



SAN ONOFRE NUCLEAR GENERATING STATION

Annual Radioactive Effluent Release Report

2011

January – December

PREFACE

San Onofre Nuclear Generating Station is located next to San Onofre State Beach, adjoining Camp Pendleton Marine Corps Base, in San Diego County, 64 miles south of Los Angeles, California. There are two operating pressurized water reactors with a total rated capacity of 2254 net megawatts electrical.

Unit 1, rated at 410 net megawatts electrical, was supplied by Westinghouse Electric Company and began commercial operation on January 1, 1968. The unit was permanently shutdown on November 30, 1992. By August 31, 2004, all fuel was transferred to the Independent Spent Fuel Storage Installation (ISFSI). By November 29, 2006, all remaining monitored effluent pathways were permanently removed from service. Unit 1 is owned by Southern California Edison (80%) and San Diego Gas and Electric (20%).

Unit 2 and Unit 3 were supplied by Combustion Engineering, Inc., with turbine generators supplied by G.E.C. Turbine Generators, Ltd., of England. The units began commercial operation on August 18, 1983, and April 1, 1984, respectively and are rated at 1127 net megawatts electrical each. The twin units are owned by Southern California Edison (78.21%), San Diego Gas and Electric (20%), and the City of Riverside (1.79%).

Effective December 29, 2006, the City of Anaheim has transferred its ownership interests in San Onofre Units 2 and 3 and the entitlement to the Units 2 and 3 output, to Southern California Edison Company, except that it retains its ownership interests in its spent nuclear fuel and Units 2 and 3's independent spent fuel storage installation located on the facility's site. In addition, the City of Anaheim retains financial responsibility for its spent fuel and for a portion of the Units 2 and 3 decommissioning costs. The City of Anaheim remains a licensee for purposes of its retained interests and liabilities.

San Onofre Nuclear Generating Station

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SECTION A. INTRODUCTION

This Annual Radioactive Effluent Release Report summarizes the gaseous and liquid radioactive effluent releases and radwaste shipments made from the San Onofre Nuclear Generating Station, Units 2 and 3. This report is prepared in the general format of USNRC Regulatory Guide 1.21 and includes:

1. Quarterly Summaries of Gaseous and Liquid Effluents for "Continuous" and "Batch" Modes of Release
2. Percent of Applicable Limits
3. Estimated Total Percent Error
4. Lower Limit of Detection Concentrations
5. Batch Release Summaries
6. Previous Radioactive Effluent Release Report Addendum
7. Radwaste Shipments
8. 10 CFR 50 Appendix I Requirements
9. Changes to Offsite Dose Calculation Manual

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SECTION B. GASEOUS EFFLUENTS

Table 1A, "Gaseous Effluents Summation of All Releases," provides a detailed listing of gaseous effluents released quarterly in four categories: fission and activation gases, iodine 131, particulates with half lives greater than eight days, and tritium. Listed for each of the four categories are:

- (1) the total curies released
- (2) the average release rate
- (3) the percent of applicable limit
- (4) the estimated total error

In addition, the particulate category lists the gross alpha radioactivity released for each quarter.

The methodology used to calculate the percent of Applicable Limit is presented in Section F of this report. The methodology used in Table 1A to calculate the estimated total error is presented in Section G of this report.

Table 1B, "Gaseous Effluents Elevated Release," has not been included in this report since San Onofre Nuclear Generating Station Units 2 and 3 do not conduct elevated releases.

Table 1C, "Gaseous Effluents Ground Level Releases," provides the systematic listing by radionuclide for the quantity of radioactivity released in three categories: fission gases, iodines, and particulates. The total radioactivity for each radionuclide is listed for each quarterly period by both "continuous" and "batch" modes of release.

Waste gas decay tank releases are considered to be "batch" releases. Containment purges and plant stack releases are considered to be "continuous" releases.

Table 1D, "Gaseous Effluents Lower Limit of Detection," provides a listing of lower limit of detection concentrations for radionuclides not detected in Tables 1A and 1C.

Table 1E, "Gaseous Effluents Radiation Doses at the Site Boundary," provides a quarterly summary of doses at the site boundary for this report period.

Table 1F, "Gaseous Effluents Batch Release Summary," provides summary information regarding batch releases conducted during this report period from San Onofre Nuclear Generating Station.

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TABLE 1A

GASEOUS EFFLUENTS SUMMATION OF ALL RELEASES

		Unit	First Quarter	Second Quarter	Estimated Total Error, %
A. Fission and activation gases					
1.	Total release	Ci	1.58E+1	2.19E+1	3.00E+1
2.	Average release rate for period	μCi/sec	2.03E+0	2.78E+0	
3.	Percent of applicable limit	% MPC	1.02E-2	8.59E-3	
4.	Percent Effluent Concentration Limit	% ECL	2.66E-2	1.76E-2	
B. Iodines					
1.	Total I-131	Ci	1.10E-4	1.33E-4	1.90E+1
2.	Average release rate for period	μCi/sec	1.41E-5	1.69E-5	
3.	Percent of applicable limit	% MPC	6.79E-5	8.12E-5	
4.	Percent Effluent Concentration Limit	% ECL	3.40E-5	4.06E-5	
C. Particulates					
1.	Particulates with half-lives >8 days	Ci	6.35E-5	1.84E-6	1.60E+1
2.	Average release rate for period	μCi/sec	8.16E-6	2.34E-7	
3.	Percent of applicable limit	% MPC	4.75E-6	5.62E-8	
4.	Percent Effluent Concentration Limit	% ECL	2.16E-5	1.12E-7	
5.	Gross alpha activity	Ci	<LLD	<LLD	5.00E+1
D. Tritium					
1.	Total release	Ci	1.80E+1	4.12E+1	2.50E+1
2.	Average release rate for period	μCi/sec	2.31E+0	5.24E+0	
3.	Percent of applicable limit	% MPC	5.56E-3	1.26E-2	
4.	Percent Effluent Concentration Limit	% ECL	1.11E-2	2.52E-2	

LLD Lower Limit of Detection; see Table 1D

- (1) On 2/7/11 and 2/8/11, for approximately 9 hours condenser air ejector particulate and iodine sample were missed. The previous and subsequent samples, which had no measurable activity, were used to estimate the activity during the missed sample period.

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TABLE 1A (Continued)

GASEOUS EFFLUENTS SUMMATION OF ALL RELEASES

		Unit	Third Quarter	Fourth Quarter	Estimated Total Error, %
A. Fission and activation gases					
1.	Total release	Ci	3.09E+1	3.41E+1	3.00E+1
2.	Average release rate for period	μCi/sec	3.88E+0	4.29E+0	
3.	Percent of applicable limit	% MPC	6.39E-3	8.39E-3	
4.	Percent Effluent Concentration Limit	% ECL	4.51E-3	1.10E-2	
B. Iodines					
1.	Total I-131	Ci	3.01E-4	2.04E-4	1.90E+1
2.	Average release rate for period	μCi/sec	3.79E-5	2.57E-5	
3.	Percent of applicable limit	% MPC	1.82E-4	1.23E-4	
4.	Percent Effluent Concentration Limit	% ECL	9.09E-5	6.16E-5	
C. Particulates					
1.	Particulates with half-lives >8 days	Ci	<LLD	3.29E-5	1.60E+1
2.	Average release rate for period	μCi/sec	N/A	4.14E-6	
3.	Percent of applicable limit	% MPC	N/A	9.93E-7	
4.	Percent Effluent Concentration Limit	% ECL	N/A	1.99E-6	
5.	Gross alpha activity	Ci	<LLD	<LLD	5.00E+1
D. Tritium					
1.	Total release	Ci	1.04E+1	1.10E+1	2.50E+1
2.	Average release rate for period	μCi/sec	1.31E+0	1.38E+0	
3.	Percent of applicable limit	% MPC	3.14E-3	3.32E-3	
4.	Percent Effluent Concentration Limit	% ECL	6.28E-3	6.64E-3	

LLD Lower Limit of Detection; see Table 1D

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TABLE 1C

GASEOUS EFFLUENTS GROUND LEVEL RELEASES
CONTINUOUS MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation gases					
argon-41	Ci	3.21E+0	2.10E+0	1.33E-1	1.17E+0
krypton-85	Ci	<LLD	<LLD	<LLD	<LLD
krypton-85m	Ci	1.52E-1	9.88E-2	<LLD	<LLD
krypton-87	Ci	1.63E-1	8.86E-2	<LLD	<LLD
krypton-88	Ci	2.93E-1	1.84E-1	<LLD	<LLD
xenon-133	Ci	8.55E+0	1.85E+1	3.07E+1	3.29E+1
xenon-133m	Ci	6.87E-2	7.23E-2	<LLD	<LLD
xenon-135	Ci	9.96E-1	6.72E-1	<LLD	<LLD
xenon-135m	Ci	1.01E-1	5.80E-2	<LLD	<LLD
xenon-138	Ci	1.40E-1	9.29E-2	<LLD	<LLD
Total for period	Ci	1.37E+1	2.19E+1	3.09E+1	3.41E+1
2. Iodines					
iodine-131	Ci	1.10E-4	1.33E-4	3.01E-4	2.04E-4
iodine-132	Ci	<LLD	2.92E-7	<LLD	<LLD
iodine-133	Ci	6.94E-5	1.39E-4	2.22E-4	3.53E-4
iodine-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	1.80E-4	2.72E-4	5.23E-4	5.57E-4

LLD Lower Limit of Detection; see Table 1D.

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TABLE 1C (Continued)

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES
CONTINUOUS MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
3. Particulates					
barium-140	Ci	<LLD	<LLD	<LLD	<LLD
bromine-82	Ci	1.16E-5	1.96E-5	2.81E-5	8.25E-5
cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
cerium-144	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	2.48E-6	<LLD	<LLD	<LLD
cesium-137	Ci	1.80E-6	<LLD	<LLD	<LLD
chromium-51	Ci	9.39E-7	<LLD	<LLD	<LLD
cobalt-57	Ci	4.29E-8	<LLD	<LLD	<LLD
cobalt-58	Ci	4.01E-5	1.84E-6	<LLD	3.29E-5
cobalt-60	Ci	1.46E-5	<LLD	<LLD	<LLD
iron-59	Ci	<LLD	<LLD	<LLD	<LLD
lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	2.93E-7	<LLD	<LLD	<LLD
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
niobium-95	Ci	2.78E-6	<LLD	<LLD	<LLD
strontium-89	Ci	<LLD	<LLD	<LLD	<LLD
strontium-90	Ci	<LLD	<LLD	<LLD	<LLD
tellurium-132	Ci	2.23E-6	<LLD	<LLD	<LLD
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-95	Ci	4.39E-7	<LLD	<LLD	<LLD

LLD Lower Limit of Detection; see Table 1D.

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TABLE 1C (Continued)

GASEOUS EFFLUENTS GROUND LEVEL RELEASES
BATCH MODE *

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation gases					
argon-41	Ci	2.07E-1	N/A	N/A	N/A
krypton-85	Ci	1.64E+0	N/A	N/A	N/A
krypton-85m	Ci	8.37E-3	N/A	N/A	N/A
krypton-87	Ci	7.99E-3	N/A	N/A	N/A
krypton-88	Ci	1.70E-2	N/A	N/A	N/A
xenon-133	Ci	1.63E-1	N/A	N/A	N/A
xenon-133m	Ci	6.04E-3	N/A	N/A	N/A
xenon-135	Ci	4.90E-2	N/A	N/A	N/A
xenon-135m	Ci	6.23E-3	N/A	N/A	N/A
xenon-138	Ci	1.75E-2	N/A	N/A	N/A
Total for period	Ci	2.12E+0	N/A	N/A	N/A

N/A No batch releases during second, third or fourth quarters of 2011

* Iodines and particulates are not analyzed prior to release via batch mode.

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TABLE 1D

GASEOUS EFFLUENTS LOWER LIMIT OF DETECTION
CONTINUOUS and BATCH MODE

Radionuclides	Continuous Mode LLD (μCi/cc)	Batch Mode LLD (μCi/cc)
1. Fission and activation gases		
krypton-85	3.00E-5	1.40E-3
krypton-85m	7.50E-8	3.10E-6
krypton-87	3.80E-7	1.40E-5
krypton-88	2.70E-7	1.10E-5
xenon-133	*	9.90E-6
xenon-133m	6.00E-7	2.70E-5
xenon-135	7.70E-8	3.50E-6
xenon-135m	2.90E-6	4.40E-5
xenon-138	5.00E-6	6.70E-5
2. Iodines		
iodine-132	2.10E-9	N/A
iodine-135	2.4E-10	N/A
3. Particulates		
barium-140	7.20E-13	N/A
cerium-141	8.30E-14	N/A
cerium-144	3.40E-13	N/A
cesium-134	2.00E-13	N/A
cesium-137	1.70E-13	N/A
chromium-51	7.70E-13	N/A
cobalt-57	4.30E-14	N/A
cobalt-58	1.80E-13	N/A
cobalt-60	2.90E-13	N/A
iron-59	4.50E-13	N/A
lanthanum-140	1.40E-12	N/A
manganese-54	1.80E-13	N/A
molybdenum-99	1.00E-13	N/A
niobium-95	1.80E-13	N/A
strontium-89	1.00E-11	N/A
strontium-90	1.00E-11	N/A
tellurium-132	1.20E-13	N/A
zinc-65	4.80E-13	N/A
zirconium-95	3.10E-13	N/A
4. alpha	1.00E-11	N/A

* Radionuclide was >LLD in all 4 quarters

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TABLE 1E

GASEOUS EFFLUENTS RADIATION DOSES AT THE SITE BOUNDARY

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
A. Noble Gas					
1. Gamma Air Dose	mrad	6.79E-3	4.85E-3	1.84E-3	3.42E-3
2. Percent Applicable Limit	%	6.79E-2	4.85E-2	1.84E-2	3.42E-2
3. Beta Air Dose	mrad	4.57E-3	4.59E-3	4.97E-3	5.84E-3
4. Percent Applicable Limit	%	2.28E-2	2.30E-2	2.49E-2	2.92E-2
B. Tritium, Iodine, Particulates (at the nearest receptor)					
1. Organ Dose	mrem	3.18E-3	6.59E-3	2.26E-3	2.24E-3
2. Percent Applicable Limit	%	2.12E-2	4.39E-2	1.51E-2	1.49E-2

NOTE: Calculations performed in accordance with the ODCM utilizing the historical X/Q.

