

MANUAL: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

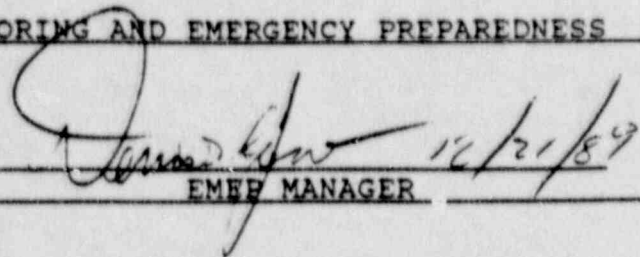
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PAGE 1 OF 34

LEAD DEPARTMENT:

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ENVIRONMENTAL MONITORING AND EMERGENCY PREPAREDNESS


12/21/89
EMEP MANAGER

REVISION SUMMARY:

Complete rewrite to incorporate the provisions of USNRC Generic Letter 89-01 in support of submittal of Technical Specification Proposed Amendment No. PA-182 (Appendix C Defueled Technical Specifications).

This revision is administrative in that no REMP requirements (Table 1) or sample locations (Table 6) have been deleted. Five editorial changes have been made to **Table 6** to correct previous omissions.

TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	RADIOLOGICAL ENVIRONMENTAL MONITORING	3
2.0	LAND USE CENSUS	14
3.0	FUEL CYCLE DOSE	15
4.0	INTERLABORATORY COMPARISON PROGRAM	17
5.0	DEFINITIONS	17
6.0	RADIOLOGICAL REPORT REQUIREMENTS	18
7.0	REFERENCES	19
8.0	IDENTIFICATION CONVENTION FOR <u>TABLE 6</u> SAMPLE LOCATIONS	21

<u>TABLE</u>	<u>TITLE</u>	<u>PAGE</u>
1	RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM	5
2	MAXIMUM VALUES FOR THE LOWER LIMIT OF DETECTION, LLD	10
3	REPORTING LEVELS FOR REMP MEASUREMENTS	13
4	SAMPLE TYPES/CLASSES	22
5	SECTOR DESIGNATIONS	23
6	RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS	24

RADIOLOGICAL ENVIRONMENTAL MONITORING REQUIREMENTS AND BASES

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 formerly contained in the Rancho Seco Appendix A Technical Specifications, through Amendment #114, as Limiting Conditions for Operation, Surveillance Standards (and associated Bases) and Administrative Controls.

This revision was prompted by the provisions of Generic Letter 89-01 (reference 7.14). For ease of intercomparison, each section contains a reference to the applicable Technical Specification (TS) Appendix A section from which the requirements were derived.

1.0 RADIOLOGICAL ENVIRONMENTAL MONITORING (TS 4.1, 3.22/4.26)

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

- 1.1 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 6.1, 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 if specimens are unobtainable due to hazardous conditions or seasonal unavailability.
- 1.2 With the level of radioactivity in an environmental sampling medium exceeding the Reporting Level of **Table 3** when averaged over any calendar quarter, in addition to complying with the requirements of Section 3.0, FUEL CYCLE DOSE, prepare and submit to the Commission within 30 days after the level of radioactivity has been determined, a Special Report which includes an evaluation of any release conditions, environmental factors or other aspects which caused the Reporting Levels to be exceeded. This report will define corrective actions to reduce emissions such that potential exposures will meet 10 CFR 50 Appendix I annual dose limitations. When more than one of the radionuclides in **Table 3** are detected in the sampling medium, the Special Report shall be submitted if the Reporting Level fraction summation equals or exceeds unity (1.0).

When radionuclides other than those in **Table 3** are detected and are the result of plant effluents, this Special Report shall be submitted if the potential annual dose to an individual is greater than or equal to the calendar year limits of 10 CFR 50 Appendix I. This Special Report is not required if the measured level of radioactivity was not the result of plant effluents; however, the condition shall be reported and described in the AREOR.

- 1.3 With milk or fesh leafy vegetation samples unavailable from any of the sample locations required by Table 1, identify the cause of the unavailability of samples and the locations for obtaining replacement samples in the next AREOR. The locations from which samples were unavailable may then be deleted from Table 6 provided the locations from which the replacement samples were obtained are added to Table 6 as replacement locations, if available.
- 1.4 The radiological environmental monitoring samples shall be collected per Table 1 from the locations shown in Table 6. These samples shall be analyzed to the requirements of Table 1 and Table 2.
- 1.5 The environmental air monitors used for sampling the Table 1 AIRBORNE EXPOSURE PATHWAY shall be subject to a MONTHLY function check and shall be calibrated ONCE EVERY 18 MONTHS.
- 1.6 The REMP required by Section 1.0 provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides 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 radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and Offsite Dose Calculation Manual (ODCM) modeling of the environmental exposure pathways.

Guidance for Section 1.0 was provided by reference 7.13. REMP changes may be initiated based on operational experience and changes in the regional population or agricultural practices. The detection capabilities required by Table 2 are state of the art for routine environmental measurements in industrial laboratories. The LLD's for drinking water meet the requirements of 40 CFR 141.

