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U.S. Nuclear Regulatory Commission
Region IV Administrator
612 E. Lamar Blvd., Suite 400
Arlington, Texas 76011-4125

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

Docket No. 72-11
Rancho Seco Independent Spent Fuel Storage Installation
License No. SNM-2510

**ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR 2010**

Attention: Region IV Administrator

In accordance with Rancho Seco Quality Manual, Appendix A, Section 1.5.3, we are submitting the Rancho Seco 2010 Annual Radiological Environmental Operating Report for the period of January 1, 2010 through December 31, 2010.

If you or members of your staff have questions requiring additional information or clarification, please contact me at (916) 732-4817.

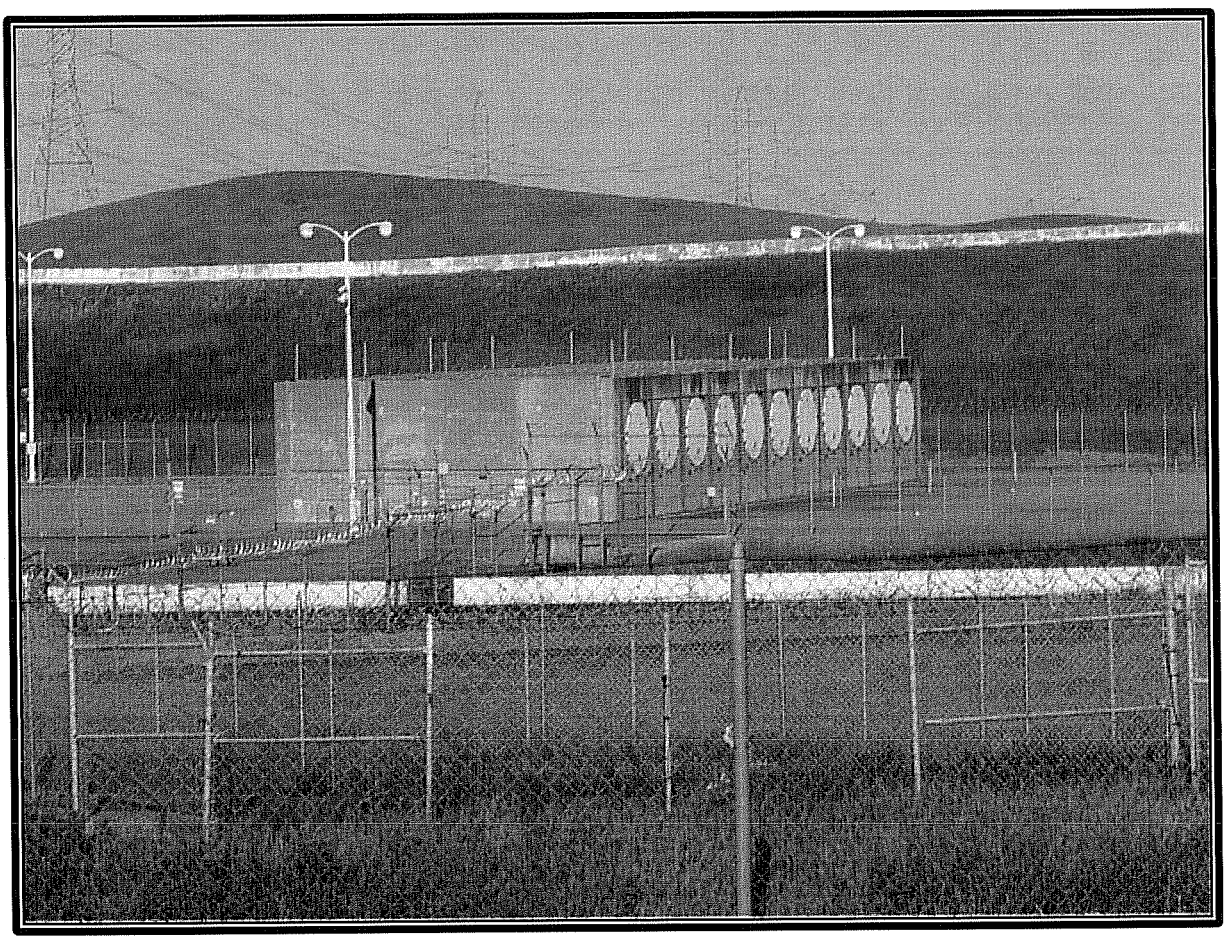
Sincerely,

E. Ronningen

Einar Ronningen
Superintendent, Rancho Seco Assets

Cc: NRC Document Control Desk
Christopher Staab
John Hickman

# ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT



## JANUARY - DECEMBER 2010

**Rancho Seco Nuclear Station**
**Herald, California**

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

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

# 2010 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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# 2010 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, 2010 through December 31, 2010. This program is conducted by Sacramento Municipal Utility District (SMUD) staff in accordance with the REMP Manual. This report is compiled and submitted in accordance with the Rancho Seco Quality Manual, Appendix A, Section 1.5.2.3 [RS01].

The results of the 2010 Radiological Environmental Monitoring Program showed that the operation of Rancho Seco Nuclear Station had no significant radiological impact on the environment.

The facility is currently in a static mode of materials storage. There are two licensed areas at the site: an approximately 1-acre facility licensed under 10 CFR 50 storing Class B and Class C low-level radioactive waste in the Interim Onsite Storage Building (IOSB), and; the approximately 10-acre Independent Spent Fuel Storage Installation (ISFSI) licensed under 10 CFR Part 72 for the storage of used nuclear fuel. Activities to complete the license termination for the Part 50 facility will be completed after a suitable disposal facility becomes available for the stored material.

In accordance with the current site status, the REMP Manual was revised in early 2010 to reflect that the only normal remaining pathway to impact a member of the public at the Rancho Seco Nuclear Station is the direct radiation pathway from the ISFSI and IOSB. Major changes include the elimination of all liquid effluent pathways, and most gaseous effluent pathways: if repackaging of the stored low-level waste is required prior to shipment for disposal, monitoring for potential release of particulate material in gaseous effluents will be performed. The material is currently in storage packaged and ready for shipment, so any need to remove the material from its packaging is considered unlikely. However, the procedures and processes for monitoring and analyzing this sample stream have been retained in facility procedures.

During the reporting period, the environs adjacent to RSNS were monitored using Luxel monitoring badges. 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 and review of historical data, ranged from indistinguishable above background levels to slightly elevated levels.

Onsite Luxel badge locations near the ISFSI access road show higher readings, attributed to the ISFSI, and are within design calculations.

## II. LAND USE CENSUS

With the completion of Phase I of Radiological Decommissioning, the requirement to perform a Land Use Census was removed as a required program from the Rancho Seco Quality Manual (RSQM). This revision to the RSQM was determined by SMUD to not be a reduction in effectiveness of the program, and was submitted to the NRC in 2008. Following the 60-day response period, no objection was received from the NRC and the REMP Manual was revised to delete the requirement to perform a Land Use Census.

## III. RADIOLOGICAL IMPACT EVALUATION

### PREDICTED POTENTIAL RADIOLOGICAL IMPACT

Gaseous Effluent Exposure Pathways

The REMP Manual was revised in January 2010 to reflect the elimination of all routine gaseous exposure pathways. No gaseous effluent releases were conducted in 2010, therefore no dose calculations were performed.

Liquid Effluent Exposure Pathways

The onsite liquid effluent pathway and any potential source of liquid effluents were removed during the decommissioning process; therefore there were no liquid effluent releases conducted nor dose calculations performed for 2010.

### FUEL CYCLE DOSE EVALUATION

REMP Manual section 8.1.4 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 [CFRa].

