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MPC&D 02-037

April 23, 2002

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 2001**

Dear Mr. Merschoff:

Attached is the Rancho Seco Annual Radiological Environmental Operating Report (AREOR) for 2001. 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,

Steve Redeker  
Manager, Plant Closure & Decommissioning

Cc: Document Control Desk, NRC, Washington DC  
J. Hickman, NRC, Rockville

*JE25*

# **ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT**



**JANUARY -- DECEMBER 2001**

**Rancho Seco Nuclear Station  
Herald, California  
License Number DPR-54**

# 2001 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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# 2001 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, 2001 through December 31, 2001. 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 2001 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 in progress and scheduled to be complete by the fourth quarter of 2002.

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, soil, and sediment samples obtained from the environment of the No Name, Clay, Hadselville, and Laguna Creeks contributed the majority of positive isotopic identifications. Cesium-137 and Cobalt-60 are the predominant nuclides identified in the aquatic and soil environment. Mn-54 was detected in one of the storm drain soil samples. Tritium activity in Surface Water and Runoff Water samples 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. 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 0.03 mRem (as calculated using the Rancho Seco Offsite Dose Calculation Manual (ODCM)). This calculated organ dose commitment was 0.2% of the associated PDTS limit (10CFR50, Appendix I guideline).

Noble gases were not released in 2001 and therefore no dose calculations for noble gases were necessary.

#### Liquid Effluent Exposure Pathways

During 2001, 2.53 E+07 liters of waste water were released into "No Name" Creek from the two onsite Retention Basins. This volume of wastewater was dispersed into 1.58 E+10 liters of dilution water. The estimated error associated with determining these volumes were 5% and 20%, respectively.

The Liquid source term resulted in a calculated annual child total body dose commitment of 0.065 mRem and a calculated child liver dose commitment of 0.093 mRem (as calculated using the ODCM). These calculated dose commitments were 2.17% and 0.93%, 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 2001 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 0.03 mRem [RS01] is based on tritium activity. No particulate isotopes of Station origin were released during 2001. 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 2001, 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 2001, 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 2001 Rancho Seco Annual Radioactive Effluent Release Report [RS01]. The observed results presented in Table 1 were obtained using the Cs-137 activity reported for the fish samples from 2001 (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 2001 Station operations only and was not affected by radioactivity introduced into the environment prior to 2001. A major portion of the activity identified by Program measurements in 2001 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 be 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. 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

2001 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
0.065 (Child Total Body)	0.059 (Adult Total Body)	1.97 % Total Body (3 mrem guideline)
0.093 (Child-Liver)	0.093 (Teen Liver)	0.93 % Organ (10 mrem guideline)

- Notes:**
- (a) Reported in the 2001 Annual Radiological Effluents 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 results of the gross beta analyses of the particulate samples are given in Appendix F, Table F-1.

## IV-B. DIRECT RADIATION MONITORING

### DATA EVALUATION

A comparison review of all Luxel data for the indicator and control locations during 2001 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 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 2001 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** -- Eleven garden vegetation samples and two grape samples were collected and analyzed for nuclides of interest during 2001. 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. Tritium activity in the grape samples was less than detectable.

**Soil (discharge canal)** -- Eight soil samples were collected and analyzed for nuclides of interest from the effluent discharge canal and downstream creeks during 2001. Cs-137 (7 samples, 92 to 738 pCi/kg, 357 pCi/kg mean) and Co-60 (1 sample, 17 pCi/kg) 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<sup>2</sup> 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 2001. 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 (21 samples, 18 to 182 pCi/kg, 53 pCi/kg mean), Co-60 (2 samples, 65 to 134 pCi/kg, 100 pCi/kg mean), and Mn-54 (1 sample, 11 pCi/kg). 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 2001. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (14 samples, 34 to 32190 pCi/kg, 8637 pCi/kg mean) and Co-60 (7 samples, 70 to 959 pCi/kg, 449 pCi/kg mean). Sampling at these locations is within an approximately 3 m<sup>2</sup> 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 2001 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 2001 and analyzed for nuclides of interest by gamma spectrometry. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (2 samples, 21 to 57 pCi/kg, 50 pCi/kg mean).

**Sediment** - 24 samples of sediment were collected from the discharge canal and the Clay/Hadselville/ Laguna Creeks during 2001. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (22 samples, 17.6 to 366 pCi/kg, 122.9 pCi/kg mean) and Co-60 (5 samples, 9.8 to 25.9 pCi/kg, 17.5 pCi/kg mean).

The presence of nuclides of interest in sediments is attributed to historical permitted liquid effluent discharges.

## IV-E. WATER MONITORING

### DATA EVALUATION

**Algae** - Five samples of algae were collected from the discharge canal and the Clay/Hadselville/ Laguna creeks during 2001. Cs-137 (3 samples, 17.7 to 57 pCi/kg, 37.7 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** - 39 well water samples were collected at indicator and control locations around the site during 2001. Tritium and gamma spectrometry analysis of the samples indicated results less than LLD. Gross beta activity levels for all samples were within regulatory limits.

**Runoff Water** - 31 runoff water samples were collected at the site boundary during 2001. No nuclides of interest were identified by gamma spectrometry. Tritium analysis, when liquid effluent releases were in progress, indicated positive tritium results as expected. Tritium results in three samples indicated 793 pCi/L, 3600 pCi/L, and 62600 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 provide monthly composite samples. During 2001, 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 the samples collected during planned liquid effluent releases. The tritium activity was measured at 199 pCi/L- 412 pCi/L. Tritium activity was detected in the composite and grab samples. One tritium result from the composite sampler at Folsom South Canal (RSW3.7NO, control location) indicated 412 pCi/L. The State DHS sample result for the same location was <282 pCi/L. Reanalysis of the original sample confirmed the presence of tritium. The sample taken at RSW0.7NO (water sump, indicator location) collected on the same day indicated <200pCi/L. There had been an effluent release prior to the sample collection date and the sample should have indicated a positive result. Based on the investigation conducted, it can be concluded that the samples for RSW3.7NO and RSW0.7NO were labeled incorrectly.

**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. No gamma emitting isotopes were found present in the 24 samples collected in 2001. Gross Beta analysis 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 2001, 14 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  
Location of Facility Sacramento, California Reporting Period January - December 2001  
(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) <sup>b</sup>	All Indicator Locations Mean (f) <sup>b</sup> Range	Location with Highest Annual Mean		Control locations Mean (f) <sup>a</sup> Range	Number of Nonroutine Reported Measurements
				Name Distance & Direction	Mean (f) <sup>b</sup> Range		
Air Particulates (pCi/M <sup>3</sup> )	Gross β (203)	0.01	0.022 (102/102) (0.010- 0.085)	RAS0.3MO 0.3 miles 247°	0.022 (50/50) (0.010-0.085)	0.022 (102/102) (0.010-0.072)	0
	γ-spec (12)						
	<sup>137</sup> Cs	0.01	<LLD		<LLD	<LLD	
	<sup>134</sup> Cs	0.01	<LLD		<LLD	<LLD	
Direct Radiation (mRem/qr.)	Luxel (137)	NA	16.5 (115-115) (11-37)	RTL0.4NO 0.4 miles 270°	32.8 (4/4) (29-37)	14.7 (22/22) (11-22)	0
Garden Vegetables (pCi/kg)	γ-spec (6)						
	<sup>60</sup> Co	60	<LLD		<LLD	<LLD	0
	<sup>137</sup> Cs	60	<LLD		<LLD	<LLD	0
	<sup>134</sup> Cs	60	<LLD		<LLD	<LLD	0
	Tritium (2)	1000	<LLD		<LLD	<LLD	0

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", for information on determining LLD and Minimum Detectable Activity (MDA).

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				Name Distance & Direction	Mean (f) <sup>b</sup> Range			
Soil Discharge Canal (pCi/kg)	γ-spec (8)							
		<sup>60</sup> Co	150	17 (1/8) (17-17)	RSL0.6MO 0.6 miles 248°	17 (1/2) (17-17)	NA	0
		<sup>137</sup> Cs	150	357 (7/8) (92-738)	RSL1.5NO 1.5 miles 270°	580 (2/2) (422-738)	NA	0
		<sup>134</sup> Cs	150	<LLD	<LLD	<LLD	NA	0
Soil Storm Drain (pCi/kg)	γ-spec (30)							
		<sup>60</sup> Co	150	100(2/30) (65-134)	RSL0.2HO 0.2 miles 150°	134 (1/2) (<9-134)	NA	0
		<sup>137</sup> Cs	150	53 (21/30) (18-182)	RSL0.2HO2 0.2 miles 150°	132 (1/2) (<11-182)	NA	0
		<sup>134</sup> Cs	150	<LLD	<LLD	<LLD	NA	0
		<sup>54</sup> Mn	150	11 (1/30) (11-11)	RSL0.2HO2 0.2 miles 150°	11 (1/2) (11-11)	NA	0

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", for information on determining LLD and Minimum Detectable Activity (MDA).

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				Name Distance & Direction	Mean (f) <sup>b</sup> Range		
Soil Depression Area (pCi/kg)	γ-spec (14)						
	<sup>60</sup> Co	150	449 (7/14) (70-959)	RSL0.4MP1 0.4 miles 248°	908 (2/2) (856-959)	NA	0
	<sup>137</sup> Cs	150	8637 (14/14) (34-32190)	RSL0.4MP1 0.4 miles 248°	31895 (2/2) (31600-32190)	NA	0
	<sup>134</sup> Cs	150	<LLD	<LLD	<LLD	NA	0
Sediment (pCi/kg)	γ-spec (24)						
	<sup>60</sup> Co	150	18 (5/24) (14-26)	RMS0.6MO 0.6 miles 248°	18 (8/8) (10-26)	NA	0
	<sup>137</sup> Cs	150	123 (22/24) (18-366)	RMS0.6MO 0.6 miles 248°	224 (8/8) (102-366)	NA	0
	<sup>134</sup> Cs	150	<LLD	<LLD	<LLD	NA	0

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", for information on determining LLD and Minimum Detectable Activity (MDA).

