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Richard J. St. Onge
Director
Nuclear Regulatory Affairs

Tech Spec Section D6.9.1.3
Tech Spec Section 5.7.1.2

May 9, 2011

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: **Docket Nos. 50-206, 50-361, 50-362 and 72-41**
2010 Annual Radiological Environmental Operating Report
San Onofre Nuclear Generating Station Units 1, 2 and 3 and
Independent Spent Fuel Storage Facility

Dear Sir or Madam:

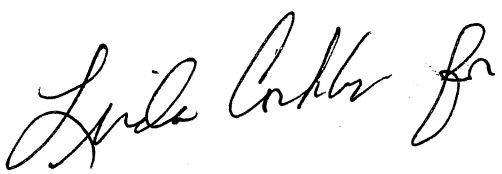
As required by Technical Specification (TS) Section D6.9.1.3 of San Onofre Nuclear Generating Station (SONGS) Unit 1 Facility Operating License DPR-13, and TS Section 5.7.1.2 of Facility Operating Licenses NPF-10 and NPF-15 for SONGS Units 2 and 3, respectively, this letter transmits the 2010 Annual Radiological Environmental Operating Report (AREOR) for SONGS Units 1, 2 and 3.

The AREOR covers the operation of SONGS during January 1, 2010 through December 31, 2010 and includes summaries, interpretations, and analyses of trends of the results of the Radiological Environmental Monitoring Program.

In addition, the AREOR includes the results for direct radiation monitoring near the Independent Spent Fuel Storage Installation.

If you require any additional information, please contact Mr. Ryan I. Treadway at (949) 368-9985.

Sincerely,



P.O. Box 128
San Clemente, CA 92674

Enclosure

cc: E. E. Collins, NRC Regional Administrator, Region IV
J. E. Whitten, Region IV, San Onofre Unit 1
Mark S. Haire, NRC Region IV, San Onofre Units 2 & 3
R. Hall, NRC Project Manager, San Onofre Units 2 and 3
S. Helton, NRC Project Manager, San Onofre ISFSI
G. G. Warnick, NRC Senior Resident Inspector, San Onofre Units 2 and 3
S. Y. Hsu, California Department of Public Health

2010
Radiological Environmental Operating Report

San Onofre Nuclear Generating Station

Southern California Edison

An Edison International Company

Docket Nos. 50-206, 50-361, 50-362

License Nos. DPR-13, NPF-10, NPF-15

April 2011

SOUTHERN CALIFORNIA EDISON®

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2010 ANNUAL

RADIOLOGICAL ENVIRONMENTAL

OPERATING REPORT

San Onofre Nuclear Generating Station

UNITS 1, 2, & 3

Southern California Edison

An Edison International Company

Prepared by: N.A Hansen 4/27/11

Approved by: R.K. Heckler 4/27/11

Approved by: M.J. Johnson 4/27/11

Approved by: M. M. Lewis 5/3/11

Approved by: R. L. McCann 5/2/11

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Executive Summary

The data from the San Onofre Nuclear Generating Station (SONGS) Radiological Environmental Monitoring Program (REMP) indicate that SONGS had a negligible radiological environmental impact during 2010. We further conclude that dose to a member of the general public attributable to all SONGS related radiological activities is below regulatory limits.

Preparation of the 2010 Annual Radiological Environmental Operating Report (AREOR) used the data reduction protocol described in NUREG/CR-4007. A meaningful analysis of data at, near, or below the detection limit must necessarily involve a consideration of the degrees of uncertainty associated with the data. The data have been summarized in the Statistical Summary of REMP Data found in Appendix B. The plant related radionuclides, including Cs-137 (cesium-137) in soil, as well as I-131 (iodine-131) in kelp, detected above the *a posteriori* MDC (minimum detectable concentration) are attributable to fallout from nuclear weapons testing (Cs-137) and medical administrations of radionuclides (I-131). These isotopes have been detected at indicator as well as control locations in past years. The naturally occurring radionuclides, including Be-7 (beryllium-7), K-40 (potassium-40), and Th-228 (thorium-228), were detected in both control and indicator locations at similar concentrations and are not related to the operation of SONGS. Tritium (H-3, hydrogen-3) was detected in one ocean water sample at a level below the *a priori* LLD. The single detection of tritium in ocean water in 2010 is attributable to the sampling being taken during a planned, controlled discharge of a waste stream from SONGS. Subsequent samples did not detect tritium in ocean water. Refer to Appendix B for a more detailed discussion. No other SONGS related radionuclides were detected in REMP samples during 2010.

INTRODUCTION

SONGS consists of two pressurized water nuclear reactors housed in separate containment buildings. Unit 1 attained initial criticality June 1967, was permanently retired from service in November 1992. The Unit 1 aboveground structures have been removed. Unit 2 attained initial criticality in July 1982 and Unit 3 in August 1983. Both units continue to operate today.

The purpose of the REMP is to quantify ambient radiation levels in the environs of SONGS, and to identify and quantify concentrations of radioactivity in various environmental media in the vicinity of SONGS that have a potential radiation exposure pathway to a member of the general public. Thermoluminescent dosimeters (TLDs) are used to measure direct radiation levels. Sampled environmental media include soil, shoreline sediment (beach sand), air (particulate & iodine), local crops, non-migratory marine species, kelp, drinking water, ocean water, and ocean bottom sediments. Each of the samples was analyzed for both naturally-occurring and SONGS-related radionuclides.

The REMP is conducted in accordance with Section 5.0 of the SONGS Offsite Dose Calculation Manual (ODCM).

To conform with 10 CFR Part 50, Appendix I, Section IV B.2, data on measurable levels of radiation and radioactive materials in the environment have been compared against predicted

(calculated) values to evaluate the relationship between quantities of radioactive material released in effluents and resultant radiation doses to individuals from principal pathways of exposure. Refer to Appendix B for a correlation of effluent to environmental concentrations.

A land use census was performed in 2010 to ensure that changes in the use of areas at and beyond the site boundary are identified and that modifications to the monitoring program are made if required by the results of this census. Appendix F of the report identifies changes to the census and the resultant dose increase, if any, to individuals from principal pathways of exposures in conformance with 10CFR Part 50, Appendix I, Section IV. B.3.

OBJECTIVES

1. To fulfill the radiological environmental monitoring requirements of the ODCM

2. To detect any significant increase in the concentration of radionuclides in critical pathways.

3. To detect any significant change in ambient gamma radiation levels.

4. To verify that the operation of SONGS Units 2 and 3 has a negligible effect on the health and safety of the public and the environment.

SAMPLE COLLECTION

Samples of various environmental media were obtained to meet the stated objectives. The selection of sample types was based on established critical pathways for the transfer of radionuclides through the environment to individuals, and the evaluation of data during the operational phase. Sampling locations were selected with consideration given to site meteorology, local demography, and land uses. Refer to Appendix A for a complete list of REMP sample locations as described in Table 5-4 of the ODCM.

Sampling locations were divided into two classes, indicator and control. Control stations were at locations considered to be unaffected by SONGS operations. All others are considered indicator locations and may be potentially affected by SONGS operations.

REGULATORY LIMITS, GUIDANCE, AND REQUIREMENTS

* 10CFR50

  The Code of Federal Regulations Title 10, Part 50, Appendix I.

* 40CFR190

  The Environmental Protection Agency (EPA) has established environmental radiation protection standards for nuclear power plants in 40CFR190. These limits are applicable to the sum of both liquid and gaseous effluents and direct radiation. The environmental

doses calculated at SONGS are a small fraction of the dose limits established by the EPA. refer to the 2010 SONGS Annual Radiological Effluent Release Report for details.

* 10CFR20

  10CFR20, Appendix B, Table II, "Effluent Concentrations" and Appendix C, "Concentration for Release to Sewerage"

Guidance:

* Regulatory Guide 4.1

  Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants, 1975

* Regulatory Guide 4.2

  Preparation of Environmental Reports for Nuclear Power Stations, 1976

* Regulatory Guide 4.8

  Environmental Technical Specifications for Nuclear Power Plants, 1975

* Regulatory Guide 4.13

  Performance, Testing, and Procedural Specification for Thermoluminescent Dosimetry: Environmental Applications, 1977

* NUREG-0133

  Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants

* Regulatory Guide 1.109

  Calculation of Annual Doses to Man from Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I, 1977

* NUREG-1301

  Offsite Dose Calculations Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, Generic Letter 89-01, Supplement No. 1, 1991

* ANSI N545 (TLD's)

  American National Standard Performance, Testing, And Procedural Specifications for Thermoluminesence Dosimetry (Environmental Application), 1975

* Regulatory Guide 4.15

  Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, 1979

* NUREG 1576 MARLAP

  Multi-agency Radiological Laboratory Analytical Protocols

* NUREG/CR-4007 Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements, 1984

DATA MANAGEMENT

The tabulated means, ranges and standard deviations presented in Appendix B were calculated following the standard format specified in Regulatory Guide 4.8, the Radiological Assessment Branch Technical Position, Revision 1, 1979, and in accordance with the protocol outlined in NUREG/CR-4007. A custom data management software package was used to perform the statistical analysis and tabulation of the data.

The REMP data are reviewed for accuracy and comparison against NRC reporting levels, and then entered into the REMP database. One of the REMP menus flags measurements exceeding the administrative levels (10% of the NRC reporting levels) established by Southern California Edison (SCE). The *a posteriori* MDC is compared to the maximum value for the *a priori* Lower Limit of Detection (LLD) specified in the ODCM. This ensures that regulatory limits for the maximum LLD are met.

The impact of SONGS on the surrounding environment was assessed through a series of analyses. These analyses included: data reduction, comparisons of indicator to control locations, and summary (Appendix B); comparison of operational to preoperational environmental data (Appendix D); summary of deviations from sampling requirements and corrective actions taken (Appendix E); and the results of the 2010 Land Use Census (Appendix F).

All Radiological Environmental Monitoring activities for San Onofre are assessed in accordance with Quality Assurance requirements as defined in Regulatory Guide 4.15. The Contracted Environmental Analysis Laboratory (CEAL) participated in an interlaboratory comparison program in partial fulfillment of the quality assurance requirements for environmental monitoring. The CEAL participated in cross check programs which meet the intent of Reg. Guide 4.15. Refer to Appendix C.

DETECTION LIMIT TERMINOLOGY

This report utilizes three distinct terms to describe the concept of "lower limit of detection" at various detection confidence levels. The terms are briefly defined below. For a more thorough discussion, the reader should refer to NUREG/CR-4007.

Critical level - Defined as 1.64 sigma. For a sufficiently large database of [isotopically analyzed] sample results, with the "true" activity being equal to zero, approximately 5% of the results are expected to be above the critical level.

Lower Limit of Detection (LLD) - The LLD is the *a priori* (before the fact) lower limit of detection. This value is calculated for each isotope and every matrix based on typical or expected values of decay time, sample size, counter efficiency, etc. These values are listed in the ODCM and represent the maximum permissible value for the "lower limit of detection" for specified sample media.

Minimum Detectable Concentration (MDC) - The MDC is the *a posteriori* (after the fact) lower limit of detection based on actual decay time, measured sample size, counting efficiency as determined by recent calibration, etc. The MDC is compared to the LLD to verify that the measurement met the ODCM requirements for the maximum value of the LLD for the listed analytes. Values above the MDC are presumed to represent "detected" activity at the 95% detection confidence level. Refer to NUREG 1576.

The 2010 SONGS REMP data required by the ODCM have been summarized in the Statistical Summary of REMP Data found in Appendix B.

CONCLUSION

Levels of radioactivity in environmental media are a function of several factors including: site release rates; meteorology; number, location, size and date of nuclear weapons tests; seasonal variability of fallout; soil conditions; local terrain and variability in the natural environment.

Radiological environmental data collected throughout 2010 have been evaluated to determine the impact, if any, of San Onofre operations on the surrounding environment. To accomplish this, several methods of evaluation were employed, namely:

1. Compilation and verification of all data, as well as a determination of those data considered to be significantly greater than background levels.

2. Correlation of effluent concentrations to concentrations in the environment. Refer to Appendix B.

3. Examination of time-dependent variations of pertinent radioisotopes in selected environmental media throughout the year at both indicator and control locations.

4. Comparison of radioactivity in various media in 2010 against the levels observed in pre-operational years.

5. Historical trending of radionuclides in various media during operational years.

In comparing these findings to the conservatively-defined limits of the facility operating licenses, it is concluded that the radiological environmental impact of the operation of SONGS through 2010 has been negligible, and the resulting dose to a member of the general public is negligible.

REFERENCES

1. 10CFR50, Appendix I

2. Land Use Census for SONGS Units l, 2 and 3 Radiological Environmental Monitoring Program, October 2010.

3. SONGS Offsite Dose Calculation Manual (ODCM) Revision 4, Section 5.0, 2010.

4. SONGS Radiological Monitoring (RM) Procedures: SO123-RM-1 (SO123-IX-1.10).

5. L. Currie. 1968 "Limits for the Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Analytical Chemistry, vol. 40 pp. 586-593

APPENDIX A

SAMPLE TYPE AND SAMPLING LOCATION

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)	DISTANCE* (miles)	DIRECTION* (Sector)
Direct Radiation			
1	City of San Clemente (Former SDG&E Offices)	5.7	NW
2	Camp San Mateo – MCB	3.6	N
3	Camp San Onofre – MCB	2.8	NE
4	Camp Horno – MCB	4.4	E
6	Old El Camino Real (AKA Old highway 101)	3.0	ESE
8	Noncommissioned Officers' Beach Club	1.4	NW
10	Bluff (Adjacent to PIC #1)	0.7	WNW
11	Former Visitors' Center	0.4 **	NW
12	South Edge of Switchyard	0.2 **	E
13	Southeast Site Boundary (Bluff)	0.4 **	ESE
15	Southeast Site Boundary (Office Building)	0.1 **	SSE
16	East Southeast Site Boundary	0.4 **	ESE
19	San Clemente Highlands	4.9	NNW
22	Former US Coast Guard Station - San Mateo Point	2.7	WNW
23	SDG&E Service Center Yard	8.1	NW
31	Aurora Park - Mission Viejo	18.6	NNW
33	Camp Talega – MCB	5.9	N
34	San Onofre School – MCB	1.9	NW
35	Range 312 – MCB	4.8	NNE
36	Range 208C – MCB	4.1	NE
38	San Onofre State Beach Park	3.4	SE
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	NNW
41	Old Route 101 – East	0.3 **	E
44	Fallbrook Fire Station	17.7	E

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 4. Direction determined from degrees true north.
** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)
*** Soil samples are not required by Technical Specifications.
**** Kelp samples are not required by Technical Specifications.
MCB Marine Corps Base Camp Pendleton
PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)	DISTANCE* (miles)	DIRECTION* (Sector)
Direct Radiation (Continued)			
46	San Onofre State Beach Park	1.0	SE
47	Camp Las Flores – MCB	8.6	SE
49	Camp Chappo – MCB	12.9	ESE
50	Oceanside Fire Station (Control)	15.6	SE
53	San Diego County Operations Center	44.2	SE
54	Escondido Fire Station	31.8	ESE
55	San Onofre State Beach (U1 West)	0.2 **	WNW
56	San Onofre State Beach (U1 West)	0.2 **	W
57	San Onofre State Beach (Unit 2)	0.1 **	SW
58	San Onofre State Beach (Unit 3)	0.1 **	S
59	SONGS Meteorological Tower	0.3 **	WNW
61	Mesa - East Boundary (Adjacent to PIC #4)	0.7	N
62	MCB - Camp Pendleton (Adjacent to PIC #5)	0.7	NNE
63	MCB - Camp Pendleton (Adjacent to PIC #6)	0.6	NE
64	MCB - Camp Pendleton (Adjacent to PIC #7)	0.6	ENE
65	MCB - Camp Pendleton (Adjacent to PIC #8)	0.7	E
66	San Onofre State Beach (Adjacent to PIC #9)	0.6	ESE
67	Former SONGS Evaporation Pond (Adjacent to PIC #2)	0.6	NW
68	Range 210C – MCB	4.4	ENE
73	South Yard Facility	0.4 **	ESE
74	Oceanside City Hall (Backup Control)	15.6	SE
75	Gate 25 MCB	4.6	SE
76	El Camino Real Mobil Station	4.6	NW
77	Area 62 Heavy Lift Pad	4.2	N
78	Horno Canyon (AKA Sheep Valley)	4.4	ESE

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 4. Direction determined from degrees true north.
** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)
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MCB Marine Corps Base Camp Pendleton
PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)	DISTANCE* (miles)	DIRECTION* (Sector)
Airborne			
1	City of San Clemente (City Hall)	5.1	NW
7	AWS Roof	0.18 **	NW
9	State Beach Park	0.6	ESE
10	Bluff	0.7	WNW
11	Mesa EOF	0.7	NNW
12	Former SONGS Evaporation Pond	0.6	NW
13	Marine Corp Base (Camp Pendleton East)	0.7	E
15	Oceanside City Hall (Control)	15.6	SE
16	San Luis Rey Substation (Control)[1]	16.7	SE
Soil Samples ***			
1	Camp San Onofre	2.8	NE
2	Old Route 101 - East Southeast	3.0	ESE
3	Basilone Road / I-5 Freeway Off ramp	2.0	NW
5	Former Visitors Center	0.4 **	NW
7	Prince of Peace Abbey (Control)	15	SE

1 Air Sampler # 16 replaced Air Sampler #15 as the control air sampler during the week of December 26, 2010

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 4. Direction determined from degrees true north.
** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)
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PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)	DISTANCE* (miles)	DIRECTION* (Sector)
Ocean Water			
A	Station Discharge Outfall - Unit 1	0.6	SW
B	Outfall - Unit 2	1.5	SW
C	Outfall - Unit 3	1.2	SSW
D	Newport Beach (Control)	30.0	NW
51	Unit 2 Conduit (not listed in the ODCM)	0.1	SW
52	Unit 3 Conduit (not listed in the ODCM)	0.1	SSW
Drinking Water			
4	Camp Pendleton Drinking Water Reservoir	2.0	NW
5	Oceanside City Hall (Control)	15.6	SE
Shoreline Sediment (Beach Sand)			
1	San Onofre State Beach (SE)	0.6	SE
2	San Onofre Surfing Beach	0.8	WNW
3	San Onofre State Beach (SE)	3.5	SE
4	Newport Beach North End (Control)	29.2	NW
Local Crops			
2	Oceanside (Control)	15-25	SE to ESE
4	San Clemente Residence (Ola Vista) with Garden (not sampled in 2010)	4.4	NW
6	SONGS Garden	0.4	NNW
Non-Migratory Marine Animals			
A	Unit 1 Outfall	0.9	WSW
B	Units 2/3 Outfall	1.5	SSW
C	Laguna Beach (Control)	15 to 150	WNW to NW

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 4. Direction determined from degrees true north.
** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)
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**** Kelp samples are not required by Technical Specifications.
MCB Marine Corps Base Camp Pendleton
PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)	DISTANCE* (miles)	DIRECTION* (Sector)
Kelp ****			
A	San Onofre Kelp Bed	1.5	S
B	San Mateo Kelp Bed	3.8	WNW
C	Barn Kelp Bed	6.3	SSE
E	Salt Creek (Control)	11 to 13	WNW to NW
Ocean Bottom Sediments			
B	Unit 1 Outfall	0.8	SSW
C	Unit 2 Outfall	1.6	SW
D	Unit 3 Outfall	1.2	SSW
E	Laguna Beach (Control)	17-19	NW
F	SONGS Upcoast	0.9	WSW
51	Unit 2 Conduit (not listed in the ODCM)	0.1	SW
52	Unit 3 Conduit (not listed in the ODCM)	0.1	SSW

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 4. Direction determined from degrees true north.
** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)
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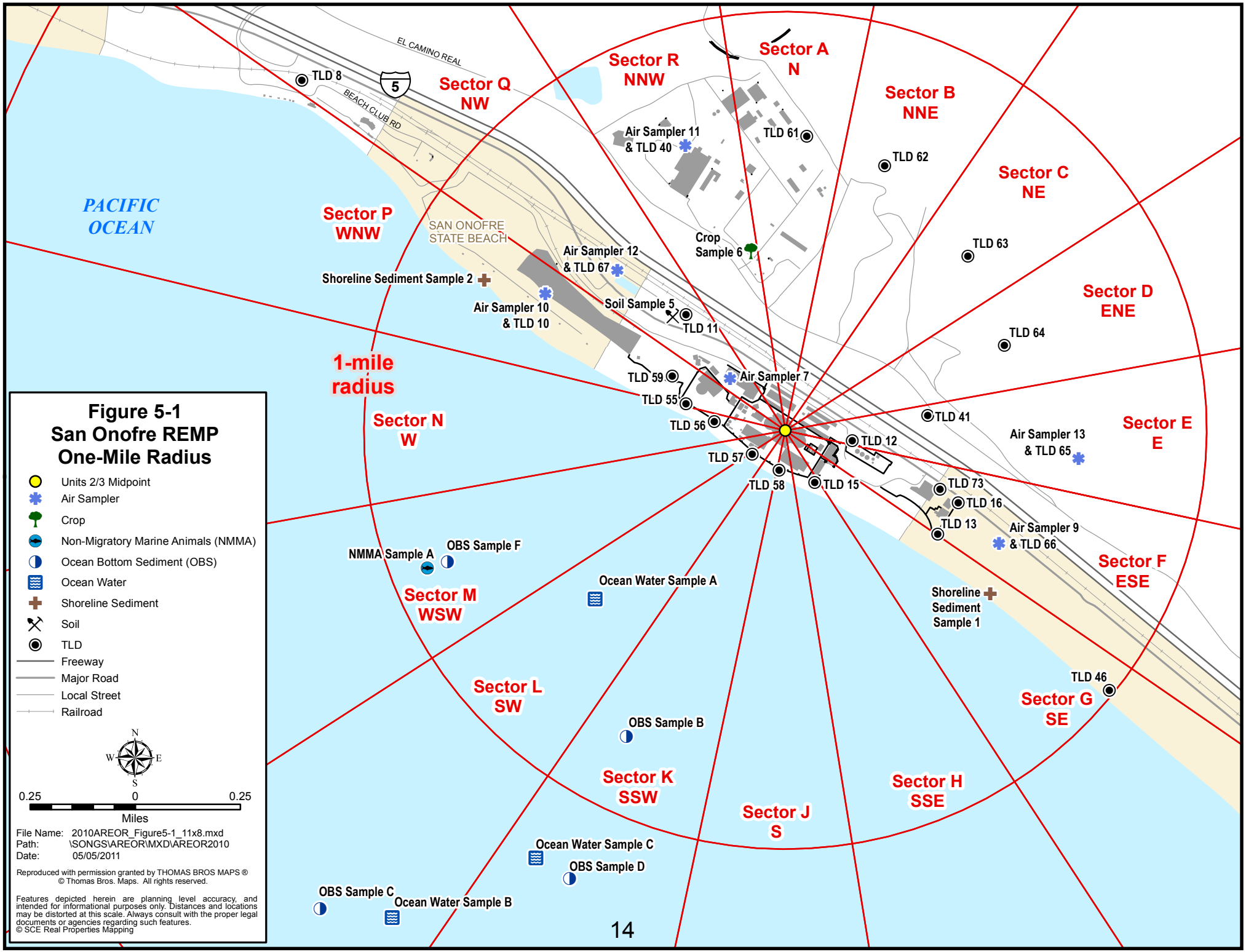
TABLE A-2