Consistent with REMP Manual section 5.0, no fuel cycle dose evaluation was required to be performed during 2010 since no REMP measurement exceeded the established reporting levels. Additionally, with no liquid or gaseous effluent releases, effluent dose predictions did not exceed twice the dose guidelines of 10 CFR Part 50, Appendix I [CFRb]. Therefore, Appendix I guidelines for radioactive effluents were not exceeded and determination of an actual dose commitment delivered to a real member of the public was not required.

Analysis of the Luxel measurements taken at the perimeter of the facility (fence boundaries beyond which public access is not normally controlled) indicate that in no case could a real member of the public have received more than 25 mrem during 2010, indicating compliance with 10 CFR 72.104.

## OBSERVED POTENTIAL RADIOLOGICAL IMPACT

Gaseous Effluent Exposure Pathways

Routine gaseous effluent pathways have been deleted from the ODCM and REMP Manual to reflect site conditions. No gaseous effluents were released in 2010, therefore no dose calculations were performed.

Liquid Effluent Exposure Pathways

All liquid effluent pathways have been decommissioned at Rancho Seco. The REMP Manual was revised to delete all liquid exposure pathway sample locations in reflection of current site conditions, therefore no dose calculations were completed for 2010.

Direct Radiation Exposure Pathway

Based on Luxel control and indicator locations, and a review of historical data, the RSNS did not contribute a significant component to the recorded direct gamma radiation field. The current year's data compared with previously reported data shows that there has been no measurable change in the direct radiation effect on the environment. Since RSNS is in a static materials storage condition, and there has been no detectable change in the direct radiation measurements of the surrounding environment, the conclusion remains that the Station has no significant direct radiation effect on the environment. This is the same conclusion that has been made since the fuel was placed into the ISFSI in 2002.

Luxel badge locations around the ISFSI security fence indicated higher readings, attributed to the fuel stored in the ISFSI, and are within design calculations. This monitoring is outside of the REMP and therefore the results of this monitoring are not included in this report.

## IV. PROGRAM ANALYSIS RESULTS SUMMARY

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

⇒ **Direct Radiation** (Section IV-C)

Table 3 is a comprehensive data summary presented in a format considered acceptable by the US Nuclear Regulatory Commission. Information contained in Table 3 was derived from data presented in Appendix F.

## IV-A. ATMOSPHERIC MONITORING

### DATA EVALUATION

The REMP Manual was revised in January 2010 to delete all sample locations except for the Luxel direct radiation monitoring badges. No data was collected.

## IV-B. WATER MONITORING

### DATA EVALUATION

The REMP Manual was revised in January 2010 to delete all sample locations except for the Luxel direct radiation monitoring badges. No data was collected.

## IV-C. DIRECT RADIATION MONITORING

### DATA EVALUATION

The revision to the REMP Manual conducted in 2010 changed some locations where dose monitoring is performed to reflect the current status of the licensed facility as discussed above. To ensure continuity of data, the 2010 indicator data was compared to indicator data collected during the years 2005 through 2009. The comparison was conducted in two sets: all data from the years 2005 through 2010 was compared; then, only the data collected from the same locations in each of those years was compared. The results of the comparisons show that there is no significant change in the data during the years compared, validating the conclusion stated in Section III. The information is presented in Table 1 and Table 2 below, and graphically shown in Figure 1 and Figure 2 below.

In addition, the control location data was compared for the years 2005 through 2010. The conclusion is that the background dose is variable across the same range of values as the indicator data.

Table 1: Range of Quarterly Measurements at All Indicator Locations, mrem

| Year | Minimum | Mean | Maximum |
|---|---|---|---|
| 2005 | 12 | 17 | 31 |
| 2006 | 13 | 19 | 32 |
| 2007 | 12 | 19 | 30 |
| 2008 | 11 | 19 | 31 |
| 2009 | 13 | 18 | 25 |
| 2010 | 13 | 18 | 24 |

Figure 1, Graphical Comparison of All Indicator Location Data

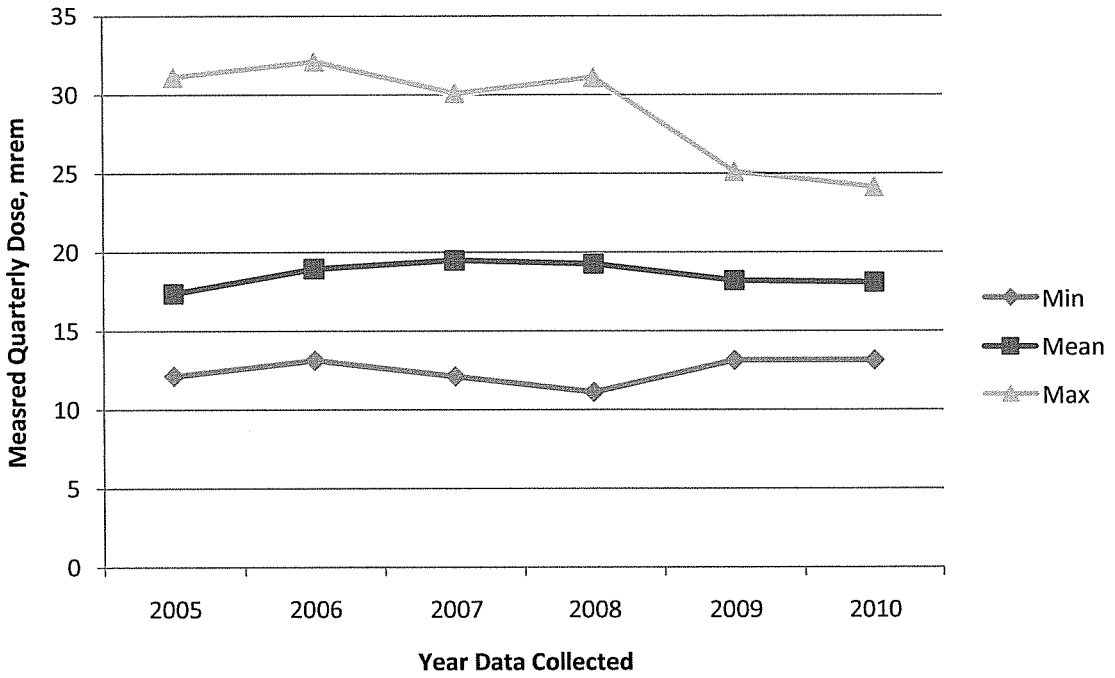
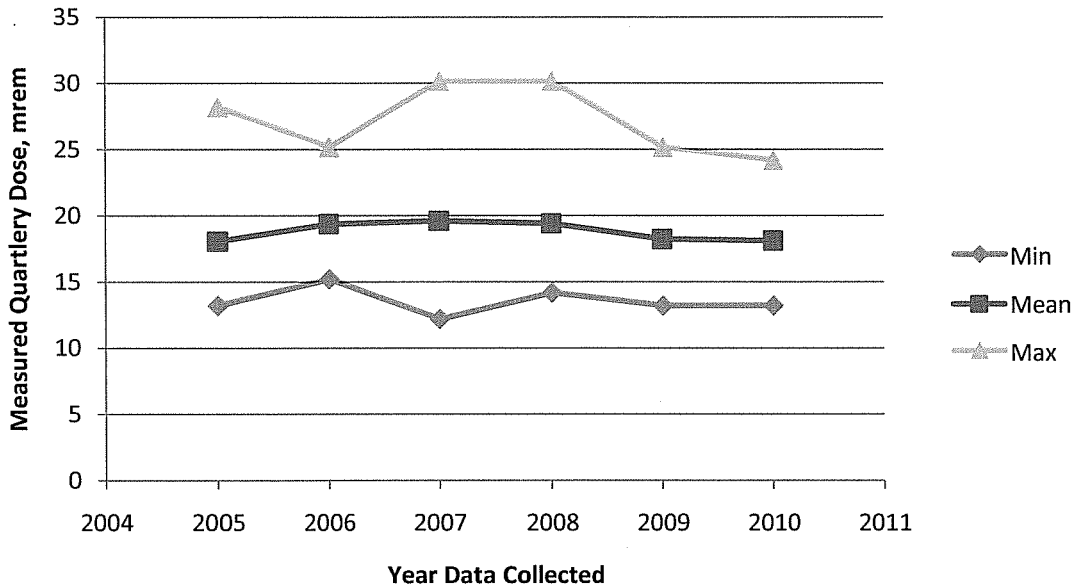