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				Name Distance & Direction	Mean (f) <sup>b</sup> Range		
Fish (pCi/kg)	γ-spec (2)						
	<sup>54</sup> Mn	130	<LLD	<LLD		NA	0
	<sup>60</sup> Co	130	<LLD	<LLD		NA	0
	<sup>65</sup> Zn	260	<LLD	<LLD		NA	0
	<sup>137</sup> Cs	130	39 (2/2) (21-57)	RFS0.6MO 0.6 miles 248°	39 (2/2) (21-57)	NA	0
	<sup>134</sup> Cs	130	<LLD	<LLD		NA	0
Algae (pCi/kg)	γ-spec (8)						
	<sup>60</sup> Co	150	<LLD	<LLD		NA	0
	<sup>137</sup> Cs	150	23.5 (7/12) (10-57)	RAG0.6NO 0.6 miles 270°	33 (2/2) (9-57)	NA	0
	<sup>134</sup> Cs	150	<LLD	<LLD		NA	0

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", 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

Location of Facility Sacramento, California Reporting Period January - December 2001  
(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) <sup>b</sup>	All Indicator Locations Mean (f) <sup>b</sup> Range	Location with Highest Annual Mean		Control locations Mean (f) <sup>b</sup> Range	Number of Nonroutine Reported Measurements
				Name Distance & Direction	Mean (f) <sup>b</sup> Range		
Well Water (pCi/L)	Gross β (35)	4	3.6 (16/35) (2.1-8.7)	RWW0.8LO 0.8 miles 225°	6.38 (2/4) (4.08-8.68)	2.6 (2/4) (2.4-2.9)	0
	Tritium (39)	1000	<LLD	<LLD		<LLD	0
	γ-spec (35)						
	<sup>54</sup> Mn	15	<LLD	<LLD		<LLD	0
	<sup>60</sup> Co	15	<LLD	<LLD		<LLD	0
	<sup>65</sup> Zn	30	<LLD	<LLD		<LLD	0
	<sup>137</sup> Cs	10	<LLD	<LLD		<LLD	0
	<sup>134</sup> Cs	10	<LLD	<LLD		<LLD	0
Runoff Water (pCi/L)	Tritium (31)	2000	355 (3/31) (793-6260)	RRW0.6MO 0.6 miles 248°	3551 (3/31) (793-6260)	NA	0
	γ-spec (31)						
	<sup>54</sup> Mn	15	<LLD	<LLD		NA	0
	<sup>60</sup> Co	15	<LLD	<LLD		NA	0
	<sup>65</sup> Zn	30	<LLD	<LLD		NA	0
	<sup>137</sup> Cs	18	<LLD	<LLD		NA	0
	<sup>134</sup> Cs	15	<LLD	<LLD		NA	0

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", 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  
Location of Facility Sacramento, California Reporting Period January - December 2001  
(County, State)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD) <sup>b</sup>	All Indicator Locations Mean (f) <sup>b</sup> Range	Location with Highest Annual Mean		Control locations Mean (f) <sup>a</sup> Range	Number of Nonroutine Reported Measurements
				Name Distance & Direction	Mean (f) <sup>b</sup> Range		
Surface Water (pCi/L)	Tritium (64)	2000	276 (5/64) (199-412)	RSW0.7NO 0.7 miles 270°	338 (2/12) (263-412)	<LLD	0
	γ-spec (64)						
	<sup>54</sup> Mn	15	<LLD		<LLD	<LLD	0
	<sup>60</sup> Co	15	<LLD		<LLD	<LLD	0
	<sup>65</sup> Zn	30	<LLD		<LLD	<LLD	0
	<sup>137</sup> Cs	18	<LLD		<LLD	<LLD	0
	<sup>134</sup> Cs	15	<LLD		<LLD	<LLD	0
Drinking Water (pCi/L)	Gross β (24)	4	3.3 (8/12) (2.5-4.4)	RDW0.1GO 0.1 miles 135°	3.3 (8/12) (2.5-4.4)	3.3 (8/12) (2.3-4.1)	0
	Tritium (24)	1000				<LLD	0
	γ-spec (24)						
	<sup>54</sup> Mn	15	<LLD		<LLD	<LLD	0
	<sup>60</sup> Co	15	<LLD		<LLD	<LLD	0
	<sup>65</sup> Zn	30	<LLD		<LLD	<LLD	0
	<sup>137</sup> Cs	10	<LLD		<LLD	<LLD	0
	<sup>134</sup> Cs	10	<LLD		<LLD	<LLD	0

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", 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  
Location of Facility Sacramento, California Reporting Period January - December 2001  
(County, State)

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

<sup>a</sup> Mean and Range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parentheses. (f)

<sup>b</sup> LLD values from Table E-2. See page E-8, "SENSITIVITY OF THE REMP MEASUREMENT PROCESS", for information on determining LLD and Minimum Detectable Activity (MDA).

## V. REFERENCES

- CFRa Code of Federal Regulations, 2000, "National Primary Drinking Water Regulations," Title 40, Part 141.
- CFRb Code of Federal Regulations, 2000, "Standards for Protection Against Radiation," Title 10, Part 20.
- CFRc Code of Federal Regulations, 2000, "Domestic Licensing of Production and Utilization Facilities," Title 10, Part 50.
- CFRd Code of Federal Regulations, 2000, "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.
- RS01 Rancho Seco Nuclear Station, 2001, "Annual Radioactive Effluent Release Report, January -December 2001," 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 method of conducting the primary survey was to use an aerial survey that was conducted during June 2000. Evaluating the aerial photographs continues to provide an accurate method of determining locations and distances of the nearest residences. For the 2000 Land Use Census 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, residential, 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 Galt Irrigation report covering 2001 and 2002 will be requested during the last quarter of 2002. This information will be used to complete the 2002 census, which is 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

\* Distance to residence updated using GPS, no change in ranking from previous census

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

## 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

\* Distance updated using GPS

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.

## C. IRRIGATED CROP EXPOSURE PATHWAY SUMMARY

### Laguna Creek

#### Galt Irrigation District

The Galt Irrigation District's 1999 Crop Report stated 3211.242 acre-feet of Laguna Creek water was diverted for irrigation purposes during the 1999 crop production season. Crops irrigated were sudan, clover, pasture, corn, and alfalfa over a total of 986 acres.

The Galt Irrigation District's 2000 Crop Report stated 2296.37 acre-feet of Laguna Creek water was diverted for irrigation purposes during the 2000 crop production season. Crops irrigated were corn, rice, clover, pasture sudan and alfalfa over a total of 1201 acres

#### Clay Irrigation District

The Clay Irrigation District's 1999 Irrigation Report stated 4513 acre-feet of Laguna Creek water was diverted for irrigation purposes during the 1999 season. The water diverted was reported to be used for pasturage. No acreage numbers were reported

The Clay Irrigation District's 2000 Irrigation Report stated 4390 acre-feet of Laguna Creek water was diverted for irrigation purposes during the 2000 season. The water diverted was reported to be used for pasturage. No acreage numbers were reported

This usage reported for 1999 and 2000 is reported as an estimate. The estimate was determined to be one third of the total discharge from Rancho Seco. The other two thirds is estimated to be used by Galt Irrigation District.

#### Rossini Farming Company

In addition to the above, SMUD has contracted with Rossini Farming Co., the owners of the vineyards adjacent to Rancho Seco Station, to supply irrigation water from Clay Creek on an as needed basis.

The following information was reported by the Rancho Seco Quality Group, which monitors the usage. From January 14, 1999 to December 7, 2000 a total of 122.895 Acre-feet of water was used from the effluent creek for irrigating purposes for the vineyards.

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

Past census evaluations have been unsuccessful in determining the usage/ occupancy factors for this 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 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 are being evaluated and a sample program has been established as the vineyards reached maturity.

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.

## 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**

<u>Exposure Pathway</u>	<u>Location</u>	<u>Comment</u>
Inhalation	1175* m ENE	Resident location having the highest dispersion parameter
Ground Plane	1175* m ENE	Resident location having the highest deposition parameter

\* updated using GPS

### **LIQUID EFFLUENT**

<u>Exposure Pathway</u>	<u>Location</u>	<u>Comment</u>
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	Commercial vineyards and potential 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.

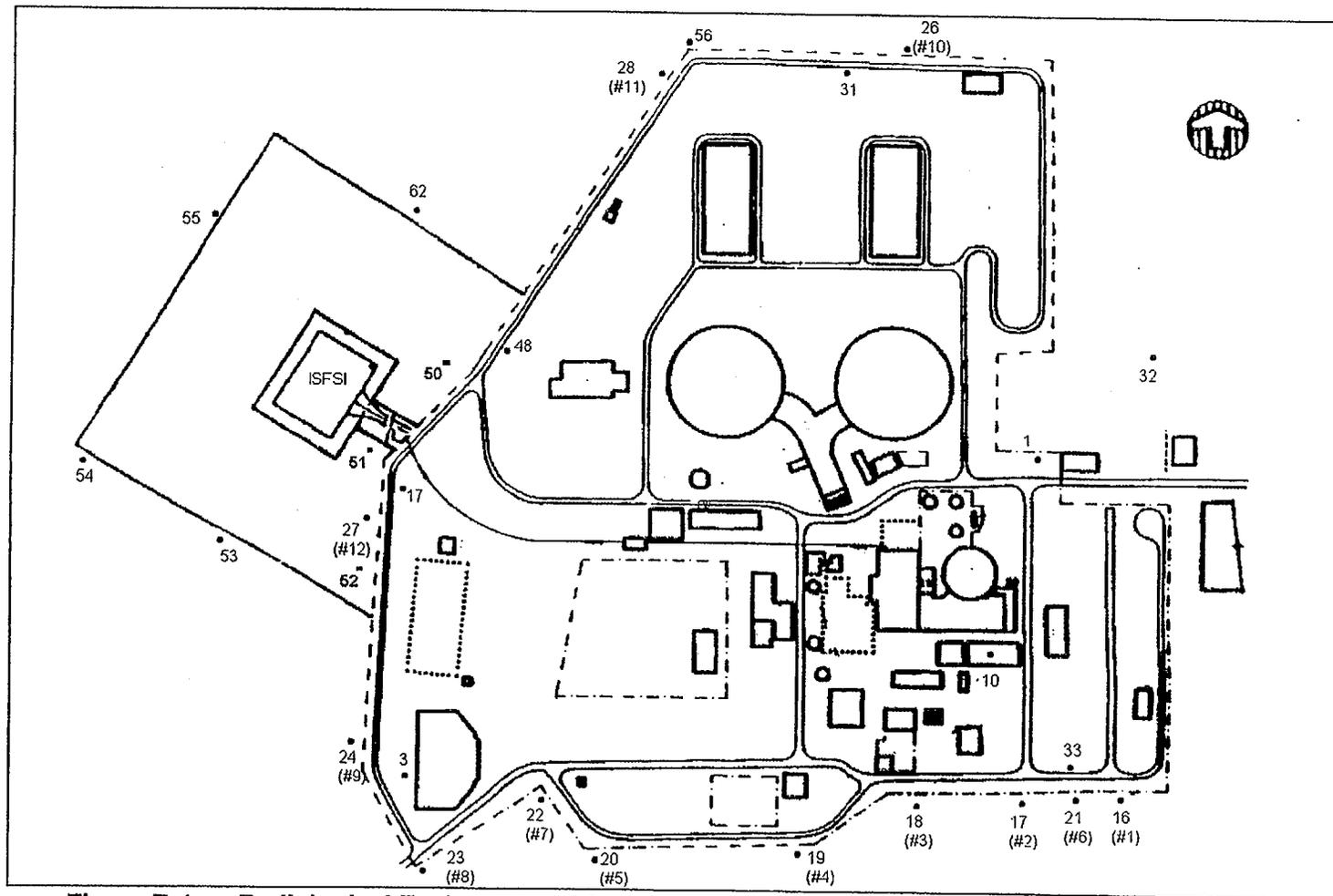
The next letter designates the sector in which the monitoring location is located. The letters A through R are used for sector designators. The letters I and O are not used to prevent confusion with the numbers one and zero in the ID codes.

