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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 10, 2010

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**
2009 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 2009 Annual Radiological Environmental Operating Report (AREOR) for SONGS Units 1, 2 and 3.

The AREOR covers the operation of SONGS during the calendar year 2009 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. Clay E. Williams at (949) 368-6707.

Sincerely,

P.O. Box 128
San Clemente, CA 92674

Enclosure

cc: E. E. Collins, Regional Administrator, NRC Region IV
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2009
Radiological Environmental Operating Report

San Onofre Nuclear Generating Station

Southern California Edison
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Docket Nos. 50-206, 50-361, 50-362
License Nos. DPR-13, NPF-10, NPF-15

April 2010

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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 2009.

Preparation of the 2009 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 and sediment, 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 substantially 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 2009 is attributable to the sampling being taken shortly after the 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 2009.

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 removal of Unit 1 structures was completed in 2008. 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 2009 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. The standards for normal operation recommend that the dose from all discharges of radioactivity should not exceed 25 mrem/yr. 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.

* 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 2009 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 2009 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 2009 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 2009 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 2009 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 2008.

3. SONGS Offsite Dose Calculation Manual (ODCM) Revision 1, Section 5.0, 2008.

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 Route 101 (East-Southeast)	3.0	ESE
8	Noncommissioned Officers' Beach Club	1.4	NW
10	Bluff (Adjacent to PIC #1)	0.7	WNW
11	Former Visitors' Center	0.4 **	NW
12	South Edge of Switchyard	0.2 **	E
13	Southeast Site Boundary (Bluff)	0.4 **	ESE
15	Southeast Site Boundary (Office Building)	0.1 **	SSE
16	East Southeast Site Boundary	0.4 **	ESE
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 (Control)	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. 2. 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
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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 **	W
56	San Onofre State Beach (U1 West)	0.2 **	W
57	San Onofre State Beach (Unit 2)	0.1 **	WSW
58	San Onofre State Beach (Unit 3)	0.1 **	S
59	SONGS Meteorological Tower	0.3 **	WNW
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	Sheep Valley	4.4	ESE

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 2. 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
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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 Visitor's Center	0.4 **	NW
7	Prince of Peace Abbey (Control)	15	SE

1 Air Sampler # 16 will replace 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. 2. 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.
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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	NNW
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	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.2. Direction determined from degrees true north.

*** Soil samples are not required by Technical Specifications.

**** Kelp samples are not required by Technical Specifications.

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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 (0.6 mile West)	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.2. Direction determined from degrees true north.

*** Soil samples are not required by Technical Specifications.

**** Kelp samples are not required by Technical Specifications.

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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

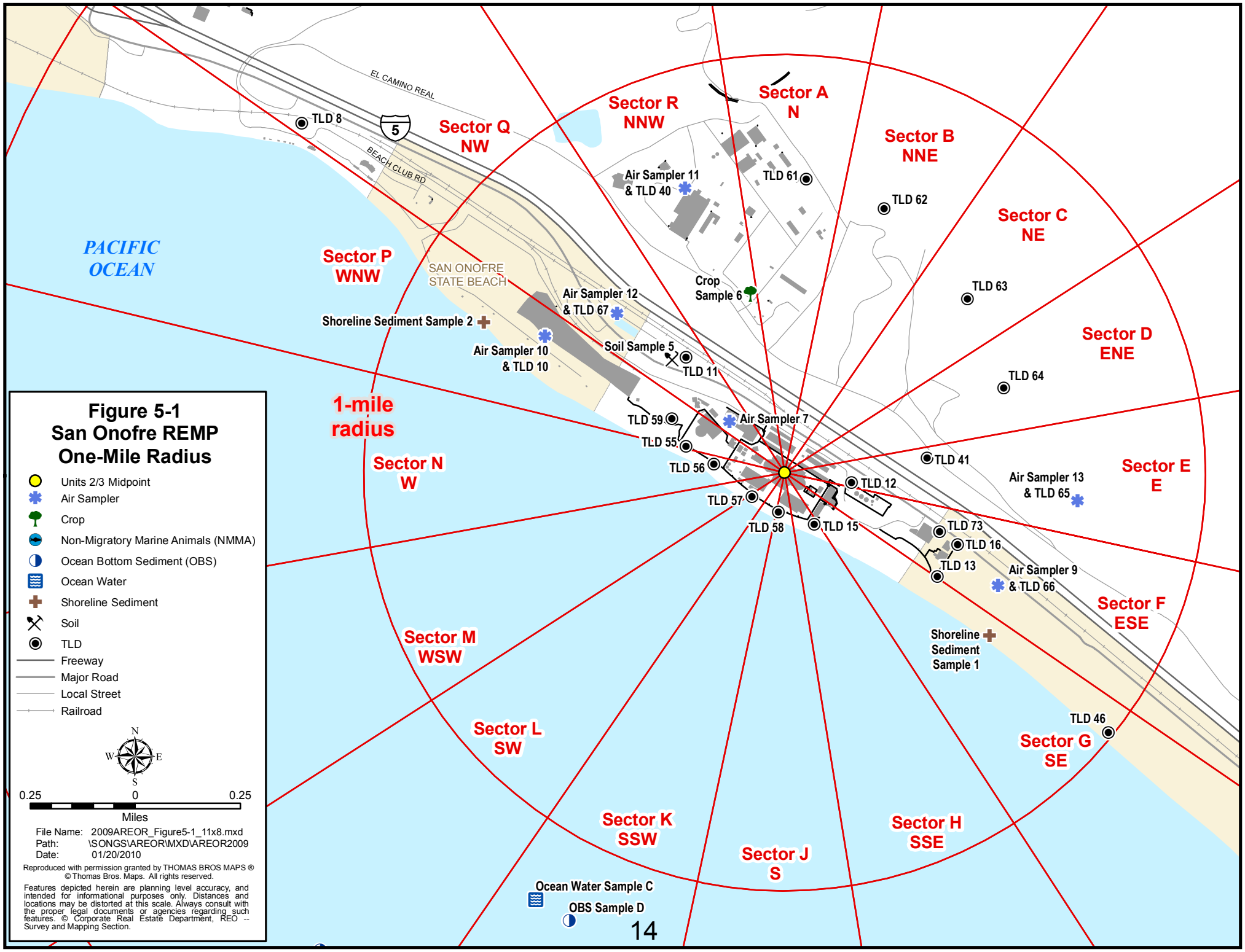
Figure 5-1
San Onofre REMP
One-Mile Radius
Units 2/3 Midpoint
Air Sampler
Crop
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Major Road
Local Street
Railroad
N
W
E
S
0.25
0
0.25
Miles
File Name: 2009AREOR_Figure5-1_11x8.mxd
Path: \SONGS\AREOR\MXD\AREOR2009
Date: 01/20/2010
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5
SAN ONOFRE STATE BEACH
1-mile radius
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
TLD 8
TLD 61
TLD 62
TLD 63
TLD 64
TLD 41
TLD 12
TLD 13
TLD 15
TLD 16
TLD 73
TLD 46
TLD 59
TLD 55
TLD 56
TLD 57
TLD 58
TLD 11
Air Sampler 11 & TLD 40
Air Sampler 12 & TLD 67
Air Sampler 10 & TLD 10
Air Sampler 7
Air Sampler 13 & TLD 65
Air Sampler 9 & TLD 66
Crop Sample 6
Soil Sample 5
Shoreline Sediment Sample 2
Shoreline Sediment Sample 1
Ocean Water Sample C
OBS Sample D