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TABLE 1F

GASEOUS EFFLUENTS BATCH RELEASE SUMMARY

	12 month period
1. Number of batch releases:	3 releases
2. Total time period for batch releases:	2654 minutes
3. Maximum time period for a batch release:	1564 minutes
4. Average time period for a batch release:	885 minutes
5. Minimum time period for a batch release:	476 minutes

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SECTION C. LIQUID EFFLUENTS

Table 2A, "Liquid Effluents Summation of All Releases," provides a detailed summary of liquid effluents released quarterly in three categories: fission and activation products, tritium, and dissolved and entrained gases. Listed for each of the three categories are:

- (1) the total curies released
- (2) the average diluted concentration
- (3) the percent of applicable limit
- (4) the estimated total error

In addition, Table 2A lists:

- (1) the gross alpha radioactivity
- (2) the volume of waste released (prior to dilution)
- (3) the volume of dilution water

The methodology used to calculate the percent of applicable limit is presented in Section F of this report. The methodology used to calculate the estimated total error in Table 2A is presented in Section G of this report.

Table 2B, "Liquid Effluents," provides the systematic listing by radionuclide for the quantity of radioactivity released in each category. The total radioactivity of each radionuclide released is listed for each quarterly period by both "continuous" and "batch" modes of release.

Table 2C, "Liquid Effluents Lower Limit of Detection," provides a listing of lower limit of detection concentrations for radionuclides not detected in Table 2B.

Table 2D, "Liquid Effluents Radiation Doses at the Liquid Site Boundary," presents a quarterly summary of doses at the Liquid Site Boundary for this report period.

Table 2E, "Liquid Effluents Batch Release Summary," provides summary information regarding batch releases conducted during this report period from San Onofre Nuclear Generating Station.

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TABLE 2A

LIQUID EFFLUENTS SUMMATION OF ALL RELEASES

		Unit	First Quarter	Second Quarter	Estimated Total Error, %
A. Fission and activation products					
1.	Total release (not including tritium, gases, alpha)	Ci	3.40E-4	1.66E-3	1.90E+1
2.	Average diluted concentration during period	µCi/ml	4.92E-13	2.16E-12	
3.	Percent of applicable limit	% MPC	1.19E-6	3.14E-6	
4.	Percent Effluent Concentration Limit	% ECL	3.15E-6	2.42E-5	
B. Tritium					
1.	Total release	Ci	3.11E+1	1.53E+2	1.90E+1
2.	Average diluted concentration during period	µCi/ml	4.50E-8	2.00E-7	
3.	Percent of applicable limit	% MPC	1.50E-3	6.67E-3	
4.	Percent Effluent Concentration Limit	% ECL	4.50E-3	2.00E-2	
C. Dissolved and entrained gases					
1.	Total release	Ci	5.53E-6	5.00E-3	1.90E+1
2.	Average diluted concentration during period	µCi/ml	8.00E-15	6.54E-12	
3.	Percent of applicable limit	% MPC	4.00E-9	3.27E-6	
4.	Percent Effluent Concentration Limit	% ECL	4.00E-9	3.27E-6	
D. Gross alpha activity					
1.	Total release	Ci	<LLD	<LLD	5.00E+1
E.	Volume of waste released (batch & continuous, prior to dilution)	liters	5.82E+7	6.69E+7	5.00E+0
F.	Volume of dilution water used during period	liters	6.91E+11	7.65E+11	5.00E+0

LLD Lower Limit of Detection; see Table 2C.

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TABLE 2A (Continued)

LIQUID EFFLUENTS SUMMATION OF ALL RELEASES

		Unit	Third Quarter	Fourth Quarter	Estimated Total Error, %
A. Fission and activation products					
1.	Total release (not including tritium, gases, alpha)	Ci	9.64E-4	6.59E-3	1.90E+1
2.	Average diluted concentration during period	µCi/ml	1.25E-12	8.52E-12	
3.	Percent of applicable limit	% MPC	1.33E-5	3.01E-5	
4.	Percent Effluent Concentration Limit	% ECL	2.95E-5	6.96E-5	
B. Tritium					
1.	Total release	Ci	2.25E+2	7.49E+2	1.90E+1
2.	Average diluted concentration during period	µCi/ml	2.92E-7	9.68E-7	
3.	Percent of applicable limit	% MPC	9.73E-3	3.23E-2	
4.	Percent Effluent Concentration Limit	% ECL	2.92E-2	9.68E-2	
C. Dissolved and entrained gases					
1.	Total release	Ci	2.50E-2	1.00E+0	1.90E+1
2.	Average diluted concentration during period	µCi/ml	3.24E-11	1.30E-9	
3.	Percent of applicable limit	% MPC	1.62E-5	6.48E-4	
4.	Percent Effluent Concentration Limit	% ECL	1.62E-5	6.48E-4	
D. Gross alpha activity					
1.	Total release	Ci	<LLD	**	5.00E+1
E.	Volume of waste released (batch & continuous, prior to dilution)	liters	6.59E+7	5.24E+7	5.00E+0
F.	Volume of dilution water used during period	liters	7.71E+11	7.74E+11	5.00E+0

LLD Lower Limit of Detection; see Table 2C.

** Fourth quarter analysis not available at report time: values will be included in the next Annual Report.

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TABLE 2B

LIQUID EFFLUENTS
CONTINUOUS MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation products					
barium-140	Ci	<LLD	<LLD	<LLD	<LLD
cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
cerium-144	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
cesium-137	Ci	<LLD	<LLD	8.86E-6	<LLD
chromium-51	Ci	<LLD	<LLD	<LLD	<LLD
cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD
iodine-131	Ci	<LLD	<LLD	<LLD	<LLD
iron-55	Ci	<LLD	<LLD	<LLD	**
iron-59	Ci	<LLD	<LLD	<LLD	<LLD
lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
niobium-95	Ci	<LLD	<LLD	<LLD	<LLD
strontium-89	Ci	<LLD	<LLD	<LLD	**
strontium-90	Ci	<LLD	<LLD	<LLD	**
technetium-99m	Ci	<LLD	<LLD	<LLD	<LLD
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-95	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	<LLD	<LLD	8.86E-6	<LLD
2. Dissolved and entrained gases					
xenon-133	Ci	<LLD	<LLD	<LLD	<LLD
xenon-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	<LLD	<LLD	<LLD	<LLD

LLD Lower Limit of Detection; see Table 2C.

** Fourth quarter analysis not available at report time: values will be included in the next Annual Report.

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TABLE 2B (Continued)

LIQUID EFFLUENTS
BATCH MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation products					
antimony-122	Ci	<LLD	<LLD	<LLD	3.46E-6
antimony-125	Ci	<LLD	1.72E-4	3.02E-4	7.49E-4
barium-140	Ci	<LLD	<LLD	<LLD	<LLD
cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
cerium-144	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	<LLD	3.59E-6	1.90E-5	1.29E-7
cesium-137	Ci	<LLD	6.47E-5	9.84E-5	8.08E-5
chromium-51	Ci	<LLD	5.83E-5	4.66E-5	1.75E-3
cobalt-57	Ci	<LLD	8.20E-6	<LLD	<LLD
cobalt-58	Ci	3.10E-4	1.18E-3	2.55E-4	2.69E-3
cobalt-60	Ci	1.76E-5	1.45E-4	1.41E-4	6.43E-4
iodine-131	Ci	<LLD	<LLD	2.51E-5	4.80E-5
iron-55	Ci	<LLD	<LLD	<LLD	**
iron-59	Ci	<LLD	<LLD	<LLD	<LLD
lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	<LLD	<LLD	2.02E-6	1.16E-4
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
niobium-95	Ci	<LLD	5.38E-6	5.16E-5	2.65E-4
silver-110m	Ci	<LLD	1.88E-5	1.41E-5	6.37E-5
strontium-89	Ci	<LLD	<LLD	<LLD	**
strontium-90	Ci	<LLD	<LLD	<LLD	**
technetium-99m	Ci	<LLD	<LLD	<LLD	<LLD
tin-117m	Ci	1.25E-5	<LLD	<LLD	<LLD
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-95	Ci	<LLD	<LLD	<LLD	1.82E-4
Total for period	Ci	3.40E-4	1.66E-3	9.55E-4	6.59E-3
2. Dissolved and entrained gases					
krypton-85	Ci	<LLD	4.98E-3	2.46E-2	9.04E-1
xenon-131m	Ci	<LLD	<LLD	<LLD	1.65E-2
xenon-133	Ci	5.53E-6	2.55E-5	4.00E-4	8.31E-2
xenon-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	5.53E-6	5.00E-3	2.50E-2	1.00E+0

LLD Lower Limit of Detection; see Table 2C.

** Fourth quarter analysis not available at report time; values will be included in the next Annual Report.

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TABLE 2C

LIQUID EFFLUENTS LOWER LIMIT OF DETECTION

Radionuclides	Continuous Mode LLD ($\mu\text{Ci/cc}$)	Batch Mode LLD ($\mu\text{Ci/cc}$)
1. Fission and activation products		
antimony-122	N/A	1.40E-7
antimony-125	N/A	2.00E-7
barium-140	4.70E-7	3.90E-7
cerium-141	6.60E-8	6.10E-8
cerium-144	2.70E-7	2.70E-7
cesium-134	1.20E-7	1.20E-7
cesium-137	1.10E-7	1.10E-7
chromium-51	5.20E-7	4.80E-7
cobalt-57	N/A	3.60E-8
cobalt-58	1.10E-7	*
cobalt-60	1.60E-7	*
iodine-131	9.20E-8	6.90E-8
iron-55	1.00E-6	1.00E-6
iron-59	2.60E-7	2.50E-7
lanthanum-140	9.20E-7	3.00E-7
manganese-54	1.10E-7	1.10E-7
molybdenum-99	8.70E-8	4.10E-8
niobium-95	1.10E-7	1.00E-7
silver-110m	N/A	1.60E-7
strontium-89	5.00E-8	5.00E-8
strontium-90	5.00E-8	5.00E-8
technetium-99m	8.80E-8	4.20E-8
tin-117m	N/A	3.50E-8
zinc-65	2.80E-7	2.80E-7
zirconium-95	1.90E-7	1.80E-7
2. Dissolved and entrained gases		
krypton-85	N/A	3.30E-5
xenon-131m	N/A	3.00E-6
xenon-133	3.40E-7	*
xenon-135	8.90E-8	8.90E-8
3. gross alpha	1.00E-7	1.00E-7

* Radionuclide was >LLD in all 4 quarters

N/A Radionuclide not detected in continuous flow paths

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TABLE 2D

LIQUID EFFLUENTS RADIATION DOSES AT THE LIQUID SITE BOUNDARY

	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
A.					
1. Total body dose	mrem	5.52E-5	2.72E-4	3.90E-4	1.30E-3
2. Percent Applicable Limit	%	1.84E-3	9.08E-3	1.30E-2	4.33E-2
B.					
1. Limiting organ dose	mrem	9.50E-5	4.33E-4	4.75E-4	1.85E-3
2. Percent Applicable Limit	%	9.50E-4	4.33E-3	4.75E-3	1.85E-2
3. Limiting organ for period		GI-LLI	GI-LLI	GI-LLI	GI-LLI

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TABLE 2E

LIQUID EFFLUENTS BATCH RELEASE SUMMARY

	12 month period
1. Number of batch releases:	215 releases
2. Total time period for batch releases:	31073 minutes
3. Maximum time period for a batch release:	657 minutes
4. Average time period for a batch release:	145 minutes
5. Minimum time period for a batch release:	79 minutes
6. Average saltwater flow during batch releases:	740000 gpm

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SECTION D. PREVIOUS RADIOACTIVE EFFLUENT RELEASE REPORT ADDENDUM

2007 ARERR

SECTION K. MISCELLANEOUS

ABNORMAL RELEASES

- Waste Gas Decay Tank Leaks

Nuclear Oversight audit recommended an engineering evaluation be performed to determine if there was a leak from Waste Gas Decay Tank T-088 to the Plant Vent Stack from 07/29/2007 at 1200 to 08/02/2007 at 2200 as reported in the 2007 ARERR. The evaluation determined that the leak was directed back to the waste gas header through MU006. This evaluation is documented in NN 201112449.

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SECTION E. RADWASTE SHIPMENTS

TABLE 3 (Units 2 & 3)

SOLID WASTE AND IRRADIATED FUEL SHIPMENT

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

1. Type of waste	Unit	12 month period	Estimated total error (%)
a. Spent resins, filter sludge's	m ³	1.38E+1	3.00E+1
	Ci	7.64E+0	
b. Dry active waste (DAW), compactable and non-compactable	m ³	1.53E+3	3.00E+1
	Ci	4.77E+2	
c. Irradiated components	m ³	N/A	N/A
	Ci	N/A	
d. Other: Filters	m ³	7.11E-1	3.00E+1
	Ci	1.19E+0	

Note: Total curie content estimated

N/A No shipment made.

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A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

2. Estimate of major nuclide composition (Spent resins, filter sludge's)		
a. antimony-125	%	5.67E+0
carbon-14	%	2.16E+0
cerium-144	%	9.27E-2
cesium-134	%	9.20E-1
cesium-137	%	2.37E+1
cobalt-57	%	2.71E-5
cobalt-58	%	1.63E-3
cobalt-60	%	5.07E+0
iodine-129	%	9.62E-3
iron-55	%	5.73E+0
iron-59	%	4.15E-5
manganese-54	%	3.81E-2
nickel-59	%	2.79E-1
nickel-63	%	5.60E+1
niobium-95	%	3.06E-4
strontium-89	%	1.03E-4
strontium-90	%	5.93E-2
technetium-99	%	2.33E-2
tritium	%	2.06E-1
zirconium-95	%	1.51E-4

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A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

2. Estimate of major nuclide composition (DAW)		
b. americium-241	%	5.99E-6
antimony-124	%	2.43E-4
antimony-125	%	1.89E+0
carbon-14	%	1.78E-2
cerium-144	%	4.63E-4
cesium-134	%	3.07E-4
cesium-137	%	1.60E-1
chromium-51	%	3.75E-3
cobalt-57	%	2.27E-1
cobalt-58	%	5.28E-1
cobalt-60	%	2.36E+1
curium-242	%	2.97E-6
curium-243/44	%	9.35E-8
iron-55	%	6.67E+1
iron-59	%	1.00E-3
manganese-54	%	1.74E+0
nickel-63	%	4.97E+0
niobium-95	%	5.21E-3
plutonium-238	%	5.89E-6
strontium-89	%	3.85E-4
strontium-90	%	3.59E-5
technetium-99	%	4.89E-2
tin-113	%	1.83E-2
europium-152	%	9.04E-6
zirconium-95	%	1.70E-2
c. not applicable	%	N/A

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SAN ONOFRE NUCLEAR GENERATING STATION

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

2. Estimate of major nuclide composition (Other: Filters)		
d. antimony-125	%	5.12E+0
carbon-14	%	1.09E+0
cerium-144	%	4.82E-2
cesium-134	%	4.53E-1
cesium-137	%	2.24E+0
cobalt-57	%	2.29E-1
cobalt-58	%	1.94E+0
cobalt-60	%	7.08E+1
iron-55	%	9.26E+0
manganese-54	%	2.58E+0
nickel-63	%	6.03E+0
niobium-95	%	1.61E-2
strontium-89	%	4.63E-3
strontium-90	%	1.67E-2
tin-113	%	6.25E-2
zirconium-95	%	1.01E-1

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SAN ONOFRE NUCLEAR GENERATING STATION

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

3. Solid Waste Disposition		
Number of Shipments	Mode of Transportation	Destination
86	Truck/Flatbed Trailer	EnergySolutions Clive Utah
1	Type A Cask	EnergySolutions Clive Utah
1*	Type A Cask	EnergySolutions Clive Utah
1**	Truck/Flatbed Trailer	EnergySolutions Duratek OakRidge Tennessee
26	Truck/Flatbed Trailer	EnergySolutions Duratek OakRidge Tennessee

SCE maintains a contract with EnergySolutions Duratek that provides volume reduction services. The processed volume was shipped from the EnergySolutions Duratek facility to the EnergySolutions Clive Utah Burial Site using 55 shipments. Those 55 shipments included waste from other generators. SCE's waste volume was a fraction of the total waste volume of these shipments.