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)

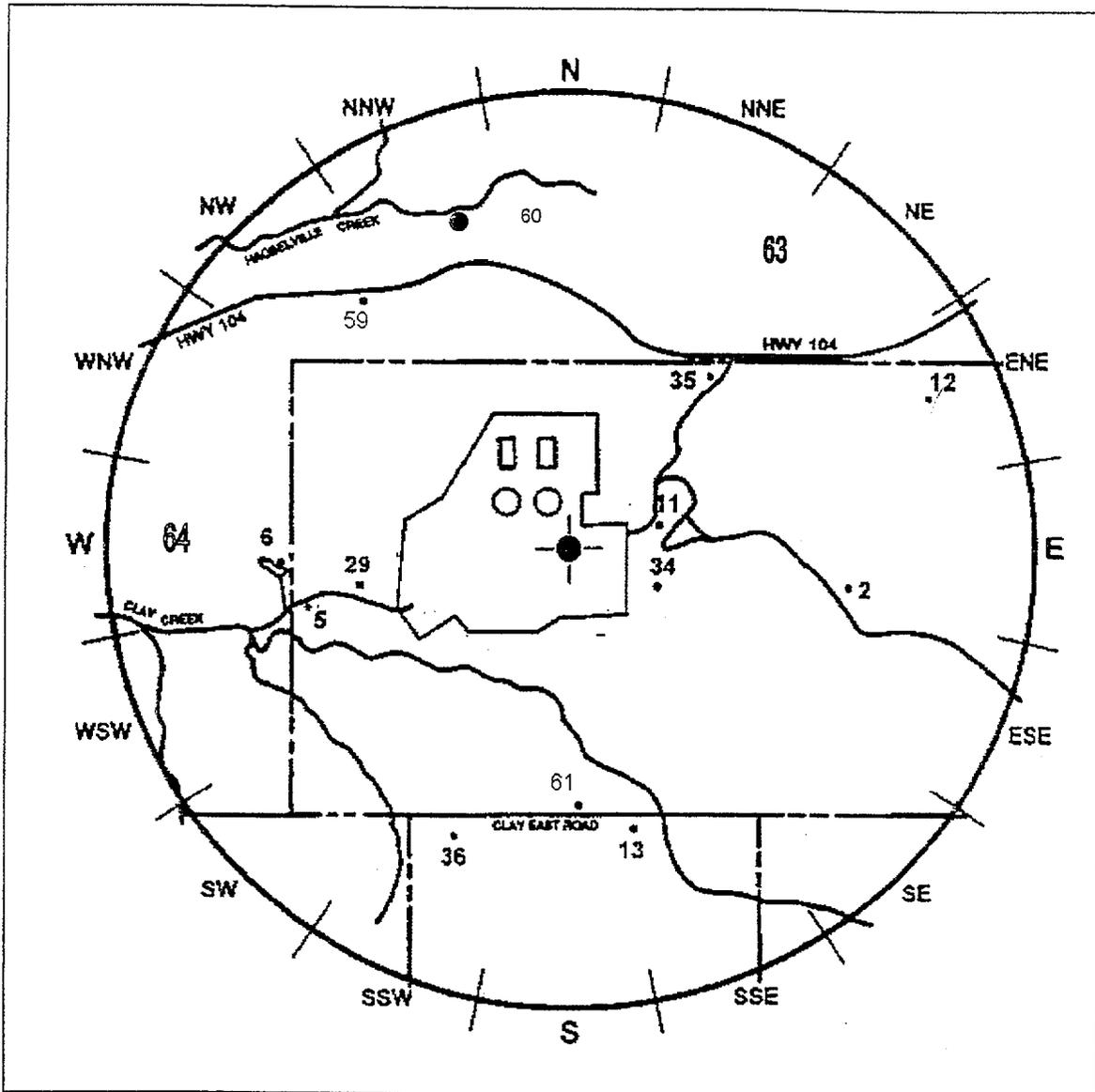
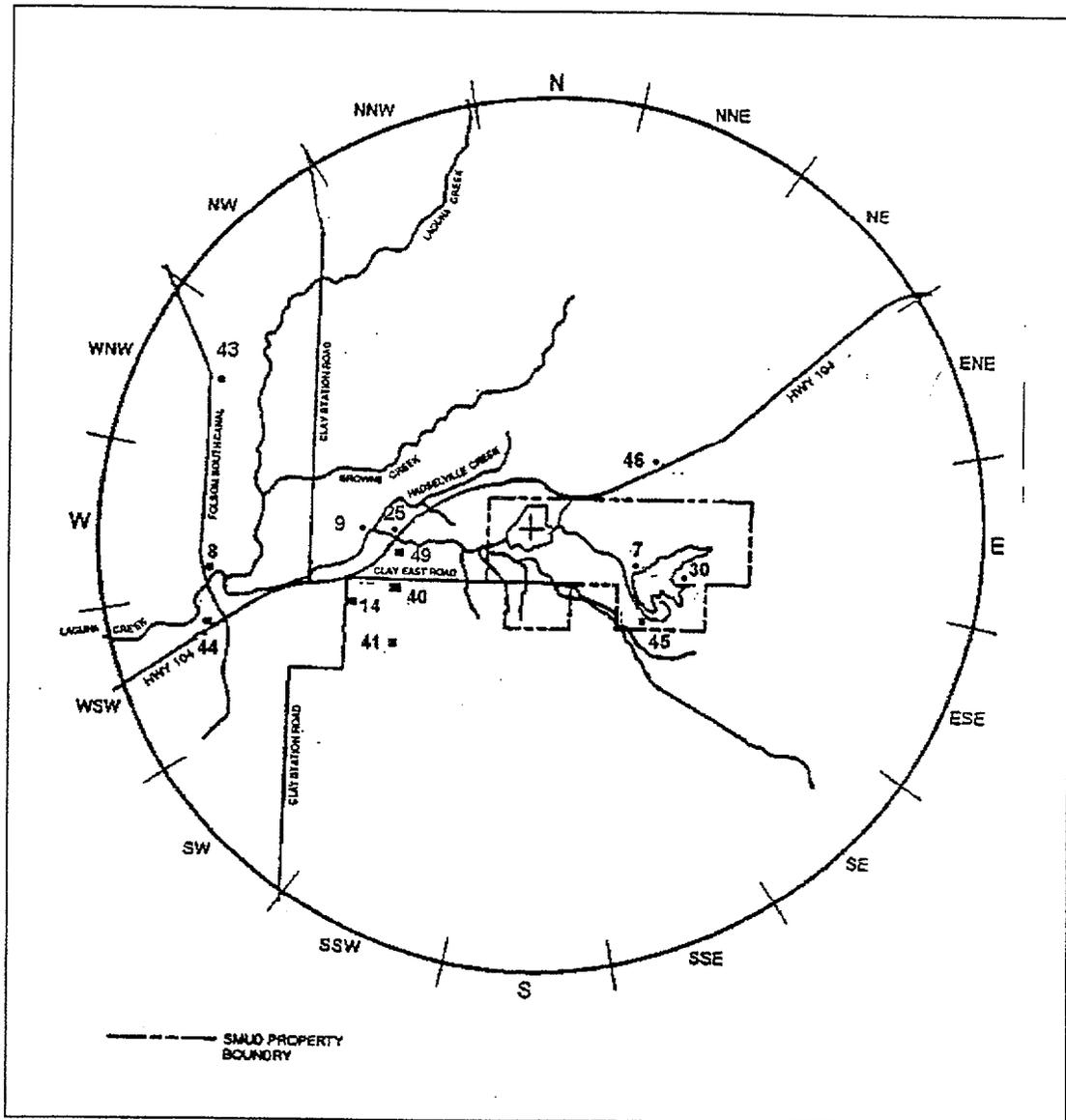


Figure B-2 Radiological Environmental Sampling Locations within 1 mile from the Reactor Building



