OFFSITE DOSE CALCULATION MANUAL

NUCLEAR ORGANIZATION

UNIT 1

S01-ODCM
Revision 19
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ODCM

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INTRODUCTION

The OFFSITE DOSE CALCULATION MANUAL (ODCM) is a supporting document of the RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS (NUREG 0472). The ODCM enumerates dose and concentration specifications, instrument requirements, as well as describes the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and airborne effluents. In order to meet release limits, it additionally provides calculations for liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints. The environmental section contains a list of the sample locations for the radiological environmental monitoring program.

The ODCM will be maintained at the Site for use as a document of Specifications and acceptable methodologies and calculations to be used in implementing the Specifications. Changes in the calculational methods or parameters will be incorporated into the ODCM in order to assure that the ODCM represents current methodology.

1.0 RADIOACTIVE LIQUID EFFLUENTS

1.1 LIQUID EFFLUENTS CONCENTRATION

1.1.1 SPECIFICATION

Applicability: At all times.

Objective: Maintain the concentration of radioactive liquid material released from the site below 10 CFR 20 limits.

Specification:

A. The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see Figure 6-1) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} μCi/ml.

B. Action:

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, without delay restore the concentration to within the above limits.

1.0 **<u>RADIOACTIVE LIQUID EFFLUENTS</u>** (Continued)

1.1 <u>LIQUID EFFLUENTS CONCENTRATION</u> (Continued)

1.1.2 **SURVEILLANCE**

<u>Applicability</u>: At all times.

<u>Objective</u>: To verify that discharge of radioactive liquid material to UNRESTRICTED AREAS is maintained below 10 CFR 20 limits.

<u>Specification</u>:

A. Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 1-1

B. The results of the radioactivity analyses shall be used in accordance with Section 1.4 to assure that the concentrations at the point of release are maintained within the limits of Specification 1.1.1.

TABLE 1-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) ($\mu Ci/ml$)[a]
A. Batch Waste Release Tanks	P Each Batch	P Each Batch	Principal Gamma Emitters[c]	5×10^{-7}
(1) Holdup Tanks[b]			I-131	1×10^{-6}
(2) **DELETED** (3) **DELETED**	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P Each Batch	M Composite[d]	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P Each Batch	Q Composite[d]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Release[e]	3 x W Grab Sample	W Composite[f]	Principal Gamma Emitters[c]	5×10^{-7}
			I-131	1×10^{-6}
(1) Reheater Pit Sump (2) Yard Drain Sump	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	3 x W Grab Sample	M Composite[f]	H-3 Gross Alpha	1×10^{-5} 1×10^{-7}
	3 x W Grab Sample	Q Composite[f]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

TABLE 1-1
(Continued)

TABLE NOTATION

a. The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with a 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda\ \Delta t)}$$

where,

LLD is "a priori" lower limit of detection as defined above (as microcuries per unit mass or volume).

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute).

E is the counting efficiency (as counts per disintegration),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide,

Δt for plant effluents is the elapsed time between the midpoint of sample collection and time of counting,

Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

b. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed to assure representative sampling.

TABLE 1-1
(Continued)

TABLE NOTATION (Continued)

c. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks that are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

d. A composite sample is one which results in a specimen that is representative of the liquids released.

e. A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

f. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be representative of the effluent release.

1.0 **RADIOACTIVE LIQUID EFFLUENTS** (Continued)

1.2 LIQUID EFFLUENT DOSE

1.2.1 **SPECIFICATION**

Applicability: At all times.

Objective: Maintain the release of radioactive liquid effluents from the site as low as is reasonably achievable.

Specification:

A. The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to UNRESTRICTED AREAS (see Figure 6-1) shall be limited:

1. During any calendar quarter to ≤ 1.5 mrem to the total body and to ≤ 5 mrem to any organ, and

2. During any calendar year to ≤ 3 mrem to the total body and to ≤ 10 mrem to any organ.

B. Action:

1. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification D6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

1.0 **RADIOACTIVE LIQUID EFFLUENTS** (Continued)

1.2 LIQUID EFFLUENT DOSE (Continued)

1.2.2 **SURVEILLANCE**

Applicability: At all times.

Objective: To verify that doses due to the release of radioactive liquid effluents are as low as is reasonably achievable.

Specification: Cumulative dose contributions from liquid effluents shall be determined in accordance with Section 1.5 at least once per 31 days.

1.3 LIQUID WASTE TREATMENT

1.3.1 SPECIFICATION

Applicability: At all times.

Objective: Maintain radioactive releases from the site as low as is reasonably achievable by use of the liquid radwaste treatment system.

Specification:

A. The liquid radwaste treatment system shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected dose due to the liquid effluent from San Onofre Unit 1, to UNRESTRICTED AREAS (see Figure 6-1) would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31 day period.

B. Action

1. With radioactive liquid waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification D6.9.2, a Special Report that includes the following information:

   a. Explanation of why liquid radwaste was being discharged without treatment, identification of any nonfunctional equipment or subsystems and the reason for nonfunctional status.

   b. Action(s) taken to restore the nonfunctional equipment to FUNCTIONAL status.

   c. Summary description of action(s) taken to prevent a recurrence.

1.0 RADIOACTIVE LIQUID EFFLUENTS (Continued)

1.3 LIQUID WASTE TREATMENT (Continued)

1.3.2 SURVEILLANCE

Applicability: At all times.

Objective: To verify the functionality and potential use of the liquid radwaste treatment system.

Specification: Doses due to liquid releases shall be projected at least once per 31 days in accordance with Section 3.1.

1.4 LIQUID EFFLUENT MONITOR SETPOINTS

Liquid Radwaste Effluent Line Monitors provide alarm and automatic termination of release prior to exceeding the concentration limits specified in 10CFR20, Appendix B, Table II, Column 2 at the release point to the unrestricted area. To meet Specification 1.1.2 and for the purpose of implementation of Specification 1.1.1, the alarm/trip setpoints for liquid effluent monitors and flow measurement devices are set to assure that the following equation is satisfied:

$$\frac{C_m R}{F+R} \leq MPC_{eff} \tag{1-1}$$

where:

MPC_{eff} = effective effluent maximum concentration permissible limit (μCi/ml) at the release point to the unrestricted area for the radionuclide mixture being released,

$$= \frac{1}{\sum_{i=1}^{N} \left(\frac{F_i}{MPC_i} \right)} \tag{1-2}$$

F_i = fractional concentration of the i^{th} radionuclide as obtained by sample analysis.

N = number of radionuclides identified in sample analysis.

MPC_i = MPC of the i^{th} radionuclide (10CFR20, App B, Table II, Column 2).

1.4 LIQUID EFFLUENT MONITOR SETPOINTS (Continued)

C_m = setpoint representative of a radionuclide concentration for the radiation monitor measuring the radioactivity in the waste effluent line prior to dilution and subsequent release, μCi/ml.

R = permissible waste effluent flow rate at the radiation monitor location, in volume per unit time in the same units as for F.

F = dilution water flow in volume per unit time. The dilution water flow is 3,000 gpm per saltwater pump (2 total).

Administrative values are used to reduce each setpoint to account for the potential activity in other releases. These administrative values shall be periodically reviewed based on actual release data (including, for example, any saltwater discharge of the component cooling water heat exchanger) and revised as necessary.

1.4.1 BATCH RELEASE SETPOINT DETERMINATION

The waste flow (R) and monitor setpoint (C_m) are set to meet the condition of equation (1-1) for the effective MPC (MPC_{eff}) limit. The method by which this is accomplished is as follows:

STEP 1: The isotopic concentration for each batch tank to be released is obtained from the sum of the measured concentrations in the tank as determined by analysis.

$$C = \Sigma_i C'_{\gamma i} + C_\alpha + C_s + C_t + C_{Fe} + C_{Xe} \qquad (1\text{-}3)$$

where:

C	=	total concentration in each tank, μCi/ml
$\sum_i C'_{\gamma i}$	=	sum of the measured concentrations for each radionuclide, i, in the gamma spectrum, excluding Xe-133, μCi/ml
C_α	=	gross alpha concentration determined in the previous monthly composite sample, μCi/ml
C_s	=	Sr-89 and Sr-90 concentrations as determined in the previous quarterly composite sample, μCi/ml
C_t	=	H-3 concentration as determined in the previous monthly composite sample, or as measured in the sample taken prior to release, μCi/ml
C_{Fe}	=	Fe-55 concentration as determined in the previous quarterly composite sample, μCi/ml
C_{Xe}	=	Xe-133 concentration as determined by isotopic analysis, μCi/ml

1.4.1 **BATCH RELEASE SETPOINT DETERMINATION** (Continued)

STEP 2: The effective MPC (MPC_{eff}) for each batch tank, or sump is determined using:

$$MPC_{eff} = \frac{1}{\Sigma_i \left(\frac{C_{\gamma i}/C}{MPC_{\gamma i}}\right) + \left(\frac{C_s/C}{MPC_s}\right) + \left(\frac{C_t/C}{MPC_t}\right) + \left(\frac{C_\alpha/C}{MPC_\alpha}\right) + \left(\frac{C_{Fe}/C}{MPC_{Fe}}\right)} \qquad (1\text{-}4)$$

$MPC_{\gamma i}$, MPC_s, MPC_t, MPC_{Fe}, MPC_α = the limiting concentrations of the appropriate radionuclide from 10CFR20, Appendix B, Table II, Column 2.

NOTE: For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-4 μCi/ml total activity.

STEP 3: The radioactivity monitor setpoint C_m, μCi/ml, may now be specified based on the values of C, $\sum_i C'_{\gamma i}$, F, MPC_{eff} and R to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2.

STEP 4: If the monitor reads in CPM, the setpoint may be derived using the applicable calibration constants given in Table 1-2 to correspond to the calculated monitor limit C_m, μCi/ml.

$$CPM_{max} = \frac{(C_m,\ \mu Ci/ml)}{(Cal.\ Const.,\ \mu Ci/cc/cpm)} \qquad (1\text{-}6)$$

1.0 **RADIOACTIVE LIQUID EFFLUENTS** (Continued)

1.4 LIQUID EFFLUENT MONITOR SETPOINTS (Continued)

1.4.1 **BATCH RELEASE SETPOINT DETERMINATION** (Continued)

1.4.1.1 LIQUID RADWASTE EFFLUENT LINE (RT-1218)

The value for C_m, the concentration limit at the detector, is determined by using:

$$C_m \le \frac{(RW) \quad (F+R) \quad (\Sigma_i C'_{\gamma i})}{(R) \left(\frac{C}{MPC_{eff}}\right)} \qquad (1\text{-}5)$$

where:

	RW	=	Radwaste Effluent discharge administrative value.
	F	=	dilution water flow in volume per unit time.
		=	3000 gpm per saltwater pump (2 total).
	$\sum_i C'_{\gamma i}$	=	total gamma isotopic concentration, excluding Xe-133, μCi/ml.
Radwaste holdup tanks	R	=	50 gpm/pump (x no. of pumps to be run)
Radwaste monitor tanks	R	=	50 gpm/pump (x no. of pumps to be run)
	C	=	total gamma concentration in each batch sample.
	MPC_{eff}	=	from equation (1-4).

RW, S_{2100}, and S_{2101} are administrative values used for simultaneous releases from the Radwaste Effluent discharge, the Reheater Pit Sump, and the Yard Drain Sump. The fractions RW, S_{2100}, and S_{2101} will be assigned such that $(RW + S_{2100} + S_{2101}) \le 1.0$. The 1.0 is an administrative value used to account for the potential activity for all release pathways. This assures that the total concentration from all release points to the plant discharge will not result in a release of concentrations exceeding the limits of 10CFR20, Appendix B, Table II, Column 2 from the site.

NOTE: If $C_m \le \Sigma_i C'_{\gamma i}$, then no release is possible. To increase C_m, increase dilution flow F (by running more pumps in the applicable discharge structure), and/or decrease the effluent flow rates R (by throttling the combined flow as measured on CV110) and recalculate C_m using the new F, R and equation (1-5).

1.4.2 CONTINUOUS RELEASE SETPOINT DETERMINATION

STEP 1: The isotopic concentration for the continuous releases are obtained for each release stream (reheater pit sump or yard sump) from the sum of the respective measured concentrations as determined by analysis:

$$C = \Sigma_i C'_{\gamma i} + C_\alpha + C_s + C_t + C_{Fe} + C_{Xe} \qquad (1\text{-}3)$$

where:

C = total concentration, µCi/ml

$\sum_i C'_{\gamma i}$ = total gamma activity associated with each radionuclide, i, in the weekly composite analysis for the release stream, excluding Xe-133, µCi/ml.

C_α = total measured gross alpha concentration determined from the previous monthly composite analysis for the release stream, µCi/ml.

C_s = total measured concentration of Sr-89 and Sr-90 as determined from the previous quarterly composite analysis for the release stream, µCi/ml.

C_t = total measured H-3 concentration determined from the previous monthly composite analysis for the release stream, µCi/ml.

C_{Fe} = total Fe-55 concentration as determined in the previous quarterly composite sample for the release stream, µCi/ml.

C_{Xe} = Xe-133 concentration as determined by isotopic analysis, µCi/ml

STEP 2: The effective MPC (MPC_{eff}) for each release stream (reheater pit sump or yard drain sump) is determined using:

$$MPC_{eff} = \frac{1}{\Sigma_i \left(\frac{C_{\gamma i}/C}{MPC_i} \right) + \left(\frac{C_s/C}{MPC_s} \right) + \left(\frac{C_\alpha/C}{MPC_\alpha} \right) + \left(\frac{C_{Fe}/C}{MPC_{Fe}} \right) + \left(\frac{C_t/C}{MPC_t} \right)} \quad (1\text{-}9)$$

STEP 3: The setpoint (μCi/ml), for each continuous release radioactivity monitor may now be specified based on the respective values of C, $\sum_i C'_{\gamma i}$, F, MPC_{eff}, and R to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2.

STEP 4: If the monitor reads in CPM, the setpoint may be derived using the applicable calibration constants given in Table 1-2 to correspond to the calculated monitor limit C_m, μCi/ml.

$$CPM_{max} = \frac{(C_m,\ \mu Ci/ml)}{(Cal.\ Const.,\ \mu Ci/cc/cpm)} \quad (1\text{-}6)$$

1.0 **RADIOACTIVE LIQUID EFFLUENTS** (Continued)

1.4 LIQUID EFFLUENT MONITOR SETPOINTS (Continued)

1.4.2 **CONTINUOUS RELEASE SETPOINT DETERMINATION** (Continued)

1.4.2.1 REHEATER PIT SUMP EFFLUENT LINE (REHEATER PIT SUMP) (RT-2100)

The value of C_{2100}, the concentration limit at the detector, μCi/ml, is determined using:

$$C_{2100} \leq \frac{(S_{2100})\ (F+R)\ \Sigma_i C'_{\gamma i}}{RC/MPC_{eff}} \qquad (1\text{-}11)$$

where: C_{2100} = limiting concentration at monitor RT-2100, μCi/ml.

C, $\sum_i C'_{\gamma i}$, MPC_{eff} = values of C, $\sum_i C'_{\gamma i}$ and MPC_{eff} (defined in STEPS 1 and 2 above)

R = 350 gpm/pump (x no. sump pumps to be run)

RW, S_{2100}, and S_{2101} are administrative values used for simultaneous releases from the Radwaste Effluent discharge, the Reheater Pit Sump, and the Yard Drain Sump. The fractions RW, S_{2100}, and S_{2101} will be assigned such that $(RW + S_{2100} + S_{2101}) \leq 1.0$. The 1.0 is an administrative value used to account for the potential activity for all release pathways. This assures that the total concentration from all release points to the plant discharge will not result in a release of concentrations exceeding the limits of 10CFR20, Appendix B, Table II, Column 2 from the site.

NOTE: If $C_{2100} \leq \sum_i C'_{\gamma i}$, then no release is possible. To increase C_{2100}, increase the dilution flow F (by running more pumps) and recalculate C_{2100} using the new value of F and equation (1-11).

1.4.2.2 YARD SUMP EFFLUENT LINE (RT-2101)

The value of C_{2101}, the concentration limit at the detector, μCi/ml, is determined using:

$$C_{2101} \leq \frac{(S_{2101})\ (F+R)\ \Sigma_i C'_{\gamma i}}{RC/MPC_{eff}} \tag{1-12}$$

where:

C_{2101} = limiting concentration at monitor RT-2101, μCi/ml.

C, $\sum_i C'_{\gamma i}$, MPC_{eff} = values of C, $\sum_i C'_{\gamma i}$ and MPC_{eff} (defined in STEPS 1 and 2 above)

R = 1000 gpm/pump (x no. sump pumps to be run)

RW, S_{2100}, and S_{2101} are administrative values used for simultaneous releases from the Radwaste Effluent discharge, the Reheater Pit Sump, and the Yard Drain Sump. The fractions RW, S_{2100}, and S_{2101} will be assigned such that $(RW + S_{2100} + S_{2101}) \leq 1.0$. The 1.0 is an administrative value used to account for the potential activity for all release pathways. This assures that the total concentration from all release points to the plant discharge will not result in a release of concentrations exceeding the limits of 10CFR20, Appendix B, Table II, Column 2 from the site.

NOTE: If $C_{2101} \leq \sum_i C'_{\gamma i}$, then no release is possible. To increase C_{2101}, increase the dilution flow F (by running more pumps) and recalculate C_{2101} using the new value of F and equation (1-12).

1.0 **RADIOACTIVE LIQUID EFFLUENTS** (Continued)

Table 1-2[a]

Liquid Effluent Radiation Monitor Calibration Constants
(μCi/cc/cpm)

MONITOR	Co-60	Ba-133	Cs-137
RT-1218	5.24E-9	6.37E-9	9.51E-9
RT-2100	1.48E-9	2.19E-9	2.89E-9
RT-2101	1.35E-9	2.12E-9	3.00E-9

[a] This table provides typical (±20%) calibration constants for the liquid effluent radiation monitors.

1.5 DOSE CALCULATION FOR LIQUID EFFLUENTS

The liquid releases considered in the following dose calculations are described in Section 1.4. The dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas are calculated for the purpose of implementing Specification 1.2.1 using the following expression.

$$D_\tau = \sum_{i}^{n} \left[A_{i\tau} \sum_{j}^{m} (\Delta t_j \ C_{ij} \ F_j) \right] \tag{1-13}$$

where:

$A_{i\tau}$ = site related adult ingestion dose commitment factor to the total body or an organ, τ, for each identified principal gamma and beta emitter, i, from Table 1-3, mrem/hr per μCi/ml.

n = number of principal gamma and beta emitters, i.

C_{ij} = average concentration of radionuclide, i, in the undiluted liquid effluent during time period, Δt_j, μCi/ml.

m = number of time periods, j.

D_τ = dose commitment to the total body or an organ, τ, from the liquid effluent for the time period, Δt_j, mrem.

F_j = average dilution factor (actually mixing ratio) for C_{ij} during the time period, Δt_j. This factor is the ratio of the maximum undiluted liquid waste flow during time period, Δt_j, to the average flow from the site discharge structure to unrestricted receiving waters,

or = $\dfrac{\text{maximum liquid radioactive waste flow}}{\text{discharge structure exit flow}}$

Δt_j = length of the j^{th} time period over which C_{ij} and F_j are averaged for all liquid releases, hours.