* Indicates both Dry Active Waste and Filters were on the same shipment

** Indicates both Dry Active Waste and Resin were on the same shipment

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

C. DEWATERING

Number of Containers	Solidification Agent
None	N/A

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SAN ONOFRE NUCLEAR GENERATING STATION

SECTION E. RADWASTE SHIPMENTS

TABLE 3 (COMMON)

SOLID WASTE AND IRRADIATED FUEL SHIPMENT

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

1. Type of waste	Unit	12 month period	Estimated total error (%)
a. Spent resins, filter sludge's, evaporator bottoms	m ³	N/A	N/A
	Ci	N/A	
b. Dry active waste (DAW), compactable and non-compactable	m ³	N/A	N/A
	Ci	N/A	
c. Irradiated components	m ³	N/A	N/A
	Ci	N/A	
d. Other: Filters	m ³	N/A	N/A
	Ci	N/A	

N/A No shipment made.

2. Estimate of major nuclide composition (by type of waste)		
a. not applicable	%	N/A
b. not applicable	%	N/A
c. not applicable	%	N/A
d. not applicable	%	N/A

3. Solid Waste Disposition (SONGS 1, 2, and 3)		
Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

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SOLID WASTE AND IRRADIATED FUEL SHIPMENT

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

C. DEWATERING

Number of Containers	Solidification Agent
None	N/A

D. CHANGES TO THE PROCESS CONTROL PROGRAM AT SAN ONOFRE UNITS 1, 2 & 3

None.

REFERENCES:

1. Unit 1 Technical Specifications, section D6.13.2.
2. Units 2 and 3 License Controlled Specifications, section 5.0.103.2.2.
3. Procedure SO123-VII-8.5.1 (Rev. 8) "Radwaste Process Control Program".
4. Procedure SO123-VII-8.1.6 (Rev. 5 - TCN 5-1) "Radioactive Waste Shipment Data For The Annual Effluent Release Report".
5. Regulatory Guide 1.21, June 1974.

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SAN ONOFRE NUCLEAR GENERATING STATION

SECTION F. APPLICABLE LIMITS

Gaseous Effluents Applicable Limits

The percent of Applicable Limits, tabulated in Sections A, B, C, and D of Table 1A, were calculated using the following equation:

- % Applicable Limit =
$$\frac{(\text{Rel Rate}) (X/Q) (100)}{\text{MPC}_{\text{eff}}}$$

where: Rel Rate = total curies released in each category and each quarter, divided by the seconds in a quarter; the value in Sections A.2, B.2, C.2 and D.2 of Table 1A, $\mu\text{Ci/sec}$.

X/Q = $4.80\text{E-}6 \text{ sec/m}^3$; the annual average atmospheric dispersion defined in the ODCM.

- MPC_{eff} =
$$\frac{1}{\sum_{i=1}^n \frac{F_i}{\text{MPC}_i}}$$

where: F_i = fractional abundance of the i^{th} radionuclide obtained by dividing the activity (curies) for each radionuclide, C_i , by the sum of all the isotopic activity, C_T .

n = total number of radionuclides identified

MPC_i = Maximum Permissible Concentration (MPC) of the i^{th} radionuclide from 10 CFR 20 (20.1-20.602), Appendix B, Table II, Column 1.

- % ECL =
$$\frac{(\text{Rel Rate}) (X/Q) (100)}{\text{ECL}_{\text{eff}}}$$

where: Rel Rate = total curies released in each category and each quarter, divided by the seconds in a quarter; the value in Sections A.2, B.2, C.2 and D.2 of Table 1A, $\mu\text{Ci/sec}$.

X/Q = $4.80\text{E } 6 \text{ sec/m}^3$; the annual average atmospheric dispersion defined in the ODCM.

- ECL_{eff} =
$$\frac{1}{\sum_{i=1}^n \frac{F_i}{\text{ECL}_i}}$$

where: F_i = fractional abundance of the i^{th} radionuclide obtained by dividing the activity (curies) for each radionuclide, C_i , by the sum of all the isotopic activity, C_T .

n = total number of radionuclides identified

ECL_i = Effluent Concentration Limit (ECL) of the i^{th} radionuclide from 10 CFR 20 (20.1001-20.2402), Appendix B, Table 2, Column 1.

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SECTION F. APPLICABLE LIMITS (Continued)

Liquid Effluents Applicable Limits

The percent of Applicable Limits, tabulated in Sections A, B, and C of Table 2A, were calculated using the following equations:

- % Applicable Limit =
$$\frac{(\text{Dil Conc}) (100)}{\text{MPC}_{\text{eff}}}$$

where: Dil Conc = total curies released in each category and each quarter divided by the total volume released (sum of Sections E and F in Table 2A); the value in Sections A.2, B.2, and C.2 of Table 2A, $\mu\text{Ci/ml}$.

- MPC_{eff} =
$$\frac{1}{\sum_{i=1}^n \frac{F_i}{\text{MPC}_i}}$$

where: F_i = fractional abundance of the i^{th} radionuclide obtained by dividing the activity (curies) for each radionuclide, C_i , by the sum of all the isotopic activity, C_T .

n = total number of radionuclides identified

MPC_i = Maximum Permissible Concentration (MPC) of the i^{th} radionuclide from 10 CFR 20 (20.1-20.602), Appendix B, Table II, Column 2.

- % ECL =
$$\frac{(\text{Dil Conc}) (100)}{\text{ECL}_{\text{eff}}}$$

where: Dil Conc = total curies released in each category and each quarter divided by the total volume released (sum of Sections E and F in Table 2A); the value in Sections A.2, B.2, and C.2 of Table 2A, $\mu\text{Ci/ml}$.

- ECL_{eff} =
$$\frac{1}{\sum_{i=1}^n \frac{F_i}{\text{ECL}_i}}$$

where: F_i = fractional abundance of the i^{th} radionuclide obtained by dividing the activity (curies) for each radionuclide, C_i , by the sum of all the isotopic activity, C_T .

n = total number of radionuclides identified

ECL_i = Effluent Concentration Limit (ECL) of the i^{th} radionuclide from 10 CFR 20 (20.1001-20.2402), Appendix B, Table 2, Column 2.

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SECTION F. APPLICABLE LIMITS (Continued)

APPENDIX A

GASEOUS EFFLUENTS – APPLICABLE LIMITS

- A. Table 1A lists the total curies released and the release rate. The percent of applicable limit compares the release concentration limits of 10 CFR 20 Appendix B, Table II, Column 1.
- B. Table 1E lists the air doses as calculated using the historical X/Q. The air dose due to noble gases released in gaseous effluents from SONGS (per reactor) to areas at and beyond the site boundary shall be limited to the following values:
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.
- C. The dose to a Member of the Public from iodines, tritium, and all radionuclides in particulate form with half-lives greater than eight days in gaseous effluents released from SONGS (per reactor) to areas at and beyond the site boundary shall be limited to the following values:
1. During any calendar quarter: ≤ 7.5 mrem to any organ.
 2. During any calendar year: ≤ 15 mrem to any organ.

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SECTION F. APPLICABLE LIMITS (Continued)

APPENDIX A (Continued)

LIQUID EFFLUENTS – APPLICABLE LIMITS

- A. Table 2A lists the total curies released, the diluted concentration, and percent of applicable limit. The percent of applicable limit compares the diluted concentration of radioactive material released to the concentrations specified in 10 CFR 20 Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained gases. For dissolved or entrained noble gases, the concentration is limited to $2.00\text{E-}4 \mu\text{Ci/ml}$.
- B. Table 2D lists the doses due to liquid releases. The dose commitment to a Member of the Public from radioactive materials in liquid effluent release from SONG (per reactor) to unrestricted areas shall be limited to the following values:
1. During any calendar quarter: $\leq 1.5 \text{ mrem}$ to the total body and $\leq 5 \text{ mrem}$ to any organ.
 2. During any calendar year: $\leq 3 \text{ mrem}$ to the total body and $\leq 10 \text{ mrem}$ to any organ.

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SECTION G. ESTIMATION OF ERROR

Estimations of the error in reported values of gaseous and liquid effluents releases have been made.

Sources of error for gaseous effluents batch releases are:

- (1) tank volumes
- (2) sampling
- (3) counting
- (4) calibration

Sources of error for gaseous effluents - continuous releases are:

- (1) fan flow rate
- (2) sampling
- (3) counting
- (4) calibration
- (5) differential pressure drop

Sources of error for liquid effluents - batch releases are:

- (1) tank volumes
- (2) sampling
- (3) counting
- (4) calibration

Sources of error for liquid effluents - continuous releases are:

- (1) dilution flow rate
- (2) sampling
- (3) counting
- (4) calibration

These sources of error are independent, and thus, the total error is calculated according to the following formula:

$$\text{Total Error} = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 \dots \sigma_i^2}$$

where: σ_i = Error associated with each component.

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SECTION H. 10 CFR 50 APPENDIX I REQUIREMENTS

Table 1 in Section H presents the quarterly and annual maximum dose to an individual. Six different categories are presented:

- (1) Liquid Effluents - Whole Body
- (2) Liquid Effluents - Organ
- (3) Airborne Effluents - Tritium, Iodines and Particulates
- (4) Noble Gases - Gamma
- (5) Noble Gases - Beta
- (6) Direct Radiation

The doses for categories 1 and 2 were calculated using the methodology of the ODCM; these data are also presented in Table 2D. Categories 3, 4, and 5 were calculated utilizing RETDAS (Radioactive Effluent Tracking and Dose Assessment Software), Regulatory Guide 1.109 methodology, and concurrent meteorology. Table 1E of gaseous effluents previously presented, however, lists data similar to categories 3, 4 and 5 using methods described in the ODCM and the historical meteorology (X/Q). Category 6 presents direct dose data measured by TLD dosimeters. Each portion of each category is footnoted to briefly describe each maximum individual dose presented.

For members of the public, per the ODCM, who may at times be within the site boundary¹, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. For members of the public who traverse the site boundary via highway I-5, the residency time shall be considered negligible and hence the dose "0".

Table 2 in Section H presents the percent of Applicable Limits for each dose presented in Table 1.

¹ ODCM Figures 1-2 & 2-2.

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TABLE 1

SOURCE	Dose * (millirems)				
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Year
LIQUID EFFLUENTS	1)	2)	3)	4)	5)
Whole Body	5.52E-5	2.72E-4	3.90E-4	1.30E-3	2.02E-3
Organ	6)	7)	8)	9)	10)
	9.50E-5	4.33E-4	4.75E-4	1.85E-3	2.85E-3
AIRBORNE EFFLUENTS	11)	12)	13)	14)	15)
Tritium, Iodines, and Particulates	3.03E-3	3.20E-3	1.13E-3	2.27E-3	9.15E-3
NOBLE GASES **	16)	17)	18)	19)	20)
Gamma	3.37E-2	1.44E-2	3.27E-3	1.41E-2	6.55E-2
Beta	21)	22)	23)	24)	25)
	2.24E-2	1.22E-2	8.82E-3	2.82E-2	7.17E-2
DIRECT RADIATION	26)	27)	28)	29)	30)
	1.69E-1	1.69E-1	1.96E-1	1.66E-1	6.88E-1

* The numbered footnotes below briefly explain how each maximum dose was calculated, including the organ and the predominant pathway(s).

** Noble gas doses due to airborne effluent are in units of mrad, reflecting the air dose.

1. This value was calculated using the methodology of the ODCM.
2. This value was calculated using the methodology of the ODCM.
3. This value was calculated using the methodology of the ODCM.
4. This value was calculated using the methodology of the ODCM.
5. This value was calculated using the methodology of the ODCM.
6. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
7. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
8. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.

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9. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
10. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
11. The maximum organ dose was to an adult's thyroid and was located in the NNE sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
12. The maximum organ dose was to an adult's thyroid and was located in the NNE sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
13. The maximum organ dose was to a child's thyroid and was located in the WNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
14. The maximum organ dose was to an adult's thyroid and was located in the NNE sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
15. The maximum organ dose was to an adult's thyroid and was located in the NNE sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
16. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
17. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
18. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
19. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
20. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
21. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
22. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
23. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
24. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
25. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
26. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the W sector.

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27. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the W sector.
28. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the W sector.
29. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the W sector.
30. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the W sector.

TABLE 2

SOURCE	Percent Applicable Limit				
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Year
LIQUID EFFLUENTS					
Whole Body	1.84E-3	9.08E-3	1.30E-2	4.33E-2	3.36E-2
Organ	9.50E-4	4.33E-3	4.75E-3	1.85E-2	1.42E-2
AIRBORNE EFFLUENTS					
Tritium, Iodines, and Particulates	2.02E-2	2.13E-2	7.55E-3	1.52E-2	3.05E-2
NOBLE GASES					
Gamma	3.37E-1	1.44E-1	3.27E-2	1.41E-1	3.27E-1
Beta	1.12E-1	6.11E-2	4.41E-2	1.41E-1	1.79E-1

NOTE: Direct Radiation is not specifically addressed in the Applicable Limits.