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

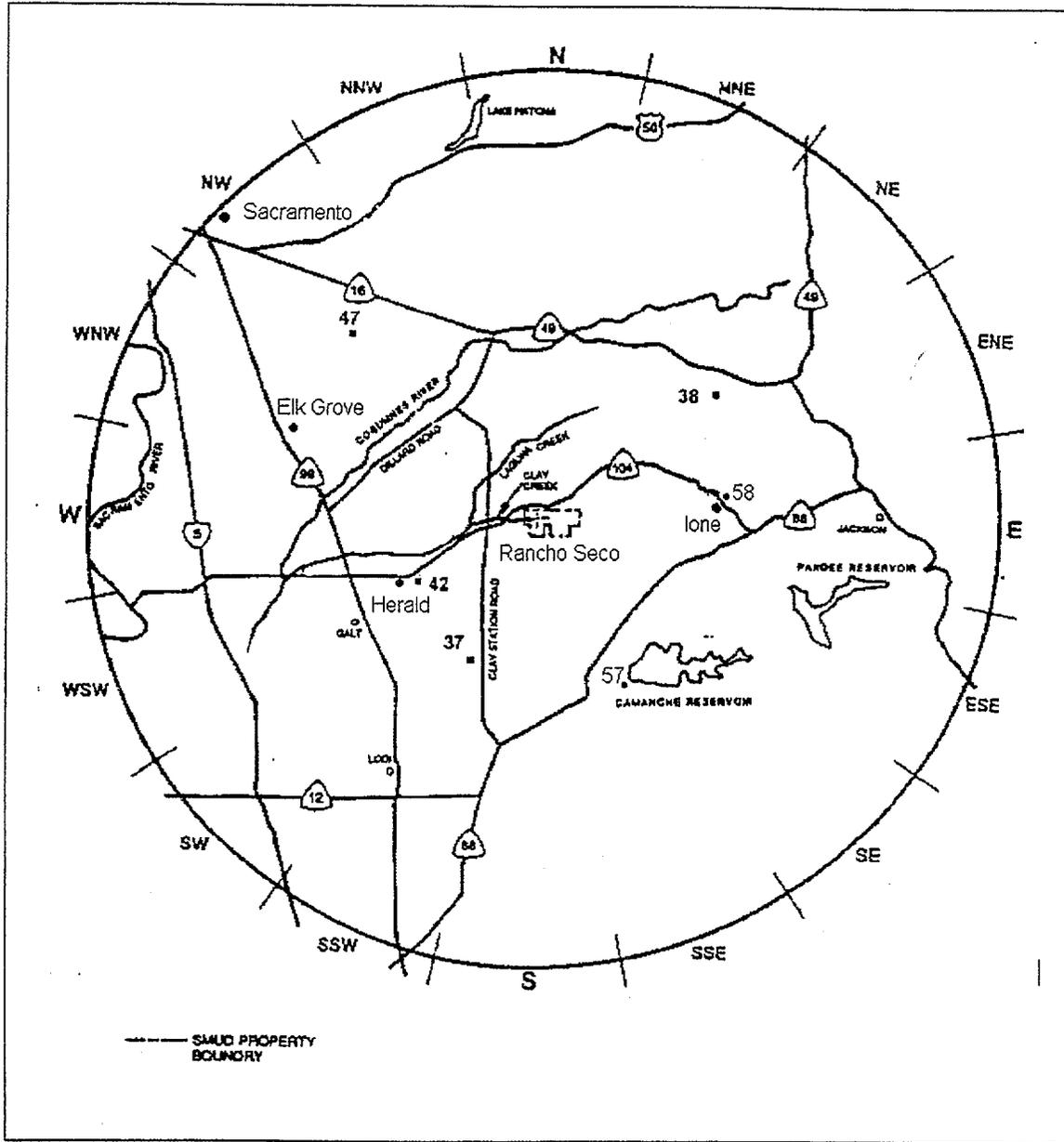


Figure B-4 Radiological Environmental Sampling Locations 5 to 25 miles from the Reactor Building

**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	RWW2.1MO	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	RWW0.7RP	IND	60	Quarterly	Vineyard Well (northwest of Hwy 104)	0.7	R
WELL WATER	RWW0.6RP	IND	59	Quarterly	Vineyard Well (south of Hwy 104)	0.6	R
WELL WATER	RWW0.9CP	IND	63	Quarterly	Vineyard Well (northeast 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
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/ GRAPES	RLVXX.XX	CON	NA	Semi-Annual/ Annual	Truck Garden which provides local produce from the local area	NA	NA
GRAPES	RLV0.7NO	IND	64	Annual	Vineyard west of site	0.7	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	RTL0.3RO	IND.	31	Quarterly	NNW @ Perimeter Fence N/O Spray Ponds; #1	0.3	R
LUXEL	RTL0.3CO	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	RTL0.4FO	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/ lone; #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	RTL1.8FO	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
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	RTL0.5NP	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 (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, and other laboratories. 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.

From December 2000 to December 2001, Eberline Services analyzed 35 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 programs. Landauer participated in a biennial program provided by the Idaho National Environmental Laboratory (INEL). The results from this study were not available for inclusion in this report. Landauer also maintains NVLAP certification with NIST. A review of Landauer's NVLAP certification results 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

2001 INTERLABORATORY COMPARISON PROGRAM

Sample Type (QAP 53)	Sample Date	Assay Type	EML Result	Eberline Result	Control Limits Reported/ Range
Air Filter	12/00	Co-60	8.430±0.480	7.360 ± 0.190	0.79-1.30
Air Filter	12/00	Cs-137	7.410 ± 0.360	6.580 ± 0.200	0.78-1.35
Air Filter	12/00	Gross Beta	1.520 ±0.150	1.150 ±0.050	0.76-1.52
Air Filter	12/00	Mn-54	43.200±1.300	38.570±0.360	0.80-1.36
Soil	12/00	Cs-137	1020.000 ±51.000	1002.000 ±8.000	0.80-1.29
Vegetation	12/00	Co-60	32.800 ±1.300	31.050 ±2.780	0.75-1.51
Vegetation	12/00	Cs-137	867.000 ±44.000	862.4000 ±6.900	0.80-1.37
Water	12/00	Co-60	73.700 ±2.900	73.650 ±1.250	0.80-1.20
Water	12/00	Cs-137	67.000 ±3.500	68.210 ±1.040	0.80-1.24
Water	12/00	Gross Beta	950.000 ±90.000	895.900 ±21.100	0.56-1.50
Water	12/00	Tritium	93.100 ±0.300	108.000 ±7.000	0.74-2.29

**TABLE C-1**  
**(cont.)**  
**2001 INTERLABORATORY COMPARISON PROGRAM**

<b>Sample Type (QAP 54)</b>	<b>Sample Date</b>	<b>Assay Type</b>	<b>EML Result</b>	<b>Eberline Result</b>	<b>Control Limits Reported/ Range</b>
Air Filter	6/01	Co-60	19.440±0.500	17.880 ± 0.560	0.79-1.30
Air Filter	6/01	Cs-134	2.830 ± 0.160	3.168 ± 0.453	0.74-1.21
Air Filter	6/01	Cs-137	8.760 ± 0.340	8.510 ± 0.373	0.78-1.35
Air Filter	6-/01	Gross Beta	2.580 ±0.150	2.243 ±0.045	0.76-1.52
Air Filter	6/01	Mn-54	6.520±1.280	5.997±0.393	0.80-1.36
Soil	6/01	Cs-137	1740.000 ±90.000	1798.000 ±20.000	0.80-1.29
Vegetation	6/01	Co-60	30.400 ±1.200	25.700 ±4.400	.075-1.51
Vegetation	6/01	Cs-137	842.000 ±42.000	836.800 ±11.800	0.80-1.37
Water	6/01	Co-60	98.200 ±3.600	109.400 ±1.500	0.80-1.20
Water	6/01	Cs-137	73.000 ±3.700	81.900±1.180	0.80-1.24
Water	6/01	Gross Beta	1297.000 ±100.000	1240.000 ±25.000	0.56-1.50
Water	6/01	Tritium	79.300 ±2.000	85.520 ±6.890	0.74-2.29

**TABLE C-1**  
**(cont.)**  
**2001 INTERLABORATORY COMPARISON PROGRAM**

<b>Sample Type (QAP 55)</b>	<b>Sample Date</b>	<b>Assay Type</b>	<b>EML Result</b>	<b>Eberline Result</b>	<b>Control Limits Reported/ Range</b>
Air Filter	12/01	Co-60	17.500±0.470	15.540 ± 0.350	0.79-1.30
Air Filter	12/01	Cs-134	12.950 ± 0.362	14.090 ± 0.660	0.74-1.21
Air Filter	12/01	Cs-137	17.100 ± 0.580	15.550 ± 0.350	0.78-1.35
Air Filter	12/01	Gross Beta	12.770 ±1.277	11.750 ±0.590	0.76-1.52
Air Filter	12/01	Mn-54	81.150±4.760	74.610±0.620	0.80-1.36
Soil	12/01	Cs-137	612.330 ±30.620	546.400 ±4.600	0.80-1.29
Vegetation	12/01	Co-60	35.300 ±1.436	30.950 ±1.410	.075-1.51
Vegetation	12/01	Cs-137	1030.000 ±51.800	928.000 ±4.000	0.80-1.37
Water	12/01	Co-60	209.000 ±7.590	228.400 ±2.300	0.80-1.20
Water	12/01	Cs-137	45.133 ±2.467	52.250±1.270	0.80-1.24
Water	12/01	Gross Beta	7970.000 ±800.000	8125.000 ±406.000	0.56-1.50
Water	12/01	Tritium	207000 ±2.690	221.420 ±9.690	0.74-2.29

## 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, Eberline Services. 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 totalizer, which measures 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 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 2001 samples were also collected from the vineyards near the site.

**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 gallon 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 2001 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 2001. The REMP manual was revised during 2001. Revision 13 to the REMP manual was an editorial revision to change the word "position" to "positive" in footnote "a" of Table 2, located on page 23 of the manual.

## **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. 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. With the off-loading of spent fuel to the ISFSI, the ISFSI has 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-2001) 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 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 cosmogenic 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, 26 soil, and 2 garden vegetation locations. Two vineyard sample locations were administrated added during 2001.

**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 nine groundwater wells and two drinking water taps.

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.

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 2001 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 2001.

## 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 <sup>3</sup> )	Fish (pCi/kg, wet)	Food Products (pCi/kg, wet)
H-3	20000 <sup>a</sup>			
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 <sup>b</sup>	2 <sup>c</sup>		

Notes: <sup>a</sup> For drinking water samples, this is a 40 CFR Part 141 value

<sup>b</sup> 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.