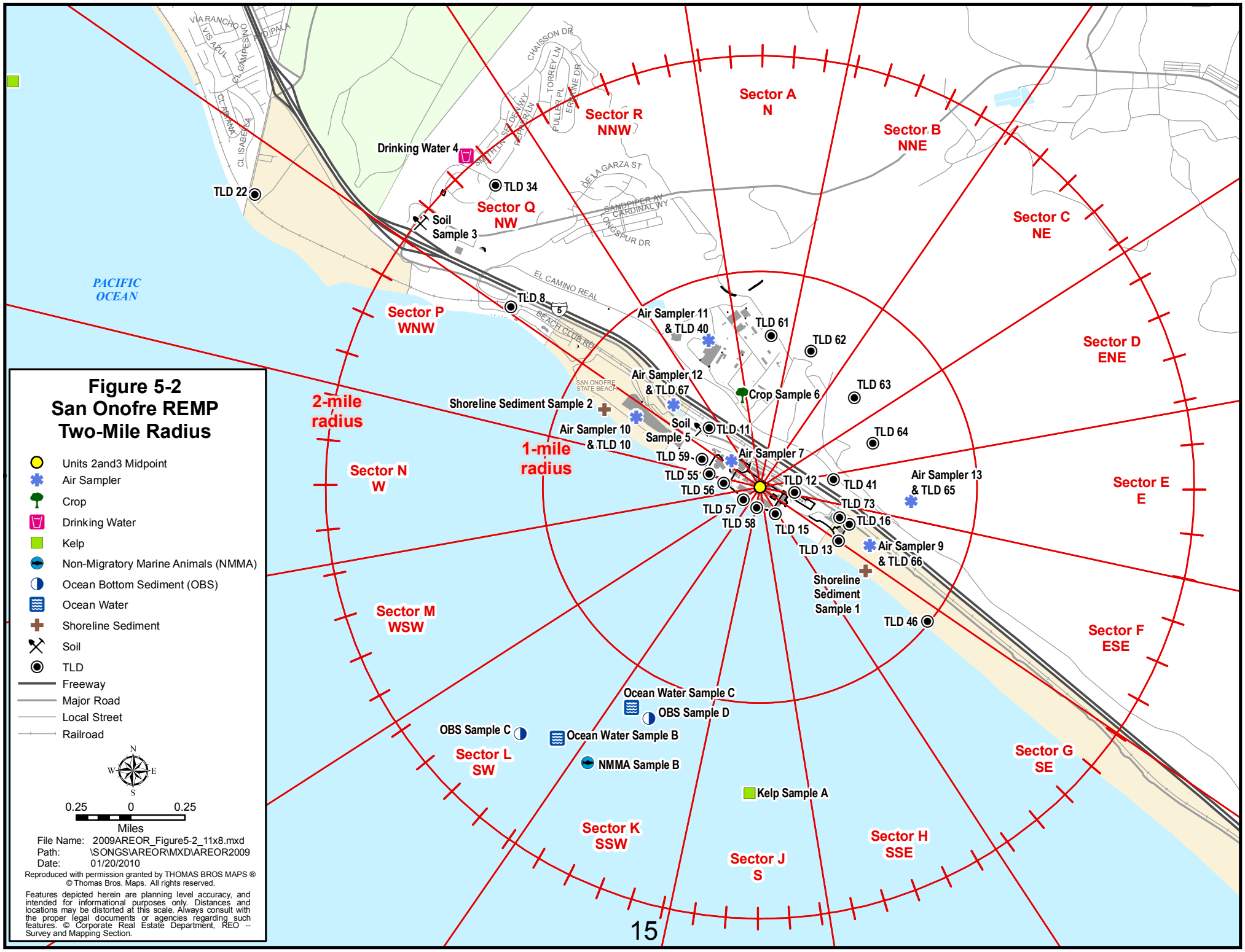
Figure 5-2
San Onofre REMP
Two-Mile Radius
Units 2and3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Major Road
Local Street
Railroad
N
W
E
S
0.25
0
0.25
Miles
File Name: 2009AREOR_Figure5-2_11x8.mxd
Path: \SONGS\AREOR\MXD\AREOR2009
Date: 01/20/2010
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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
2-mile radius
1-mile radius
Drinking Water 4
TLD 22
TLD 34
Soil Sample 3
TLD 8
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 73
TLD 57
TLD 58
TLD 15
TLD 16
TLD 13
Air Sampler 9 & TLD 66
Shoreline Sediment Sample 1
TLD 46
Ocean Water Sample C
OBS Sample D
OBS Sample C
Ocean Water Sample B
NMMA Sample B
Kelp Sample A
EL CAMINO REAL
BEACH CLUB RD
SAN ONOFRE STATE BEACH
DELA GARZA ST
SANDPIPER AV
CARDINAL WY
LONGSPUR DR
CHAISSON DR
TORREY LN
PULLER PL
ERSKINE DR
SMITH ST
DE WY
PERRY LN
VIA RANCHO
VIS AZUL
CAMPESINO
PALA
CL ABANICA
CL ISABELLA
5

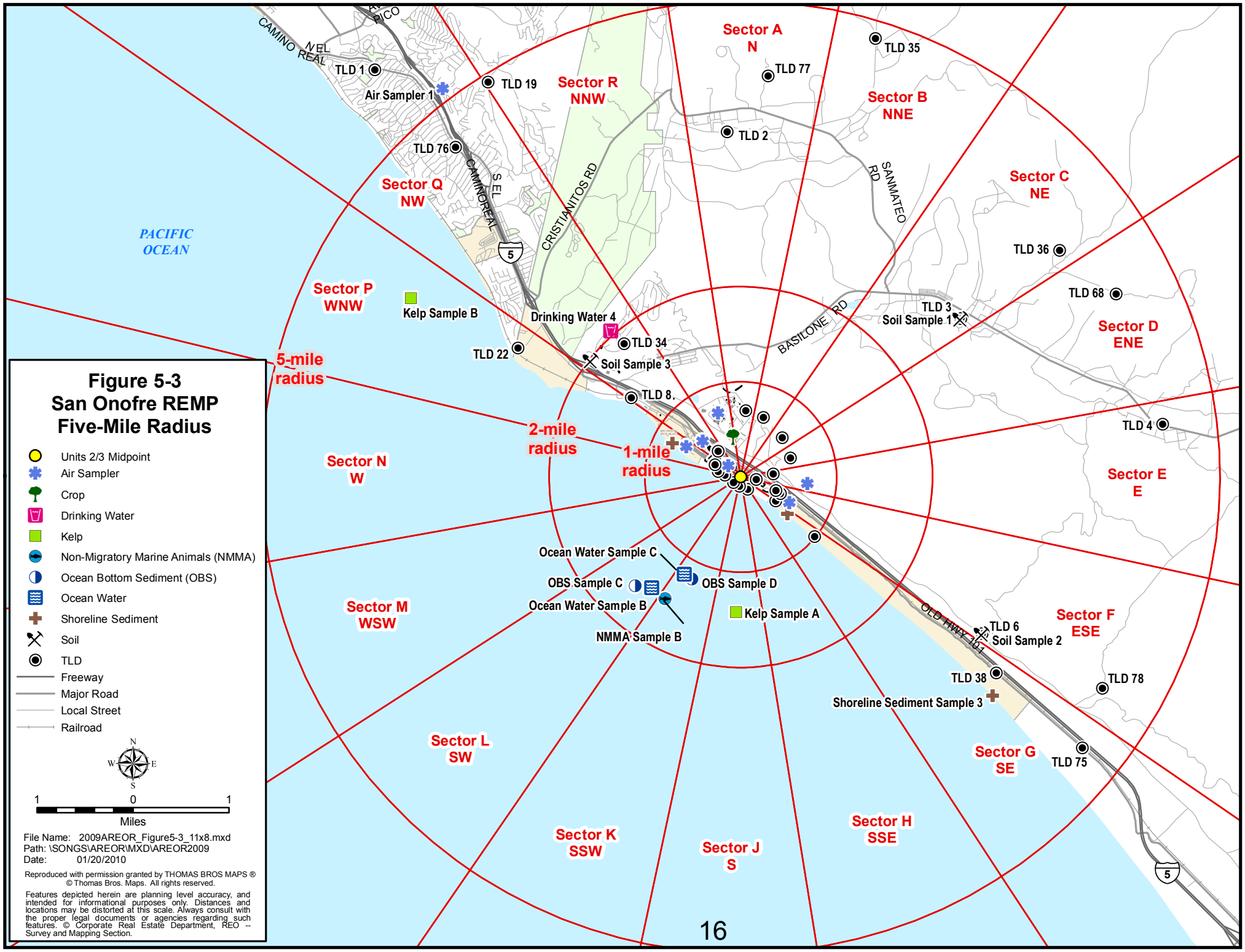
Figure 5-3
San Onofre REMP
Five-Mile Radius
Units 2/3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Major Road
Local Street
Railroad
N
W
E
S
1
0
1
Miles
File Name: 2009AREOR_Figure5-3_11x8.mxd
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PACIFIC OCEAN
CAMINO REAL
EL CAMINO REAL
CRISTIANITOS RD
SANMATEO RD
BASILONE RD
OLD HWY 101
5
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 76
TLD 77
TLD 35
TLD 2
TLD 36
TLD 68
TLD 3
TLD 22
TLD 34
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
Ocean Water Sample C
OBS Sample C
OBS Sample D
Ocean Water Sample B
NMMA Sample B
Kelp Sample A
Shoreline Sediment Sample 3