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SECTION I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

None of the changes impact the accuracy or reliability of effluent dose or setpoint calculations. The level of radioactive effluent control required by 10CFR20, 40CFR190, 10CFR50.35a and Appendix I to 10CFR50 will be maintained.

Throughout the document, change bars are marked in one of four ways as follows:

A Addition
D Deletion
F Editorial/Format change
R Revision

Page #	changes due to new revision	Reason
Title Pages	Revised from previous revision to Rev 5	R
Page #		Reason
2-29	Revised U2&3 Controlling Location Factors	R
2-30	Revised SYF Controlling Location Factors	R
2-31	Revised NIA Controlling Location Factors	R
5-18	Deleted Airborne Sample and Sampling Location 15 for Oceanside City Hall (Control)	D
5-18	Deleted Note for replacing Airborne Sample and Sampling Control Location	D
5-19	Deleted Local Crop location San Clemente Resident w/Garden	D
5-27	Revised Figure 5-5 - Deleted Airborne Sample and Sampling Location 15 for Oceanside City Hall (Control)	R
Appendix A	Changed Format to incorporate Ri report from Health Physics Engineering	F
Ai	Format changed and revised References	R
A1-1	Format changed	F
A1-2	Format changed - former page A1-4	F
A1-3	Format changed - former page A1-2	F
A1-4	Format changed - former page A1-3	F
A1-5	Added	A
A1-6	Added	A
A1-7	Format changed - former page A1-5	F
A1-8	Format changed - former page A1-6	F
A1-9	Format changed - former page A1-7	F
A1-10	Format changed - former page A1-8	F
A1-11	Format changed - former page A1-9	F
A1-12	Format changed - former page A1-10, revised values per LUC	R
A1-13	Format changed - former page A1-11, revised values per LUC	R

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SECTION I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (Continued)

A1-14	Added	A
A1-15	Format changed - former page A1-12, revised values per LUC	R
A1-16	Format changed - former page A1-14, revised values per LUC	R
A1-17	Format changed - former page A1-13	F
A1-18	Added	A
A1-19	Format changed - former page A1-16, revised values per LUC	R
A1-20	Format changed - former page A1-15, revised values per LUC	R
A1-21	Added	A
A1-22	Added	A
A1-23	Added	A
A1-24	Added	A
A1-25	Format changed - former page A1-18	F
A1-26	Format changed - former page A1-17, revised values per LUC	R
A1-27	Added	A
A1-28	Format changed - former page A1-19, revised values per LUC	R
A1-29	Added	A
A1-30	Format changed - former page A1-20	F
A1-31	Format changed - former page A1-21, revised values per LUC	R
A1-32	Added	A
A1-33	Added	A
A1-34	Added	A
A1-35	Format changed - former page A1-22	F
A1-36	Format changed - former page A1-23	F
A1-37	Added	A
A1-38	Added	A
A1-39	Added	A
A1-40	Format changed - former page A1-25	F
A1-41	Added	A
A1-42	Added	A
A1-43	Format changed - former page A1-26	F
A2-1	Deleted Pathway Camp Horno Sewage Trmnt.	D
	Added Pathway Surf Beach/Life Guard	A
A2-2	Added	A

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SECTION I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (Continued)

A2-3	Deleted Pathway Sheep (Meat)/Shepherd	D
	Added Pathway Cotton Point Estates	A
A2-4	Added	A
A2-5	Deleted Pathway Deer Consumer/Hunter	D
	Added Pathway St Park Office Trlr	A
A2-6	Added	A
A2-7	Added	A
A2-8	Added	A
A2-9	Deleted Pathway Sheep (Meat)/Shepherd	D
	Added Pathway San Mateo Pt Homes	A
A2-10	Deleted Pathway Deer Consumer/Hunter	D
	Added Pathway Camp Mesa	A
A2-11	Added	A
A2-12	Added	A
A2-13	Added	A
A2-14	Added	A
A2-15	Added	A
A2-16	Added	A
A2-17	Added	A
A2-18	Added	A
A2-19	Added	A
A2-20	Format changed - former page A2-2, revised values per LUC	A
A2-21	Format changed - former page A2-4, revised values per LUC	A
A2-22	Format changed - former page A2-6, revised values per LUC	A
A2-23	Format changed - former page A2-7, revised values per LUC	A
A2-24	Added	A
A2-25	Format changed - former page A2-8, revised values per LUC	A
A2-26	Added	A
A3-1	Format changed	F
A3-2	Added	A
A3-3	Format changed - former page A3-2	F
A3-4	Format changed - former page A3-3, revised values per LUC	R
A3-5	Added	A

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SECTION I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (Continued)

A3-6	Added	A
A3-7	Format changed - former page A3-4, revised values per LUC	R
A3-8	Format changed - former page A3-5, revised values per LUC	R
A3-9	Format changed - former page A3-6, revised values per LUC	R
A3-10	Format changed - former page A3-7	F
A3-11	Format changed - former page A3-8, revised values per LUC	R
A3-12	Format changed - former page A3-9	F
A3-13	Deleted Pathway Deer Consumer/Hunter	D
	Format changed - former page A3-10, revised values per LUC	R
A3-14	Format changed - former page A3-11	F
A3-15	Format changed - former page A3-12, revised values per LUC	R
A3-16	Deleted Pathway Deer Consumer/Hunter	D
	Added Pathway Sewage Treat. Facility	A
A3-17	Added	A
A3-18	Format changed - former page A3-14, revised values per LUC	R
A3-19	Format changed - former page A3-15, revised values per LUC	R
A3-20	Format changed - former page A3-17, revised values per LUC	R
A3-21	Format changed - former page A3-18, revised values per LUC	R
A3-22	Format changed - former page A3-19, revised values per LUC	R
A3-23	Format changed - former page A3-20, revised values per LUC	R
A3-24	Added	A
A3-25	Added	A
A3-26	Format changed - former page A3-21, revised values per LUC	R
Appendix B		
Cover	Revised to Revision 5	R

The Land Use Census (LUC) for 2010 did not identify a new location with a higher calculated or committed dose than those calculated for the locations evaluated in the previous revision to the ODCM. Therefore, no new location(s) are reported per ODCM 5.2.1.

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SECTION J. CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

NONE.

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SECTION K. MISCELLANEOUS

ABNORMAL RELEASES

- Waste Gas Decay Tank Leak

An unplanned monitored release of Waste Gas Decay Tank T-087 occurred on 2/9/2011 during maintenance on a Waste Gas Compressor discharge valve due to leak by on a red tagged closed boundary valve. Release permit 1G-058-0 was generated for the WGDT and the release was monitored by Plant Vent Stack instrumentation. Approximately $4.8\text{E-}1$ curies of noble gas were released which resulted in a whole body dose of $3.93\text{E-}4$ mrem to a member of the public. The curies released and associated dose are included in Table 1A and Table 1, respectively. This event is documented in NN 201325935.

- Electrical Cable Vault Release

On 03/31/11, an estimated 500 gallons of water containing $3.8\text{E-}6$ microCi/ml of tritium was pumped from an electrical cable vault located inside the protected area to the outfall via the storm drain system. This unplanned, unmonitored release resulted in a conservatively estimated $7.3\text{E-}5$ curies of tritium released and a whole body dose of $1.23\text{E-}11$ mrem to a member of the public. This event is documented in NN 201398775

- Leaking Unit 2 Steam Generator Blowdown Valves

In August 2011, leakage of secondary water past the Unit 2 steam generator E-089 blowdown isolation valve to the outfall at 0.2 gpm was identified. In October 2011, Unit 2 Steam Generator E-088 was identified to be leaking past its blowdown isolation valve with a combined leakage to the outfall of 0.4 gpm. Compensatory sampling was performed all year (samples indicated no detectable gamma activity for 2011 with approximately $3\text{E-}6$ microCi/ml of tritium). The curies released were accounted for in weekly release permits. This unplanned, unmonitored release resulted in $3.93\text{E-}4$ curies of tritium released and a whole body dose of $6.54\text{E-}10$ mrem to a member of the public. The curies and dose are included in Table 2A and Table 1, respectively. These events are documented in NN 201616240 and NN 201689124

- Leaking Unit 3 Steam Generator Blowdown Valves

In August 2011, Unit 3 Steam Generators were estimated to be leaking past their blowdown isolation valves to the outfall at 0.5 gpm. Compensatory sampling was performed all year (samples indicated no detectable gamma activity for 2011 with approximately $6\text{E-}6$ microCi/ml of tritium). The curies released were accounted for in weekly release permits. This unplanned, unmonitored release resulted in $2.05\text{E-}3$ curies of tritium released and a whole body dose of $3.47\text{E-}9$ mrem to a member of the public. The curies and dose are included in Table 2A and Table 1, respectively. This event is documented in NN 201614180 and NN 201614181

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SECTION K. MISCELLANEOUS (Continued)

PLANNED UNMONITORED RELEASES

- Unit 3 Condenser Drain Down

During Unit 3 Condenser drain down from 12/28/2010 to 1/10/2011, $1.4\text{E-}5$ microCi/ml tritium was detected in the Unit 3 condensate on 1/3/2011 due to Unit 2 supplying auxiliary steam containing tritium for the Unit 3 gland seals. This resulted in a planned unmonitored release of radioactive material. An estimated $8.06\text{E-}2$ Ci of tritium were released and are included in Table 2A. This resulted in a whole body dose of $1.55\text{E-}7$ mrem to a member of the public and is included in Table 1. This event is documented in NN 201273125.

- Unit 3 Condenser Drain Down

Unit 3 Condenser drain down from 2/10/2011 to 2/18/2011, with approximately $3.9\text{E-}6$ microCi/ml tritium activity, resulted in a planned unmonitored release of radioactive material. An estimated $8.11\text{E-}2$ Ci of tritium were released and are included in Table 2A. This resulted in a whole body dose of $1.78\text{E-}7$ mrem to a member of the public and is included in Table 1. This event is documented in NN 201347981.

- Unit 2 Condenser Drain Down

Unit 2 Condenser drain down from 9/9/2011 to 9/11/2011, with approximately $5\text{E-}6$ microCi/ml tritium activity, resulted in a planned unmonitored release of radioactive material. An estimated $8.21\text{E-}3$ Ci of tritium were released resulting in a whole body dose to a member of the public of $1.38\text{E-}8$ mrem. This event is documented in NN 201644408.

- Unit 3 Condenser Drain Down

Unit 3 Condenser drain down from 9/9/2011 to 9/12/2011, with approximately $5\text{E-}6$ microCi/ml tritium activity, resulted in a planned unmonitored release of radioactive material. An estimated $9.02\text{E-}3$ Ci of tritium were released resulting in a whole body dose to a member of the public of $1.51\text{E-}8$ mrem. This event is documented in NN 201644434.

- Unit 3 Steam Generator Replacement Outage Temporary Construction Opening Release

From 10/13/2010 to 1/13/2011, an unmonitored release of airborne activity occurred during Unit 3 Steam Generator Replacement Outage as the result of the temporary construction openings required to support replacement of the steam generators. Sampling was performed at these construction openings and an estimation of the curies released and resultant dose was performed. Releases totaled $5.3\text{E-}1$ curies of which noble gases were $5.3\text{E-}1$ curies, iodines were $7.12\text{E-}6$ curies, particulates were $2.5\text{E-}4$ curies and no tritium was detected. The projected dose was (a) gamma air dose: $2.88\text{E-}5$ mrad at the site boundary, (b) beta air dose: $8.57\text{E-}5$ mrad at the site boundary, (c) organ dose: $1.35\text{E-}5$ mrem at the highest receptor. This event is documented in NN 201287642.

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SECTION K. MISCELLANEOUS (Continued)

EFFLUENT RADIATION MONITORS OUT OF SERVICE GREATER THAN 30 DAYS

January 1, 2011 - December 31, 2011

S.O.N.G.S. 2			
Monitor	Inoperability Period	Inoperability Cause	Explanation
2RT-7870, Condenser Air Ejector Process Flow Monitor	04/17/2000 - present	Inoperable process flow measuring device whenever vacuum pump is running.	Design deficiency caused process flow instrument to be inoperable while the vacuum pump is running, as high flow values are not sensed. Flow monitor works properly during normal operations. The monitor is isokinetic during vacuum pump operation due to the substitute flow value that is inserted whenever the vacuum pump is running. The issue was previously documented in ARs 000101252 and 000400960. It is currently being tracked in NN200001437.
2RT-6753, Steam Generator E089 Blowdown Monitor	9/18/11 – 3/3/12	Indication failed low	The monitor indication was found below scale. The Victoreen monitors will be replaced with new digital equipment as documented in NN 201651473. The monitor status was tracked by LCOAR 2-2011-0329.
2RT-7865, Plant Vent Stack / Containment Purge Monitor	11/6/11 - 2/19/12	Heat Trace temperature low	During very cold and rainy periods, excessive heat loss results in low heat trace temperature. Replacement of the heat tracing is being tracked and documented in 2-LCOAR-2011-0388 and NN 201720631.

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EFFLUENT RADIATION MONITORS OUT OF SERVICE GREATER THAN 30 DAYS (Continued)

January 1, 2011 - December 31, 2011

S.O.N.G.S. 3			
Monitor	Inoperability Period	Inoperability Cause	Explanation
3RT-7870, Condenser Air Ejector Process Flow Monitor	04/17/2000 - present	Inoperable process flow measuring device whenever vacuum pump is running.	Design deficiency caused process flow instrument to be inoperable while the vacuum pump is running, as high flow values are not sensed. Flow monitor works properly during normal operations. The monitor is isokinetic during the vacuum pump operation due to the substitute flow value that is inserted whenever the vacuum pump is running. The issue was previously documented in ARs 000101252 and 000400960. It is currently tracked in NN 200001437.
	2/13/11 – 5/25/11	Process Flow Rate outside range	Following startup 2/13/11, Unit 3 experienced high condenser air ejector flow due to excessive condenser air in-leakage. In-leakage was located and repaired 5/24/11. Required compensatory samples were collected during the inoperable period. The flow rate monitor status was tracked by 3-LCOAR-2011-0046.
3RT-7870, Condenser Air Ejector Monitor Heat Tracing	11/3/11 – 1/12/12	Failed heat trace	Heat trace circuit 2TICJ407 was found failed high during routine panel checks. A degraded connector was replaced under NMO 800798851 and the heat trace restored on 1/12/12. The deficiency was tracked by 3-LCOAR-2011-0367.
3RT-6759, Steam Generator E088 Blowdown Monitor	8/18/11 – 10/7/11	Failed Detector	The monitor indication fails low intermittently. These monitors are obsolete and parts are difficult to obtain. Replacement of the Victoreen monitors with new digital equipment is documented in NN 201651473. The condition was tracked and documented in 3-EDMR-2011-0117 and NN 201610643.
3RT-7821, Turbine Building Sump Monitor	10/17/11 – 11/25/11	Temporary pumps installed	The flow path was removed from service. Temporary pumps transferred sump contents to Unit 2 Turbine Building Sump. The condition was tracked by 3-LCOAR-2011-0342..