<sup>c</sup> Gross Beta activity in 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<sup>ac</sup>  
(NRC79A)

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

**2001 SAMPLE ANALYSIS RAW DATA TABLES**

**TABLE F-1  
2001 WEEKLY AIR SAMPLE SUMMARY**

Gross Beta Activity in Air Particulates  
(pCi/m<sup>3</sup>)

Collect Date	RAS01CO	2 sigma	RAS03MO	2 sigma	RAS07EO	2 sigma	RAS18FP	2 sigma
1/2/2001	0.072	0.002	0.060	0.002	0.072	0.003	0.065	0.002
1/8/2001	0.081	0.003	0.085	0.002	0.093	0.003	0.085	0.004
1/16/2001	0.014	0.001	0.014	0.001	0.015	0.001	0.014	0.001
1/23/2001	0.042	0.002	0.041	0.002	0.044	0.002	0.039	0.004
1/30/2001	0.014	0.001	0.015	0.001	0.016	0.001	0.015	0.001
2/6/2001	0.037	0.001	0.036	0.001	0.037	0.001	0.038	0.001
2/13/2001	0.012	0.001	0.012	0.001	0.012	0.001	0.012	0.001
2/20/2001	0.019	0.001	0.019	0.001	0.018	0.001	0.020	0.001
2/26/2001	0.010	0.002	0.000	0.000	0.008	0.001	0.008	0.001
3/6/2001	0.019	0.001	0.018	0.001	0.018	0.001	0.020	0.001
3/13/2001	0.017	0.001	0.014	0.002	0.017	0.001	0.016	0.001
3/20/2001	0.021	0.001	0.020	0.003	0.019	0.001	0.021	0.001
3/27/2001	0.017	0.001	0.016	0.002	0.017	0.001	0.017	0.001
4/2/2001	0.015	0.001	0.017	0.002	0.014	0.001	0.015	0.001
4/10/2001	0.011	0.001	0.012	0.001	0.012	0.001	0.010	0.001
4/16/2001	0.015	0.001	0.015	0.001	0.015	0.001	0.015	0.001
4/23/2001	0.013	0.001	0.013	0.001	0.013	0.001	0.012	0.001
4/30/2001	0.016	0.001	0.015	0.001	0.016	0.001	0.015	0.001
5/7/2001	0.019	0.001	0.019	0.001	0.018	0.001	0.018	0.001
5/15/2001	0.020	0.001	0.021	0.001	0.022	0.001	0.019	0.001
5/22/2001	0.018	0.001	0.018	0.001	0.018	0.001	0.018	0.001
5/29/2001	0.019	0.001	0.019	0.001	0.019	0.001	0.019	0.001
6/4/2001	0.018	0.001	0.017	0.001	0.018	0.001	0.017	0.001
6/11/2001	0.013	0.001	0.025	0.001	0.014	0.001	0.014	0.001
6/19/2001	0.016	0.001	0.027	0.001	0.016	0.001	0.022	0.001
6/25/2001	0.020	0.001	0.035	0.001	0.021	0.002	0.023	0.003

**TABLE F-1**  
**2001 WEEKLY AIR SAMPLE SUMMARY**  
**(continued)**

Gross Beta Activity in Air Particulates  
 (pCi/m<sup>3</sup>)

Collect Date	RAS01CO	2 sigma	RAS03MO	2 sigma	RAS07EO	2 sigma	RAS18FP	2 sigma
7/3/2001	0.013	0.002	0.014	0.001	0.013	0.001	0.013	0.001
7/9/2001	0.022	0.002	0.024	0.002	0.024	0.001	0.026	0.002
7/23/2001	0.012	0.001	0.010	0.001	0.011	0.001	0.010	0.001
7/31/2001	0.012	0.001	0.013	0.001	0.012	0.001	0.013	0.001
8/7/2001	0.010	0.001	0.010	0.001	0.010	0.001	0.009	0.001
8/13/2001	0.014	0.002	0.015	0.001	0.014	0.001	0.014	0.001
8/21/2001	0.017	0.001	0.017	0.001	0.016	0.001	0.016	0.001
8/28/2001	0.014	0.001	0.015	0.002	0.014	0.002	0.014	0.002
9/4/2001	0.016	0.001	0.016	0.001	0.017	0.002	0.014	0.002
9/10/2001	0.017	0.001	0.017	0.002	0.016	0.001	0.016	0.002
9/17/2001	0.019	0.001	0.018	0.001	0.021	0.001	0.020	0.002
9/24/2001	0.028	0.001	0.027	0.002	0.027	0.001	0.027	0.002
10/2/2001	0.023	0.001	0.024	0.001	0.023	0.001	0.020	0.001
10/8/2001	0.029	0.002	0.028	0.002	0.027	0.002	0.024	0.002
10/16/2001	0.033	0.001	0.031	0.002	0.030	0.001	0.030	0.002
10/23/2001	0.034	0.002	0.034	0.002	0.033	0.001	0.031	0.002
10/30/2001	0.035	0.002	0.034	0.001	0.034	0.001	0.033	0.002
11/6/2001	0.033	0.001	0.033	0.001	0.035	0.002	0.031	0.002
11/14/2001	0.022	0.001	0.023	0.001	0.023	0.001	0.022	0.002
11/20/2001	0.046	0.002	0.042	0.001	0.043	0.002	0.043	0.002
12/4/2001	0.016	0.001	0.016	0.001	0.016	0.001	0.014	0.001
12/11/2001	0.017	0.001	0.016	0.001	0.015	0.001	0.015	0.001
12/18/2001	0.021	0.001	0.021	0.001	0.020	0.001	0.020	0.001
12/26/2001	0.015	0.001	0.014	0.001	0.015	0.001	0.014	0.001
1/2/2002	0.021	0.001	0.022	0.002	0.021	0.001	0.022	0.001

Table F-2

2001 Luxel Summary (Direct Radiation)  
 Quarterly  
 (mRem)

ID	Type	2001-1	2001-2	2001-3	2001-4
RTL0.3RO	Indicator	20.0	15.0	17.0	16.0
RTL0.3CO	Indicator	16.0	17.0	17.0	13.0
RTL0.3NO	Indicator	19.0	18.0	17.0	15.0
RTL0.3LO	Indicator	18.0	15.0	17.0	20.0
RTL0.3HO	Indicator	17.0	17.0	14.0	14.0
RTL0.4FO	Indicator	15.0	18.0	14.0	17.0
RTL0.5CO	Indicator	20.0	16.0	17.0	14.0
RTL0.6KO	Indicator	15.0	16.0	12.0	15.0
RTL10.0HP	Control	16.0	15.0	17.0	17.0
RTL2.7MO	Indicator	15.0	13.0	13.0	12.0
RTL8.2KO	Control	22.0	19.0	20.0	0.0
RTL7.8CO	Control	14.0	0.0	14.0	15.0
RTL1.8FO	Indicator	13.0	15.0	12.0	11.0
RTL1.5MO	Indicator	21.0	16.0	18.0	15.0
RTL3.9KO	Indicator	17.0	15.0	14.0	13.0
RTL7.4MO	Control	17.0	15.0	17.0	22.0
RTL3.7NO	Indicator	16.0	16.0	15.0	0.0
RTL3.8MO	Indicator	17.0	16.0	16.0	13.0
RTL1.9NO	Indicator	19.0	19.0	20.0	16.0
RTL1.7FO	Indicator	17.0	14.0	14.0	12.0
RTL1.4DO	Indicator	18.0	17.0	19.0	17.0
RTL10.0EP	Control	15.0	12.0	13.0	12.0
RTL8.0PO	Control	16.0	18.0	15.0	11.0
RTL0.8DO	Indicator	17.0	15.0	15.0	14.0
RTL0.6MO	Indicator	17.0	15.0	13.0	10.0
RTL0.4NO	Indicator	31.0	34.0	37.0	29.0
RTL0.4NO1	Indicator	18.0	19.0	16.0	16.0
RTL0.3PO	Indicator	17.0	15.0	15.0	14.0
RTL0.3NP	Indicator	17.0	18.0	19.0	18.0
RTL0.4NP	Indicator	18.0	17.0	17.0	18.0
RTL0.5NP	Indicator	17.0	17.0	17.0	18.0
RTL0.3QP	Indicator	16.0	16.0	14.0	14.0
RTL0.7QP	Indicator	17.0	19.0	15.0	15.0
RTL0.7JO	Indicator	19.0	16.0	15.0	13.0
RTL0.4PP	Indicator	18.0	17.0	18.0	17.0

Table F-3

2001 Garden Vegetables

Semi-annual  
(pCi/kg, wet)

Sample ID	Collection Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137	Tritium
RLV0.6MO	2/20/2001	<7.9	<9.5	<20	<11	<7.9	
RLV18.0KO	2/20/2001	<4.5	<5.6	<12	<5.8	<4.7	
RLV0.6MO	4/2/2001	<9.2	<9.0	<20	<32	<10	
RLV18.0KO	4/2/2001	<9.9	<24	<26	<13	<12	
RLV0.6MO	8/7/2001	<12	<15	<29	<15	<11	
RLV18.0KO	8/7/2001	<7.5	<8.6	<19	<9.2	<7.9	
RLV0.6MO	9/10/2001	<11	<15	<29	<14	<11	
RLV0.7NO	9/10/2001	<5.4	<5.9	<15	<6.2	<5.3	
RLV18.0KO	9/10/2001	<13	<13	<30	<16	<14	
RLV18.0KO	9/10/2001	<6.3	<6.9	<15	<8.0	<6.2	
RLV0.6BP	11/14/2001						<98
RLV0.6MO	11/15/2001	<13	<16	<30	<14	<12	
RLV18.0KO	11/20/2001	<11	<11	<27	<14	<11	

Table F-4

2001 SEDIMENT  
Quarterly  
(pCi/kg)

Sample ID	Collection Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RMS1.8NO	2/5/2001	<11	<14	<35	<14	119
RMS0.6MO	2/5/2001	<8.2	14.2	<13	<9.3	177
RMS0.3MO	2/5/2001	<14	<13	<32	<17	72.4
RMS3.7NO	2/5/2001	<9.7	<9.2	<23	<12	22.6
RMS0.6MOQ	2/5/2001	<8.6	25.9	<22	<11	266
RMS0.7NO	2/5/2001	<4.7	<5.2	<11	<7.2	127
RMS0.6MOQ	5/7/2001	<4.5	9.84	<9.8	<8.3	225
RMS0.7NO	5/7/2001	<8.4	<9.1	<23	<16	48.9
RMS1.8NO	5/7/2001	<7.2	<8.9	<19	<10	122
RMS0.6MO	5/7/2001	<4.8	<18	<11	<16	267
RMS0.3MO	5/7/2001	<4.5	<4.6	<9.4	<12	<8.5
RMS3.7NO	5/7/2001	<3.8	<4.1	<8.4	<6.6	<5.3
RMS0.7NO	8/7/2001	<4.3	<4.5	<12	<5.7	44.7
RMS1.8NO	8/7/2001	<9.3	<10	<27	<12	64.0
RMS0.6MO	8/7/2001	<4.1	<8.4	<10	<9.4	119
RMS0.3MO	8/7/2001	<6.5	<8.5	<16	<8.2	37.4
RMS3.7NO	8/7/2001	<3.5	<4.5	<10	<6.1	47.2
RMS0.6MOQ	8/7/2001	<6.1	<6.1	<14	<7.1	102
RMS0.3MO	11/6/2001	<4.4	<5.1	<9.7	<5.9	29.8
RMS3.7NO	11/6/2001	<8.4	<9.4	<25	<11	17.6
RMS0.6MOQ	11/6/2001	<6	15.0	<20	<8	268
RMS0.7NO	11/6/2001	<5	<5	<10	<6	73.7
RMS1.8NO	11/6/2001	<8	<8	<20	<10	87.3
RMS0.6MO	11/6/2001	<5.2	22.4	<15	<7.2	366