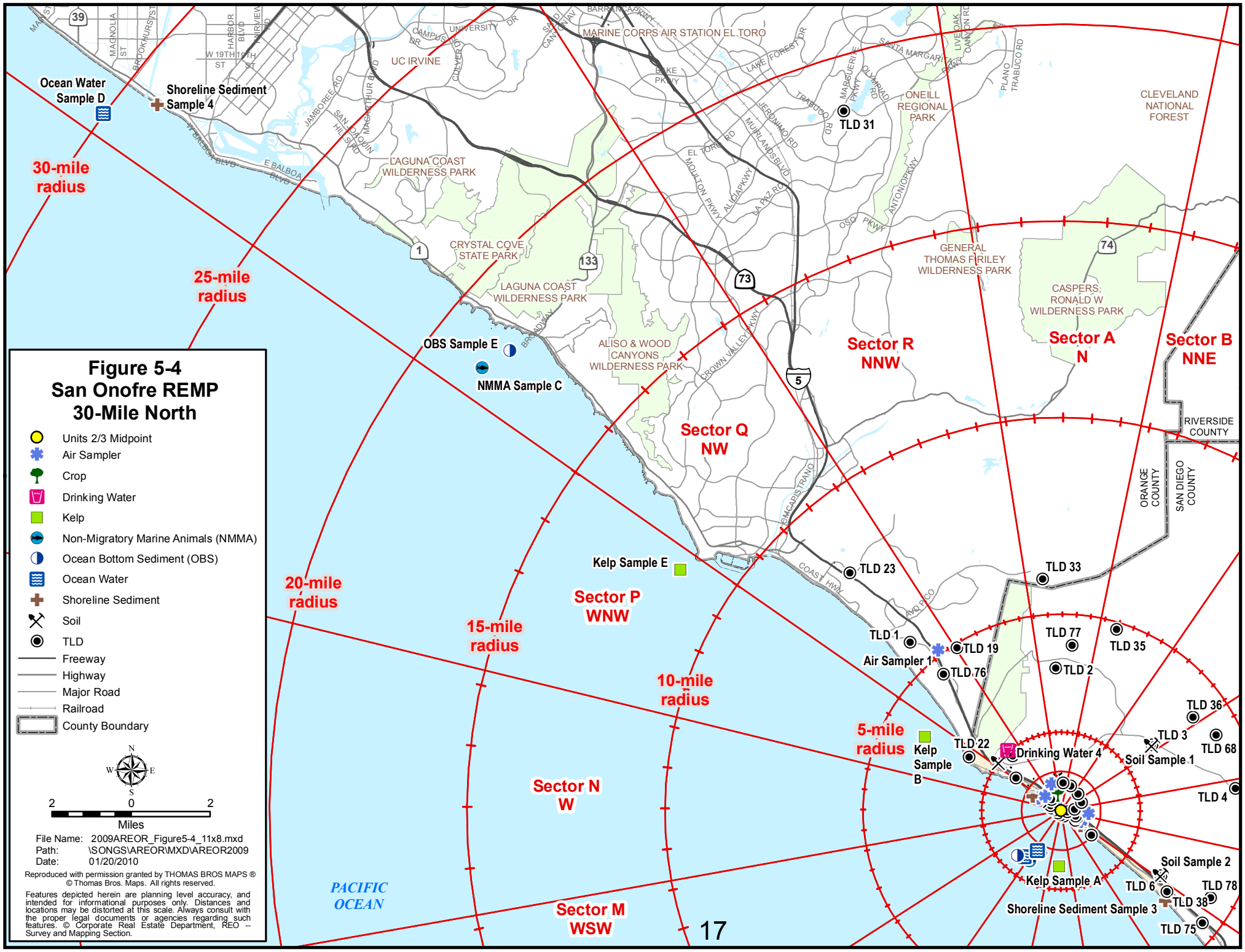
Figure 5-4
San Onofre REMP
30-Mile North
Units 2/3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Highway
Major Road
Railroad
County Boundary
N
W
E
S
2
0
2
Miles
File Name: 2009AREOR_Figure5-4_11x8.mxd
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Date: 01/20/2010
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30-mile radius
25-mile radius
20-mile radius
15-mile radius
10-mile radius
5-mile radius
Sector R
NNW
Sector A
N
Sector B
NNE
Sector Q
NW
Sector P
WNW
Sector N
W
Sector M
WSW
Ocean Water Sample D
Shoreline Sediment Sample 4
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 31
TLD 23
TLD 33
TLD 1
TLD 19
TLD 76
TLD 77
TLD 35
TLD 2
TLD 36
TLD 3
TLD 68
TLD 22
TLD 4
TLD 6
TLD 78
TLD 38
TLD 75
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
GENERAL THOMAS FRILEY WILDERNESS PARK
CASPERS, RONALD W WILDERNESS PARK
CLEVELAND NATIONAL FOREST
RIVERSIDE COUNTY
ORANGE COUNTY
SAN DIEGO COUNTY

