW0.6RP	11/28/2000	4.23	<190	<6.1	<6.6	<12	<6.7	<11
RWW0.8LO	11/28/2000	2.76	<190	<8.1	<11	<22	<9.9	<9.6
RWW0.8DO	11/28/2000	<3.8	<190	<3.2	<3.7	<7.4	<4.5	<3.7
RWW0.3EO	11/28/2000	6.59	<190	<6.7	<7.5	<17	<8.9	<7.7
RWW3.7MO	11/28/2000	<1.8	<190	<8.1	<11	<22	<9.9	<9.6
RWW0.9CP	11/29/2000	<2.9	<190	<6.1	<7.3	<15	<7.5	<7.1

TABLE F-8

2000 RUNOFF WATER

Biweekly
(pCi/L)

Sample ID	Collect Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RRW0.6MO	1/11/2000	<218	<7.84	<7.61	<15.5	<8.28	<7.53
RRW0.6MO	1/25/2000	<189	<7.65	<8.45	<18.2	<10.5	<8.56
RRW0.6MO	2/9/2000	<231	<6.9	<7.2	<20	<8.0	<5.5
RRW0.6MO	2/23/2000	<164	<4.73	<6.76	<15.0	<6.35	<5.32
RRW0.6MO	3/7/2000	<190	<9.22	<11.0	<19.5	<11.0	<8.26
RRW0.6MO	3/21/2000	<210	<10	<8.4	<23	<12	<8.4
RRW0.6MOQ	3/21/2000	<200	<6.2	<6.6	<17	<13	<5.4
RRW0.6MO	4/4/2000	<180	<7.7	<10	<23	<9.9	<8.4
RRW0.6MO	4/18/2000	<190	<5.7	<7.1	<13	<7.4	<6.6
RRW0.6MO	5/2/2000	<210	<4.2	<6.1	<13	<12	<4.9
RRW0.6MO	5/16/2000	<200	<4.5	<6.3	<14	<7.0	<5.3
RRW0.6MO	5/30/2000	<170	<8.1	<8.9	<17	<9.0	<7.4
RRW0.6MO	6/12/2000	<160	<4.9	<6.4	<16	<6.9	<5.1
RRW0.6MOQ	6/12/2000	<160	<8.8	<9.1	<21	<28	<8.2
RRW0.6MO	6/27/2000	<160	<4.9	<6.3	<14	<6.7	<4.8
RRW0.6MO	7/10/2000	<160	<9.6	<11	<23	<13	<11
RRW0.6MO	7/24/2000	<160	<4.6	<6.3	<14	<6.4	<4.9
RRW0.6MO	8/8/2000	<200	<8.0	<9.5	<18	<9.4	<8.9
RRW0.6MO	8/21/2000	<190	<6.0	<6.8	<13	<8.7	<12
RRW0.6MO	9/5/2000	<460	<8.4	<9.7	<19	<12	<10
RRW0.6MOQ	9/5/2000	<460	<11	<12	<23	<11	<10
RRW0.6MO	9/19/2000	5060/	<5.1	<5.4	<10	<7.1	<5.9
RRW0.6MO	10/3/2000	<160	<7.6	<8.7	<16	<9.2	<7.9
RRW0.6MO	10/17/2000	<230	<5.3	<5.5	<10	<7.4	<5.6
RRW0.6MO	10/31/2000	<190	<8.4	<9.1	<19	<12	<8.9
RRW0.6MO	11/14/2000	<110	<6.9	<6.9	<12	<7.2	<7.7
RRW0.6MO	11/28/2000	<190	<8.5	<9.4	<19	<9.4	<8.1
RRW0.6MOQ	11/28/2000	<190	<7.9	<7.5	<14	<8.6	<7.5
RRW0.6MO	12/12/2000	<160	<8.9	<9.1	<19	<10	<9.8
RRW0.6MO	12/26/2000	<200	<6.0	<6.3	<12	<7.0	<6.0

TABLE F-9
2000 SURFACE WATER
Monthly Grab / Monthly Composite
(pCi/L)