Table 2: Range of Values at Same Indicator Locations, mrem

| Year | Minimum | Mean | Maximum |
|---|---|---|---|
| 2005 | 13 | 18 | 28 |
| 2006 | 15 | 19 | 25 |
| 2007 | 12 | 20 | 30 |
| 2008 | 14 | 19 | 30 |
| 2009 | 13 | 18 | 25 |
| 2010 | 13 | 18 | 24 |

Figure 2, Graphical Comparison of Same Indicator Location Data




As can be seen from Figure 2, there is no significant change in the measurements taken at the same locations since 2005.

A comparison review of all Luxel data for the indicator and control locations during 2010 showed that there was a range of observed data, but no significant observable direct radiation component due to Station operations (i.e., storage or utilization of licensed radioactive material within the restricted area).

Luxel badge locations on the outside fence of the ISFSI show higher readings, but this is expected due to the spent fuel storage in the ISFSI. The results are within the design criteria and no license or regulatory limits were exceeded.

The summary data for 2010 direct radiation monitoring is presented in Table 3. Comprehensive data tables are given in Appendix F, Table F-1.

TABLE 3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

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

Location of Facility **Sacramento, California** (County, State). Reporting Period **January - December 2010**

| **Medium or Pathway Sampled (Unit of Measurement)** | **Type and Total Number of Analysis Performed** | **Lower Limit of Detection (LLD)** | **All Indicator Locations Mean (f)[a] Range** | **Location with Highest Annual Mean Name / Distance & Direction** | **Mean (f)[a] Range** | **Control locations Mean (f)[a] Range** | **Number of Nonroutine Reported Measurements** |
|---|---|---|---|---|---|---|---|
| Direct Radiation (mrem/qtr.) | Luxel 96 | 1 mrem/qtr | 18.0 (87/88) (13-224) | RTL0.3N0 0.3 miles 270° | 22 (4/4) (19-24) | 16 (8/8) (12-18) | 0 |

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

## V. REFERENCES


| | |
|---|---|
| CFRa | Code of Federal Regulations, 2008, "Environmental Radiation Protection Standards for Nuclear Power Operations," Title 40, Part 190. |
| CFRb | Code of Federal Regulations, 2008, "Domestic Licensing of Production and Utilization Facilities," Title 10, Part 50. |
| 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. |
| 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 (40 CFR Part 190)," NUREG-0543. |
| RS01 | Rancho Seco Quality Control Manual, Appendix A |

# VI. APPENDICES

## APPENDIX A: LAND USE CENSUS RESULTS

With the revision of the REMP Manual in January 2010, the requirement to complete a Land Use Census has been deleted. Information regarding previous Land Use Census conducted prior to the revision can be found in previous year's AREOR.

## 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:

TL Direct Gamma Radiation (Luxel)

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 |

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.

**Figure B-2** **Distant Locations Map:** Sampling locations away from the site are shown on this map.

**Map Key**

○ 94 Location that requires monitoring per REMP

● 1 Historical Location: data is collected and reported, but not required per REMP