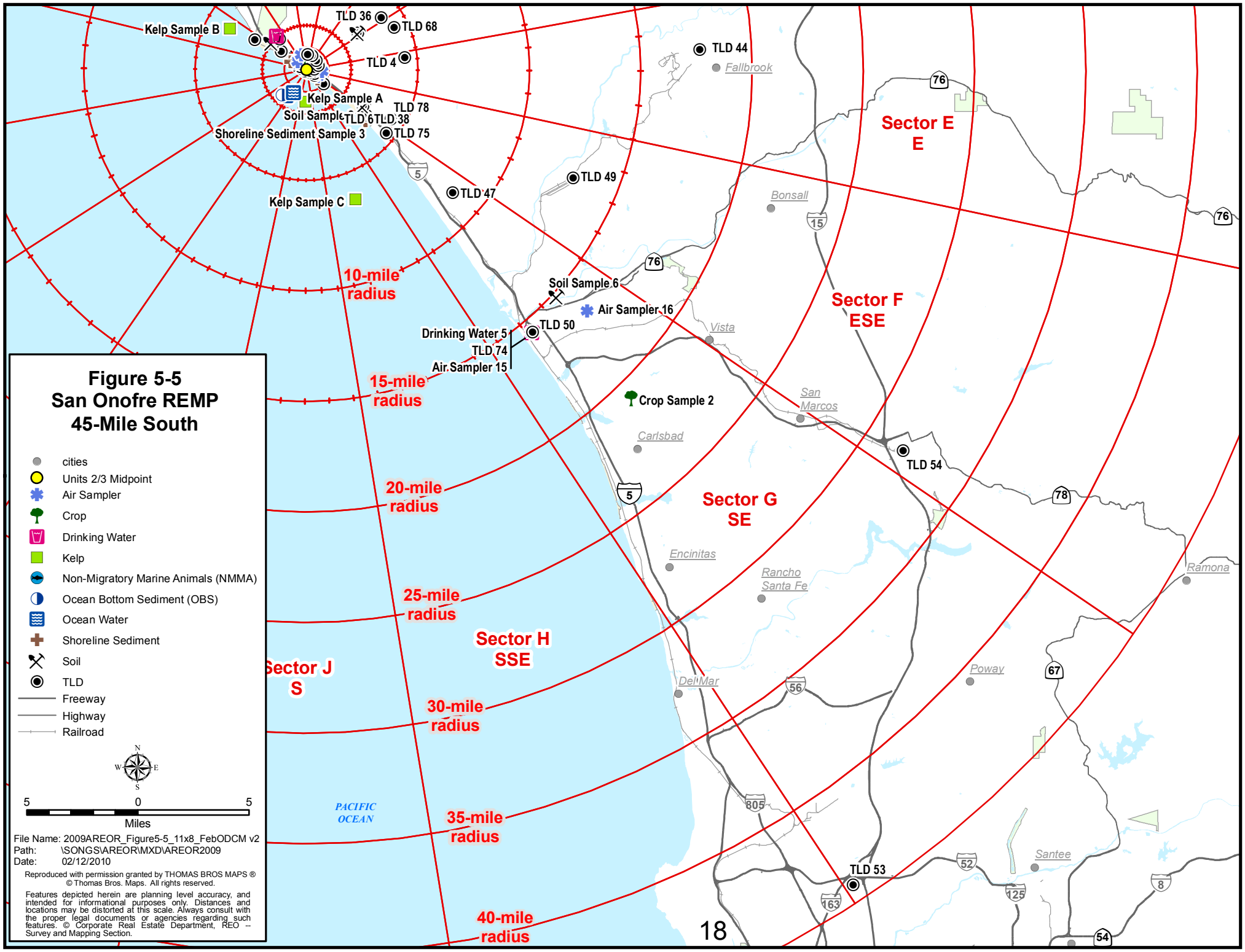
Figure 5-5
San Onofre REMP
45-Mile South
cities
Units 2/3 Midpoint
Air Sampler
Crop
Drinking Water
Kelp
Non-Migratory Marine Animals (NMMA)
Ocean Bottom Sediment (OBS)
Ocean Water
Shoreline Sediment
Soil
TLD
Freeway
Highway
Railroad
5 0 5
Miles
File Name: 2009AREOR_Figure5-5_11x8_FebODCM v2
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Date: 02/12/2010
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Kelp Sample B
TLD 36
TLD 68
TLD 4
Kelp Sample A
Soil Sample 4
TLD 6
TLD 38
TLD 78
TLD 75
Shoreline Sediment Sample 3
Kelp Sample C
TLD 47
TLD 49
TLD 44
Fallbrook
Bonsall
Soil Sample 6
Air Sampler 16
TLD 50
Drinking Water 5
TLD 74
Air Sampler 15
Vista
Crop Sample 2
San Marcos
Carlsbad
TLD 54
Encinitas
Rancho Santa Fe
Ramona
Poway
Del Mar
Santee
TLD 53
PACIFIC OCEAN
10-mile radius
15-mile radius
20-mile radius
25-mile radius
30-mile radius
35-mile radius
40-mile radius
Sector E
E
Sector F
ESE
Sector G
SE
Sector H
SSE
Sector J
S
5
76
15
78
67
56
805
52
125
163
8
54

APPENDIX B

SUMMARY, RESULTS, AND DISCUSSIONS

OF 2009 ENVIRONMENTAL DATA

SUMMARY

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 2009 to December 2009 were evaluated. The 2009 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 2009 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 2009 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, tritium was detected in ocean water, 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 2009.

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 2009 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 17.26 mR with a range of 10.65 to 24.94 mR. The average control location dose was 16.47 mR with a range of 12.88 to 20.11 mR. The routine 2009 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 total annual dose.

2009 REMP TLD data (Average Dose vs. Distance from SONGS)

	Average Quarterly Dose in mR
TLDs ≤ 0.5 miles from SONGS	19.10
TLDs > 0.5 miles AND ≤ 1.0 mile from SONGS	15.24
TLDs > 1.0 mile AND ≤ 5.0 miles from SONGS	16.97
TLDs > 5 miles from SONGS (Control TLDs)	16.47

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 2009. 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 2009 and for previous years. This figure shows the close correlation between the control and indicator location TLD dose data.

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 eight indicator locations and from one control location. 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 0.0169 to 0.0862 pCi/m^3, averaging 0.0438 pCi/m^3 of air. The concentrations of gross beta activity in the samples from the control locations ranged from 0.0225 to 0.0777 pCi/m^3, averaging 0.0441 pCi/m^3 of air. Figure 3D shows the variation in gross beta activity level in 2009 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 2009 was 0.0862 pCi/m^3 and the 2008 control location average was 0.0416 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 2009 at SONGS were statistically indistinguishable from zero.

No samples yielded station related isotopic results confirmed above the *a posteriori* MDC. Quarterly composite gamma spectral analysis 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 2009, 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 October 2009 near the Unit 2 diffusers represents surface water in the vicinity of the Unit 2 diffuser discharge plume. The October 2009 station B, Unit 2 Outfall, indicator ocean water tritium analysis results were below the *a priori* LLD, but above the *a posteriori* MDC. The concentration of H-3 (tritium) measured in ocean water was consistent with a calculated value based on the level of radioactivity in a planned, controlled discharge of a waste stream from SONGS approximately three hours before the sample was taken and on the known mixing conditions. The October 2009 station B H-3 sample result was 613 pCi/l with an MDC of 425 pCi/l. The California Department of Public Health's analysis of the October 2009 station B split sample yielded a sample result of 387 pCi/l H-3 with an MDA (Minimum Detectable Activity) of 238 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 2009 monthly DPH and 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 2009. 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.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.

D. Drinking Water

In 2009, 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 2009. 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 2009 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 2009.

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 2009, all of the conduit sample analysis results were below the MDC for station related radionuclides.

We conclude that the operation of SONGS had no measurable 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 2009. 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 2009 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 2009 soil samples yielded naturally occurring K-40 and Th-228. Cs-137 was detected in two indicator samples, as well as the control sample. Cs-137 is often detected in environmental sediment samples and the presence of Cs-137 is most likely related to 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 2009, the operation of SONGS had a negligible impact on the environment as measured by this sample medium.

J. Kelp Sampling

Kelp was collected in April and October of 2009 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 2009 included K-40 and I-131. K-40 is naturally occurring and not related to the operation of SONGS. I-131 was detected in all sixteen kelp samples collected during 2009 and is most likely attributable to the San Juan Sewage Plant effluents.

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 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.