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EFFLUENT RADIATION MONITORS OUT OF SERVICE GREATER THAN 30 DAYS (Continued)

January 1, 2011 - December 31, 2011

S.O.N.G.S. 2/3			
Monitor	Inoperability Period	Inoperability Cause	Explanation
2/3RT-7813, Liquid Radwaste Discharge Monitor	5/10/11 – 7/28/11	Spurious Alarms	Multiple spurious alarms over a two hour period due to a communication problem between the local processing unit (LPU) and the remote display unit. The LPU was replaced. The spurious faults did not impact the ability of the radiation detection channel to satisfy the specified function. The condition was tracked and documented by 2-LCOAR-2011-0162 and 3-LCOAR-2011-0153.
2/3RT-7808, Plant Vent Stack Monitor	5/9/11 – 1/12/12	Replacement pumps trip on pressure pulsations	The sample pumps were replaced by metal bellows pumps as part of equipment preventative maintenance. The replacement pumps produced pressure pulsations that caused the discharge pressure switch to trip the pumps. The pressure switch was abandoned and the monitor was returned to service. The monitor status was tracked by 2-EDMR-2011-0063.
2/3RT-2101, NIA Yard Drains Sump Monitor	11/9/11 - 1/10/12	Pump P1060 does not start on High Level	An inoperable sump pump prevented performance of the 18 month channel calibration. The monitor was declared inoperable when the calibration became overdue. Compensatory samples were collected and analyzed during the period of inoperability. The monitor status was tracked under 2-LCOAR-2011-0225.

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SECTION K. MISCELLANEOUS (Continued)ONSITE GROUND WATER SAMPLES

This section provides results of on-site samples of ground water in accordance with the voluntary Industry Ground Water Protection Initiative. The sample and the frequency of sampling may change over time.

January 1, 2011 – December 31, 2011

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
1/8/11	NIA-3	<LLD	<LLD
	NIA-4	<LLD	<LLD
	NIA-6	4.57E-7	<LLD
	NIA-6	6.09E-7	<LLD
	NIA-8	1.31E-6	<LLD
	NIA-9	<LLD	<LLD
1/16/11	NIA-4	<LLD	<LLD
	NIA-6	5.55E-7	<LLD
	NIA-7	<LLD	<LLD
	NIA-8	1.01E-6	<LLD
	NIA-9	<LLD	<LLD
1/17/11	NIA-10	<LLD	<LLD
	NIA-11	<LLD	<LLD
1/22/11	NIA-3	<LLD	<LLD
	NIA-4	<LLD	<LLD
	NIA-5	1.81E-6	<LLD
	NIA-6	6.77E-7	<LLD
	NIA-7	5.79E-7	<LLD
	NIA-8	8.28E-7	<LLD
	NIA-9	<LLD	<LLD
1/27/11	NIA-7	<LLD	<LLD
	NIA-7	<LLD	<LLD
1/28/11	NIA-7	<LLD	<LLD
	NIA-7	<LLD	<LLD

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

NIA = Temporary wells installed in the North Industrial Area for investigation of groundwater.

a priori LLD = H-3: 3.0E-6 $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$ = indicated microcuries per milliliter

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ONSITE GROUND WATER SAMPLES (Continued)

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
1/29/11	NIA-7 NIA-7 NIA-7	<LLD <LLD 7.96E-7	<LLD <LLD <LLD
1/30/11	NIA-7 NIA-7 NIA-7	<LLD 5.60E-7 <LLD	<LLD <LLD <LLD
1/31/11	NIA-7 NIA-7	5.49E-7 <LLD	<LLD <LLD
2/1/11	NIA-3 NIA-4 NIA-5 NIA-6 NIA-7 NIA-8 NIA-9 NIA-10 NIA-11 GW-NIA-1 GW-NIA-2	<LLD <LLD 1.20E-6 <LLD <LLD 1.99E-6 <LLD <LLD <LLD <LLD 7.90E-7	<LLD <LLD <LLD <LLD <LLD <LLD <LLD <LLD <LLD <LLD <LLD
2/12/11	NIA-6 NIA-6 GW-NIA-1 GW-NIA-2	5.45E-7 8.89E-7 <LLD <LLD	<LLD <LLD <LLD <LLD
3/3/11	GW-PA-1 GW-PA-2 GW-PA-3	<LLD <LLD <LLD	<LLD <LLD <LLD
3/4/11	PA-4	<LLD	<LLD

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

NIA = Temporary wells installed in the North Industrial Area for investigation of groundwater .

a priori LLD = H-3: 3.0E-6 $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$ = indicated microcuries per milliliter

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SAN ONOFRE NUCLEAR GENERATING STATION

ONSITE GROUND WATER SAMPLES (Continued)

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
3/13/11	NIA-6	3.33E-6	<LLD
	NIA-6	3.72E-6	<LLD
	NIA-6	3.83E-6	<LLD
	NIA-6	3.69E-6	<LLD
	NIA-6	3.72E-6	<LLD
	NIA-6	3.57E-6	<LLD
	NIA-6	3.31E-6	<LLD
3/24/11	NIA-6	6.89E-7	<LLD
3/30/11	GW-OCA-2	<LLD	<LLD
	GW-OCA-3	<LLD	<LLD
3/31/11	GW-NIA-1	<LLD	<LLD
	GW-NIA-2	<LLD	<LLD
	GW-OCA-1	<LLD	<LLD
4/2/11	NIA-3	<LLD	<LLD
	NIA-4	<LLD	<LLD
	NIA-5	5.19E-7	<LLD
	NIA-6	3.53E-6	<LLD
	NIA-6	3.54E-6	<LLD
	NIA-6	2.52E-6	<LLD
	NIA-6	2.81E-6	<LLD
	NIA-6	2.26E-6	<LLD
	NIA-6	3.63E-6	<LLD
	NIA-7	2.12E-6	<LLD
6/11/11	NIA-5	5.82E-7	<LLD
	NIA-6	2.24E-6	<LLD
	GW-NIA-1	<LLD	<LLD
	GW-NIA-2	7.98E-7	<LLD
6/17/11	GW-OCA-2	<LLD	<LLD
6/18/11	NIA-3	<LLD	<LLD
	NIA-4	<LLD	<LLD
	GW-NIA-7	1.37E-6	<LLD
	NIA-10	<LLD	<LLD
	NIA-11	<LLD	<LLD
6/20/11	GW-OCA-1	<LLD	<LLD

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

NIA = Temporary wells installed in the North Industrial Area for investigation of groundwater .

a priori LLD = H-3: 3.0E-6 $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$ = indicated microcuries per milliliter

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

SAN ONOFRE NUCLEAR GENERATING STATION

ONSITE GROUND WATER SAMPLES (Continued)

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
6/23/11	GW-OCA-3	<LLD	<LLD
6/24/11	GW-PA-1	<LLD	<LLD
	GW-PA-2	<LLD	<LLD
	GW-PA-3	<LLD	<LLD
	GW-PA-4	8.38E-7	<LLD
7/16/11	NIA-8	7.29E-7	<LLD
	NIA-9	<LLD	<LLD
8/6/11	GW-NIA-1	<LLD	<LLD
	GW-NIA-2	1.39E-6	<LLD
8/11/11	GW-PA-4	6.87E-7	<LLD
8/13/11	NIA-6	1.52E-6	<LLD
	NIA-7	<LLD	<LLD
8/20/11	NIA-3	<LLD	<LLD
	NIA-4	<LLD	<LLD
	NIA-5	1.05E-6	<LLD
9/19/11	GW-OCA-1	<LLD	<LLD
9/21/11	GW-OCA-3	<LLD	<LLD
9/22/11	GW-PA-1	<LLD	<LLD
	GW-PA-2	<LLD	<LLD
	GW-PA-3	<LLD	<LLD
	GW-PA-4	8.68E-7	<LLD
9/24/11	NIA-5	1.07E-6	<LLD
	NIA-6	1.98E-6	<LLD
	NIA-10	<LLD	<LLD
	NIA-11	<LLD	<LLD
9/26/11	GW-OCA-2	<LLD	<LLD
10/31/11	GW-PA-4	5.64E-7	<LLD
12/9/11	GW-PA-4	<LLD	<LLD
12/15/11	GW-PA-2	<LLD	<LLD
	GW-PA-3	<LLD	<LLD

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

NIA = Temporary wells installed in the North Industrial Area for investigation of groundwater .

a priori LLD = H-3: 3.0E-6 $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$ = indicated microcuries per milliliter

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

SAN ONOFRE NUCLEAR GENERATING STATION

ONSITE GROUND WATER SAMPLES (Continued)

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
12/16/11	GW-PA-1	<LLD	<LLD
12/18/11	NIA-6 GW-NIA-1 GW-NIA-2	1.70E-6 <LLD 7.25E-7	<LLD <LLD <LLD
12/22/11	GW-OCA-3	<LLD	<LLD
12/23/11	GW-OCA-1 GW-OCA-2	<LLD <LLD	<LLD <LLD
12/24/11	NIA-14 NIA-15 NIA-15	<LLD <LLD <LLD	<LLD <LLD <LLD

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

NIA = Temporary wells installed in the North Industrial Area for investigation of groundwater .

a priori LLD = H-3: 3.0E-6 $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$ = indicated microcuries per milliliter

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUS (Continued)40 CFR 190 REQUIREMENTS

Table 1 below presents the annual site-wide doses and percent of ODCM Specification limits to members of the public. These values were calculated utilizing doses resulting from all effluent pathways and direct radiation. The different categories presented are: (1) Total Body, (2) Limiting Organ, and (3) Thyroid.

Dose Category	Units	Year
1. Total Body		
a. Total Body Dose	mrem	1.25E+0
b. Percent ODCM Specification Limit	%	5.01E+0
2. Limiting Organ		
a. Organ Dose (GI-LLI)	mrem	1.20E-2
b. Percent ODCM Specification Limit	%	4.80E-2
3. Thyroid		
a. Thyroid Dose	mrem	1.11E-2
b. Percent ODCM Specification Limit	%	1.49E-2

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUS (Continued)

CARBON-14

In June, 2009, the NRC revised its guidance in Regulatory Guide (RG) 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 2. RG 1.21 explains, in part, the quantity of carbon 14 (C-14) discharged can be estimated by sample measurements or by use of a normalized C-14 source term and scaling factors based on power generation, or estimated by use of the GALE code from NUREG-0017. The dose contribution of C-14 from liquid radioactive waste is much less than that contributed by gaseous radioactive waste, evaluation of C-14 in liquid radioactive waste is not required.

- If sampling is performed, the sampling frequency may be adjusted to that interval that allows adequate measurement and reporting of effluents.
- If estimating C-14 based on scaling factors and fission rates, a precise and detailed evaluation of C-14 is not necessary. It is not necessary to calculate uncertainties for C-14 or to include C-14 uncertainty in any subsequent calculation of overall uncertainty.

Electric Power Research Institute (EPRI) Technical Report 1021106, "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents," to estimate the production and release quantities of C-14.

C-14 calculated production, discharge parameters and resulting dose are reported here, separately from tables 1, 1A, 1C, 1E, 2 and 40CFR190 table 1.

Calculated C-14 production , Ci/EFY ⁽¹⁾	U2 = 15.7 U3 = 15.4
2011 Unit capacity factors	U2 = 0.98 U3 = 0.84
Fraction release of produced C-14 to atmosphere	0.98
Fraction of C-14 chemical form assumed	Organic = 0.80 Inorganic = 0.20
Curies C-14 released to atmosphere	U2 = 15.4 U3 = 12.9
Critical receptor dose ⁽²⁾ [Child (bone)], mrem	2.15E-1

(1) Effective Full Power Year

(2) Due to ingestion of meat (deer) grazing in the NNE sector

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

SAN ONOFRE NUCLEAR GENERATING STATION

SECTION L. S.O.N.G.S. CONCLUSIONS

- Gaseous releases totaled $2.12\text{E}+2$ curies of which noble gases were $1.03\text{E}+2$ curies, iodines were $1.53\text{E}-3$ curies, particulates were $2.42\text{E}-4$ curies and tritium was $8.07\text{E}+1$ curies.
- The radiation doses from gaseous releases were: (a) gamma air dose: $6.55\text{E}-2$ mrad at the site boundary, (b) beta air dose: $7.17\text{E}-2$ mrad at the site boundary, (c) organ dose: $9.15\text{E}-3$ mrem at the highest receptor.
- Airborne carbon-14 release totaled $2.82\text{E}+1$ curies.
- The radiation dose from carbon-14 was an organ dose of $2.15\text{E}-1$ mrem at the highest receptor. The dose decreased slightly from 2010 ($7.77\text{E}-1$ mrem) due to removal of a garden near the site boundary from the 2011 Land Use Census.
- Liquid releases totaled $1.16\text{E}+3$ curies of which particulates and iodines were $9.55\text{E}-3$ curies, tritium was $1.16\text{E}+3$ curies, and noble gases were $1.03\text{E}+0$ curies.
- The radiation doses from liquid releases were: (a) total body: $2.02\text{E}-3$ mrem, (b) limiting organ: $2.85\text{E}-3$ mrem.
- The radioactive releases and resulting doses generated from Units 2 and 3 were below the Applicable Limits for both gaseous and liquid effluents.
- SONGS 2 and 3 made 115 radwaste shipments to EnergySolutions, UT and EnergySolutions Duratek, TN. The total volume of the 115 shipments was $1.54\text{E}+3$ cubic meters containing $4.86\text{E}+2$ curies of radioactivity. There were no radwaste shipments from Unit 1.
- Meteorological conditions during the year were typical for SONGS. Meteorological dispersion was good 37% of the time, fair 37% of the time and poor 27% of the time.
- The results of samples taken from on-site ground water wells in support of the Industry Ground Water Protection Initiative are reported in Section K. An investigation is being performed in the area formerly occupied by Unit 1 to characterize low, but detectable levels of tritium that are well below all regulatory limits (Notification 201053677). An investigation is being performed in the Unit 2/3 protected area to characterize low, but detectable levels of tritium that are well below all regulatory limits (Notification 201594817). Ground water beneath SONGS is not a source of drinking water.
- The net result from the analysis of these effluent releases indicates that the operation of SONGS has met all the requirements of the applicable regulations that ensure adequate protection of the health of members of the public.

