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AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

MPC&D 03-051

April 22, 2003

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

Docket 50-312  
Rancho Seco Nuclear Station  
License DPR-54

**2002 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT**

Attention: Mr. Merschoff

In accordance with Rancho Seco Quality Manual Appendix A, Section 1.5.3, the District submits the enclosed Rancho Seco Annual Radiological Environmental Operating Report for the period January 1, 2002 through December 31, 2002.

You or members of your staff requiring additional information or clarification may contact Steve Nicolls at (916) 732-4850.

Sincerely,

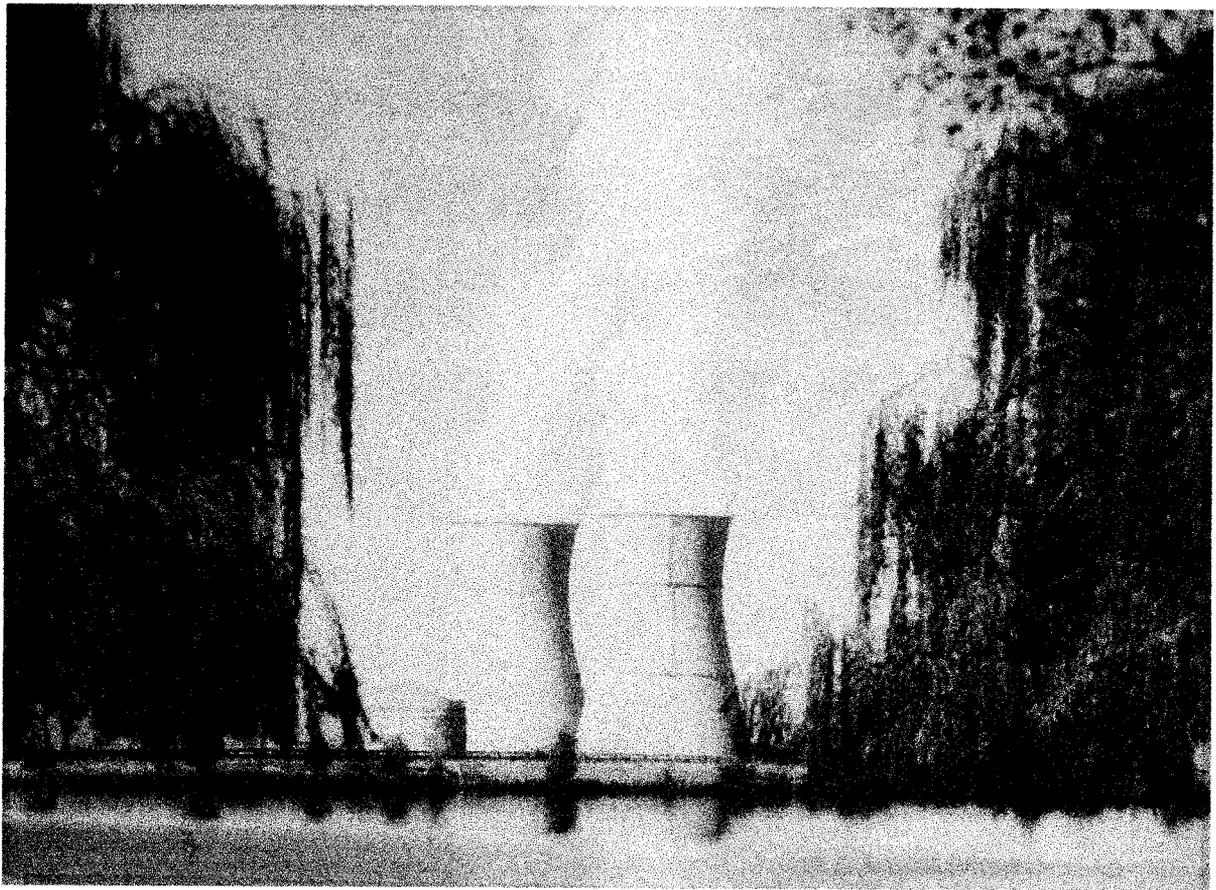
A handwritten signature in black ink, appearing to read "Steve Redeker", written in a cursive style.