K. Deer Sampling

Deer meat and bone samples were collected in 2009 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 2009 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 2008 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 2009 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 showing that environmental concentrations are not statistically higher around SONGS than at the control locations are consistent with the low levels of radio-iodine released during 2009. 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 2009 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 within 3 hours of a batch release from SONGS caused the October 2009 Station B ocean water tritium sample tritium analysis to be > *a posteriori* MDC. Unique sampling conditions (collection closely timed with a release) 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 2009. 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
F- Dana Point Kelp
G- Capistrano Beach Reef
G- Capistrano Beach Reef
San Juan Outfall
H- San Clemente Pier Reef
H- San Clemente Pier Reef
I- Wheeler North Artificia
I- Wheeler North Artificia
B- San Mateo Kelp
B- San Mateo Kelp
A- San Onofre Kelp
A- San Onofre Kelp
Unit 2 & 3 Diffusers
C- Barn Kelp
C- Barn Kelp
Pacific Ocean
SELVA RD
COAST HWY
CM D LOS MARES
CM VERA CRUZ
AVD PICO
AVD PICO
AVD PICO
CL DL CERRO
ORANGE COUNTY
SAN DIEGO COUNTY
SAN MATEO RD
CRISTIANITOS RD
BASILONE RD
BASILONE RD
OLD HWY 101
5
5
Figure 5-6
2009 Kelp Samples
SanJuanOutfall
Kelp Samples
April 20, 2009
October 19, 2009
Units 2/3 Midpoint
Diffusers
Freeway
Major Road
Railroad
County Boundary
N
W
E
S
1
0
1
2
Miles
File Name: 2009AREOR_Figure5-6_11x8.mxd
Path: ~SONGS\AREOR\MXD\AREOR2009
Date: 03/24/2010
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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 20APR09	I-131	(92 ± 11) E-3 pCi/g	7 E-3 pCi/g
Aquatic Kelp San Mateo Kelp Bed Station B 20APR09	I-131	(78 ± 10) E-3 pCi/g	8 E-3 pCi/g
Aquatic Kelp Barn Kelp Bed Station C 20APR09	I-131	(74 ± 9) E - 3 pCi/g	7 E-3 pCi/g
Aquatic Kelp Salt Creek Station E 20APR09	I-131	(113 ± 13) E-3 pCi/g	8 E-3 pCi/g
Aquatic Kelp Dana Point Kelp Bed Station F 20APR09	I-131	(114 ± 11) E-3 pCi/g	7 E-3 pCi/g
Aquatic Kelp Capistrano Beach Reef Station G 20APR09	I-131	(110 ± 11) E-3 pCi/g	6 E-3 pCi/g
Aquatic Kelp San Clemente Pier Station H 20APR09	I-131	(89 ± 11) E-3 pCi/g	9 E-3 pCi/g
Aquatic Kelp Wheeler North Artificial Reef Station I 20APR09	I-131	(152 ± 14) E-3 pCi/g	7 E-3 pCi/g
Soil Camp San Onofre Location # 1 21SEP09	Cs-137	(51 ± 39) E-3 pCi/g	44 E-3 pCi/g
Soil Old El Camino Real Location #2 21SEP09	Cs-137	(393 ± 51) E-3 pCi/g	32 E-3 pCi/g
Soil Prince of Peace Abbey Location #7 22SEP09	Cs-137	(267 ± 40) E-3 pCi/g	26 E-3 pCi/g
Aquatic Kelp San Onofre Kelp Bed Station A 19OCT09	I-131	(10 ± 7) E - 3 pCi/g	7 E-3 pCi/g

Sample Media & location	Radionuclide	Sample Value	MDC (*a posteriori*)
Aquatic Kelp San Mateo Kelp Bed Station B 19OCT09	I-131	(11 ± 6) E-3 pCi/g	7 E-3 pCi/g
Aquatic Kelp Barn Kelp Bed Station C 19OCT09	I-131	(11 ± 6) E - 3 pCi/g	7 E-3 pCi/g
Aquatic Kelp Salt Creek Station E 19OCT09	I-131	(45 ± 6) E-3 pCi/g	6 E-3 pCi/g
Aquatic Kelp Dana Point Kelp Bed Station F 19OCT09	I-131	(46 ± 7) E-3 pCi/g	7 E-3 pCi/g
Aquatic Kelp Capistrano Beach Reef Station G 19OCT09	I-131	(32 ± 6) E-3 pCi/g	6 E-3 pCi/g
Aquatic Kelp San Clemente Pier Station H 19OCT09	I-131	(29 ± 7) E-3 pCi/g	5 E-3 pCi/g
Aquatic Kelp Wheeler North Artificial Reef Station I 19OCT09	I-131	(32 ± 6) E-3 pCi/g	5 E-3 pCi/g
Ocean Water Station B Unit 2 Outfall 19OCT09	H-3	(613 ± 315) pCi/*l*	425 pCi/*l*

TABLE B-2

REMP SAMPLE ANALYSIS SUMMARY FOR 2009

Medium	Analysis Type	Sampling Frequency	# of Locations	Total # of Analyses in 2009 [1]
Direct Radiation	Dosimetry	Quarterly	49	195
Airborne Particulates	Gross Beta	Weekly	10	487
Charcoal Cartridge	I-131	Weekly	10	453
Airborne Particulates	Ge (Li) Scan	Quarterly	10	38
Ocean Water	Ge (Li) Scan, H-3	Monthly	4	48
Ocean Water	H-3	Quarterly	4	16
Ocean Water Conduit	Ge (Li) Scan	Semi-Annually	2	4
Drinking Water, Unfiltered	Ge (Li) Scan, H-3 Gross Beta	Monthly	3 3 3	33 33 33
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 REMP samples not required by the ODCM, including air sampler # 14, air sampler # 16, San Clemente drinking water sample # 2, and additional control kelp samples. These samples were not collected for all of 2009. Collection of air sampler # 14 was discontinued in 2009. Collection of air sampler # 16 (control) was started in 2009. The San Clemente drinking water sample (collection requested by the City of San Clemente) was not available for three months during 2009. One ODCM specified direct radiation sample was not available during 2009. 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 2009

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

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		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean (Range)		
Quarterly Gamma Exposure – Table 1A (mR/std quarter)							
	Gamma 195	5	17.26 (151/151) (10.65 – 24.94)	South Yard Facility, 0-4, ESE	23.18 (4/4) (20.15 – 24.94)	16.47 (44/44) (12.88 – 20.11)	0

(1) Indicator location TLDs include all REMP TLDs 5.0 miles or closer to SONGS 2/3 midpoint.
(2) Control location TLDs include all REMP TLDs more than 5.0 miles from SONGS 2/3 midpoint.
(3) TLD data excludes QC TLDs, transit dose TLDs, and ISFSI TLDs.

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Reporting Period: 1/1/2009 to 12/31/2009

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		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean (Range)		
Weekly Airborne Particulates Gross Beta Activity – Table 2 (pCi/cu.m)								
	Gross Beta	487	0.01	0.0438 (386/386) (0.0169 – 0.0862)	Mesa Medical Facility 0.7 Mi. NNW	0.0562 (22/22) (0.0238 – 0.0804)	0.0441 (101/101) (0.0225 – 0.0777)	0

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Reporting Period: 1/1/2009 to 12/31/2009

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		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean (Range)		
Weekly Radioiodine I-131 Activity – Table 3 (pCi/cu.m)								
	I-131	453	0.07	0.0085 (25/386) (0.0040 – 0.0299)	Marine Corp Base (Camp Pendleton East) 0.7 Mi. E	0.0100 (7/52) (0.0053 – 0.0299)	0.0084 (5/67) (0.0052 – 0.0160)	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 2009 in this media.