SECTOR AND DIRECTION DESIGNATION FOR REMP SAMPLE LOCATION MAP

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


EL CAMINO REAL
BEACH CLUB RD
5
TLD 8
PACIFIC OCEAN
SAN ONOFRE STATE BEACH
Sector Q NW
Sector R NNW
Sector A N
Sector B NNE
Sector C NE
Sector D ENE
Sector E E
Sector F ESE
Sector G SE
Sector H SSE
Sector J S
Sector K SSW
Sector L SW
Sector M WSW
Sector N W
Sector P WNW
1-mile radius
Air Sampler 11 & TLD 40
TLD 61
TLD 62
TLD 63
TLD 64
Crop Sample 6
Air Sampler 12 & TLD 67
Shoreline Sediment Sample 2
Air Sampler 10 & TLD 10
Soil Sample 5
TLD 11
TLD 59
TLD 55
TLD 56
TLD 57
TLD 58
Air Sampler 7
TLD 41
TLD 12
TLD 15
Air Sampler 13 & TLD 65
TLD 73
TLD 16
TLD 13
Air Sampler 9 & TLD 66
TLD 46
Shoreline Sediment Sample 1
NMMA Sample A
OBS Sample F
Ocean Water Sample A
OBS Sample B
Ocean Water Sample C
OBS Sample D
OBS Sample C
Ocean Water Sample B
Figure 5-1
San Onofre REMP
One-Mile Radius
Units 2/3 Midpoint
Air Sampler
Crop
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Major Road
Local Street
Railroad
N
W
E
S
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0
0.25
Miles
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Date: 05/05/2011
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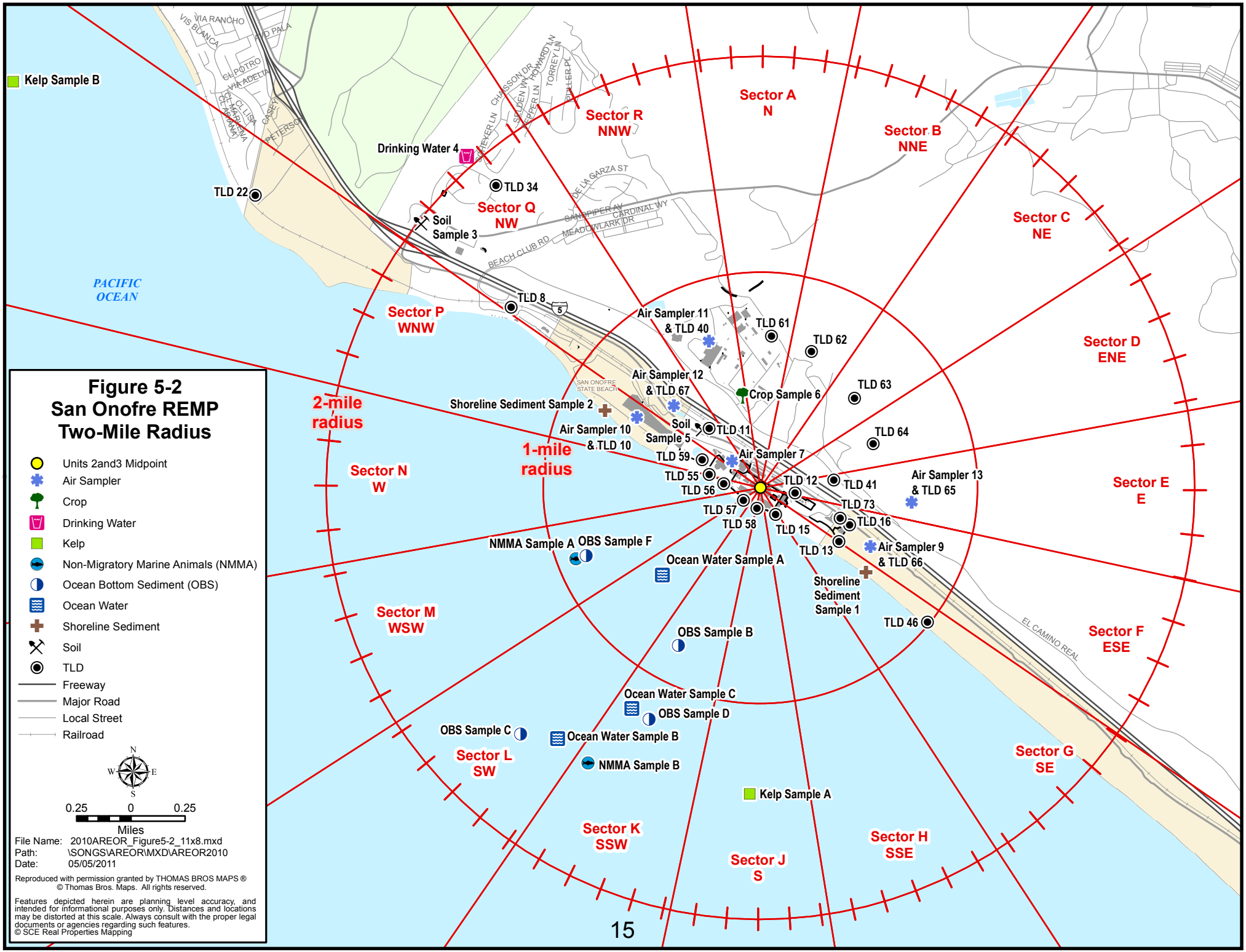
Kelp Sample B
Drinking Water 4
TLD 22
TLD 34
Soil Sample 3
TLD 8
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Sector A N
Sector B NNE
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Sector D ENE
Sector E E
Sector F ESE
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Sector H SSE
Sector J S
Sector K SSW
Sector L SW
Sector M WSW
Sector N W
Sector P WNW
Sector Q NW
2-mile radius
1-mile radius
Air Sampler 11 & TLD 40
TLD 61
TLD 62
TLD 63
TLD 64
Air Sampler 12 & TLD 67
Crop Sample 6
Shoreline Sediment Sample 2
Air Sampler 10 & TLD 10
Soil Sample 5
TLD 11
TLD 59
Air Sampler 7
TLD 55
TLD 56
TLD 12
TLD 41
Air Sampler 13 & TLD 65
TLD 57
TLD 58
TLD 73
TLD 16
TLD 15
TLD 13
Air Sampler 9 & TLD 66
NMMA Sample A
OBS Sample F
Ocean Water Sample A
Shoreline Sediment Sample 1
TLD 46
OBS Sample B
Ocean Water Sample C
OBS Sample D
OBS Sample C
Ocean Water Sample B
NMMA Sample B
Kelp Sample A
SAN ONOFRE STATE BEACH
EL CAMINO REAL
BEACH CLUB RD
DE LA GARZA ST
SANDPIPER LN
CARDINAL WY
MEADOWLARK DR
VIA RANCHO VIS BLANCA
VIA PALA
CHASSON DR
HOWARD LN
TORREY LN
PETERSON
Figure 5-2
San Onofre REMP
Two-Mile Radius
Units 2and3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Major Road
Local Street
Railroad
N
W
E
S
0.25 0 0.25
Miles
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Date: 05/05/2011
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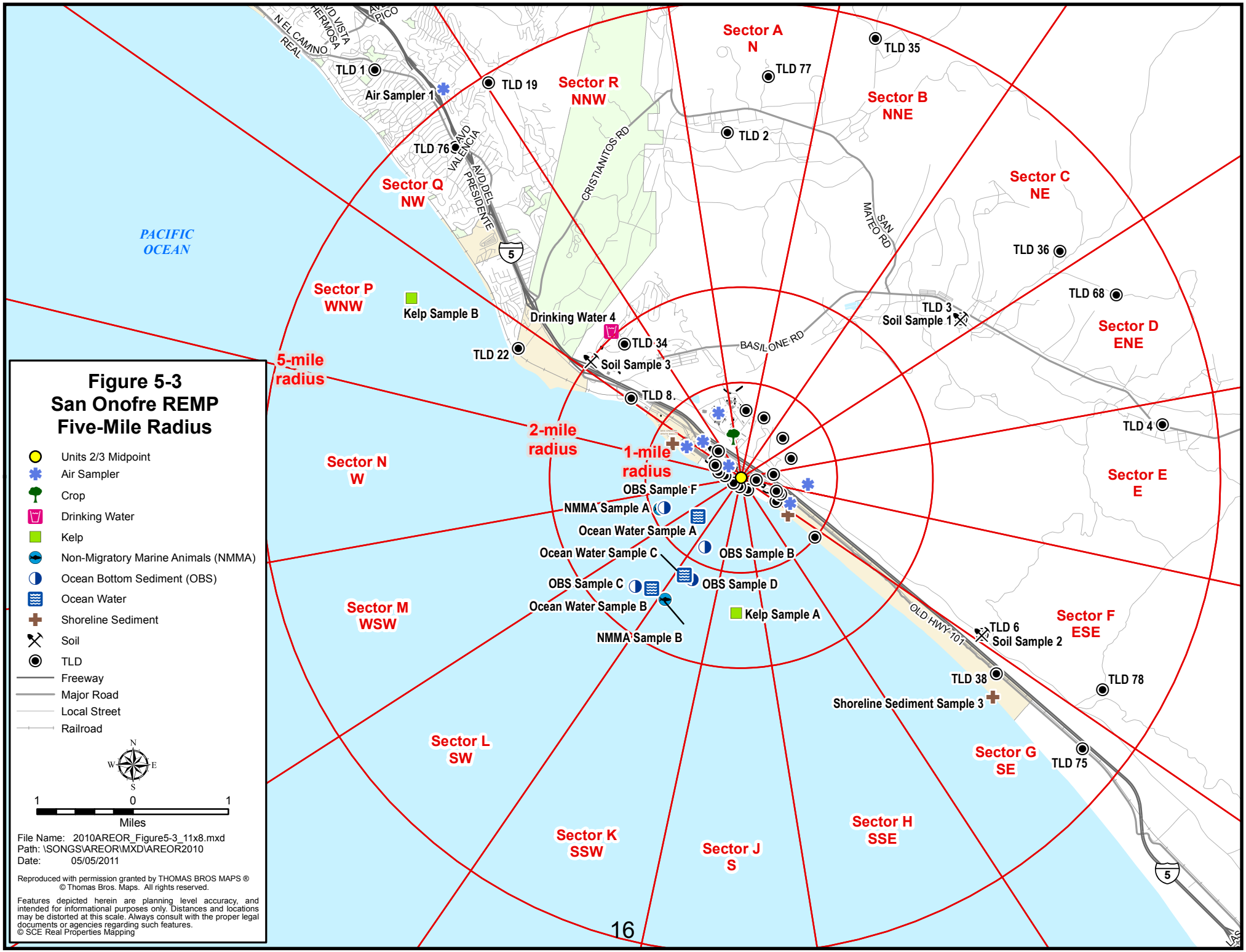
Figure 5-3
San Onofre REMP
Five-Mile Radius
Units 2/3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Major Road
Local Street
Railroad
N
W
E
S
1
0
1
Miles
File Name: 2010AREOR_Figure5-3_11x8.mxd
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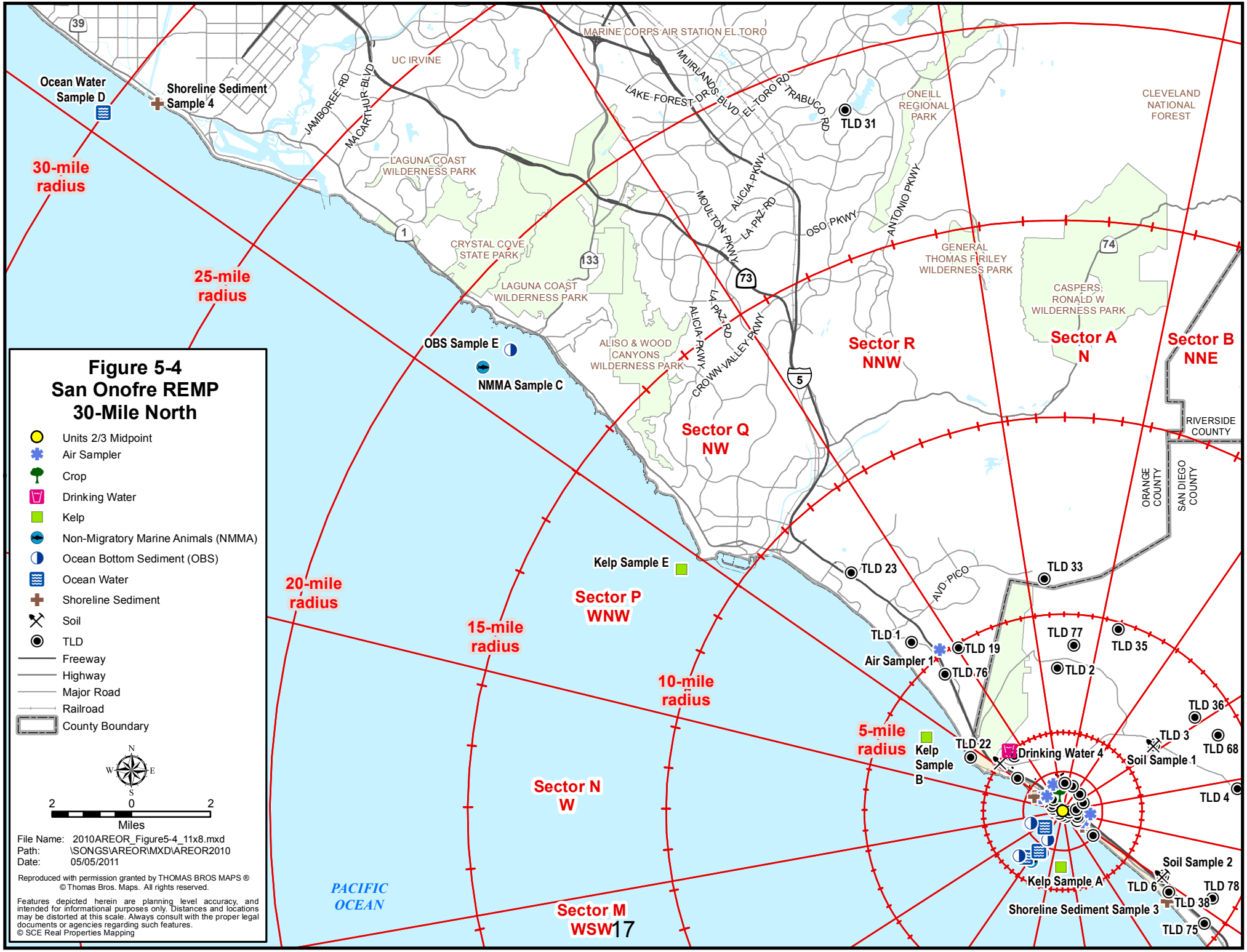
PACIFIC OCEAN
Sector A N
Sector B NNE
Sector C NE
Sector D ENE
Sector E E
Sector F ESE
Sector G SE
Sector H SSE
Sector J S
Sector K SSW
Sector L SW
Sector M WSW
Sector N W
Sector P WNW
Sector Q NW
Sector R NNW
5-mile radius
2-mile radius
1-mile radius
TLD 1
TLD 19
TLD 35
TLD 77
TLD 2
TLD 76
TLD 36
TLD 68
TLD 3
TLD 34
TLD 22
TLD 8
TLD 4
TLD 6
TLD 38
TLD 78
TLD 75
Air Sampler 1
Kelp Sample B
Drinking Water 4
Soil Sample 1
Soil Sample 3
Soil Sample 2
OBS Sample F
NMMA Sample A
Ocean Water Sample A
Ocean Water Sample C
OBS Sample B
OBS Sample C
OBS Sample D
Ocean Water Sample B
Kelp Sample A
NMMA Sample B
Shoreline Sediment Sample 3
CRISTIANITOS RD
SAN MATEO RD
BASILONE RD
OLD HWY 101
AVD VALENCIA
AVD DEL PRESIDENTE
N EL CAMINO REAL
5


Ocean Water Sample D
Shoreline Sediment Sample 4
30-mile radius
25-mile radius
20-mile radius
15-mile radius
10-mile radius
5-mile radius
OBS Sample E
NMMA Sample C
Kelp Sample E
Kelp Sample B
Kelp Sample A
Air Sampler 1
Drinking Water 4
Soil Sample 1
Soil Sample 2
Shoreline Sediment Sample 3
TLD 1
TLD 2
TLD 3
TLD 4
TLD 6
TLD 19
TLD 22
TLD 23
TLD 31
TLD 33
TLD 35
TLD 36
TLD 38
TLD 68
TLD 75
TLD 76
TLD 77
TLD 78
Sector N W
Sector P WNW
Sector Q NW
Sector R NNW
Sector A N
Sector B NNE
PACIFIC OCEAN
MARINE CORPS AIR STATION EL TORO
UC IRVINE
LAGUNA COAST WILDERNESS PARK
CRYSTAL COVE STATE PARK
ALISO & WOOD CANYONS WILDERNESS PARK
ONEILL REGIONAL PARK
CLEVELAND NATIONAL FOREST
GENERAL THOMAS FIRLEY WILDERNESS PARK
CASPERS, RONALD W WILDERNESS PARK
RIVERSIDE COUNTY
ORANGE COUNTY
SAN DIEGO COUNTY
JAMBOREE RD
MACARTHUR BLVD
LAKE FOREST DR
MUIRLANDS BLVD
EL TORO RD
TRABUCO RD
MOULTON PKWY
ALICIA PKWY
LA PAZ RD
OSO PKWY
ANTONIO PKWY
CROWN VALLEY PKWY
AVD PICO
Figure 5-4
San Onofre REMP
30-Mile North
Units 2/3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Highway
Major Road
Railroad
County Boundary
N
W
E
S
2 0 2
Miles
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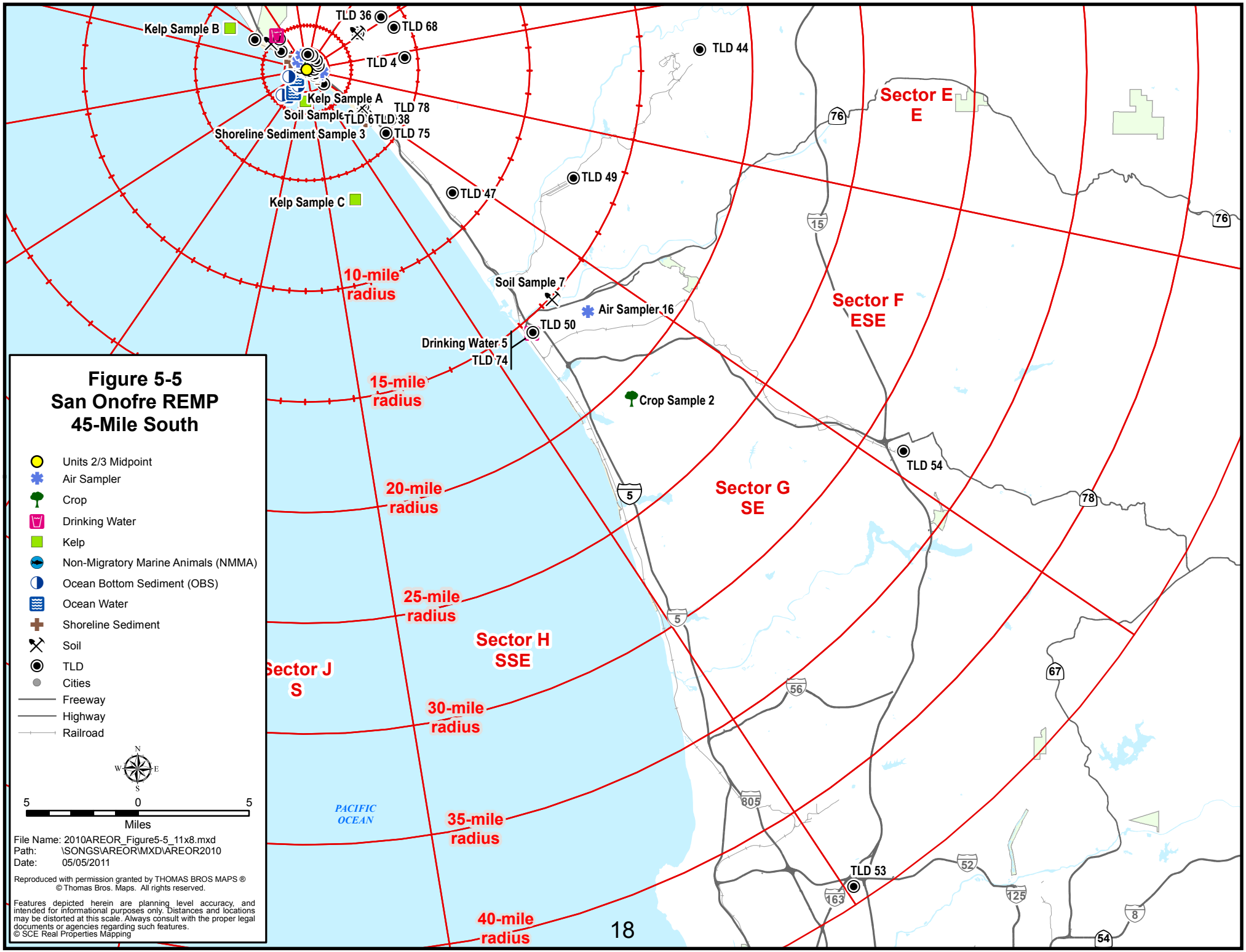
Kelp Sample B
TLD 36
TLD 68
TLD 4
TLD 44
Kelp Sample A
Soil Sample
TLD 6
TLD 38
TLD 78
Shoreline Sediment Sample 3
TLD 75
Sector E
E
76
TLD 49
TLD 47
Kelp Sample C
15
76
10-mile
radius
Soil Sample 7
Air Sampler 16
TLD 50
Sector F
ESE
Drinking Water 5
TLD 74
15-mile
radius
Crop Sample 2
TLD 54
20-mile
radius
Sector G
SE
5
78
25-mile
radius
5
Sector H
SSE
Sector J
S
67
56
30-mile
radius
805
PACIFIC
OCEAN
35-mile
radius
TLD 53
52
163
125
8
54
40-mile
radius
Figure 5-5
San Onofre REMP
45-Mile South
Units 2/3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Cities
Freeway
Highway
Railroad
N
W
E
S
5
0
5
Miles
File Name: 2010AREOR_Figure5-5_11x8.mxd
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Date: 05/05/2011
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APPENDIX B

SUMMARY, RESULTS, AND DISCUSSIONS

OF 2010 ENVIRONMENTAL DATA

SUMMARY

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 2010 to December 2010 were evaluated. The 2010 REMP data were evaluated according to the criteria described in NUREG/CR-4007 and with the methodology described by Currie (1968).* The REMP data above the critical level (1.64 times one sigma) for selected radionuclides, were reduced and tabulated in the Statistical Summary of REMP Data in accordance with the format specified in Reg. Guide 4.8. The 2010 SONGS REMP database, when examined in accordance with the Currie data reduction protocol, leads to the conclusion that SONGS had no statistically significant radiological environmental impact. A summary of the type and number of REMP samples obtained in 2010 appears in Table B-2.

As noted above, the SONGS REMP data base behaves substantially similar to a data base with values statistically indistinguishable from zero for station related isotopes. The exceptions, summarized in Table B-1, include isotopically analyzed samples with station related activity reported above the *a posteriori* MDC. All sample values were significantly less than the NRC reporting levels. I-131 was detected in kelp and Cs-137 was detected in soil. These radionuclides have been detected in control as well as indicator locations in previous years. Cs-137 is commonly detected in environmental sediment samples because of fallout from weapons testing. Cs-137 has been intermittently detected in the indicator and in the control soil samples in past years and no correlation between Cs-137 level in soil and proximity to the plant has been observed. The data strongly suggest that the low level Cs-137 in certain soil samples is due to fallout from nuclear weapons testing and from Chernobyl. We conclude that the low level Cs-137 in soil is not due to the operation of SONGS. I-131 is a medically administered radionuclide which is often detected in sewage plant outfalls The I-131 detected in the kelp samples is attributable to sewage plant discharges external to SONGS. Tritium in one ocean water indicator sample was detected at a level less than the *a priori* LLD (lower limit of detection) but greater than the lower, sample specific, *a posteriori* MDC (minimum detectable concentration). The detected ocean water tritium is attributable to the operation of SONGS. We conclude that SONGS had a negligible radiological environmental impact during 2010.

Historical trending of data near and below the detection limits is necessarily limited. The concentration of radionuclides in the environs of SONGS has trended downward since the early to mid 1980s. In the past decade only a few REMP analysis results have been above the detection limit. These isotopes are detected in control as well as indicator locations and there are known sources for these radionuclides external to SONGS. The overall trend of the REMP data at SONGS is *de minimis* levels of anthropogenic radioactivity with occasional samples showing radioactivity above the *a posteriori* MDC.

* L. Currie. 1968 "Limits for the Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Analytical Chemistry, vol. 40 pp. 586-593

RESULTS AND DISCUSSIONS OF 2010 ENVIRONMENTAL DATA

A. Direct Radiation

The purpose of this program element was to measure the quarterly environmental gamma radiation in the vicinity of SONGS. To accomplish this task, calcium sulfate ($CaSO_4$) thermoluminescent dosimeters (TLDs) were placed at 38 indicator and 11 control locations. They were collected and analyzed quarterly in accordance with ANSI-N545 standards. TLDs within five miles of SONGS were considered indicator locations. TLDs located greater than five miles from SONGS are considered control locations. The indicator locations are selected as inner and outer rings as required by the ODCM. Additional TLDs are placed at locations of interest such as schools and hospitals.

Six laboratory control TLDs were analyzed quarterly. TLD numbers 17, 18, and 60 are used for background dose normalization. TLDs #A and #B are used to compensate for transit dose. A fader TLD is used to evaluate for the time and temperature dependent "fade" that may affect dosimeter data.

After the samples were analyzed, the measured doses were corrected for pre and post field exposure times. The average indicator location dose was 16.6 mR with a range of 10.2 to 24.6 mR. The average control location dose was 15.8 mR with a range of 12.5 to 19.6 mR. The routine 2010 REMP TLD data has been grouped into four categories based on distance from SONGS for the purposes of trending any correlation between distance from SONGS and average quarterly dose.

2010 REMP TLD data (Average Dose vs. Distance from SONGS)

	Average Quarterly Dose in mR
TLDs ≤ 0.5 miles from SONGS	18.7
TLDs > 0.5 miles AND ≤ 1.0 mile from SONGS	14.4
TLDs > 1.0 mile AND ≤ 5.0 miles from SONGS	16.3
TLDs > 5 miles from SONGS (Control TLDs)	15.8

Statistically, the control and indicator doses beyond the EAB (Exclusion Area Boundary)are the same value. The routine indicator location at the South Yard Facility (0.4 miles ESE from the Units 2/3 midpoint) had the highest TLD average in 2010. The operation of SONGS had no impact beyond the EAB as measured by this sample medium.

Figure 2A compares environmental radiation levels of indicator and control locations for the operational year 2010 and for previous years. This figure shows the close correlation between the control and indicator location TLD dose data.

Direct Radiation baseline evaluation and estimation of natural background

An in-depth analysis of the environmental radiation results for the period of 2001 through 2009 was completed for all the monitoring locations. It can be inferred that if the standard deviation was low and no additional exposure above background was identified at a particular station, the average of that station's radiation exposure results should be equal to natural background (baseline) at that location. The baseline results for REMP TLDs have been summarized with the annual and quarterly values in the 2010 TLD Data Table. Natural background radiation is variable and a minor shift in location can yield a measurable change in background radiation. For example, REMP TLD # 33 (Camp Talega) was moved 20 meters due to maintenance work on the adjacent military facilities. This minor location adjustment resulted in a baseline shift for location # 33. A similar minor location adjustment for station # 54 also resulted in a baseline shift in 2010.

The baseline environmental exposure analysis of the 2001 through 2009 environmental TLD results included an assessment of the standard deviation of the quarterly results at each location. This is an appropriate methodology to determine the ability to detect radiation exposure above natural background. The highest value of three standard deviations for all of the quarterly measurements was 4.8 mR and the highest value was 9.7 mR for the annual results, providing justification for *a priori* LLDs of 5 mR per quarter and 10 mR per year. The quarterly and annual results expressed in the 2010 TLD Data Table as values of positive exposure above natural background or as a notation of <LLD if the background is not exceeded.

An empirical determination of the background baseline for stations within the EAB (Exclusion Area Boundary) is not possible due to the known plant related radiological activities (storage and transport of radioactive materials) that occurred during the baseline calculation study period. The average of the non-EAB stations close to the beach was approximately 15.0 mR per quarter. A value of 15.0 mR per quarter was conservatively selected as the baseline for the REMP stations located within the EAB (REMP stations 13, 15, 16, 55, 56, 57, 58, 59, and 73). In 2010, the highest exposure above natural background was 9.6 mR in a quarter and 32.6 mR for the year. The annual exposure for REMP TLD stations within the EAB ranged from < LLD (<10 mR per year) to 32.6 mR per year. The maximum associated exposure to a member of the general public, based on a maximum occupancy of 300 hours per year, is approximately 1 mR per year.

Station 61 indicated a positive exposure above baseline that may be associated with the storage and transport of the radiography source that is maintained at a facility near Station # 61 and was used during the Unit 3 Steam Generator Replacement project.