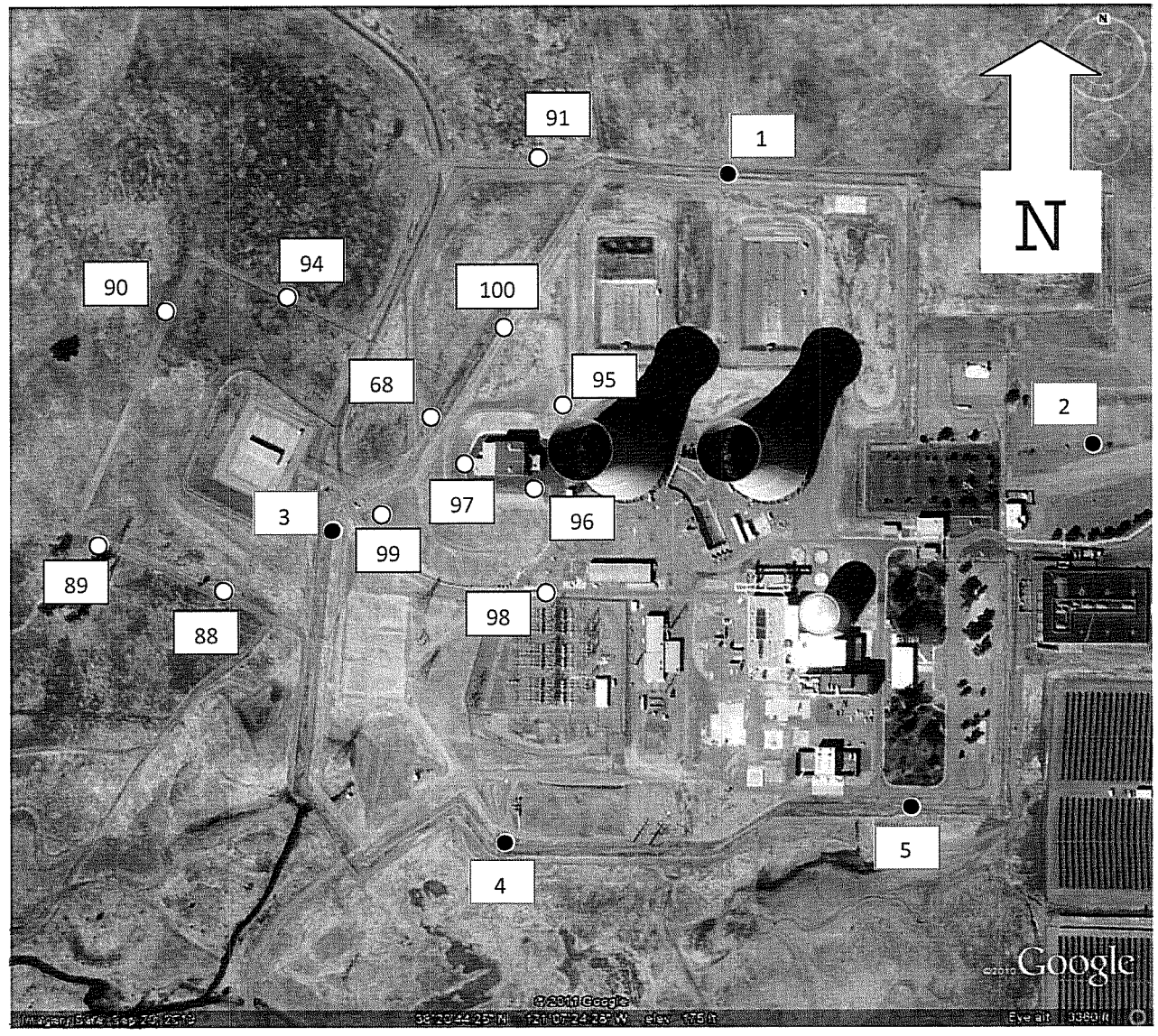



**Figure B-1 Radiological Environmental Sampling Locations on and near the Site**

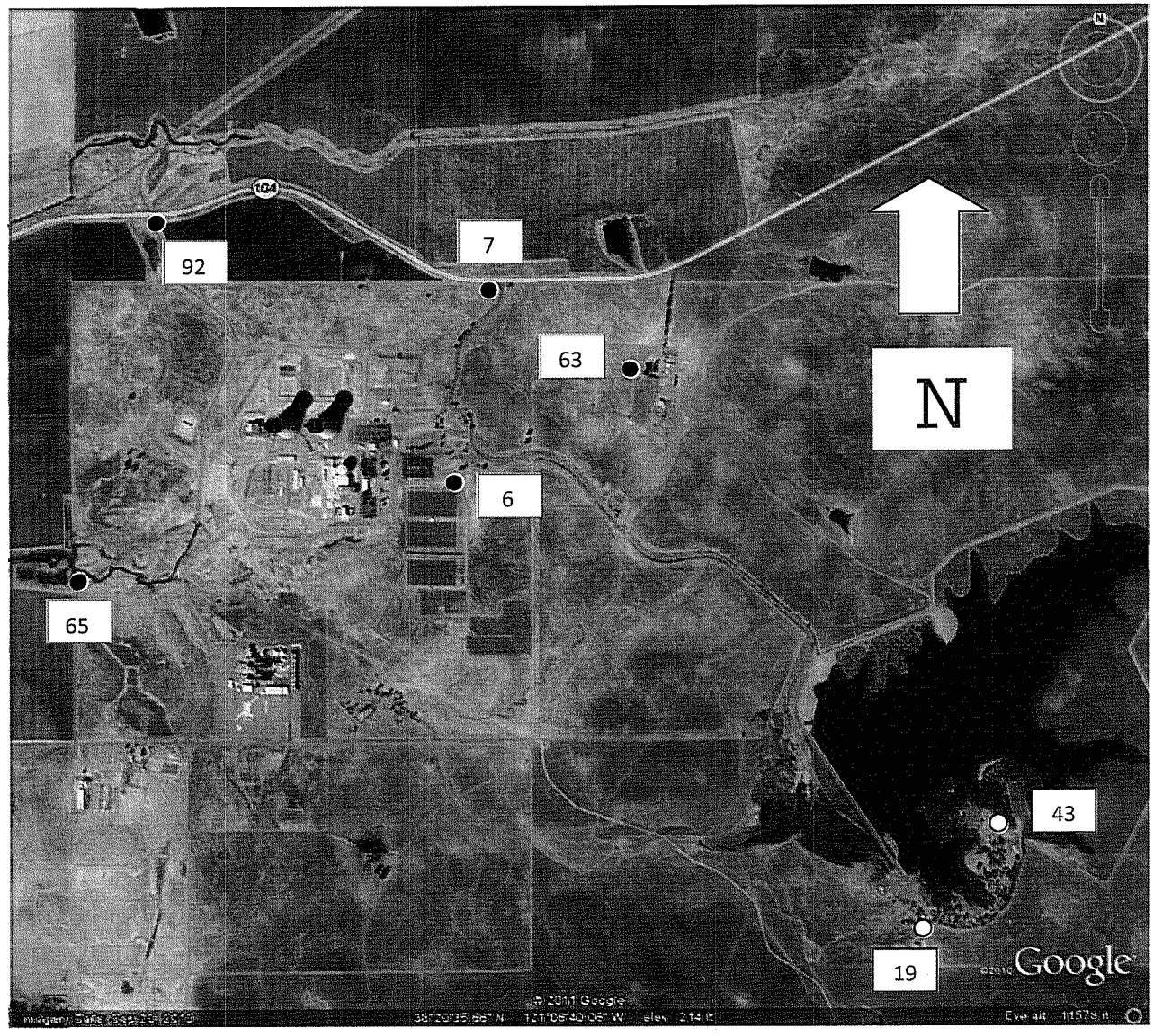



**Figure B-2 Radiological Environmental Sampling Locations distant from the Site**

## 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 |
|---|---|---|---|---|---|---|---|
| LUXEL | RTL0.3RO | IND.* | 1 | Quarterly | Perimeter Fence North of Spray Ponds | 0.3 | R |
| LUXEL | RTL0.3CO | IND.* | 2 | Quarterly | NE corner upper parking lot | 0.3 | C |
| LUXEL | RTL0.3NO | IND. | 3 | Quarterly | W Perimeter Fence road/ pole/ top of hill | 0.3 | N |
| LUXEL | RTL0.3LO | IND.* | 4 | Quarterly | S Perimeter Fence near intake filters | 0.3 | L |
| LUXEL | RTL0.3HO | IND.* | 5 | Quarterly | Pole near perimeter fence south of Admin. Bldg | 0.3 | H |
| LUXEL | RTL0.4F0 | IND.* | 6 | Quarterly | Photovoltaic Facility - NE Fence | 0.4 | F |
| LUXEL | RTL0.5CO | IND.* | 7 | Quarterly | Rt. 104 entrance to Rancho Seco | 0.5 | C |
| LUXEL | RTL1.7FO[1] | CON. | 43 | Quarterly | Well pump fence @ reservoir | 1.7 | G |
| LUXEL | RTL1.8FO | CON. | 19 | Quarterly | Rancho Seco Lake Maintenance Building | 1.8 | F |
| LUXEL | RTL0.8DO | IND.* | 63 | Quarterly | Marciel Ranch; 14626 Twin Cities Rd | 0.8 | D |
| LUXEL | RTL0.6MO | IND.* | 65 | Quarterly | Site Boundary South of creek | 0.6 | M |
| LUXEL | RTL0.3PO | IND. | 68 | Quarterly | West Perimeter Fence, West of IOSB | 0.3 | P |
| LUXEL | RTL0.3NP | IND.* | 88 | Quarterly | South ISFSI 100m Fence | 0.3 | N |

[1] This Control location on the fence near the recreational facility well has not been moved: however, the "ID Code" has been corrected to reflect the actual distance and direction (sector) of the monitoring location. This location was previously listed with ID Code RTL0.7GO.

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

| Sample Type | ID Code | Class | Map Location No. | Collection Frequency | Description. of Location | Miles | Sector |
|---|---|---|---|---|---|---|---|
| LUXEL | RTL0.4NP | IND.* | 89 | Quarterly | Southwest Corner ISFSI 100 m Fence | 0.4 | N |
| LUXEL | RTL0.5NP | IND.* | 90 | Quarterly | Northwest ISFSI 100 m Fence | 0.5 | P |
| LUXEL | RTL0.3QP | IND.* | 91 | Quarterly | North Perimeter Fence | 0.3 | Q |
| LUXEL | RTL0.7QP | IND.* | 92 | Quarterly | Highway 104 at the rail spur on pole | 0.7 | Q |
| LUXEL | RTL0.4PP | IND.* | 94 | Quarterly | North ISFSI 100 m Fence | 0.4 | P |
| LUXEL | RTL0.2PP | IND. | 95 | Quarterly | Well East of IOSB | 0.2 | P |
| LUXEL | RTL0.2NP | IND. | 96 | Quarterly | IOSB Electrical Transformer, SE corner | 0.2 | P |
| LUXEL | RTL0.3NP | IND. | 97 | Quarterly | IOSB west roof access ladder | 0.3 | P |
| LUXEL | RTL0.2NP | IND. | 98 | Quarterly | Switchyard Fence north side | 0.2 | N |
| LUXEL | RTL0.3NP | IND. | 99 | Quarterly | ISFSI 100 meter fence, vehicle access gate | 0.3 | N |
| LUXEL | RTL0.3NP | IND.* | 100 | Quarterly | West Perimeter Fence, NW of IOSB | 0.3 | N |

Note: * indicates "boundary" locations indicative of dose to a real member of the public.