Table 1

Page 1 of 5

RADIOLOGICAL ENVIRONMENTAL MONITORING Program^a

AIRBORNE EXPOSURE PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 8

Collection Method: Continuous air sample
Collection Frequency: At least WEEKLY as required by filter dust loading

Analysis Type:

Iodine Adsorber - Iodine-131 (pCi/m³)
Particulate Filter - Gross Beta & Gamma Spec^b (pCi/m³)

Analysis Frequency:

Iodine Adsorber - Each sample
Particulate Filter - Gross Beta each sample^c, Gamma Spec each sample^d and QUARTERLY^e

DIRECT RADIATION EXPOSURE PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 40

Collection Method: Continuous monitoring^f
Collection Frequency: At least QUARTERLY

Analysis Type: Integrated gamma exposure (mR or mrem)
Analysis Frequency: Gamma exposure QUARTERLY

SURFACE WATER EXPOSURE PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 5

Collection Method: Four (4) grab and one (1) downstream composite
Collection Frequency: Downstream Composite - CONTINUOUS^g
Grab - At least WEEKLY

Analysis Type: Gamma Spec, tritium and iodine-131^{h,i} (pCi/L)
Analysis Frequency: Composite - MONTHLY and/or FORTNIGHTLY^{h,i}
Grab - Each Sample

Table 1 (cont.)

Page 2 of 5

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM^a

GROUNDWATER EXPOSURE PATHWAY¹

Sampling and Analysis Requirements

Sample Load: 3
Collection Method: Grab
Collection Frequency: Grab - At least QUARTERLY
Analysis Type: Gamma Spec, tritium and iodine-131^{hi} (pCi/L)
Analysis Frequency: Each sample

SEDIMENT EXPOSURE PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 2
Collection Method: Surface deposit grab (top 3 inches, 2 feet from shoreline)
Collection Frequency: At least SEMI-ANNUALLY
Analysis Type: Gamma Spec (pCi/kg-wet)
Analysis Frequency: Each sample

AQUATIC LIFE CONSUMPTION PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 3
Collection Method: Net, line or trap
Collection Frequency: At least QUARTERLY
Analysis Type: Gamma Spec of edible portions (pCi/kg-wet)
Analysis Frequency: Each sample

Table 1 (cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM^a

MILK CONSUMPTION PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 4
Collection Method: Grab
Collection Frequency: At least WEEKLY^k or MONTHLY
Analysis Type: Gamma Spec and Iodine-131 (pCi/L)
Analysis Frequency: Each sample

IRRIGATED CROP ("FOOD") CONSUMPTION PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 2
Collection Method: Grab
Collection Frequency: At time of harvest or MONTHLY^{l,m}
Analysis Type: Gamma Spec of edible portions (pCi/kg-wet)
Analysis Frequency: Each sample

NON-IRRIGATED CROP ("FOOD") CONSUMPTION PATHWAY

Sampling and Analysis Requirements

Minimum Sample Load: 2
Collection Method: Grab
Collection Frequency: At time of harvest or MONTHLY^l
Analysis Type: Gamma Spec of edible portions (pCi/kg-wet)
Analysis Frequency: Each sample

Table 1 (cont.)

Page 4 of 5

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Notes for Table 1

- a Sample site descriptions implementing Table 1 are identified in Table 6.
- b For purposes of Table 1, analysis by gamma spec(troscopy) is defined as the identification and quantification of gamma-emitting nuclides that may be attributable to Station effluents. As a minimum, specific searches shall be made for the applicable Table 2 nuclides.
- c Particulate filters should be analyzed after at least 24 hours have elapsed to allow for the decay of interfering radon and thoron daughter nuclides.
- d Applies only to each field indicator particulate filter having gross beta activity which is greater than ten (10) times the highest field control particulate filter gross beta activity for the same sampling interval.
- e Analysis shall be performed of each location composite of filters accumulated over a quarter.
- f Monitoring shall be provided by thermoluminescence dosimeter (TLD) having at least two (2) phosphors AND/OR one (1) dose rate recording device such as a pressurized ion chamber.
- g Composite samples should be collected with equipment (or equivalent) which is capable of collecting an aliquot at time intervals which are very short (e.g., hourly) relative to the analysis frequency (e.g., MONTHLY).
- h Iodine analysis is required only if the water is utilized as a drinking water supply for human consumption.
- i Required only if the calculated predicted potential dose delivered as a result of annual drinking water consumption exceeds one (1) mrem. The dose shall be calculated for the maximum member of the public using the methodology contained in the ODCM and actual Station source terms.

Table 1 (cont.)

Page 5 of 5

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

- i Includes groundwater supplies utilized for domestic consumption.
- k When milch animals are grazing on pasture.
- l If harvest occurs continuously, frequency shall be at least MONTHLY throughout the growing season.
- m To effectively monitor this pathway, tuberous, root and vegetable crop samples should be obtained. Irrigated grasses should be sampled if used as forage for beef or milch animals.