2010 TLD Data

Table B-3 Baseline and Background corrected REMP TLD data

#	Location	Dist Miles		Quarterly Baseline	2010 Quarterly Results (mR) 1	2	3	4	2010 Quarterly Results (mR) 1	2	3	4	Annual Baseline	2010 Annual Total (mR)		2010 Total
1	City of San Clemente	5.7		17.5	16.1	19.1	17.6	17.6	<LLD	<LLD	<LLD	<LLD	69.9	70.4		<LLD
2	Camp San Mateo - MCB	3.5		18.6	17.1	19.1	18.8	17.6	<LLD	<LLD	<LLD	<LLD	74.4	72.5		<LLD
3	Camp San Onofre - MCB	2.6		16.4	15.0	17.0	17.1	15.5	<LLD	<LLD	<LLD	<LLD	65.5	64.5		<LLD
4	Camp Horno - MCB	4.5		18.1	17.2	18.4	18.3	18.5	<LLD	<LLD	<LLD	<LLD	72.3	72.3		<LLD
6	Old Route 101 (ESE)	3.0		11.4	10.2	12.6	11.4	11.9	<LLD	<LLD	<LLD	<LLD	45.6	46.0		<LLD
8	Noncommissioned Officers Beach Clut	1.4		15.4	14.8	17.6	17.1	16.2	<LLD	<LLD	<LLD	<LLD	61.8	65.7		<LLD
10	Bluff (adjacent to PIC#1)	0.7		16.4	15.1	16.8	16.4	15.1	<LLD	<LLD	<LLD	<LLD	65.7	63.4		<LLD
19	San Clemente Highlands	5.0		17.8	17.2	19.4	18.0	19.1	<LLD	<LLD	<LLD	<LLD	71.3	73.6		<LLD
22	Former US Coast Guard Station	2.7		17.9	15.8	19.0	18.0	17.1	<LLD	<LLD	<LLD	<LLD	71.7	69.9		<LLD
23	SDG&E Service Center Yard	8.1		15.8	14.8	17.4	15.7	16.6	<LLD	<LLD	<LLD	<LLD	63.1	64.4		<LLD
31	Aurora Park - Mission Viejo (Control)	18.6		18.5	17.0	19.6	18.2	17.6	<LLD	<LLD	<LLD	<LLD	74.1	72.4		<LLD
33	Camp Talega - MCB	5.7	**	18.9		19.5	19.3	18.4	<LLD	<LLD	<LLD	<LLD	75.4	76.2		<LLD
34	San Onofre School - MCB	1.9		16.2	14.8	17.1	15.7	15.7	---	<LLD	<LLD	<LLD	64.7	63.2		<LLD
35	Range 312 - MCB	4.7		16.9	15.7	17.9	16.7	16.6	<LLD	<LLD	<LLD	<LLD	67.5	66.9		<LLD
36	Range 208C - MCB	4.2		19.5	18.4	20.8	20.1	18.0	<LLD	<LLD	<LLD	<LLD	77.8	77.3		<LLD
38	San Onofre State Beach Park	3.3		14.3	13.1	14.9	13.7	13.8	<LLD	<LLD	<LLD	<LLD	57.2	55.5		<LLD
40	SCE Training Center - Mesa (PIC#3)	0.7		17.1	16.2	17.1	16.7	17.0	<LLD	<LLD	<LLD	<LLD	68.4	67.0		<LLD
44	Fallbrook Fire Station	17.7		14.0	13.4	15.1	14.7	14.9	<LLD	<LLD	<LLD	<LLD	56.0	58.2		<LLD
46	San Onofre State Beach Park	0.9		12.2	11.0		11.4	11.0	<LLD	<LLD	<LLD	<LLD	48.7	44.4		<LLD
47	Camp Las Flores - MCB	8.6		13.3	12.5	13.7	12.9	12.7	<LLD	<LLD	<LLD	<LLD	53.1	51.8		<LLD
49	Camp Chappo - MCB	12.8		14.2	13.7	14.3	13.9	13.9	<LLD	<LLD	<LLD	<LLD	56.9	55.8		<LLD
50	Oceanside Fire Station (Control)	15.6		16.6	16.1	16.5	16.0	16.7	<LLD	<LLD	<LLD	<LLD	66.3	65.3		<LLD
53	San Diego County Operations Center	44.3		18.2	16.8	17.4	17.5	16.8	<LLD	<LLD	<LLD	<LLD	72.9	68.4		<LLD
54	Escondido Fire Station	31.8	**	16.1	12.9	17.7	18.6	16.1	<LLD	<LLD	<LLD	<LLD	58.7	65.3		<LLD
61	Mesa - East Boundary (PIC #4)	0.6		15.4	13.8	15.2	15.4	**21.5**	<LLD	<LLD	<LLD	**6.1**	61.7	65.9		<LLD
62	Camp Pendleton (PIC #5)	0.6		12.6	11.9	12.8	13.3	12.4	<LLD	<LLD	<LLD	<LLD	50.4	50.4		<LLD
63	Camp Pendleton (PIC #6)	0.6		13.9	13.0	14.2	14.5	13.9	<LLD	<LLD	<LLD	<LLD	55.5	55.5		<LLD
64	Camp Pendleton (PIC #7)	0.6		15.0	14.3	15.0	15.3	14.3	<LLD	<LLD	<LLD	<LLD	60.1	58.9		<LLD
65	Camp Pendleton (PIC #8)	0.7		13.4	13.0	14.4	13.8	12.8	<LLD	<LLD	<LLD	<LLD	53.8	53.8		<LLD
66	San Onofre State Beach (PIC #9)	0.6		14.0	13.8	14.7	14.4	13.2	<LLD	<LLD	<LLD	<LLD	55.9	56.1		<LLD
67	Former SONGS Evap Pond (PIC # 2)	0.6		16.9	15.9	17.7	17.7	15.4	<LLD	<LLD	<LLD	<LLD	67.7	66.7		<LLD
68	Range 210C - MCB	4.3		15.0	14.2	16.4	15.7	14.5	<LLD	<LLD	<LLD	<LLD	60.2	60.7		<LLD
74	Oceanside City Hall (Backup Control)	15.6		13.3	12.5	13.8	13.2	12.8	<LLD	<LLD	<LLD	<LLD	53.4	52.3		<LLD
75	Gate 25 - MCB	4.6		15.9	14.4	17.0	16.7	14.9	<LLD	<LLD	<LLD	<LLD	63.6	63.0		<LLD
76	El Camino Real Mobil Station	4.6		17.3	16.6	18.9	17.3	17.1	<LLD	<LLD	<LLD	<LLD	69.4	69.9		<LLD
77	Area 62 Heavy Lift Pad	4.3		19.2	17.0	20.4	20.5	16.9	<LLD	<LLD	<LLD	<LLD	76.9	74.7		<LLD
78	Horno Canyon	4.4		11.1	10.8	12.1	11.6	11.3	<LLD	<LLD	<LLD	<LLD	44.6	45.7		<LLD
11	Former Visitors' Center	0.4*		15.0	14.7	16.9	15.9	14.8	<LLD	<LLD	<LLD	<LLD	60.0	62.3		<LLD
12	South Edge of Switchyard	0.2*		15.0	14.3	17.1	16.6	16.3	<LLD	<LLD	<LLD	<LLD	60.0	64.3		<LLD
13	Southeast Site Boundary (Bluff)	0.4*		15.0	19.3	23.4	23.3	20.1	<LLD	**8.4**	**8.3**	**5.1**	60.0	86.2		**26.2**
15	Southeast Site Boundary (Office Bldg)	0.1*		15.0	19.0	22.5	20.0	19.4	<LLD	**7.5**	**5.0**	<LLD	60.0	81.0		**21.0**
16	East Southeast Site Boundary	0.4*		15.0	16.8	18.4	19.6	19.2	<LLD	<LLD	<LLD	<LLD	60.0	73.9		**13.9**
41	Old Route 101 - East	0.3*		15.0	14.3	16.2	15.4	15.5	<LLD	<LLD	<LLD	<LLD	60.0	61.3		<LLD
55	San Onofre State Beach (U1 West)	0.2*		15.0	16.8	18.9	18.0	19.5	<LLD	<LLD	<LLD	<LLD	60.0	73.2		**13.2**
56	San Onofre State Beach (U1 West)	0.2*		15.0	17.7	19.1	19.0	18.5	<LLD	<LLD	<LLD	<LLD	60.0	74.3		**14.3**
57	San Onofre State Beach (Unit 2)	0.1*		15.0	18.8	20.7	19.6	19.0	<LLD	**5.7**	<LLD	<LLD	60.0	78.1		**18.1**
58	San Onofre State Beach (Unit 3)	0.1*		15.0	17.5	19.8	20.0	18.0	<LLD	<LLD	**5.0**	<LLD	60.0	75.3		**15.3**
59	SONGS Meteorological Tower	0.3*		15.0	18.0	19.7	20.6	18.4	<LLD	<LLD	**5.6**	<LLD	60.0	76.7		**16.7**
73	South Yard Facility	0.4*		15.0	22.4	24.6	23.4	22.2	**7.4**	**9.6**	**8.4**	**7.2**	60.0	92.6		**32.6**

* Within Exclusion Area Boundary

** Station was moved; new baseline has been estiamted based on similar station baselines (# 33 used average of # 2 and # 77; # 54 used average of # 53 and # 44)

Quality Control Duplicate Direct Radiation Samples

Duplicate QC TLDs were installed adjacent to TLD #66 and TLD #67. Refer to Appendix C for results. These TLDs were not required by the ODCM and are not included in the Statistical Summary of REMP Data.

ISFSI Direct Radiation Samples

ISFSI (Independent Spent Fuel Storage Installation) TLDs were deployed in the vicinity of the ISFSI. Data from these TLDs have not been included in the statistical summary of REMP data since these TLDs are not required by the ODCM. The ISFSI data are listed and discussed in Appendix J.

B. Airborne Particulate, Iodine, and Composite Isotopic Analyses

Air particulate samples were collected on a weekly basis from seven indicator locations and from two control locations. The samples were analyzed for gross beta activity, I-131, and composited quarterly for gamma isotopic analysis. Sample locations were selected according to the requirements of the ODCM.

Gross beta analysis is a measure of total radioactivity of beta-emitting radionuclides in a sample. Beta radiation is emitted by many radionuclides, but beta decay gives a continuous energy spectrum rather than the discrete energy lines or peaks associated with gamma radiation. Gross beta measurements only indicate whether the sample contains normal or abnormal concentrations of beta-emitting radionuclides and does not identify specific radionuclides. Gross beta measurement data serves as a screening tool to determine if further analysis is required.

All gross beta activity analysis results were above the *a posteriori* MDC. The concentration of gross beta activity in the samples collected from the indicator locations ranged from 0.0133 to 0.0850 pCi/m^3, averaging 0.0351 pCi/m^3 of air. The concentrations of gross beta activity in the samples from the control locations ranged from 0.0157 to 0.0786 pCi/m^3, averaging 0.0367 pCi/m^3 of air. Figure 3D shows the variation in gross beta activity level in 2010 at different locations. This graph show a close correlation between the indicator and control location data.

Per the requirements of the ODCM, Section 5, Table 5.1, an assessment was performed to determine whether the gross beta activity of the indicators exceeded 10 times the background (control location #15). The results showed that indicator locations maximum gross beta activity in air in 2010 was 0.0850 pCi/m^3 and the 2009 control location average was 0.0441 pCi/m^3. No action was taken since no indicator location value exceeded ten times the annual average gross beta activity of the control location data from the previous year.

All samples analyzed for I-131 were less than the *a posteriori* MDC and all I-131 samples were less than the *a priori* lower limit of detection (LLD). The airborne indicator and control I-131 REMP samples taken in 2010 at SONGS were statistically indistinguishable from zero.

No samples yielded station related isotopic results confirmed above the *a posteriori* MDC. Quarterly composite gamma spectral analyses yielded naturally occurring beryllium-7 (Be-7) above the *a posteriori* MDC.

We conclude that the operation of SONGS had no impact on the environment as measured by this sample medium.

C. Ocean Water

Monthly ocean water samples were collected from three indicator locations in the vicinity of each station discharge and from the control location at Newport Beach. The samples were analyzed for naturally-occurring and SONGS-related gamma-emitting radionuclides. Quarterly composite ocean water samples were analyzed for tritium according to ODCM requirements.

Throughout 2010, only naturally occurring radionuclides were detected in the monthly gamma spectral analyses of ocean water. Monthly ocean water samples were also analyzed for tritium, consistent with the State of California Department of Public Health (DPH) split sample program. The sample taken in April 2010 near the Unit 3 diffusers represents surface water in the vicinity of the Unit 3 diffuser discharge plume. The April 2010 station C, Unit 3 Outfall, indicator ocean water tritium analysis results were below the *a priori* LLD, but above the *a posteriori* MDC. The sample was collected during a planned, controlled discharge of a waste stream from SONGS. The April 2010 station C H-3 sample result was 1450 pCi/l with an MDC of 447 pCi/l. The DPH tritium analysis result was 1320 pCi/l with an MDA of 270 pCi/l. The amount of H-3 detected in ocean water is well below all regulatory limits. Because no drinking water pathway exists at SONGS, the public dose consequence is negligible. The remaining 2010 monthly SONGS ocean water tritium analysis results were less than the a *posteriori* MDC.

Naturally occurring potassium-40 (K-40) was detected in all ocean water samples obtained in 2010. Excluding naturally occurring radionuclides, the ocean water gamma isotopic database is statistically indistinguishable from a database with zero activity.

The data indicate that the operation of SONGS had a negligible impact on the environment as measured by this sample medium.

D. Drinking Water

In 2010, drinking water samples were collected on a monthly basis from one indicator location and from the Oceanside control location. Samples were analyzed for tritium, gross beta, and naturally-occurring and SONGS-related gamma emitting radionuclides. There is no drinking water pathway for liquid effluent at SONGS.

No station related radionuclides were detected in drinking water during 2010. The gross beta activity is due to naturally occurring radionuclides. The drinking water gamma isotopic database is statistically indistinguishable from a database with zero activity. The operation of SONGS had no impact on this sample medium.

E. Shoreline Sediment (Beach Sand)

Beach sand was collected semiannually in 2010 from three indicator locations and from a control location situated in Newport Beach. After collection, the samples were analyzed for plant-related

and naturally-occurring radionuclides. Naturally occurring K-40 and thorium-228 (Th-228) were detected in all samples. No plant related radionuclides were reported above the *a posteriori* MDC. The operation of SONGS had no impact on the environment as measured by this sample medium.

F. Ocean Bottom Sediments

Ocean bottom sediments were collected in the vicinity of each of the three SONGS discharge locations and at the Newport Beach control location. The samples were analyzed by gamma-spectral analysis for naturally-occurring and station-related radionuclides. Naturally occurring K-40 and Th-228 were detected in ocean bottom sediment samples collected during 2010.

Four non-ODCM ocean bottom sediment samples were obtained from two locations, Unit 2 outfall conduit and Unit 3 outfall conduit. The conduit samples were collected to measure the radiological environmental effect potentially resulting from the minor conduit leakage. During 2010, all of the conduit sample analysis results were below the MDC for station related radionuclides.

We conclude that the operation of SONGS had no impact on the environment as measured by this sample medium.

G. Non-Migratory Marine Species (Flesh)

Species of adult fish, crustacea and mollusks, were collected on a semi-annual basis at the SONGS Unit l outfall, the SONGS Units 2/3 outfall and from Laguna Beach control location. The flesh portion of each sample type was analyzed for gamma-emitting station-related and naturally occurring radionuclides. The results were subsequently reported to SCE in terms of wet sample weights. Because results based on a wet sample weight are most useful for calculating doses, the results of sample analyses are summarized in terms of "as received" wet weights. No plant related radionuclides were detected above the *a posteriori* MDC.

Naturally-occurring K-40 was detected in most marine species samples collected during 2010. No plant related isotopes were reported above the *a posteriori* MDC. The operation of SONGS had no impact on the environment as measured by this sample medium. The potential dose to members of the public from consumption of marine species near SONGS is negligible.

H. Local Crops

Fleshy and leafy crops were collected semiannually in 2010 from the SONGS garden and from the control location 21 miles from SONGS Units 2/3 midpoint in sector F. The crop samples were analyzed quantitatively for naturally occuring and plant related radionuclides. Only naturally occurring radionuclides were detected. SONGS had no measurable impact on this sample medium.

I. Soil

To determine if there is evidence of a build-up of radionuclides in the land near SONGS, indicator soil samples were collected from the East Site Boundary (Former Visitor's center), Old Route 101, Basilone Road, and Camp San Onofre. A control sample was obtained from Oceanside. Surface soil was collected from all indicator and control locations at the depth of 3 inches. The sampling protocol is consistent with the procedure described in HASL-300. Soil sampling is not required by the ODCM.

Soil samples were analyzed for naturally-occurring and SONGS-related gamma-emitting radionuclides using gamma spectral analysis. All 2010 soil samples yielded naturally occurring K-40 and Th-228. Cs-137 was detected in three indicator samples, as well as the control sample. Cs-137 in environmental sediment samples is attributable to residual nuclear weapons testing fallout.

Cs-137 and strontium-90 (Sr-90) were detected in soil profile analyses conducted in previous years. These radionuclides are mostly due to the nuclear weapons testing fallout depositing on soil and retention of these radionuclides due to their long half lives. The presence of Cs-137 in the indicator and the control locations in previous years supports the conclusion that the major source of this radionuclide is fallout deposition. During 2010, the operation of SONGS did not have a measurable effect on the environment as measured by this sample medium.

J. Kelp Sampling

Kelp was collected in April and October of 2010 from the San Onofre kelp beds, San Mateo kelp bed, Barn kelp bed, the Dana Point Kelp Bed, the Capistrano Beach Reef, the San Clemente Pier, the Wheeler North Artificial Reef, and from the Salt Creek control location. Upon collection, the samples were analyzed by gamma-spectral analysis for naturally-occurring and Station-related radionuclides. The radionuclides detected in 2010 included K-40 and I-131. K-40 is naturally occurring and not related to the operation of SONGS. I-131 was detected in eight kelp samples collected during 2010 and is attributable discharges from the San Juan Sewage Plant.

I-131 has been detected at indicator and control locations in previous years. The northern control locations are too far away and in the predominantly upstream current direction for the I-131 activity to be attributable to SONGS. The control kelp sample stations near the San Juan Sewage Plant outfall have consistently yielded the highest I-131 activity. Refer to Table B-1 for a complete list of the 2010 kelp samples with detectable I-131activity. The I-131 activity in kelp data, graphically presented in Figure 4, shows a relatively close correlation between indicator and control locations over a 25 year period - further supporting the assessment that the likely source for this radionuclide is external to SONGS. Refer to Figure 5-6 for the relative location of the kelp beds, the San Juan Sewage Plant outfall, and the SONGS outfalls. The data strongly support the conclusion that the I-131 detected in kelp is attributable to medically administered I-131 discharged through the San Juan Sewage Plant outfall and not to the operation of SONGS.

K. Deer Sampling

Deer meat and bone samples were collected in 2010 because locally harvested deer meat is a potential pathway to humans. Road kill deer were sampled in accordance with a California Fish and Game scientific take permit issued to the Camp Pendleton Game Warden. The 2010 analysis results were less than the *a posteriori* MDC (Minimum Detectable Concentration) for SONGS

related radionuclides. The deer meat and bone data collected to date are consistent with the activity attributable to fallout. Effects from the operation of SONGS were not detected in this sample media.

L. Correlation of Effluent Concentrations to Concentrations in the Environment

In accordance with 10 CFR 50 Appendix I, IV.b.2 data on measurable levels of radiation and radioactive materials in the environment have been evaluated to determine the relationship between quantities of radioactive material released in effluents and resultant radiation doses to individuals from principal pathways of exposure.

The REMP soil Cs-137 levels in the control and indicator samples are statistically equal which leads to the conclusion that Cs-137 in soil is attributable to residual fallout from external anthropogenic factors such as nuclear weapons testing and Chernobyl. The predicted concentration for Cs-137 in soil (based on effluent data reported in the 2009 SONGS Annual Radioactive Effluent Release Report) is about 2 to 3 orders of magnitude lower than the measured concentration of Cs-137 in soil. The effluent based correlation calculation indicates that even if there were no Cs-137 in soil from sources external to SONGS, the Cs-137 concentration in soil attributable to the operation of SONGS would be undetectable and the resultant doses to individuals would be negligible.

Data from 2010 continue to support the historical conclusion that the measured concentration of I-131 in kelp is not increasing near SONGS, and is not statistically higher around SONGS than it is at the control locations. I-131 in kelp is due to the release of medical administrations to the ocean from sewage treatment facilities. The data are consistent with the low levels of radio-iodine released from SONGS during 2010. The effluent based correlation calculation indicates that I-131 activity in kelp attributable to the operation of SONGS would be undetectable and the resultant doses to individuals would be negligible.

The control and indicator samples of deer meat and bone samples collected during 2010 are statistically equal and all less than the a posteriori MDC for SONGS related radionuclides. This data is consistent with the low levels of Sr-90 and Cs-137 released from SONGS. The evaluation indicates that Cs-137 activity in deer meat attributable to the operation of SONGS would be undetectable and the resultant doses to individuals would be negligible.

The collection of an ocean water sample during a liquid batch release from SONGS caused the April 2010 Station C ocean water tritium sample tritium analysis to be > *a posteriori* MDC. Unique sampling conditions (The sample was collected during a planned, controlled discharge of a waste stream from SONGS.) and the variability of the local current conditions may have led to detectable concentrations of tritium in these samples and would be expected. The remaining samples show no detectable concentration of tritium and demonstrate that environmental concentrations are consistent with the low levels of tritium released during 2010. The evaluation indicates that tritium activity in ocean water attributable to the operation of SONGS would result in negligible doses to individuals.

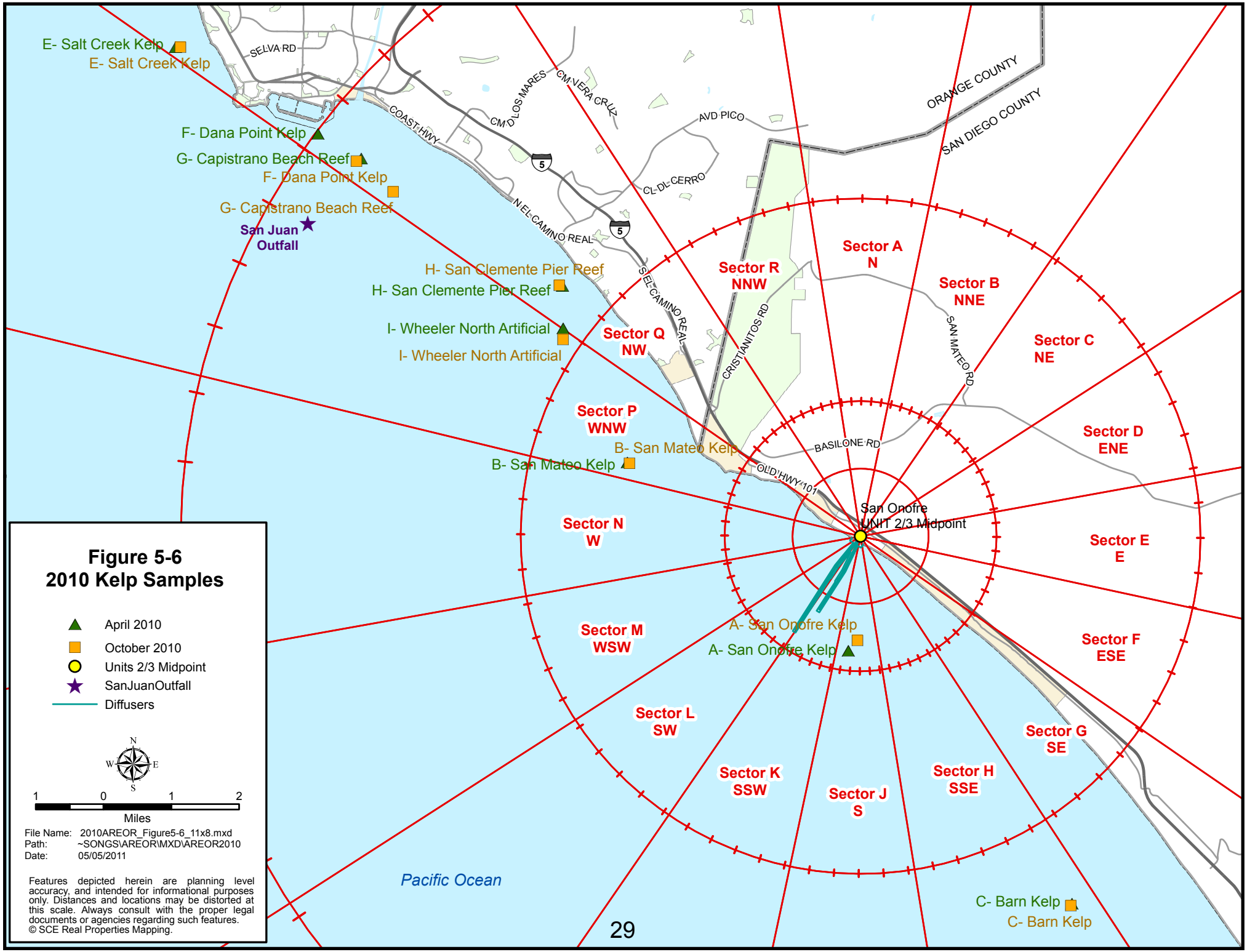
E- Salt Creek Kelp
E- Salt Creek Kelp
F- Dana Point Kelp
G- Capistrano Beach Reef
F- Dana Point Kelp
G- Capistrano Beach Reef
San Juan Outfall
H- San Clemente Pier Reef
H- San Clemente Pier Reef
I- Wheeler North Artificial
I- Wheeler North Artificial
B- San Mateo Kelp
B- San Mateo Kelp
A- San Onofre Kelp
A- San Onofre Kelp
C- Barn Kelp
C- Barn Kelp
SELVA RD
COAST HWY
CM DE LOS MARES
CM VERA CRUZ
AVD PICO
CL DL CERRO
N EL CAMINO REAL
S EL CAMINO REAL
CRISTIANITOS RD
SAN MATEO RD
BASILONE RD
OLD HWY 101
ORANGE COUNTY
SAN DIEGO COUNTY
Sector A N
Sector B NNE
Sector C NE
Sector D ENE
Sector E E
Sector F ESE
Sector G SE
Sector H SSE
Sector J S
Sector K SSW
Sector L SW
Sector M WSW
Sector N W
Sector P WNW
Sector Q NW
Sector R NNW
San Onofre UNIT 2/3 Midpoint
Pacific Ocean
Figure 5-6
2010 Kelp Samples
April 2010
October 2010
Units 2/3 Midpoint
SanJuanOutfall
Diffusers
N
W
E
S
1 0 1 2
Miles
File Name: 2010AREOR_Figure5-6_11x8.mxd
Path: ~SONGS\AREOR\MXD\AREOR2010
Date: 05/05/2011
Features depicted herein are planning level accuracy, and intended for informational purposes only. Distances and locations may be distorted at this scale. Always consult with the proper legal documents or agencies regarding such features.
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TABLE B-1

Summary of SONGS related Gamma Isotopic Analyses confirmed above MDC

Sample Media & location	Radionuclide	Sample Value	MDC (*a posteriori*)
Aquatic Kelp San Onofre Kelp Bed Station A 26APR10	I-131	(47 ± 21) E-3 pCi/g	15 E-3 pCi/g
Aquatic Kelp San Mateo Kelp Bed Station B 26APR10	I-131	(80 ± 17) E-3 pCi/g	11 E-3 pCi/g
Aquatic Kelp Barn Kelp Bed Station C 26APR10	I-131	(36 ± 15) E - 3 pCi/g	14 E-3 pCi/g
Aquatic Kelp Salt Creek Station E 26APR10	I-131	(51 ± 20) E-3 pCi/g	17 E-3 pCi/g
Aquatic Kelp Dana Point Kelp Bed Station F 26APR10	I-131	(176 ± 23) E-3 pCi/g	13 E-3 pCi/g
Aquatic Kelp San Clemente Pier Station H 26APR10	I-131	(57 ± 16) E-3 pCi/g	13 E-3 pCi/g
Aquatic Kelp Wheeler North Artificial Reef Station I 26APR10	I-131	(97 ± 20) E-3 pCi/g	13 E-3 pCi/g
Soil Camp San Onofre Location # 1 9SEP10	Cs-137	(48 ± 24) E-3 pCi/g	21 E-3 pCi/g
Soil Old El Camino Real Location #2 9SEP10	Cs-137	(43 ± 22) E-3 pCi/g	21 E-3 pCi/g
Soil Former Visitor Center Location #5 9SEP10	Cs-137	(35 ± 17) E-3 pCi/g	19 E-3 pCi/g
Soil Prince of Peace Abbey Location #7 9SEP10	Cs-137	(53 ± 17) E-3 pCi/g	14 E-3 pCi/g
Aquatic Kelp Dana Point Kelp Bed Station F 27OCT10	I-131	(22 ± 13) E-3 pCi/g	16 E-3 pCi/g

Sample Media & location	**Radionuclide**	**Sample Value**	**MDC (*a posteriori*)**
Ocean Water Station C Unit 2 Outfall 20APR10	H-3	(1450 ± 376) pCi/*l*	447 pCi/*l*

TABLE B-2

REMP SAMPLE ANALYSIS SUMMARY FOR 2010

Medium	Analysis Type	Sampling Frequency	# of Locations	Total # of Analyses in 2010 [1]
Direct Radiation	Dosimetry	Quarterly	49	194
Airborne Particulates	Gross Beta	Weekly	10	467
Charcoal Cartridge	I-131	Weekly	10	467
Airborne Particulates	Ge (Li) Scan	Quarterly	10	36
Ocean Water	Ge (Li) Scan, H-3	Monthly	4	52
Ocean Water	H-3	Quarterly	4	16
Drinking Water, Unfiltered	Ge (Li) Scan, H-3 Gross Beta	Monthly	4 4 4	30 30 30
Shoreline Sediment	Ge (Li) Scan	Semi-Annually	4	8
Ocean Bottom Sediment	Ge (Li) Scan	Semi-Annually	7	14
Marine Species, Flesh	Ge (Li) Scan	Semi-Annually	3	24
Crops	Ge (Li) Scan	Semi-Annually	2	8
Kelp	Ge (Li) Scan	Semi-Annually	8	16
Soil	Ge (Li) Scan	Annually	5	5

1. The total number of analyses listed above include samples not required by the ODCM, including San Clemente drinking water well samples, additional ocean water samples, additional ocean bottom sediment samples, and additional control kelp samples. These samples were not collected for all of 2010. The San Clemente drinking water sample (collection requested by the City of San Clemente) was not available for six months during 2010. Two ODCM specified direct radiation sample was not available during 2010. Additional control kelp samples were obtained to track I-131 (iodine-131) activity in kelp attributable to municipal waste water discharges. Therefore, the total number of analyses will not always equal the product of the ODCM specified sample frequency times the total number of ODCM locations.