METEOROLOGY

METEOROLOGY

The meteorology of the San Onofre Nuclear Generating Station for each of the four quarters, 2011 is described in this section. Meteorological measurements have been made according to the guidance provided in USNRC Regulatory Guide 1.23, "Onsite Meteorological Programs." A summary report of the meteorological measurements taken during each calendar quarter are presented in Table 4A as joint frequency distribution (JFD) of wind direction and wind speed by atmospheric stability class.

Hourly meteorological data for batch releases have been recorded for the periods of actual release. These data are available, as well as the hourly data for the Annual Report, but have not been included in this report because of the bulk of data records.

Table 4A lists the joint frequency distribution for each quarter, 2011. Each page of Table 4A represents the data for the individual stability classes: A, B, C, D, E, F, and G. The last page of each section is the JFD for all the stability classes. The wind speeds have been measured at the 10 meter level, and the stability classes are defined by the temperature differential between the 10 meter and 40 meter levels.

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

January - March

Table 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11010100-11033123
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
 EXTREMELY UNSTABLE (DT/DZ -1.9 C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	1	0	0	0	0	0	0	1
NNE	0	0	0	0	1	0	0	0	0	0	0	0	1
NE	0	0	0	0	0	1	0	1	0	0	0	0	2
ENE	0	0	0	0	1	0	1	0	0	0	0	0	2
E	0	0	0	0	1	0	0	0	0	0	0	0	1
ESE	0	0	0	1	2	0	0	0	0	0	0	0	3
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	1	1	0	4	4	3	0	0	0	0	13
S	0	0	0	1	1	18	25	2	0	0	0	0	47
SSW	0	0	0	3	11	19	20	0	0	0	0	0	53
SW	0	0	0	2	13	16	10	1	0	0	0	0	42
WSW	0	0	0	5	9	38	37	2	0	0	0	0	91
W	0	0	0	0	7	41	47	3	0	0	0	0	98
WNW	0	0	0	0	2	17	50	2	0	0	0	0	71
NW	0	0	0	0	0	2	5	0	0	0	0	0	7
NNW	0	0	0	1	0	0	0	0	0	0	0	0	1
TOTALS	0	0	1	14	48	157	199	14	0	0	0	0	433
NUMBER OF VALID HOURS	433												0
NUMBER OF INVALID HOURS	0												0
NUMBER OF CALMS													0
TOTAL HOURS FOR THE PERIOD													433

PASQUILL B
 MODERATELY UNSTABLE (-1.9 < DT/DZ -1.7 C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	1	1	0	0	0	0	2
SSE	0	0	0	0	0	2	2	2	0	0	0	0	6
S	0	0	0	0	0	4	1	1	0	0	0	0	6
SSW	0	0	0	0	2	3	2	1	0	0	0	0	8
SW	0	0	0	0	0	2	3	0	0	0	0	0	5
WSW	0	0	0	1	3	0	0	0	0	0	0	0	4
W	0	0	0	0	0	2	2	0	0	0	0	0	4
WNW	0	0	0	0	0	1	2	0	0	0	0	0	3
NW	0	0	0	0	1	0	3	0	0	0	0	0	4
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	1	6	14	18	5	0	0	0	0	44
NUMBER OF VALID HOURS	44												0
NUMBER OF INVALID HOURS	0												0
NUMBER OF CALMS													0
TOTAL HOURS FOR THE PERIOD													44

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

January - March
Table 4ASITE: SAN ONOFRE
PERIOD OF RECORD 11010100-11033123
WIND SPEED (M/S) AT 10 METER LEVELPASQUILL C
SLIGHTLY UNSTABLE ($-1.7 < DT/DZ$ -1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	2	0	0	0	0	0	0	2
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	1	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	1	0	0	0	0	1
SSE	0	0	0	0	0	0	3	2	0	0	0	0	5
S	0	0	0	0	1	2	0	1	0	0	0	0	4
SSW	0	0	0	0	1	1	1	1	0	1	1	0	6
SW	0	0	0	2	1	1	3	1	0	0	0	0	8
WSW	0	0	0	0	2	0	0	0	0	0	0	0	2
W	0	0	0	0	2	3	0	1	0	0	0	0	6
WNW	0	0	0	0	2	2	1	0	0	0	0	0	5
NW	0	0	0	0	1	1	2	0	0	0	0	0	4
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	2	10	12	11	7	0	1	1	0	44

NUMBER OF VALID HOURS 44
NUMBER OF INVALID HOURS 0NUMBER OF CALMS 0
TOTAL HOURS FOR THE PERIOD 44PASQUILL D
NEUTRAL ($-1.5 < DT/DZ$ -0.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	2	4	3	3	0	0	0	0	0	12
NNE	0	0	1	1	4	7	5	4	0	0	0	0	22
NE	0	0	0	1	2	0	1	0	0	0	0	0	4
ENE	0	0	0	1	0	2	0	0	0	0	0	0	3
E	0	0	0	0	1	2	1	1	0	0	0	0	5
ESE	0	0	0	2	2	3	8	0	0	0	0	0	15
SE	0	0	0	0	3	7	31	25	5	2	0	0	73
SSE	0	0	0	1	6	13	16	13	3	1	6	0	59
S	0	0	1	4	1	6	1	2	5	2	2	0	24
SSW	0	0	1	3	2	6	1	1	3	0	2	0	19
SW	0	0	0	5	4	1	6	5	1	0	0	0	22
WSW	0	0	0	3	2	4	6	7	0	1	0	0	23
W	0	0	2	1	3	11	9	9	2	0	0	0	37
WNW	0	0	0	1	1	10	12	5	0	0	0	0	29
NW	0	0	2	4	2	15	11	4	0	0	0	0	38
NNW	0	0	0	2	7	8	1	0	0	0	0	0	18
TOTALS	0	0	7	31	44	98	112	76	19	6	10	0	403

NUMBER OF VALID HOURS 403
NUMBER OF INVALID HOURS 0NUMBER OF CALMS 0
TOTAL HOURS FOR THE PERIOD 403

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

January - March

Table 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11010100-11033123
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
 SLIGHTLY STABLE (-0.5 < DT/DZ 1.5 C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	6	9	8	0	0	0	0	0	0	23
NNE	0	0	0	7	15	16	18	0	0	0	0	0	56
NE	0	0	1	3	4	3	2	3	3	0	0	0	19
ENE	0	0	1	3	2	4	3	2	0	0	0	0	15
E	0	0	0	1	4	12	2	0	0	0	0	0	19
ESE	0	0	0	1	5	10	3	0	0	0	0	0	19
SE	0	0	0	1	2	3	2	0	0	0	0	0	8
SSE	0	0	0	1	5	5	3	0	0	0	1	0	15
S	0	0	0	1	3	0	1	0	1	0	0	0	6
SSW	0	0	0	0	1	2	0	0	0	0	0	0	3
SW	0	0	0	4	2	2	0	0	0	0	0	0	8
WSW	0	0	0	4	1	0	3	1	0	0	0	0	9
W	0	0	0	1	7	6	3	1	0	0	0	0	18
WNW	0	0	0	4	2	11	5	3	0	0	0	0	25
NW	0	0	1	2	3	5	9	1	0	0	0	0	21
NNW	0	0	0	7	1	4	4	0	0	0	0	0	16
TOTALS	0	0	3	46	66	91	58	11	4	0	1	0	280
NUMBER OF VALID HOURS				280				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				280	

PASQUILL F
 MODERATELY STABLE (1.5 < DT/DZ 4.0 C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	7	11	5	0	0	0	0	0	0	23
NNE	0	1	0	13	46	51	14	0	0	0	0	0	125
NE	0	0	0	12	19	10	4	7	0	0	0	0	52
ENE	0	0	1	3	7	7	1	3	0	0	0	0	22
E	0	0	2	4	2	6	0	0	0	0	0	0	14
ESE	0	0	0	2	2	2	0	0	0	0	0	0	6
SE	0	0	1	0	2	0	0	0	0	0	0	0	3
SSE	0	0	0	4	0	1	0	0	0	0	0	0	5
S	0	0	2	4	3	1	0	0	0	0	0	0	10
SSW	0	1	0	4	3	2	1	0	0	0	0	0	11
SW	0	0	1	3	2	0	0	0	0	0	0	0	6
WSW	0	1	0	4	1	2	0	0	0	0	0	0	8
W	0	0	0	1	2	3	0	0	0	0	0	0	6
WNW	0	1	0	1	5	11	3	0	0	0	0	0	21
NW	0	0	2	4	3	7	2	0	0	0	0	0	18
NNW	0	0	0	2	3	2	2	0	0	0	0	0	9
TOTALS	0	4	9	68	111	110	27	10	0	0	0	0	339
NUMBER OF VALID HOURS				339				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				339	

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

January - March
Table 4ASITE: SAN ONOFRE
PERIOD OF RECORD 11010100-11033123
WIND SPEED (M/S) AT 10 METER LEVELPASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	2	3	9	11	0	0	0	0	0	25
NNE	0	0	0	5	16	165	201	11	0	0	0	0	398
NE	0	0	0	4	11	36	23	5	0	0	0	0	79
ENE	0	0	1	3	7	7	3	0	0	0	0	0	21
E	0	0	1	6	4	1	2	0	0	0	0	0	14
ESE	0	0	1	1	4	1	0	0	0	0	0	0	7
SE	0	0	0	1	3	1	0	0	0	0	0	0	5
SSE	0	0	0	2	1	1	0	0	0	0	0	0	4
S	0	0	0	1	3	1	0	0	0	0	0	0	5
SSW	0	0	0	1	2	0	1	0	0	0	0	0	4
SW	0	0	2	0	1	0	1	0	0	0	0	0	4
WSW	0	0	0	3	1	0	0	0	0	0	0	0	4
W	0	0	0	3	3	0	0	0	0	0	0	0	6
WNW	0	0	0	3	4	6	4	0	0	0	0	0	17
NW	0	0	1	1	5	3	3	0	0	0	0	0	13
NNW	0	0	1	3	0	5	2	0	0	0	0	0	11
TOTALS	0	0	7	39	68	236	251	16	0	0	0	0	617
NUMBER OF VALID HOURS													617
NUMBER OF INVALID HOURS													0
NUMBER OF CALMS													0
TOTAL HOURS FOR THE PERIOD													617

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	17	27	28	14	0	0	0	0	0	86
NNE	0	1	1	26	82	239	238	15	0	0	0	0	602
NE	0	0	1	20	36	50	31	16	3	0	0	0	157
ENE	0	0	3	10	17	20	9	5	0	0	0	0	64
E	0	0	3	11	12	21	6	1	0	0	0	0	54
ESE	0	0	1	7	15	16	11	0	0	0	0	0	50
SE	0	0	1	2	10	11	34	27	5	2	0	0	92
SSE	0	0	1	9	12	26	28	20	3	1	7	0	107
S	0	0	3	11	12	32	28	6	6	2	2	0	102
SSW	0	1	1	11	22	33	26	3	3	1	3	0	104
SW	0	0	3	16	23	22	23	7	1	0	0	0	95
WSW	0	1	0	20	19	44	46	10	0	1	0	0	141
W	0	0	2	6	24	66	61	14	2	0	0	0	175
WNW	0	1	0	9	16	58	77	10	0	0	0	0	171
NW	0	0	6	11	15	33	35	5	0	0	0	0	105
NNW	0	0	1	15	11	19	9	0	0	0	0	0	55
TOTALS	0	4	27	201	353	718	676	139	23	7	12	0	2160
NUMBER OF VALID HOURS													2160
NUMBER OF INVALID HOURS													0
NUMBER OF CALMS													0
TOTAL HOURS FOR THE PERIOD													2160

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

April - June

TABLE 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11040100-11063023
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
 EXTREMELY UNSTABLE (DT/DZ -1.9 C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	2	1	0	0	0	0	0	3
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	1	0	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	1	0	0	0	0	0	0	1
SSE	0	0	0	0	0	0	4	0	0	0	0	0	4
S	0	0	0	0	1	9	33	18	0	0	0	0	61
SSW	0	0	0	0	2	18	70	9	0	0	0	0	99
SW	0	0	0	2	7	31	50	2	0	0	0	0	92
WSW	0	0	0	1	4	59	75	4	1	0	0	0	144
W	0	0	0	0	1	35	126	10	0	0	0	0	172
WNW	0	0	0	0	1	19	78	24	1	0	0	0	123
NW	0	0	0	0	0	0	9	6	1	0	0	0	16
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	3	16	175	446	73	3	0	0	0	716
NUMBER OF VALID HOURS													716
NUMBER OF INVALID HOURS													0
NUMBER OF CALMS													0
TOTAL HOURS FOR THE PERIOD													716

PASQUILL B
 MODERATELY UNSTABLE (-1.9 < DT/DZ -1.7 C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	1	3	0	1	0	0	0	5
S	0	0	0	0	0	2	8	1	0	0	0	0	11
SSW	0	0	0	0	2	4	3	2	0	0	0	0	11
SW	0	0	0	0	5	4	16	2	0	0	0	0	27
WSW	0	0	0	0	3	5	1	0	0	0	0	0	9
W	0	0	0	0	2	7	1	3	0	0	0	0	13
WNW	0	0	0	0	0	2	3	0	0	0	0	0	5
NW	0	0	0	0	2	1	3	2	0	0	0	0	8
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	0	14	26	39	10	1	0	0	0	90
NUMBER OF VALID HOURS													90
NUMBER OF INVALID HOURS													0
NUMBER OF CALMS													0
TOTAL HOURS FOR THE PERIOD													90

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

April - June
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11040100-11063023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE ($-1.7 < DT/DZ$, 1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	1	0	0	0	0	0	0	0	1
NNE	0	0	0	0	0	1	1	1	0	0	0	0	3
NE	0	0	0	0	0	1	0	0	0	0	0	0	1
ENE	0	0	0	0	0	1	0	0	0	0	0	0	1
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	1	1	5	3	0	0	0	0	10
S	0	0	0	1	2	2	8	0	0	0	0	0	13
SSW	0	0	0	0	0	3	7	1	0	0	0	0	11
SW	0	0	0	0	7	6	7	2	0	0	0	0	22
WSW	0	0	0	1	1	5	3	1	0	0	0	0	11
W	0	0	0	0	1	2	0	2	0	0	0	0	5
WNW	0	0	0	1	1	3	1	0	0	0	0	0	6
NW	0	0	0	1	3	5	5	1	0	0	0	0	15
NNW	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTALS	0	0	0	4	17	31	37	11	0	0	0	0	100
NUMBER OF VALID HOURS				100				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				100	