Table 2
MAXIMUM VALUES FOR THE LOWER LIMIT OF DETECTION, LLD^{a,d}

Analysis	Water (pCi/L)	Airborne Particulate or Gases (pCi/m ³)	Fish (pCi/kg-wet)	Milk (pCi/L)	Food Products (pCi/kg-wet)	Mud and Silt (pCi/kg-wet)
Gross Beta	4 ^b	0.01				
H ³	2,000(1,000 ^b)					
Mn ⁵⁴	15		130			
Fe ⁵⁹	30		260			150
Co ⁵⁸	15		130			150
Co ⁶⁰	15		130			
Zn ⁶⁵	30		260			
Zr, Nb ⁹⁵	15 ^e					
I ¹³¹	1 ^b	0.07		1	60	
CS ¹³⁴	15(10 ^b)	0.01 ^c	130	15	60	150
CS ¹³⁷	18(10 ^b)	0.01 ^c	150	18	80	180
Ba, La ¹⁴⁰	15 ^e			15 ^e		

Table 2 (cont.)

Page 2 of 3

MAXIMUM VALUES FOR THE LOWER LIMIT OF DETECTION, LLD^{a,d}

^a The Lower Limit of Detection (LLD) values for the radionuclides presented in **Table 2** are those recommended in reference 7.13.

The LLD of a radioanalysis system is that value which will indicate the presence or absence of radioactivity in a sample when the probability of a false positive and of a false negative determination is stated. The probabilities of the false positive and false negative determinations are taken as equal to 0.05. The equation for estimating the maximum LLD is given by the following equation:

$$\text{LLD} = \frac{2.71/t_s + 3.29S_b}{0.037(\text{YEV})\exp(-lt_c)}, \text{ pCi/L, pCi/kg-wet or pCi/m}^3$$

where:

- 2.71 = factor to account for Poisson statistics at very low background count rate
- 3.29 = twice the constant used to establish the one-sided 0.95 confidence interval
- S_b = standard deviation of the background count rate
- = $[B/(t_b t_s) + B/t_b^2]^{0.5}$
- B = background counts
- t_b = background count interval, sec
- t_s = sample count interval, sec
- 0.037 = conversion factor, dis/sec/pCi

Table 2 (cont.)

Page 3 of 3

MAXIMUM VALUES FOR THE LOWER LIMIT OF DETECTION, LLD^{a,d}

Y = radiochemical process yield (product of all factors such as abundance, chemical yield, etc.)

E = counting efficiency, cts/dis

V = sample volume or mass, L or kg

l = physical decay constant for the associate nuclide, sec⁻¹

t_c = elapsed time from the midpoint of sample collection to the midpoint of counting, sec

The LLD is defined as an a priori (before the fact) estimate and is not to be calculated for each sample analyzed on an a posteriori (after the fact) basis.

Occasionally, unavoidably small sample sizes or other uncontrollable circumstances may result in a priori LLD values not being met. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

^b LLD for water samples utilized for human consumption only.

^c Composite analysis LLD is shown; individual sample LLD is 0.05.

^d Other peaks which are measurable and identifiable, together with the nuclides in Table 2, shall be identified and reported.

• Total for parent and daughter.

Table 3

REPORTING LEVELS FOR REMP MEASUREMENTS

Analysis	Water (pCi/L)	Airborne Particulate or Gases (pCi/m ³)	Fish (pCi/kg-wet)	Milk (pCi/L)	Food Products (pCi/kg-wet)
H ³	20,000 ^a				
Mn ⁵⁴	1,000		30,000		
Fe ⁵⁹	400		10,000		
Co ⁵⁸	1,000		30,000		
Co ⁶⁰	300		10,000		
Zn ⁶⁵	300		20,000		
Zr, Nb ⁹⁵	400 ^b				
I ¹³¹	2	0.9		3	100
Cs ¹³⁴	30	10	1,000	60	1,000
Cs ¹³⁷	50	20	2,000	70	2,000
Ba, La ¹⁴⁰	200 ^b			300 ^b	
Gross Beta	40	2			

^a Applies to water samples utilized for human consumption only. This value is as specified in 40 CFR 141.

^b Total for parent and daughter.

2.0 LAND USE CENSUS (TS 3.23/4.27)

A Land Use Census shall be conducted annually and shall identify the location of the nearest milk animal, the nearest residence and the nearest garden of greater than 500 square feet producing fresh leafy vegetation in each of the 16 meteorological sectors within a distance of five (5) miles. Broad leaf vegetation sampling may be performed at the Station site boundary in the direction sector with the highest deposition parameter in lieu of the garden census.

The Land Use Census shall also include information relevant to the liquid effluent pathway and gaseous effluent pathway such that the ODCM and the REMP Manual can be kept current with existing environmental and societal use of land surrounding the Station.