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Reporting Period: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Quarterly Comp. Airborne Particulates Gamma – Table 4A (pCi/cu.m)								
	Be-7	38	-	0.27 (30/30) (0.16 – 0.35)	Mesa EOF 0.7 Mi. NNW	0.29 (4/4) (0.23 – 0.34)	0.26 (8/8) (0.20 – 0.33)	0
	Cs-134	38	0.05	3.65E-4 (2/30) (2.57E-4 – 4.72E-4)	City of San Clemente (City Hall) 5.1 Mi. NW	4.72E-4 (1/4) (4.72E-4 – 4.72E-4)	<LLD (0/8) (-)	0
	Cs-137	38	0.06	3.37E-4 (4/30) (2.87E-4 – 3.98E-4)	City of San Clemente (City Hall) 5.1 Mi. NW	3.98E-4 (1/4) (3.98E-4 – 3.98E-4)	<LLD (0/8) (-)	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 2009. 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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Reporting Period: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: 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	5.11 (3/40) (4.29 – 6.19)	Unit 3 Conduit 0.1 Mi. SSW	6.19 (1/2) (6.19 – 6.19)	4.20 (4/12) (3.61 – 4.78)	0
	Be-7	52	-	8.28 (1/40) (8.28 – 8.28)	Unit 3 Conduit 0.1 Mi SSW	8.28 (1/2) (8.28 – 8.28)	< LLD (0/12) (-)	0
	Co-58	52	15	1.21 (1/40) (1.21 – 1.21)	(C) Outfall -Unit 3 1.2 Mi. SSW	1.21 (1/12) (1.21 – 1.21)	< LLD (1/12) (-)	0
	Co-60	52	15	1.27 (5/40) (1.10 – 1.62)	(A) Station Outfall – Unit 1 0.6 Mi. SW	1.42 (2/12) (1.22 – 1.62)	< LLD (0/12) (-)	0
	Cs-134	52	15	1.65 (7/40) (1.34 – 2.31)	Unit 3 Conduit 0.1 Mi. SSW	2.31 (1/2) (2.31 – 2.31)	< LLD (0/12) (-)	0
	Cs-137	52	18	1.21 (4/40) (0.89 – 1.75)	(A) Station Outfall – Unit 1 0.6 Mi. SW	1.75 (1/12) (1.75 – 1.75)	1.35 (1/12) (1.35 – 1.35)	0
	Fe-59	52	30	4.87 (1/40) (4.87 – 4.87)	(B) Outfall – Unit 2 1.5 Mi. SW	4.87 (1/12) (4.87 – 4.87)	< LLD (0/12) (-)	0
	H-3	52	3000	349.00 (4/40) (247.00 – 613.00)	(B) Outfall – Unit 2 1.5 Mi. SW	613.00 (1/12) (613.00 – 613.00)	303.00 (1/12) (303.00 – 303.00)	0

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis – Table 5 (pCi/l)								
	I-131	52	15	1.43 (3/40) (1.37 – 1.52)	(B) Outfall – Unit 2 1.5 Mi. SW	1.46 (2/12) (1.40 – 1.52)	< LLD (0/12) (-)	0
	K-40	52	-	338.85 (40/40) (288.00 – 390.00)	Unit 2 Conduit 0.1 Mi. SW	350.50 (2/2) (327.00 – 374.00) (2/2)	338.00 (12/12) (295.00 – 384.00)	0
	La-140	52	15	1.65 (1/40) (1.65 – 1.65)	(A) Station Discharge Outfall – Unit 1 0.6 Mi. SW	1.65 (1/12) (1.65 – 1.65)	< LLD (0/12) (-)	0
	Mn-54	52	15	< LLD (0/40) (-)		---- (0/12) (-)	< LLD (0/12) (-)	0
	Nb-95	52	15	1.59 (12/40) (0.91 – 4.29)	Unit 2 Conduit 0.1 Mi. SW	4.29 (1/2) (4.29 – 4.29)	1.12 (1/12) (1.12 – 1.12)	0
	Zn-65	52	30	< LLD (0/40) (-)		---- (0/2) (-)	< LLD (0/12) (-)	0
	Zr-95	52	15	2.35 (4/40) (1.72 – 3.14)	Unit 2 Conduit 0.1 Mi. SW	3.14 (1/2) (3.14 – 3.14)	< LLD (0/12) (-)	0

The naturally occurring radioactive isotope K-40 (Potassium 40) was detected in all SONGS Ocean water samples analyzed in 2009. 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 2009 (K-40) and the radionuclides listed in the ODCM

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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	Location with Highest Annual Mean: 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	249.00 (1/12) (249.00 – 249.00)	(B) Outfall – Unit 2 1.5 Mi. SW	249.00 (1/4) (249.00 – 249.00)	< LLD (0/4) (-)	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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis – Table 9A (pCi/l)								
	Ba-140	33	15	< LLD (0/21) (-)		--- (0/12) (-)	< LLD (0/12) (-)	0
	Be-7	33	-	11.82 (2/21) (9.94 – 13.70)	San Clemente Golf Course Well 3.3 Mi. NW	11.82 (2/9) (9.94 – 13.70)	< LLD (0/12) (-)	0
	Co-58	33	15	0.99 (1/21) (0.99 – 0.99)	Oceanside (Control) 15.6 Mi. SE	1.02 (1/12) (1.02 – 1.02)	1.02 (1/12) (1.02 – 1.02)	0
	Co-60	33	15	< LLD (0/21) (-)		--- (0/12) (-)	< LLD (0/12) (-)	0
	Cs-134	33	15	1.66 (4/21) (1.56 – 1.79)	Oceanside (Control) 15.6 Mi. SE	2.07 (1/12) (2.07 – 2.07)	2.07 (1/12) (2.07 – 2.07)	0
	Cs-137	33	18	0.93 (2/21) (0.87 – 0.98)	Oceanside (Control) 15.6 Mi. SE	1.37 (3/12) (0.96 – 1.96)	1.37 (3/12) (0.96 – 1.96)	0
	Fe-59	33	30	2.39 (3/21) (2.00 – 2.81)	San Clemente Golf Course Well 3.3 Mi. NW	2.41 (2/9) (2.00 – 2.81)	2.04 (2/12) (1.68 – 2.40)	0
	Gross Beta	33	4	4.69 (15/21) (2.06 – 8.29)	San Clemente Golf Course Well 3.3 Mi. NW	5.86 (9/9) (2.76 – 8.29)	5.46 (11/12) (1.94 – 13.90)	0
	H-3	33	3000	< LLD (0/21) (-)		---- (0/12) (-)	< LLD (0/12) (–)	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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis – Table 9A (pCi/l)								
	I-131	33	15	1.25 (1/21) (1.25 – 1.25)	Camp Pendleton 2.2 Mi NNW	1.25 (1/12) (1.25 – 1.25)	< LLD (0/12) (–)	0
	K-40	33	-	30.00 (5/21) (23.50 – 35.50)	Oceanside (Control) 15.6 Mi. SE	59.30 (1/12) (59.30 – 59.30)	59.30 (1/12) (59.30 – 59.30)	0
	La-140	33	15	< LLD (0/21) (-)		---- (0/12) (-)	< LLD (0/12) (-)	0
	Mn-54	33	15	1.90 (1/21) (1.90 – 1.90)	San Clemente Golf Course Well 3.3 Mi. NW	1.90 (1/9) (1.90 – 1.90)	< LLD (0/12) (-)	0
	Nb-95	33	15	2.23 (11/21) (1.25 – 4.26)	Camp Pendleton 2.2 Mi. NNW	2.27 (9/12) (1.25 – 4.26)	1.48 (4/12) (1.12 – 1.95)	0
	Zn-65	33	30	3.75 (3/21) (2.42 – 4.99)	Camp Pendleton 2.2 Mi. NNW	4.99 (1/12) (4.99 – 4.99)	2.01 (1/12) (2.01 – 2.01)	0
	Zr-95	33	15	1.89 (2/21) (1.80 – 1.98)	Oceanside (Control) 15.6 Mi. SE	2.48 (1/12) (2.48 – 2.48)	2.48 (1/12) (2.48 – 2.48)	0

During 2009 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 2009 (Gross Beta) as well as those radionuclides listed in the ODCM