Steve J. Redeker  
Manager, Plant Closure and Decommissioning

Enclosure

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

# **ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT**



**JANUARY - DECEMBER 2002**

**Rancho Seco Nuclear Station  
Herald, California**

**10 CFR Part 50 License Number DPR-54**

**10 CFR Part 72 License Number SNM 2510**

# 2002 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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# 2002 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, 2002 through December 31, 2002. This program is conducted by the Radiation Protection/ Chemistry Group at RSNS and is conducted in accordance with the Rancho Seco Quality Manual, Appendix A, Section 1.5.2.3 [RS02].

The results of the 2002 Radiological Environmental Monitoring Program showed that the operation of Rancho Seco Nuclear Station had no significant radiological impact on the environment.

Currently, the Plant is permanently shutdown and undergoing Decommissioning. Fuel off-loading into dry storage was completed on August 21, 2002.

On August 26, 2002, the Onsite Dose Calculation Manual (ODCM) was revised. As part of the revision, the gaseous effluent pathway was removed from the effluent program. This revision was due to the evaluation, which showed that no gaseous effluent pathway is present from either the Auxiliary Building or Reactor Building discharge points. Due to this revision, no evaluation of the gaseous pathway was conducted in this report. No gaseous effluents activity was detected in REMP samples conducted during 2001 or 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 (greater than minimum detected activity) were below the reporting levels. All Lower Limits of Detection (LLD) were at or lower than the maximum required by the Nuclear Regulatory Commission (NRC)

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 the regulatory limits of 10 CFR Part 20.

## I. EXECUTIVE SUMMARY (Continued)

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 Plant Effluent Surface Water and Runoff Water samples was detected during periods of liquid effluent releases.

## II. LAND USE CENSUS

The 2003 Land Use Census was conducted in accordance with the Rancho Seco Quality Manual [RS02] Section 1.4.3.2 and the Radiological Environmental Monitoring Program (REMP) manual section 4.0. This evaluation is in accordance with the requirements of 10 CFR Part 50, Appendix I, section IV.B.3. The land use census is performed on a biennial schedule and was performed during 2001/ 2002 and then completed in 2003. The next land use census is scheduled to be conducted during 2003/ 2004 and completed in 2005.

## III. RADIOLOGICAL IMPACT EVALUATION

### PREDICTED POTENTIAL RADIOLOGICAL IMPACT

#### Gaseous Effluent Exposure Pathways (deleted on August 26, 2002 from the ODCM)

The maximum calculated annual organ dose commitment due to gaseous releases of tritium and particulate isotopes was 0.111 mRem (as calculated using the Rancho Seco Offsite Dose Calculation Manual (ODCM)). This calculated organ dose commitment was 0.737% of the associated Rancho Seco Quality Manual (RSQM) [RS02] limit (10CFR50, Appendix I guideline).

Noble gases were not released in 2002 and therefore no dose calculations for noble gases were necessary.

Elimination of the gaseous pathway from the ODCM on August 26, 2003 was done in accordance with the requirements of 10 CFR 20.1302.

#### Liquid Effluent Exposure Pathways

During 2002, 4.35 E+07 liters of wastewater were released into "No Name" Creek from the two-onsite Retention Basins. This volume of wastewater was dispersed into 1.68 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 adult/ child total body dose commitment of 0.238 mRem and a calculated adult/child liver and child bone dose commitment of 0.372 mRem (as calculated using the ODCM). These calculated dose commitments were 7.93% and 3.72%, respectively, of the associated 10 CFR Part 50, Appendix I guidelines. The quarterly dose commitments reflect the age group(s) 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

REMP Manual section 8.14 requires each Annual Radiological Environmental Operating Report (AREOR) to include information related to REMF 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 REMF manual section 5.0, no fuel cycle dose evaluation was required to be performed during 2002 since no REMF measurement exceeded the established reporting levels. Additionally, the Station effluent dose predictions did not exceed twice the dose guidelines of 10 CFR Part 50, 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 0.111 mRem [RS01] is based on tritium and particulate activity. Cesium 137 particulate activity was released during the fourth quarter of 2002. 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 predicted tritium and particulate activity dose calculations. Therefore, no dose comparison was completed.