**TABLE F-4**  
(continued)

**2001 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
RSL0.5MPAK	Site Boundary	5/1/2001	<19	<21	<42	<16	459
RSL0.5MPAK	Site Boundary	10/18/2001	<15	<15	<30	<13	351
RSL0.5MPAL	Site Boundary	10/18/2001	<12	<9	<21	<9	273
RSL0.5MPAL	Site Boundary	5/1/2001	<14	<15	<28	<12	322
RSL0.5MPAM	Site Boundary	10/18/2001	<12	179	<30	<13	3949
RSL0.5MPAM	Site Boundary	5/1/2001	<20	488	<43	<22	7600
RSL0.5MPAN	Site Boundary	10/18/2001	<7	<8	<17	<6	34
RSL0.5MPAN	Site Boundary	5/1/2001	<10	<8	<21	<9	259
RSL0.6MO	Site Boundary	5/1/2001	<11	17	<25	<10	612
RSL0.6MO	Site Boundary	11/1/2001	<8	<11	<19	<7	345
RSL0.7NO	Water Sump	11/1/2001	<7	<9	<17	<7	92
RSL0.7NO	Water Sump	5/1/2001	<15	<12	<33	<11	142
RSL1.5NO	Silva Property	10/18/2001	<12	<15	<24	<10	422
RSL1.5NO	Silva Property	5/1/2001	<17	<15	<34	<14	738
RSL1.8NO	Hadselville/ Clay Creeks	10/18/2001	<12	<14	<38	<10	145
RSL1.8NO	Hadselville/ Clay Creeks	5/1/2001	<13	<15	<28	<13	<13

**TABLE F-4**  
(continued)  
**2001 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	5/1/2001	<19	<21	<42	<16	459
RSL0.5MPAK	Site Boundary	10/18/2001	<15	<15	<30	<13	351
RSL0.5MPAL	Site Boundary	10/18/2001	<12	<9	<21	<9	273
RSL0.5MPAL	Site Boundary	5/1/2001	<14	<15	<28	<12	322
RSL0.5MPAM	Site Boundary	10/18/2001	<12	179	<30	<13	3949
RSL0.5MPAM	Site Boundary	5/1/2001	<20	488	<43	<22	7600
RSL0.5MPAN	Site Boundary	5/1/2001	<10	<8	<21	<9	259
RSL0.5MPAN	Site Boundary	10/18/2001	<7	<8	<17	<6	34
RSL0.4MP1	Depression	10/18/2001	<20	856	<47	<33	32190
RSL0.4MP1	Depression	5/1/2001	<22	959	<53	<40	31600
RSL0.4MP2	Depression	5/1/2001	<14	336	<34	<23	14100
RSL0.4MP2	Depression	10/18/2001	<13	257	<27	<20	12930
RSL0.4MP3	Depression	10/18/2001	<11	<16	<26	<14	5145
RSL0.4MP3	Depression	5/1/2001	<12	70	<23	<21	11700

**TABLE F-4**  
(continued)

**2001 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	5/1/2001	<13	<12	<27	<9	34
RSL0.3NP1	ISFSI #1	11/5/2001	<10	<11	<24	<8	<10
RSL0.3NP2	ISFSI #2	11/5/2001	<11	<9	<25	<8	<12
RSL0.3NP2	ISFSI #2	5/1/2001	<11	<10	<26	<8	52
RSL0.3NP3	ISFSI #3	5/1/2001	<12	<10	<22	<9	<10
RSL0.3NP3	ISFSI #3	11/5/2001	<10	<9	<25	<8	36
RSL0.2HO1	Storm Drain #1	5/1/2001	<8	<7	<18	<7	48
RSL0.2HO1	Storm Drain #1	11/1/2001	<9	<8	<17	<7	18
RSL0.2HO2	Storm Drain #2	11/1/2001	<11	<9	<22	<8	<11
RSL0.2HO2	Storm Drain #2	5/1/2001	<18	134	<39	<14	182
RSL0.2JO	Storm Drain #3	5/1/2001	<9	<11	<25	<9	21
RSL0.2JO	Storm Drain #3	11/1/2001	<11	65	<25	<10	156
RSL0.2KO	Storm Drain #4	5/1/2001	<9	<9	<21	<7	20
RSL0.2KO	Storm Drain #4	11/1/2001	<11	<10	<21	<8	<12
RSL0.3LO	Storm Drain #5	5/1/2001	<10	<10	<26	<9	57
RSL0.3LO	Storm Drain #5	11/1/2001	<8	<9	<20	<7	34
RSL0.2HO	Storm Drain #6	5/1/2001	11	<9	<24	<8	60
RSL0.2HO	Storm Drain #6	11/1/2001	<10	<10	<26	<9	41
RSL0.3MO7	Storm Drain #7	5/1/2001	<9	<11	<24	<7	21
RSL0.3MO7	Storm Drain #7	11/1/2001	<8	<9	<18	<6	30
RSL0.3MO8	Storm Drain #8	11/1/2001	<9	<7	<19	<7	35
RSL0.3MO8	Storm Drain #8	5/1/2001	<13	<13	<30	<11	60
RSL0.3MO9	Storm Drain #9	10/18/2001	<4	<8	<19	<8	28
RSL0.3MO9	Storm Drain #9	5/1/2001	<12	<11	<24	<9	47
RSL0.3AO	Storm Drain #10	10/18/2001	<7	<8	<20	<7	65
RSL0.3AO	Storm Drain #10	5/1/2001	<7	<8	<24	<8	70
RSL0.3QO	Storm Drain #11	10/18/2001	<9	<9	<24	<8	<11
RSL0.3QO	Storm Drain #11	5/1/2001	<9	<11	<26	<7	<12
RSL0.3NO	Storm Drain #12	5/1/2001	<10	<10	<22	<8	<11
RSL0.3NO	Storm Drain #12	10/18/2001	<8	<9	<20	<7	<9

**TABLE F-5**

**2001 FISH**  
Semi-Annual  
(pCi/kg, wet)

Sample ID	Collection Date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RFS0.6MO(1)	5/10/2001	<14	<17	<57	<15	56.8
RFS0.6MO(1)	11/15/2001	<4.8	<5.8	<14	<5.8	21.3

Note: (1)=Predator Species

**TABLE F-6**

**2001 ALGAE**  
Semi-annual  
(pCi/kg, wet)

Sample ID	Collection date	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RAG1.3FO	5/22/2001	<5.4	<5.6	<11	<6.9	<5.9
RAG0.3MO	5/22/2001	<11	<13	<24	<14	38.3
RAG1.8NO	5/22/2001	<9.0	<11	<20	<12	17.7
RAG0.6MO	5/22/2001	<21	<25	<49	<26	57.0
RAG0.7NO	5/22/2001	<13	<22	<29	<17	<17
RAG1.3FO	8/28/2001	<7.3	<7.7	<17	<15	<7.9
RAG0.3MO	8/28/2001	<7.9	<11	<20	<9.3	<9.0
RAG1.8NO	8/28/2001	<5.9	<9.4	<14	<6.8	14.8
RAG0.6MO	8/28/2001	<6.9	<7.8	<17	<8.0	9.32
RAG0.7NO	8/28/2001	<7.8	<7.2	<16	<9.2	<7.6
RAG0.7NOQ	8/28/2001	<2.8	<3.3	<7.1	<3.7	10.1
RAG3.7NO	8/28/2001	<8.1	<9.4	<19	<10	17

**TABLE F-7**  
**2001 WELL WATER**  
Quarterly  
(pCi/L)

Sample ID	Collection Date	Gross Beta	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RWW0.8LO	2/26/2001	<3.6	<200	<9.4	<10	<20	<11	<9.6
RWW0.8DO	2/26/2001	2.87	<190	<5.9	<6.4	<13	<7.2	<6.2
RWW0.9CP	2/26/2001	2.70	<190	<6.6	<7.4	<17	<8.5	<12
RWW0.7RP	2/26/2001	2.24	<200	<5.6	<5.7	<12	<7.6	<5.7
RWW0.6RP	2/26/2001	6.82	<190	<6.8	<7.5	<18	<16	<7.5
RWW3.7MO	2/26/2001	2.36	<190	<5.8	<5.9	<12	<12	<5.8
RWW2.1MO	2/26/2001	<2.7	<200	<6.0	<7.0	<13	<7.2	<6.2
RWW1.5MP	2/26/2001	<2.2	<210	<5.6	<6.0	<12	<6.6	<5.3
RWW0.3EO	2/26/2001	<3.6	<190	<9.7	<11	<19	<11	<9.8
RWW0.3EO	5/29/2001	2.05	<200	<4.8	<4.8	<10	<9.9	<5.3
RWW0.8LO	5/29/2001	<2.2	<200	<8.1	<9.3	<18	<15	<9.2
RWW2.1MO	5/29/2001	<2.3	<210	<8.3	<9.9	<20	<9.8	<8.0
RWW3.7MO	5/29/2001	<2.0	<200	<7.6	<8.0	<15	<8.1	<7.3
RWW0.6RP	5/29/2001	2.40	<200	<7.6	<10	<19	<10	<8.8
RWW0.7RP	5/29/2001	3.85	<200	<4.9	<5.3	<10	<5.3	<4.1
RWW0.9CP	5/29/2001	<2.7	<210	<4.6	<4.8	<9.8	<7.6	<10
RWW1.5MP	5/29/2001	<2.5	<200	<9.0	<11	<22	<11	<8.7
RWW0.8DO	5/29/2001	<3.0	<200	<8.2	<10	<21	<11	<9.3
RWW0.8DO	8/28/2001	2.40	<230	<5.3	<8.1	<11	<7.2	<6.3
RWW0.3EO	8/28/2001	2.81	<230	<4.5	<4.9	<9.2	<5.7	<4.3
RWW0.9CP	8/28/2001	<2.1	<230	<7.4	<7.6	<15	<8.0	<7.5
RWW0.7RP	8/28/2001	3.84	<230	<7.6	<12	<18	<9.8	<8.4
RWW0.6RP	8/28/2001	3.54	<230	<6.6	<7.4	<13	<6.7	<6.1
RWW3.7MO	8/28/2001	<2.9	<230	<7.8	<8.7	<18	<10	<8.5
RWW2.1MO	8/28/2001	<2.2	<230	<5.8	<8.5	<12	<12	<6.3
RWW0.8LO	8/28/2001	4.08	<230	<4.8	<7.4	<9.9	<6.9	<5.5
RWW1.5MP	8/28/2001	<1.9	<230	<7.7	<9.2	<18	<10	<8.7
RWW3.7MO	11/28/2001		<200					
RWW1.5MP	11/28/2001		<200					
RWW0.8LO	11/28/2001		<200					
RWW0.8DO	11/28/2001		<200					
RWW0.6RP	12/4/2001	4.36	<190	<10	<10	<20	<12	<10
RWW0.9CP	12/4/2001	2.38	<200	<8.1	<9.1	<17	<10	<8.2
RWW0.8LO	12/4/2001	8.68	<200	<6.7	<7.2	<16	<8.6	<7.2
RWW2.1MO	12/4/2001	<2.5	<200	<6.6	<7.0	<15	<7.0	<6.6
RWW3.7MO	12/4/2001	2.30	<190	<4.2	<4.5	<8.5	<5.2	<4.0
RWW0.8DO	12/4/2001	<1.8	<190	<9.3	<9.9	<18	<11	<8.9
RWW1.5MP	12/4/2001	<2.7	<190	<3.6	<4.3	<8.2	<4.6	<3.5
RWW0.3EO	12/4/2001	3.75	<190	<7.4	<8.7	<18	<9.2	<7.0