- 2.1 The Land Use Census shall be conducted by using methods that will provide the best results, such as door-to-door survey, aerial survey, or by consulting local agriculture authorities. The Land Use Census, or portions thereof, shall be conducted during the appropriate time of the year to provide the best results. The results of the Land Use Census shall be included in the AREOR covering the censused year as required by section 6.1.2.
- 2.2 With the Land Use Census identifying a location(s) which yields a calculated dose or dose commitment greater than the values currently being calculated in the ODCM for compliance with 10 CFR 50 Appendix I, identify the new locations in the next AREOR.
- 2.3 With the Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained in accordance with Section 1.0, RADIOLOGICAL ENVIRONMENTAL MONITORING, add the new location(s) to **Table 6** within 30 days or submit a Special Report to the Commission that identifies the cause(s) for exceeding these requirements and the proposed corrective actions for precluding recurrence.

The sampling location(s), excluding the control station location, having the lowest calculated dose or dose commitment(s) [via the same exposure pathway] may be deleted from **Table 6** after October 31 of the census year. Identify the new location(s) in the next AREOR including a revised figure(s) and table for the REMP Manual reflecting the new location(s).

- 2.4 The Section 2.0 requirements are provided to ensure that changes in the use of unrestricted areas are identified and that modifications to the REMP and the ODCM are made if required by the results of the Land Use Census. These requirements also satisfy the requirements of Section IV.V.3 of Appendix I to 10 CFR 50.

Restricting the Land Use Census to gardens of greater than 500 square feet provides assurance that significant exposure pathways via leafy vegetation consumption will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetation assumed (reference 7.15) to be consumed by a child. In specifying this minimum garden size, it was further assumed that 20 percent of the garden was used for growing broad leaf vegetation (e.g., lettuce or cabbage) and that the productivity was two (2) kg/m².

In addition, by gathering information on the liquid effluent pathway and the gaseous effluent pathway, the Land Use Census provides assurance that proper radiological environmental monitoring and radioactive effluent controls are in place for the adequate protection of the health and safety of the general public.

3.0 FUEL CYCLE DOSE (TS 3.25; TS 4.29 does not apply to the REMP)

The dose or dose commitment to any real MEMBER OF THE PUBLIC due to releases of radioactive material in gaseous and liquid 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.

- 3.1 With any of the Reporting Levels of Table 3 being exceeded, calculations shall be made to determine whether the Section 3.0 fuel cycle dose/dose commitment limits have been exceeded. Contributions from direct radiation sources (including outside storage tanks, etc.) shall be included in this calculation.
- 3.2 If the Section 3.0 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 3.0 limits. This Special Report shall also include a schedule for achieving conformance with the Section 3.0 limits.

This Special Report, as defined in 10 CFR 20.405(c), 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.

- 3.3 If the estimated dose(s) exceeds Section 3.0 limits, and if the release condition resulting in the violation of 40 CFR 190 has not already been corrected, the Special Report shall also include a request for a variance in accordance with the provision of 40 CFR 190. Submittal of the Special Report is considered a timely request, and a variance is granted until USNRC staff action on the request is complete.
- 3.4 The Section 3.0 requirements are provided, in part, to meet the dose limitations of 40 CFR 190 that have been incorporated into 10 CFR 20 by 46 FR 18525. 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 is engaged in carrying out any operation which is part of the uranium fuel cycle.

4.0 INTERLABORATORY COMPARISON PROGRAM (TS 3.26/4.30)

The laboratory performing analysis of Table 6 samples pursuant to the requirements of Table 1 shall AT ALL TIMES participate in an Interlaboratory Comparison Program (ICP) approved by the Commission.

- 4.1 With ICP analyses not being performed as required in Section 4.0, report the corrective actions taken to prevent a recurrence to the Commission in the AREOR as required by section 6.1.
- 4.2 A summary of the results obtained as a participant in the ICP shall be included in the AREOR as required by section 6.1.
- 4.3 The requirement to participate in an ICP is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR 50.

5.0 DEFINITIONS (TS 1.0)

- 5.1 FORTNIGHTLY - Once per fourteen (14) days
- 5.2 RESTRICTED AREA - That portion of the Station property, access to which is controlled by security fencing, equipment and personnel.
- 5.3 SITE BOUNDARY - That portion of the Station property beyond which the District has no legal basis for controlling access. The distance from the Reactor Building to the closest Site Boundary location in each of the 16 meteorological sectors is shown below:

<u>Sector Distance</u> (m)		<u>Sector Distance</u> (m)	
N	659	S	1759
NNE	674	SSW	1107
NE	801	SW	1153
ENE	1211	WSW	983
E	3796	W	966
ESE	1673	WNW	987
SE	1153	NW	788
SSE	1202	NNW	670

- 5.4 MEMBER(S) OF THE PUBLIC - Individuals, who by virtue of their occupational status, have no formal association with the plant. This category shall include non-employees of the District who are permitted to use portions of the site for

recreational, occupational or other purposes not associated with Station functions. This category shall not include non-employees (such as vending machine service men or postmen) who, as part of their formal job function, occasionally enter an area that is controlled by the Station for purposes of protection of individuals from exposure to radiation and radioactive materials.

- 5.5 MAXIMUM EXPOSED (HYPOTHETICAL) INDIVIDUAL - An imaginary individual who, with regard to usage or exposure pathway parameters in the vicinity of the Station, has habits greater than usually expected for the average of the population in general.