TABLE 1-3

DOSE COMMITMENT FACTORS*, $A_{i\tau}$
(mrem/hr per μCi/ml)

Radio-Nuclide	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
H-3		2.82E-1	2.82E-1	2.82E-1	2.82E-1	2.82E-1	2.82E-1
Na-24	4.57E-1	4.57E-1	4.57E-1	4.57E-1	4.57E-1	4.57E-1	4.57E-1
Cr-51			5.58E+0	3.34E+0	1.23E+0	7.40E+0	1.40E+3
Mn-54		7.06E+3	1.35E+3		2.10E+3		2.16E+4
Mn-56		1.78E+2	3.15E+1		2.26E+2		5.67E+3
Fe-55	5.11E+4	3.53E+4	8.23E+3			1.97E+4	2.03E+4
Fe-59	8.06E+4	1.90E+5	7.27E+4			5.30E+4	6.32E+5
Co-57		1.42E+2	2.36E+2				3.59E+3
Co-58		6.03E+2	1.35E+3				1.22E+4
Co-60		1.73E+3	3.82E+3				3.25E+4
Cu-64		2.14E+2	1.01E+2		5.40E+2		1.83E+4
Zn-65	1.61E+5	5.13E+5	2.32E+5		3.43E+5		3.23E+5
Br-84			9.39E-2				7.37E-7
Rb-88		1.79E+0	9.49E-1				2.47E-11
Sr-89	4.99E+3		1.43E+2				8.00E+2
Sr-90	1.23E+5		3.01E+4				3.55E+3
Sr-91	9.18E+1		3.71E+0				4.37E+2
Sr-92	3.48E+1		1.51E+0				6.90E+2
Y-90	6.06E+0		1.63E-1				6.42E+4
Y-91m	5.73E-2		2.22E-3				1.68E-1
Y-92	5.32E-1		1.56E-2				9.32E+3
Zr-95	1.59E+1	5.11E+0	3.46E+0		8.02E+0		1.62E+4
Zr-97	8.81E-1	1.78E-1	8.13E-2		2.68E-1		5.51E+4
Nb-95	1.84E+0	1.03E+0	5.51E-1		1.01E+0		6.22E+3
Nb-95m	1.84E+0	1.03E+0	5.51E-1		1.01E+0		6.22E+3
Nb-97	1.55E-2	3.91E-3	1.43E-3		4.56E-3		1.44E+1
Mo-99		1.28E+2	2.43E+1		2.89E+2		2.96E+2
Tc-99M	1.30E-2	3.66E-2	4.66E-1		5.56E-1	1.79E-2	2.17E+1
Ru-103	1.07E+2		4.60E+1		4.07E+2		1.25E+4
Ru-106	1.59E+3		2.01E+2		3.06E+3		1.03E+5
Ag-110m	1.42E+3	1.32E+3	7.82E+2		2.59E+3		5.37E+5
Sn-113							2.26E+5
Sn-117m							2.26E+5
Sb-124	2.76E+2	5.22E+0	1.09E+2	6.70E-1		2.15E+2	7.84E+3
Sb-125	1.77E+2	1.97E+0	4.20E+1	1.79E-1		1.36E+2	1.94E+3
Te-129m	9.31E+2	3.47E+2	1.47E+2	3.20E+2	3.89E+3		4.69E+3
Te-132	2.04E+2	1.32E+2	1.24E+2	1.46E+2	1.27E+3		6.24E+3
I -131	2.18E+2	3.12E+2	1.79E+2	1.02E+5	5.35E+2		8.23E+1
I- 132	1.06E+1	2.85E+1	9.96E+0	9.96E+2	4.54E+1		5.35E+0
I -133	7.45E+1	1.30E+2	3.95E+1	1.90E+4	2.26E+2		1.16E+2
I -134	5.56E+0	1.51E+1	5.40E+0	2.62E+2	2.40E+1		1.32E-2
I -135	2.32E+1	6.08E+1	2.24E+1	4.01E+3	9.75E+1		6.87E+1

NOTE: where no value is given, no data are available

*Sources: Reg. Guide 1.109, Table E-11, Table A-1
USNRC NUREG-0172, Table 4
ICRP-30, Part 3, Supplement A

Methodology: USNRC NUREG-0133, Section 4.3.1

TABLE 1-3

DOSE COMMITMENT FACTORS*, $A_{i\tau}$
(mrem/hr per μCi/ml)

Radio-Nuclide	Bone	Liver	Total Body	Thyroid	Kidney	Lung	GI-LLI
Cs-134	6.84E+3	1.63E+4	1.33E+4		5.27E+3	1.75E+3	2.85E+2
Cs-136	7.16E+2	2.83E+3	2.04E+3		1.57E+3	2.16E+2	3.21E+2
Cs-137	8.77E+3	1.20E+4	7.85E+3		4.07E+3	1.35E+3	2.32E+2
Cs-138	6.07E+0	1.20E+1	5.94E+0		8.81E+0	8.70E-1	5.12E-5
Ba-139	7.85E+0	5.59E-3	2.30E-1		5.23E-3	3.17E-3	1.39E+1
Ba-140	1.64E+3	2.06E+0	1.08E+2		7.02E-1	1.18E+0	3.38E+3
La-140	1.57E+0	7.94E-1	2.10E-1				5.83E+4
Ce-141	3.43E+0	2.32E+0	2.63E-1		1.08E+0		8.86E+3
Ce-143	6.04E-1	4.46E+2	4.94E-2		1.97E-1		1.67E+4
Ce-144	1.79E+2	7.47E+1	9.59E+0		4.43E+1		6.04E+4
Nd-147	3.96E+0	4.58E+0	2.74E-1		2.68E+0		2.20E+4
W -187	9.16E+0	7.66E+0	2.68E+0				2.51E+3
Np-239	3.53E-2	3.47E-3	1.91E-3		1.08E-2		7.11E+2

NOTE: where no value is given, no data are available

*Sources: Reg. Guide 1.109, Table E-11, Table A-1
USNRC NUREG-0172, Table 4
ICRP-30, Part 3, Supplement A

Methodology: USNRC NUREG-0133, Section 4.3.1

1.0 **RADIOACTIVE LIQUID EFFLUENTS** (Continued)

1.6 REPRESENTATIVE SAMPLING

Prior to sampling of a batch release, each batch shall be thoroughly mixed to assure representative sampling in accordance with the requirements of Regulatory Guide 1.21 and NUREG-0800, Section 11.5. The methodology for mixing and sampling is described in SO123-III-5.23, "Generating Effluent Releases Permits Using The VAX Computer" and SO123-III-5.2.1 "Unit 1 Radioactive Liquid Radwaste Sampling and Analysis".

2.0 <u>RADIOACTIVE GASEOUS EFFLUENTS</u>

2.1 <u>DOSE RATE</u>

2.1.1 SPECIFICATION

<u>Applicability</u>: At all times.

<u>Objective</u>: Maintain the dose rate at the exclusion area boundary from radioactive gaseous effluents within 10 CFR 20 limits.

<u>Specification</u>:

A. The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Figure 6-1) shall be limited to the following values:

1. The dose rate limit for noble gases shall be $\leq$ 500 mrem/year to the total body and $\leq$ 3000 mrem/year to the skin, and

2. The dose rate limit for I-131, I-133, for tritium and for all radionuclides in particulate form with half lives greater than 8 days shall be $\leq$ 1500 mrem/year to any organ.

B. Action

With the dose rate(s) exceeding the above limits, without delay restore the release rate to within the above limit(s).

2.1.2 SURVEILLANCE

Applicability: At all times.

Objective: To verify the dose rate due to the discharge of radioactive gaseous effluents is maintained within 10 CFR 20 limits.

Specification:

A. The dose rate due to noble gases in gaseous effluents shall be determined to be within the limits of Specification 2.1.1 in accordance with Section 2.5.1.

B. The dose rate due to iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the limits of Specification 2.1.1 in accordance with Section 2.5.2 by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 2-1.

2.0 **RADIOACTIVE GASEOUS EFFLUENTS** (Continued)

TABLE 2-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[a] (μCi/ml)
Plant Stack	M Grab Sample	M	Principal Gamma Emitters[b]	1×10^{-4}
			H-3[c]	1×10^{-6}
	Continuous[d]	W[e] Charcoal Sample	I-131	1×10^{-12}
	Continuous[d]	W[e] Particulate Sample	Principal Gamma Emitters[b] (I-131, Others)	1×10^{-11}
	Continuous[d]	M Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous[d]	Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous[d]	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1×10^{-6}

TABLE 2-1
(Continued)

TABLE NOTATION

a. The LLD is defined, for purposes of these specifications as the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with a 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda\ \Delta t)}$$

where,

LLD is "a priori" lower limit of detection as defined above (as microcuries per unit mass or volume).

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute).

E is the counting efficiency (as counts per disintegration),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of disintegrations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide,

Δt for plant effluents is the elapsed time between the midpoint of sample collection and time of counting,

Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an _a priori_ (before the fact) limit representing the capability of a measurement system and not as an _a posteriori_ (after the fact) limit for a particular measurement.

b. The principal gamma emitters for which the LLD specification applies are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

TABLE 2-1
(Continued)

TABLE NOTATION (Continued)

c. Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel area, whenever spent fuel is in the spent fuel pool.

d. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Specifications 2.1.1, 2.2.1, and 2.3.1.

e. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler.

2.0 **RADIOACTIVE GASEOUS EFFLUENTS** (Continued)

2.2 DOSE, NOBLE GASES

2.2.1 **SPECIFICATION**

Applicability: At all times.

Objective: Maintain the dose due to noble gases in gaseous effluents as low as is reasonably achievable.

Specification:

A. The air dose due to noble gases released in gaseous effluents from San Onofre Unit 1 to areas at and beyond the SITE BOUNDARY (see Figure 6-1) shall be limited to the following:

1. During any calendar quarter: ≤ 5 mrad for gamma radiation and ≤ 10 mrad for beta radiation.

2. During any calendar year: ≤ 10 mrad for gamma radiation and ≤ 20 mrad for beta radiation.

B. Action:

1. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification D6.9.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

2.2 DOSE, NOBLE GASES (Continued)

2.2.2 **SURVEILLANCE**

Applicability: At all times.

Objective: To verify the dose due to noble gases in radioactive gaseous effluent is maintained as low as is reasonably achievable.

Specification: Cumulative dose contributions for noble gases for the current calendar quarter and current calendar year shall be determined in accordance with Section 2.7.1 at least once per 31 days.

2.0 **RADIOACTIVE GASEOUS EFFLUENTS** (Continued)

2.3 DOSE, IODINE-131, IODINE-133, TRITIUM AND RADIONUCLIDES IN PARTICULATE FORM

2.3.1 SPECIFICATION

Applicability: At all times.

Objective: Maintain the dose due to radioiodine, radioactive materials in particulate form and radionuclides other than noble gases in gaseous effluents as low as is reasonably achievable.

Specification:

A. The dose to a MEMBER OF THE PUBLIC from I-131, I-133, from tritium and from all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from San Onofre Unit 1 to areas at and beyond the SITE BOUNDARY (see Figure 6-1) shall be limited to the following:

   1. During any calendar quarter: $\leq$ 7.5 mrem to any organ; and

   2. During any calendar year: $\leq$ 15 mrem to any organ.

B. Action:

   1. With the calculated dose from the release of I-131, I-133, tritium and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification D6.9.2, a Special Report that identifies the cause(s) for exceeding the limit and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

2.0 **RADIOACTIVE GASEOUS EFFLUENTS** (Continued)

2.3 DOSE, IODINE-131, IODINE-133, TRITIUM AND RADIONUCLIDES IN PARTICULATE FORM (Continued)

2.3.2 **SURVEILLANCE**

Applicability: At all times.

Objective: To verify the dose due to iodine-131, iodine-133, tritium and radionuclides in particulate form with half-lives greater than 8 days is maintained as low as is reasonably achievable.

Specification: Cumulative dose contributions for the current calendar quarter and current calendar year for iodine-131, iodine-133, tritium and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with Section 2.7.2 at least once per 31 days.

2.4 GASEOUS RADWASTE TREATMENT

2.4.1 **DELETED**

2.0 **RADIOACTIVE GASEOUS EFFLUENTS** (Continued)

2.5 GASEOUS EFFLUENT MONITOR SETPOINTS

2.5.1 **PLANT VENT STACK**

For the purpose of implementation of Specification 2.1.1, the alarm setpoint level for noble gas monitors is based on the gaseous effluent flow rate and meteorological dispersion factor.

Total Body

$$C_{det} = \frac{(0.03)\left(2120\ \frac{\text{cfm}}{\text{m}^3/\text{sec}}\right)(\ 500\ \text{mrem/yr})\left(10^{-6}\ \text{m}^3/\text{cc}\right)}{(\text{Flow rate, cfm})\left(\chi/Q,\ \text{sec/m}^3\right)\Sigma_i\left(K_i,\ \frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}\right)\left(\frac{C_i}{C_{tot}}\right)} \qquad (2\text{-}1)$$

Skin

$$C_{det} = \frac{(0.03)\left(2120\ \frac{\text{cfm}}{\text{m}^3/\text{sec}}\right)(\ 3000\ \text{mrem/yr})\left(10^{-6}\ \text{m}^3/\text{cc}\right)}{(\text{Flow rate, cfm})\left(\chi/Q,\ \text{sec/m}^3\right)\Sigma_i\left(L_i + 1.1M_i\ \frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}\right)\left(\frac{C_i}{C_{tot}}\right)} \qquad (2\text{-}2)$$

2.5.1 **PLANT VENT STACK** (Continued)

where:

C_{det}	= instantaneous concentration at the detector, μCi/cc
0.03	= an administrative factor used to account for potential activity from other airborne release pathways on Site
K_i	= total body dose conversion factor for the i^{th} gamma emitting noble gas, from Table 2-3, mrem/yr per μCi/m^3
L_i	= skin dose conversion factor for the i^{th} noble gas, from Table 2-3, mrem/yr per μCi/m^3
M_i	= air dose conversion factor for the i^{th} noble gas, from Table 2-3, mrem/yr per μCi/m^3
1.1	= conversion factor to convert gamma air dose to skin dose.
3000 mrem/yr	= skin dose rate limit, as specified by Specification 2.1.1
500 mrem/yr	= total body dose rate limit, as specified by Specification 2.1.1
C_i	= concentration of the i^{th} noble gas, as determined by sample analysis, μCi/cc
C_{tot}	= total concentration of noble gases, as determined by sample analysis, μCi/cc
Flow Rate	= plant vent flow rate, cfm = 20,000 cfm/fan (x no. of fans to be run)
2120	= conversion constant, cfm to m^3/sec
X/Q	= historical annual average dispersion factor for any landward sector = 1.3E-5 sec/m^3

RT-1254, Wide Range Gas Monitor

The maximum release rate, μCi/sec, is determined by converting the concentration at the detector, C_{det}, to an equivalent release rate, μCi/sec, as follows:

$$A_{max} = (C_{det},\ \mu Ci/cc)\ (\text{flow rate, cc/sec}) \quad (2\text{-}3)$$

where:

A_{max} = maximum permissible release rate

C_{det} = smaller of the values of C_{det} obtained from equations (2-1) and (2-2).

Flow Rate = vent stack flow rate, cc/sec
= 9.44×10^6 cc/sec x (number of fans)

The release rate setpoint shall not be set greater than the maximum release rate determined above when this monitor is being used to meet the requirements of Specification 2.1.1.

2.0 **RADIOACTIVE GASEOUS EFFLUENTS** (Continued)

2.6 GASEOUS EFFLUENT DOSE RATE

The methodology used for the purpose of implementation of Specification 2.1.1 for the dose rate above background to an individual in an unrestricted area is calculated by using the following expressions:

2.6.1 **FOR NOBLE GASES:**

$$\dot{D}_{TB} = \Sigma_i \left[K_i (\overline{X/Q}) \ \dot{Q}_i \right] \qquad (2\text{-}7)$$

$$\dot{D}_s = \Sigma_i \left[(L_i + 1.1M_i) \ (\overline{X/Q}) \ \dot{Q}_i \right] \qquad (2\text{-}8)$$

where:

$\dot{D}_{TB}$ = total body dose rate in unrestricted areas due to airborne radioactive effluents, mrem/yr.

$\dot{D}_s$ = skin dose rate in unrestricted areas due to airborne radioactive effluents, mrem/yr.

K_i = total body dose factor due to gamma emissions for each identified noble gas radionuclide, i, from Table 2-3, mrem/yr per $\mu Ci/m^3$.

L_i = skin dose factor due to the beta emissions for each identified noble gas radionuclide, i, from Table 2-3, mrem/yr per $\mu Ci/m^3$.

M_i = air dose factor due to gamma emissions for each identified noble gas radionuclide, i, from Table 2-3, mrad/yr per $\mu Ci/m^3$ (Unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose.)

$\dot{Q}_i$ = measured or calculated release rate of radionuclide, i, $\mu Ci/sec$

$(\overline{X/Q})$ = 1.3E-5 sec/m^3. The maximum annual average atmospheric dispersion factor for any area at or beyond the unrestricted area boundary for a landward sector.

2.6 GASEOUS EFFLUENT DOSE RATE (Continued)

2.6.2 **FOR I-131, I-133, RADIOACTIVE MATERIALS IN PARTICULATE FORM WITH HALF LIVES GREATER THAN EIGHT DAYS AND H-3:**

$$\dot{D}_o = \Sigma_i \left[\Sigma_k (P_{ik} \bar{W}_k) \dot{Q}_i \right] \qquad (2\text{-}9)$$

$\dot{D}_o$ = organ dose rate in unrestricted areas due to airborne effluents, mrem/yr

$\dot{Q}_i$ = measured or calculated release rate of radionuclide, i, μCi/sec

P_{ik} = dose parameter for radionuclide, i, for pathway, k, from Table 2-4 for the inhalation pathway, mrem/yr per $\mu Ci/m^3$. The dose factors are based on the critical individual organ and the child age group.

$\bar{W}_k$ = highest calculated annual average dispersion parameter for estimating the dose to an individual at or beyond the unrestricted area boundary for pathway k.

= $(\overline{X/Q})$, 1.3E-5 sec/m^3 for the inhalation pathway. The location is the unrestricted area in the NW sector.

= $(\overline{D/Q})$, 7.2E-8 sec/m^3 for the food and ground pathways. The location is the unrestricted area in the NW sector.

2.0 RADIOACTIVE GASEOUS EFFLUENTS (Continued)

2.7 GASEOUS EFFLUENT DOSE CALCULATION

2.7.1 DOSE FROM NOBLE GASES IN GASEOUS EFFLUENT

The gaseous releases considered in the following dose calculations are described in Section 2.5.1. The air dose in unrestricted areas due to noble gases released in gaseous effluents is calculated using the following expressions:

2.7.1.1 FOR HISTORICAL METEOROLOGY:

$$D_\gamma = 3.17\text{x}10^{-8}\ \Sigma_i \left[M_i\ (\overline{X/Q})\ Q_i\right] \tag{2-10}$$

$$D_\beta = 3.17\text{x}10^{-8}\ \Sigma_i \left[N_i\ (\overline{X/Q})\ Q_i\right] \tag{2-11}$$

where:

D_γ	=	total gamma air dose from gaseous effluents, mrad
D_β	=	total beta air dose from gaseous effluents, mrad
M_i	=	air dose factor due to gamma emissions for each identified noble gas radionuclide, i, from Table 2-3, mrad/yr per μCi/m^3
N_i	=	air dose due to beta emissions for each identified noble gas radionuclide, i, from Table 2-3, mrad/yr per μCi/m^3
$(\overline{X/Q})$	=	1.3E-5 sec/m^3. The maximum annual average atmospheric dispersion factor for any area at or beyond the unrestricted area boundary for a landward sector.
Q_i	=	amount of noble gas radionuclide, i, released in gaseous effluents, μCi.
$3.17\text{x}\ 10^{-8}$	=	inverse seconds/year

2.7.1.2 FOR METEOROLOGY CONCURRENT WITH RELEASE:

NOTE: Consistent with the methodology provided in Regulatory Guide 1.109 and the following equations, RRRGS (Radioactive Release Report Generating System) software is used to perform the actual calculations.

$$D_{\gamma\theta} = 1.14\times10^{-4}\Sigma_i\left[M_i\Sigma_j\left(\Delta t_j\ (X/Q)_{j\theta}\ \dot{Q}_{ij}\right)\right] \qquad (2\text{-}12)$$

$$D_{\beta\theta} = 1.14\times10^{-4}\Sigma_i\left[N_i\Sigma_j\left(\Delta t_j\ (X/Q)_{j\theta}\ \dot{Q}_{ij}\right)\right] \qquad (2\text{-}13)$$

where:

$D_{\gamma\theta}$ = total gamma air dose from gaseous effluents in sector θ, mrad

$D_{\beta\theta}$ = total beta air dose from gaseous effluents in sector θ, mrad

M_i = air dose factor due to gamma emissions for each identified noble gas radionuclide, i, from Table 2-3, mrad/yr per $\mu Ci/m^3$

N_i = air dose factor due to beta emissions for each identified noble gas radionuclide, i, from Table 2-3, mrad/yr per $\mu Ci/m^3$

Δt_j = length of the j^{th} time period over which $(X/Q)_{j\theta}$ and $\dot{Q}_{ij}$ are averaged for gaseous releases, hours

$(X/Q)_{j\theta}$ = atmospheric dispersion factor for time period, Δt_j at exclusion boundary location in landward sector θ determined by concurrent meteorology, sec/m^3

$\dot{Q}_{ij}$ = average release rate of radionuclide, i,in gaseous effluents during time period, Δt_j, $\mu Ci/sec$

1.14×10^{-4} = inverse hours/year

2.7.2 DOSE FROM I-131, I-133, RADIOACTIVE MATERIAL IN PARTICULATE FORM AND H-3

The dose to an individual from I-131, I-133, radioactive materials in particulate form with half lives greater than eight days and H-3 in gaseous effluents released to unrestricted areas is calculated using the following expressions:

2.7.2.1 FOR HISTORICAL METEOROLOGY:

$$D_o = 3.17\text{x}10^{-8}\ \Sigma_i \left[\Sigma_k (R_{ik} W_k)\ Q_i\right] \qquad (2\text{-}14)$$

where:

D_o = total projected dose from gaseous effluents to an individual, mrem

Q_i = amount of radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half lives greater than eight days, i, released in gaseous effluents, μCi

$\sum_k R_{ik} W_k$ = sum of all pathways k for radionuclide, i, of the R_i* W product, mrem/yr per μCi/sec. The $\sum_k R_{ik} W_k$ value for each radionuclide, i, is given in Table 2-5. The value given is the maximum $\sum_k R_{ik} W_k$ for all locations and is based on the most restrictive age groups.