STATISTICAL SUMMARY OF REMP DATA FOR 2010

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362
SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Weekly Airborne Particulates Gross Beta Activity – Table 2 (pCi/cu.m)							
	Gross Beta 467	0.01	0.0351 (363/363) (0.0133 – 0.0850)	San Luis Rey Substation 16.7 Mi. SE	0.0383 (52/52) (0.0177 – 0.0786)	0.0367 (104/104) (0.0157 – 0.0786)	0

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Weekly Radioiodine I-131 Activity – Table 3 (pCi/cu.m)							
	I-131 467	0.07	0.0079 (19/363) (0.0037-0.0251)	Marine Corp Base (Camp Pendleton East) 0.7 Mi. E	0.0158 (2/51) (0.0065 – 0.0251)	0.0096 (4/104) (0.0064 – 0.0135)	0

This table summarizes the weekly air iodine 131 cartridge data above the critical level (1.64 x one sigma). Note that in an ideal gamma isotopic database, consisting entirely of sample values with no detectable radioactivity, approximately 5% of the data will be greater than the critical level. Iodine 131 was not detected during 2010 in this media.

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Quarterly Comp. Airborne Particulates Gamma – Table 4A (pCi/cu.m)								
	Be-7	36		0.22 (28/28) (0.15 – 0.30)	Marine Corp Base (Camp Pendleton East) 0.7 Mi. E	0.24 (4/4) (0.17 – 0.28)	0.22 (8/8) (0.17 – 0.25)	0
	Cs-134	36	0.05	3.91E-4 (4/28) (3.09E-4 – 4.30E-4)	Marine Corp Base (Camp Pendleton Eastl) 0.7 Mi. E	4.30E-4 (1/4) (4.30E-4 – 4.30E-4)	3.71E-4(1/8) (3.71E-4-3.71E-4)	0
	Cs-137	36	0.06	<LLD (0/28) (-)	San Luis Rey Substation 16.7 Mi. SE	3.24E-4 (2/4) (3.11E-4 – 3.36E-4)	3.24E-4 (2/8) (3.11E-4 - 3.36E-4)	0

Be-7 (Beryllium 7) is a naturally occurring radioactive isotope produced by cosmic radiation. Be-7 was confirmed above the detection limit in all the SONGS air particulate quarterly composite samples analyzed in 2010. The results for all plant related radionuclides were less than the *a posteriori* MDC.

The term "< LLD," as used above, means that all results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background. The numerical values for Cs-134 (Cesium-134) and Cs-137 (Cesium-137) listed in this table are those values above the critical level and do not indicate that these radionuclides were detected in any samples.

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis – Table 5 (pCi/l)								
	Ba-140	52	15	5.18 (2/40) (5.00 – 5.36)	(C) Outfall - Unit 3 1.2 Mi. SSW	5.36 (1/12) (5.36 – 5.36)	<LLD (0/12) (-)	0
	Be-7	52		7.94 (4/40) (6.89 – 8.96)	(B) Outfall – Unit 2 1.5 Mi. SW	8.29 (3/12) (7.84 – 8.96)	7.27 (1/12) (7.27 - 7.27)	0
	Co-58	52	15	1.23 (3/40) (1.12 – 1.32)	(D) Newport Beach 30 Mi. NW	1.89 (1/12) (1.89 – 1.89)	1.89 (1/12) (1.89 - 1.89)	0
	Co-60	52	15	0.94 (1/40) (0.94 – 0.94)	(D) Newport Beach 30 Mi. NW	1.63 (1/12) (1.63 – 1.63)	1.63 (1/12) (1.63 - 1.63)	0
	Cs-134	52	15	1.63 (2/40) (1.38 – 1.87)	Unit 2 Conduit 0.1 Mi. SW	1.87 (1/2) (1.87 – 1.87)	1.39 (1/12) (1.39 - 1.39)	0
	Cs-137	52	18	1.34 (4/40) (1.06 - 2.07)	(A) Station Discharge Outfall - Unit 1 0.6 Mi. SW	2.07 (1/12) (2.07 - 2.07)	1.50 (2/12) (1.42 - 1.57)	0
	Fe-59	52	30	2.45 (3/40) (2.03 – 3.02)	(B) Outfall – Unit 2 1.5 Mi. SW	3.02 (1/12) (3.02 – 3.02)	< LLD (0/12) (-)	0
	H-3	52	3000	441.18 (5/40) (91.90 – 1450.00)	(C) Outfall – Unit 3 1.2 Mi. SSW	770.95 (2/12) (91.90 – 1450.00)	<LLD (0/12) (-)	0
	I-131	52	15	1.77 (1/40) (1.77 - 1.77)	(C) Outfall – Unit 3 1.2 Mi. SSW	1.77 (1/12) (1.77 – 1.77)	< LLD (0/12) (-)	0
	K-40	52		347.78 (40/40) (311.00 – 382.00)	Unit 3 Conduit 0.1 Mi. SSW	365.50 (2/2) (356.00 – 375.00)	338.42 (12/12) (318.00 – 366.00)	0
	La-140	52	15	1.78 (4/40) (1.55 - 2.02)	Unit 2 Conduit 0.1 Mi. SW	2.02 (1/2) (2.02 - 2.02)	1.93 (1/12) (1.93 - 1.93)	0
	Mn-54	52	15	0.83 (1/40) (0.83 - 0.83)	(D) Newport Beach 30 Mi. NW	0.98 (1/12) (0.98 - 0.98)	0.98 (1/12) (0.98 – 0.98)	0
	Nb-95	52	15	1.39 (10/40) (0.86 - 2.22)	(C) Outfall-Unit 3 1.2 Mi. SSW	1.53 (3/12) (1.11 – 2.22)	1.31 (3/12) (1.20 – 1.49)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis – Table 5 (pCi/l)								
	Zn-65	52	30	< LLD (0/40) (-)		--- (0/2) (-)	< LLD (0/12) (-)	0
	Zr-95	52	15	2.24 (1/40) (2.24 - 2.24)	(C) Outfall- Unit 3 1.2 Mi. SSW	2.24 (1/12) (2.24 - 2.24)	1.83 (1/12) (1.83 - 1.83)	0

The naturally occurring radioactive isotope K-40 (Potassium 40) was detected in all SONGS Ocean water samples analyzed in 2010. The analysis results for all other radionuclides were less than the detection limit.

The term "< LLD," as used above, means that all results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background. The numerical values listed in this table are those values above the critical level and do not indicate that these radionuclides were detected in any samples.

This table is a statistical summary of the radionuclides detected in 2010 (K-40) and the radionuclides listed in the ODCM

Tritium was detected in one ocean water sample.

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Quarterly Composite Ocean Water Tritium Activity – Table 7 (pCi/l)								
	H-3	16	3000	278.00 (1/12) (278.00 – 278.00)	(C) Outfall – Unit 3 1.2 Mi. SSW	278.00 (1/4) (278.00 – 278.00)	< LLD (0/4) (-)	0

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SAN ONOFRE NUCLEAR GENERATING STATION

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SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis – Table 9A (pCi/l)								
	Ba-140	30	15	< LLD (0/18) (-)	Oceanside (Control) 15.6 Mi. SE	6.68 (1/12) (6.68 - 6.68)	6.68 (1/12) (6.68 – 6.68)	0
	Be-7	30		< LLD (0/18) (-)		---- (0/5) (-)	<LLD (0/12) (-)	0
	Co-58	30	15	< LLD (0/18) (-)		---- (0/12) (-)	<LLD (0/12) (-)	0
	Co-60	30	15	1.42 (2/18) (1.37- 1.47)	San Clemente Well #8 4 Mi. NNW	1.47 (1/5) (1.47- 1.47)	1.42 (2/12) (1.36 - 1.47)	0
	Cs-134	30	15	2.08 (1/18) (2.08 - 2.08)	San Clemente Well #8 4 Mi. NNW	2.08 (1/5) (2.08 – 2.08)	1.13 (3/12) (0.97 – 1.31)	0
	Cs-137	30	18	1.48 (2/18) (1.32 – 1.64)	Oceanside (Control) 15.6 Mi. SE	1.48 (1/12) (1.48 - 1.48)	1.48 (1/12) (1.48 - 1.48)	0
	Fe-59	30	30	2.70 (5/18) (1.90 - 3.92)	San Clemente Well #8 4 Mi. NNW	3.02 (2/5) (2.11 - 3.92)	<LLD (0/12) (-)	0
	Gross Beta	30	4	2.85 (11/18) (1.67 - 5.62)	Oceanside (Control) 15.6 Mi. SE	3.94 (11/12) (2.18 - 6.38)	3.94 (11/12) (2.18 – 6.38)	0
	H-3	30	3000	405.00 (1/18) (405.00 - 405.00)	Camp Pendleton 2.2 Mi. NNW	405.00 (1/12) (405.00 - 405.00)	123.00 (1/12) (123.00 - 123.00)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis – Table 9A (pCi/l)								
	I-131	30	15	1.50 (1/18) (1.50 – 1.50)	Camp Pendleton 2.2 Mi. NNW	1.50 (1/12) (1.50 – 1.50)	<LLD (0/12) (-)	0
	K-40	30		31.22 (5/18) (17.00 - 42.20)	San Clemente Well #8 4 Mi. NNW	40.35 (2/5) (38.50 - 42.20)	22.80 (3/12) (17.60- 25.90)	0
	La-140	30	15	2.23 (1/18) (2.23 - 2.23)	Camp Pendleton 2.2 Mi. NNW	2.23 (1/12) (2.23 - 2.23)	< LLD (0/12) (-)	0
	Mn-54	30	15	<LLD (0/18) (-)	Oceanside (Control) 15.6 Mi. SE	1.22 (1/12) (1.22 – 1.22)	1.22 (1/12) (1.22 - 1.22)	0
	Nb-95	30	15	2.69 (6/18) (1.08 - 4.77)	Camp Pendleton 2.2 Mi. NNW	3.01 (5/12) (1.66 – 4.77)	1.26 (4/12) (0.79 - 1.72)	0
	Zn-65	30	30	2.56 (2/18) (2.37 - 2.74)	Camp Pendleton 2.2 Mi. NNW	2.56 (2/12) (2.37 - 2.74)	<LLD (0/12) (-)	0
	Zr-95	30	15	2.33 (2/18) (1.87 - 2.78)	San Clemente Well #8 4 Mi. NNW	2.78 (1/5) (2.78 – 2.78)	<LLD (0/12) (-)	0

During 2010 gross beta was confirmed above the *a posteriori* MDC in most drinking water samples. Gross beta is attributable to naturally occurring radionuclides. All the other analysis results were less than detectable for SONGS related radionuclides.

The term "< LLD," as used above, means that all results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background. The numerical values listed in this table are those values above the critical level and do not indicate that these radionuclides were detected in any samples.

This table is a statistical summary of the analysis results confirmed above the *a posteriori* MDC in 2010 (Gross Beta) as well as those radionuclides listed in the ODCM

Starting in October 2006 San Clemente drinking water was sampled and analyzed as a courtesy to the City of San Clemente. This table includes the City of San Clemente drinking water analysis results.

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-annual Shoreline Sediment Gamma Spectral Analysis – Table 10 (pCi/g)								
	Cs-134	8	0.15	0.0407 (4/6) (0.0254 - 0.0624)	San Onofre State Beach 0.6 Mi. SE	0.0439 (2/2) (0.0254 – 0.0624)	0.0269 (2/2) (0.0179 – 0.0359)	0
	Cs-137	8	0.18	0.0059 (1/6) (0.0059 - 0.0059)	San Onofre State Beach 3.5 Mi. SE	0.0059 (1/2) (0.0059 - 0.0059)	<LLD (0/2) (-)	0
	K-40	8		11.88 (6/6) (5.56 - 17.20)	Newport Beach North End 29.2 Mi. NW	24.50 (2/2) (22.00 - 27.00)	24.50 (2/2) (22.00 – 27.00)	0
	Th-228	8		0.65 (6/6) (0.17 – 1.50)	San Onofre State Beach 0.6 Mi. SE	1.03 (2/2) (0.56 – 1.50)	0.47 (2/2) (0.42 – 0.53)	0

During 2010 naturally occurring Th-228 (thorium 228) and K-40 (potassium 40) were confirmed above the *a posteriori* MDC in most shoreline sediment samples.

The term "< LLD," used above, indicates that all analysis results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background. The numerical values listed in this table for Cs-137 are those values above the critical level and do not indicate that Cs-137 was detected in any samples.

This table is a statistical summary of the analysis results confirmed above the *a posteriori* MDC in 2010 (K-40 and Th-228) as well as those radionuclides listed in the ODCM

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Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis – Table 11 (pCi/g)								
	Cs-134	14	0.15	0.0369 (6/12) (0.0281 – 0.0528)	(C) Unit 2 Outfall 1.6 Mi. SW	0.0528 (1/2) (0.0528 - 0.0528)	0.0186 (1/2) (0.0186 - 0.0186)	0
	Cs-137	14	0.18	0.0270 (2/12) (0.0222 – 0.0318)	(C) Unit 2 Outfall 1.6 Mi. SW	0.0318 (1/2) (0.0318 - 0.0318)	0.0113 (1/2) (0.0113 - 0.0113)	0
	K-40	14		17.43 (12/12) (14.90 - 20.80)	Unit 3 Conduit 0.1 Mi. SSW	20.00 (2/2) (19.20 - 20.80)	18.95 (2/2) (18.90 – 19.00)	0
	Th-228	14		0.64 (12/12) (0.23 - 1.02)	(C) Unit 2 Outfall 1.6 Mi. SW	0.86 (2/2) (0.70 - 1.02)	0.33 (2/2) (0.28 – 0.39)	0

During 2010, naturally occurring Th-228 (thorium 228) and K-40 (potassium 40) were confirmed above the *a posteriori* MDC in most ocean bottom sediment samples.

The term "< LLD," used above, indicates that all analysis results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background. The numerical values listed in this table for Cs-137 are those values above the critical level and do not indicate that Cs-137 was detected in any samples.

This table is a statistical summary of the analysis results confirmed above the *a posteriori* MDC in 2010 (K-40 and Th-228) as well as those radionuclides listed in the ODCM

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Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Black Perch	Co-58	4	0.13	< LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Black Perch	Co-60	4	0.13	< LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Black Perch	Cs-134	4	0.13	0.0045 (1/2) (0.0045 – 0.0045)	(C) Laguna Beach 18.2 Mi. NW	0.0045 (1/2) (0.0045 - 0.0045)	0.0045 (1/2) (0.0045 - 0.0045)	0
Black Perch	Cs-137	4	0.15	0.0048 (1/2) (0.0048 - 0.0048)	(C) Laguna Beach 18.2 Mi. NW	0.0051 (1/2) (0.0051 - 0.0051)	0.0051 (1/2) (0.0051 - 0.0051)	0
Black Perch	Fe-59	4	0.26	<LLD (0/2) (-)		**----** (0/2) (-)	< LLD (0/2) (-)	0
Black Perch	K-40	4		3.24 (2.2) (3.20 - 3.28)	(C Laguna Beach 18.2 Mi. NW	3.48 (2/2) (3.45 - 3.50)	3.48 (2/2) (3.45 - 3.50	0
Black Perch	Mn-54	4	0.13	<LLD (0/2) (-)		**----** (0/2) (-)	<LLD (0/2) (-)	0
Black Perch	Zn-65	4	0.26	< LLD (0/2) (-)		---- (0/2) (-)	<LLD (0/2) (-)	0

<LLD results are less than the critical level 1.64 sigma.

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Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Blacksmith	Co-58	3	0.13	<LLD (0/3) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0
Blacksmith	Co-60	3	0.13	<LLD (0/3) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0
Blacksmith	Cs-134	3	0.13	0.0035 (1/3) (0.0035 - 0.0035)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0035 (1/2) (0.0035 – 0.0035)	< LLD (0/0) (-)	0
Blacksmith	Cs-137	3	0.15	0.0068 (2/3) (0.0047 - 0.0089)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0089 (1/1) (0.0089-0.0089)	< LLD (0/0) (-)	0
Blacksmith	Fe-59	3	0.26	<LLD (0/3) (-)		---- (0/2) (-)	< LLD (0/0) (-)	0
Blacksmith	K-40	3		3.51 (3/3) (3.26 – 3.86)	(A) Unit 1 Outfall 0.9 Mi. WSW	3.56 (2/2) (3. 26 – 3.86)	<LLD (0/0) (-)	0
Blacksmith	Mn-54	3	0.13	< LLD (0/3) (-)		---- (0/2) (-)	< LLD (0/0) (-)	0
Blacksmith	Zn-65	3	0.26	< LLD (0/3) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0

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Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
California Mussel	Co-58	6	0.13	<LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
California Mussel	Co-60	6	0.13	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
California Mussel	Cs-134	6	0.13	<LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
California Mussel	Cs-137	6	0.15	0.0036 (1/4) (0.0036 - 0.0036)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0036 (1/2) (0.0036 - 0.0036)	< LLD (0/2) (-)	0
California Mussel	Fe-59	6	0.26	< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0057 (1/2) (0.0057 - 0.0057)	0.0057 (1/2) (0.0057 - 0.0057)	0
California Mussel	K-40	6		2.06 (4/4) (1.86 - 2.28)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	2.07 (2/2) (1.86 - 2.28)	1.87 (2/2) (1.73 – 2.01)	0
California Mussel	Mn-54	6	0.13	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
California Mussel	Zn-65	6	0.26	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0

<LLD results are less than the critical level 1.64 sigma.

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Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Sheephead	Co-58	4	0.13	< LLD (0/2) (-)		---- (0/2) (-)	<LLD (0/2) (-)	0
Sheephead	Co-60	4	0.13	<LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Sheephead	Cs-134	4	0.13	0.0041 (1/2) (0.0041 – 0.0041)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0041 (1/2) (0.0041 – 0.0041)	< LLD (0/2) (-)	0
Sheephead	Cs-137	4	0.15	<LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0036 (1/2) (0.0036 – 0.0036)	0.0036 (1/2) (0.0036 – 0.0036)	0
Sheephead	Fe-59	4	0.26	< LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Sheephead	K-40	4		3.84 (2/2) (3.76 – 3.91)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	3.84 (2/2) (3.76 – 3.91)	3.54 (2/2) (3.32 - 3.76)	0
Sheephead	Mn-54	4	0.13	0.0052 (1/2) (0.0052 - 0.0052)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0052 (1/2) (0.0052 - 0.0052)	< LLD (0/2) (-)	0
Sheephead	Zn-65	4	0.26	< LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0

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Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Sand Bass	Co-58	1	0.13	< LLD (0/1) (-)		---- (0/1) (-)	<LLD (0/0) (-)	0
Sand Bass	Co-60	1	0.13	<LLD (0/1) (-)		---- (0/1) (-)	<LLD (0/0) (-)	0
Sand Bass	Cs-134	1	0.13	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0
Sand Bass	Cs-137	1	0.15	0.0038 (1/1) (0.0038 - 0.0038)	(B) Units 2 and 3 Outfall 1.5Mi. SSW	0.0038 (1/1) (0.0038 - 0 0038)	< LLD (0/0) (-)	0
Sand Bass	Fe-59	1	0.26	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0
Sand Bass	K-40	1		3.18 (1/1) (3.18 – 3.18)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	3.18 (1/1) (3.18 – 3.18)	<LLD (0/0) (-)	0
Sand Bass	Mn-54	1	0.13	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0
Sand Bass	Zn-65	1	0.26	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/0) (-)	0
Spiny Lobster	Co-58	6	0.13	<LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0042 (1/2) (0.0042 - 0.0042)	0.0042 (1/2) (0.0042 - 0.0042)	0
Spiny Lobster	Co-60	6	0.13	0.0055 (1/4) (0.0055 - 0.0055)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0055 (1/2) (0.0055 - 0.0055)	<LLD (0/2) (-)	0
Spiny Lobster	Cs-134	6	0.13	<LLD (0/4) (-)		---- (0/2) (-)	<LLD (0/2) (-)	0
Spiny Lobster	Cs-137	6	0.15	<LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0029 (1/2) (0.0029 - 0.0029)	0.0029 (1/2) (0.0029-0.0029)	0

<LLD results are less than the critical level 1.64 sigma.

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Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Spiny Lobster	Fe-59	6	0.26	0.0058 (1/4) (0.0058 - 0.0058)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0058 (1/2) (0.0058 - 0.0058)	<LLD (0/2) (-)	0
Spiny Lobster	K-40	6		3.61 (4/4) (3.28 - 4.03)	(C) Laguna Beach 18.2 Mi. NW	3.93 (2/2) (3.88-3.98)	3.93 (2/2) (3.88 – 3.98)	0
Spiny Lobster	Mn-54	6	0.13	<LLD (0/4) (-)		---- (0/2) (-)	<LLD (0/2) (-)	0
Spiny Lobster	Zn-65	6	0.26	<LLD (0/4) (-)		---- (0/2) (-)	<LLD (0/2) (-)	0

<LLD results are less than the critical level 1.64 sigma.

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Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g)										
Cabbage	Be-7	1		< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Cabbage	Cs-134	1	0.06	< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Cabbage	Cs-137	1	0.08	< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Cabbage	I-131	1	0.06	< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Cabbage	K-40	1		< LLD	(0/0)	South East of Oceanside 22 Mi. SE	1.57	(1/1)	1.57	(1/1)	0
				(-)			(1.57-1.57)		(1.57-1.57)	
Lettuce	Be-7	1		< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Lettuce	Cs-134	1	0.06	< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Lettuce	Cs-137	1	0.08	< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		
Lettuce	I-131	1	0.06	< LLD	(0/0)	---	(0/1)	< LLD	(0/1)	0
				(-)		(-)		(-)		

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SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with the Highest Annual Mean Name, Distance and Direction	Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g)										
Lettuce	K-40	1	< LLD (-)	(0/0)	South East of Oceanside 22 Mi SE	1.58 (1.58-1.58)	(1/1)	1.58 (1.58-1.58)	(1/1)	0
Sorrel	Be-7	2	0.26 (0.11-0.41)	(2/2)	SONGS Garden 0.4 Mi. NNW	0.26 (0.11-0.41)	(2/2)	< LLD (-)	(0/0)	0
Sorrel	Cs-134	2	0.06 < LLD (-)	(0/2)		--- (-)	(0/2)	< LLD (-)	(0/0)	0
Sorrel	Cs-137	2	0.08 < LLD (-)	(0/2)		--- (-)	(0/2)	< LLD (-)	(0/0)	0
Sorrel	I-131	2	0.06 < LLD (-)	(0/2)		--- (-)	(0/2)	< LLD (-)	(0/0)	0
Sorrel	K-40	2	3.30 (2.81-3.79)	(2/2)	SONGS Garden 0.4 Mi. NNW	3.30 (2.81-3.79)	(2/2)	< LLD (-)	(0/0)	0
Tomato	Be-7	4	< LLD (-)	(0/2)		--- (-)	(0/2)	< LLD (-)	(0/2)	0
Tomato	Cs-134	4	0.06 < LLD (-)	(0/2)		--- (-)	(0/2)	< LLD (-)	(0/2)	0
Tomato	Cs-137	4	0.08 < LLD (-)	(0/2)		--- (-)	(0/2)	< LLD (-)	(0/2)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362
SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with the Highest Annual Mean Name, Distance and Direction	Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g)											
Tomato	I-131	4	0.06	0.0066 (0.0066-0.0066)	(1/2)	SONGS Garden 0.4 Mi. NNW	0.0066 (0.0066-0.0066)	(1/2)	< LLD (-)	(0/2)	0
Tomato	K-40	4		2.34 (2.16-2.51)	(2/2)	SONGS Garden 0.4 Mi. NNW	2.34 (2.16-2.51)	(2/2)	1.56 (1.40-1.72)	(2/2)	0

During 2010, naturally occurring K-40 (potassium 40) and Be-7 (Beryllium 7) were confirmed above the *a posteriori* MDC in local crop samples.

The term "< LLD," used above, indicates that all analysis results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular analysis result should be considered as other than background. The numerical values listed in this table for Cs-137 are those values above the critical level and do not indicate that Cs-137 was detected in any samples.

This table is a statistical summary of the analysis results confirmed above the *a posteriori* MDC in 2010 (K-40) as well as those radionuclides listed in the ODCM

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362
SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Annual Soil Analysis – Depth 3 ” Table 14 (pCi/g)								
	Cs-134	5	0.15	0.0531 (4/4) (0.0324 - 0.0801)	Camp San Onofre 2.6 Mi. NE	0.0801 (1/1) (0.0801 – 0.0801)	0.0161 (1/1) (0.0161 – 0.0161)	0
	Cs-137	5	0.18	0.0421 (3/4) (0.0347 – 0.0483)	Prince of Peace Abbey 15 Mi. SE	0.0528 (1/1) (0.0528 – 0.0528)	0.528 (1/1) (0.0528 – 0.0528)	0
	K-40	5		16.40 (4/4) (8.60 – 22.60)	Camp San Onofre 2.6 Mi. NE	22.60 (1/1) (22.60 - 22.60)	3.06 (1/1) (3.06 – 3.06)	0
	Th-228	5		0.78 (4/4) (0.50 – 0.98)	Basilone Road/ I-5 Freeway Off ramp 2 Mi. NW	0.98 (1/1) (0.98 – 0.98)	0.21 (1/1) (0.21 – 0.21)	0

During 2010, naturally occurring Th-228 (thorium 228) and K-40 (potassium 40) were confirmed above the *a posteriori* MDC in all soil samples. Cs-137 (Cesium 137) was detected in four samples and is attributable to fallout from nuclear weapons testing and from Chernobyl.