6.0 RADIOLOGICAL REPORT REQUIREMENTS (TS 6.9.2)

6.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT (AREOR)

- 6.1.1 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.
- 6.1.2 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. The AREOR shall also include the results of the Land Use Census required by Section 2.0, LAND USE CENSUS. In the event a radionuclide concentration should be confirmed in excess of the Reporting Level in Table 3 by environmental measurements, the AREOR shall describe a planned course of corrective action.
- 6.1.3 The AREOR shall include summarized and tabulated results of all radiological environmental samples taken 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 data shall be submitted as soon as possible in a supplementary report.
- 6.1.4 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) and the results of participation in the Interlaboratory Comparison Program required by Section 4.0. The AREOR shall also include information related to Section 3.0, URANIUM FUEL CYCLE DOSE.

6.2 SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (SARERR)

Any changes made to the REMP MANUAL during the SARERR reporting period shall be included in that SARERR.

7.0 REFERENCES

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

- 7.1 American National Standards Institute (ANSI), Performance, Testing and Procedural Specifications for Thermoluminescence Dosimetry (Environmental Applications), ANSI Standard N545 (1975).
- 7.2 American Nuclear Insurers and Mutual Atomic Energy Liability Underwriters (ANI/MAELU), Environmental Monitoring Programs, Information Bulletin 86-1 (1986).
- 7.3 ANI/MAELU, "Radiological Environmental Monitoring," Engineering Inspection Criteria for Nuclear Liability Insurance, Section 5.2, Revision 2 (1988).
- 7.4 ANI/MAELU, Nuclear Liability Insurance Records Retention, Information Bulletin 80-1A, Rev. 2 (1986).
- 7.5 Committee on the Biological Effects of Ionizing Radiations (BEIR), The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980, BEIR III Report (1980).
- 7.6 National Council on Radiation Protection (NCRP), A Handbook of Radioactivity Measurements Procedures, NCRP Report No. 58, Second Edition (1985).
- 7.7 NCRP, Radiological Assessment: Predicting the Transport, Bioaccumulation and Uptake by Man of Radionuclides Released to the Environment, NCRP Report No. 76 (1984)
- 7.8 Sacramento Municipal Utility District, "Radiological Environmental Monitoring Program Evaluation," Internal Report (1987).
- 7.9 USEPA, "Environmental Standards for the Uranium Fuel Cycle," 40 CFR 190, Subpart B (1987).
- 7.10 USEPA, Upgrading Environmental Radiation Data, Health Physics Society Committee Report HPSR-1, EPA 520/1-80-012 (1980).
- 7.11 USNRC, "Criterion 64 - Monitoring Radioactive Releases," 10 CFR 50, Appendix A (1988)

- 7.12 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 (1988).
- 7.13 USNRC, "An Acceptable Radiological Environmental Monitoring Program," Branch Technical Position, Rev. 1 (November 1979).
- 7.14 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 Offsite Dose Calculation Manual or the Process Control Program", Generic Letter 89-01 (January 31, 1989).
- 7.15 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)
- 7.16 USNRC, Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, Regulatory Guide 1.113 (1977).
- 7.17 USNRC, Measuring and Reporting of Radioactivity in the Environs of Nuclear Power Plants, Regulatory Guide 4.1 (1973).
- 7.18 USNRC, Preparation of Environmental Reports for Nuclear Power Stations, Regulatory Guide 4.2, Rev. 2 (1976)
- 7.19 USNRC, Performance, Testing and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications," Regulatory Guide 4.13.
- 7.20 USNRC, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, Regulatory Guide 4.15, Rev. 1 (1979).
- 7.21 USNRC, Radiological Assessment: A Textbook on Environmental Dose Assessment, NUREG/CR-3332 (1983)
- 7.22 USNRC, Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements, NUREG/CR-4007 (1984).
- 7.23 USNRC, Radiological Effluent Technical Specifications for PWRs, NUREG-0472, Rev. 2 (July 1979).

- 7.24 USNRC, Radiological Monitoring by NRC Licensees for Routine Operations of Nuclear Facilities, NUREG-0475 (1978).
- 7.25 USNRC, Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard (40 CFR 190), NUREG-0543 (1980).
- 7.26 USNRC, "Permissible Levels of Radiation in Unrestricted Areas," 10 CFR 20.105 (1988).
- 7.27 USNRC, "Reports of Overexposures and Excessive Levels and Concentrations," 10 CFR 20.405 (1988).
- 7.28 Merril Eisenbud, Environmental Radioactivity From Natural, Industrial, and Military Sources, Third Edition (1987).