PASQUILL D
NEUTRAL ($-1.5 < DT/DZ$, -0.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	6	7	3	0	0	0	0	0	0	16
NNE	0	0	0	5	11	10	8	0	0	0	0	0	34
NE	0	0	0	2	1	4	2	0	0	0	0	0	9
ENE	0	0	3	2	0	2	0	0	0	0	0	0	7
E	0	0	0	3	3	3	3	0	0	0	0	0	12
ESE	0	0	0	4	5	8	7	0	0	0	0	0	24
SE	0	0	0	5	7	23	56	7	2	0	0	0	100
SSE	0	0	0	3	14	37	64	26	3	0	0	0	147
S	0	0	0	4	15	34	46	3	0	0	0	0	102
SSW	0	0	1	11	21	27	27	3	2	0	0	0	92
SW	0	0	1	10	18	19	16	3	0	0	0	0	67
WSW	0	1	2	9	9	12	16	2	0	0	0	0	51
W	0	0	0	4	6	5	7	13	2	0	0	0	37
WNW	0	0	0	5	3	4	4	4	1	0	0	0	21
NW	0	0	1	6	6	12	9	6	1	0	0	0	41
NNW	0	0	1	6	4	9	7	0	0	0	0	0	27
TOTALS	0	1	9	85	130	212	272	67	11	0	0	0	787
NUMBER OF VALID HOURS				787				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				787	

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

April - June
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11040100-11063023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
SLIGHTLY STABLE ($-0.5 < DT/DZ$ 1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	1	6	5	1	0	0	0	0	0	14
NNE	0	0	0	8	13	13	3	1	0	0	0	0	38
NE	0	0	0	4	2	0	1	0	0	0	0	0	7
ENE	0	0	1	2	6	2	1	0	0	0	0	0	12
E	0	0	1	4	0	2	1	0	0	0	0	0	8
ESE	0	0	0	0	2	6	1	0	0	0	0	0	9
SE	0	0	0	1	1	1	10	0	0	0	0	0	13
SSE	0	0	0	0	0	1	2	0	0	0	0	0	3
S	0	0	1	1	0	2	0	0	0	0	0	0	4
SSW	0	0	0	1	1	0	1	0	0	0	0	0	3
SW	0	0	0	1	0	0	0	0	0	0	0	0	1
WSW	0	0	0	0	1	2	0	0	0	0	0	0	3
W	0	1	2	2	3	0	0	0	0	0	0	0	8
WNW	0	0	0	2	2	3	2	0	0	0	0	0	9
NW	0	0	0	0	1	1	3	1	0	0	0	0	6
NNW	0	0	0	1	1	3	3	0	0	0	0	0	8
TOTALS	0	1	6	28	39	41	29	2	0	0	0	0	146
NUMBER OF VALID HOURS				146	NUMBER OF CALMS				0				
NUMBER OF INVALID HOURS				0	TOTAL HOURS FOR THE PERIOD				146				

PASQUILL F
MODERATELY STABLE ($1.5 < DT/DZ$ 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	3	2	2	0	0	0	0	0	7
NNE	0	0	1	6	27	36	3	0	0	0	0	0	73
NE	0	0	0	6	7	3	1	0	0	0	0	0	17
ENE	0	0	0	2	1	4	0	0	0	0	0	0	7
E	0	0	0	2	0	2	0	0	0	0	0	0	4
ESE	0	0	0	1	0	0	0	0	0	0	0	0	1
SE	0	0	0	2	0	2	0	0	0	0	0	0	4
SSE	0	0	1	0	0	0	0	0	0	0	0	0	1
S	0	0	0	1	1	0	0	0	0	0	0	0	2
SSW	0	0	0	2	0	1	0	0	0	0	0	0	3
SW	0	0	0	2	0	0	0	0	0	0	0	0	2
WSW	0	0	0	1	3	1	0	0	0	0	0	0	5
W	0	0	0	0	3	2	2	0	0	0	0	0	7
WNW	0	0	0	1	1	4	2	0	0	0	0	0	8
NW	0	0	0	3	2	1	2	0	0	0	0	0	8
NNW	0	0	1	1	0	0	0	0	0	0	0	0	2
TOTALS	0	0	3	30	48	58	12	0	0	0	0	0	151
NUMBER OF VALID HOURS				151	NUMBER OF CALMS				0				
NUMBER OF INVALID HOURS				0	TOTAL HOURS FOR THE PERIOD				151				

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

April - June

TABLE 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11040100-11063023
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
 EXTREMELY STABLE (DT/DZ > 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	2	0	1	0	0	0	0	0	3
NNE	0	0	0	0	3	87	56	0	0	0	0	0	146
NE	0	0	0	2	2	9	3	1	0	0	0	0	17
ENE	0	0	1	0	0	0	1	0	0	0	0	0	2
E	0	0	0	1	0	2	1	0	0	0	0	0	4
ESE	0	0	0	1	0	0	1	0	0	0	0	0	2
SE	0	0	0	0	0	0	2	0	0	0	0	0	2
SSE	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	1	0	0	0	0	0	0	0	0	1
SSW	0	0	0	2	0	0	0	0	0	0	0	0	2
SW	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	1	1	0	0	0	0	0	2
W	0	0	0	0	1	0	0	0	0	0	0	0	1
WNW	0	0	0	1	0	2	1	0	0	0	0	0	4
NW	0	0	0	0	0	2	0	0	0	0	0	0	2
NNW	0	0	1	1	1	1	2	0	0	0	0	0	6
TOTALS	0	0	2	9	9	104	69	1	0	0	0	0	194

NUMBER OF VALID HOURS
 NUMBER OF INVALID HOURS

194
 0

NUMBER OF CALMS
 TOTAL HOURS FOR THE PERIOD

0
 194

ALL STABILITY CLASSES, ALL DT/DZ
 WIND SPEED (M/S) AT 10 METER LEVEL

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	7	19	10	4	0	0	0	0	0	41
NNE	0	0	1	19	54	147	71	2	0	0	0	0	294
NE	0	0	0	14	12	19	8	1	0	0	0	0	54
ENE	0	0	5	6	7	9	3	0	0	0	0	0	30
E	0	0	1	10	3	10	5	0	0	0	0	0	29
ESE	0	0	0	6	7	14	9	0	0	0	0	0	36
SE	0	0	0	8	8	27	68	7	2	0	0	0	120
SSE	0	0	1	3	15	40	78	29	4	0	0	0	170
S	0	0	1	8	19	49	95	22	0	0	0	0	194
SSW	0	0	1	16	26	53	108	15	2	0	0	0	221
SW	0	0	1	15	37	60	89	9	0	0	0	0	211
WSW	0	1	2	12	21	85	96	7	1	0	0	0	225
W	0	1	2	6	17	51	136	28	2	0	0	0	243
WNW	0	0	0	10	8	37	91	28	2	0	0	0	176
NW	0	0	1	10	14	22	31	16	2	0	0	0	96
NNW	0	0	3	9	6	14	12	0	0	0	0	0	44
TOTALS	0	2	20	159	273	647	904	164	15	0	0	0	2184

NUMBER OF VALID HOURS
 NUMBER OF INVALID HOURS

2184
 0

NUMBER OF CALMS
 TOTAL HOURS FOR THE PERIOD

0
 2184

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

July - September
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11070100-11093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
EXTREMELY UNSTABLE (DT/DZ -1.9 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	0	1	0	0	0	0	0	1
NNE	0	0	0	0	3	2	5	0	0	0	0	0	10
NE	0	0	0	0	2	0	0	0	0	0	0	0	2
ENE	0	0	0	1	0	0	0	0	0	0	0	0	1
E	0	0	0	1	0	1	0	0	0	0	0	0	2
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	9	1	1	0	0	0	0	11
S	0	1	0	0	0	13	19	7	0	0	0	0	40
SSW	0	0	0	1	7	24	26	0	0	0	0	0	58
SW	0	0	0	2	9	47	31	0	0	0	0	0	89
WSW	0	0	0	2	9	84	55	2	0	0	0	0	152
W	0	0	0	3	9	91	108	1	0	0	0	0	212
WNW	0	0	0	3	10	45	115	6	0	0	0	0	179
NW	0	0	0	2	2	12	13	2	0	0	0	0	31
NNW	0	0	0	0	2	1	0	0	0	0	0	0	3
TOTALS	0	1	0	15	53	329	374	19	0	0	0	0	791
NUMBER OF VALID HOURS					791	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					791		

PASQUILL B
MODERATELY UNSTABLE ($-1.9 < DT/DZ$ -1.7 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	3	2	2	0	0	0	0	0	0	7
NNE	0	0	0	4	5	1	0	0	0	0	0	0	10
NE	0	0	0	0	1	0	1	0	0	0	0	0	2
ENE	0	0	0	1	1	0	0	0	0	0	0	0	2
E	0	0	0	0	0	1	0	0	0	0	0	0	1
ESE	0	0	1	3	1	1	0	0	0	0	0	0	6
SE	0	0	0	2	1	1	2	0	0	0	0	0	6
SSE	0	0	0	0	0	2	5	3	2	0	0	0	12
S	0	1	0	2	3	8	7	0	0	0	0	0	21
SSW	0	0	0	2	6	7	10	0	0	0	0	0	25
SW	0	0	0	1	5	14	2	0	0	0	0	0	22
WSW	0	0	0	3	3	1	1	0	0	0	0	0	8
W	0	0	0	3	3	0	0	0	0	0	0	0	6
WNW	0	0	1	4	7	4	1	0	0	0	0	0	17
NW	0	0	0	1	2	3	2	0	0	0	0	0	8
NNW	0	0	0	0	2	0	0	0	0	0	0	0	2
TOTALS	0	1	2	29	42	45	31	3	2	0	0	0	155
NUMBER OF VALID HOURS					155	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					155		

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

July - September
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11070100-11093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE (-1.7 < DT/DZ -1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	2	1	1	0	0	0	0	0	0	4
NNE	0	0	0	0	1	6	2	0	0	0	0	0	9
NE	0	0	0	1	4	4	0	0	0	0	0	0	9
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	1	0	0	0	0	0	0	1
ESE	0	0	0	1	0	3	2	0	0	0	0	0	6
SE	0	0	0	3	0	0	5	0	0	0	0	0	8
SSE	0	0	0	2	4	15	12	7	1	0	0	0	41
S	0	0	0	1	5	9	17	0	0	0	0	0	32
SSW	0	0	0	4	5	8	9	0	0	0	0	0	26
SW	0	0	1	4	5	9	5	0	0	0	0	0	24
WSW	0	0	0	5	6	9	4	0	0	0	0	0	24
W	0	0	0	2	1	4	1	0	0	0	0	0	8
WNW	0	0	0	2	6	4	1	0	0	0	0	0	13
NW	0	0	0	7	6	2	6	1	0	0	0	0	22
NNW	0	0	0	3	4	1	1	0	0	0	0	0	9
TOTALS	0	0	1	37	48	76	65	8	1	0	0	0	236

NUMBER OF VALID HOURS
NUMBER OF INVALID HOURS

236
0

NUMBER OF CALMS
TOTAL HOURS FOR THE PERIOD

0
236

PASQUILL D
NEUTRAL (-1.5 < DT/DZ -0.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	7	13	6	1	1	0	0	0	0	29
NNE	0	0	2	9	22	27	3	0	0	0	0	0	63
NE	0	0	0	2	6	6	0	1	0	0	0	0	15
ENE	0	2	0	4	2	1	0	0	0	0	0	0	9
E	0	0	2	6	6	7	1	0	0	0	0	0	22
ESE	0	0	2	5	1	12	5	0	0	0	0	0	25
SE	0	0	0	3	9	24	17	0	0	0	0	0	53
SSE	0	0	0	7	14	50	50	1	0	0	0	0	122
S	0	0	2	11	18	33	17	2	0	0	0	0	83
SSW	0	0	1	14	14	13	9	0	0	0	0	0	51
SW	0	0	2	9	9	4	2	0	0	0	0	0	26
WSW	0	0	1	13	2	13	3	0	0	0	0	0	32
W	0	1	3	7	4	8	6	3	0	0	0	0	32
WNW	0	0	2	11	3	6	2	1	0	0	0	0	25
NW	0	0	5	12	7	11	9	0	0	0	0	0	44
NNW	0	0	1	14	6	7	0	1	0	0	0	0	29
TOTALS	0	3	24	134	136	228	125	10	0	0	0	0	660

NUMBER OF VALID HOURS
NUMBER OF INVALID HOURS

660
0

NUMBER OF CALMS
TOTAL HOURS FOR THE PERIOD

0
660

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

July - September

TABLE 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11070100-11093023
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
 SLIGHTLY STABLE ($-0.5 < DT/DZ$, 1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	1	1	8	5	3	1	0	0	0	0	0	19
NNE	0	0	5	18	14	15	0	0	0	0	0	0	52
NE	0	0	1	7	3	0	0	0	0	0	0	0	11
ENE	0	0	1	4	2	2	0	0	0	0	0	0	9
E	0	0	1	3	2	1	1	0	0	0	0	0	8
ESE	0	0	1	2	3	3	0	0	0	0	0	0	9
SE	0	1	0	1	3	2	2	0	0	0	0	0	9
SSE	0	1	0	1	8	5	3	0	0	0	0	0	18
S	0	0	0	3	3	1	2	1	0	0	0	0	10
SSW	0	0	2	1	0	2	0	0	0	0	0	0	5
SW	0	0	0	1	3	0	0	0	0	0	0	0	4
WSW	0	0	1	2	0	1	0	0	0	0	0	0	4
W	0	1	0	1	1	0	1	0	0	0	0	0	4
WNW	0	0	2	1	0	7	3	1	0	0	0	0	14
NW	0	0	0	1	1	3	1	0	0	0	0	0	6
NNW	0	0	1	4	1	7	1	0	0	0	0	0	14
TOTALS	0	4	16	58	49	52	15	2	0	0	0	0	196
NUMBER OF VALID HOURS					196	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					196		