R_{ik} = dose factor for each identified radionuclide, i, for pathway k (for the inhalation pathway, mrem/yr per μCi/m^3 and for the food and ground plane pathways, m^2-mrem/yr per μCi/sec at the controlling location. The R_{ik}'s for each age group are given in Tables 2-6 thru 2-16. Data in these tables are derived using the NRC code, PARTS. (See the annual update of revised R_i parameters based on changes in the Land Use Census provided by Corporate Health Physics and Environmental.)

W_k = annual average dispersion parameter for estimating the dose to an individual at the controlling location for pathway k.

= $(\overline{X/Q})$ for the inhalation pathway, sec/m^3. The $(\overline{X/Q})$ for each controlling location is given in Tables 2-6 thru 2-16.

= $(\overline{D/Q})$ for the food and ground plane pathways, m^{-2}. The $(\overline{D/Q})$ for each controlling location are given in Tables 2-6 thru 2-16.

2.7.2 **DOSE FROM I-131, I-133, RADIOACTIVE MATERIAL IN PARTICULATE FORM AND H-3** (Continued)

2.7.2.2 FOR METEOROLOGY CONCURRENT WITH RELEASES:

NOTE: Consistent with the methodology provided in Regulatory Guide 1.109 and the following equations, RRRGS (Radioactive Release Report Generating System) software is used to perform the actual calculations.

$$D_\theta = 1.14 \times 10^{-4} \sum_i^l \sum_j^m \sum_k^n \left[(\Delta t_j)\ (R_{ik\theta})\ (W_{jk\theta})\ (\dot{Q}_{ij}) \right] \quad (2\text{-}15)$$

where:

D_θ = total annual dose from gaseous effluents to an individual in sector θ, mrem.

Δt_j = length of the j^{th} period over which $W_{jk\theta}$ and $\dot{Q}_{ij}$ are averaged for gaseous releases, hours

$\dot{Q}_{ij}$ = average release rate of radionuclide, i, in gaseous effluents during time period Δt_j, μCi/sec

$R_{ik\theta}$ = dose factor for each identified radionuclide i, for pathway k for sector θ (for the inhalation pathway, mrem/yr per $\mu Ci/m^3$, and for the food and ground plane pathways, m^2 mrem/yr per μCi/sec) at the controlling location.

The dose factor is based on the maximum dose to the most restrictive age group. A listing of R_{ik} for the controlling locations in each landward sector for each group is given in Tables 2-6 thru 2-16. The θ is determined by the concurrent meteorology.

$W_{jk\theta}$ = dispersion parameters for the time period Δt_j for each pathway k for calculating the dose to an individual at the controlling location in sector θ using concurrent meteorological conditions.

= (X/Q) for the inhalation pathway, sec/m^3

= (D/Q) for the food and ground plane pathways, m^{-2}

TABLE 2-3

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS**

Radio-Nuclide	Total Body Dose Factor K_i (mrem/yr per $\mu Ci/m^3$)	Skin Dose Factor L_i (mrem/yr per $\mu Ci/m^3$)	Gamma Air Dose Factor M_i (mrad/yr per $\mu Ci/m^3$)	Beta Air Dose Factor N_i (mrad/yr per $\mu Ci/m^3$)
Kr-85m	1.17E+3	1.46E+3	1.23E+3	1.97E+3
Kr-85	1.61E+1	1.34E+3	1.72E+1	1.95E+3
Kr-87	5.92E+3	9.73E+3	6.17E+3	1.03E+4
Kr-88	1.47E+4	2.37E+3	1.52E+4	2.93E+3
Xe-131m	9.15E+1	4.76E+2	1.56E+2	1.11E+3
Xe-133m	2.51E+2	9.94E+2	3.27E+2	1.48E+3
Xe-133	2.94E+2	3.06E+2	3.53E+2	1.05E+3
Xe-135m	3.12E+3	7.11E+2	3.36E+3	7.39E+2
Xe-135	1.81E+3	1.86E+3	1.92E+3	2.46E+3
Xe-138	8.83E+3	4.13E+3	9.21E+3	4.75E+3
Ar-41	8.84E+3	2.69E+3	9.30E+3	3.28E+3

**Source: USNRC Reg. Guide 1.109, Table B-1

TABLE 2-4

DOSE PARAMETER P_{ik}*

CHILD AGE GROUP
CRITICAL ORGAN

Radionuclide	Inhalation Pathway (mrem/yr per μCi/m^3)	Radionuclide	Inhalation Pathway (mrem/yr per μCi/m^3)
H - 3	1.1E+3	I -131	1.6E+7
Cr-51	1.7E+4	I -132	1.9E+5
Mn-54	1.6E+6	I -133	3.8E+6
Co-57	5.1E+5	I -134	5.1E+4
Co-58	1.1E+6	I -135	7.9E+5
Co-60	7.1E+6	Cs-134	1.0E+6
Sr-89	2.2E+6	Cs-136	1.7E+5
Sr-90	1.0E+8	Cs-137	9.1E+5
Zr-95	2.2E+6	Ba-140	1.7E+6
Nb-95	6.1E+5	Ce-141	5.4E+5
Ru-103	6.6E+5	Ce-144	1.2E+7
Te-129m	1.8E+6		

*Source: USNRC NUREG-0133, Section 5.2.1.1

TABLE 2-5

CONTROLLING LOCATION FACTORS

Radionuclide	$\sum_k R_{ik} W_k$ mrem/yr per μCi/sec	Use:
H -3	1.64E-3	B: Outage Workers
Cr-51	7.83E-2	B: Outage Workers
Mn-54	1.82E+1	B: Outage Workers
Co-57	4.52E+0	B: Outage Workers
Co-58	6.18E+0	B: Outage Workers
Co-60	2.56E+2	B: Outage Workers
Sr-89	4.96E+1	Q: SC Ranch (No. Res.)
Sr-90	2.08E+3	Q: SC Ranch (No. Res.)
Zr-95	6.37E+0	B: Outage Workers
Nb-95	6.90E+0	E: Deer Consumer/Hunter
Ru-103	1.09E+1	E: Deer Consumer/Hunter
Te-129m	5.40E+0	E: Deer Consumer/Hunter
Cs-134	7.97E+1	B: Outage Workers
Cs-136	1.95E+0	B: Outage Workers
Cs-137	1.17E+2	B: Outage Workers
Ba-140	2.88E+0	B: Outage Workers
Ce-141	9.33E-1	B: Outage Workers
Ce-144	1.92E+1	Q: SC Ranch (No. Res.)
I -131	2.69E+1	Q: SC Res with Garden
I -132	2.64E-1	B: Outage Workers
I -133	5.10E+0	B: Outage Workers
I -134	7.14E-2	B: Outage Workers
I -135	1.04E+0	B: Outage Workers
UN-ID	1.01E+1	B: Outage Workers

Footnote: These values to be used in manual calculations are the maximum $\sum_k R_{ik} W_k$ for all locations based on the most restrictive age group.

TABLE 2-7

DOSE PARAMETER R_i FOR SECTOR P

Pathway = Surf Beach/Life Guard   Distance = 0.4 miles
X/Q = 2.7E-6 sec/m^3 D/Q = 1.2E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	7.8E+0	-0-	4.2E+1	-0-	9.6E+1	-0-
Cr-51	-0-	-0-	1.2E+2	3.2E+4	6.9E+2	1.5E+5	1.1E+3	3.5E+5
Mn-54	-0-	-0-	1.1E+4	9.5E+6	6.5E+4	4.5E+7	1.1E+5	1.1E+8
Co-57	-0-	-0-	3.5E+3	2.4E+6	1.9E+4	1.1E+7	2.8E+4	2.6E+7
Co-58	-0-	-0-	7.6E+3	2.6E+6	4.4E+4	1.2E+7	7.1E+4	2.9E+7
Co-60	-0-	-0-	4.9E+4	1.5E+8	2.9E+5	7.0E+8	4.5E+5	1.6E+9
Sr-89	-0-	-0-	1.5E+4	1.5E+2	7.9E+4	7.1E+2	1.1E+5	1.6E+3
Sr-90	-0-	-0-	7.0E+5	-0-	3.5E+6	-0-	7.5E+6	-0-
Zr-95	-0-	-0-	1.5E+4	1.7E+6	8.8E+4	8.2E+6	1.3E+5	1.9E+7
Nb-95	-0-	-0-	4.2E+3	9.4E+5	2.5E+4	4.5E+6	3.8E+4	1.0E+7
Ru-103	-0-	-0-	4.6E+3	7.5E+5	2.6E+4	3.6E+6	3.8E+4	8.3E+6
Te-129m	-0-	-0-	1.2E+4	1.4E+5	6.5E+4	6.4E+5	8.8E+4	1.5E+6
Cs-134	-0-	-0-	7.0E+3	4.7E+7	3.7E+4	2.2E+8	6.5E+4	5.2E+8
Cs-136	-0-	-0-	1.2E+3	1.0E+6	6.3E+3	4.9E+6	1.1E+4	1.1E+7
Cs-137	-0-	-0-	6.3E+3	7.1E+7	2.8E+4	3.4E+8	4.7E+4	7.8E+8
Ba-140	-0-	-0-	1.2E+4	1.4E+5	6.6E+4	6.7E+5	9.7E+4	1.6E+6
Ce-141	-0-	-0-	3.8E+3	9.4E+4	2.0E+4	4.5E+5	2.8E+4	1.0E+6
Ce-144	-0-	-0-	8.2E+4	4.8E+5	4.4E+5	2.3E+6	5.9E+5	5.3E+6
I -131	-0-	-0-	1.1E+5	1.2E+5	4.8E+5	5.6E+5	9.1E+5	1.3E+6
I -132	-0-	-0-	1.3E+3	8.5E+3	4.9E+3	4.1E+4	8.7E+3	9.4E+4
I -133	-0-	-0-	2.7E+4	1.7E+4	9.5E+4	8.0E+4	1.6E+5	1.9E+5
I -134	-0-	-0-	3.5E+2	3.1E+3	1.3E+3	1.5E+4	2.3E+3	3.4E+4
I -135	-0-	-0-	5.5E+3	1.7E+4	2.0E+4	8.2E+4	3.4E+4	1.9E+5
UN-ID	-0-	-0-	6.9E+3	5.1E+6	4.1E+4	2.4E+7	6.6E+4	5.7E+7

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

TABLE 2-7

DOSE PARAMETER R_i FOR SECTOR P

Pathway = Cotton Point Estates with Garden   Distance = 2.6 miles
X/Q = 1.3E-7 sec/m^3 D/Q = 3.9E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	4.0E+3	1.3E+3	2.6E+3	1.3E+3	2.3E+3
Cr-51	1.3E+4	4.7E+6	1.7E+4	1.1E+7	2.1E+4	1.5E+7	1.4E+4	1.6E+7
Mn-54	1.0E+6	1.4E+9	1.6E+6	2.0E+9	2.0E+6	2.3E+9	1.4E+6	2.3E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	5.8E+8	5.9E+5	6.6E+8	3.7E+5	6.3E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	7.5E+8	1.3E+6	9.7E+8	9.3E+5	9.9E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.4E+10	8.7E+6	2.5E+10	6.0E+6	2.5E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	3.5E+10	2.4E+6	1.5E+10	1.4E+6	9.8E+9
Sr-90	4.1E+7	-0-	1.0E+8	1.4E+12	1.1E+8	8.3E+11	9.9E+7	6.7E+11
Zr-95	1.8E+6	2.5E+8	2.2E+6	1.1E+9	2.7E+6	1.5E+9	1.8E+6	1.4E+9
Nb-95	4.8E+5	1.4E+8	6.1E+5	4.3E+8	7.5E+5	5.9E+8	5.0E+5	6.1E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	5.0E+8	7.8E+5	6.8E+8	5.0E+5	6.6E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.9E+9	2.0E+6	1.8E+9	1.2E+6	1.5E+9
Cs-134	7.0E+5	6.8E+9	1.0E+6	3.2E+10	1.1E+6	2.3E+10	8.5E+5	1.8E+10
Cs-136	1.3E+5	1.5E+8	1.7E+5	3.7E+8	1.9E+5	3.2E+8	1.5E+5	3.2E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	3.5E+10	8.5E+5	2.4E+10	6.2E+5	1.9E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	3.0E+8	2.0E+6	2.3E+8	1.3E+6	2.8E+8
Ce-141	5.2E+5	1.4E+7	5.4E+5	4.2E+8	6.1E+5	5.5E+8	3.6E+5	5.2E+8
Ce-144	9.8E+6	7.0E+7	1.2E+7	1.0E+10	1.3E+7	1.3E+10	7.8E+6	1.1E+10
I -131	1.5E+7	1.7E+7	1.6E+7	4.8E+10	1.5E+7	3.1E+10	1.2E+7	3.8E+10
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	8.1E+8	2.9E+6	4.6E+8	2.2E+6	5.3E+8
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	1.2E+7	6.2E+5	8.2E+6	4.5E+5	9.1E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	3.5E+9	1.2E+6	2.6E+9	8.6E+5	2.0E+9

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-7

DOSE PARAMETER R_i FOR SECTOR P

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TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = Outage Workers
X/Q = 3.2E-6 sec/m^3

Distance = 0.5 miles
D/Q = 1.7E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -131	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -132	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -133	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -134	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
I -135	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-

Inhalation Pathway, units = $\frac{mrem/yr}{\mu Ci/m^3}$

Food & Ground Pathway, units = $\frac{(m^2)(mrem/yr)}{\mu Ci/sec}$

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = San Onofre Mobile Homes — Distance = 1.2 miles
X/Q = 9.1E-7 sec/m^3 — D/Q = 4.3E-9 m^{-2}

Radio-Nuclide	Infant Inhalation Pathway	Infant Food & Ground Pathway	Child Inhalation Pathway	Child Food & Ground Pathway	Teen Inhalation Pathway	Teen Food & Ground Pathway	Adult Inhalation Pathway	Adult Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	-0-	1.3E+3	-0-	1.3E+3	-0-
Cr-51	1.3E+4	4.7E+6	1.7E+4	4.7E+6	2.1E+4	4.7E+6	1.4E+4	4.7E+6
Mn-54	1.0E+6	1.4E+9	1.6E+6	1.4E+9	2.0E+6	1.4E+9	1.4E+6	1.4E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	3.4E+8	5.9E+5	3.4E+8	3.7E+5	3.4E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	3.8E+8	1.3E+6	3.8E+8	9.3E+5	3.8E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.2E+10	8.7E+6	2.2E+10	6.0E+6	2.2E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	2.2E+4	2.4E+6	2.2E+4	1.4E+6	2.2E+4
Sr-90	4.1E+7	-0-	1.0E+8	-0-	1.1E+8	-0-	9.9E+7	-0-
Zr-95	1.8E+6	2.5E+8	2.2E+6	2.5E+8	2.7E+6	2.5E+8	1.8E+6	2.5E+8
Nb-95	4.8E+5	1.4E+8	6.1E+5	1.4E+8	7.5E+5	1.4E+8	5.0E+5	1.4E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	1.1E+8	7.8E+5	1.1E+8	5.0E+5	1.1E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.0E+7	2.0E+6	2.0E+7	1.2E+6	2.0E+7
Cs-134	7.0E+5	6.8E+9	1.0E+6	6.8E+9	1.1E+6	6.8E+9	8.5E+5	6.8E+9
Cs-136	1.3E+5	1.5E+8	1.7E+5	1.5E+8	1.9E+5	1.5E+8	1.5E+5	1.5E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	1.0E+10	8.5E+5	1.0E+10	6.2E+5	1.0E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	2.1E+7	2.0E+6	2.1E+7	1.3E+6	2.1E+7
Ce-141	5.2E+5	1.4E+7	5.4E+5	1.4E+7	6.1E+5	1.4E+7	3.6E+5	1.4E+7
Ce-144	9.8E+6	7.0E+7	1.2E+7	7.0E+7	1.3E+7	7.0E+7	7.8E+6	7.0E+7
I -131	1.5E+7	1.7E+7	1.6E+7	1.7E+7	1.5E+7	1.7E+7	1.2E+7	1.7E+7
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	2.4E+6	2.9E+6	2.4E+6	2.2E+6	2.4E+6
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	2.5E+6	6.2E+5	2.5E+6	4.5E+5	2.5E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	7.5E+8	1.2E+6	7.5E+8	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-8

DOSE PARAMETER R_i FOR SECTOR Q

Pathway = San Mateo Pt Homes
X/Q = 2.8E-7 sec/m^3

Distance = 2.5 miles
D/Q = 1.1E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	-0-	1.3E+3	-0-	1.3E+3	-0-
Cr-51	1.3E+4	4.7E+6	1.7E+4	4.7E+6	2.1E+4	4.7E+6	1.4E+4	4.7E+6
Mn-54	1.0E+6	1.4E+9	1.6E+6	1.4E+9	2.0E+6	1.4E+9	1.4E+6	1.4E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	3.4E+8	5.9E+5	3.4E+8	3.7E+5	3.4E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	3.8E+8	1.3E+6	3.8E+8	9.3E+5	3.8E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.2E+10	8.7E+6	2.2E+10	6.0E+6	2.2E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	2.2E+4	2.4E+6	2.2E+4	1.4E+6	2.2E+4
Sr-90	4.1E+7	-0-	1.0E+8	-0-	1.1E+8	-0-	9.9E+7	-0-
Zr-95	1.8E+6	2.5E+8	2.2E+6	2.5E+8	2.7E+6	2.5E+8	1.8E+6	2.5E+8
Nb-95	4.8E+5	1.4E+8	6.1E+5	1.4E+8	7.5E+5	1.4E+8	5.0E+5	1.4E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	1.1E+8	7.8E+5	1.1E+8	5.0E+5	1.1E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.0E+7	2.0E+6	2.0E+7	1.2E+6	2.0E+7
Cs-134	7.0E+5	6.8E+9	1.0E+6	6.8E+9	1.1E+6	6.8E+9	8.5E+5	6.8E+9
Cs-136	1.3E+5	1.5E+8	1.7E+5	1.5E+8	1.9E+5	1.5E+8	1.5E+5	1.5E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	1.0E+10	8.5E+5	1.0E+10	6.2E+5	1.0E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	2.1E+7	2.0E+6	2.1E+7	1.3E+6	2.1E+7
Ce-141	5.2E+5	1.4E+7	5.4E+5	1.4E+7	6.1E+5	1.4E+7	3.6E+5	1.4E+7
Ce-144	9.8E+6	7.0E+7	1.2E+7	7.0E+7	1.3E+7	7.0E+7	7.8E+6	7.0E+7
I -131	1.5E+7	1.7E+7	1.6E+7	1.7E+7	1.5E+7	1.7E+7	1.2E+7	1.7E+7
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	2.4E+6	2.9E+6	2.4E+6	2.2E+6	2.4E+6
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	2.5E+6	6.2E+5	2.5E+6	4.5E+5	2.5E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	7.5E+8	1.2E+6	7.5E+8	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-9

DOSE PARAMETER R_i FOR SECTOR R

Pathway = San Onofre Mobile Homes   Distance = 1.2 miles
X/Q = 6.0E-7 sec/m^3 D/Q = 3.5E-9 m^{-2}