Starting in October 2006 San Clemente Well # 6 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	Location with Highest Annual Mean: 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	0.0222 (1/6) (0.0222 - 0.0222)	San Onofre State Beach 0.6 Mi. SE	0.0222 (1/2) (0.0222 – 0.0222)	0.0151 (1/2) (0.0151 – 0.0151)	0
	Cs-137	8	0.18	<LLD (0/6) (-)		---- (0/2) (-)	<LLD (0/2) (-)	0
	K-40	8	-	13.49 (6/6) (5.07 – 20.90)	Newport Beach North End 29.2 Mi. NW	23.15 (2/2) (21.80 – 24.50)	23.15 (2/2) (21.80 – 24.50)	0
	Th-228	8	-	0.35 (6/6) (0.20 – 0.95)	San Onofre State Beach 3.5 Mi. SE	0.61 (2/2) (0.28 – 0.95)	0.34 (2/2) (0.30 – 0.38)	0

During 2009 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 2009 (K-40 and Th-228) as well as those radionuclides listed in the ODCM

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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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	Location with Highest Annual Mean: 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	0.0494 (5/12) (0.0265 – 0.0728)	(E) Laguna Beach 18.2 Mi. NW	0.0686 (1/2) (0.0686 – 0.0686)	0.0686 (1/2) (0.0686 – 0.0686)	0
	Cs-137	14	0.18	0.0235 (1/12) (0.0235 – 0.0235)	(D) Unit 3 Outfall 1.2 Mi. SSW	0.0235 (1/2) (0.0235 – 0.0235)	< LLD (0/2) (-)	0
	K-40	14	-	17.25 (12/12) (14.30 – 19.70)	Unit 2 Conduit 0.1 Mi. SSW	19.15 (2/2) (18.60 – 19.70)	13.30 (2/2) (11.60 – 15.00)	0
	Th-228	14		0.46 (12/12) (0.14 – 0.93)	(C) Unit 2 Outfall 1.6 Mi. SW	0.80 (2/2) (0.67 – 0.93)	0.58 (2/2) (0.11 – 1.05)	0

During 2009, 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 2009 (K-40 and Th-228) 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: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Black Perch	Co-58	4	0.13	< LLD (0/3) (-)		---- (0/2) (-)	< LLD (0/1) (-)	0
Black Perch	Co-60	4	0.13	< LLD (0/3) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0
Black Perch	Cs-134	4	0.13	0.0023 (1/3) (0.0023 – 0.0023)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0023 (1/1) (0.0023 – 0.0023)	< LLD (0/1) (-)	0
Black Perch	Cs-137	4	0.15	0.0031 (1/3) (0.0031 – 0.0031)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0031 (1/2) (0.0031 – 0.0031)	< LLD (0/1) (-)	0
Black Perch	Fe-59	4	0.26	0.0051 (1/3) (0.0051 – 0.0051)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0051 (1/1) (0.0051 – 0.0051)	< LLD (0/1) (-)	0
Black Perch	K-40	4	-	3.19 (3/3) (2.95 – 3.50)	(A) Unit 1 Outfall 0.9 Mi. WSW	3.31 (2/2) (3.11 – 3.50)	3.04 (1/1) (3.04 – 3.04)	0
Black Perch	Mn-54	4	0.13	< LLD (0/3) (-)		---- (0/2) (-)	< LLD (0/1) (-)	0
Black Perch	Zn-65	4	0.26	< LLD (0/3) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detectio n (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Blacksmith	Co-58	2	0.13	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0
Blacksmith	Co-60	2	0.13	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0
Blacksmith	Cs-134	2	0.13	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0
Blacksmith	Cs-137	2	0.15	0.0026 (1/1) (0.0026 – 0.0026)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0026 (1/1) (0.0026 – 0.0026)	< LLD (0/1) (-)	0
Blacksmith	Fe-59	2	0.26	0.0055 (1/1) (0.0055 – 0.0055)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0055 (1/1) (0.0055 – 0.0055)	< LLD (0/1) (-)	0
Blacksmith	K-40	2	-	3.50 (1/1) (3.50 – 3.50)	(C) Laguna Beach 18.2 Mi. NW	3.58 (1/1) (3. 58 – 3.58)	3.58 (1/1) (3. 58 – 3.58)	0
Blacksmith	Mn-54	2	0.13	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0
Blacksmith	Zn-65	2	0.26	< LLD (0/1) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0

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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
California Mussel	Co-58	6	0.13	0.0022 (1/4) (0.0022 – 0.0022)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0022 (1/2) (0.0022 – 0.0022)	< 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	0.0035 (1/4) (0.0035 – 0.0035)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0035 (1/2) (0.0035 – 0.0035)	< LLD (0/2) (-)	0
California Mussel	Cs-137	6	0.15	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
California Mussel	Fe-59	6	0.26	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
California Mussel	K-40	6	-	1.85 (4/4) (1.67 – 1.96)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	1.91 (2/2) (1.86 – 1.96)	1.49 (2/2) (1.47 – 1.50)	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.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Sheephead	Co-58	6	0.13	< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi NW	0.0077 (1/2) (0.0077 – 0.0077)	0.0077 (1/2) (0.0077 – 0.0077)	0
Sheephead	Co-60	6	0.13	0.0044 (1/4) (0.0044 – 0.0044)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0044 (1/2) (0.0044 – 0.0044)	< LLD (0/2) (-)	0
Sheephead	Cs-134	6	0.13	0.0022 (1/4) (0.0022 – 0.0022)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0022 (1/2) (0.0022 – 0.0022)	< LLD (0/2) (-)	0
Sheephead	Cs-137	6	0.15	0.0045 (3/4) (0.0037 – 0.0060)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0060 (1/2) (0.0060 – 0.0060)	0.0031 (1/2) (0.0031 – 0.0031)	0
Sheephead	Fe-59	6	0.26	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Sheephead	K-40	6	-	3.64 (4/4) (3.48 – 3.98)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	3.77 (2/2) (3.56 – 3.98)	3.00 (2/2) (2.43 – 3.56)	0
Sheephead	Mn-54	6	0.13	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Sheephead	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.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g)								
Spiny Lobster	Co-58	6	0.13	< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi NW	0.0032 (1/2) (0.0032 – 0.0032)	0.0032 (1/2) (0.0032 – 0.0032)	0
Spiny Lobster	Co-60	6	0.13	0.0221 (1/4) (0.0221 – 0.0221)	(C) Laguna Beach 18.2 Mi NW	0.0113 (1/2) (0.0113 – 0.0113)	0.0113 (1/2) (0.0113 – 0.0113)	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) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Spiny Lobster	Fe-59	6	0.26	< LLD (0/4) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Spiny Lobster	K-40	6	-	3.39 (4/4) (2.97 – 3.71)	(A) Unit 1 Outfall 0.9 Mi. WSW	3.44 (2/2) (3.38 – 3.49)	3.28 (2/2) (3.04 – 3.51)	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.

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
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) (-)	South East of Oceanside 22 Mi. SE	0.0050 (1/1) (0.0050 – 0.0050)	0.0050 (1/1) (0.0050 – 0.0050)	0
Cabbage	Cs-137	1	0.08	< LLD (0/0) (-)	South East of Oceanside 22 Mi. SE	0.0061 (1/1) (0.0061 – 0.0061)	0.0061 (1/1) (0.0061 – 0.0061)	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	1.28 (1/1) (1.28 – 1.28)	1.28 (1/1) (1.28 – 1.28)	0
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