This was also confirmed during 2002, as none of the REMF 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 2002, 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 was 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 2002 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 2002 (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 2002 Station operations only and was not affected by radioactivity introduced into the environment prior to 2002. A portion of the activity identified by Program measurements in 2002 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 2003 Land Use Census indicates the potential for a liquid/ fish or liquid/ irrigated vegetation pathway. This potential will be updated in the 2005 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**

**2002 Liquid Effluent Pathway Potential Dose Comparison**

**POTENTIAL DOSE COMMITMENT**  
 (Based on the maximally exposed group)

<b>PREDICTED DOSE COMMITMENT (a) (mRem)</b>	<b>OBSERVED DOSE COMMITMENT (b) (c) (mRem)</b>	<b>PERCENT OF THE 10 CFR PART 50 APPENDIX I DOSE LIMITS</b>
0.238 (child total body for 2 <sup>nd</sup> quarter and adult total body for 1 <sup>st</sup> , 3 <sup>rd</sup> , and 4 <sup>th</sup> quarter)	0.071 (Adult Total Body)	2.36 % Total Body (3 mRem guideline)
0.372 (child-liver for 1 <sup>st</sup> quarter, child bone for 2 <sup>nd</sup> and 3 <sup>rd</sup> quarter, and adult liver for 4 <sup>th</sup> quarter)	0.112 (Teen Liver)	0.112 % Organ (10 mRem guideline)

- Notes:**
- (a) Reported in the 2002 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 (MDA) 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 2002 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 of 10 CFR Part 20.

The summary data for 2002 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** -- Six garden vegetation samples and three grape samples were collected and analyzed for nuclides of interest during 2002. No gamma emitting isotopes were found in any of the samples analyzed. A site boundary irrigated garden has been utilized as 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 two indicator locations. These three 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 2002. Cs-137 (7 samples, 42 to 266 pCi/kg, 131 pCi/kg mean) was detected by the analyses. The remaining nuclide identifications were numerically below the required LLD-equivalent activity concentration. The presence of the identified nuclides is attributed to historical Station operations. Sampling at these locations is within an approximately 10-m<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).

## IV-C. TERRESTRIAL MONITORING

### DATA EVALUATION (Continued)

**Soil (storm drain outfall)** -- Thirty soil samples were collected from fifteen storm drain outfall locations during 2002. 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 (19 samples, 13 to 102 pCi/kg, 43 pCi/kg mean), and Mn-54 (1 sample, 7 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).

**Soil (depression area)** -- Fourteen (14) soil samples at seven locations were collected in 2002. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (12 samples, 70 to 48150 pCi/kg, 10736 pCi/kg mean), Cs-134 (2 samples, 60 to 177 pCi/kg, 119 pCi/kg mean), and Co-60 (6 samples, 86 to 1102 pCi/kg, 470 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 2002 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 2002 and analyzed for nuclides of interest by gamma spectrometry. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (2 samples, 39 to 55 pCi/kg, 47 pCi/kg mean).

**Sediment** - 24 samples of sediment were collected from the discharge canal and the Clay/Hadselville/ Laguna Creeks during 2002. Gamma spectrometry analysis of these samples indicated the presence of Cs-137 (24 samples, 17 to 604 pCi/kg, 111 pCi/kg mean) and Co-60 (3 samples, 8 to 35 pCi/kg, 21 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** - Eleven samples of algae were collected from the discharge canal and the Clay/Hadselville/ Laguna creeks during 2002. Cs-137 (9 samples, 7 to 58 pCi/kg, 22 pCi/kg mean) was detected by gamma spectrometry analysis.

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

**Well Water** - 34 well water samples were collected at indicator and control locations around the site during 2002. 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** - 34 runoff water samples were collected at the site boundary during 2002. 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 eight samples indicated 287 pCi/L to 2280 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 2002, 70 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 effluent discharge samples collected during planned liquid effluent releases. The tritium activity was measured at 210 pCi/L to 2950 pCi/L.

**Drinking Water** - Water supplied from two site wells is distributed in a potable water supply system for Station personnel consumption and use. A new well was placed in service in 2002 to serve the Secondary Alarm Station (SAS) for the ISFSI. Samples from this location started in June 2002. On a monthly frequency, samples were 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 34 samples collected in 2002. 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 2002, 12 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