Sample ID	Collect Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSW0.3MO	1/25/2000	<194	<3.76	<4.62	<7.89	<4.67	<4.00
RSW0.7NO	1/25/2000	<187	<7.06	<8.22	<15.9	<9.25	<7.86
RSW1.3FO	1/25/2000	<192	<6.13	<6.72	<13.4	<7.47	<6.36
RSW1.8NOQ	1/25/2000	<197	<4.24	<5.31	<12.2	<5.98	<4.75
RSW1.8NO	1/25/2000	<188	<3.95	<4.46	<7.58	<5.00	<4.00
RSW3.7NO	1/25/2000	<192	<8.27	<8.33	<16.1	<9.27	<8.44
RSW1.3FO	2/29/2000	<198	<7.64	<8.76	<15.6	<8.41	<7.52
RSW0.7NO	2/29/2000	<199	<8.12	<9.20	<19.7	<10.4	<9.03
RSW0.3MO	2/29/2000	<196	<4.36	<4.51	<9.28	<5.38	<4.33
RSW3.7NO	2/29/2000	<199	<9.50	<9.72	<17.5	<9.93	<9.62
RSW1.8NO	2/29/2000	<196	<9.53	<9.98	<20.8	<11.2	<8.72
RSW3.7NO	3/28/2000	<207	<8.90	<12.0	<21.0	<9.90	<9.00
RSW0.3MO	3/28/2000	<214	<8.00	<9.50	<16.0	<10.0	<9.20
RSW0.7NO	3/28/2000	<214	<4.30	<4.40	<8.30	<5.40	<4.10
RSW1.8NO	3/28/2000	<204	<5.70	<6.50	<17.0	<12.0	<5.30
RSW1.3FO	3/28/2000	<203	<6.70	<7.30	<16.0	<8.80	<5.30
RSW1.8NO	4/25/2000	<190	<6.9	<8.5	<15	<8.0	<7.0
RSW3.7NO	4/25/2000	<190	<4.3	<5.4	<12	<7.8	<4.3
RSW0.3MO	4/25/2000	<180	<6.4	<6.9	<13	<7.0	<6.7
RSW1.8NOQ	4/25/2000	<190	<7.7	<8.7	<18	<10	<8.6
RSW0.7NO	4/25/2000	<190	<5.0	<5.6	<15	<6.6	<5.0
RSW1.3FO	4/25/2000	<190	<3.8	<5.4	<12	<5.2	<4.4
RSW0.7NO	5/30/2000	<170	<9.0	<11	<21	<10	<9.0
RSW0.3MO	5/30/2000	<170	<7.5	<8.5	<17	<8.6	<7.3
RSW3.7NO	5/30/2000	<170	<8.7	<8.4	<20	<12	<8.9
RSW1.8NO	5/30/2000	<170	<4.0	<4.5	<9.4	<5.4	<4.2
RSW1.3FO	5/30/2000	<170	<4.0	<5.0	<12	<5.5	<4.3
RSW0.3MO	6/26/2000	<160	<5.0	<6.9	<15	<6.9	<4.9
RSW1.8NO	6/27/2000	<160	<4.6	<6.1	<14	<11	<4.6
RSW0.7NO	6/27/2000	<150	<4.2	<5.5	<12	<7.3	<4.2
RSW1.3FO	6/27/2000	<160	<4.2	<5.7	<13	<11	<4.1
RSW3.7NO	6/27/2000	<160	<7.2	<7.9	<15	<8.5	<7.4

TABLE F-9
(continued)