PASQUILL F
 MODERATELY STABLE ($1.5 < DT/DZ$, 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	2	1	1	0	0	0	0	0	4
NNE	0	0	0	7	22	16	1	0	0	0	0	0	46
NE	0	0	0	0	2	2	0	0	0	0	0	0	4
ENE	0	0	0	0	1	0	0	1	0	0	0	0	2
E	0	0	0	0	1	2	0	0	0	0	0	0	3
ESE	0	0	0	0	0	1	0	1	0	0	0	0	2
SE	0	0	0	0	2	3	1	0	0	0	0	0	6
SSE	0	0	0	3	1	0	1	0	0	0	0	0	5
S	0	0	2	4	2	0	0	0	0	0	0	0	8
SSW	0	0	0	0	2	1	1	0	0	0	0	0	4
SW	0	0	1	1	1	0	0	0	0	0	0	0	3
WSW	0	0	0	1	4	2	0	0	0	0	0	0	7
W	0	0	0	0	1	3	1	0	0	0	0	0	5
WNW	0	0	0	0	2	3	1	0	0	0	0	0	6
NW	0	0	0	0	1	1	1	0	0	0	0	0	3
NNW	0	0	0	1	1	1	0	0	0	0	0	0	3
TOTALS	0	0	3	17	45	36	8	2	0	0	0	0	111
NUMBER OF VALID HOURS					111	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					111		

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

July - September
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11070100-11093023
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	2	1	0	0	0	0	0	3
NNE	0	0	0	0	1	19	4	0	0	0	0	0	24
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	1	0	0	0	0	0	0	0	0	1
E	0	0	0	1	0	1	0	0	0	0	0	0	2
ESE	0	0	0	1	0	1	0	0	0	0	0	0	2
SE	0	0	0	0	0	1	1	0	0	0	0	0	2
SSE	0	0	0	1	1	1	0	0	0	0	0	0	3
S	0	0	0	2	0	0	0	0	0	0	0	0	2
SSW	0	0	0	0	0	0	0	0	0	0	0	0	0
SW	0	0	0	2	3	1	0	0	0	0	0	0	6
WSW	0	0	0	3	0	0	0	0	0	0	0	0	3
W	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	2	0	2	1	0	0	0	0	0	5
NW	0	0	0	1	1	1	2	0	0	0	0	0	5
NNW	0	0	0	1	0	0	0	0	0	0	0	0	1
TOTALS	0	0	0	15	6	29	9	0	0	0	0	0	59
NUMBER OF VALID HOURS				59				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				59	

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	1	2	20	23	15	5	1	0	0	0	0	67
NNE	0	0	7	38	68	86	15	0	0	0	0	0	214
NE	0	0	1	10	18	12	1	1	0	0	0	0	43
ENE	0	2	1	11	6	3	0	1	0	0	0	0	24
E	0	0	3	11	9	14	2	0	0	0	0	0	39
ESE	0	0	4	12	5	21	7	1	0	0	0	0	50
SE	0	1	0	9	15	31	28	0	0	0	0	0	84
SSE	0	1	0	14	28	82	72	12	3	0	0	0	212
S	0	2	4	23	31	64	62	10	0	0	0	0	196
SSW	0	0	3	22	34	55	55	0	0	0	0	0	169
SW	0	0	4	20	35	75	40	0	0	0	0	0	174
WSW	0	0	2	29	24	110	63	2	0	0	0	0	230
W	0	2	3	16	19	106	117	4	0	0	0	0	267
WNW	0	0	5	23	28	71	124	8	0	0	0	0	259
NW	0	0	5	24	20	33	34	3	0	0	0	0	119
NNW	0	0	2	23	16	17	2	1	0	0	0	0	61
TOTALS	0	9	46	305	379	795	627	44	3	0	0	0	2208
NUMBER OF VALID HOURS				2208				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				2208	

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

October - December

TABLE 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11100100-11123123
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A
 EXTREMELY UNSTABLE (DT/DZ -1.9 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	0	1	2	0	0	0	0	3
NNE	1	0	0	0	1	0	0	0	0	0	0	0	2
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	1	0	1	0	0	0	0	2
ESE	0	0	0	1	1	0	0	0	0	0	0	0	2
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	2	2	7	2	0	0	0	0	13
S	0	0	0	1	6	17	20	1	0	0	0	0	45
SSW	0	0	0	1	7	16	8	0	0	0	0	0	32
SW	0	0	0	7	12	13	3	2	0	0	0	0	37
WSW	0	0	0	3	14	24	18	1	1	0	0	0	61
W	0	0	0	1	12	72	42	2	1	0	0	0	130
WNW	0	0	0	0	2	52	53	4	0	0	0	0	111
NW	0	0	0	0	1	4	8	1	0	0	0	0	14
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	1	0	0	14	58	201	160	16	2	0	0	0	452
NUMBER OF VALID HOURS					452	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					452		

PASQUILL B
 MODERATELY UNSTABLE ($-1.9 < DT/DZ$ -1.7 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	1	0	1	0	0	0	0	2
NNE	4	0	0	0	0	0	0	1	0	0	0	0	5
NE	0	0	0	0	1	0	0	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	1	0	0	0	0	0	1
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	1	1	12	4	0	0	0	0	18
S	0	0	0	0	0	2	3	0	0	0	0	0	5
SSW	0	0	0	0	0	2	3	1	0	0	0	0	6
SW	0	0	0	1	0	2	2	1	0	0	0	0	6
WSW	0	0	0	0	1	0	0	0	0	0	0	0	1
W	0	0	0	1	2	2	0	0	0	0	0	0	5
WNW	0	0	0	1	1	2	1	0	0	0	0	0	5
NW	0	0	0	0	1	4	3	0	0	0	0	0	8
NNW	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTALS	4	0	0	3	7	16	26	8	0	0	0	0	64
NUMBER OF VALID HOURS					64	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					64		

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

October - December
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11100100-11123123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C
SLIGHTLY UNSTABLE ($-1.7 < DT/DZ$ -1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	1	0	0	0	0	0	0	0	1
NNE	2	0	0	0	2	2	0	0	0	0	0	0	6
NE	0	0	0	0	0	0	1	1	0	0	0	0	2
ENE	0	0	1	0	0	0	0	0	0	0	0	0	1
E	0	0	0	0	1	0	1	0	0	0	0	0	2
ESE	0	0	0	0	1	0	0	0	1	0	0	0	2
SE	0	0	0	1	0	0	0	1	3	0	0	0	5
SSE	0	0	0	0	0	3	4	2	2	0	0	0	11
S	0	0	0	1	1	1	4	0	2	1	0	0	10
SSW	0	0	0	0	1	2	1	0	0	0	0	0	4
SW	1	0	0	1	1	0	5	0	0	0	0	0	8
WSW	0	0	0	2	0	0	0	0	0	0	0	0	2
W	0	0	0	3	3	4	0	0	0	0	0	0	10
WNW	0	0	0	1	4	1	0	0	0	0	0	0	6
NW	0	0	0	1	0	4	1	0	0	0	0	0	6
NNW	0	0	0	0	0	1	0	1	0	0	0	0	2
TOTALS	3	0	1	10	15	18	17	5	8	1	0	0	78

NUMBER OF VALID HOURS	78	NUMBER OF CALMS	0
NUMBER OF INVALID HOURS	0	TOTAL HOURS FOR THE PERIOD	78

PASQUILL D
NEUTRAL ($-1.5 < DT/DZ$ -0.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	5	5	7	2	3	0	0	0	0	23
NNE	0	1	0	11	13	12	2	4	1	0	0	0	44
NE	0	0	0	2	4	1	1	0	0	0	0	0	8
ENE	0	0	1	5	1	1	0	0	0	0	0	0	8
E	0	0	0	3	4	0	3	0	0	0	0	0	10
ESE	0	0	0	3	2	8	10	1	3	0	0	0	27
SE	0	0	0	1	5	12	23	10	1	0	0	0	52
SSE	0	0	0	4	11	15	21	7	5	3	0	0	66
S	0	0	1	5	7	10	7	1	1	2	0	0	34
SSW	0	0	1	3	3	2	14	2	0	0	0	0	25
SW	0	0	1	5	3	5	8	4	3	0	0	0	29
WSW	0	1	1	5	4	1	2	1	1	0	0	0	16
W	0	0	2	6	4	5	1	0	1	0	0	0	19
WNW	0	0	0	4	5	8	3	0	0	0	0	0	20
NW	0	0	0	3	5	14	8	0	0	0	0	0	30
NNW	0	0	1	2	8	8	2	0	0	0	0	0	21
TOTALS	0	2	9	67	84	109	107	33	16	5	0	0	432

NUMBER OF VALID HOURS	432	NUMBER OF CALMS	0
NUMBER OF INVALID HOURS	0	TOTAL HOURS FOR THE PERIOD	432

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

October - December

TABLE 4A

SITE: SAN ONOFRE
 PERIOD OF RECORD 11100100-11123123
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E
 SLIGHTLY STABLE ($-0.5 < DT/DZ$ 1.5 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	7	3	6	1	1	0	0	0	0	19
NNE	0	0	3	13	17	14	4	0	0	0	0	0	51
NE	0	0	4	10	5	3	3	2	0	0	0	0	27
ENE	0	0	1	7	8	5	5	0	2	0	0	0	28
E	0	0	2	5	5	10	2	1	4	1	0	0	30
ESE	0	0	2	6	4	6	3	0	1	0	0	0	22
SE	0	0	0	3	2	7	10	1	0	0	0	0	23
SSE	0	0	0	0	3	1	2	1	0	0	0	0	7
S	0	0	1	6	2	4	0	0	0	0	0	0	13
SSW	0	0	1	1	0	1	0	0	1	0	0	0	4
SW	0	0	0	2	1	0	0	0	0	0	0	0	3
WSW	0	0	0	2	4	1	1	0	0	0	0	0	8
W	0	0	0	4	2	4	0	0	0	0	0	0	10
WNW	0	1	0	4	2	3	6	2	0	0	0	0	18
NW	0	1	2	4	3	5	2	0	0	0	0	0	17
NNW	0	0	2	4	4	4	4	0	0	0	0	0	18
TOTALS	0	2	19	78	65	74	43	8	8	1	0	0	298
NUMBER OF VALID HOURS				298				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				298	

PASQUILL F
 MODERATELY STABLE ($1.5 < DT/DZ$ 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	7	5	1	0	0	0	0	0	13
NNE	0	0	3	17	37	58	19	0	0	0	0	0	134
NE	0	0	4	18	19	16	3	0	0	0	0	0	60
ENE	0	1	3	13	7	12	2	0	0	0	0	0	38
E	0	1	0	2	1	3	0	0	0	0	0	0	7
ESE	0	0	0	0	6	5	1	0	0	0	0	0	12
SE	0	0	0	0	2	1	1	0	0	0	0	0	4
SSE	0	0	0	2	1	3	3	0	0	0	0	0	9
S	0	0	0	1	4	0	1	0	0	0	0	0	6
SSW	0	0	0	0	1	1	0	0	0	0	0	0	2
SW	0	0	0	1	0	0	0	1	0	0	0	0	2
WSW	0	0	0	3	0	0	0	0	0	0	0	0	3
W	0	0	1	1	6	2	0	0	0	0	0	0	10
WNW	0	0	0	3	1	11	2	0	0	0	0	0	17
NW	0	0	0	1	3	2	0	0	0	0	0	0	6
NNW	0	0	0	4	1	1	1	0	0	0	0	0	7
TOTALS	0	2	11	66	96	120	34	1	0	0	0	0	330
NUMBER OF VALID HOURS				330				NUMBER OF CALMS				0	
NUMBER OF INVALID HOURS				0				TOTAL HOURS FOR THE PERIOD				330	

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT – 2011

METEOROLOGY

October - December
TABLE 4A

SITE: SAN ONOFRE
PERIOD OF RECORD 11100100-11123123
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G
EXTREMELY STABLE (DT/DZ > 4.0 C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	2	1	7	3	0	0	0	0	0	13
NNE	1	0	0	5	17	135	213	9	0	0	0	0	380
NE	0	0	0	3	17	38	16	1	0	0	0	0	75
ENE	0	0	1	3	5	7	5	0	0	0	0	0	21
E	0	0	0	0	4	4	3	0	0	0	0	0	11
ESE	0	0	0	2	1	2	0	0	0	0	0	0	5
SE	0	0	0	0	0	1	0	0	0	0	0	0	1
SSE	0	0	0	0	1	4	2	0	0	0	0	0	7
S	0	0	0	2	3	1	1	1	0	0	0	0	8
SSW	0	0	0	2	0	0	1	0	0	0	0	0	3
SW	0	0	0	0	2	2	0	0	0	0	0	0	4
WSW	0	0	0	2	0	1	0	0	0	0	0	0	3
W	0	0	0	0	2	4	0	0	0	0	0	0	6
WNW	0	0	1	0	4	3	1	0	0	0	0	0	9
NW	0	0	1	0	1	0	1	0	0	0	0	0	3
NNW	0	0	0	0	1	3	1	0	0	0	0	0	5
TOTALS	1	0	3	21	59	212	247	11	0	0	0	0	554

NUMBER OF VALID HOURS	554	NUMBER OF CALMS	0
NUMBER OF INVALID HOURS	0	TOTAL HOURS FOR THE PERIOD	554

ALL STABILITY CLASSES, ALL DT/DZ
WIND SPEED (M/S) AT 10 METER LEVEL

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	2	14	17	26	8	7	0	0	0	0	74
NNE	8	1	6	46	87	221	238	14	1	0	0	0	622
NE	0	0	8	33	46	58	24	4	0	0	0	0	173
ENE	0	1	7	28	21	25	12	0	2	0	0	0	96
E	0	1	2	10	15	18	9	2	4	1	0	0	62
ESE	0	0	2	12	15	21	15	1	5	0	0	0	71
SE	0	0	0	5	9	21	34	12	4	0	0	0	85
SSE	0	0	0	6	19	29	51	16	7	3	0	0	131
S	0	0	2	16	23	35	36	3	3	3	0	0	121
SSW	0	0	2	7	12	24	27	3	1	0	0	0	76
SW	1	0	1	17	19	22	18	8	3	0	0	0	89
WSW	0	1	1	17	23	27	21	2	2	0	0	0	94
W	0	0	3	16	31	93	43	2	2	0	0	0	190
WNW	0	1	1	13	19	80	66	6	0	0	0	0	186
NW	0	1	3	9	14	33	23	1	0	0	0	0	84
NNW	0	0	3	10	14	17	9	1	0	0	0	0	54
TOTALS	9	6	43	259	384	750	634	82	34	7	0	0	2208

NUMBER OF VALID HOURS	2208	NUMBER OF CALMS	0
NUMBER OF INVALID HOURS	0	TOTAL HOURS FOR THE PERIOD	2208