Radio-Nuclide	Infant Inhalation Pathway	Infant Food & Ground Pathway	Child Inhalation Pathway	Child Food & Ground Pathway	Teen Inhalation Pathway	Teen Food & Ground Pathway	Adult Inhalation Pathway	Adult Food & Ground Pathway
H -3	6.5E+2	-0-	1.1E+3	-0-	1.3E+3	-0-	1.3E+3	-0-
Cr-51	1.3E+4	4.7E+6	1.7E+4	4.7E+6	2.1E+4	4.7E+6	1.4E+4	4.7E+6
Mn-54	1.0E+6	1.4E+9	1.6E+6	1.4E+9	2.0E+6	1.4E+9	1.4E+6	1.4E+9
Co-57	3.8E+5	3.4E+8	5.1E+5	3.4E+8	5.9E+5	3.4E+8	3.7E+5	3.4E+8
Co-58	7.8E+5	3.8E+8	1.1E+6	3.8E+8	1.3E+6	3.8E+8	9.3E+5	3.8E+8
Co-60	4.5E+6	2.2E+10	7.1E+6	2.2E+10	8.7E+6	2.2E+10	6.0E+6	2.2E+10
Sr-89	2.0E+6	2.2E+4	2.2E+6	2.2E+4	2.4E+6	2.2E+4	1.4E+6	2.2E+4
Sr-90	4.1E+7	-0-	1.0E+8	-0-	1.1E+8	-0-	9.9E+7	-0-
Zr-95	1.8E+6	2.5E+8	2.2E+6	2.5E+8	2.7E+6	2.5E+8	1.8E+6	2.5E+8
Nb-95	4.8E+5	1.4E+8	6.1E+5	1.4E+8	7.5E+5	1.4E+8	5.0E+5	1.4E+8
Ru-103	5.5E+5	1.1E+8	6.6E+5	1.1E+8	7.8E+5	1.1E+8	5.0E+5	1.1E+8
Te-129m	1.7E+6	2.0E+7	1.8E+6	2.0E+7	2.0E+6	2.0E+7	1.2E+6	2.0E+7
Cs-134	7.0E+5	6.8E+9	1.0E+6	6.8E+9	1.1E+6	6.8E+9	8.5E+5	6.8E+9
Cs-136	1.3E+5	1.5E+8	1.7E+5	1.5E+8	1.9E+5	1.5E+8	1.5E+5	1.5E+8
Cs-137	6.1E+5	1.0E+10	9.1E+5	1.0E+10	8.5E+5	1.0E+10	6.2E+5	1.0E+10
Ba-140	1.6E+6	2.1E+7	1.7E+6	2.1E+7	2.0E+6	2.1E+7	1.3E+6	2.1E+7
Ce-141	5.2E+5	1.4E+7	5.4E+5	1.4E+7	6.1E+5	1.4E+7	3.6E+5	1.4E+7
Ce-144	9.8E+6	7.0E+7	1.2E+7	7.0E+7	1.3E+7	7.0E+7	7.8E+6	7.0E+7
I -131	1.5E+7	1.7E+7	1.6E+7	1.7E+7	1.5E+7	1.7E+7	1.2E+7	1.7E+7
I -132	1.7E+5	1.2E+6	1.9E+5	1.2E+6	1.5E+5	1.2E+6	1.1E+5	1.2E+6
I -133	3.6E+6	2.4E+6	3.8E+6	2.4E+6	2.9E+6	2.4E+6	2.2E+6	2.4E+6
I -134	4.5E+4	4.5E+5	5.1E+4	4.5E+5	4.0E+4	4.5E+5	3.0E+4	4.5E+5
I -135	7.0E+5	2.5E+6	7.9E+5	2.5E+6	6.2E+5	2.5E+6	4.5E+5	2.5E+6
UN-ID	6.5E+5	7.5E+8	1.0E+6	7.5E+8	1.2E+6	7.5E+8	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-10

DOSE PARAMETER R_i FOR SECTOR A

Page 1 of 1

Pathway = Camp San Mateo — Distance = 3.5 miles
X/Q = 7.8E-8 sec/m^3 — D/Q = 4.4E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-11

DOSE PARAMETER R_i FOR SECTOR B

Page 1 of 2

Pathway = Sanitary Landfill | Distance = 2.1 miles
X/Q = 1.4E-7 sec/m^3 | D/Q = 1.2E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+3	1.1E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+5	3.2E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	8.4E+4	7.8E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	2.1E+5	8.7E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	4.9E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	3.2E+5	4.9E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	2.3E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	4.0E+5	5.7E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	3.1E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+5	2.5E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+5	4.5E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	1.9E+5	1.6E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	3.3E+4	3.4E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+5	2.3E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	2.9E+5	4.7E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	8.3E+4	3.1E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	1.6E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.7E+6	3.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.6E+4	2.8E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	4.9E+5	5.6E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	6.8E+3	1.0E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+5	5.8E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	1.7E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-11

DOSE PARAMETER R_i FOR SECTOR B

Pathway = Outage Workers   Distance = 0.3 miles
X/Q = 3.9E-6 sec/m^3 D/Q = 3.4E-8 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	2.2E+2	-0-	3.7E+2	-0-	4.2E+2	-0-	4.2E+2	-0-
Cr-51	4.3E+3	1.5E+6	5.7E+3	1.5E+6	7.0E+3	1.5E+6	4.8E+3	1.5E+6
Mn-54	3.3E+5	4.6E+8	5.3E+5	4.6E+8	6.6E+5	4.6E+8	4.7E+5	4.6E+8
Co-57	1.3E+5	1.1E+8	1.7E+5	1.1E+8	2.0E+5	1.1E+8	1.2E+5	1.1E+8
Co-58	2.6E+5	1.3E+8	3.7E+5	1.3E+8	4.5E+5	1.3E+8	3.1E+5	1.3E+8
Co-60	1.5E+6	7.2E+9	2.4E+6	7.2E+9	2.9E+6	7.2E+9	2.0E+6	7.2E+9
Sr-89	6.8E+5	7.2E+3	7.2E+5	7.2E+3	8.1E+5	7.2E+3	4.7E+5	7.2E+3
Sr-90	1.4E+7	-0-	3.4E+7	-0-	3.6E+7	-0-	3.3E+7	-0-
Zr-95	5.8E+5	8.4E+7	7.4E+5	8.4E+7	9.0E+5	8.4E+7	5.9E+5	8.4E+7
Nb-95	1.6E+5	4.6E+7	2.0E+5	4.6E+7	2.5E+5	4.6E+7	1.7E+5	4.6E+7
Ru-103	1.8E+5	3.6E+7	2.2E+5	3.6E+7	2.6E+5	3.6E+7	1.7E+5	3.6E+7
Te-129m	5.6E+5	6.6E+6	5.9E+5	6.6E+6	6.6E+5	6.6E+6	3.9E+5	6.6E+6
Cs-134	2.3E+5	2.3E+9	3.4E+5	2.3E+9	3.8E+5	2.3E+9	2.8E+5	2.3E+9
Cs-136	4.5E+4	5.0E+7	5.7E+4	5.0E+7	6.5E+4	5.0E+7	4.9E+4	5.0E+7
Cs-137	2.0E+5	3.4E+9	3.0E+5	3.4E+9	2.8E+5	3.4E+9	2.1E+5	3.4E+9
Ba-140	5.3E+5	6.8E+6	5.8E+5	6.8E+6	6.8E+5	6.8E+6	4.2E+5	6.8E+6
Ce-141	1.7E+5	4.5E+6	1.8E+5	4.5E+6	2.0E+5	4.5E+6	1.2E+5	4.5E+6
Ce-144	3.3E+6	2.3E+7	4.0E+6	2.3E+7	4.5E+6	2.3E+7	2.6E+6	2.3E+7
I -131	4.9E+6	5.7E+6	5.4E+6	5.7E+6	4.9E+6	5.7E+6	4.0E+6	5.7E+6
I -132	5.6E+4	4.1E+5	6.4E+4	4.1E+5	5.0E+4	4.1E+5	3.8E+4	4.1E+5
I -133	1.2E+6	8.2E+5	1.3E+6	8.2E+5	9.7E+5	8.2E+5	7.2E+5	8.2E+5
I -134	1.5E+4	1.5E+5	1.7E+4	1.5E+5	1.3E+4	1.5E+5	9.9E+3	1.5E+5
I -135	2.3E+5	8.4E+5	2.6E+5	8.4E+5	2.1E+5	8.4E+5	1.5E+5	8.4E+5
UN-ID	2.2E+5	2.5E+8	3.3E+5	2.5E+8	4.1E+5	2.5E+8	2.9E+5	2.5E+8

R

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-12

DOSE PARAMETER R_i FOR SECTOR C

Pathway = Camp San Onofre   Distance = 2.7 miles
X/Q = 9.3E-8 sec/m^3 D/Q = 8.3E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-12

DOSE PARAMETER R_i FOR SECTOR C

Pathway = Deer Consumer/Hunter
X/Q = 3.7E-7 sec/m^3

Distance = 1.1 miles
D/Q = 4.6E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-13

DOSE PARAMETER R_i FOR SECTOR D

Pathway = Camp San Onofre   Distance = 3.0 miles
X/Q = 7.0E-8 sec/m^3 D/Q = 7.2E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-14

DOSE PARAMETER R_i FOR SECTOR E

Page 1 of 2

Pathway = Deer Consumer/Hunter — Distance = 1.0 miles

X/Q = 6.0E-7 sec/m^3 — D/Q = 8.4E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway	Inhalation Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	2.8E+1	-0-	2.3E+1	3.5E+1	3.9E+1
Cr-51	-0-	-0-	-0-	5.0E+4	-0-	1.0E+5	3.9E+2	3.2E+5
Mn-54	-0-	-0-	-0-	7.7E+5	-0-	1.4E+6	3.8E+4	4.1E+7
Co-57	-0-	-0-	-0-	4.6E+6	-0-	8.0E+6	1.0E+4	2.3E+7
Co-58	-0-	-0-	-0-	9.6E+6	-0-	1.9E+7	2.5E+4	4.7E+7
Co-60	-0-	-0-	-0-	3.6E+7	-0-	7.2E+7	1.6E+5	7.2E+8
Sr-89	-0-	-0-	-0-	4.9E+7	-0-	2.6E+7	3.8E+4	3.1E+7
Sr-90	-0-	-0-	-0-	1.0E+9	-0-	8.0E+8	2.7E+6	1.2E+9
Zr-95	-0-	-0-	-0-	6.2E+7	-0-	1.1E+8	4.8E+4	2.0E+8
Nb-95	-0-	-0-	-0-	2.3E+8	-0-	4.5E+8	1.4E+4	8.2E+8
Ru-103	-0-	-0-	-0-	4.2E+8	-0-	7.5E+8	1.4E+4	1.3E+9
Te-129m	-0-	-0-	-0-	5.9E+8	-0-	4.5E+8	3.2E+4	6.4E+8
Cs-134	-0-	-0-	-0-	1.4E+8	-0-	1.2E+8	2.3E+4	3.4E+8
Cs-136	-0-	-0-	-0-	5.1E+6	-0-	4.2E+6	4.0E+3	9.5E+6
Cs-137	-0-	-0-	-0-	1.3E+8	-0-	9.3E+7	1.7E+4	4.0E+8
Ba-140	-0-	-0-	-0-	5.0E+6	-0-	4.2E+6	3.5E+4	7.4E+6
Ce-141	-0-	-0-	-0-	1.5E+6	-0-	2.4E+6	9.9E+3	4.2E+6
Ce-144	-0-	-0-	-0-	1.8E+7	-0-	2.9E+7	2.1E+5	4.9E+7
I -131	-0-	-0-	-0-	6.5E+8	-0-	4.3E+8	3.3E+5	5.9E+8
I -132	-0-	-0-	-0-	-0-	-0-	-0-	3.1E+3	3.4E+4
I -133	-0-	-0-	-0-	1.6E+1	-0-	8.6E+0	5.9E+4	6.7E+4
I -134	-0-	-0-	-0-	-0-	-0-	-0-	8.2E+2	1.2E+4
I -135	-0-	-0-	-0-	1.1E-15	-0-	6.3E-16	1.2E+4	6.9E+4
UN-ID	-0-	-0-	-0-	1.1E+8	-0-	9.4E+7	2.4E+4	1.4E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-14

DOSE PARAMETER R_i FOR SECTOR E

Pathway = Camp Horno   Distance = 4.2 miles
X/Q = 7.3E-8 sec/m^3 D/Q = 6.9E-10 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+3	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+4	4.7E+6
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	1.4E+9
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	3.4E+8
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	9.3E+5	3.8E+8
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	6.0E+6	2.2E+10
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	1.4E+6	2.2E+4
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	9.9E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	1.8E+6	2.5E+8
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.4E+8
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	5.0E+5	1.1E+8
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+6	2.0E+7
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	8.5E+5	6.8E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.5E+8
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+5	1.0E+10
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	2.1E+7
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	3.6E+5	1.4E+7
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	7.8E+6	7.0E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	1.2E+7	1.7E+7
I -132	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.2E+6
I -133	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+6	2.4E+6
I -134	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+4	4.5E+5
I -135	-0-	-0-	-0-	-0-	-0-	-0-	4.5E+5	2.5E+6
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+5	7.5E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-15

DOSE PARAMETER R_i FOR SECTOR F

Pathway = San Onofre State Park/Guard Shack   Distance = 1.0 miles
X/Q = 5.8E-7 sec/m^3 D/Q = 4.8E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+2	-0-
Cr-51	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+3	8.0E+5
Mn-54	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	2.4E+8
Co-57	-0-	-0-	-0-	-0-	-0-	-0-	6.3E+4	5.9E+7
Co-58	-0-	-0-	-0-	-0-	-0-	-0-	1.6E+5	6.5E+7
Co-60	-0-	-0-	-0-	-0-	-0-	-0-	1.0E+6	3.7E+9
Sr-89	-0-	-0-	-0-	-0-	-0-	-0-	2.4E+5	3.7E+3
Sr-90	-0-	-0-	-0-	-0-	-0-	-0-	1.7E+7	-0-
Zr-95	-0-	-0-	-0-	-0-	-0-	-0-	3.0E+5	4.3E+7
Nb-95	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	2.3E+7
Ru-103	-0-	-0-	-0-	-0-	-0-	-0-	8.6E+4	1.9E+7
Te-129m	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+5	3.4E+6
Cs-134	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.2E+9
Cs-136	-0-	-0-	-0-	-0-	-0-	-0-	2.5E+4	2.6E+7
Cs-137	-0-	-0-	-0-	-0-	-0-	-0-	1.1E+5	1.8E+9
Ba-140	-0-	-0-	-0-	-0-	-0-	-0-	2.2E+5	3.5E+6
Ce-141	-0-	-0-	-0-	-0-	-0-	-0-	6.2E+4	2.3E+6
Ce-144	-0-	-0-	-0-	-0-	-0-	-0-	1.3E+6	1.2E+7
I -131	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+6	2.9E+6
I -132	-0-	-0-	-0-	-0-	-0-	-0-	2.0E+4	2.1E+5
I -133	-0-	-0-	-0-	-0-	-0-	-0-	3.7E+5	4.2E+5
I -134	-0-	-0-	-0-	-0-	-0-	-0-	5.1E+3	7.7E+4
I -135	-0-	-0-	-0-	-0-	-0-	-0-	7.7E+4	4.3E+5
UN-ID	-0-	-0-	-0-	-0-	-0-	-0-	1.5E+5	1.3E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

TABLE 2-16

DOSE PARAMETER R_i FOR SECTOR G

Pathway = San Onofre State Park Beach Campground Distance = 1.1 miles
X/Q = 5.2E-7 sec/m^3 D/Q = 2.4E-9 m^{-2}

Radio-Nuclide	Infant		Child		Teen		Adult	
	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway	Inhala-tion Pathway	Food & Ground Pathway
H -3	8.0E+1	-0-	1.4E+2	-0-	1.6E+2	-0-	2.9E+2	-0-
Cr-51	1.6E+3	5.7E+5	2.1E+3	5.7E+5	2.6E+3	5.7E+5	3.3E+3	1.1E+6
Mn-54	1.2E+5	1.7E+8	1.9E+5	1.7E+8	2.4E+5	1.7E+8	3.2E+5	3.2E+8
Co-57	4.7E+4	4.2E+7	6.3E+4	4.2E+7	7.2E+4	4.2E+7	8.4E+4	7.8E+7
Co-58	9.6E+4	4.7E+7	1.4E+5	4.7E+7	1.7E+5	4.7E+7	2.1E+5	8.7E+7
Co-60	5.6E+5	2.7E+9	8.7E+5	2.7E+9	1.1E+6	2.7E+9	1.4E+6	4.9E+9
Sr-89	2.5E+5	2.7E+3	2.7E+5	2.7E+3	3.0E+5	2.7E+3	3.2E+5	4.9E+3
Sr-90	5.0E+6	-0-	1.2E+7	-0-	1.3E+7	-0-	2.3E+7	-0-
Zr-95	2.2E+5	3.1E+7	2.8E+5	3.1E+7	3.3E+5	3.1E+7	4.0E+5	5.7E+7
Nb-95	5.9E+4	1.7E+7	7.6E+4	1.7E+7	9.3E+4	1.7E+7	1.2E+5	3.1E+7
Ru-103	6.8E+4	1.3E+7	8.2E+4	1.3E+7	9.7E+4	1.3E+7	1.2E+5	2.5E+7
Te-129m	2.1E+5	2.4E+6	2.2E+5	2.4E+6	2.4E+5	2.4E+6	2.6E+5	4.5E+6
Cs-134	8.7E+4	8.4E+8	1.3E+5	8.4E+8	1.4E+5	8.4E+8	1.9E+5	1.6E+9
Cs-136	1.7E+4	1.9E+7	2.1E+4	1.9E+7	2.4E+4	1.9E+7	3.3E+4	3.4E+7
Cs-137	7.5E+4	1.3E+9	1.1E+5	1.3E+9	1.0E+5	1.3E+9	1.4E+5	2.3E+9
Ba-140	2.0E+5	2.5E+6	2.1E+5	2.5E+6	2.5E+5	2.5E+6	2.9E+5	4.7E+6
Ce-141	6.4E+4	1.7E+6	6.7E+4	1.7E+6	7.6E+4	1.7E+6	8.3E+4	3.1E+6
Ce-144	1.2E+6	8.6E+6	1.5E+6	8.6E+6	1.6E+6	8.6E+6	1.8E+6	1.6E+7
I -131	1.8E+6	2.1E+6	2.0E+6	2.1E+6	1.8E+6	2.1E+6	2.7E+6	3.9E+6
I -132	2.1E+4	1.5E+5	2.4E+4	1.5E+5	1.9E+4	1.5E+5	2.6E+4	2.8E+5
I -133	4.4E+5	3.0E+5	4.7E+5	3.0E+5	3.6E+5	3.0E+5	4.9E+5	5.6E+5
I -134	5.5E+3	5.5E+4	6.3E+3	5.5E+4	4.9E+3	5.5E+4	6.8E+3	1.0E+5
I -135	8.6E+4	3.1E+5	9.8E+4	3.1E+5	7.7E+4	3.1E+5	1.0E+5	5.8E+5
UN-ID	8.0E+4	9.2E+7	1.2E+5	9.2E+7	1.5E+5	9.2E+7	2.0E+5	1.7E+8

Inhalation Pathway, units = $\frac{\text{mrem/yr}}{\mu\text{Ci/m}^3}$

Food & Ground Pathway, units = $\frac{(\text{m}^2)(\text{mrem/yr})}{\mu\text{Ci/sec}}$

3.0 TOTAL AND PROJECTED DOSES

3.1 LIQUID DOSE PROJECTION

The methodology used for projecting a liquid dose for Specification 1.3.2 is as follows:

1. Determine the monthly total body and organ doses resulting from releases during the previous twelve months.
2. Projected Dose = Previous 12 months' dose divided by 12 for the total body and each organ.

3.2 GASEOUS DOSE PROJECTION

DELETED

3.0 **TOTAL AND PROJECTED DOSES** (Continued)

3.3 DOSE

3.3.1 **SPECIFICATION**

Applicability: At all times.

Objective: Maintain the dose due to the release of radioactive materials within specified limits.

Specification: A. The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC, due to releases of radioactivity and to radiation, from uranium fuel cycle sources shall be limited to ≤ 25 mrem to the total body or any organ (except the thyroid which shall be limited to ≤ 75 mrem).

B. Action:

1. With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Specifications 1.2.1.A, 2.2.1.A or 2.3.1.A, calculations should be made to determine whether the above limits of Specification 3.3.1.A have been exceeded. If such is the case, prepare and submit to the Commission within 30 days pursuant to Technical Specification D6.9.2, a Special Report that defines the corrective action to be taken to reduce subsequent releases, to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. The Special Report, as defined in 10CFR20.2203(a)(4), 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, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

3.0 **TOTAL AND PROJECTED DOSES** (Continued)

3.3 DOSE (Continued)

3.3.2 **SURVEILLANCE**

Applicability: At all times.

Objective: To verify the doses due to liquid and gaseous effluents are maintained as low as is reasonably achievable.

Specification: Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Specifications 1.2.1.A, 2.2.1.A, and 2.3.1.A and in accordance with Sections 1.5, 2.7.1, and 2.7.2.

3.0 **TOTAL AND PROJECTED DOSES** (Continued)

3.4 TOTAL DOSE CALCULATIONS

3.4.1 **TOTAL DOSE TO MOST LIKELY MEMBER OF THE PUBLIC**

The total annual dose or total dose commitment to any member of the public, due to releases of radioactivity and to radiation, from uranium fuel cycle sources within 5 miles of the Site is calculated using the following expressions. This methodology is used to meet the dose limitations of 40 CFR 190 per twelve consecutive months. The transportation of radioactive material is excluded from the dose calculations.

The Annual Total Dose is determined monthly for maximum organ (gas & liquid), whole body (gas & liquid) and thyroid (gas & liquid) to verify that the Site total (Units 1, 2 and 3) is less than or equal to 25 mrem, 25 mrem and 75 mrem respectively.