2000 SURFACE WATER
Monthly Grab/ Monthly Composite
(pCi/L)

Sample ID	Collect Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSW1.8NO	7/24/2000	<160	<5.5	<5.6	<12	<7.2	<6.0
RSW0.3MO	7/24/2000	<160	<4.6	<6.7	<14	<8.0	<5.2
RSW1.8NOQ	7/24/2000	<160	<8.1	<1.0	<19	<10	<8.5
RSW1.3FO	7/24/2000	<160	<5.2	<5.3	<12	<6.9	<5.8
RSW0.7NO	7/24/2000	<160	<6.4	<7.4	<14	<7.9	<6.8
RSW3.7NO	7/24/2000	<160	<5.6	<6.3	<13	<8.2	<6.7
RSW0.3MO	8/29/2000	<450	<10	<11	<22	<14	<11
RSW3.7NO	8/29/2000	<450	<13	<15	<26	<16	<15
RSW0.7NO	8/29/2000	<460	<6.4	<6.8	<13	<8.3	<6.0
RSW1.8NO	8/29/2000	<450	<13	<23	<3	<16	<14
RSW1.3FO	8/29/2000	<460	<9.8	<10	<22	<17	<11
RSW1.8NO	9/26/2000	<160	<7.6	<8.1	<15	<8.0	<6.7
RSW1.3FO	9/26/2000	<196	<6.0	<6.1	<13	<8.4	<6.8
RSW0.7NO	9/26/2000	<160	<8.0	<8.5	<17	<12	<9.0
RSW3.7NO	9/26/2000	<160	<6.6	<6.9	<14	<9.5	<7.5
RSW0.3MO	9/26/2000	510	<7.0	<8.5	<14	<7.8	<6.4
RSW0.7NO	10/31/2000	260	<6.4	<8.6	<15	<7.7	<6.7
RSW1.3FO	10/31/2000	<190	<3.6	<4.0	<7.6	<4.5	<4.0
RSW3.7NO	10/31/2000	<190	<3.2	<3.9	<7.7	<4.3	<3.8
RSW0.3MO	10/31/2000	<190	<8.9	<9.7	<19	<10	<8.6
RSW1.8NO	10/31/2000	<190	<7.8	<8.4	<18	<10	<8.5
RSW1.8NOQ	10/31/2000	<190	<5.3	<5.5	<10	<7.5	<3.9
RSW1.3FO	11/27/2000	<180	<5.0	<5.1	<11	<13	<5.7
RSW0.3MO	11/27/2000	<190	<5.5	<5.6	<11	<11	<5.5
RSW3.7NO	11/27/2000	<190	<6.8	<6.7	<14	<14	<6.9
RSW0.7NO	11/27/2000	<380	<7.2	<7.5	<16	<9.1	<7.5
RSW1.8NO	11/27/2000	<190	<6.1	<7.1	<15	<8.1	<6.7
RSW1.8NO	12/26/2000	<200	<5.9	<6.4	<14	<15	<6.9
RSW0.3MO	12/26/2000	<200	<9.1	<9.0	<17	<10	<8.6
RSW3.7NO	12/26/2000	<200	<5.1	<5.5	<12	<11	<5.7
RSW0.7NO	12/26/2000	<200	<7.4	<7.3	<16	<20	<7.5
RSW1.3FO	12/26/2000	<200	<8.2	<8.9	<19	<11	<9.0

TABLE F-10

2000 Drinking Water
Monthly
(pCi/L)

Sample ID	Collect Date	Gross beta	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RDW0.1GO	1/25/2000	3.6	<197	<4.48	<5.91	<12.9	<7.64	45+-5.4
RDW1.8FP	1/25/2000	<3.82	<205	<3.82	<8.88	<10.4	<20.2	<8.66
RDW1.8FP	2/29/2000	<4.95	<203	<7.12	<8.78	<13.7	<7.90	<7.20
RDW0.1GO	2/29/2000	<4.05	<198	<5.23	<6.64	<15.1	<7.14	<5.44
RDW0.1GO	3/13/2000	<3.71	<210	<9.48	<10.3	<17.9	<11.3	<11.4
RDW0.1GO	3/28/2000	<2.5	<210	<4.0	<4.9	<7.8	<4.9	<4.3
RDW1.8FP	3/28/2000	3.24	<200	<6.7	<9.0	<15	<8.3	<7.7
RDW1.8FP	4/25/2000	<3.78	<207	<4.13	<5.58	<13.0	<5.86	<4.90
RDW0.1GO	4/25/2000	4.3	<210	<4.81	<6.28	<15.7	<6.64	<5.53
RDW0.1GO	5/30/2000	<3.7	<200	<9.0	<9.0	<20	<16	<9.2
RDW1.8FP	5/30/2000	<3.2	<200	<4.0	<5.4	<12	<5.7	<4.4
RDW0.1GO	6/27/2000	3.25	<200	<6.5	<7.4	<13	<7.8	<6.2
RDW1.8FP	6/27/2000	3.01	<200	<4.1	<5.9	<12	<5.7	<4.3
RDW1.8FP	7/24/2000	2.74	<160	<7.8	<8.5	<19	<13	<8.4
RDW0.1GO	7/24/2000	2.63	<160	<3.8	<5.3	<13	<5.4	<4.1
RDW0.1GO	8/29/2000	2.93	<217	<1.05	<1.56	<2.71	<1.23	<0.961
RDW1.8FP	8/29/2000	2.32	<217	<9.51	<9.66	<21.6	<12.8	<11.0
RDW0.1GO	9/26/2000	<4.8	<190	<6.7	<8.2	<15	<8.4	<7.0
RDW1.8FP	9/26/2000	2.02	<190	<5.6	<5.8	<11	<10	<6.2
RDW1.8FP	10/31/2000	2.98	<190	<7.5	<8.9	<18	<9.5	<8.1
RDW0.1GO	10/31/2000	4.10	<180	<5.2	<5.9	<10	<7.5	<6.1
RDW0.1GO	11/27/2000	3.36	<190	<3.4	<4.1	<7.0	<4.2	<3.8
RDW1.8FP	11/27/2000	2.82	<180	<6.0	<6.7	<13	<7.2	<6.6
RDW0.1GO	12/26/2000	3.64	<200	<8.2	<8.3	<15	<9.9	<7.9
RDW1.8FP	12/26/2000	3.46	<200	<5.7	<6.3	<13	<7.0	<6.2