8.0 IDENTIFICATION CONVENTION FOR TABLE 6 SAMPLE LOCATIONS

Sampling and monitoring sites designated in **Table 6** are identified using the following convention:

- 8.1 To establish the fact that the **Table 6** samples originate from the Rancho Seco REMP, the letter "R" precedes every sample site designator.
- 8.2 The next two (2) letters are selected to identify SAMPLE TYPE. Refer to **Table 4** for a listing of the SAMPLE CLASSES/TYPES and the associated two letter abbreviation.
- 8.3 The numbers following the SAMPLE TYPE abbreviation reflect the straight-line DISTANCE (miles) to the sample site, referenced to the center of the Reactor Building.
- 8.4 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 5** for a listing of the sector designators.
- 8.5 The final character in the sample site designation is the letter "O" which designates the sample as being one added to the REMP following Station initial criticality.
- 8.6 The present identification convention has been selected in preference to the system originally used to identify samples and sites. Since it is desirable to retain the ability to identify, and continue to use data from, previously collected samples, the former identification convention is also shown parenthetically in **Table 6**.

Table 4

SAMPLE TYPES/CLASSES

<u>Type/Class Designation</u>	<u>Definition</u>
AG	Algae
AS	Airborne Particulate/Iodine
BF	Cattle Beef
BT	Cattle Thyroid
CF	Crawfish
CON	Control (CLASS)
DU	Duck
DW	Drinking Water
FG	Frog
FS	Fish
HS	Honey
IND	Indicator (CLASS)
LV	Garden Vegetation
MF	Raw Milk
MS	Mud & Silt, Sediment
PH	Pheasant
PV	Pasturage (forage)
RB	Rabbit
RI	Rice
RW	Runoff, Surface Water
SG	Small Game
SL	Soil
SW	Surface Water
TL	Direct Radiation (TLD)
WW	Well Water

Table 5
SECTOR DESIGNATIONS

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

Table 6

Page 1 of 11

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
<u>AIR</u> (Particulates and Iodine)			
RAS0.1C0 (RAHO)	IND	Weekly	On Site (PAP Building Carport)
RAS0.6K0 (RAD0)	IND	Weekly	Tokay Substation
RAS6.2Q0 (RAA0)	IND	Weekly	Miller Residence
RAS7.8C0 (RAF0)	IND	Weekly	Carbondale
RAS9.0E0 (RAE0)	IND	Weekly	Ione
RAS10.H0 (RAG0)	CON	Weekly	Fish Hatchery
RAS18.K0 (RAC0)	CON	Weekly	Lodi Substation
RAS23.Q0 (RAB0)	CON	Weekly	SMUD Headquarters
<u>MILK</u>			
RMF0.8D0 (RMFD0)	IND	Weekly	Marciel Ranch
RMF5.8P0 (RMFA0)	IND	Weekly	Mederios Dairy
RMF8.2K0 (RMFB0)	IND	Weekly	Angelo Dairy
RMF24.0LO	CON	Weekly	DeSnayer Dairy (eff. 10/07/88)

Table 6 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
<u>RUNOFF WATER</u>			
RRW0.3M0 (RRWCO)	IND	Biweekly	Effluent Discharge
RRW0.6M0	IND	Biweekly	Site Boundary
<u>SURFACE WATER</u>			
RSW0.7N0	IND	Monthly	Water Sump
RSW1.3F0 (RSWCO)	IND	Monthly	Rancho Seco Reservoir
RSW3.7N0 (RSWB0)	CON	Monthly	Folsom South Canal Composite Sample
RSW15.5F0	IND	Monthly	Lake Pardee Reservoir (eff. 08/09/88)
RSW12.0G0 (RSWA0)	CON	Monthly	Camanche Reservoir
RSW0.3M0	IND	Monthly	Effluent Discharge Composite Sample
<u>DRINKING WATER</u>			
RDW0.1G0 (RWWCO)	IND	Monthly	Rancho Seco Site Consumption (potable water)
<u>RAIN WATER</u>			
RRN0.6E0	IND	Seasonal	Met Station
RRN23.0Q0	CON	Seasonal	SMUD Headquarters

Table 6 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
<u>PASTURAGE</u>			
RPV0.8D0 (RLVH0)	IND	Monthly	Marciel Ranch
RPV24.0LO	CON	Monthly	DeSnayer Dairy (eff. 10/07/88)
RPV5.8P0 (RLVFO)	IND	Monthly	Mederios Dairy
RPV8.2K0 (RLVGO)	IND	Monthly	Angelo Dairy
<u>WELL WATER</u>			
RWW0.3E0 (RWWA0)	IND	Quarterly	Site Well
RWW0.8D0	CON	Quarterly	Marciel Ranch (also serves as a drinking water control sample)
RWW0.8H0 (RWE0)	IND	Quarterly	Clay Cattle Feedlot
RWW3.7M0 (NEW)	IND	Quarterly	Silva Feed Lot
RWW2.1N0	IND	Quarterly	Silva Rancho Vaquero Well (NEW)
RWW1.8F0 (RWE0)	IND	Quarterly	Rancho Seco Reservoir
RWW2.1M0 (RWWB0)	IND	Quarterly	Clay Area Well

Table 6 (Cont.)