3.4.1 TOTAL DOSE TO MOST LIKELY MEMBER OF THE PUBLIC (Continued)

3.4.1.1 ANNUAL TOTAL ORGAN DOSE (D_{TOT} (O))

$$D_{TOT}(O) = \sum_{l=1}^{12} \sum_{j=1}^{2/3} \left[D_{jl}(OG) + D_{jl}(OL) + D_{jl}^{^3H}(OG)^{*} \right] \quad (3\text{-}1)$$

*NOTE: $D_{jl}^{^3H}(OG) = 0$ for bone

**All to be summed over the most recent 12 months.

where:

$$D_{jl}(OG) = K \sum_{i=1}^{n} C_i \, \Sigma_k R_{ik} \, W_k \quad (3\text{-}2)$$

i	=	each isotope in specific organ category
j	=	Units 1, 2 and 3
l	=	months 1 - 12**
K	=	3.1688E-2 $\frac{\text{year-}\mu\text{Ci}}{\text{sec-Ci}}$
n	=	number of isotopes in the specified organ category
C_i	=	total particulate gas curies released for the month
$\sum_k R_{ik} W_k$	=	controlling location factors from ODCM Table 2-5, Unit 1 and Table 2-6, Units 2/3
$D_{jl}(OL)$	=	liquid organ dose for the specified organ, in mrem, for the month. [Unit 1 (1-13), Units 2/3 (1-19)]
$D_{jl}^{^3H}(OG)^{*}$	=	gas organ dose from tritium, mrem, for the month. [Unit 1 (2-14), Units 2/3 (2-18)]

3.0 **TOTAL AND PROJECTED DOSES** (Continued)

3.4 TOTAL DOSE CALCULATIONS (Continued)

3.4.1 **TOTAL DOSE TO MOST LIKELY MEMBER OF THE PUBLIC** (Continued)

3.4.1.2 ANNUAL TOTAL WHOLE BODY DOSE (D_{TOT} (WB))

$$D_{TOT}(WB) = \sum_{l=1}^{12} \sum_{j=1}^{2/3} \left[D_{jl}(WBL) + D_{jl}^{^3H}(OG) + 0.9\, D_{jl}(\gamma) \right] + D(Direct) \quad (3\text{-}3)$$

*To be summed over the most recent 12 months.

where:

j	=	Units 1, 2 and 3
l	=	months 1 - 12*
$D_{jl}(WBL)$	=	liquid whole body organ dose mrem, for the whole month. [Unit 1 (1-13), Units 2/3 (1-19)]
$D_{jl}^{^3H}(OG)$	=	gas organ dose from tritium, mrem, for the month. [Unit 1 (2-14), Units 2/3 (2-18)]
$D_{jl}(\gamma)$	=	gamma air dose, mrad, for the month. 0.9 converts mrad to mrem. [Unit 1 (2-10), Units 2/3 (2-14)]

$$D\ (Direct) = \sum_{q=1}^{4} \left[\max[D(site)_q] - \frac{\sum_{p=1}^{n} D(bkgd)_q}{n} \right] .0342 \quad (3\text{-}4)$$

p	=	for all TLDs per quarter
q	=	for Quarters 1-4
.0342	=	prorated occupancy factor based on 300 hours/year.
site	=	TLD locations within 5 miles of the site.

3.4.1.2 ANNUAL TOTAL WHOLE BODY DOSE (D_{TOT} (WB)) (Continued)

*Direct Radiation
The direct radiation levels are evaluated most recently using thulium doped TLDs. The TLDs are placed at a minimum of 30 locations around the site. The average dose from TLDs 5 to 50 miles from the site is used as background. These sites are subject to change.
The background is subtracted from the highest reading TLD within 5 miles of the site (generally numbers 55 through 58). This value is the direct dose but must be prorated by the occupancy factor.

Example: Beach time (west boundary, seawall) of 300 hrs/yr, east and north boundaries of 20 hrs/yr, or 8 hrs/yr for the south boundary and west fence of parking lot 1 (top of bluff).
Reference: E. M. Goldin memorandum for file, "Occupancy Factors at San Onofre Owner Controlled Area Boundaries", dated October 1, 1991.

3.4.1.3 ANNUAL TOTAL THYROID DOSE (D_{TOT} (T))

$$D_{TOT}(T) = \sum_{l=1}^{12} \sum_{j=1}^{2/3} \left[D_{jl}\,(OG) + D_{jl}\,(OL)\right] \tag{3-5}$$

*To be summed over the most recent 12 months.

where:

j	=	Units 1, 2 and 3
l	=	months 1 - 12*
D_{jl}(OG)	=	thyroid organ dose from gaseous iodine for the month, mrem. [from (3-2)]
D_{jl}(OL)	=	liquid thyroid organ dose for the month, mrem. [Unit 1 (1-13), Units 2/3 (1-19)]

4.0 **EQUIPMENT**

4.1 RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION

4.1.1 **SPECIFICATION**

Applicability: During releases via this pathway.

Objective: Monitor and control radioactive liquid effluent releases.

Specification:

A. The radioactive liquid effluent monitoring instrumentation channels shown in Table 4-1 shall be FUNCTIONAL with their alarm/trip setpoints set to ensure that the limits of Specification 1.1.1 are not exceeded.

B. Action:

1. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure that the limits of Specification 1.1.1 are met, without delay suspend the release of radioactive liquid effluents monitored by the affected channel or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

2. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels FUNCTIONAL, take the ACTION shown in Table 4-1. If the nonfunctional instruments remain nonfunctional for greater than 30 days, explain in the next Annual Radioactive Effluent Release Report why the nonfunctional status was not corrected in a timely manner.

3. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels FUNCTIONAL and either the appropriate ACTION items in Table 4-1 not taken or the necessary surveillances not performed at the specified frequency prescribed in Table 4-2, perform an evaluation based on the significance of the event in accordance with the site Corrective Action Program.

TABLE 4-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS FUNCTIONAL	ACTION
1. Gross Radioactive Monitors Providing Automatic Termination of Release		
a. Liquid Radwaste Effluent Line (R-1218)	(1)	16
b. **DELETED**		
c. Turbine Building Sumps Effluent Line (Reheater Pit Sump) (R-2100)	(1)	18
d. Yard Sump Effluent Line (R-2101)	(1)	18
e. **DELETED**		
2. Flow Rate Measurement Devices		
a. Liquid Radwaste Effluent Line (FE-16/FT-8, FE-18/FT-10)	(1)	20
b. Circulating Water Outfall[1]		
c. **DELETE**		
3. Plant Information Monitoring System (PIMS)[2] (Control Room Alarm Annunciation)	(1)	25

[1]Pump status, valve turns or calculations are utilized to estimate flow.

[2]Applies to each effluent radiation monitor that utilizes the PIMS, as they are turned over to station.

TABLE 4-1
(Continued)

TABLE NOTATION

ACTION 16 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases may continue provided that prior to initiating a release:

1. At least two separate samples which can be taken by a single person are analyzed in accordance with Specification 1.1.2, and;

2. At least two technically qualified persons verify the release rate calculations and discharge valving.

ACTION 17 **DELETED**

ACTION 18 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided that, at least once per 12 hours, grab samples are collected and analyzed within 4 hours of collection time for gross radioactivity (beta or gamma) at a lower limit of detection of at least 10^{-7} microcurie/ml.

ACTION 19 **DELETED**

ACTION 20 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided the process flow rate is estimated at least once per 12 hours during actual releases. In addition, a new flow estimate shall be made within 1 hour after a change that affects process flow has been completed. Pump curves may be used to estimate process flow.

ACTION 25 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided the monitor is verified FUNCTIONAL by performing a CHANNEL CHECK at least once per 4 hours during actual releases, otherwise, declare the affected monitor non-functional.

4.0 **EQUIPMENT** (Continued)

4.1 RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION (Continued)

4.1.2 SURVEILLANCE

Applicability: During releases via this pathway.

Objective: To specify the minimum frequency and type of surveillance to be applied to the radioactive liquid instrumentation.

Specification:

A. The setpoints shall be determined in accordance with Section 1.4.

B. Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL TEST operations at the frequencies shown in Table 4-2.

TABLE 4-2

RADIOACTIVE LIQUID EFFLUENT MONITORING
INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL TEST
1. Gross Beta or Gamma Radioactivity Monitoring Providing Alarm and Automatic Isolation				
a. Liquid Radwaste Effluent Line (R-1218)	D	P(6)	18M(3)	Q(1)
b. **DELETED**				
c. Turbine Building Sump Effluent Line (Reheater Pit sump R-2100)	D	M(6)	18M(3)	Q(1)
d. Yard Sump Effluent Line (R-2101)	D	M(6)	18M(3)	Q(1)
e. **DELETED**				
2. Flow Rate Monitors				
a. Liquid Radwaste Effluent Line (FE-16/FT-8, FE-18/FT-10)	D(4)	N/A	18M	N/A
3. Plant Information Monitoring System (PIMS) (Control Room Alarm Annunciation)	D(7)	N/A	N/A(5)	Q(1)

TABLE 4-2
(Continued)

TABLE NOTATION

(1) The CHANNEL TEST also demonstrates the following:

1. Automatic isolation of this pathway and control room alarm annunciation occurs when the instrument indicates measured levels above the alarm/trip setpoint.

2. Control Room alarm annunciation when the instrument controls are not set in the operate mode.

(3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from the suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for this requirement.)

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once daily on any day in which continuous, periodic, or batch releases are made.

(5) The Plant Information Monitoring System (PIMS) software and hardware do not require CHANNEL CALIBRATION. The PIMS software is quality affecting and controlled by the site Software Modification Request Process under procedure SO123-V-4.71, Software Development and Maintenance. The PIMS hardware is installed plant equipment and controlled by the site design change process utilizing procedure SO123-XXIX-2.10, Design Change Process, or SO123-XXIV-10.21, Field Change Notice (FCN) and Field Interim Design Change Notice (FIDCN).

(6) MGPI monitors perform a periodic automatic detector response verification. No manual operator action is required as the monitor will report a failure if the source check does not pass.

(7) Effective upon turnover of the first MGPI monitor.

4.0 **EQUIPMENT** (Continued)

4.2 RADIOACTIVE GASEOUS EFFLUENT INSTRUMENTATION

4.2.1 **SPECIFICATION**

Applicability: During releases via this pathway.

Objective: Monitor and control radioactive gaseous releases.

Specification: A. The radioactive gaseous effluent monitoring instrumentation channels show in Table 4-3 shall be FUNCTIONAL with their alarm/trip setpoints set to ensure that the limits of Specification 2.1.1 are not exceeded.

B. ACTION

1. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure that the limits of 2.1.1 are met, without delay suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel nonfunctional, or change the setpoint so it is acceptably conservative.

2. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels FUNCTIONAL, take the ACTION shown in Table 4-3. If the nonfunctional instruments remain nonfunctional for greater than 30 days, explain in the next Annual Radioactive Effluent Release Report why the nonfunctional status was not corrected in a timely manner.

3. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels FUNCTIONAL and either the appropriate ACTION items in Table 4-3 not taken or the necessary surveillances not performed at the specified frequency prescribed in Table 4-4, perform an evaluation based on the significance of the event in accordance with the site Corrective Action Program.

TABLE 4-3

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS FUNCTIONAL	ACTION
1. Stack Monitoring System[1]		
a. **DELETED**		
b. Noble Gas Activity MONITOR R-1254[4]	(1)	22
c. Iodine Sampler CARTRIDGE R-1254[5]	(1)	23
d. Particulate Sample FILTER R-1254[5]	(1)	23
e. Deleted		
f. Sampler Flow Rate Measuring Device	(1)	24
2. Plant Information Monitoring System (PIMS)[6] (Control Room Alarm Annunciation)	(1)	26

---

1 Includes the following subsystems:
  a. Spent Fuel Building ventilation and Auxiliary Building ventilation.
  b. Containment Building ventilation

2 **DELETED.**

3 **DELETED.**

4 High range not required. Mid range shall be maintained functional during evolutions in which an FHA is possible. This includes fuel handling and movement of heavy loads over the fuel in the pool. Low range required in service at all times. (Ref. design calculation DC-3782)

5 Heat tracing is required to be functional.

6 Applies to each effluent radiation monitor that utilizes the PIMS, as they are turned over to station.

TABLE 4-3

(Continued)

TABLE NOTATION

ACTION 21 **DELETED**

ACTION 22 With the number of channels FUNCTIONAL less than the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue, provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 23 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via the affected pathway may continue, provided samples are continuously collected with auxiliary sampling equipment as required in Table 2-1.

ACTION 24 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided the particulate and iodine sample flowrate is estimated or verified at least once per 12 hours during actual releases.

ACTION 26 With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue provided the monitor is verified FUNCTIONAL by performing a CHANNEL CHECK at least once per 4 hours during actual releases, otherwise, declare the affected monitor non-functional.

4.2.2 SURVEILLANCE

Applicability: During releases via this pathway.

Objective: To specify the minimum frequency and type of surveillance to be applied to the radioactive gaseous monitoring instrumentation.

Specification:

A. The setpoints shall be determined in accordance with Section 2.5.

B. Each radioactive gaseous process or effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL TEST operations at the frequencies shown in Table 4-4.

TABLE 4-4

RADIOACTIVE GASEOUS EFFLUENT MONITORING
INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL TEST
1. Stack Monitoring System				
a. **DELETED**				
b. Noble Gas Activity Monitor R-1254	D	M(5)	18M(2)	Q(1)
c. Iodine Sampler Cartridge R-1254	N/A	N/A	N/A	N/A
d. Particulate Sampler Filter R-1254	N/A	N/A	N/A	N/A
e. Stack Fan Flow		See Note (3)		
f. Sampler Flow Rate Measuring Device	D	N/A	18M	N/A
2. Plant Information Monitoring System (PIMS) (Control Room Alarm Annunciation)	D(6)	N/A	N/A(4)	Q(1)

TABLE NOTATION

(1) The CHANNEL TEST also demonstrates the following:

1. Control room alarm annunciation occurs when the instrument indicates measured levels above the alarm/trip setpoint.

2. Control room alarm annunciation when the instrument controls are not set in the operate mode.

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used. (Operating plants may substitute previously established calibration procedures for this requirement.)

(3) Perform stack fan flow measurement once every 60 months.

(4) The Plant Information Monitoring System (PIMS) software and hardware do not require CHANNEL CALIBRATION. The PIMS software is quality affecting and controlled by the site Software Modification Request Process under procedure SO123-V-4.71, Software Development and Maintenance. The PIMS hardware is installed plant equipment and controlled by the site design change process utilizing procedure SO123-XXIX-2.10, Design Change Process, or SO123-XXIV-10.21, Field Change Notice (FCN) and Field Interim Design Change Notice (FIDCN).

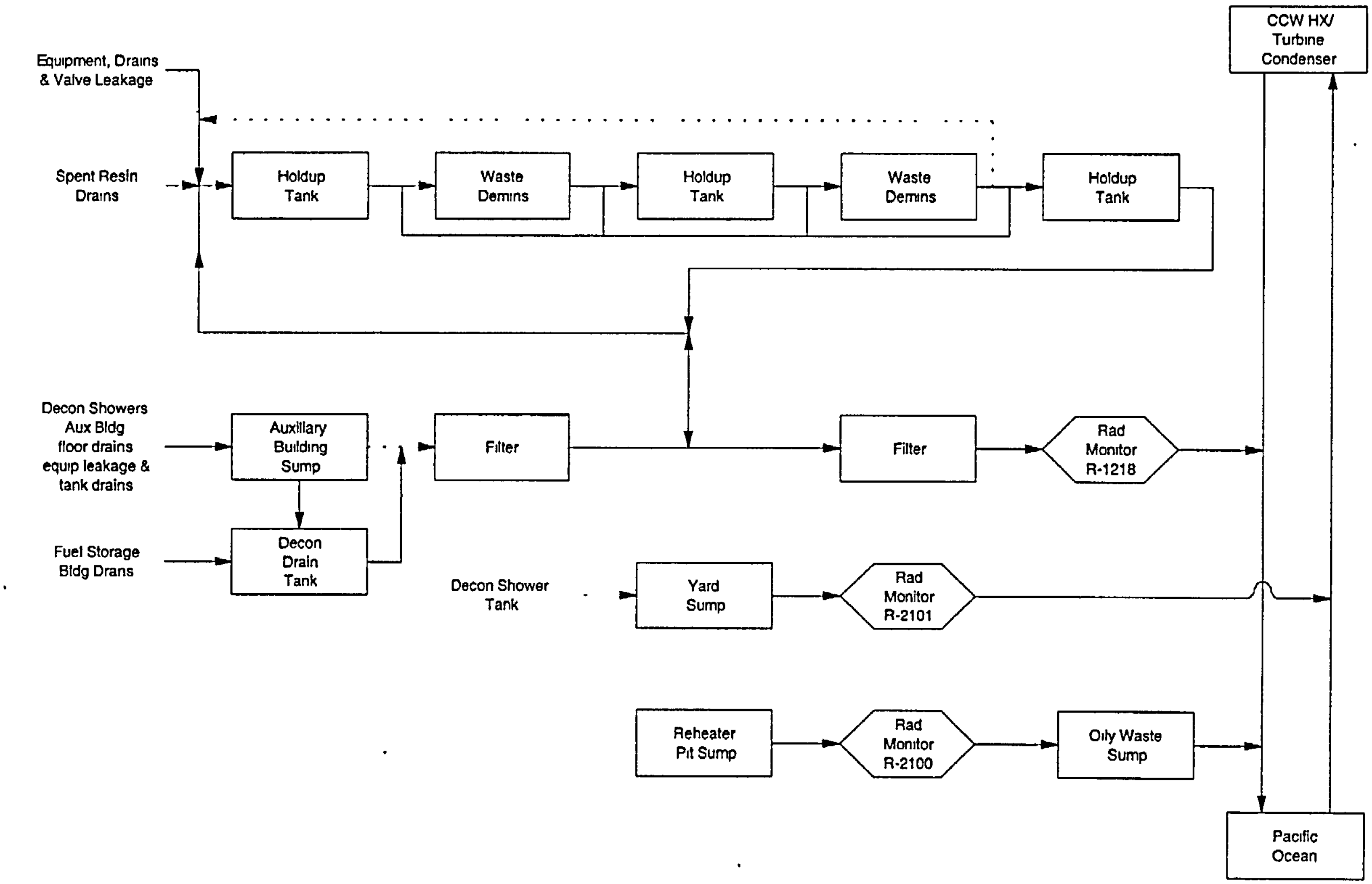
(5) The monitor performs an automatic check source test each 24 hours. No manual operator action is required.

(6) Effective upon turnover to station of the R-1254/PIMS configuration.