The term “< LLD,” used above, indicates that all analysis results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background.

This table is a statistical summary of the analysis results for K-40 and those radionuclides listed in the ODCM for sediment samples.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362
SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2010 to 12/31/2010

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Kelp Analysis – Table 15 (pCi/g)								
	Cs-134	16	0.06	< LLD (0/6) (-)		---- (0/2) (-)	< LLD (0/10) (-)	0
	Cs-137	16	0.08	< LLD (0/6) (-)		---- (0/2) (-)	<LLD (0/10) (-)	0
	I-131	16	0.06	0.0544 (3/6) (0.0357 - 0.0803)	Dana Point Kelp Bed (F) 9 to 10 Mi. NW	0.0922 (2/2) (0.0223 – 0.18)	0.0495 (9/10) (0.0076 – 0.18)	0
	K-40	16		8.98 (6/6) (6.67 – 11.10)	Dana Point Kelp Bed (F) 9 to 10 Mi. NW	11.65 (2/2) (11.10 – 12.20)	10.29 (10/10) (7.26 – 13.40)	0

During 2010, naturally occurring K-40 (potassium 40) were confirmed above the *a posteriori* MDC in all kelp samples. I-131 (iodine 131) was also confirmed above the *a posteriori* MDC in twelve samples. I-131 is known to be a constituent of sewage plant discharges due to medically administered I-131. The activity of I-131 in the control sample (Salt Creek – about 11 miles up coast from SONGS) has historically been higher than the I-131 activity in kelp closer to SONGS. I-131 in kelp is attributable to sewage plant effluents.

The term "< LLD," used above, indicates that all analysis results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular sample result should be considered other than background.

***The April 2010 Wheeler North Artificial Reef Kelp sample was collected 5.4 miles WNW. The October 2010 sample was 5.2 miles WNW.

APPENDIX C

SUMMARY OF QUALITY CONTROL PROGRAMS

All REMP samples are collected, shipped, and analyzed in accordance with NRC Regulatory Guide 4.15. Marine radiological environmental samples are collected by a vendor, MBC Environmental, per the vendors Quality Assurance manual. REMP sample analysis is performed by the Contracted Environmental Analysis Laboratory (CEAL) in accordance with the Laboratory Quality Assurance Plan. During 2010 the CEAL was GEL (General Engineering Laboratory). The CEAL for REMP TLDs was Areva.

INTERLABORATORY CROSS-CHECK PROGRAM:

The CEAL participates in a number of independent cross check programs, including the National Institute of Standards and Technology (NIST) and Analytics cross-check programs. A summary of the cross check data is included in Table C-1. The CEAL's performance meets the criteria described in Reg. Guide 4.15. Discrepancies and non-agreement results are resolved through a formal Condition Report evaluation process.

QUARTERLY DUPLICATE TLDs

SONGS deployed a duplicate TLD package in the same location and canister as TLD 66. The quarterly dose measured by these separate TLD packages is statistically equal.

DUPLICATE TLD DATA COMPARISON

	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
TLD 66	13.8 ± 0.8	14.7 ± 0.8	14.4 ± 0.6	13.2 ± 0.7
TLD 200	13.4 ± 1.6	14.0 ± 0.7	14.6 ± 0.7	13.2 ± 0.6

- Data is reported as mR per standard quarter ± 1 sigma

ANNUAL DUPLICATE TLDs

An annual duplicate TLD package is collocated with TLD 67.

TLD 67 **average dose in mR** **per standard quarter** **(July 2009 to July 2010)**	**TLD 201 (annual duplicate)** **dose in mR** **per standard quarter** **(July 2009 to July 2010)**
17.4	**16.8**

COMPARISON OF TLD TO PIC DATA,

PIC 3 17.5	PIC 4 18.2	PIC 6 14.5	PIC 8 11.1
TLD 40 17.0	TLD 61 21.5	TLD 63 13.9	TLD 65 12.8

PIC data converted to mR per standard quarter compared to the 4th Quarter co-located 2010 TLD data.

CALIBRATION OF AIR SAMPLER VOLUME METERS

The Shop Services and Instrumentation Division of SCE performs an annual calibration procedure using standards referenced to NIST on all REMP air sampler gas meters. When the gas meters are removed from service, the meter is calibrated and the calibration reports are reviewed for bias. This is an *a posteriori* review of the gas meter performance to evaluate method bias and to identify possible outlier analysis results. In 2010, one (1) gas meter failed to meet this criterion at all calibrated flow rates. A review of the affected gross beta data has revealed no meaningful anomalies. Thus no discernable impact to the REMP database or conclusions resulted from use of the out of tolerance gas meter.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Eckert & Ziegler
Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 • U.S.A.

Tel 404•352•8677
Fax 404•352•2837

RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

First Quarter 2010
(Ref. Date 18-MAR-2010)

11-May-2010
Walter Levich, Interim QA Manager

ANA Form002 Rev. ---

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E7052-278 I-131 Cartridge GEL ID 249561001	I-131	8.58E+01 pCi	4.07E+00	8.54E+01 pCi	1.43E+00	1.00
E7053-278 Sr-89/90 w/MAF Milk GEL ID 249561002	Sr-89	7.91E+01 pCi/L	2.13E+00	9.28E+01 pCi/L	1.55E+00	0.85
	Sr-90	1.12E+01 pCi/L	7.10E-01	1.27E+01 pCi/L	2.12E-01	0.88
E7054-278 Gamma Milk GEL ID 249561003	I-131	6.91E+01 pCi/L	5.11E+00	7.40E+01 pCi/L	1.24E+00	0.93
	Ce-141	2.61E+02 pCi/L	1.31E+01	2.61E+02 pCi/L	4.36E+00	1.00
	Cr-51	3.81E+02 pCi/L	3.10E+01	3.61E+02 pCi/L	6.03E+00	1.05
	Cs-134	1.76E+02 pCi/L	9.60E+00	1.78E+02 pCi/L	2.97E+00	0.99
	Cs-137	1.61E+02 pCi/L	7.86E+00	1.58E+02 pCi/L	2.64E+00	1.02
	Co-58	1.45E+02 pCi/L	7.86E+00	1.43E+02 pCi/L	2.38E+00	1.02
	Mn-54	2.10E+02 pCi/L	1.10E+01	2.07E+02 pCi/L	3.46E+00	1.01
	Fe-59	1.60E+02 pCi/L	1.06E+01	1.37E+02 pCi/L	2.29E+00	1.17
	Zn-65	2.71E+02 pCi/L	1.51E+01	2.54E+02 pCi/L	4.24E+00	1.07
	Co-60	1.90E+02 pCi/L	9.69E+00	1.83E+02 pCi/L	3.06E+00	1.04
E7055-278 Gamma Water GEL ID 249561004	I-131	8.12E+01 pCi/L	5.33E+00	7.22E+01 pCi/L	1.21E+00	1.12
	Ce-141	2.78E+02 pCi/L	1.33E+01	2.63E+02 pCi/L	4.40E+00	1.06
	Cr-51	3.86E+02 pCi/L	3.37E+01	3.64E+02 pCi/L	6.08E+00	1.06
	Cs-134	1.85E+02 pCi/L	1.07E+01	1.79E+02 pCi/L	2.99E+00	1.03
	Cs-137	1.71E+02 pCi/L	9.62E+00	1.59E+02 pCi/L	2.66E+00	1.07
	Co-58	1.51E+02 pCi/L	8.74E+00	1.44E+02 pCi/L	2.40E+00	1.05
	Mn-54	2.30E+02 pCi/L	1.26E+01	2.09E+02 pCi/L	3.49E+00	1.10
	Fe-59	1.60E+02 pCi/L	1.00E+01	1.38E+02 pCi/L	2.31E+00	1.16
	Zn-65	2.97E+02 pCi/L	1.51E+01	2.56E+02 pCi/L	4.27E+00	1.16
	Co-60	1.94E+02 pCi/L	9.30E+00	1.85E+02 pCi/L	3.08E+00	1.05

First Quarter 2010 (Ref. Date 18-MAR-2010)

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

Second Quarter 2010

(Ref. Date 17-Jun-2010)

24-Aug-2010

Walter Levich, Interim QA Manager

ANA Form002 Rev. ---

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E7117-278 I-131 Cartridge GEL ID 254809001	I-131	7.97E+01 pCi	3.89E+00	8.02E+01 pCi	1.34E+00	0.99
E7118-278 Sr-89/90 w/MAF Milk GEL ID 254809002	Sr-89	7.95E+01 pCi/L	2.15E+00	9.34E+01 pCi/L	1.56E+00	0.85
	Sr-90	1.57E+01 pCi/L	8.80E-01	1.67E+01 pCi/L	2.79E-01	0.94
E7119-278 Gamma Milk GEL ID 254809003	I-131	1.06E+02 pCi/L	6.13E+00	9.69E+01 pCi/L	1.62E+00	1.09
	Ce-141	1.27E+02 pCi/L	7.55E+00	1.10E+02 pCi/L	1.84E+00	1.15
	Cr-51	3.90E+02 pCi/L	2.93E+01	3.39E+02 pCi/L	5.66E+00	1.15
	Cs-134	1.37E+02 pCi/L	8.40E+00	1.26E+02 pCi/L	2.10E+00	1.09
	Cs-137	1.68E+02 pCi/L	8.48E+00	1.50E+02 pCi/L	2.51E+00	1.12
	Co-58	1.13E+02 pCi/L	7.11E+00	1.01E+02 pCi/L	1.69E+00	1.12
	Mn-54	1.99E+02 pCi/L	1.15E+01	1.69E+02 pCi/L	2.82E+00	1.18
	Fe-59	1.55E+02 pCi/L	1.06E+01	1.19E+02 pCi/L	1.98E+00	1.30
	Zn-65	2.40E+02 pCi/L	1.36E+01	2.06E+02 pCi/L	3.44E+00	1.17
	Co-60	2.14E+02 pCi/L	1.14E+01	1.97E+02 pCi/L	3.28E+00	1.09
E7120-278 Gamma Water GEL ID 254809004	I-131	7.59E+01 pCi/L	5.14E+00	7.89E+01 pCi/L	1.32E+00	0.96
	Ce-141	1.80E+02 pCi/L	9.29E+00	1.61E+02 pCi/L	2.68E+00	1.12
	Cr-51	5.14E+02 pCi/L	3.46E+01	4.94E+02 pCi/L	8.25E+00	1.04
	Cs-134	1.87E+02 pCi/L	1.03E+01	1.83E+02 pCi/L	3.06E+00	1.02
	Cs-137	2.33E+02 pCi/L	1.10E+01	2.18E+02 pCi/L	3.65E+00	1.07
	Co-58	1.61E+02 pCi/L	8.82E+00	1.47E+02 pCi/L	2.46E+00	1.09
	Mn-54	2.65E+02 pCi/L	1.38E+01	2.46E+02 pCi/L	4.11E+00	1.08
	Fe-59	1.98E+02 pCi/L	1.20E+01	1.73E+02 pCi/L	2.89E+00	1.14
	Zn-65	3.27E+02 pCi/L	1.72E+01	3.00E+02 pCi/L	5.00E+00	1.09
	Co-60	3.06E+02 pCi/L	1.57E+01	2.86E+02 pCi/L	4.78E+00	1.07

Second Quarter 2010 (Ref. Date 17-Jun-2010)

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

Third Quarter 2010

(Ref. Date 16-Sep-2010)

10-Dec-10

Walter Levich, Interim QA Manager

ANA Form002 Rev. ---

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E7193-278 I-131 Cartridge	I-131	5.97E+01 pCi	2.72E+00	6.02E+01 pCi	1.01E+00	0.99
GEL ID 260859001						
E7194-278 Sr-89/90 w/MAF Milk	Sr-89	7.62E+01 pCi/L	2.25E+00	9.28E+01 pCi/L	1.55E+00	0.82
	Sr-90	1.30E+01 pCi/L	1.39E+00	1.47E+01 pCi/L	2.45E-01	0.88
GEL ID 260859002						
E7195-278 Gamma Milk	I-131	1.01E+02 pCi/L	6.72E+00	9.41E+01 pCi/L	1.57E+00	1.07
	Ce-141	1.39E+02 pCi/L	8.13E+00	1.30E+02 pCi/L	2.17E+00	1.07
	Cr-51	2.48E+02 pCi/L	2.45E+01	2.34E+02 pCi/L	3.90E+00	1.06
	Cs-134	9.85E+01 pCi/L	6.10E+00	9.30E+01 pCi/L	1.55E+00	1.06
	Cs-137	9.87E+01 pCi/L	5.40E+00	9.45E+01 pCi/L	1.58E+00	1.04
	Co-58	7.02E+01 pCi/L	4.40E+00	7.37E+01 pCi/L	1.23E+00	0.95
GEL ID 2608590003	Mn-54	1.20E+02 pCi/L	6.50E+00	1.19E+02 pCi/L	1.99E+00	1.01
	Fe-59	1.02E+02 pCi/L	7.63E+00	9.11E+01 pCi/L	1.52E+00	1.12
	Zn-65	2.37E+02 pCi/L	1.29E+01	2.04E+02 pCi/L	3.40E+00	1.16
	Co-60	1.77E+02 pCi/L	9.27E+00	1.71E+02 pCi/L	2.85E+00	1.04
E7196-278 Gamma Water	I-131	7.24E+01 pCi/L	4.70E+00	6.44E+01 pCi/L	1.08E+00	1.12
	Ce-141	1.74E+02 pCi/L	8.87E+00	1.65E+02 pCi/L	2.76E+00	1.05
	Cr-51	3.12E+02 pCi/L	2.44E+01	2.97E+02 pCi/L	4.95E+00	1.05
	Cs-134	1.22E+02 pCi/L	7.37E+00	1.18E+02 pCi/L	1.97E+00	1.03
	Cs-137	1.24E+02 pCi/L	6.70E+00	1.20E+02 pCi/L	2.00E+00	1.03
	Co-58	9.63E+01 pCi/L	5.77E+00	9.35E+01 pCi/L	1.56E+00	1.03
GEL ID 2608590004	Mn-54	1.70E+02 pCi/L	9.43E+00	1.52E+02 pCi/L	2.53E+00	1.12
	Fe-59	1.42E+02 pCi/L	9.51E+00	1.16E+02 pCi/L	1.93E+00	1.23
	Zn-65	2.97E+02 pCi/L	1.53E+01	2.59E+02 pCi/L	4.32E+00	1.15
	Co-60	2.34E+02 pCi/L	1.08E+01	2.17E+02 pCi/L	3.62E+00	1.08

Third Quarter 2010 (Ref. Date 16-Sep-2010)

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Eckert & Ziegler
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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

Fourth Quarter 2010
(Ref. Date 09-Dec-2010)

25-Feb-11
Walter Levich, Interim QA Manager

[1] The acceptable ratio is ± 25% of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E7355-278 I-131 Cartridge	I-131	7.68E+01 pCi	3.67E+00	8.49E+01 pCi	1.42E+00	0.90
GEL ID 268293001						
E7356-278 Sr-89/90 w/MAF Milk	Sr-89	8.05E+01 pCi/L	1.98E+00	9.80E+01 pCi/L	1.64E+00	0.82
	Sr-90	1.44E+01 pCi/L	7.53E-01	1.35E+01 pCi/L	2.25E-01	1.07
GEL ID 268293002						
E7357-278 Gamma Milk	I-131	1.00E+02 pCi/L	5.33E+00	9.69E+01 pCi/L	1.62E+00	1.03
	Ce-141	-3.42E+00 pCi/L	1.59E+00	Not Present	----	----
	Cr-51	4.31E+02 pCi/L	2.78E+01	4.56E+02 pCi/L	7.61E+00	0.95
	Cs-134	1.41E+02 pCi/L	7.53E+00	1.57E+02 pCi/L	2.62E+00	0.90
	Cs-137	1.86E+02 pCi/L	8.74E+00	1.86E+02 pCi/L	3.11E+00	1.00
	Co-58	9.32E+01 pCi/L	5.16E+00	9.02E+01 pCi/L	1.51E+00	1.03
GEL ID 268293003	Mn-54	1.29E+02 pCi/L	6.68E+00	1.20E+02 pCi/L	2.00E+00	1.08
	Fe-59	1.48E+02 pCi/L	9.83E+00	1.31E+02 pCi/L	2.19E+00	1.13
	Zn-65	1.95E+02 pCi/L	1.11E+01	1.74E+02 pCi/L	2.91E+00	1.12
	Co-60	3.07E+02 pCi/L	1.53E+01	3.01E+02 pCi/L	5.02E+00	1.02
E7358-278 Gamma Water	I-131	1.04E+02 pCi/L	5.65E+00	1.00E+02 pCi/L	1.67E+00	1.04
	Ce-141	1.52E+00 pCi/L	2.06E+00	Not Present	----	----
	Cr-51	4.53E+02 pCi/L	2.97E+01	4.55E+02 pCi/L	7.59E+00	1.00
	Cs-134	1.47E+02 pCi/L	7.97E+00	1.57E+02 pCi/L	2.62E+00	0.94
	Cs-137	2.02E+02 pCi/L	9.64E+00	1.86E+02 pCi/L	3.10E+00	1.09
	Co-58	9.21E+01 pCi/L	5.52E+00	9.00E+01 pCi/L	1.50E+00	1.02
GEL ID 268293004	Mn-54	1.31E+02 pCi/L	7.26E+00	1.19E+02 pCi/L	1.99E+00	1.10
	Fe-59	1.45E+02 pCi/L	9.79E+00	1.31E+02 pCi/L	2.18E+00	1.11
	Zn-65	2.01E+02 pCi/L	1.17E+01	1.74E+02 pCi/L	2.90E+00	1.16
	Co-60	3.15E+02 pCi/L	1.66E+01	3.00E+02 pCi/L	5.01E+00	1.05

Fourth Quarter 2010 (Ref. Date 09-Dec-2010)

[1] The acceptable ratio is ± 25% of the known value for Analytics.

APPENDIX D

COMPARISON OF OPERATIONAL TO PREOPERATIONAL DATA AND ANALYSIS OF TRENDS

Comparison of Operational to Preoperational Data and Analysis of Trends

Unit 1 achieved criticality on June 14, 1967 and was permanently retired from service on November 30, 1992. Unit 2 attained initial criticality on July 26, 1982 and Unit 3 on August 29, 1983.

A variety of environmental samples were analyzed and the analytical results (January 1, 1979 to July 31, 1982) were compared with the 2010 operational data obtained for SONGS Units 2/3.

The following media were evaluated and compared with the operational data of SONGS Units 1, 2 and 3:

A.	External Radiation	F.	Ocean Bottom Sediments
B.	Air Particulates	G.	Marine Species
C.	Radioiodine	H.	Local Crops
D.	Ocean Water	I.	Soil
E.	Shoreline Sediment (sand)	J.	Kelp
		K.	Drinking Water

All of the measurements obtained from the SONGS Unit 1 operational Radiological Environmental Monitoring Program (REMP) during the period from January 1979 to July 1982 are used as the preoperational baseline for SONGS Units 2/3. This is in accordance with San Onofre Units 2/3, Environmental Report, Operating License Stage, Appendix 6A, Pre-operational Radiological Environmental Monitoring, May 31, 1978. Comparisons of preoperational data to 2010 operational data are possible for each of the exposure pathways to man, namely: (1) direct radiation, (2) air particulates (inhalation), and (3) ocean water (waterborne). Comparisons can also be made between preoperational and operational data for ocean bottom sediment data to ascertain if there has been any significant increase in radioactivity in ocean bottom sediments in the vicinity of the SONGS Units 2/3 outfalls.

Overall, the preoperational data are much higher than the operational data. The decrease in radioactivity is due primarily to the cessation of nuclear weapons testing and to the decay of fallout radionuclides. There is a close correlation between indicator and control data over several decades. See Figures 2A, 2B, 3A, 3B, 3C and 4. There are no indications of adverse effects from SONGS on the environment.

A. Direct Radiation

SONGS Units 2/3:

Direct radiation measurements for the SONGS REMP were made quarterly at 38 indicator locations and 11 control locations in 2010. (See Appendix I for ISFSI TLD data). Direct radiation samples (TLDs) were collected at a number of inner and outer ring locations as specified by the ODCM. During the preoperational period from January 1979 to July 31, 1982, the indicator stations ranged from 16.1 to 46.6 mR. The preoperational indicator average was 25.3 mR. The preoperational control range was 19.3 to 30.1 and the control mean was 23.1 mR. During the 2010 operational year for Units 2/3, the routine indicator TLD locations ranged from 10.2 to 24.6 mR, averaging 16.6 mR while the control locations ranged from 12.5 to 19.6 mR with an average of 15.8 mR.

Factors such as meteorology, geographic location, the fallout from atmospheric nuclear weapons testing, and seasonal fluctuations account for the variability in the data seen during the preoperational period for each location. The decrease in radiation levels at all TLD sample locations is attributable to the curtailment of the atmospheric nuclear weapons testing, and the continued decay of fission products from previous nuclear weapons tests.

The average direct radiation doses were larger at both indicator and control locations during the preoperational period than during the 2010 operational period for SONGS Units 2/3. The larger average observed during the preoperational time span may be attributable to Chinese atmospheric nuclear weapons tests on March 14, 1978 and on October 15, 1980. The large average of the annual direct radiation levels seen at most TLD sample locations during 1986 and 1987 is attributable to the Chernobyl Nuclear Power Plant accident that occurred April 26, 1986.

Figure 2A and 2B compares the environmental radiation levels of selected indicator and control locations. Simultaneous variation in the radiation levels at both the control and indicator locations show that the variations are due to factors external to SONGS. The operation of SONGS had no impact on the environment as measured by this sample medium.

B. Air Particulates

SONGS Units 2/3:

From January 1979 through July 1982 (considered to be the preoperational period for SONGS Units 2/3), there is a period of noticeably higher gross beta activity in air at all sample locations. This period extends from the fourth quarter of 1980 through the fourth quarter of 1981. These higher activity levels are attributable to the Chinese atmospheric nuclear weapons test conducted on October 15, 1980.

Figures 3A, 3B, and 3C compare the monthly average gross beta particulate in air activity levels of selected indicator locations with the control location over a period of 32 years (January 1976 to December 2010). The data clearly show a close correlation between the indicator and control locations for the entire time period covered. The various spike increases in gross beta activity at all sample locations are closely grouped and timed to coincide with known events external to SONGS with worldwide radiological impact. These events include: Chinese atmospheric nuclear weapons testing on September 17, 1977; March 14, 1978; October 15, 1980; and the April 1986 Chernobyl accident. The graphs (Figures 3A, 3B and 3C) show that the environmental levels of gross beta remained substantially similar at both the indicator and the control locations over an extended period of time, with both control and indicator locations showing simultaneous variations of equal magnitude. The fluctuations in gross beta activity are not attributable to SONGS and are the result of other environmental phenomena and seasonal variations.

C. Radioiodine

SONGS Units 2/3:

Most of the preoperational and all of the 2010 operational data for I-131 level were below the detection limit.

D. Ocean Water

SONGS Units 2/3:

Ocean water samples were collected on a monthly basis in the vicinity of each of the Station discharge outfalls, which served as indicator locations, and from the Newport Beach control location. The ocean water samples are analyzed for naturally-occurring and station-related gamma-emitting radionuclides. They are composited quarterly and analyzed for tritium.

During the preoperational period, naturally-occurring potassium-40 was detected in each of the samples collected from both indicator and control locations. Other gamma-emitting radionuclides were detected in only one ocean water sample. In May 1980, Co-58, Co-60, Cs-l34, and Cs-137 were detected in an ocean water sample collected from the SONGS Unit l outfall. Concentrations of the radionuclides in this sample were 11, 6, 380, and 430 pCi/l, respectively. Tritium was also detected in two of the ocean water samples collected in May 1980 from the SONGS Unit 2 outfall and from the Newport Beach control location.

Tritium was detected in one indicator ocean water sample was below the *a priori* LLD but above the *a posteriori* MDC. The data for all other SONGS related radionuclides at all other ocean water locations during the 2010 operational period were below both the *a priori* LLD and the lower *a posteriori* MDC. We conclude that the operation of SONGS had a negligible impact on the environment as measured by this sample medium.

E. Shoreline Sediments (Sand)

SONGS Units 2/3:

Beach sand is collected semiannually from three indicator locations and from a control location situated at Newport Beach. The samples are analyzed for naturally-occurring and plant-related radionuclides.

To assess the impact of SONGS operations on this environmental medium, preoperational data were compared to 2010 operational data. The radionuclide detected in shoreline sediment in the preoperational time frame was Cs-137 with a range of 0.012 to 0.022 pCi/g, averaging 0.019 in 5 sediment samples. One control sample with a Cs-137 activity of 0.032 pCi/g was observed in July 1979. The presence of Cs-137 in both control and indicator locations during the preoperational period leads to the conclusion that the root cause is external to SONGS and is most likely attributable to atmospheric nuclear weapons testing. No SONGS-related radionuclides were detected in shoreline sediment during the 2010 operational period. Thus the impact of SONGS on the environment as measured by the sample medium is considered to be negligible.

F. Ocean Bottom Sediments

SONGS Units 2/3:

During the preoperational and operational periods, representative samples of ocean bottom sediments were collected semiannually from each of the Station discharge outfalls and from a control station in Laguna Beach. The samples were analyzed for naturally occurring and SONGS related radionuclides. The results of the analyses are listed in Table D-1B.

SONGS-related radionuclides were also detected in samples collected during preoperational period. Manganese-54 (Mn-54) was detected in 5 of the 28 samples. The concentrations of Mn-54 in these samples ranged from 0.015 to 0.49 pCi/g, averaging 0.13 pCi/g. Cobalt-58 (Co-58) was detected in nine samples. The concentration of Co-58 in the samples ranged from 0.013 to 1.16 pCi/g, averaging 0.20 pCi/g. Cobalt-60 (Co-60) was measured in 15 of the 28 samples. The concentration of Co-60 in the sample ranged from 0.014 to 8.l pCi/g, averaging 0.79 pCi/g. Cs-137 was also detected in 16 of the 28 samples. The concentrations of Cs-137 in the samples ranged from 0.014 to 0.090 pCi/g, averaging 0.039 pCi/g. Cerium-144 (Ce-144) was found in two samples. The concentration of Ce-144 in the samples was 0.06 and 0.26 pCi/g, respectively.

The results indicate that there has not been a build-up of radionuclides with time in ocean bottom sediments near SONGS. The results also indicate notable decrease in the concentrations of plant-related radionuclides in the ocean bottom sediment. Although Co-58, Co-60, and Cs-137 are normally associated with nuclear power operations, preoperational study reveals no accumulation trend for these radionuclides, and no increase in levels for these radionuclides was detected during the operational period.