TABLE F-11

2000 Rain Water
Seasonal
(pCi/L)

Sample id	Collect date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RRN0.8DO	1/18/2000	<191	<7.18	<7.94	<15.5	<9.74	<8.52
RRN0.8DO	1/25/2000	<191	<6.43	<6.44	<13.2	<6.79	<6.58
RRN0.8DO	2/8/2000	<230	<7.96	<12.8	<17.3	<9.81	<7.88
RRN0.8DO	2/22/2000	<168	<8.09	<9.55	<19.1	<11.2	<9.78
RRN0.8DO	2/29/2000	<198	<4.28	<5.62	<12.4	<5.76	<4.14
RRN0.8DO	3/21/2000	<200	<4.2	<6.2	<14	<5.9	<4.8
RRN0.8DO	4/25/2000	<200	<7.2	<8.7	<17	<9.4	<7.4
RRN0.8DO	5/8/2000	<200	<4.6	<5.5	<13	<9.5	<4.6
RRN0.8DO	5/23/2000	<170	<4.5	<5.9	<13	<12	<4.7
RRN0.8DO	6/12/2000	<160	<8.4	<13	<20	<10	<8.9
RRN0.8DO	9/5/2000	<450	<11	<13	<23	<14	<12
RRN0.8DO	10/10/2000	<160	<6.0	<6.9	<15	<8.4	<7.2
RRN0.8DO	10/31/2000	<190	<6.9	<8.4	<15	<8.2	<7.7
RRN0.8DO	11/27/2000	<190	<5.4	<5.4	<11	<12	<5.5
RRN0.8DO	12/12/2000	<150	<6.5	<6.4	<13	<8.8	<6.6
RRN0.8DO	12/26/2000	<200	<9.7	<12	<20	<11	<9.1

APPENDIX G
2000 MISSED SAMPLE REPORT

In accordance with the requirements REMP manual section 3.1, the following samples are being reported as not being collected for the reasons indicated during 2000. Corrective action as required by the REMP manual is as indicated.

Luxel Monitoring Badges (Direct radiation pathway)

Location # 30 RTL7.4MO, Herald Fire Station (Control) -- On March 30, 2000, the monitoring badges at this location were missing during the routine changeout. Second Quarter 2000 monitoring badges were restored at this location. No data will be available for this location for the first quarter 2000.

Air Sampler (Airborne Pathway)

RAS0.7EO, Meteorological Tower (control) – On May 23, 2000, during the weekly change-out, the air sampler at this location was found not running. Air sampler stopped due to a blown fuse in the air sampler. Air sampler was replaced and sampling was restored at this location. Air sampling at this location did not meet continuous requirement. Minimum volume for air sample was met and sample data was reported for this sample period for this location. PDQ 2000-0053 was written to document the occurrence.

RAS0.7EO, Meteorological Tower (control) – On July 18, 2000, during the weekly change-out, the air sampler at this location was found not running. Air sampler stopped due to a blown fuse in the air sampler. Air sampler was replaced and sampling was restored at this location. Air sampling at this location did not meet continuous requirement. Minimum volume for air sample was not met and sample data was reported for this sample period for this location. PDQ 2000-0074 was written to document the occurrence.

RAS0.7EO, Meteorological Tower (control) – On July 24, 2000, during the weekly change-out, the air sampler at this location was found not running. Air sampler stopped due to a blown fuse in the air sampler. This was the second occurrence for a blown fuse with two different air samplers. Air sampler was replaced and sampling was restored at this location. Air sampling at this location did not meet continuous requirement. Minimum volume for air sample was not met and sample data was reported for this sample period for this location. PDQ 2000-0076 was written to document the occurrence.

APPENDIX G
2000 MISSED SAMPLE REPORT
(Continued)

Algae (Liquid Effluent Pathway

Algae samples are collected on a semi-annual basis from seven locations along the Clay/ Hadselville creeks and at the site reservoir. These samples are administratively controlled. Samples for the second half of 2000 were not collected at the following locations due to excessive flow, which prevented the growth of algae.

RAG0.3MO Plant Effluent outfall

RAG0.6MO Site Boundary

RAG2.2NO Hadselville Creek at Hwy 104

No data will be reported for these locations for the second half of 2000.

APPENDIX H
ADDENDUM TO 1999 AREOR REPORT

1. Page 9 of Section IV-E. Water monitoring, Algae data was repeated.