**TABLE F-8**  
**2001 RUNOFF WATER**

Biweekly  
(pCi/L)

Sample ID	Collection Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RRW0.6MO	1/8/2001	<170	<6.0	<6.3	<13	<8.1	<6.2
RRW0.6MO	1/23/2001	<200	<8.5	<9.2	<19	<11	<9.4
RRW0.6MO	2/5/2001	<170	<3.5	<3.8	<8.1	<4.4	<3.6
RRW0.6MO	2/20/2001	<200	<7.3	<7.7	<18	<9.4	<8.3
RRW0.6MOQ	2/20/2001	<200	<6.7	<7.6	<16	<8.7	<7.3
RRW0.6MO	3/6/2001	<200	<6.2	<6.6	<13	<6.6	<6.5
RRW0.6MO	3/20/2001	<190	<7.8	<9.2	<19	<11	<9.3
RRW0.6MO	4/2/2001	<200	<5.7	<5.9	<12	<9.1	<6.5
RRW0.6MO	4/16/2001	<190	<4.8	<4.9	<9.7	<12	<5.6
RRW0.6MO	4/30/2001	<190	<7.1	<8.4	<17	<9.6	<8.4
RRW0.6MO	5/15/2001	<200	<7.5	<8.9	<19	<10	<8.3
RRW0.6MOQ	5/15/2001	<200	<4.0	<4.5	<8.3	<4.8	<3.9
RRW0.6MO	5/30/2001	793	<10	<10	<20	<11	<8.9
RRW0.6MO	6/11/2001	<210	<6.9	<7.3	<16	<7.6	<6.9
RRW0.6MO	6/25/2001	<210	<8.1	<9.3	<17	<10	<8.7
RRW0.6MO	12/18/2001	6260	<7.7	<7.8	<17	<9.9	<7.8
RRW0.6MO	12/26/2001	<190	<7.4	<7.4	<16	<8.3	<7.6

TABLE F-8

2001 RUNOFF WATER  
(continued)

Biweekly  
(pCi/L)

Sample ID	Collection Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RRW0.6MO	7/9/2001	<220	<4.4	<5.2	<8.9	<5.3	<4.0
RRW0.6MO	7/23/2001	<200	<7.0	<8.6	<17	<9.6	<8.4
RRW0.6MO	8/7/2001	<180	<7.3	<8.3	<19	<9.6	<9.2
RRW0.6MOQ	8/7/2001	<180	<5.1	<5.8	<12	<7.4	<13
RRW0.6MO	8/21/2001	<240	<7.1	<8.7	<16	<9.3	<8.3
RRW0.6MO	9/4/2001	<210	<8.1	<9.7	<19	<8.8	<7.3
RRW0.6MO	9/10/2001	<190	<5.7	<6.5	<14	<6.8	<6.4
RRW0.6MO	9/25/2001	<200	<6.7	<13	<16	<8.6	<7.0
RRW0.6MO	10/8/2001	<200	<8.8	<12	<19	<11	<8.3
RRW0.6MO	10/23/2001	3600	<8.0	<11	<21	<11	<8.7
RRW0.6MOQ	11/6/2001	<200	<3.5	<4.0	<7.6	<5.8	<4.1
RRW0.6MO	11/6/2001	<210	<8.9	<11	<18	<11	<9.1
RRW0.6MO	11/20/2001	<200	<7.9	<8.3	<18	<8.8	<8.0
RRW0.6MO	12/4/2001	<200	<7.3	<7.4	<17	<8.2	<7.2

**TABLE F-9  
2001 SURFACE WATER**

Monthly Grab / Monthly Composite  
(pCi/L)

Sample ID	Collection Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSW1.8NOQ	1/23/2001	<200	<6.7	<6.8	<15	<8.0	<6.9
RSW1.3FO	1/23/2001	<200	<5.1	<5.2	<11	<7.0	<5.2
RSW0.7NO	1/23/2001	<200	<8.3	<10	<17	<10	<8.0
RSW0.3MO	1/23/2001	<200	<5.4	<9.5	<11	<7.0	<5.6
RSW3.7NO	1/23/2001	<200	<5.0	<5.1	<11	<6.4	<5.4
RSW1.8NO	1/23/2001	<200	<5.5	<6.3	<12	<6.3	<5.4
RSW1.8NO	2/26/2001	<220	<6.5	<6.7	<13	<11	<6.6
RSW3.7NO	2/26/2001	<210	<8.0	<9.0	<21	<11	<8.8
RSW1.3FO	2/26/2001	<200	<6.4	<6.6	<14	<15	<14
RSW0.7NO	2/26/2001	<230	<9.5	<11	<21	<11	<9.2
RSW0.3MO	2/26/2001	<210	<4.2	<4.7	<9.6	<5.5	<4.2
RSW0.3MO	3/27/2001	<160	<7.2	<8.6	<17	<16	<15
RSW0.7NO	3/27/2001	<160	<3.6	<4.6	<8.1	<5.2	<4.6
RSW1.8NO	3/27/2001	<160	<7.0	<8.4	<16	<16	<8.2
RSW1.3FO	3/27/2001	<160	<8.5	<10	<19	<10	<9.0
RSW3.7NO	3/27/2001	<160	<5.3	<5.5	<11	<9.9	<6.0
RSW0.7NO	4/30/2001	<190	<5.0	<9.5	<11	<7.2	<5.7
RSW1.3FO	4/30/2001	<200					
RSW1.8NOQ	4/30/2001	<200	<4.1	<4.8	<8.7	<5.8	<4.4
RSW3.7NO	4/30/2001	<190	<7.2	<8.2	<12	<7.6	<6.8
RSW0.3MO	4/30/2001	<200	<6.5	<4.6	<8.3	<5.3	<4.5
RSW1.8NO	4/30/2001	<200	<6.1	<6.1	<13	<8.3	<6.8
RSW1.3FO	4/30/2001	<200	<5.7	<6.4	<12	<6.9	<5.9

**TABLE F-9**  
(continued)

**2001 SURFACE WATER**  
Monthly Grab/ Monthly Composite  
(pCi/L)

Sample ID	Collection Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSW0.3MO	5/29/2001	295	<6.0	<4.9	<8.9	<5.2	<4.3
RSW0.7NO	5/29/2001	<170	<6.4	<6.3	<14	<6.9	<6.4
RSW1.8NO	5/29/2001	<160	<4.4	<7.4	<9.7	<6.4	<5.3
RSW1.3FO	5/29/2001	<150	<4.2	<4.3	<8.8	<6.7	<4.7
RSW3.7NO	5/29/2001	<160	<9.3	<10	<20	<10	<9.5
RSW3.7NO (reanalyze)	6/25/2001	345					
RSW3.7NO (new analysis)	6/25/2001	252					
RSW0.3MO	6/25/2001	210	<4.6	<5.0	<9.5	<5.2	<4.3
RSW3.7NO (original)	6/25/2001	412	<7.8	<8.9	<17	<10	<9.1
RSW1.3FO	6/25/2001	<200	<4.7	<5.2	<11	<6.6	<5.4
RSW0.7NO	6/25/2001	<200	<5.1	<5.5	<12	<7.1	<5.9
RSW3.7NO (State)	6/25/2001	<282					
RSW1.8NO	6/25/2001	<210	<4.2	<4.8	<8.6	<4.8	<4.2
RSW0.3MO	7/31/2001	<220	<8.8	<12	<19	<11	<8.0
RSW0.7NO	7/31/2001	<210	<4.5	<4.5	<8.7	<5.6	<4.2
RSW1.8NO	7/31/2001	<210	<5.1	<5.5	<11	<7.0	<5.9
RSW3.7NO	7/31/2001	<220	<6.4	<8.3	<15	<8.3	<7.1
RSW1.8NOQ	7/31/2001	<210	<9.7	<10	<21	<12	<10
RSW1.3FO	7/31/2001	<210	<7.3	<8.6	<17	<9.7	<8.3
RSW0.7NO	8/28/2001	412	<9.4	<9.1	<19	<12	<11
RSW1.8NO	8/28/2001	<220	<7.3	<8.8	<17	<8.5	<7.5
RSW0.3MO	8/28/2001	<220	<9.0	<11	<21	<11	<9.7
RSW1.3FO	8/28/2001	<230	<4.4	<4.7	<9.5	<6.1	<4.5
RSW3.7NO	8/28/2001	<230	<9.2	<9.3	<17	<10	<8.1

**TABLE F-9**  
(continued)

**2001 SURFACE WATER**  
Monthly Grab/ Monthly Composite  
(pCi/L)

Sample ID	Collection Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RSW0.3MO	9/25/2001	<200	<4.4	<4.8	<9.7	<5.6	<4.0
RSW0.7NO	9/25/2001	<210	<8.7	<9.1	<18	<9.9	<8.2
RSW1.8NO	9/25/2001	<210	<7.2	<7.9	<17	<8.4	<7.0
RSW3.7NO	9/25/2001	<210	<7.0	<7.1	<14	<8.1	<6.8
RSW0.7NO	10/30/2001	263	<5.8	<6.4	<13	<12	<6.7
RSW0.3MO	10/30/2001	199	<5.5	<6.3	<13	<6.7	<6.4
RSW1.8NOQ	10/30/2001	<170	<6.6	<7.8	<14	<8.4	<6.8
RSW1.3FO	10/30/2001	<160	<3.4	<3.7	<6.2	<4.2	<3.3
RSW3.7NO	10/30/2001	<160	<9.7	<13	<24	<12	<11
RSW1.8NO	10/30/2001	<170	<6.8	<8.0	<16	<7.1	<7.1
RSW0.3MO	11/28/2001	<200	<8.3	<8.5	<21	<11	<8.7
RSW0.7NO	12/4/2001	<170	<7.3	<7.7	<16	<7.5	<6.9
RSW1.8NO	12/4/2001	<170	<9.0	<11	<21	<10	<8.4
RSW1.3FO	12/4/2001	<170	<8.1	<8.6	<18	<11	<8.0
RSW0.7NO	12/26/2001	<200	<6.6	<6.8	<13	<7.5	<7.0
RSW0.3MO	12/26/2001	<190	<8.2	<8.3	<17	<9.6	<8.1
RSW1.8NO	12/26/2001	<190	<8.8	<9.8	<18	<11	<9.5
RSW1.3FO	12/26/2001	<190	<3.8	<4.3	<8.2	<4.4	<3.4
RSW3.7NO	12/26/2001	<190	<6.7	<7.0	<15	<8.5	<7.1