The concentration of station-related radionuclides in all ocean bottom sediment samples analyzed in 2010 was below the *a posteriori* MDC. We conclude that operation of SONGS Units 2/3 has had a negligible impact upon this environmental medium.

TABLE D-1A

SHORELINE SEDIMENTS CONCENTRATION (pCi/g, wet weight)
PREOPERATIONAL AND OPERATIONAL DATA*
SONGS UNITS 2/3

		INDICATOR		CONTROL	
Radionuclide**	**Period**	**Range**	**Average**	**Range**	**Average**
Cs-137	PreOp	0.012-0.022	0.019	<LLD-0.032	<LLD
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

TABLE D-1B

OCEAN BOTTOM SEDIMENTS CONCENTRATION (pCi/g, wet weight)
PREOPERATIONAL AND OPERATIONAL DATA*
SONGS UNITS 2/3

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	0.0150-0.49	0.129	<LLD	<LLD
Co-58	PreOp	0.013-1.160	0.199	<LLD	<LLD
Co-60	PreOp	0.014-8.100	0.788	<LLD	<LLD
Ag-110m	PreOp	<LLD-0.020	<LLD	<LLD	<LLD
Cs-137	PreOp	0.014-0.090	0.039	<LLD-0.043	<LLD
Cs-137	Operational	<LLD	<LLD	<LLD	<LLD
Ce-144	PreOp	0.060-0.260	0.160	<LLD	<LLD
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

***** **PreOp = January 1979 to July 1982; Operational - January to December 2010**
****** **During January to December 2010 all station related Radionuclides from all sample locations were < LLD**
LLD **Lower limits of detection for operational data are listed in Appendix B.**

G. Marine Species (Flesh)

SONGS Units 2/3:

Non-migratory marine species were collected semi-annually near SONGS to determine the amount of radioactivity that could be consumed by man or that was present in the food chain to man. Marine species caught by the SONGS outfalls and from Laguna Beach include two species of adult fish, crustacea and mollusks. Upon collection, the flesh portion is analyzed for gamma-emitting, radionuclides as specified in the ODCM. The results are subsequently reported as pCi/gram wet weight.

Results for several marine species for both the preoperational and 2010 operational periods for Units 2/3 are summarized in Table D-2. The marine species used for purposes of comparison include: sheephead (a fish), Blacksmith, black perch (a fish), bay mussel (a mollusk), spiny lobster (a crustacea), and keyhole limpet (a mollusk). Radionuclides analyzed but not included in Table D-2 were below the lower limits of detection for both the preoperational and operational periods.

During the 2010 operational period, no SONGS related radionuclides were detected at either the *a priori* LLD or the lower *a posteriori* MDC. The data indicate no accumulation trends. The operation of SONGS Units 2/3 in 2010 had no impact on the environment as measured by this sample medium.

TABLE D-2

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 2010 OPERATIONAL DATA (SONGS UNITS 2/3)*

Sheephead Flesh**

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Co-58	PreOp	0.016-0.030	0.023	<LLD	<LLD
Co-60	PreOp	0.005-0.044	0.017	<LLD	<LLD
Ag-110m	PreOp	<LLD-0.004	<LLD	<LLD	<LLD
Cs-137	PreOp	0.004-0.018	0.007	0.005-0.012	0.007
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

Black Perch Flesh**

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Co-58	PreOp	0.009-0.011	0.010	<LLD	<LLD
Co-60	PreOp	0.004-0.045	0.017	<LLD	<LLD
Ag-110m	PreOp	0.002-0.009	0.006	<LLD	<LLD
Cs-137	PreOp	0.003-0.015	0.008	0.004-0.014	0.009
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

***** **PreOp = January 1979 to July 1982; Operational = January to December 2010. The species collected in 2010 were California Mussel, Black Perch, Blacksmith, Sheephead, Sand Bass, and Spiny Lobster.**

****** **During January to December 2010 all station related Radionuclides from all sample locations were < LLD**

LLD **Lower limits of detection for operational data are listed in Appendix B.**

TABLE D-2

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 2010 OPERATIONAL DATA (SONGS UNITS 2/3)*

Mussel Flesh (Bay or California)**

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	0.009-0.025	0.017	<LLD	<LLD
Co-58	PreOp	0.008-0.080	0.028	--	--
Co-60	PreOp	0.005-0.40	0.077	<LLD	<LLD
Cs-137	PreOp	0.003-0.006	0.004	<LLD	<LLD
Ru-103	PreOp	<LLD-0.045	<LLD	<LLD	<LLD
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

Spiny Lobster Flesh**

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Co-58	PreOp	0.007-0.270	0.086	<LLD	<LLD
Co-60	PreOp	0.014-0.210	0.060	<LLD	<LLD
Cs-137	PreOp	0.005-0.011	0.008	0.040-0.015	0.008
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

*** PreOp = January 1979 to July 1982; Operational = January to December 2010. The species collected in 2010 were California Mussel, Black Perch, Blacksmith, Sheephead, Sand Bass, and Spiny Lobster.**

**** During January to December 2010 all station related Radionuclides from all sample locations were < LLD**

LLD Lower limits of detection for operational data are listed in Appendix B.

TABLE D-2

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 2010 OPERATIONAL DATA (SONGS UNITS 2/3)*

Sea Hare Flesh**

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Co-57	PreOp	0.006-0.017	0.009	<LLD	<LLD
Co-58	PreOp	0.006-12.4	1.233	<LLD	<LLD
Co-60	PreOp	0.016-2.000	0.448	0.003-0.027	0.013
Zn-65	PreOp	<LLD-0.10	<LLD	<LLD	<LLD
Ag-110m	PreOp	0.018-0.50	0.138	0.020-0.039	0.030
Cs-137	PreOp	<LLD-0.004	<LLD	<LLD-0.005	<LLD
All other measured	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	---	---	---	---

Keyhole Limpet (Flesh)**

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Co-58	PreOp	0.007-0.101	0.054	<LLD-0.190	<LLD
Co-60	PreOp	0.021-0.040	0.033	<LLD-0.022	0.022
Ag-110m	PreOp	0.033-0.101	0.054	0.005-0.042	0.022
Cs-137	PreOp	<LLD	<LLD	<LLD-0.005	<LLD
All other measured	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related Radionuclides	Operational	---	---	---	---

***** **PreOp = January 1979 to July 1982; Operational = January to December 2010**

****** **Sea Hare and Keyhole Limpet samples were not collected in 2010**

LLD **Lower limits of detection for operational data are listed in Appendix B.**

H. Local Crops

SONGS Units 2/3:

In the preoperational period of January 1979 through July 1982, Sr-90 was detected in the control samples of kale, parsley, and squash. Naturally occurring K-40 was detected in cucumber, kale, and tomato samples from the indicator and control locations. Ce-144 and Zr-95 were detected in one sample of parsley at the control location at concentrations of 0.12 and 0.09 pCi/g, wet weight respectively.

In the 2010 operational period, only naturally occurring radionuclides were detected in the crop samples. The operation of SONGS had no impact on the environment as measured by this sample medium.

I. Soil

SONGS Units 2/3:

A comparison of operational and preoperational data does not reveal any accumulation pattern of SONGS related isotopes in soil. The intermittent detection of Cs-137 in both indicator and control locations is due to residual fallout from atmospheric nuclear weapons testing.

J. Kelp

SONGS Units 2/3:

Kelp is collected semiannually from three indicator locations and from a control location situated in Laguna Beach. After collection, the samples are analyzed by gamma-spectral analysis for naturally-occurring and SONGS-related radionuclides. During 2010 four additional control sample locations were analyzed.

To assess the impact of SONGS operations on kelp, preoperational data were compared to 2010 operational data in Table D-4. Radionuclides detected during the preoperational period for SONGS Units 2/3 include Mn-54, Co-60, Zr-95, I-131, and Cs-137.

During the 2010 operational period, I-131 was detected in most samples. No other station related isotopes were detected in kelp samples during the 2010 operational period. Figure 4 (I-131 in Kelp) shows a close correlation between indicator and control sample locations over an extended period of time.

Although I-131 activity has been randomly detected in kelp since 1977, there is no evidence that the concentration of I-131 or other station related radionuclides in kelp is increasing near SONGS. I-131 in kelp is due to the sewer release of medical administrations, since it has been detected consistently in control as well as indicator locations. Since 1988 the concentration of I-131, when detected, has typically been highest at the control locations. These data support the conclusion that during the Units 2/3 operational period, the detection of I-131 in kelp is due to factors external to SONGS.

K. Drinking Water

No plant related radionuclides were detected during the 2010 operational period. Gross beta activity was detected during both the operational and preoperational periods at both the indicator and the control locations. No trends have been noted. There is no drinking water pathway for SONGS. The operation of SONGS had no impact on the environment as measured by this sample medium.

TABLE D-3
SOIL PREOPERATIONAL AND OPERATIONAL DATA* (pCi/g, dry weight)
SONGS UNITS 2/3

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Sr-90	PreOp	0.02-0.08	0.044	<LLD-0.03	<LLD
Cs-137	PreOp	0.02-0.20	0.096	<LLD-0.06	<LLD
Cs-137	Operational	< LLD-0.393	0.111	0.267	0.267
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

TABLE D-4
KELP PREOPERATIONAL AND OPERATIONAL DATA* (pCi/g, wet weight)
SONGS UNITS 2/3

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD-0.005	<LLD	<LLD	<LLD
Co-60	PreOp	0.006-0.009	0.008	<LLD	<LLD
Zr(Nb)-95	PreOp	0.014-0.090	0.046	0.018-0.053	0.036
I-131	PreOp	0.006-0.024	0.013	0.008-0.030	0.014
I-131	Operational	< LLD– 0.080	0.028	< LLD – 0.176	0.045
Cs-137	PreOp	0.004-0.009	0.006	<LLD	<LLD
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

* **PreOp = January 1979 to July 1982; Operational = January to December 2010**
LLD Lower Limit of Detection for operational data are listed in Appendix B.

APPENDIX E

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

IN 2010

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

Deviations from the ODCM sampling requirements are identified below in accordance with section 5.0 of the ODCM. The performance standard for environmental data collection of 95% was met for all sample types. During 2010, the ODCM specified *a priori* LLD was achieved for most REMP samples. Deviations from the ODCM were associated with external factors not within the control of REMP personnel such as limited availability of marine samples at the locations specified in the ODCM. The 2010 ODCM deviations had no meaningful impact on the REMP database and did not compromise the validity of the reported conclusions.

PART I TERRESTRIAL SAMPLING

A WEEKLY AIR SAMPLING

Downtime for each air sampler in 2010 due to weekly sample collection, annual preventive maintenance (PM), and the annual gas meter change out was approximately 46 minutes for each sampler.

Weekly Change out:	Approximately 0.5 minutes x 52 = 26 minutes
Annual PM:	Approximately 15 minutes
Annual Gas Meter change out:	Approximately 5 minutes

Down times in excess of 1 hour are described below for each ODCM required air sample.

Air Sampler 1 (City of San Clemente): No deviations were observed.

Air Sampler 9 (State Beach Park): Sampler # 9 had 10.6 hours of down time in 2010 due to external factors (heavy rain and electrical power outages).

Air Sampler 12 (Former SONGS Evaporation Pond): No deviations were observed

Air Sampler 13 (Camp Pendleton East): Sampler # 13 had 191.4 hours of down time in 2010 due to rain and an associated electrical power outage.

Air Sampler 15 (Oceanside Control): No deviations were observed.

Summary of Air Sampler Corrective Actions

The useful life of the vacuum pump motor assemblies is estimated to be five years based on the recommendation of the manufacturer and upon experience. If the internal components (motor and control valve) are replaced the useful life may be extended. During 2010 the REMP air samplers experienced no down time attributable to motor or vacuum pump assembly failure. Thus there were no avoidable air sampler deviations from the ODCM during 2010.

B. DIRECT RADIATION

TLD # 33 was not on station for the first quarter 2010 due to Camp Pendleton electrical power line work.. TLD # 46 sample collection was missed during the second quarter 2010 collection evolution (nuclear notification 201014970).

C. LOCAL CROPS

No deviations were observed.

D. SHORELINE SEDIMENTS

No deviations were observed.

E. DRINKING WATER

No deviations were observed.

F. SOIL

No deviations were observed.

PART II MARINE SAMPLING

A. NON-MIGRATORY MARINE ANIMALS

Samples were collected from the specified ODCM sample location when samples were available at that location. When the specified sample type was not available at the ODCM listed location, alternate locations were selected based on sample availability and proximity to the specified sample location. All indicator samples were obtained within two miles of the associated outfall. In some cases the indicator species is not the same as the control species due to limited availability at the indicator location. Most non-migratory marine species samples were not available at the locations specified in the ODCM. All indicator marine animal samples were collected within 2 miles of the Units 2 & 3 discharge diffusers.

B. OCEAN WATER SAMPLING

No deviations were observed.

C. OCEAN BOTTOM SEDIMENTS

No deviations were observed.

APPENDIX F

LAND USE CENSUS

INTRODUCTION

Southern California Edison conducted the annual 2010 Land Use Census (LUC) in accordance with section 5.2 of the ODCM. The purpose of the LUC is to identify important radiological exposure pathways to humans. The LUC identifies the nearest residences, milk animals, meat animals, gardens of at least 500 square feet that produce fleshy or leafy vegetables, and other specified uses (campgrounds, employment, etc.) in each of the meteorological landward sectors within five miles of SONGS. Results are summarized in Table F-1, F-2, and F-3 at the end of this appendix.

THE STUDY AREA

The study area includes half of the city of San Clemente (population estimated at 68,763 as of January 1, 2010), the San Clemente State Park, U.S. Marine Corps Base Camp Pendleton (MCB), San Onofre State Beach and Park, the San Clemente Ranch (now known as Seaview Farm), the former U. S. Coast Guard Station at San Mateo Point, and SONGS.

METHODOLOGY

A review of the 2010 LUC and documentation notebook was conducted. Verification and revision of the 2010 data was accomplished by inquiry to the cognizant agency, organization, or individual possessing direct knowledge of the item being verified.

The garden census was performed by examining aerial photographs taken. The photographic image areas which appeared to correspond to likely garden locations were converted to street addresses. The corresponding residences were observed from the nearest public road to determine if a garden was present. If the entire property was not visible from the street then a garden was assumed to be present.

The closest residence was established in each sector by correspondence with cognizant authorities (City of San Clemente Planning Department and USMC Camp Pendleton). The meat and milk animal survey was performed by contacting the natural resources office on Camp Pendleton, the Orange County Agricultural Commissioner, and the County of San Diego Department of Agriculture. Information on other uses was obtained by contacting the appropriate organizations.

DEFINITIONS

Residence is defined as any structure (single-family house, apartment, mobile home, barracks or similar unit) occupied by individual(s) for three months (2,000 hours) or longer per year.
Other Specified Use is defined as a location occupied by members of the general population as other than their primary residence. The use is divided into two categories: employment and non-employment related.

Employment use is defined as a location occupied by members of the general population engaged in normal work activities regardless of the length of time spent at the location, and regardless of its permanence, including concession stands, restaurants, markets and guard shacks.

Non-employment-related use is defined as a location occupied by members of the general population who are not engaged in normal work activities, including campgrounds, temporary housing, time-share condominiums, motels, hotels, schools and beaches.

Milk animals include, but are not limited to cows, goats and sheep, whose milk is used in dairy products for human consumption.

Meat animals include, but are not limited to deer, other game animals, cattle, goats and sheep, whose meat is used for human consumption.

Leafy vegetables include, but are not limited to lettuce, cabbage, collard greens, Bok choi, sorrel, and spinach.

Fleshy vegetables include, but are not limited to tomatoes, cucumbers, cauliflower, squash, beans, zucchini, and sweet corn.

SUMMARY OF CHANGES

Summary of Changes

1. San Onofre III housing was completed and occupied in February 2009, and was occupied for approximately 11 months during 2009. In 2010 San Onofre III housing was a full time residence all year. This is the closest permanent structure residence for all age groups in Sectors P and Q.
2. LUC # R-R3 – Camp Mesa Dry Camping had an estimated occupancy of 2808 hours in 2010.
3. The San Onofre State Beach campground was occupied by two surf camps in 2010. LUC # O-2B YMCA surfcamp occupied camping spaces at San Onofre State Beach Camp Ground for part of the summer of 2010. LUC # O-2A Endless Summer Surf Camp also occupied camp sites during the summer of 2010.
4. A construction site for new barracks was identified in Sector C. The occupancy is 1500 hours for 2010.
5. Occupancies for LUC # R-A1 and R-R2 (Songs Camp Mesa) changed to an FTR (full time residence) in 2010.
6. The total hours of occupancy changed for LUC # 31A (Border Patrol checkpoint).
7. The total hours of occupancy changed for LUC #O-9 (USMC CP Sanitary Landfill).

TABLE F-1
2010 SONGS Units 2/3 LUC Five-Mile Radius Summary Sheet

Units 2/3 Sector	LUC #	Residence	Miles From U2/3	Estimated Hours of Maximum Occupancy
A	R-A1	Camp San Mateo	3.6	FTR
	R-A2	SONGS Camp Mesa	0.4	**FTR**
B				
C	R-C2	Camp San Onofre Fire Station	2.4	3,744
	R-C1	Camp San Onofre Barracks 524101	2.8	FTR
D	R-D1	Camp San Onofre Barracks	3.0	FTR
E	R-E1	Camp Horno Barracks	4.1	FTR
F				
G				
	Sectors H, J, K, L,M, and N have no identified land uses These Sectors are primarily the Pacific Ocean and contain only a small portion of the plant site, and a beach walkway providing access for state beach park users north & south of SONGS.			
P	R-P3	San Onofre Rec Beach (SORB)	1.0	FTR
	R-P2	San Mateo Point Housing	2.7	FTR
	R-P1	Cotton Point Estates	2.7	FTR
Q	R-Q5	SORB Resident Employee	1.1	FTR
	R-Q2	**San Onofre III housing**	1.4	**FTR**
	R-Q3	San Mateo Point Housing	2.7	FTR
R	R-R2	SONGS Camp Mesa	0.4	**FTR**
	R-R3	SONGS Dry Camping PL12	0.7	**2808**
	R-R1	**San Onofre III housing**	1.3	**FTR**

Bolt Text indicates changes from 2009 LUC Data as of 10-1-2010 FTR – Full Time Residence

TABLE F-2
2010 SONGS Units 2/3 LUC Five-Mile Radius Summary Sheet

Units 2/3 Sector	LUC #	Gardens	Miles From U2/3
A			
B			
C			
D			
E			
F			
G			
	Sectors H, J, K, L,M, and N have no identified land uses These Sectors are primarily the Pacific Ocean and contain only a small portion of the plant site, and a beach walkway providing access for state beach park users north & south of SONGS.		
P	G-3	Cotton Point Estate	2.8
Q	G-8	2240 Ave Salvador	4.1
	G-5	1706 S Ola Vista	4.4
	G-6	1315 S Ola Vista	4.6
R	G-10	SONGS Garden	0.4

Bolt Text indicates changes from 2009 LUC Data as of 10-1-2010 FTR – Full Time Residence

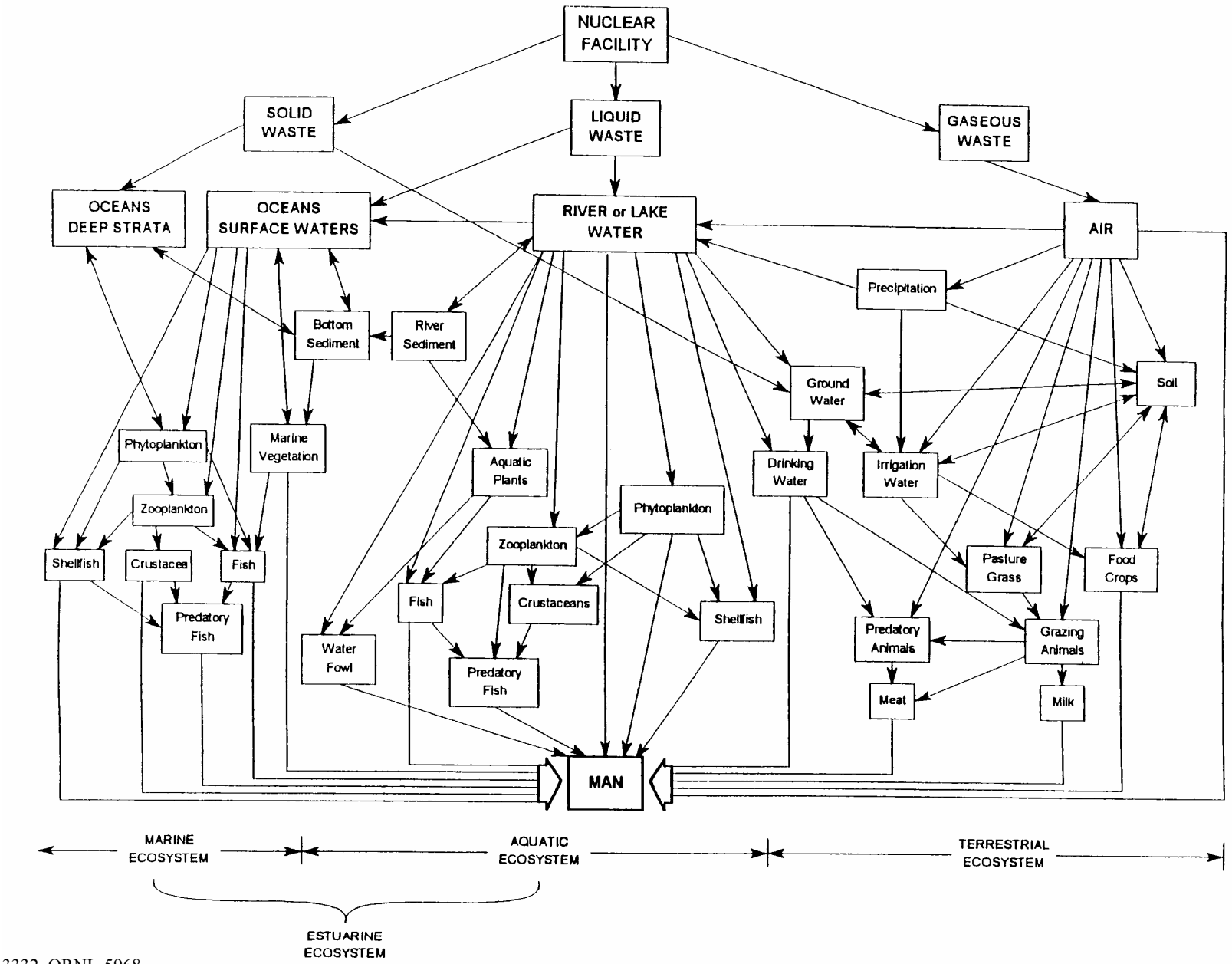
TABLE F-3
2010 SONGS Units 2/3 LUC Five-Mile Radius Summary Sheet

Units 2/3 Sector	LUC #	Other Specified Uses	Miles From U2/3	Estimated Hours of Maximum Occupancy
A	O-8	Camp San Mateo Motor Pool	3.6	2,000
	22	SCE Land Uses	0.4	---
B	O-9	USMC CP Sanitary Land Fill	2.1	**192**
C	O-10	Camp San Onofre (STP #11)	2.2	2,000
		Camp San Onofre construction site (barracks)	**2.6**	**1500**
D				
E	O-5	Camp Horno Motor Pool	4.0	2500
F	O-1	San Onofre State Beach Guard Shack	0.8	1,500
	31A	Border Patrol Checkpoint (NB)	1.9	**2400**
	31B	Hwy Patrol Weigh Sta (NB)	2.1	1,960
G	O-2	San Onofre Beach Campground	1.8	720
	32	Hwy Patrol Weigh Sta (SB)	2.1	1,960
	O-2A	Surf Camp Employees / Campground Host	2.8	4,380
	O-2B	**YMCA Surf Camp**	**2**	**864**
	Sectors H, J, K, L,M, and N have no identified land uses These Sectors are primarily the Pacific Ocean and contain only a small portion of the plant site, and a beach walkway providing access for state beach park users north & south of SONGS.			
P	O-6	Surf Beach (Lifeguard)	0.5	800
	3	Trestles Beach Lookout Tower	1.8	500
Q	O-3	State Park Office Trailer	0.6	2,000
	5	Surf Beach Guard Shack	0.7	1,500
	18	SORB Lifeguard Tower	1.2	2,000
	1A	SORB Campground Checkin	1.3	2000
R				

Bolt Text indicates changes from 2009 LUC Data as of 10-1-2010 FTR – Full Time Residence

APPENDIX G

FIGURES FOR 2010



NuReg/CR-3332, ORNL-5968,
"Radiological Assessment"

Figure 1. Potential Radiation Exposure Pathways Leading to Man

Direct Radiation Monitoring 1981 to 1999
Quarterly Environmental TLD measurements in mR
Selected TLDs located very close to SONGS vs. Selected CONTROL TLDs

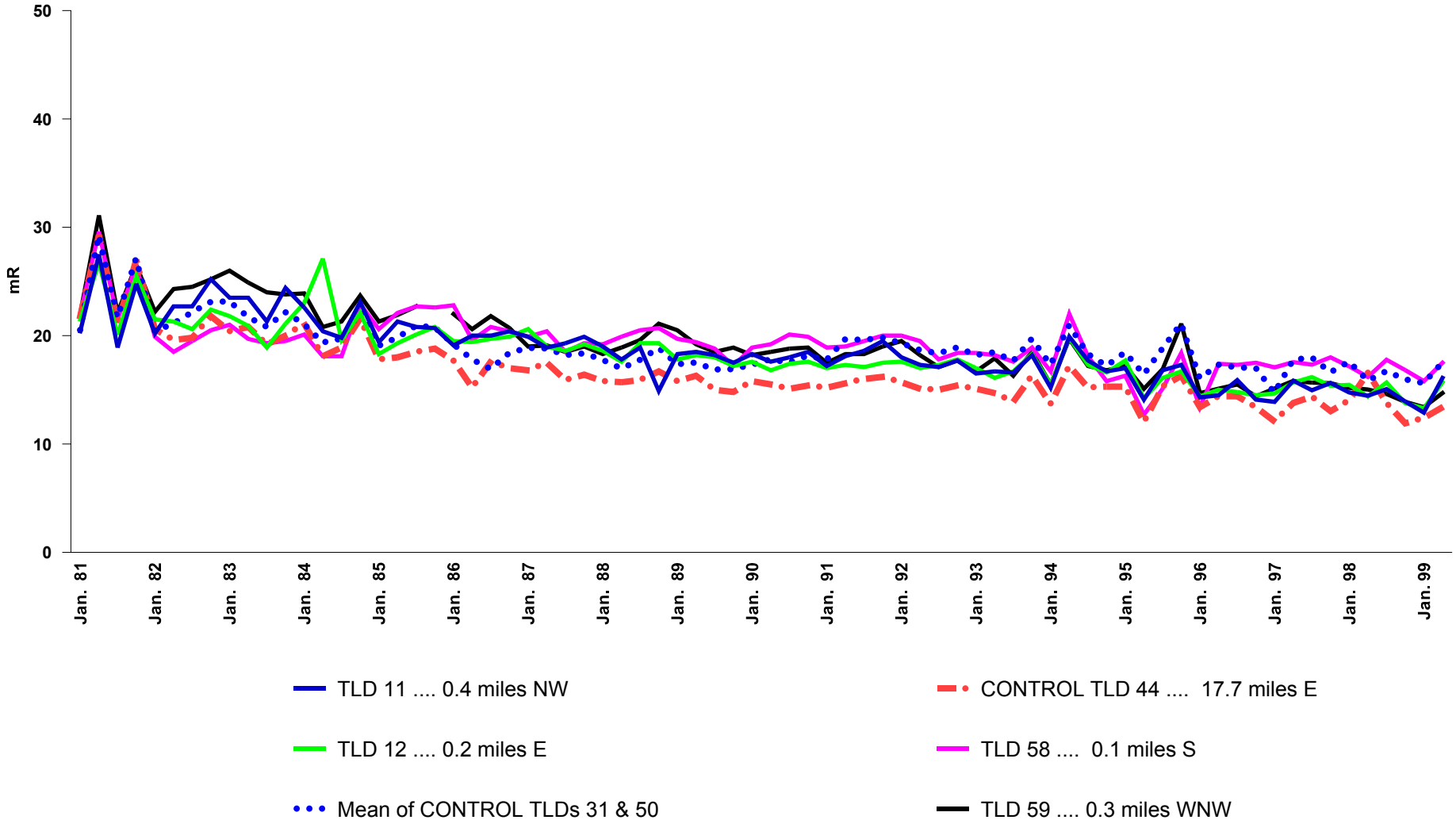


Figure 2A

Direct Radiation Monitoring 1998 to 2010
Quarterly Environmental TLD measurements in mR
Selected TLDs located very close to SONGS vs. Selected CONTROL TLDs