Note: The "Map Location No." has been changed to be identical to the "Location Number" used in Table F-1 and the maps were updated. In previous reports, different numbering systems were used for "Map Location No." in this table and the "Location Number" used in Appendix F. To prevent confusion, the same numbering system is now used throughout the report.

## 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.

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, [NRC79b].

### INTERLABORATORY COMPARISON PROGRAM

With the revision of the REMP Manual to delete all sample locations except for Direct Radiation monitoring locations, no discussion of Interlaboratory Comparison or analysis of laboratory Quality Assurance program is necessary.

### RANCHO SECO AUDIT AND SURVEILLANCE RESULTS

The Rancho Seco Quality Program requires periodic audits of REMP activities. Contract laboratory performance is evaluated by the Rancho Seco QA Department and an "Approved Vendor List" is created from these audits. Audits are either conducted by Rancho Seco QA staff or by reviewing audits conducted by other facilities (NUPIC audit review). Landauer is currently on the approved suppliers list.

## DIRECT RADIATION (Luxel) COMPARISON PROGRAM

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 and is certified through December 31, 2011. NVLAP certification is considered to satisfy the interlaboratory comparison requirements for the direct radiation measurement devices.

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

## 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. A brief description of these collection and analysis methods is included in this Appendix.

| Sample Media | Collection/Analysis Method |
|---|---|
| **DIRECT RADIATION** | Monitoring badges, (Luxels), are located within a two (2) mile radius of the site. The badges within a one (1) 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. |

## 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-Operational REMP has been revised to reflect the requirements of the ISFSI Technical Specifications for direct radiation monitoring and direct radiation monitoring of the IOS building for the 10 CFR Part 50 License.

During 2010 the program was directed and executed by the Superintendent, Rancho Seco Assets who has primary accountability.

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 Quality Manual, Appendix A, 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,
   - ⇒ Direct radiation from materials storage,
   - ⇒ 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. Provide quantitative measurements in the direct radiation exposure pathway.

4. 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 REMP Manual and sampling program was revised during 2010 to delete all sample locations except for the direct radiation pathway. The requirement for a Land Use Census and conducting an ICP for the radioactivity analysis laboratory was also deleted.

**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

Each of these parameters is discussed below.

**Effluent Release Pathways**

The principal pathways which may result in human exposure to radiation and radioactive material originating from Station operation are direct radiation from onsite sources. Gaseous and liquid effluents are not currently being discharged or monitored.

Direct Radiation

In the direct radiation pathway, potential radiation exposure may occur from radioactive material storage areas, which are contained within the facility perimeters.

**PROGRAM BASIS**
(Continued)

**MONITORING LOCATION SELECTION**

The required monitoring sites are listed in the REMP Manual, Table 3. This program is supplemented with additional samples to compensate for changes in the radiological environment surrounding Rancho Seco. Indicator sites are placed in areas, which would be most sensitive to the effects of Station operations. 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 REMP in monitoring potential exposures or doses.

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. 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 direct radiation sources and other natural phenomena or accidental releases, which may result in human exposure.

The direct radiation pathway is monitored through a network of monitoring badges at sites distributed in sectors centered on the Station. The badges are located primarily at the site around the ISFSI and IOSB. 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 locations to record direct radiation to provide 10 CFR Part 72 license required data for the Interim Spent Fuel Storage Installation (ISFSI), and provide additional monitoring data for the IOSB.

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 Direct radiation

**PROGRAM BASIS**
(Continued)

**SAMPLE MEDIA**

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

There are 14 sites that require monitoring per the REMP, which are within a 2-mile radius of the RSNS. An additional 10 locations are monitored administratively and the data is included in this report. The monitoring badges are placed at the Station Industrial Area Boundary, near the property boundary, at the ISFSI and IOSB, and at control locations located beyond one mile of the Station.

**SAMPLE ANALYSIS & DATA HANDLING**

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 2010 Radiological Environmental Monitoring Program are presented in Table 1.

Individual (raw data) results are presented in Appendix F, Table F-1.

**REGULATORY REPORTING LEVELS**

Sample analysis data is reviewed and evaluated by the Staff 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.

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 2010.

## 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.

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. No specific LLD values for Program measurements are included in this report as no applicable monitoring was performed.

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.

## SENSITIVITY OF THE REMP MEASUREMENT PROCESS (continued)

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.

With the revision of the REMP Manual to delete all exposure pathways except for direct radiation, these sensitivities are no longer applicable to the current monitoring program.

## TABLE E-1

## REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

| Analysis | Water (pCi/L) | Airborne Particulate or Gases (pCi/$m^3$) |
|---|---|---|
| H-3 | 20000[a] | |
| Mn-54 | 1000 | |
| Co-60 | 300 | |
| Zn-65 | 300 | |
| Cs-134 | 30 | 10 |
| Cs-137 | 50 | 20 |
| Gross Beta | 40 [b] | 2 [c] |

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

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

[c] Gross Beta activity 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.

## APPENDIX F: 2010 SAMPLE ANALYSIS RAW DATA TABLES

## TABLE F-1

### 2010 Luxel Summary (Direct Radiation)
Quarterly
(mrem)

| Location Number | ID | Description | Type | 2010-1 | 2010-2 | 2010-3 | 2010-4 |
|---|---|---|---|---|---|---|---|
| 1 | RTL0.3RO | Perimeter Fence North of Spray Ponds | I | 15 | 20 | 17 | 20 |
| 2 | RTL0.3CO | NE corner of parking lot | I | 16 | 17 | 17 | 18 |
| 3 | RTL0.3NO | Site fence west near south of rail spur | I | 19 | 22 | 22 | 24 |
| 4 | RTL0.3LO | Site fence south of canal pumps | I | 16 | 18 | 17 | 18 |
| 5 | RTL0.3HO | Site south of Admin Bldg. | I | 15 | 18 | 19 | 18 |
| 6 | RTL0.4FO | NE corner of PV-1 | I | 14 | 17 | 15 | 17 |
| 7 | RTL0.5CO | RS entrance sign | I | 15 | **M** | 20 | 18 |
| 19 | RTL1.8FO | RS Lake Maint. Bldg. | C | 12 | 13 | 16 | 18 |
| 43 | RTL1.7FO | RS Lake Well Encl. | C | 15 | 17 | 18 | 18 |
| 63 | RTL0.8DO | Marcial Ranch | I | 13 | 16 | 15 | 17 |
| 65 | RTL0.6MO | Site Boundary Garden | I | 13 | 15 | 15 | 17 |
| 68 | RTL0.3PO | Site fence west by ISOB | I | 16 | 18 | 19 | 20 |
| 88 | RTL0.3NP | ISFSI south fence | I | 15 | 20 | 20 | 21 |
| 89 | RTL0.4NP | ISFSI south fence | I | 17 | 17 | 18 | 19 |
| 90 | RTL0.5NP | ISFSI west fence | I | 17 | 22 | 20 | 21 |
| 91 | RTL0.3QP | Site fence NW corner | I | 15 | 17 | 19 | 18 |
| 92 | RTL0.7QP | Railroad spur | I | 15 | 18 | 18 | 19 |
| 94 | RTL0.4PP | ISFSI fence north | I | 17 | 22 | 21 | 22 |
| 95 | RTL0.2PP | IOSB Well | I | 17 | 19 | 19 | 22 |
| 96 | RTL0.2NP | IOSB Electrical Transformer | I | 18 | 19 | 21 | 22 |
| 97 | RTL0.3NP | IOSB Roof Access Ladder | I | 16 | 19 | 18 | 21 |
| 98 | RTL0.2NP | Switchyard Fence | I | 15 | 19 | 19 | 21 |
| 99 | RTL0.3NP | 100 Meter Fence | I | 16 | 20 | 21 | 21 |
| 100 | RTL0.3NP | Access Road NW of IOSB | I | 16 | 19 | 18 | 20 |

I = Indicator Location / C = Control Location

M = Missing Data, see Appendix G

## APPENDIX G: 2010 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. Corrective action as required by the REMP Manual is as indicated.