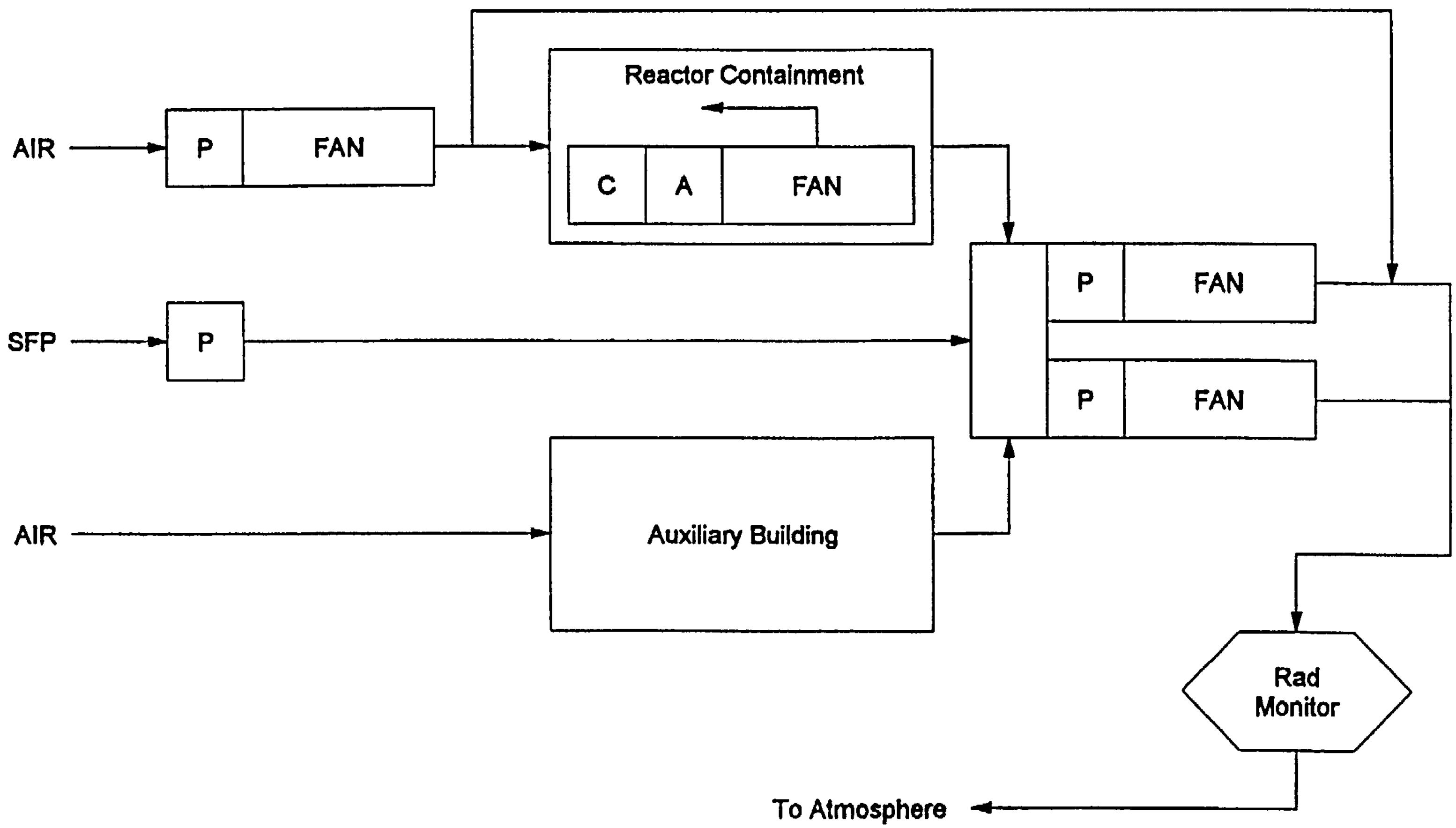
4.0 **EQUIPMENT** (Continued)

4.3 FUNCTIONALITY OF RADIOACTIVE WASTE EQUIPMENT

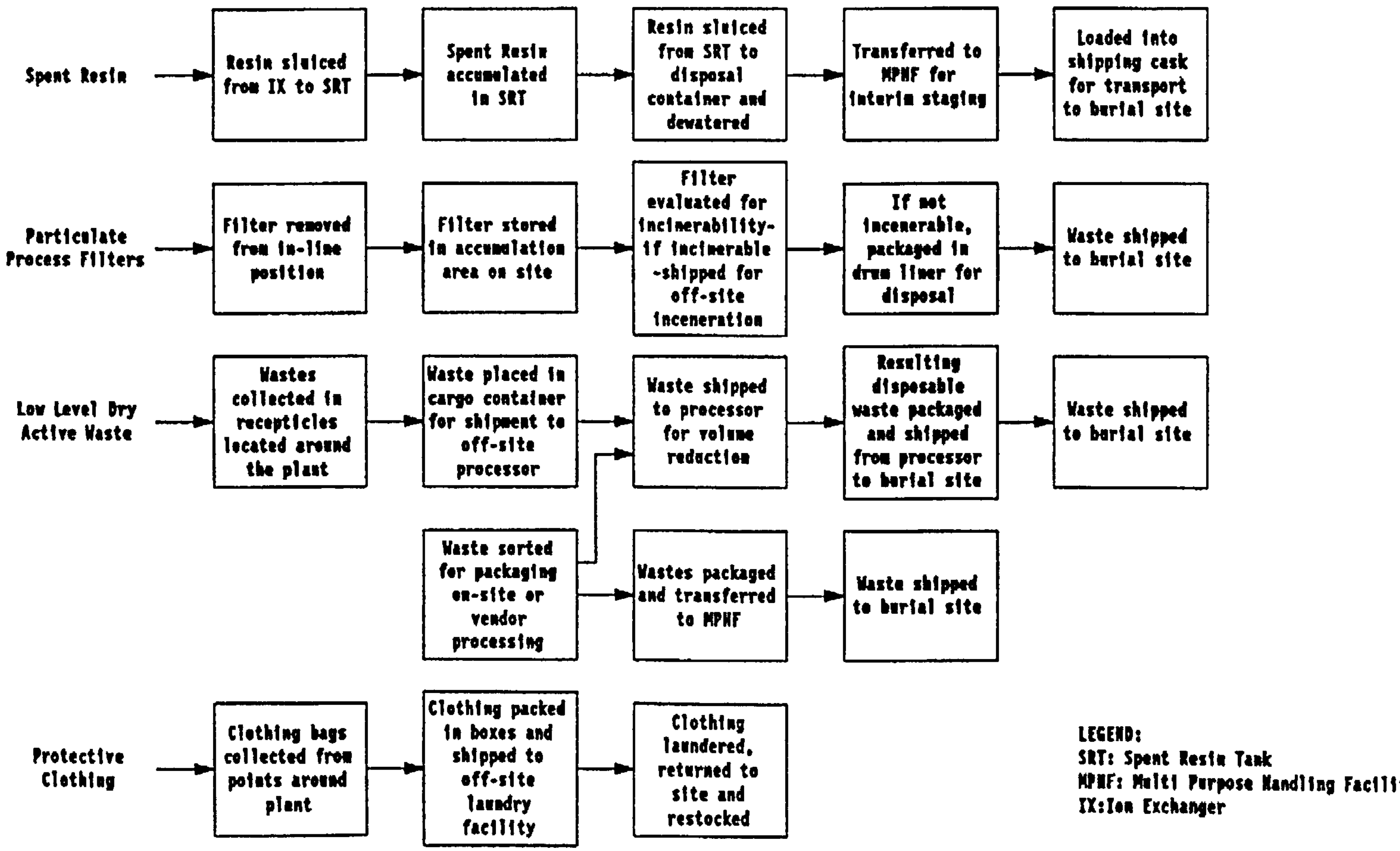
The flow diagrams defining the treatment paths and the components of the radioactive liquid, gaseous and solid waste management systems are shown in Figures 4-1 thru 4-3.



SONGS 1 Liquid Waste Discharge System
Figure 4-1



SONGS 1 Radioactive Gaseous-Waste System
Figure 4-2



SONGS 1 Solid Waste Handling
Figure 4-3

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

5.1 MONITORING PROGRAM

5.1.1 SPECIFICATION

APPLICABILITY: At all times.

OBJECTIVE: Monitor exposure pathways for radiation and radioactive material.

SPECIFICATION:

A. The radiological environmental monitoring program shall be conducted as specified in Table 5-1.

B. ACTION:

1. With the radiological environmental monitoring program not being conducted as specified in Table 5-1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report (see Section 5.4), a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

2. With the level of radioactivity as the result of plant effluents in an environmental sampling medium exceeding the reporting levels of Table 5-1 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days from the end of the affected calendar quarter a Special Report pursuant to Technical Specification D6.9.2. When more than one of the radionuclides in Table 5-1 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those in Table 5-1 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose to a MEMBER OF THE PUBLIC is equal to or greater than the calendar year limits of Specifications 1.2.1, 2.2.1, and 2.3.1. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.1 MONITORING PROGRAM (Continued)

5.1.1 **SPECIFICATION** (Continued)

SPECIFICATION: B. ACTION: (Continued)

3. With fresh leafy vegetable samples or fleshy vegetable samples unavailable from one or more of the sample locations required by Table 5-1, identify specific locations for obtaining replacement samples and add them within 30 days to the Radiological Environmental Monitoring Program given in the ODCM. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Technical Specification D6.9.1, submit in the next Annual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table for the ODCM reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of the new location(s) for obtaining samples.

TABLE 5-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations[a]	Sampling and Collection Frequency[a]	Type and Frequency of Analyses
1. AIRBORNE Radioiodine and Particulates	Samples from at least 5 locations 3 samples from offsite locations (in different sectors) of the highest calculated annual average ground level D/Q. 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q. 1 sample from a control location 15-30 km (10-20 miles) distant and in the least prevalent wind direction[c].	Continuous operation of sampler with sample collection as required by dust loading, but at least once per 7 days.[d]	Radioiodine cartridge. Analyze at least once per 7 days for I-131. Particulate sampler. Analyze for gross beta radioactivity ≥ 24 hours following filter change. Perform gamma isotopic[b] analysis on each sample when gross beta activity is ≥ 10 times the yearly mean of control samples. Perform gamma isotopic analysis on composite (by location) sample at least once per 92 days.
2. DIRECT RADIATION[e]	At least 30 locations including an inner ring of stations in the general area of the SITE BOUNDARY and an outer ring approximately in the 4 to 5 mile range from the Site with a station in each sector of each ring. The balance of the stations are in special interest areas such as population centers, nearby residences, schools, and 2 or 3 areas to serve as control stations.	At least once per 92 days.	Gamma dose. At least once per 92 days.

TABLE 5-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations[a]	Sampling and Collection Frequency[a]	Type and Frequency of Analyses
3. WATERBORNE			
a. Ocean	4 locations	At least once per month and composited quarterly	Gamma isotopic analysis of each monthly sample. Tritium analysis of composite sample at least once per 92 days.
b. Drinking[f]	2 locations	Monthly at each location.	Gamma isotopic and tritium analyses of each sample.
c. Sediment	4 locations from Shoreline	At least once per 184 days.	Gamma isotopic analysis of each sample.
d. Ocean	5 locations Bottom Sediments	At least once per 184 days.	Gamma isotopic analysis of each sample.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations[a]	Sampling and Collection Frequency[a]	Type and Frequency of Analyses
4. INGESTION			
a. Nonmigratory Marine Animals	3 locations	One sample from each group (listed below) will be collected in season, or at least once per 184 days if not seasonal. Groups to be sampled: 1. Fish - 2 adult species such as flatfish, bass, perch, or sheephead. 2. Crustacea - such as crab or lobster. 3. Mollusks - such as limpets, clams or seahares.	Gamma isotopic analysis of an edible portion.
b. Local Crops	2 locations	Representative vegetables, normally 1 leafy and 1 fleshy collected at harvest time. At least 2 vegetables collected semiannually from each location.	Gamma isotopic analysis on edible portions semiannually and I-131 analysis for leafy crops.

TABLE 5-1 (Continued)

TABLE NOTATION

a. Sample locations are indicated in Figures 5-1 through 5-5.

b. Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

c. The purpose of this sample is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites which provide valid background data may be substituted.

d. Canisters for the collection of radioiodine in air are subject to channeling. These devices should be carefully checked before operation in the field or several should be mounted in series to prevent loss of iodine.

e. Regulatory Guide 4.13 provides minimum acceptable performance criteria for thermoluminescence dosimetry (TLD) systems used for environmental monitoring. One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purpose of this table, a thermoluminescent dosimeter may be considered to be one phosphor and two or more phosphors in a packet may be considered as two or more dosimeters. Film badges should not be used for measuring direct radiation.

f. No drinking water pathway exists at SONGS.

TABLE 5-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/1)	Airborne Particulate or Gases (pCi/m^3)	Marine Animals (pCi/Kg, wet)	Local Crops (pCi/Kg, wet)
H-3	2×10^4 [a]			
Mn-54	1×10^3		3×10^4	
Fe-59	4×10^2		1×10^4	
Co-58	1×10^3		3×10^4	
Co-60	3×10^2		1×10^4	
Zn-65	3×10^2		2×10^4	
Zr-Nb-95	4×10^2			
I-131	2[b]	0.9		1×10^2
Cs-134	30	10	1×10^3	1×10^3
Cs-137	50	20	2×10^3	2×10^3
Ba-La-140	2×10^2			

[a] If no drinking pathway exists, a value of 30,000 pCi/ℓ may be used.

[b] If no drinking water pathway exists, a value of 20 pCi/ℓ may be used.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.1 MONITORING PROGRAM (Continued)

5.1.2 **SURVEILLANCE**

APPLICABILITY: At all times.

OBJECTIVE: Ensure required actions of the radiological monitoring program are being performed.

SPECIFICATION: The radiological environmental monitoring samples shall be collected pursuant to Table 5-1 from the locations given in Tables 5-4 and 5-5 and Figures 5-1 through 5-5, and shall be analyzed pursuant to the requirements of Tables 5-1 and 5-3.

TABLE 5-3

MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD)[a,c]

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Marine Animals (pCi/Kg, wet)	Local Crops (pCi/Kg, wet)	Sediment (pCi/kg, dry)
Gross beta	4	1×10^{-2}			
H-3	2000[b]				
Mn-54	15		130		
Fe-59	30		260		
Co-58, 60	15		130		
Zn-65	30		260		
Zr-95, Nb-95	15				
I-131	1[d]	7×10^{-2}		60	
Cs-134	15	5×10^{-2}	130	60	150
Cs-137	18	6×10^{-2}	150	80	180
Ba-140, La-140	15				

TABLE 5-3 (Continued)

TABLE NOTATION

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

LLD is the "a priori" lower limit of detection as defined above (as picocurie per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per transformation),

V is the sample size (in units of mass or volume),

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting.

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples (e.g., potassium-40 in milk samples). Typical values of E, V, Y and Δt shall be used in the calculations.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of the measurement system and not as a posteriori (after the fact) limit for a particular measurement.*

TABLE 5-3 (Continued)

TABLE NOTATION

b. If no drinking water pathway exists, a value of 3,000 pCi/ℓ may be used.

c. Other peaks which are measurable and identifiable, together with the radionuclides in Table 5-3, shall be identified and reported.

d. If no drinking water pathway exists, a value of 15 pCi/ℓ may be used.

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*For a more complete discussion of the LLD, and other detection limits, see the following:

(1) HASL Procedures Manual, HASL-300 (revised annually).
(2) Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry" Anal. Chem. 40, 586-93 (1968).

5.0 <u>RADIOLOGICAL ENVIRONMENTAL MONITORING</u> (Continued)

5.2 LAND USE CENSUS

5.2.1 **SPECIFICATION**

APPLICABILITY: At all times.

OBJECTIVE: Monitor the UNRESTRICTED AREAS surrounding the site for potential changes to the radiological monitoring program as necessary.

SPECIFICATION:

A. A land use census shall be conducted 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 vegetables in each of the 16 meteorological sections within a distance of five miles.

B. ACTION:

1. 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 Specification 2.3.1, pursuant to Technical Specification D6.9.1, identify the new locations in the next Annual Radioactive Effluent Release Report.

2. 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 Specification 5.1.1, add the new location within 30 days to the Radiological Environmental Monitoring Program given in the ODCM. 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 this monitoring program after October 31, of the year in which this Land Use Census was conducted. Pursuant to Technical Specification D6.9.1, submit in the next Annual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table(s) for the ODCM reflecting the new location(s) with information supporting the change in sampling locations.

*Broad leaf vegetation sampling may be performed at the SITE BOUNDARY in the direction section with the highest D/Q in lieu of the garden census.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING (Continued)

5.2 LAND USE CENSUS (Continued)

5.2.2 SURVEILLANCE

APPLICABILITY: At all times.

OBJECTIVE: Perform the land use census to ensure the monitoring program is appropriate for the surrounding areas.

SPECIFICATION: The land use census shall be conducted at least once per 12 months between the date of June 1 and October 1 using that information which will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agricultural authorities.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.3 INTERLABORATORY COMPARISON PROGRAM

5.3.1 **SPECIFICATION**

APPLICABILITY: At all times.

OBJECTIVE: To ensure laboratory analysis of radiological environmental monitoring samples is correct and accurate.

SPECIFICATION:

A. Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program that complies with Regulatory Guide 4.15.

B. ACTION:

1. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report. (Section 5.4)

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.3 INTERLABORATORY COMPARISON PROGRAM (Continued)

5.3.2 SURVEILLANCE

APPLICABILITY: At all times.

OBJECTIVE: To ensure laboratory analysis of radiological environmental monitoring samples is correct and accurate.

SPECIFICATION: A summary of the results obtained as part of the Interlaboratory Comparison Program and in accordance with the ODCM shall be included in the Annual Radiological Environmental Operating Report. (Section 5.4)

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.4 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT[1]

5.4.1 Routine radiological environmental operating reports for the unit during the previous calendar year shall be submitted prior to May 1 of each year.

5.4.2 The annual radiological environmental operating reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of land use censuses required by Specification 5.2.1. If harmful effects or evidence of irreversible damage are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

The annual radiological environmental operating reports shall include summarized and tabulated results, in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979, of all radiological environmental samples taken during the report period. In the event that some results are not available for inclusion with the report, the report 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.

The reports shall also include the following: a summary description of the radiological environmental monitoring program; a map for all sampling locations keyed to a table giving distances and directions from the site reference point; and the results of licensee participation in the Interlaboratory Comparison Program, required by Specification 5.3.1.

(Note: Information which may be required by Specifications 5.1.1, 5.1.2, 5.3.2 and Section 6.4.18 should be included.

[1]A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

5.0 **RADIOLOGICAL ENVIRONMENTAL MONITORING** (Continued)

5.5 SAMPLE LOCATIONS[1]

The Radiological Environmental Monitoring Sample Locations are identified in Figures 5-1 through 5-5. These sample locations are described in Table 5-4 and indicates the distance in miles and the direction, determined from degrees true north, from the center of the Units 2 and 3 building complex. Table 5-6 gives the sector and direction designation for the Radiological Environmental Monitoring Sample Location Map, Figures 5-1 through 5-5.

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[1]If a milk producing dairy animal is discovered within the 5 mile radius of the Emergency Planning Zone (EPZ) during the annual land use census, a monthly sampling analysis of the milk will commence.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation			
1	City of San Clemente (Former SDG&E Offices)	5.7	NW
2	Camp San Mateo (MCB, Camp Pendleton)	3.5	N
3	Camp San Onofre (MCB, Camp Pendleton)	2.6	NE
4	Camp Horno (MCB, Camp Pendleton)	4.5	E
6	Old Route 101 (East-Southeast)	3.0	ESE
8	Noncommissioned Officers' Beach Club	1.4	NW
10	Bluff (Adjacent to PIC #1)	0.7	WNW
11	Former Visitors' Center	0.4**	NW
12	South Edge of Switchyard	0.2**	E
13	Southeast Site boundary (Bluff)	0.4**	ESE
15	Southeast Site Boundary (Office Building)	0.1**	SSE
16	East Southeast Site Boundary	0.4**	ESE
17	Transit Dose	-	-
18	Transit Dose	-	-
19	San Clemente Highlands	5.0	NNW
22	Former U.S. Coast Guard Station - San Mateo Point	2.7	WNW
23	Samaritan Hospital San Clemente	8.1	NW

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** MCB - Marine Corps Base PIC - Pressurized Ion Chamber

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation (Continued)			
31	Aurora Park-Mission Viejo (CONTROL)	18.6	NNW
33	Camp Talega (MCB, Camp Pendleton)	5.7	N
34	San Onofre School (MCB, Camp Pendleton)	1.9	NW
35	Range 312 (MCB, Camp Pendleton)	4.7	NNE
36	Range 208C (MCB, Camp Pendleton)	4.2	NE
38	San Onofre State Beach Park	3.3	SE
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	NNW
41	Old Route 101 - East	0.3**	E
44	Fallbrook Fire Station	17.7	E
46	San Onofre State Beach Park	0.9	SE
47	Camp Las Flores (MCB, Camp Pendleton)	8.6	SE

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** MCB - Marine Corps Base   PIC - Pressurized Ion Chamber

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION***	DISTANCE* (miles)	DIRECTION*
	Direct Radiation (Continued)		
49	Camp Chappo (MCB, Camp Pendleton)	12.8	ESE
50	Oceanside Fire Station (CONTROL)	15.6	SE
53	San Diego County Operations Center	44.3	SE
54	Escondido Fire Station	31.8	ESE
55	San Onofre State Beach (Unit 1, West)	0.2**	W
56	San Onofre State Beach (Unit 1, West)	0.2**	W
57	San Onofre State Beach (Unit 2)	0.1**	WSW
58	San Onofre State Beach (Unit 3)	0.1**	S
59	SONGS Meteorological Tower	0.3**	WNW
60	Transit Control Storage Area	-	-
61	Mesa - East Boundary (Adjacent to PIC #4)	0.7	N
62	MCB - Camp Pendleton (Adjacent to PIC #5)	0.6	NNE
63	MCB - Camp Pendleton (Adjacent to PIC #6)	0.6	NE
64	MCB - Camp Pendleton (Adjacent to PIC #7)	0.6	ENE
65	MCB - Camp Pendleton (Adjacent to PIC #8)	0.7	E
66	San Onofre State Beach (Adjacent to PIC #9)	0.6	ESE
67	Former SONGS Evaporation Pond (Adjacent to PIC #2)	0.6	NW
68	Range 210C (MCB, Camp Pendleton)	4.3	ENE
73	South Yard Facility	0.4**	ESE
	Transit Control A	--	--
	Transit Control B	--	--
	Fader (Co-located with TLD #54)****	31.8	ESE
74	Oceanside City Hall (Backup CONTROL)	15.6	SE
75	Gate 25 MCB	4.6	SE
76	El Camino Real Mobil Station	4.6	NW
77	Area 62 Heavy lift pad	4.3	N
78	Sheep Valley	4.4	ESE

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** MCB - Marine Corps Base PIC - Pressurized Ion Chamber

**** For fading correction due to significant increase in temperature.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE* (miles)	DIRECTION*
Airborne			
1	City of San Clemente (City Hall)	5.1	NW
7	AWS ROOF	0.18**	NW
9	State Beach Park	0.6	ESE
10	Bluff	0.7	WNW
11	Mesa EOF	0.7	NNW
12	Former SONGS Evaporation Pond	0.6	NW
13	Marine Corps Base (Camp Pendleton East)	0.7	E
14	Mesa Medical Facility	0.7	NNW
15	City Hall Oceanside (CONTROL)	15.6	SE
Soil Samples			
1	Camp San Onofre	2.6	NE
2	Old Route 101 - East Southeast	3.0	ESE
3	Basilone Road/I-5 Freeway Offramp	2.0	NW
5	Former Visitor's Center	0.4**	NW
6	Oceanside (CONTROL)	16	SE
Ocean Water			
A	Station Discharge Outfall - Unit 1	0.6	SW
B	Outfall - Unit 2	1.5	SW
C	Outfall - Unit 3	1.2	SSW
D	Newport Beach (CONTROL)	30.0	NW

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Distances are within the Units 2 and 3 Site boundary (0.4 mile in all sectors) and not required by Technical Specification.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE* (miles)	DIRECTION*	
Drinking Water				
4	Camp Pendleton Drinking Water Reservoir	2.2	NNW	
5	Oceanside (CONTROL)	15.6	SE	
Shoreline Sediment (Beach Sand)				
1	San Onofre State Beach (Southeast)	0.6	SE	
2	San Onofre Surfing Beach	0.8	WNW	R
3	San Onofre State Beach (Southeast)	3.5	SE	
4	Newport Beach (North End) (CONTROL)	29.2	NW	
Local Crops				
1	San Clemente Ranch (San Mateo Canyon)	2.6	NW	
2	Oceanside (CONTROL)**	15 to 25	SE to ESE	F
4	San Clemente Resident w/Garden	4.4	NW	
6	SONGS Garden	0.4	NW	

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

** Control location shall be in sector G or F, 15 to 25 miles from the site. The control location will be selected based on sample availability. The exact location will be noted in the Annual Radiological Environmental Operating Report.