Page 4 of 11

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
<u>SEDIMENT</u> ("MUD AND SILT")			
RMS0.3M0	IND	Quarterly	Effluent Discharge
RMS0.6M0 (RMSE0)	IND	Quarterly	Site Boundary
RMS0.7N0	IND	Quarterly	Water Sump
RMS1.3F0 (RMSC0)	IND	Quarterly	Rancho Seco Reservoir
RMS1.8N0	IND	Quarterly	Confluence of Clay and Hadselville Creeks
RMS2.2N0	IND	Quarterly	Hadselville Creek and Clay Station Road (eff.1/88)
RMS14.0M0	IND	Quarterly	Laguna Creek at Twin Cities Road
RMS0.2H0	IND	Quarterly	Storm Drain Outfall 1
RMS0.2H0	IND	Quarterly	Storm Drain Outfall 2
RMS3.7N0	IND	Quarterly	Laguna Creek at Folsom South Canal
RMS5.4M0	IND	Quarterly	Laguna Creek at Laguna Road
RMS10.0N0	IND	Quarterly	Laguna Creek at McKenzie Road
RMS12.0G0	CON	Quarterly	Camanche Reservoir
<u>FISH</u> Include predator (e.g., bass, sunfish) and scavenger (e.g., catfish, sucker) species.			
RFS0.3M0	IND	Quarterly PREDATOR	Clay Creek near the Restricted Area Boundary

Table 6 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
RFS0.3MO	IND	Quarterly SCAVENGER	Clay Creek near the Restricted Area Boundary
RFS0.6MO	IND	Quarterly PREDATOR	Clay Creek near the Site Boundary
RFS0.6MO	IND	Quarterly	Clay Creek near the Site
RFS0.7NO	IND	Quarterly PREDATOR	Water sump (pond) at the Site Boundary
RFS0.7NO	IND	Quarterly SCAVENGER	Water sump (pond) at the Site Boundary
RFS1.5FO	CON	Quarterly PREDATOR	Rancho Seco Reservoir
RFS1.5FO	CON	Quarterly SCAVENGER	Rancho Seco Reservoir
RFS1.8NO	IND	Quarterly PREDATOR	Confluence of Clay and Hadselville Creeks
RFS1.8NO	IND	Quarterly SCAVENGER	Confluence of Clay and Hadselville Creeks
RFS2.2NO	IND	Quarterly PREDATOR	Hadselville Creek at Clay Station Road
RFS2.2NO	IND	Quarterly SCAVENGER	Hadselville Creek at Clay Station Road
RFS3.7NO	IND	Quarterly PREDATOR	Laguna Creek near Folsom South Canal
RFS3.7NO	IND	Quarterly SCAVENGER	Laguna Creek near Folsom South Canal
RFS5.4MO	IND	Quarterly PREDATOR	Laguna Creek at Laguna Road

Table 6 (Cont.)

Page 6 of 11

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
RFS10.0MO	IND	Quarterly PREDATOR	Laguna Creek at McKenzie Road
RFS10.0MO	IND	Quarterly SCAVENGER	Laguna Creek at McKenzie Road
RFS14.0MO	IND	Quarterly PREDATOR	Laguna Creek at Twin Cities Road
RFS14.0MO	IND	Quarterly SCAVENGER	Laguna Creek at Twin Cities Road
RFS5.4MO	IND	Quarterly SCAVENGER	Laguna Creek at Laguna Road
<u>ALGAE SAMPLES</u>			
RAG0.3MO (RBA0)	IND	Quarterly	Effluent Discharge
RAG0.6MO	IND	Quarterly	Site Boundary
RAG0.7NO	IND	Quarterly	Water sump (pond) at the Site Boundary
RAG1.3FO	CON	Quarterly	Rancho Seco Reservoir
RAG1.8NO	IND	Quarterly	Confluence of Clay and Hadselville Creek
RAG2.2NO	IND	Quarterly	Hadselville Creek near Clay Station Road
RAG3.7NO (RBB0)	IND	Quarterly	Hadselville Creek at Folsom South Canal
RAG5.4MO	IND	Quarterly	Laguna Creek at Laguna Road
RAG10.0NO	IND	Quarterly	Laguna Creek at Twin Cities Road

Table 6 (Cont.)

Page 7 of 11

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
RAG14.0M0	IND	Quarterly	Laguna Creek at McKenzie Road
<u>SOIL</u>			
RSL0.2J0	IND	Quarterly	Storm Drain Outfall 3
RSL0.2K0	IND	Quarterly	Storm Drain Outfall 4
RSL0.3L0	IND	Quarterly	Storm Drain Outfall 5
RSL0.2H0	IND	Quarterly	Storm Drain Outfall 6
RSL0.3M0	IND	Quarterly	Storm Drain Outfall 7
RSL0.31M0	IND	Quarterly	Storm Drain Outfall 8
RSL0.32M0	IND	Quarterly	Storm Drain Outfall 9
RSL0.5A0	IND	Quarterly	North Site Garden
RSL0.6M0	IND	Quarterly	Site Boundary
RSL0.3A0	IND	Quarterly	Storm Drain Outfall 10 (eff. 7/88)
RSL0.3Q0	IND	Quarterly	Storm Drain Outfall 11 (eff. 9/88)
RSL0.3N0	IND	Quarterly	Storm Drain Outfall 12
RSL0.7N0	IND	Quarterly	Silva Property
RSL1.3F0	CON	Quarterly	Rancho Seco Reservoir
RSL1.5N0	IND	Quarterly	Silva Property
RSL1.8N0	IND	Quarterly	Silva Property