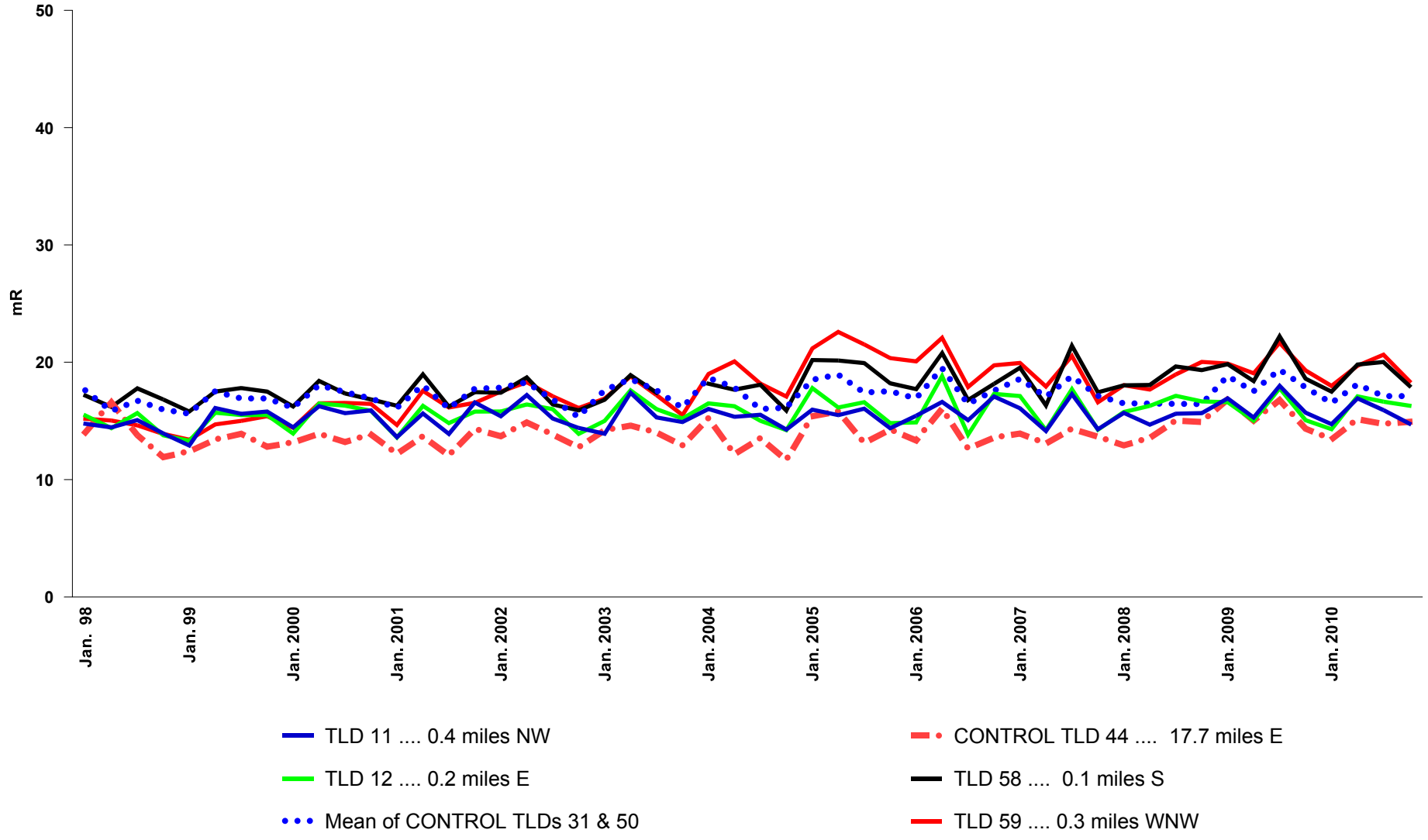


Figure 2B

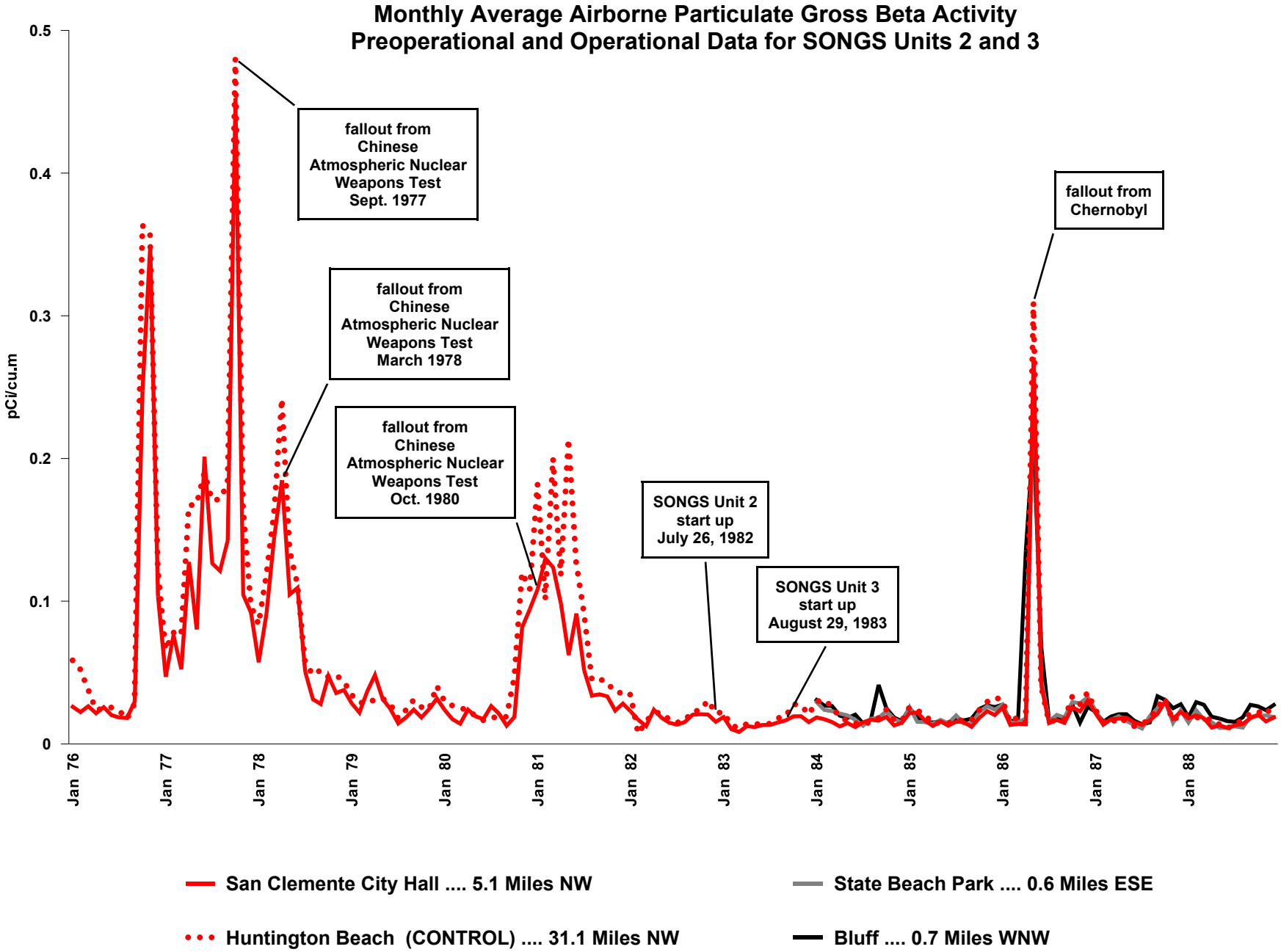

Monthly Average Airborne Particulate Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
pCi/cu.m
0.5
0.4
0.3
0.2
0.1
0
fallout from Chinese Atmospheric Nuclear Weapons Test Sept. 1977
fallout from Chinese Atmospheric Nuclear Weapons Test March 1978
fallout from Chinese Atmospheric Nuclear Weapons Test Oct. 1980
SONGS Unit 2 start up July 26, 1982
SONGS Unit 3 start up August 29, 1983
fallout from Chernobyl
Jan 76
Jan 77
Jan 78
Jan 79
Jan 80
Jan 81
Jan 82
Jan 83
Jan 84
Jan 85
Jan 86
Jan 87
Jan 88
San Clemente City Hall .... 5.1 Miles NW
State Beach Park .... 0.6 Miles ESE
Huntington Beach (CONTROL) .... 31.1 Miles NW
Bluff .... 0.7 Miles WNW

Figure 3A

Monthly Average Airborne Particulates Gross Beta Activity
SONGS Units 2 and 3 from January 1988 to December 1997

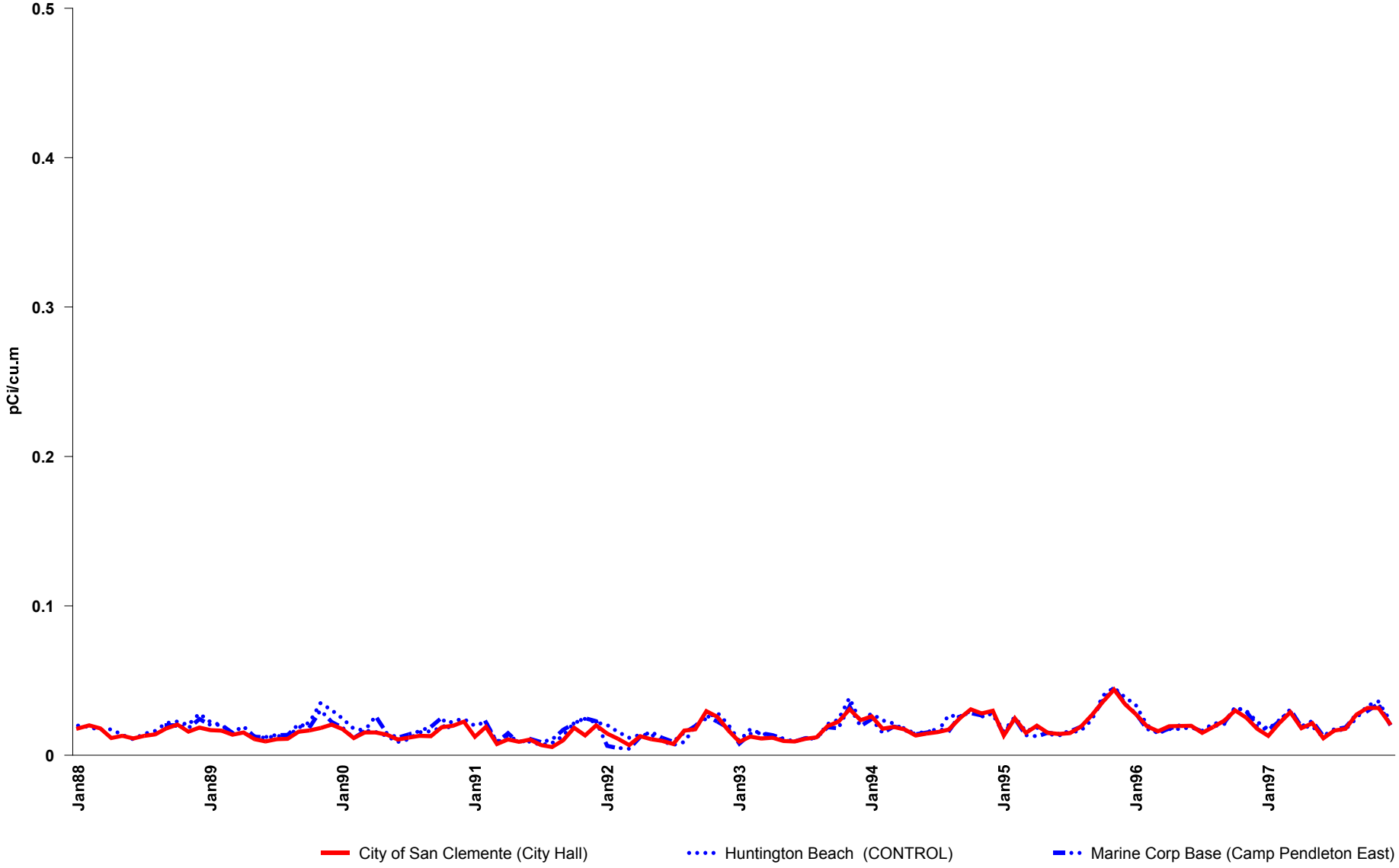


Figure 3B

Monthly Average Airborne Particulates Gross Beta Activity SONGS Units 2 and 3 January 1998 to to December 2010

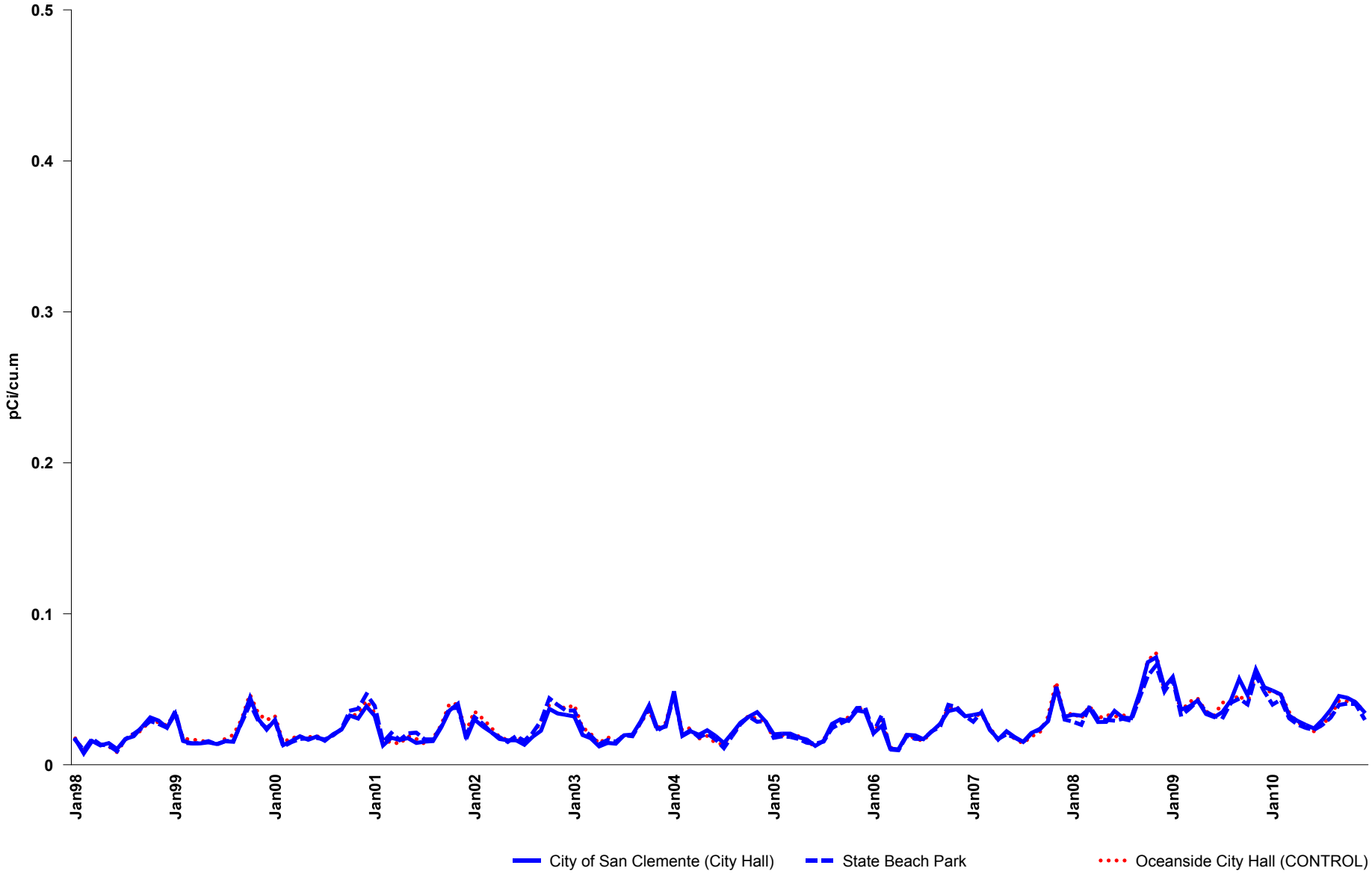


Figure 3 C

Weekly Airborne Particulate Gross Beta Activity
January to December 2010

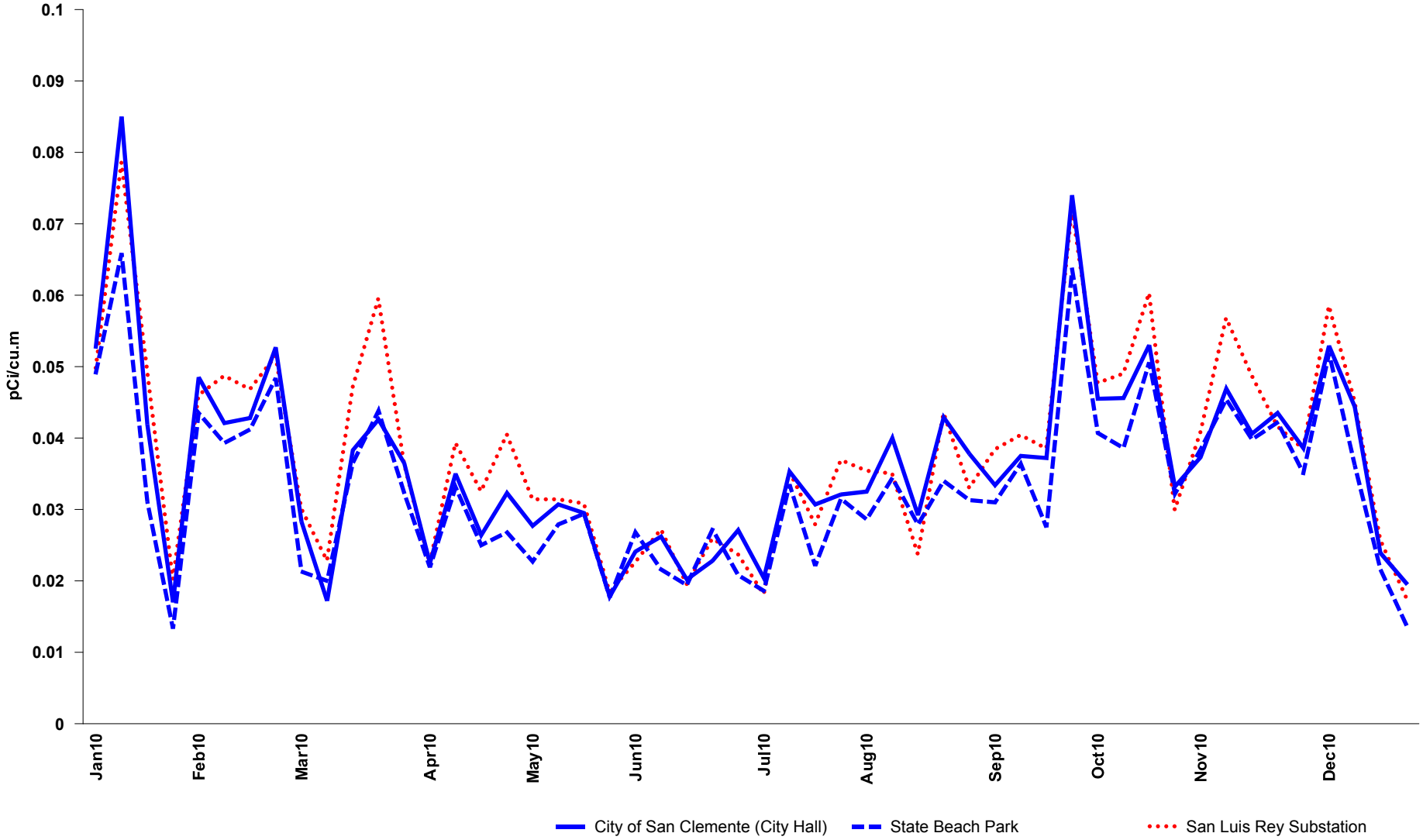


Figure 3D

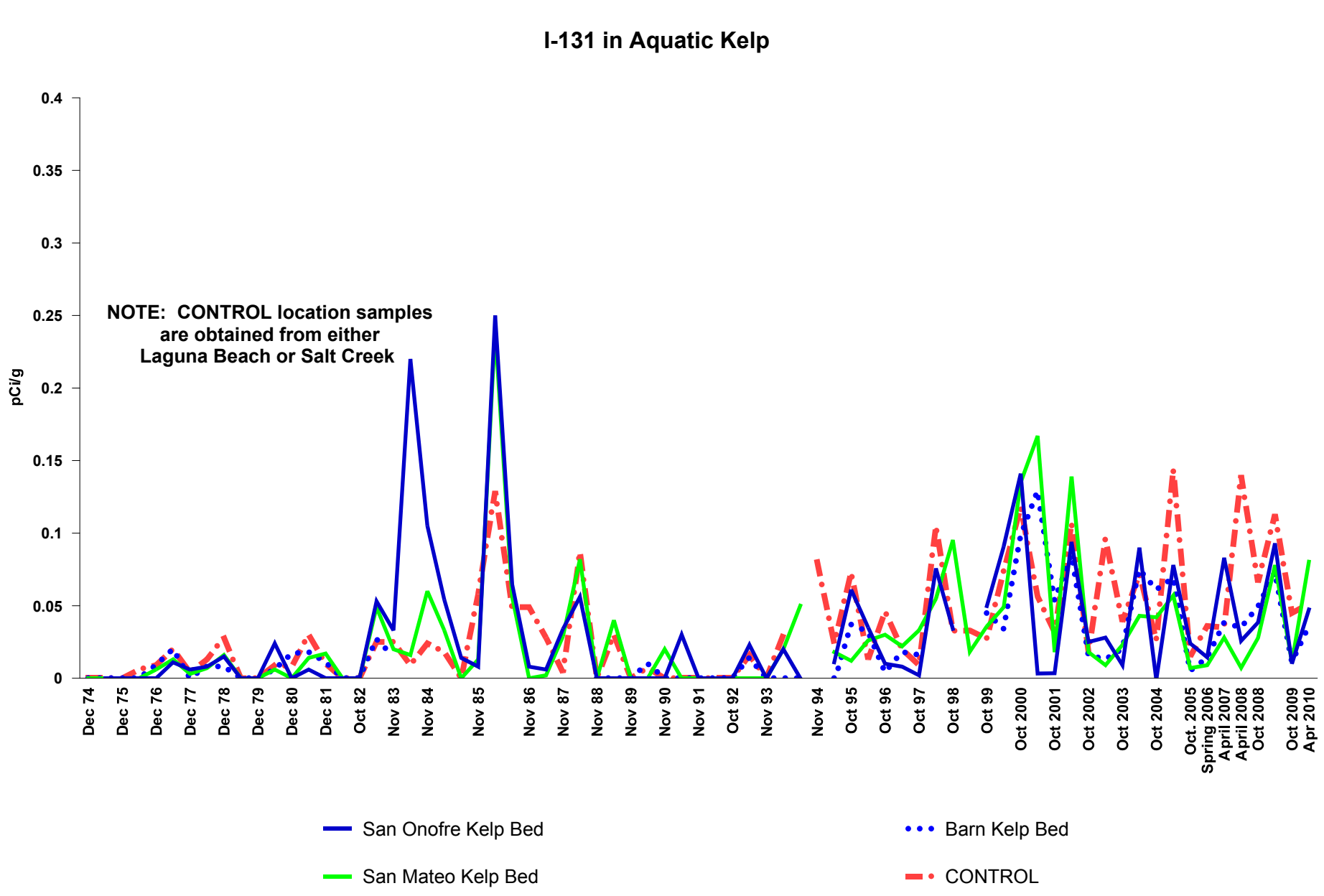

I-131 in Aquatic Kelp
NOTE: CONTROL location samples are obtained from either Laguna Beach or Salt Creek
pCi/g
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Dec 74
Dec 75
Dec 76
Dec 77
Dec 78
Dec 79
Dec 80
Dec 81
Oct 82
Nov 83
Nov 84
Nov 85
Nov 86
Nov 87
Nov 88
Nov 89
Nov 90
Nov 91
Oct 92
Nov 93
Nov 94
Oct 95
Oct 96
Oct 97
Oct 98
Oct 99
Oct 2000
Oct 2001
Oct 2002
Oct 2003
Oct 2004
Oct. 2005
Spring 2006
April 2007
April 2008
Oct 2008
Oct 2009
Apr 2010
San Onofre Kelp Bed
Barn Kelp Bed
San Mateo Kelp Bed
CONTROL

Figure 4

APPENDIX H

ERRATA TO THE 2009 AREOR

All data required by the ODCM in 2009 was reported in the 2009 AREOR. There are no errata to be appended to the 2009 AREOR.

APPENDIX I

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2010

APPENDIX I

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2010

Requirements in the standard Technical Specifications adopted under the Technical Specifications Improvement Program include reporting results of those thermoluminescent dosimeters (TLDs) that are co-located with NRC dosimeters. The NRC no longer deploys TLDs in the environs of SONGS. Some SCE TLDs are located adjacent to the former NRC TLD locations and these SCE TLDs are listed below.

California Department of Public Health (DPH) also maintains a TLD program in the environs of SONGS.