TABLE 5-4

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE* (miles)	DIRECTION*	
Non-Migratory Marine Animals				
A	Unit 1 Outfall	0.9	WSW	
B	Units 2 and 3 Outfall	1.5	SSW	
C	Laguna Beach (CONTROL)	18.2	NW	
Kelp				
A	San Onofre Kelp Bed	1.5	S	
B	San Mateo Kelp Bed	3.8	WNW	
C	Barn Kelp Bed	6.3	SSE	
D	Deleted			D
E	Salt Creek (CONTROL)	11 to 13	WNW to NW	A
Ocean Bottom Sediments				
A	Deleted			D
B	Unit 1 Outfall	0.8	SSW	
C	Unit 2 Outfall	1.6	SW	
D	Unit 3 Outfall	1.2	SSW	
E	Laguna Beach (CONTROL)	18.2	NW	
F	SONGS Upcoast	0.9	WSW	A

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true north.

TABLE 5-5

PIC - RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS SONGS 1

PRESSURIZED ION CHAMBERS		Theta (Degrees)*	DISTANCE* Meters	miles	DIRECTION/SECTOR*	
S1	San Onofre Beach	298°	1070	0.7	WNW	P
S2	SONGS Former Evap. Pnd	313°	890	0.6	NW	Q
S3	Japanese Mesa	340°	1150	0.7	NNW	R
S4	MCB - Camp Pendleton	3°	1120	0.7	N	A
S5	MCB - Camp Pendleton	19°	1050	0.6	NNE	B
S6	MCB - Camp Pendleton	46°	940	0.6	NE	C
S7	MCB - Camp Pendleton	70°	870	0.6	ENE	D
S8	MCB - Camp Pendleton	98°	1120	0.7	E	E
S9	San Onofre State Beach	121°	940	0.6	ESE	F

* Distance (meters/miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Theta direction is determined from degrees true north.

TABLE 5-6

SECTOR AND DIRECTION DESIGNATION FOR RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATION MAP

DEGREES TRUE NORTH FROM SONGS 2 AND 3 MID-POINT			NOMENCLATURE	
Sector Limit	Center Line	Sector Limit	22.5° Sector*	Direction
348.75	0 & 360	11.25	A	N
11.25	22.5	33.75	B	NNE
33.75	45.0	56.25	C	NE
56.25	67.5	78.75	D	ENE
78.75	90.0	101.25	E	E
101.25	112.0	123.75	F	ESE
123.75	135.0	146.25	G	SE
146.25	157.0	168.75	H	SSE
168.75	180.0	191.25	J	S
191.25	202.5	213.75	K	SSW
213.75	225.0	236.25	L	S
236.25	247.5	258.75	M	WSW
258.75	270.0	281.25	N	W
281.25	292.5	303.75	P	WNW
303.75	315.0	326.25	Q	NW
326.25	337.5	348.75	R	NNW

* Distance (miles) and Direction (sector) are measured relative to Units 2 and 3 midpoint. Direction is determined from degrees true North.

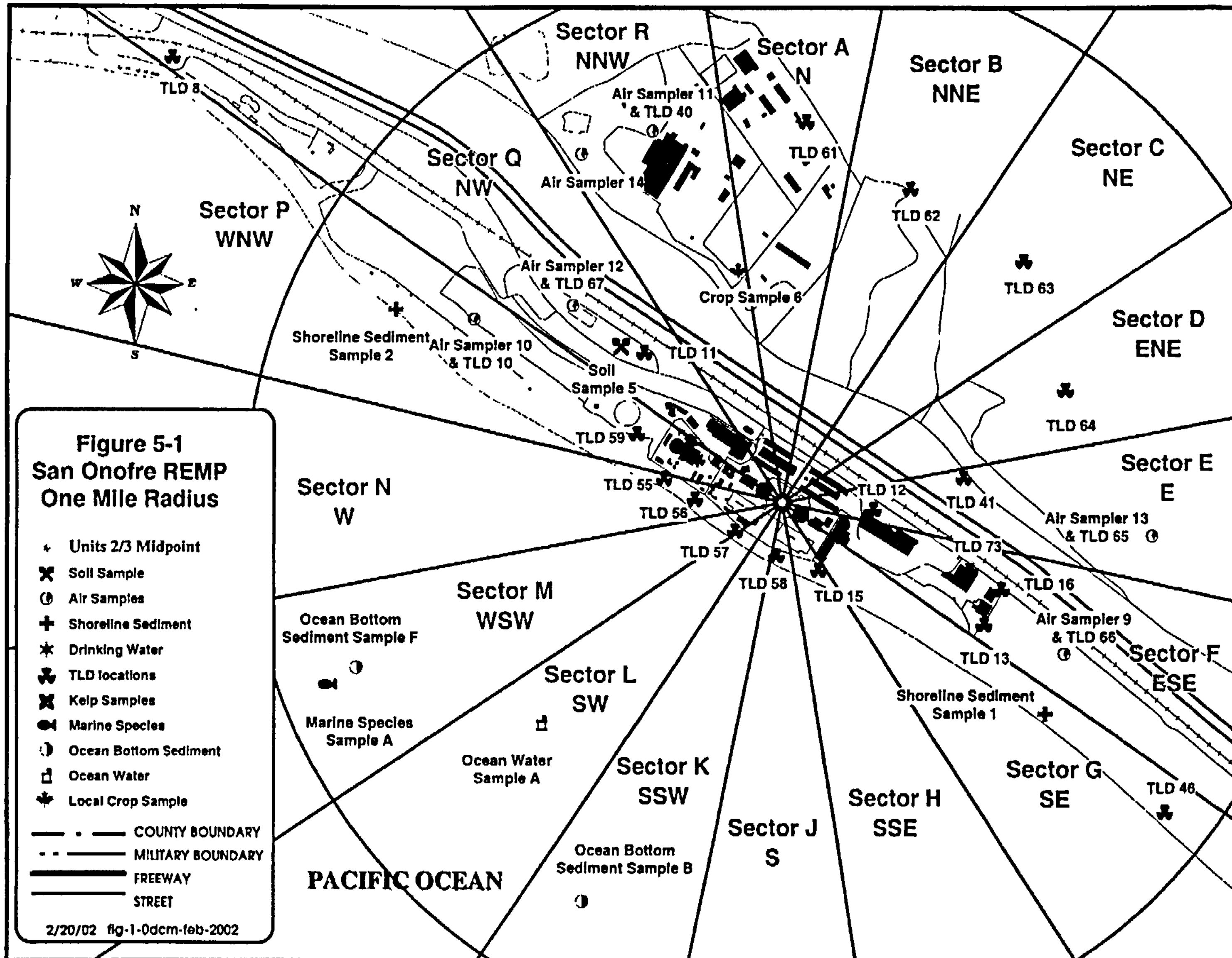

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Figure 5-1
Radiological Environmental Monitoring Sample Locations
1 Mile Radius

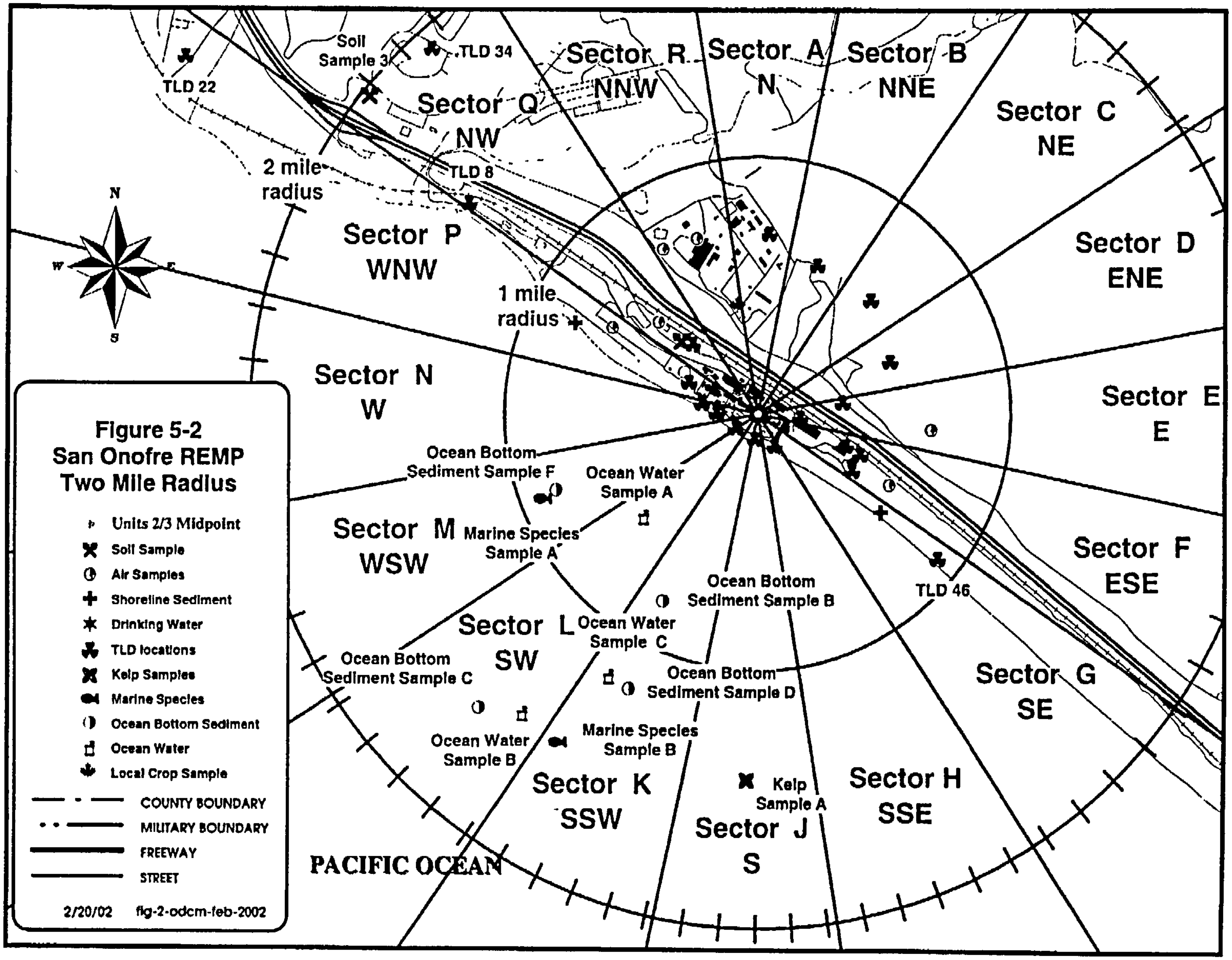

Figure 5-2
Radiological Environmental Monitoring Sample Locations
2 Mile Radius

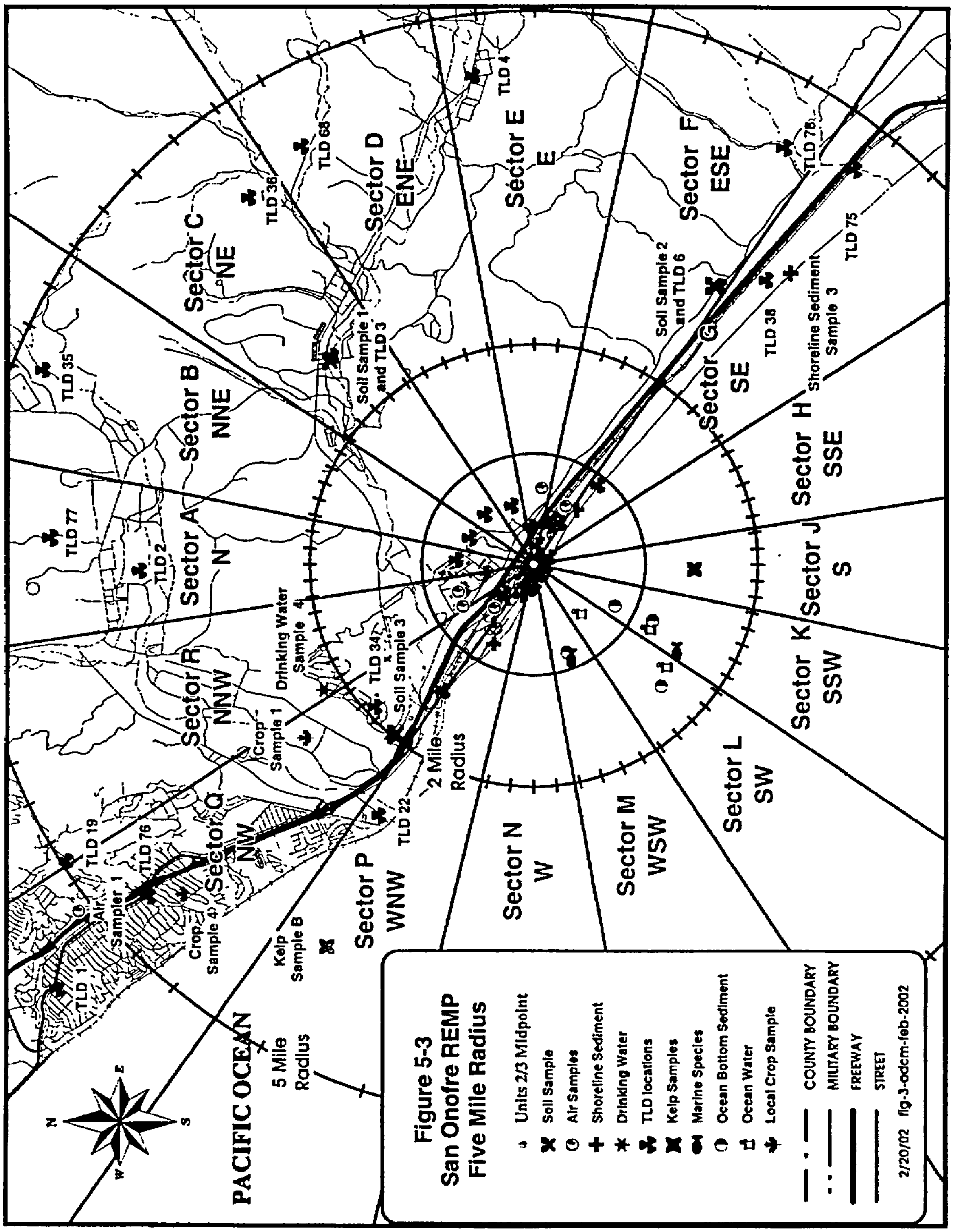

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Figure 5-3
Radiological Environmental Monitoring Sample Locations
5 Mile Radius

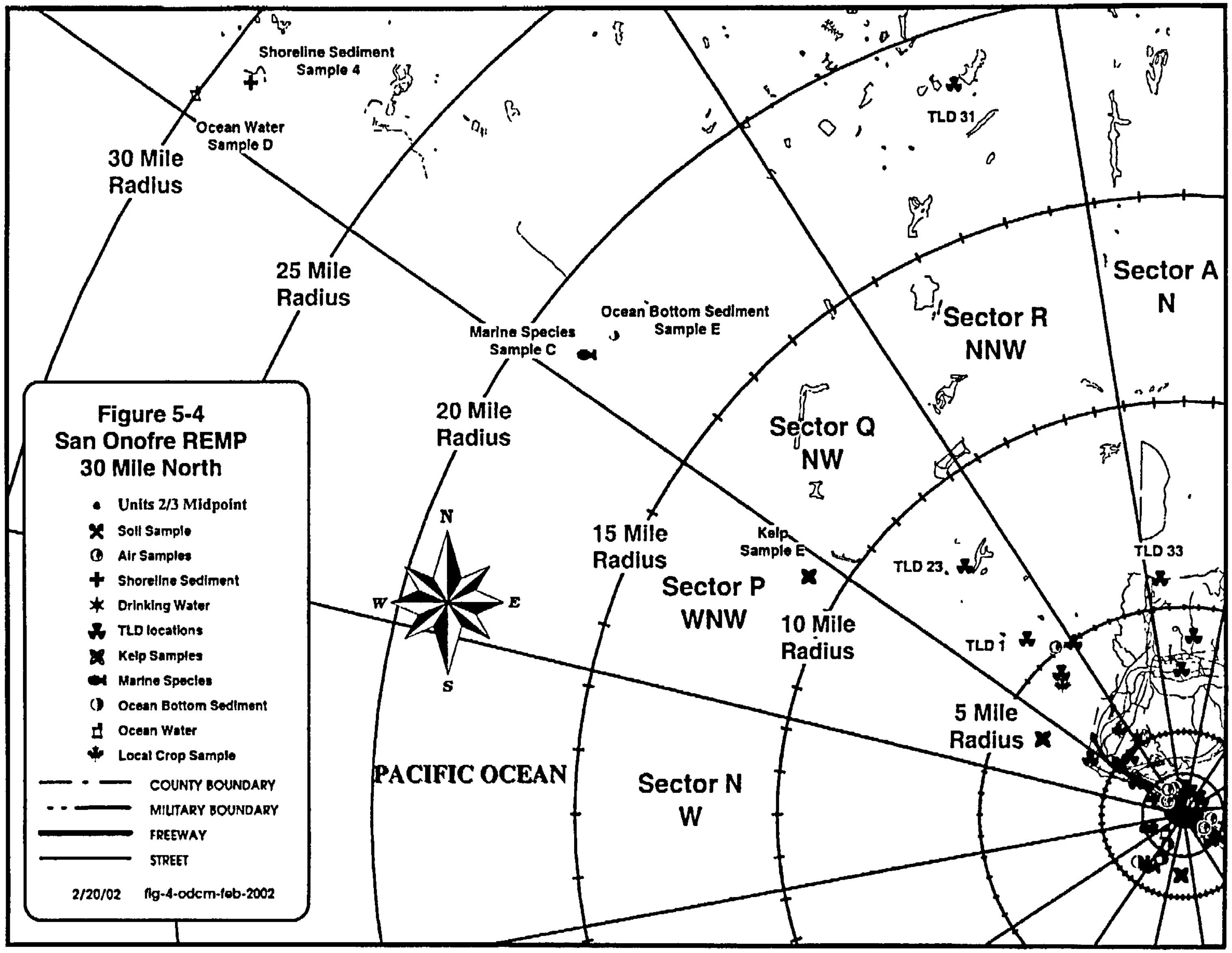

Figure 5-4
Radiological Environmental Monitoring Sample Locations - Orange County