**Direct Monitoring Pathway (Luxel Badge)**

**RTL0.5CO Rancho Seco Entrance Sign (Indicator)** – Both Luxel badges were missing from the cricket cage when the collection process was conducted for the 2nd Quarter. Inside the cricket cage was a "geocache" container housing a log where hobbyists indicate successfully locating such a container. Search of the vicinity did not find the Luxel badges. The "geocache" container was removed and the 3rd Quarter Luxel badges were placed. The incident has not been repeated as evident by successful collection of both 3rd and 4th Quarter Luxel badges. This location is not required to be monitored per REMP, Revision 15 but data continues to be collected and reported from this location.

## APPENDIX H: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM MANUAL, REVISION 15

LEAD DEPARTMENT: RP/ CHEMISTRY

EFFECTIVE DATE:

REVISION SUMMARY:

1. General Revision – updated procedure to current Site conditions. Updated Technical Specification references.
2. Section 1.0 Deleted reference to liquid and gaseous pathways
3. Section 2.0 revised to indicate Superintendent, Rancho Seco Assets has responsibility for REMP.
4. Section 2.1 revised to indicate gaseous releases are from IOS Building during activities which could cause effluent release and that direct radiation is from only the ISFSI and IOS Building. Deleted reference to liquid pathway
5. Section 2.2 – Deleted discussion about Land Use Census. Deleted reference to liquid pathway.
6. Section 3.0 deleted reference to liquid pathway
7. Section 4.0 – Revised Land Use Census to indicate Land Use Census is not required due to the reduction of radiological source terms on Site.
8. Section 5.0 Deleted reference to submitting a variance for a Special Report.
9. Section 6.0 revised to indicate ICP is not required due to no radiochemistry analysis vendor is required to support revised REMP. Vendor supplying direct radiation monitoring badges will be NVLAP certified.
10. Section 8.0 Revised to simplify reporting requirements to reflect only pathway is direct radiation.
11. Section 10.0 revised to reflect only direct radiation pathway.
12. Deleted all sample requirements from Table 1 except for Direct Radiation.
13. Deleted Table 4, Sample Types
14. Deleted all sample locations from Table 6 except for locations which support Direct Radiation pathway.
15. Renumbered Tables.

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## 0.0 POLICY

The Sacramento Municipal Utility District (SMUD) and the Rancho Seco Nuclear Station recognize their responsibility to comply with the Technical Specifications (10 CFR 50 and 10 CFR 72) and the applicable regulations, codes, standards and industry-wide criteria for establishing and maintaining a viable Radiological Environmental Monitoring Program. We are committed to operating the Rancho Seco Nuclear Station in such a manner that will assure proper radiation protection to all employees, contractors and the general public. To this end, we have committed to performing an environmental sampling program, which meets the intent of the applicable regulations while providing an accurate assessment of the radiological environment of the Rancho Seco site.

## 1.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM BASES

The Sacramento Municipal Utility District and the Rancho Seco Nuclear Station have instituted a Radiological Environmental Monitoring Program (REMP) which this manual serves to implement. The REMP is based upon the information contained in Title 10 of the Code of Federal Regulations, Part 20, Section 1302 (10 CFR 20.1302). That Regulatory basis and associated guidelines have been the foundation of the REMP and its programmatic elements which:

1. Provide the technological basis of, and the instruction for, monitoring the site and environs for radioactivity of all sources, including:

    a. naturally occurring background

    b. releases during normal operations

    c. operational occurrences and postulated accidents

    d. weapons testing and major nuclear accidents, which contribute to detectable radioactivity in the environs.

2. Ensures the annual dose equivalent to any real individual located outside the Independent Spent Fuel Storage Installation (ISFSI) controlled area does not exceed the annual dose limits in 10 CFR 72.104(a).

3. Provide the means to verify the radiological effluent control program of the Rancho Seco Nuclear Station.

4. Meet minimum limits for direct measurements in the field.

5. Provide measurements of radiation in the exposure pathway, (i.e., direct radiation), which lead to the highest potential radiation exposure of individuals resulting from station operation.

This Manual contains the minimum requirements for the conduct of the Rancho Seco Radiological Environmental Monitoring Program (REMP). The requirements are consistent with USNRC regulations, the Branch Technical Position (BTP), Radiological Effluent Technical Specifications (RETS) for PWRs (NUREG-0472), the Rancho Seco Permanently Defueled Technical Specifications (PDTS), and the ISFSI Technical Specifications as Administrative Controls.

## 2.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM DESCRIPTION

The Radiological Environmental Monitoring Program is under the cognizance of the Superintendent, Rancho Seco Assets, who has responsibility for the administration and oversight of the program.

The design of the program is consistent with the intent of Title 10 Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation" Section 1302. To implement these requirements, the Permanently Defueled Technical Specifications, ISFSI Technical Specifications, Off-site Dose Calculation Manual, Health Physics Implementing Procedures, and Surveillance Procedures have been developed. The implementing procedures address specific areas in the program that require direct attention for completion.

### 2.1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM PARAMETERS

The monitoring and sampling aspects of the program are:

- Identification of the effluent release pathways
- Identification of the human exposure pathways

Two principal release pathways at Rancho Seco Nuclear Station are:

Gaseous Effluents:
Discharges from the IOS Building.

| Note: |
| --- |
| Release of gaseous effluents will not be a normal occurrence, but this pathway description is included for completeness. See the Offsite Dose Calculation Manual for details on effluent releases from this pathway. |

Direct Radiation:
Radiation that emanates from the ISFSI or the IOS Building.

The pathways to human exposure to radioactive materials in the effluent release pathways from Rancho Seco are:

Gaseous

- Inhalation of airborne radioactive material by humans, or by animals that inhale and retain the material in animal products that are consumed by humans, i.e., meat or milk.

- Consumption of radioactive particulate material which, although carried by air currents, is deposited onto or is taken up by water sources or plants consumed by humans, or by animals that provide products that are consumed by humans, i.e., milk or meat.

- Exposure from being immersed in air containing radioactive materials as a gas and/ or particulates.

- Exposure to the direct radiation from radioactive materials that have been deposited onto surfaces from airborne releases.

Direct Radiation

- The exposure to radiation emitted from radioactive materials within the Rancho Seco Site boundary. Sources include, but are not limited to the Interim Onsite Storage Building (IOSB), and the Independent Spent Fuel Storage Installation (ISFSI).

- The exposure from being immersed in the release pathway water, to radiation emanating from material contained in the water.

## 2.2 ANALYSIS OF THE EXPOSURE PATHWAY

The analysis of the exposure pathway enables the selection of monitoring locations that fall into one of two classes, those which are, and those which are not, influenced by the exposure pathway. Those in the exposure pathway are referred to as indicator locations. Several of the unaffected locations are selected to represent baseline or control locations.