Table 6 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (FOLDER ID)	Sample Class	Collection Frequency	Location Identification
<u>CRAWFISH</u>			
RCF0.6MO	IND	Quarterly	Clay Creek at the Site Boundary
RCF3.8PO	CON	Quarterly	Folsom South Canal
RCF0.7NO	IND	Quarterly	Water sump (pond) at the Site Boundary
RCF3.7NO	IND	Quarterly	Hadselville Creek at Folsom South Canal
RCF10.0MC	IND	Quarterly	Laguna Creek at McKenzie Road
<u>GARDEN VEGETABLES</u> HARVESTED AT LEAST SEMI-ANNUALLY (SA), MONTHLY THROUGHOUT THE GROWING SEASON (MTGS)			
RLVO.5A0	IND	SA-MTGS	Broadleaf Vegetation Deposition Garden (3 broadleaf samples)
RLVO.6MO	IND	SA-MTGS	Site Boundary Vegetable Irrigation Garden (1 vegetable sample)
RLV18.KO (RLVFO)	CON	SA-MTGS	Truck Farm in the Lodi Area (3 broadleaf and 1 vegetable sample)
<u>BEEF TISSUE</u>			
RBFX.XNO	IND	SA	Beef Tissue From Cattle Raised West Of The Site
RBFX.XXO	CON	SA	Beef Tissue From Cattle Raised In Least Prevalent Wind Direction
<u>FROGS</u>			
RFGO.6MO	IND	Quarterly	Clay Creek at the Site Boundary

Table 6 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification (Former ID)	Sample Class	Collection Frequency	Location Identification
RFG1.5FO	CON	Quarterly	Rancho Seco Reservoir
RFG2.2NO	IND	Quarterly	Hadselville Creek at Clay Station Road
RFG3.7NO	IND	Quarterly	Hadselville Creek at Folsom South Canal
RFG10.0MO	IND	Quarterly	Laguna Creek at McKenzie Sectors

Table 6 (Cont.)

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification	Sample Class	TLD Map #	Sample Identification	Sample Class	TLD Map #
RTLO.3RO	IND	1	RTL1.7LO	IND	21
RTLO.3CO	IND	2	RTL1.6JO	IND	22
RTLO.3NO	IND	3	RTL1.8KO	IND	23
RTLO.3LO	IND	4	RTL1.7HO	IND	24
RTLO.3HO	IND	5	RTL3.8LO	IND	25
RTLO.4FO	IND	6	RTL3.9KO	IND	26
RTLO.5CO	IND	7	RTL3.6JO	IND	27
RTL6.2QO	IND	8	RTL3.7HO	IND	28
RTL23.QO	CON	9	RTL4.2JO	IND	29
RTL18.KO	CON	10	RTL7.4MO	IND	30
RTLO.6KO	IND	11	RTL3.7NO	IND	31
RTL9.0EO	CON	12	RTL4.8PO	IND	32
RTL10.NO	IND	13	RTL3.8MO	IND	33
RTL11.MO	CON	14	RTL3.8QO	IND	34
RTL10.HO	CON	15	RTL1.9NO	IND	35
RTL2.7MO	IND	16	RTL1.6PO	IND	36
RTL8.2KO	IND	17	RTL1.9QO	IND	37
RTL7.8CO	IND	18	RTL1.6RO	IND	38
RTL1.8GO	IND	19	RTL1.5BO	IND	39
RTL1.5MO	IND	20	RTL1.5AO	IND	40
RTL1.8CO	IND	41	RTL14.PO	CON	61
RTL4.4GO	IND	42	RTL11.MO	CON	62

Table 6 (Cont.)

Page 11 of 11

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Sample Identification	Sample Class	TLD Map #	Sample Identification	Sample Class	TLD Map #
RTL0.8FO	IND	43	RTL0.8DO	IND	63
RTL1.8EO	IND	44	RTL9.5EO	IND	64
RTL1.4DO	IND	45	RTLO.6MO	IND	65
RTL1.4DO	IND	46	RTLO.4NO	IND (eff. 7/89)	66
RTL3.0CO	IND	47	RTLO.41NO	IND (eff. 7/89)	67
RTL3.7DO	IND	48	RTLO.3PO	IND (eff. 7/89)	68
RTL3.2EO	IND	49			
RTL3.5FO	IND	50			
RTL10.EO	CON	51			
RTL19.EO	CON	52			
RTL12.GO	CON	53			
RTL11.JO	IND	54			
RTL8.0PO	IND	55			
RTL4.6QO	IND	56			
RTL7.6AO	IND	57			
RTL6.6BO	IND	58			
RTL11.RO	CON	59			
RTL11.AO	CON	60			