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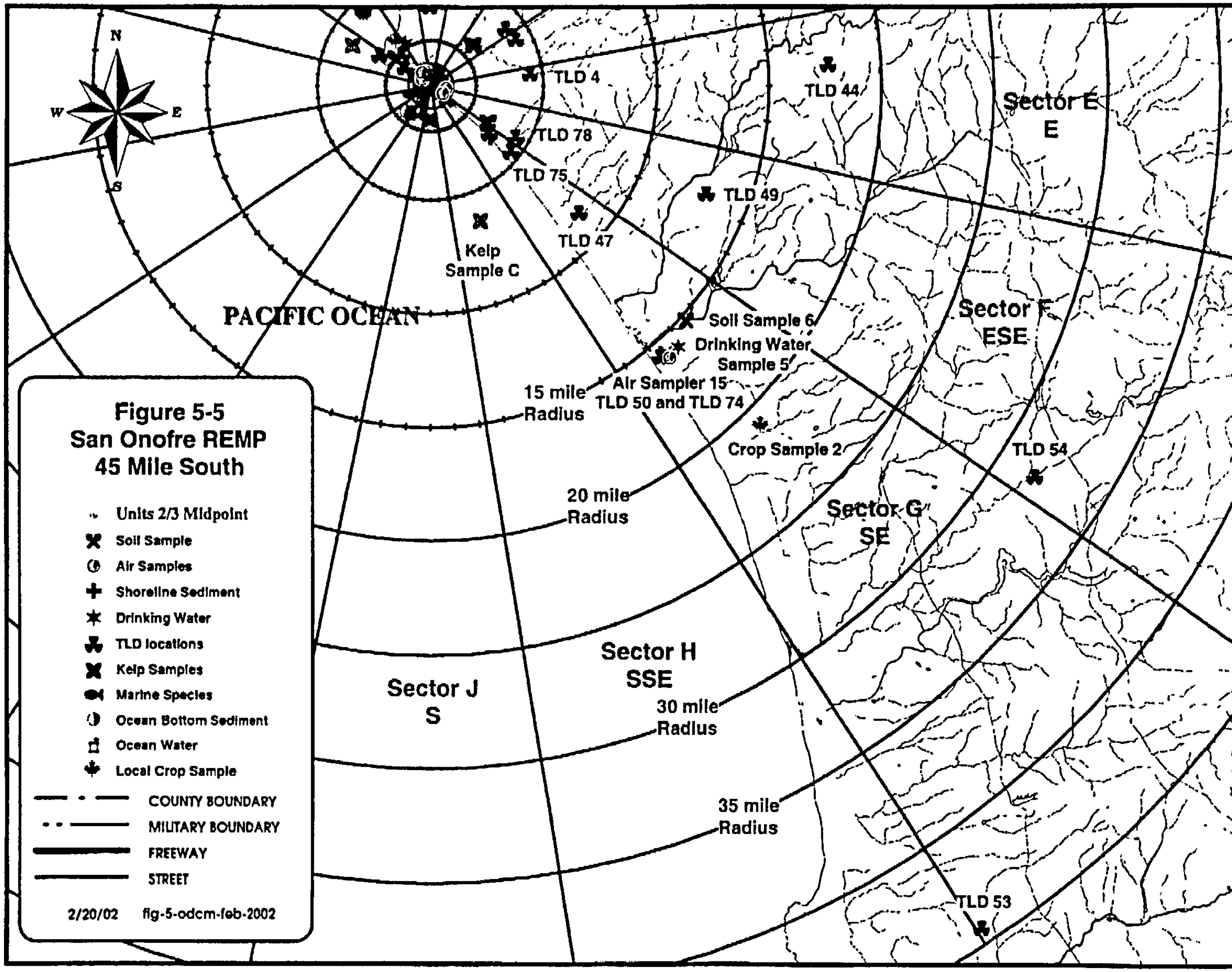

Figure 5-5
Radiological Environmental Monitoring Sample Locations - San Diego County

6.0 **ADMINISTRATIVE**

6.1 DEFINITIONS

The defined terms of this section appear in capitalized type and are applicable throughout the ODCM.

ACTION

6.1.1 ACTION shall be that part of a specification which prescribes remedial measures required under designated conditions.

CHANNEL CALIBRATION

6.1.2 A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel such that it responds with the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the sensors and alarm, interlock and/or trip functions, and may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

CHANNEL CHECK

6.1.3 A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

CHANNEL TEST

6.1.4 A CHANNEL TEST shall be the injection of a simulated signal into the channel to verify its proper response including, where applicable, alarm and/or trip initiating action. The CHANNEL TEST shall include adjustments, as necessary, of the alarm, interlock and/or trip setpoints, such that the setpoints are within the required range and accuracy.

6.0 **ADMINISTRATIVE** (Continued)

6.1 DEFINITIONS (Continued)

FREQUENCY NOTATION

6.1.5 The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 6-2.

FUNCTIONAL

6.1.6 A functional system, subsystem, train, component, or device is capable of performing its specified function(s) and is maintained in accordance with good engineering and maintenance practices for commercial grade equipment. Surveillances required within this document are required to maintain instrumentation as FUNCTIONAL.

6.1.7 **DELETED**

MEMBER(S) OF THE PUBLIC

6.1.8 MEMBER(S) OF THE PUBLIC shall include all individuals who by virtue of their occupational status have no formal association with the plant. This category shall include nonemployees of the licensee who are permitted to use portions of the site for recreational, occupational, or purposes not associated with plant functions. This category shall not include non-employees such as vending machine servicemen or postmen who, as part of their formal job function, occasionally enter an area that is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

6.0 **ADMINISTRATIVE** (Continued)

6.1 DEFINITIONS (Continued)

PROCESS CONTROL PROGRAM

6.1.9 The PROCESS CONTROL PROGRAM shall contain the current formula, sampling, analysis, and formulation determination by which SOLIDIFICATION of radioactive wastes from liquid systems is assured.

SITE BOUNDARY

6.1.10 The SITE BOUNDARY shall be that line beyond which the land is not owned, leased, or otherwise controlled by the licensee.

SOLIDIFICATION

6.1.11 SOLIDIFICATION shall be the conversion of wet wastes into a form that meets shipping and burial ground requirements.

SOURCE CHECK

6.1.12 For REM RAD analog monitors a SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

For Sorrento Electronics digital Monitors a SOURCE CHECK shall be verification of proper computer response to a check source request.

For MGPI monitors a SOURCE CHECK shall be the verification of proper computer response to the continuous internal detector, monitor calibration and electrical checks.

SURVEILLANCE REQUIREMENT: MEETING SPECIFIED FREQUENCY

6.1.13 Each Surveillance Requirement shall be performed within the specified surveillance interval with a maximum allowable extension not to exceed 25% of the specified surveillance interval.

This provision is not intended to be used repeatedly as a convenient means to extend Surveillance intervals beyond those specified. Additionally, it does not apply to any Action Statements.

UNRESTRICTED AREA

6.1.14 An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials of any area within the site boundary used for residential quarters or industrial, commercial, institutional and/or recreational purposes.

TABLE 6-2

FREQUENCY NOTATION

NOTATION	FREQUENCY
S	At least once per 12 hours
D	At least once per 24 hours
W	At least once per 7 days
M	At least once per 31 days
Q	At least once per 92 days
SA	At least once per 184 days
18M	At least once per 18 months
P	Completed prior to each release
N.A.	Not applicable

6.0 **ADMINISTRATIVE** (Continued)

6.2 SITE DESCRIPTION

The San Onofre Nuclear Generating Station is located on the West Coast of Southern California in San Diego County, about 62 miles southeast of Los Angeles and about 51 miles northwest of San Diego. The site is located within the U.S. Marine Corps Base, Camp Pendleton, California. The minimum distance to the boundary of the exclusion area as defined in 10CFR100.3 shall be 283.5 meters from the outer edge of the Unit 1 containment sphere. For the purpose of dose assessment, a slightly reduced distance of 282 meters defined by the discontinuous line in Figure 6-1 is assumed.

Basis: Leasing arrangements with the U.S. Marine Corps provide that a minimum distance to the exclusion boundary will be 283.5 meters. All dose assessments are calculated assuming 282 meters.

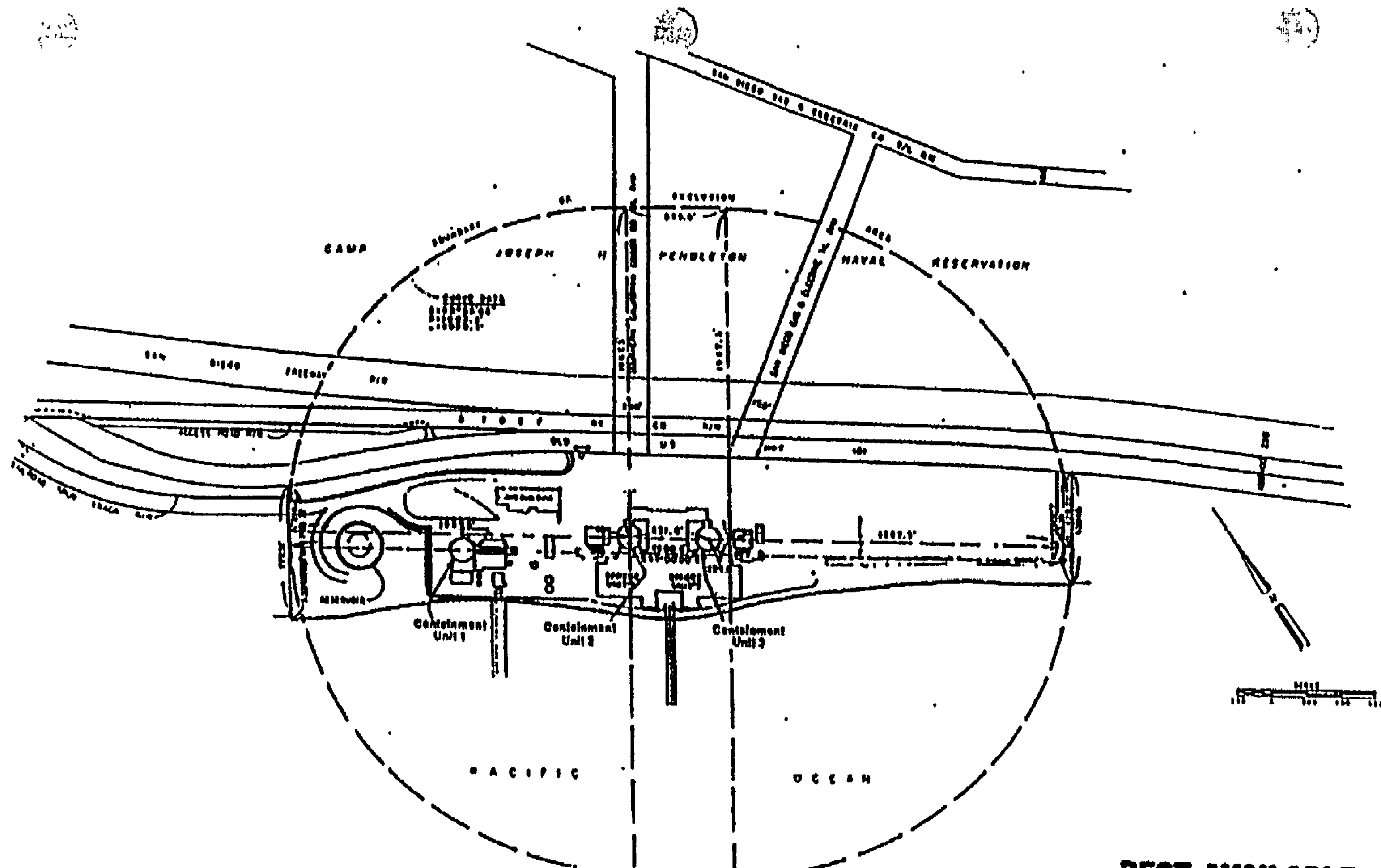

Figure 6-1
Exclusion Area
Reference: Unit 1 Permanently Defueled
Technical Specification, Figure D5.1.1

BEST AVAILABLE
DOCUMENT
FOR SCANNING

Figure 6-1
Exclusion Area
Reference: Unit 1 Permanently Defueled
Technical Specification, Figure D5.1.1

6.0 **ADMINISTRATIVE** (Continued)

6.3 ADMINISTRATIVE CONTROLS

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT[1]

6.3.1 Routine radioactive effluent release reports for the unit during the previous calendar year shall be submitted before May 1 of each year.

6.3.2 The radioactive effluent release reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The radioactive effluent release report shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, and atmospheric stability, and precipitation (if measured) on magnetic tape, or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.[2] This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with Sections 1.5 and 2.6.

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[1]A single submittal may be made for multiple unit station. The submittal should combine those sections that are common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

[2]In lieu of submission with the Annual Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

6.0 **ADMINISTRATIVE** (Continued)

6.3 ADMINISTRATIVE CONTROLS (Continued)

6.3.2 (Continued)

The radioactive effluent release report shall also include an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous calendar year to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Sections 1.5 and 2.6.

The radioactive effluent release reports shall include the following information for each type of solid waste shipped offsite during the report period:

a. Container volume,

b. Total curie quantity (specify whether determined by measurement or estimate),

c. Principal radionuclides (specify whether determined by measurement or estimate),

d. Type of waste (e.g., dewatered spent resin, compacted dry waste, evaporator bottom),

e. Type of container (e.g., LSA, Type A, Type B, Large Quantity), and

f. Solidification agent (e.g., cement, urea formaldehyde).

The radioactive release reports shall include unplanned releases from the site to UNRESTRICTED AREAS of radioactive material in gaseous and liquid effluents made during the reporting period. |R

The Annual Radioactive Effluent Release Reports shall include any changes made to the PROCESS CONTROL PROGRAM (PCP), to the OFFSITE DOSE CALCULATION MANUAL (ODCM), or major changes to radioactive waste treatment systems during the reporting period.

6.0 **ADMINISTRATIVE** (Continued)

6.3 ADMINISTRATIVE CONTROLS (Continued)

6.3.3 MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS[1] (Liquid and Gaseous)

Licensee initiated major changes to the radioactive waste systems (liquid and gaseous):

1. Shall be reported to the Commission in the Annual Radioactive Effluent Release Report for the period in which the change(s) was made effective pursuant to Technical Specification D6.5.2.9. The discussion of each change shall contain:

    a. A summary of the evaluation that led to the determination that the change could be made in accordance with applicable regulations;

    b. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

    c. A detailed description of the equipment, components and processes involved and the interfaces with other plant systems;

    d. An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents that differ from those previously predicted in the license application and amendments thereto;

    e. An evaluation of the change which shows the expected maximum exposures to an individual in the unrestricted area and to the general population that differ from those previously estimated in the license application and amendments thereto;

    f. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents, to the actual releases for the period prior to when the changes are to be made;

    g. An estimate of the exposure to plant operating personnel as a result of the change; and

    h. Documentation of the fact that the change was reviewed and found acceptable pursuant to Technical Specification D6.5.2.

2. Shall become effective upon review and acceptance pursuant to Technical Specification D6.5.2.

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[1]A single submittal may be made for a multiple unit station. The submittal should combine those sections that are common to all units at the Station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

6.0 **ADMINISTRATIVE** (Continued)

6.4 BASES

LIQUID EFFLUENT CONCENTRATION (1.1.1, 1.1.2)

6.4.1 These specifications are provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to UNRESTRICTED AREAS will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10 CFR Part 20.106(e) to the population. The concentration limit for noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

LIQUID EFFLUENT DOSE (1.2.1)

6.4.2 This specification is provided to implement the requirements of Section II.A and IV.A of Appendix I, 10 CFR Part 50. Specification A implements the guides set forth in Section II.A of Appendix I. Specification B provides the required operating flexibility and at the same time implements the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable."

LIQUID EFFLUENT DOSE (1.2.2)

6.4.3 This specification is provided to implement the requirements of Section III.A of Appendix I, 10 CFR Part 50. The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated.

6.0 **ADMINISTRATIVE** (Continued)

6.4 BASES (Continued)

LIQUID WASTE TREATMENT (1.3.1, 1.3.2)

6.4.4 The FUNCTIONALITY of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirements that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonable achievable." This specification implements the requirements of 10 CFR Part 50.36a and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the guide set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

GASEOUS EFFLUENTS DOSE RATE (2.1.1, 2.1.2)

6.4.5 This specification is provided to ensure that the dose rate at and beyond the SITE BOUNDARY from gaseous effluents will be within the annual dose limits of 10 CFR Part 20 for UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the exclusion area boundary, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 [10 CFR Part 20.106(b)]. For MEMBERS OF THE PUBLIC who may at times be within the exclusion area boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the exclusion area boundary. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the exclusion area boundary to ≤ 500 mrem/year to the total body or to ≤ 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to ≤ 1500 mrem/year.

DOSE, NOBLE GASES (2.2.1)

6.4.6 This specification is provided to implement the requirements of Section II.B and IV.A of Appendix I, 10 CFR Part 50. Specification A implements the guides set forth in Section II.B of Appendix I. Specification B provides the required operating flexibility and at the same time implements the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable."

DOSE, NOBLE GASES (2.2.2)

6.4.7 This specification implements the requirements in Section III.A of Appendix I, 10 CFR Part 50, that conformance with the guides of Appendix I, be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through the appropriate pathways is unlikely to be substantially underestimated. The ODCM equations provided for determining the air doses at the SITE BOUNDARY will be based upon the historical average atmospheric conditions.

DOSE, IODINE-131, IODINE-133, TRITIUM AND RADIONUCLIDES IN PARTICULATE FORM (2.3.1)

6.4.8 This specification is provided to implement the requirements of Sections II.C and IV.A of Appendix I, 10 CFR Part 50. Specification A is the guide set forth in Section II.C of Appendix I. Specification B provides the required operating flexibility and at the same time implements the guides set forth in Section IV.a of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable."

DOSE, IODINE-131, IODINE-133, TRITIUM AND RADIONUCLIDES IN PARTICULATE FORM (2.3.2)

6.4.9 This specification implements the requirements in Section III.A of Appendix I, 10 CFR Part 50, that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated.

DOSE, IODINE-131, IODINE-133, TRITIUM AND RADIONUCLIDES IN PARTICULATE FORM (2.3.2) (Continued)

6.4.9 (Continued)

The ODCM equations provided for determining the actual doses are based upon the historical average atmospheric conditions. The release rate specifications for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent on the existing radionuclides pathways to man in the areas at and beyond the SITE BOUNDARY. The pathways which are examined in the development of these calculations are: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation and subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure to man.

6.4.10 **DELETED**

DOSE (3.3.1)

6.4.11 This specification is provided to meet the reporting requirements of 40 CFR 190. In complying with 40 CFR 190, nuclear fuel cycle facilities over five miles away are not considered to contribute to the dose assessment.

6.0 **ADMINISTRATIVE** (Continued)

6.4 BASES (Continued)

DOSE (3.3.2)

6.4.12 This specification is provided to meet the dose limitations of 40 CFR 190. The specification requires the preparation and submittal of a Special Report whenever the calculated doses from plant radioactive effluents exceed twice the design objective doses of Appendix I. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR 190 if the individual reactors remain within the reporting requirement level. 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 12 consecutive months 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 miles must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR 190, the Special Report with a request for a variance in accordance with the provisions of 40 CFR 190.11, is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed provided the release conditions resulting in violation of 40 CFR 190 have not already been corrected. 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 nuclear fuel cycle.

RADIOACTIVE LIQUID EFFLUENT INSTRUMENTATION (4.1.1, 4.1.2)

6.4.13 The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases. The alarm/trip setpoints for these instruments are calculated in accordance with methods in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

RADIOACTIVE GASEOUS EFFLUENT INSTRUMENTATION (4.2.1, 4.2.2)

6.4.14 The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments are calculated in accordance with methods in this ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

6.0 **ADMINISTRATIVE** (Continued)

6.4 BASES (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING (5.1.1)

6.4.15 The radiological monitoring program required by this specification 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 a MEMBER OF THE PUBLIC resulting from the station operation. This monitoring program thereby supplements the radiological effluents 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 modeling of the environmental exposure pathways. The initially specified monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

RADIOLOGICAL ENVIRONMENTAL MONITORING (5.1.2)

6.4.16 The radiological environmental monitoring program required by this specification 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 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 modeling for the environmental exposure pathways.

The detection capabilities required by Table 5-3 are state-of-the-art for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as *a priori* (before the fact) limit representing the capability of a measurement system and not as *a posteriori* (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

6.0 **ADMINISTRATIVE** (Continued)

6.4 BASES (Continued)

LAND USE CENSUS (5.2.1)

6.4.17 This specification is provided to ensure that changes in the use of UNRESTRICTED AREAS are identified and that modifications to the monitoring program are made if required by the results of this census. The best survey information from the door-to-door, aerial, or consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 500 square feet provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (25 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were used, (1) that 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/square meter.

LAND USE CENSUS (5.2.2)

6.4.18 This specification is provided to ensure that changes in the use of UNRESTRICTED AREAS are identified and that modifications to the monitoring program are made if required by the results of this census. The best survey information from the door-to-door, aerial or consulting with local agricultural authorities shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50.

INTERLABORATORY COMPARISON PROGRAM (5.3.1, 5.3.2)

6.4.19 The requirements for participation in an Interlaboratory Comparison Program 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.