TABLE F-10

2001 Drinking Water  
Monthly  
(pCi/L)

Sample ID	Collection Date	Gross Beta	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RDW1.8FP	1/23/2001	<2.7	<200	<6.5	<7.0	<13	<8.0	<6.5
RDW0.1GO	1/23/2001	3.04	<200	<3.8	<4.1	<7.4	<4.6	<4.1
RDW1.8FP	2/26/2001	3.25	<200	<6.2	<5.8	<13	<8.6	<6.8
RDW0.1GO	2/26/2001	4.42	<200	<6.8	<7.2	<15	<8.2	<7.1
RDW1.8FP	3/27/2001	<2.8	<200	<3.9	<4.6	<7.9	<4.7	<4.4
RDW0.1GO	3/27/2001	<2.9	<200	<6.7	<7.9	<14	<8.2	<7.2
RDW1.8FP	4/30/2001	4.11	<210	<9.7	<11	<20	<10	<9.2
RDW0.1GO	4/30/2001	<2.7	<200	<5.5	<6.8	<12	<6.7	<5.8
RDW1.8FP	5/29/2001	<2.5	<160	<4.6	<4.6	<9.7	<6.4	<4.8
RDW0.1GO	5/29/2001	2.5	<160	<7.0	<8.3	<16	<8.8	<7.1
RDW1.8FP	6/25/2001	3.41	<200	<6.3	<7.3	<16	<8.4	<7.4
RDW0.1GO	6/25/2001	<2.4	<200	<5.3	<5.6	<11	<8.8	<5.9
RDW0.1GO	7/31/2001	<2.7	<210	<6.8	<6.9	<15	<8.0	<7.4
RDW1.8FP	7/31/2001	<3.6	<210	<9.1	<11	<20	<11	<8.5
RDW0.1GO	8/28/2001	3.55	<220	<8.6	<10	<22	<11	<9.5
RDW1.8FP	8/28/2001	3.27	<220	<7.3	<11	<15	<8.2	<7.3
RDW0.1GO	9/25/2001	3.12	<230	<7.4	<7.9	<17	<8.6	<7.6
RDW1.8FP	9/25/2001	2.29	<230	<6.2	<6.9	<13	<7.2	<6.3
RDW1.8FP	10/25/2001	2.53	<210	<8.0	<10	<20	<11	<8.5
RDW0.1GO	10/25/2001	3.93	<210	<9.3	<10	<20	<12	<11
RDW1.8FP	12/4/2001	3.37	<170	<4.4	<4.3	<9.6	<5.2	<4.1
RDW0.1GO	12/4/2001	2.65	<170	<8.9	<8.9	<20	<11	<8.7
RDW0.1GO	12/26/2001	3.44	<190	<5.2	<5.0	<9.5	<5.6	<4.5
RDW1.8FP	12/26/2001	3.78	<190	<7.2	<7.0	<16	<9.9	<7.3

TABLE F-11

2001 Rain Water  
Seasonal  
(pCi/L)

Sample ID	Collection Date	Tritium	Mn-54	Co-60	Zn-65	Cs-134	Cs-137
RRN0.8DO	1/8/2001	<160	<8.2	<8.4	<19	<11	<8.8
RRN0.8DO	1/23/2001	<200	<3.0	<3.7	<6.1	<4.0	<3.1
RRN0.8DO	2/6/2001	<170	<5.0	<5.5	<11	<6.9	<5.5
RRN0.8DO	2/20/2001	<200	<6.2	<6.2	<13	<18	<6.7
RRN0.8DO	3/13/2001	<210	<7.2	<8.0	<17	<9.8	<8.3
RRN0.8DO	3/27/2001	<160	<6.4	<7.4	<16	<12	<7.3
RRN0.8DO	4/10/2001	<200	<4.1	<4.8	<9.1	<5.6	<3.9
RRN0.8DO	4/23/2001	<190	<5.2	<6.0	<11	<6.4	<5.7
RRN0.8DO	7/3/2001	<220	<3.8	<4.2	<7.9	<4.8	<3.5
RRN0.8DO	9/26/2001	<200	<7.5	<8.3	<18	<13	<8.4
RRN0.8DO	10/30/2001	<160	<6.9	<9.4	<18	<8.2	<7.4
RRN0.8DO	11/14/2001	<200	<9.0	<12	<22	<9.5	<8.0
RRN0.8DO	12/4/2001	<190	<4.3	<5.0	<9.7	<5.7	<4.1
RRN0.8DO	12/26/2001	<190	<8.9	<10	<21	<11	<10
RRN0.8DO	1/8/2002	<200	<5.3	<6.8	<13	<7.2	<6.5
RRN0.8DO	1/29/2002	<180	<8.2	<10	<18	<9.5	<8.2

**APPENDIX G**  
**2001 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 2001. Corrective action as required by the REMP manual is as indicated.

**Luxel (Direct radiation pathway)**

**Location # 18 RTL7.8CO, Sam Jaber Residence (control)** -- On July 3, 2001, the monitoring badges at this location were missing during the routine changeout. Third Quarter 2001 monitoring badges were restored at this location. No data will be available for this location for the second quarter 2001.

**Location # 17 RTL8.2KO, Elliott Cemetary (control)** -- On January 3, 2002, the monitoring badges at this location were missing during the routine change-out. First Quarter 2002 monitoring badges were restored at this location. No data will be available for this location for the fourth quarter 2001.

**Location # 31 RTL3.7NO, Folsom South Canal (Indicator)** -- On January 3, 2002, the monitoring badges at this location were missing during the routine change-out. First Quarter 2002 monitoring badges were restored at this location. No data will be available for this location for the fourth quarter 2001.

**Surface Water (Waterborne Pathway)**

**RSW3.7NO, Folsom South Canal (control)** -- On November 29, 2001, the composite water sampler at this location did not collect a monthly composite sample. The sampler was replaced and the failed sampler was tested. No problems were found with the failed sampler. No sample data will be available from this location for the month of November 2001. PDQ 01-0138 was written to document this missed sample.

**Algae (Waterborne Pathway)**

Routine sampling of algae on May 22, 2001 did not collect samples from RAG2.2NO and RAG3.7NO due to no samples being available due to excessive flow.

**Air Sampler (Airborne Pathway)**

**RAS0.3MO, Plant Effluent (indicator)** -- On February 26, 2001, during the weekly change-out, the air sampler at this location was found not running. The power control was found in the "off" position. The sampler was not started during the previous change-out. The sampler was started and the surveillance procedure was revised to leave the air samplers "on" during change-out. No sample data will be available for this location for the week of February 20, 2001 to February 26, 2001. PDQ 01-0020 was written to document the air sampler did not meet the continuous sampling requirement.

**APPENDIX G**  
**2001 MISSED SAMPLE REPORT**  
**(Continued)**

**RAS0.7EO, Meteorological Tower (control)** – On July 16, 2001, during the weekly change-out, the air sampler at this location was found not running. The power cord for the air sampler was damaged, possibly by animal damage (chewing) to the cord. The power cord was replaced and the air sampler was restarted. PDQ 01-0081 was written to document the air sampler did not meet the continuous sampling requirement

**RAS0.1CO, PAP/ Security Building (indicator), RAS0.3MO, Plant Effluent (indicator) RAS0.7EO, Meteorological Tower (control), RAS1.8FP Rancho Seco Reservoir (control)** - Air filter samples were collected from all four locations on July 16, 2001. SP.841 was completed and the samples were shipped by UPS on July 16, 2001. The samples were picked up by UPS on July 16, 2001. The only REMP samples shipped was the air filters in a manila envelope. The sample shipment reached the UPS North Bay Hub, where the shipment was misplaced. The shipment was never found after UPS was contacted to trace the shipment. No data will be reported for this sampling period from all four locations.

**Air Sampler (Airborne Pathway)/ Surface Water (Waterborne Pathway)/ Drinking Water (Waterborne Pathway)/ Well Water (Waterborne Pathway)/ Rain Water (Waterborne Pathway)**

On November 29, 2001, samples were collected for the weekly Air Filter, monthly Surface water and Drinking Water, Quarterly Well Water, and seasonal Rain Water. The samples were shipped by UPS. When the sample container arrived at Eberline Services, twenty eight (28) of the samples were missing. UPS was contacted and they reported that according to their records, no discrepancies were noted regarding this shipment. Samples from the drinking water, surface water grab samples, and well water were collected to replace the lost samples. The following samples were missing and no data will be reported for these locations for the indicated sample period:

1. **Air Filter-RAS0.1CO/ RAS0.3MO/ RAS0.7EO/ RAS1.8FP**  
Week of 11/20/01 to 11/27/01
2. **Rain Water- RRN0.8DO**  
Seasonal sample collected on 11/28/01. No sample available for collection on 12/4/01.
3. **Drinking Water- RDW1.8FP/ RDW0.1GO**  
Monthly Sample for November 2001- Re-sampled on 12/4/01
4. **Surface Water- RSW0.7NO/ RSW1.3FO/ RSW1.8NO**  
Monthly sample for November 2001- Re-sampled on 12/4/01, the composite sample from RSW0.3MO was received in the original shipment. RSW3.7NO was not sampled due to failure of the sampler, see above.

**APPENDIX G**  
**2001 MISSED SAMPLE REPORT**  
**(Continued)**

**5. Well Water- RWW0.8DO/ RWW0.9CP/ RWW0.6RP/ RWW3.7MO/ RWW2.1MO/ RWW1.5MP/ RWW0.8LO/ RWW0.3EO**

Fourth Quarter 2001 sample. Tritium samples from locations RWW0.8DO, RWW3.7NO, RWW1.5MP, and RWW0.8LO were received in the original shipment and were analyzed. All locations were re-sampled on 12/4/01 and analyzed.