Indicator locations provide data from the surrounding environment that may be influenced by the operation of the plant because they are nearby. Such data can be used to calculate doses to verify compliance with 40 CFR 190 [This is referred to as the MEMBER OF THE PUBLIC.

The MEMBER OF THE PUBLIC is defined as any individual except when that individual is receiving an occupational dose. A MEMBER OF THE PUBLIC who is expected to receive the maximum off-site dose to real individuals may be used to calculate doses to demonstrate compliance with 40 CFR 190.]

Control sample locations are to provide data that should not be influenced by the operations of Rancho Seco. These locations are selected based upon the distance from the ISFSI and IOS Bldg. Data from these locations help discriminate between direct radiation exposure from Rancho Seco and other natural or manmade events that may impact human exposure.

The direct radiation exposure pathway is measured with the use of monitoring devices, which monitor continuously and passively. The dose is integrated over three months to accumulate a statistically significant exposure. The vast majority of the dose integrated by these devices is delivered from primordial elements in the geological surface of the Earth, which contain naturally radioactive elements. A smaller fraction of the dose is delivered by cosmic radiation, which has penetrated the Earth's atmosphere.

## 3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

The REMP shall be conducted AT ALL TIMES as specified in Table 1

3.1 With the REMP not being conducted as specified in Table 1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report (AREOR) required by Section 8.1, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence. Deviations are permitted from the required sampling schedule due to hazardous conditions.

3.2 The radiological environmental monitoring samples shall be collected per Table 1 from the locations shown in Table 3. These samples shall be analyzed to the requirements of Table 1.

3.3 The REMP required by Section 1.0 provides measurements of radiation in the exposure pathway which lead to the highest potential radiation exposures of individuals resulting from the Station operation. This monitoring program thereby implements Section IV.B.2 of Appendix I to 10 CFR 50 and supplements the REMP by verifying that the measurable levels of radiation are not higher than expected.

Guidance for Section 3.0 was provided by References 9.12 and 9.29. REMP changes may be initiated based on operational experience.

## 4.0 LAND USE CENSUS

Due to the reduction of the radiological source term on Site a Land Use Census is currently not required to be conducted. Direct radiation monitoring of the ISFSI and IOS Building is not effected by offsite conditions.

The Restricted Area of the ISFSI and fenced area of the IOS Building are the 10 CFR Part 72 and 10 CFR Part 50 (respectively) license areas. No liquid or gaseous effluents will be routinely released from these areas; therefore conducting a Land Use Census to determine changes in offsite pathways is not required as the only pathway that will remain to be monitored is the Direct Radiation pathway from the ISFSI and IOS Building.

## 5.0 FUEL CYCLE DOSE

The dose or dose commitment to any real MEMBER OF THE PUBLIC due to releases of radioactive material in gaseous effluents and to direct radiation from uranium fuel cycle sources shall AT ALL TIMES be limited to less than or equal to 25 mrem (total body or any organ), and 75 mrem (thyroid), in a calendar year.

5.1 If the Section 5.0 limits have been exceeded, prepare and submit to the Commission within 30 days a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the Section 5.0 limits. This Special Report shall also include a schedule for achieving conformance with the Section 5.0 limits.

This Special Report, as defined in 10 CFR 20.2203, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, in a calendar year that includes the release(s) covered by this Special Report. This Special Report shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations.

5.2 The Section 5.0 requirements are provided, in part, to meet the dose limitations of 40 CFR 190 that have been incorporated into 10 CFR 20. For the Rancho Seco site, it is unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR 190 if the Station remains within twice the numerical guides for design objectives of 10 CFR 50, Appendix I and if direct radiation is kept small.

The Special Report will describe a course of action, which should result in the limitation of the dose to a MEMBER OF THE PUBLIC for a calendar year to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of five (5) miles must be considered.

If the dose to any MEMBER OF THE PUBLIC is evaluated to exceed the requirements of 40 CFR 190, the Special Report along with a request for a variance (provided the release conditions resulting in violation of 40 CFR 190 have not already been corrected) is considered to be a timely request and fulfills the requirements of 40 CFR 190 until USNRC staff action is completed.

An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she receives an occupational dose.

## 6.0 INTERLABORATORY COMPARISON PROGRAM

The Direct Radiation pathway is the only pathway remaining which will be monitored. A radiochemistry analysis vendor will not routinely be used for effluent samples; therefore the requirement to have an Interlaboratory Comparison Program will not exist. As part of the REMP QA program the Vendor supplying the direct radiation monitoring devices shall be NVLAP certified.

## 7.0 DEFINITIONS

7.1 INDUSTRIAL AREA - That portion of the Station property inside the security fence encompassing the facility.

7.3 SITE BOUNDARY - That line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

7.4 RESTRICTED AREA - An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

7.5 CONTROLLED AREA - An area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

7.6 UNRESTRICTED AREA - An area, access to which is neither limited nor controlled by the licensee.

7.7 MEMBER(S) OF THE PUBLIC - Any individual except when that individual is receiving an occupational dose.

## 8.0 RADIOLOGICAL REPORT REQUIREMENTS

### 8.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT (AREOR)

8.1.1 An AREOR covering the operation of the Station during the previous calendar year shall be submitted to the USNRC prior to May 1 of each year in accordance with Rancho Seco Quality Manual, Appendix A, Section 1.5.2.3.

8.1.2 The AREOR shall include summaries and statistical evaluations of the results of the radiological environmental surveillance activities for the report period, including (as appropriate) a comparison with operational controls.

8.1.3 The AREOR shall include summarized and tabulated results of all direct radiation monitoring performed during the AREOR period. In the event that some results are not available for inclusion, the AREOR shall be submitted noting and explaining the reasons for the missing results. The missing results shall be submitted as soon as possible in a supplementary report.

8.1.4 The AREOR shall include a summary description of the REMP (including a map of all sampling locations keyed to a table giving distances and directions from the Reactor Building). The AREOR shall also include information related to Section 5.0, Fuel Cycle Dose.

### 8.2 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (ARERR)

Any changes made to the REMP MANUAL during the ARERR reporting period shall be included in that ARERR. The complete REMP manual, in its revised form, shall be submitted with the ARERR.

## 9.0 REFERENCES

The following documents pertain to the design and conduct of radiological environmental monitoring programs:

9.1 American Nuclear Insurers and Mutual Atomic Energy Liability Underwriters (ANI/MAELU), Environmental Monitoring Programs, Information Bulletin 86-1 (1986).

9.2 ANI/MAELU, Engineering Inspection Criteria for Radiological Environmental Monitoring, Section 5.2, Revision 2.

9.3 ANI/MAELU, Nuclear Liability Insurance Records Retention, Information Bulletin 80-1 A, Rev. 2 (1986).

9.4 Committee on the Biological Effects of Ionizing Radiations (BEIR), The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: BEIR V Report (1990).

9.5 National Council on Radiation Protection (NCRP), A Handbook of Radioactivity Measurements Procedures, NCRP Report No. 58, Second Edition (1985).

9.6 NCRP, Radiological Assessment: Predicting the Transport, Bioaccumulation and Uptake by Man of Radionuclides Released to the Environment, NCRP Report No. 76 (1984).

9.7 USEPA, Environmental Standards for the Uranium Fuel Cycle, 40 CFR 190, Subpart B (1993).

9.8 USEPA, Upgrading Environmental Radiation Data, Health Physics Society Committee Report HPSR-1, EPA 520/1-80-012 (1980).