The below listed quarterly TLD data is from the SCE TLDs adjacent to the DPH TLD programs. The NRC location numbers refer to the locations in the old NRC program.

2010 Data from SCE TLDs (mR/ standard quarter)

Location Number	Location Name	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
SCE -1 , NRC -7, DPH #2	San Clemente	16.1	19.1	17.6	17.6
SCE -2, NRC -23, DPH #8	Camp San Mateo	17.1	19.1	18.8	17.6
SCE -3, NRC -19, DPH #9	Camp San Onofre	15.0	17.0	17.1	15.5
SCE -6, DPH #10	Old Route 101 (East-Southeast)	10.2	12.6	11.4	11.9
SCE 10, NRC -12, DPH #6	San Onofre Surfing Beach	15.1	16.8	16.4	15.1
SCE 16, DPH #7*	ESE Site boundary	16.8	18.4	19.6	19.2
SCE 22, NRC 11, DPH #4	Coast Guard Station	15.8	19.0	18.0	17.1
SCE -34, NRC -14, DPH #5	San Onofre Elementary School	14.8	17.1	15.7	15.7
SCE 41, NRC 25, DPH #11**	Old Route 101 (Unit 3)	14.3	16.2	15.4	15.5
SCE 50, NRC 32, DPH #13	Oceanside Fire Station	16.1	16.5	16.0	16.7

* SCE 16 is approximately 15 meters from DPH 7. DPH 7 is across Basilone Rd

** SCE 41 is approximately 120 meters from DPH 11. Results included per DPH request

Appendix J

ISFSI (Independent Spent Fuel Storage Installation) TLD Data

ISFSI (Independent Spent Fuel Storage Installation) TLD Data

Per 10 CFR 72.126, SONGS implemented an area monitoring TLD program in the vicinity of the ISFSI. In the fourth quarter of 2001, 21 pre-operational TLDs were deployed in the area around the ISFSI foundation then under construction. The pre-operational TLDs data are compared to the data obtained after the commencement of used fuel storage in the ISFSI for the purposes of estimating the additional exposure potentially attributable to the operation of the ISFSI.

An evaluation of the entire REMP TLD database yielded estimated background exposure rate of approximately 15 mR / std quarter. However, some local variability within the CAB / EAB are to be attributable to factors external to SONGS (such as micro-geological variations). Another variable for the measured exposure rate is transit exposure to and from the TLD lab. The transit exposure is variable and is corrected by the lab but the issue of TLD shipment packaging geometry can not be readily corrected. Therefore, a comparison of pre-operational data and operational data needs to be considered in conjunction with a comparison of ISFSI TLD data and the background exposure rate estimate. Using this information, we conclude that the exposure rate at the CAB (10 CFR 72 Controlled Area Boundary) is less than detectable. The detection limits are 5 mR per standard quarter and 10 mR per year. The exposure attributable to the operation of the ISFSI as indicated by this media is not measurable beyond the immediate area of the ISFSI.

During the fourth quarter 2010 the storage of the original Steam Generators from Unit 3 near the ISFSI in the NIA (North Industrial Area) elevated the exposure rate measurably in the immediate area of the ISFSI. The original steam generators did not affect the exposure rate at the CAB/ EAB.

Environmental exposure rates are variable. The REMP TLD data show a seasonal variability that does not appear to be related to any activities at SONGS. The data from the REMP indicator and control TLDs behave in a synchronous manner. The data support the conclusion that macro-environmental factors are the causative agents for the seasonal variations. Refer to Figure 2a and 2b. The ISFSI TLD data gathered to date appears to follow a similar seasonal variability. Refer to Figures 6-1, 6-2, and 6a. In addition to environmental factors, some non-ISFSI work activities at Unit 1 have elevated the pre-operational measured ISFSI TLD exposure. The storage and transport of radioactive materials and waste near the location of the ISFSI foundation area in 2001 and 2002 appears to have elevated the exposure rates of TLDs 306 to 315. In addition, the removal of the Unit 1 reactor vessel in October 2002 caused a noticeable increase in the measured exposure for TLDs 301 to 315. The measured exposure rate for the ISFSI TLDs close to the ISFSI is consistent with the exposure rate expected from known radiological work activities. The elevated exposure rate from TLDs 302, 325, and 326 is due to the movement and storage of used fuel at the ISFSI.

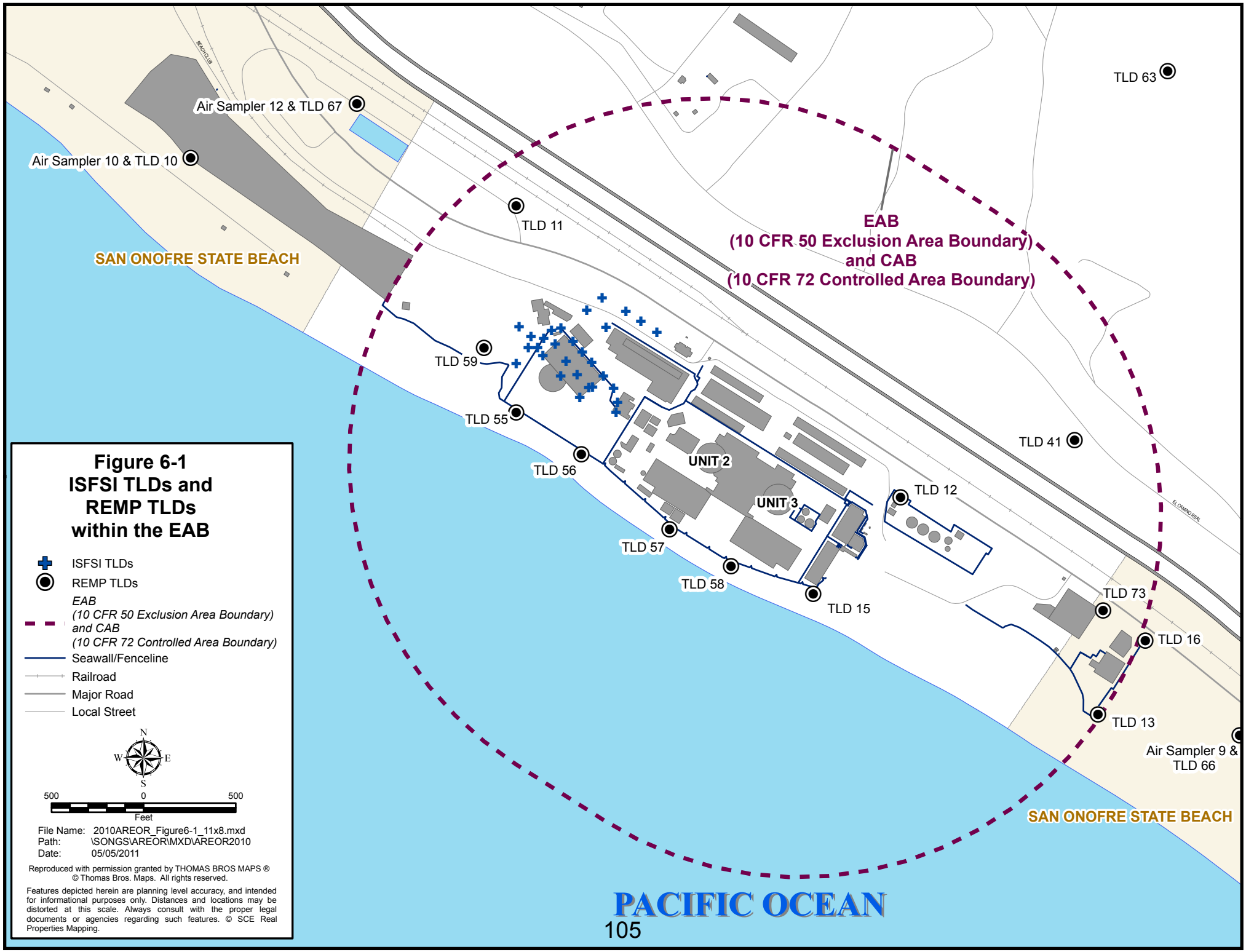
In the fourth quarter 2008, 5 TLDs were placed on the perimeter fence northeast, west, and southwest of the ISFSI module. These TLDs (322, 323, 324, 325, and 326) showed the highest measured exposure in 2010. The closest publicly accessible location is SW of the ISFSI along the San Onofre Beach access road. The background corrected annual exposure for the access road TLDs 55 and 56 was 13 and 14 mR in 2010. Assuming a maximum occupancy of 300 hours per year the dose to a member of the general public is < 1 mrem per year at this location as measured by the REMP TLDs.

Starting in the fourth quarter 2009 neutron dosimeters were placed in ISFSI TLD canisters 311, 324, 325, and 326. These TLDs shows that neutron exposure is below measurable levels for spent fuel in storage. Neutron exposure during fuel transfer is measurable at the fence surrounding the storage facility at low levels, typically a few mR per quarter. These measurements demonstrate that the neutron exposure is bounded by the projected neutron dose rates in calculation SCE-23-0508, is well within the limits specified in 10CFR72.104, and is consistent with known ISFSI radiological conditions. The measured ISFSI gamma TLD exposure rates were also determined to be consistent with the calculated ISFSI dose rates and known radiological conditions.

We conclude that exposure attributable to the storage of used fuel in the ISFSI is not measurable beyond the immediate area of the ISFSI and is well below regulatory limits.

ISFSI TLD DATA

Location	Quarterly Background	2010 Quarterly Results (mR) 1	2	3	4	Background adjusted 2010 Quarterly Results (mR) 1	2	3	4	Annual Baseline	2010 Annual Total (mR)	2010 Total
ISFSI 301	15.0	23.8	23.4	22.5	24.4	8.8	8.4	7.5	9.4	60.0	94.1	34.1
ISFSI 302	15.0	43.4	38.8	38.9	40.3	28.4	23.8	23.9	25.3	60.0	161.4	101.4
ISFSI 303	15.0	38.6	35.7	33.1	32.1	23.6	20.7	18.1	17.1	60.0	139.5	79.5
ISFSI 304	15.0	32.7	30.9	29.9	29.2	17.7	15.9	14.9	14.2	60.0	122.7	62.7
ISFSI 306	15.0	24.7	27.0	25.7	23.9	9.7	12.0	10.7	8.9	60.0	101.3	41.3
ISFSI 307	15.0	20.0	21.3	21.4	20.0	<LLD	6.3	6.4	<LLD	60.0	82.7	22.7
ISFSI 308	15.0	20.5	21.6	20.7	19.5	5.5	6.6	5.7	<LLD	60.0	82.3	22.3
ISFSI 309	15.0	18.7	20.8	21.0	17.9	<LLD	5.8	6.0	<LLD	60.0	78.4	18.4
ISFSI 310	15.0	17.8	20.9	20.1	18.1	<LLD	5.9	5.1	<LLD	60.0	76.9	16.9
ISFSI 311	15.0	17.3	19.9	19.1	17.8	<LLD	<LLD	<LLD	<LLD	60.0	74.1	14.1
ISFSI 312	15.0	13.0	15.1	16.8	13.3	<LLD	<LLD	<LLD	<LLD	60.0	58.2	<LLD
ISFSI 314	15.0	17.2	17.6	17.7	16.5	<LLD	<LLD	<LLD	<LLD	60.0	69.0	<LLD
ISFSI 315	15.0	16.8	18.9	17.4	18.0	< LLD	<LLD	<LLD	<LLD	60.0	71.1	11.1
ISFSI 316	15.0	17.6	17.3	17.6	17.8	<LLD	<LLD	<LLD	<LLD	60.0	70.3	10.3
ISFSI 317	15.0	17.9	18.9	19.7	17.5	<LLD	<LLD	<LLD	<LLD	60.0	74.0	14.0
ISFSI 318	15.0	18.0	18.5	18.8	17.7	<LLD	<LLD	<LLD	<LLD	60.0	73.0	13.0
ISFSI 319	15.0	17.7	19.2	18.6	17.7	<LLD	<LLD	<LLD	<LLD	60.0	73.2	13.2
ISFSI 320	15.0	17.6	18.9	18.3	17.7	<LLD	<LLD	<LLD	<LLD	60.0	72.5	12.5
ISFSI 321	15.0	18.2	19.3	19.3	18.1	<LLD	<LLD	<LLD	<LLD	60.0	74.9	14.9
ISFSI 322	15.0	18.1	20.2	17.9	18.2	<LLD	5.2	<LLD	<LLD	60.0	74.4	14.4
ISFSI 323	15.0	19.5	20.2	20.0	22.1	<LLD	5.2	<LLD	7.1	60.0	81.8	21.8
ISFSI 324	15.0	33.3	35.6	31.3	35.0	18.3	20.6	16.3	20.0	60.0	135.2	75.2
ISFSI 325	15.0	112.4	103.0	101.4	94.9	97.4	88.0	86.4	79.9	60.0	411.7	351.7
ISFSI 326	15.0	41.8	44.1	40.2	38.2	26.8	29.1	25.2	23.2	60.0	164.3	104.3
55 San Onofre State Beach (U1 West)	15.0	16.8	18.9	18.0	19.5	<LLD	<LLD	<LLD	<LLD	60.0	73.2	**13.2**
56 San Onofre State Beach (U1 West)	15.0	17.7	19.1	19.0	18.5	<LLD	<LLD	<LLD	<LLD	60.0	74.3	**14.3**
57 San Onofre State Beach (Unit 2)	15.0	18.8	20.7	19.6	19.0	<LLD	**5.7**	<LLD	<LLD	60.0	78.1	**18.1**
59 SONGS Meteorological Tower	15.0	18.0	19.7	20.6	18.4	<LLD	<LLD	**5.6**	<LLD	60.0	76.7	**16.7**


Air Sampler 12 & TLD 67
Air Sampler 10 & TLD 10
TLD 63
TLD 11
SAN ONOFRE STATE BEACH
EAB
(10 CFR 50 Exclusion Area Boundary)
and CAB
(10 CFR 72 Controlled Area Boundary)
TLD 59
TLD 55
TLD 56
TLD 41
UNIT 2
UNIT 3
TLD 12
TLD 57
TLD 58
TLD 15
TLD 73
TLD 16
TLD 13
Air Sampler 9 &
TLD 66
SAN ONOFRE STATE BEACH
PACIFIC OCEAN
Figure 6-1
ISFSI TLDs and
REMP TLDs
within the EAB
ISFSI TLDs
REMP TLDs
EAB
(10 CFR 50 Exclusion Area Boundary)
and CAB
(10 CFR 72 Controlled Area Boundary)
Seawall/Fenceline
Railroad
Major Road
Local Street
N
W
E
S
500
0
500
Feet
File Name: 2010AREOR_Figure6-1_11x8.mxd
Path: \SONGS\AREOR\MXD\AREOR2010
Date: 05/05/2011
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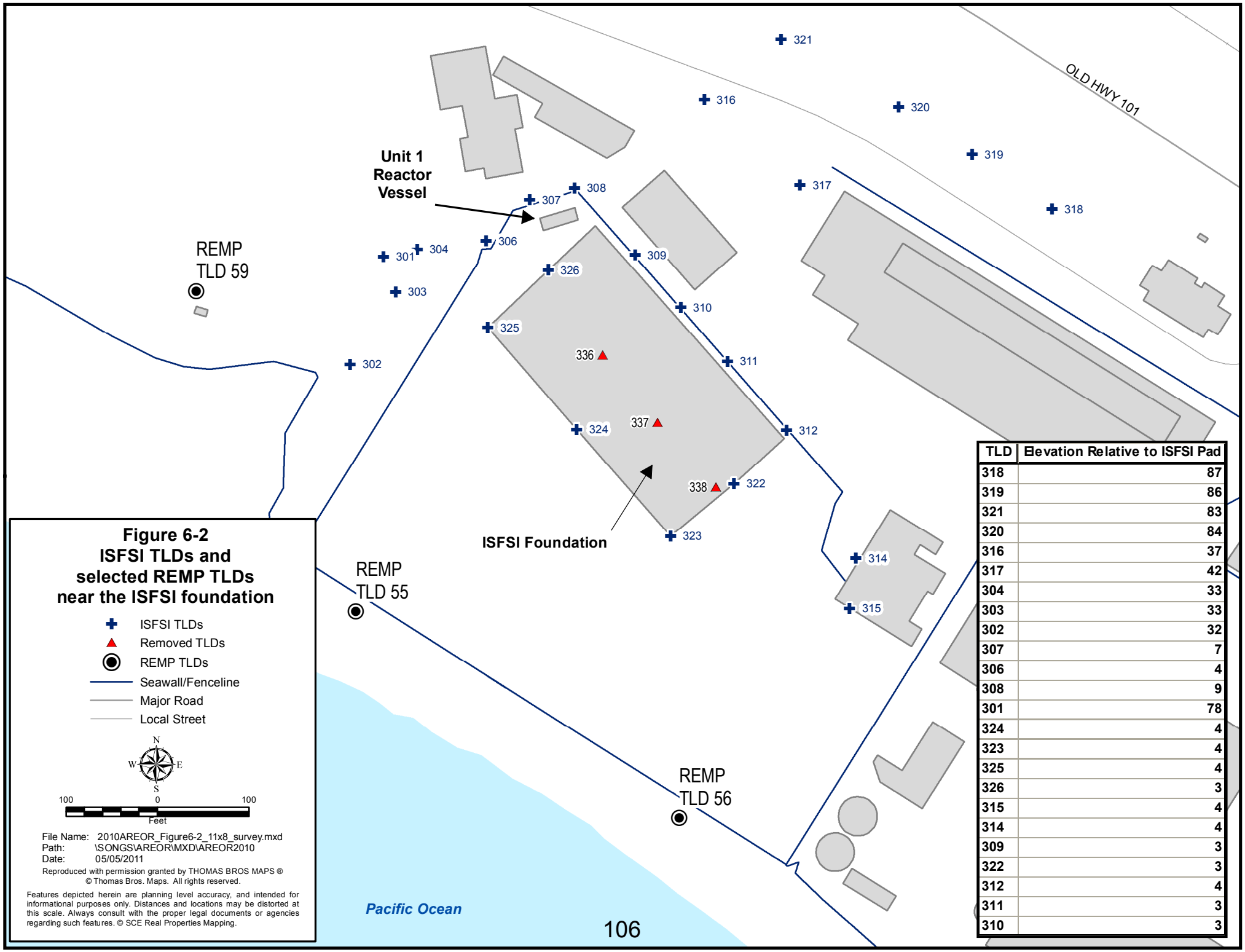

Figure 6-2
ISFSI TLDs and selected REMP TLDs near the ISFSI foundation

ISFSI TLDs
Removed TLDs
REMP TLDs
Seawall/Fenceline
Major Road
Local Street

N
W
E
S

100 0 100
Feet

File Name: 2010AREOR_Figure6-2_11x8_survey.mxd
Path: \SONGS\AREOR\MXD\AREOR2010
Date: 05/05/2011

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TLD	Elevation Relative to ISFSI Pad
318	87
319	86
321	83
320	84
316	37
317	42
304	33
303	33
302	32
307	7
306	4
308	9
301	78
324	4
323	4
325	4
326	3
315	4
314	4
309	3
322	3
312	4
311	3
310	3

Direct Radiation Monitoring
ISFSI & Selected REMP TLDs - Quarterly Gamma Exposure (mR/ std quarter)

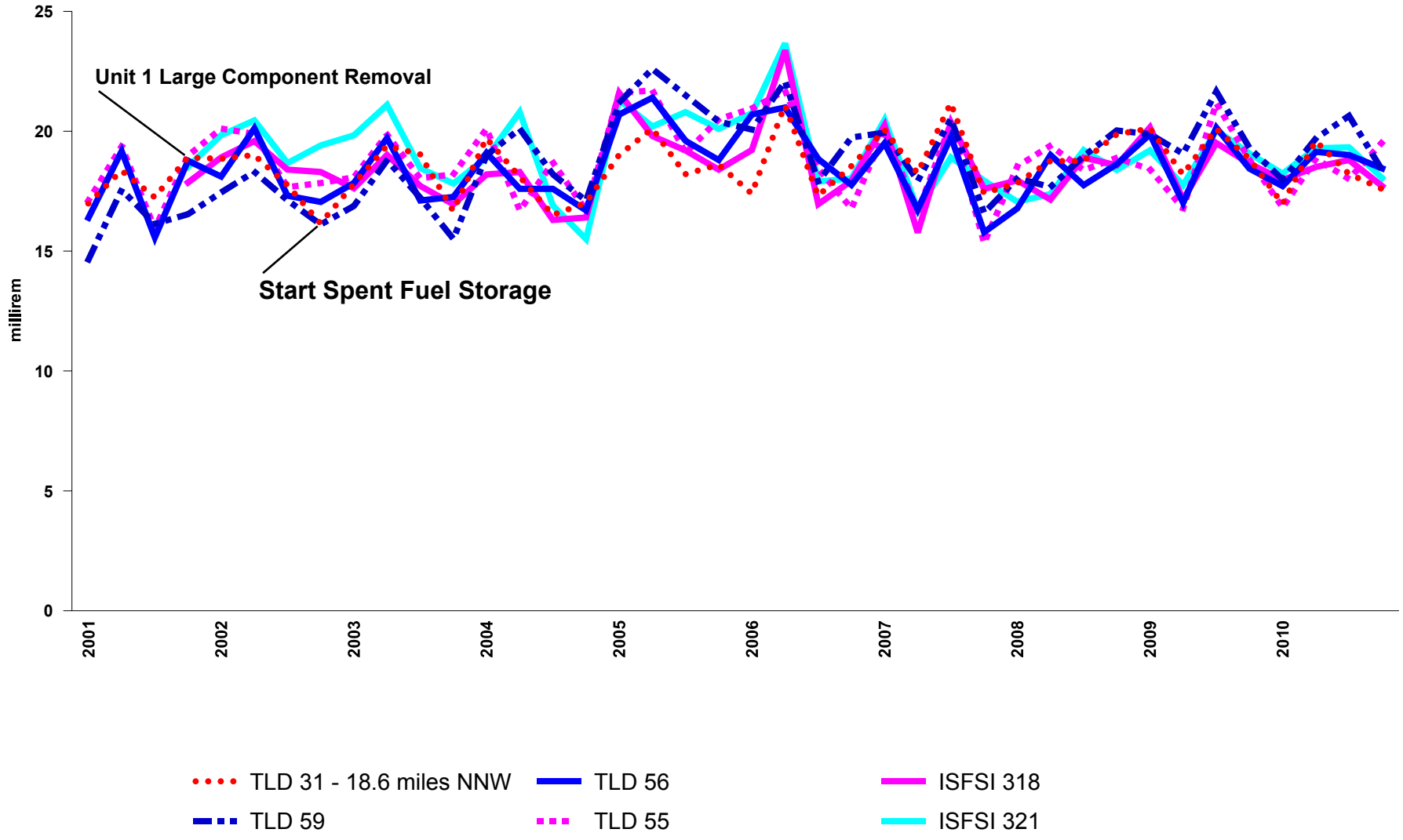


Figure 6A

Appendix K

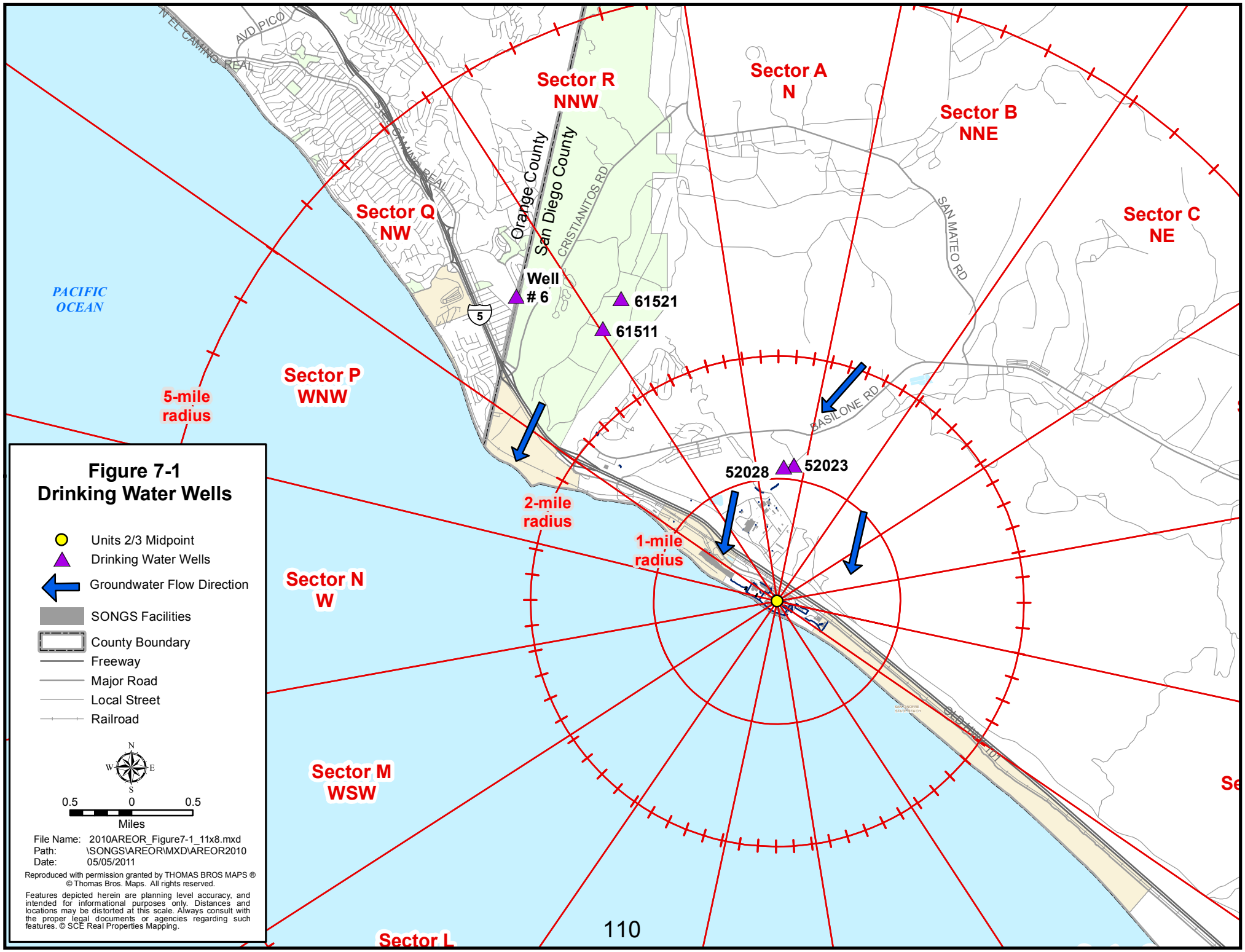
Local Drinking Water Wells

Local Drinking Water Well Data

No drinking water pathway exists at SONGS. Refer to Figures 7-1 for a general indication of groundwater flow in the vicinity of SONGS.

The drinking water wells closest to SONGS (Camp Pendleton wells # 52023, # 52028, # 610511, and # 610521) were sampled and analyzed for SONGS related radionuclides. The results were less than the *a posteriori* MDC.

We conclude that the operation of SONGS had no impact on drinking water wells in the vicinity of SONGS.



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