9.9 USNRC, Criterion 64 - Monitoring Radioactive Releases, 10 CFR 50, Appendix A (1993).

9.10 USNRC, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material In Light Water Cooled Nuclear Power Reactor Effluents, 10 CFR 50, Appendix I (1993).

9.11 USNRC, An Acceptable Radiological Environmental Monitoring Program, Branch Technical Position, Rev. 1 (November 1979).

9.12 USNRC, Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Off-site Dose Calculation Manual or the Process Control Program, Generic Letter 89-01 (January 31, 1989).

9.13 USNRC, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, Regulatory Guide 1.109 (1977).

9.14 USNRC, Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, Regulatory Guide 1.113 (1977).

9.15 USNRC, Measuring and Reporting of Radioactivity in the Environs of Nuclear Power Plants, Regulatory Guide 4.1 (1973).

9.16 USNRC, Preparation of Environmental Reports for Nuclear Power Stations, Regulatory Guide 4.2, Rev. 2 (1976).

9.17 USNRC, Performance. Testing and Procedural Specifications for Thermoluminesence Dosimetry: Environmental Applications," Regulatory Guide 4.13.

9.18 USNRC, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, Regulatory Guide 4.15, Rev. 1 (1979).

9.19 USNRC, Radiological Assessment: A Textbook on Environmental Dose NUREG/CR-3332 (1983).

9.20 USNRC, Radiological Effluent Technical Specifications for PWRs, NUREG-0472, Rev. 2 (July 1979).

9.21 USNRC, Radiological Monitoring by NRC Licensees for Routine Operations of Nuclear Facilities, NUREG-0475 (1978).

9.22 USNRC, Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard (40 CFR 190), NUREG-O543 (1980).

9.23 USNRC, Dose Limits for individual members of the public, 10 CFR 20.1301 (2008).

9.24 USNRC, Reports of exposures, radiation levels, and concentrations of radioactive material exceeding the limits, 10 CFR 2O.2203 (2008).

9.25 Rancho Seco Permanently Defueled Technical Specifications.

9.26 USNRC, Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station, NUREG/CR-0130 (June 1978)

9.27 Rancho Seco Independent Spent Fuel Storage Installation Technical Specifications.

9.28 Rancho Seco Quality Manual, Appendix A

## 10.0 IDENTIFICATION CONVENTION FOR DIRECT RADIATION MONITORING LOCATIONS

Monitoring locations designated in Table 3 are identified using the following convention:

10.1 To establish the fact that the Table 3 samples originate from the Rancho Seco REMP, the letter "R" precedes every sample site designator.

10.2 The next two (2) letters (TL) are used to identify the sample as a direct radiation location.

10.3 The numbers following 'RTL' reflect the straight-line distance (miles) to the sample site, referenced to the center of the Reactor Building.

10.4 Following the distance, a SECTOR DESIGNATOR letter is included to specify which of the 16 meteorological sectors the sample site is encompassed. Refer to Table 2 for a listing of the sector designators.

10.5 The final character in the sample site designation is the letter "O" or the letter "P". The letter "O" designates the sample as one being added to the REMP following Station initial criticality. The letter "P" designates the sample as one being added during the post operational period following the issuance of the Possession Only License.

## 11.0 REPORTING RESULTS OF RADIOLOGICAL ENVIRONMENTAL DATA

The requirements for reporting radiological environmental data are specified in Section 8.0 of this manual. Special Reports are made specific in HPIP-2050, Radiological Environmental Monitoring Program Reports. Specified therein are conditions requiring special reports, and reporting requirements in days for submittal. This includes those calculations to provide rapid assurance of the degree of compliance with 10 CFR 50 Appendix I, and 40 CFR 190 calculations after releases of any origin.

## 12.0 SELECTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

In conjunction with the requirements of the Rancho Seco Quality Manual, and the guidance described in Section 2.0 of this Manual, the selection of monitoring sites is performed. These selected locations provide at least the minimum number of locations specified in Table 1.

The second column of Table 3 identifies the Sample Class of a particular sample as either an Indicator (IND) or a Control (CON) Sample.

Environmental monitoring devices are placed in the environs around the site. These devices passively monitor radiation in the immediate environs. Data from monitoring devices is trended to establish variations, which are influenced by seasonal, meteorological, local and global sources.

All of the environmental sample locations required for the Radiological Environmental Monitoring Program is designated in Table 3. Additional sampling locations are listed in HPIP-2070, REMP Routes and Sample Locations.

## 13.0 Radiological Environmental Monitoring Program (REMP) Manual Changes

As required by the Rancho Seco Quality Manual, Appendix A, changes to the REMP manual shall be documented and the records of the reviews performed for the changes shall be retained as required by the Rancho Seco Quality Manual, Appendix A. The documentation shall contain sufficient information to support the change together with the appropriate analyses or evaluations justifying the change.

The documentation shall also contain a determination that the change will maintain the level of radioactive effluent control that is required by 10 CFR 20.1302, 40CFR190, 10 CFR 50.36a, and Appendix I to 10CFR50 and not adversely impact the accuracy or reliability of effluent dose or setpoint calculations.

Changes to the REMP manual shall become effective after review and acceptance by the Superintendent, Rancho Seco Assets.

Changes to the REMP manual shall be submitted to the Nuclear Regulatory Commission in the form of a complete, legible copy of the entire REMP Manual as a part of or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change to the REMP Manual was made. Each change shall be identified by markings in the margin of the affected pages; clearly indicating the area of the page that was changes, and shall indicate the date (e.g., month/ year) the change was implemented.

Table 1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

| Exposure Pathway and/ or Sample | Number of Samples* | Sampling and Collection Frequency | Type and Frequency of Analysis |
|---|---|---|---|
| 1. DIRECT RADIATION | At least 14 locations with 2 monitoring devices at each location | At least once per quarter | Gamma dose. At least once per quarter |

* Sample locations are shown in Table 3

Table 2

SECTOR LETTER DESIGNATIONS USED IN SAMPLE IDENTIFICATION

| Sector | Sector Degrees | True North Compass Sector |
|---|---|---|
| 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 |

Table 3

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS

| Sample Identification | Sample Class | Collection Frequency | | Location Identification |
|---|---|---|---|---|
| **DIRECT RADIATION** | | | | |
| RTL1.8FO | CON | Quarterly | #19 | Rancho Seco Lake Maint. Bldg. |
| RTL1.7FO | CON | Quarterly | #43 | Rancho Seco Lake Well |
| RTL0.3PO | IND | Quarterly | #68 | West Fence, adjacent to ISFSI |
| RTL0.3NP | IND | Quarterly | #88 | ISFSI outer Security fence, west |
| RTL0.4NP | IND | Quarterly | #89 | ISFSI outer Security fence, SW corner |
| RTL0.5NP | IND | Quarterly | #90 | ISFSI outer Security fence, NW corner |
| RTL0.3QP | IND | Quarterly | #91 | ISFSI outer Security fence, NE corner |
| RTL0.4PP | IND | Quarterly | #94 | ISFSI ALARA fence north side |
| RTL0.2PP | IND | Quarterly | #95 | IOS Bldg. Well |
| RTL0.2NP | IND | Quarterly | #96 | Transformer SE corner IOS Bldg. |
| RTL0.3NP | IND | Quarterly | #97 | Access ladder, west side IOS Bldg. |
| RTL0.2NP | IND | Quarterly | #98 | Switchyard north fence |
| RTL0.3NP | IND | Quarterly | #99 | ISFSI 100 M fence near access road |
| RTL0.3NP | IND | Quarterly | #100 | Perimeter road, NW corner IOSB. |