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2009 to 12/31/2009

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detecti on (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis – Table 13A (pCi/g)								
Lettuce	I-131	1	0.06	< LLD (0/0) (-)		---- (0/1) (-)	< LLD (0/1) (-)	0
Lettuce	K-40	1	-	< LLD (0/0) (-)	South East of Oceanside 22 Mi. SE	1.77 (1/1) (1.77 – 1.77)	1.77 (1/1) (1.77 – 1.77)	0
Sorrel	Be-7	2	-	0.32 (2/2) (0.30 – 0.33)	SONGS Garden 0.4 Mi. NNW	0.32 (2/2) (0.30 – 0.33)	< LLD (0/0) (-)	0
Sorrel	Cs-134	2	0.06	0.0054 (2/2) (0.0038 – 0.0070)	SONGS Garden 0.4 Mi. NNW	0.0054 (2/2) (0.0038 – 0.0070)	< 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	0.0041 (1/2) (0.0041 – 0.0041)	SONGS Garden 0.4 Mi. NNW	0.0041 (1/2) (0.0041 – 0.0041)	< LLD (0/0) (-)	0
Sorrel	K-40	2	-	4.64 (2/2) (3.71 – 5.56)	SONGS Garden 0.4 Mi. NNW	4.64 (2/2) (3.71 – 5.56)	< LLD (0/0) (-)	0
Tomato	Be-7	4	-	0.0200 (1/2) (0.0200 – 0.0200)	SONGS Garden 0.4 Mi. NNW	0.0200 (1/2) (0.0200 – 0.0200)	< 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: 1/3/2009 to 12/31/2009

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		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean (Range)		
Semi-Annual Local Crops Gamma Spectral Analysis – Table 13A (pCi/g)								
Tomato	Cs-134	4	0.06	< LLD (0/2) (-)	South East of Oceanside 22 Mi. SE	0.0045 (1/2) (0.0045 – 0.0045)	0.0045 (1/2) (0.0045 – 0.0045)	0
Tomato	Cs-137	4	0.08	< LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Tomato	I-131	4	0.06	< LLD (0/2) (–)		---- (0/2) (–)	< LLD (0/2) (–)	0
Tomato	K-40	4	-	2.02 (2/2) (1.90 – 2.14)	SONGS Garden 0.4 Mi. NNW	2.02 (2/2) (1.90 – 2.14)	1.85 (2/2) (1.40 – 2.30)	0

During 2009, 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 2009 (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: 1/1/2009 to 12/31/2009

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	Location with Highest Annual Mean: 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	0.0559 (2/4) (0.0490 – 0.0628)	Former Visitor's Center (East Site Boundary) 0.4 Mi. NW	0.0628 (1/1) (0.0628 – 0.0628)	0.0244 (1/1) (0.0244 – 0.0244)	0
	Cs-137	5	0.18	0.22 (2/4) (0.0513 – 0.39)	Old Route 101 - East Southeast 3 Mi. ESE	0.39 (1/1) (0.39 – 0.39)	0.27 (1/1) (0.27 – 0.27)	0
	K-40	5	-	14.76 (4/4) (8.55 – 19.50)	Camp San Onofre 2.6 Mi NE	19.50 (1/1) (19.50 – 19.50)	4.18 (1/1) (4.18 – 4.18)	0
	Th-228	5		0.67 (4/4) (0.51 – 0.77)	Former Visitor's Center (East Site Boundary) 0.4 Mi. NW	0.77 (1/1) (0.77 – 0.77)	0.25 (1/1) (0.25 – 0.25)	0

During 2009, 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: 1/3/2009 to 12/31/2009

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	Location with Highest Annual Mean: 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) (-)	Capistano Beach Reef 9.3 Mi. NW	0.0047 (1/2) (0.0047 – 0.0047)	0.0045 (2/10) (0.0043 – 0.0047)	0
	I-131	16	0.06	0.0459 (6/6) (0.0103 – 0.0917)	Wheeler North Artificial Reef (See*** Mi.	0.0922 (2/2) (0.0324 – 0.15)	0.0762 (10/10) (0.0294 – 0.15)	0
	K-40	16	-	9.82 (6/6) (8.25 – 11.70)	(E) Salt Creek (CONTROL) 11 Mi. NNW	11.20 (2/2) (9.40 – 13.00)	10.16 (10/10) (7.52 – 13.00)	0

During 2009, 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 is 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 2009 Wheeler North Artificial Reef Kelp sample was collected 5.4 miles WNW. The October 2009 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 vendor's Quality Assurance manual. REMP sample analysis is performed by the Contracted Environmental Analysis Laboratory (CEAL) in accordance with the Laboratory Quality Assurance Plan. During 2009 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	14.40 ± 1.42	13.99 ± 0.70	15.97 ± 1.15	13.56 ± 0.74
TLD 200	14.67 ± 0.84	14.49 ± 1.06	15.89 ± 0.79	14.08 ± 0.66

- 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 2008 to July 2009)**	**TLD 201 (annual duplicate)** **dose in mR** **per standard quarter** **(July 2008 to July 2009)**
17.35	**17.08**

COMPARISON OF TLD TO PIC DATA,

PIC 1 16.83	PIC 3 17.33	PIC 4 17.81	PIC 8 13.36
TLD 10 15.38	TLD 40 17.86	TLD 61 18.74	TLD 65 11.09

PIC data converted to mR per standard quarter compared to the 4th Quarter co-located 2009 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 2009, three (3) gas meter failed to meet this criterion at all calibrated flow rates and one gas meter was inoperable. 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

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
E6375-278	4th/2008	Milk	Sr-90	pCi/L	10.90	12.6	0.86[1]	Acceptable
E6376-278	4th /2008	Milk	I-131	pCi/L	76.6	79.9	0.96[1]	Acceptable
E6376-278	4th /2008	Milk	Ce-141	pCi/L	179	191	0.93[1]	Acceptable
E6376-278	4th /2008	Milk	Cr-51	pCi/L	248	246	1.01[1]	Acceptable
E6376-278	4th /2008	Milk	Cs-134	pCi/L	128	134	0.95[1]	Acceptable
E6376-278	4th /2008	Milk	Cs-137	pCi/L	123	120	1.03[1]	Acceptable
E6376-278	4th /2008	Milk	Co-58	pCi/L	101	104	0.97[1]	Acceptable
E6376-278	4th /2008	Milk	Mn-54	pCi/L	151	152	0.99[1]	Acceptable
E6376-278	4th /2008	Milk	Fe-59	pCi/L	103	100	1.02[1]	Acceptable
E6376-278	4th /2008	Milk	Zn-65	pCi/L	193	183	1.05[1]	Acceptable
E6376-278	4th /2008	Milk	Co-60	pCi/L	139	133	1.05[1]	Acceptable
E6377-278	4th /2008	Water	I-131	pCi/L	63.7	64.1	0.99[1]	Acceptable
E6377-278	4th /2008	Water	Ce-141	pCi/L	224	224	1.00[1]	Acceptable
E6377-278	4th /2008	Water	Cr-51	pCi/L	278	288	0.96[1]	Acceptable
E6377-278	4th /2008	Water	Cs-134	pCi/L	159	157	1.01[1]	Acceptable
E6377-278	4th /2008	Water	Cs-137	pCi/L	148	140	1.05[1]	Acceptable
E6377-278	4th /2008	Water	Co-58	pCi/L	126	122	1.03[1]	Acceptable
E6377-278	4th /2008	Water	Mn-54	pCi/L	192	178	1.08[1]	Acceptable
E6377-278	4th /2008	Water	Fe-59	pCi/L	128	117	1.09[1]	Acceptable
E6377-278	4th /2008	Water	Zn-65	pCi/L	238	214	1.11[1]	Acceptable
E6377-278	4th /2008	Water	Co-60	pCi/L	168	156	1.08[1]	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
RAD-75	4th /2008	Water	Sr-89	pCi/L	44.3	48.7	38.2 – 56.1	Acceptable
RAD-75	4th /2008	Water	Sr-90	pCi/L	38.2	33.6	24.6 – 38.8	Acceptable
RAD-75	4th /2008	Water	Gross Alpha	pCi/L	17.6	26.9	13.6 – 35.5	Acceptable
RAD-75	4th /2008	Water	Gross Beta	pCi/L	28.8	38	25.1 – 45.5	Acceptable
RAD-75	4th /2008	Water	H-3	pCi/L	2100	2220	1830 - 2460	Acceptable
E6582-278	1st/2009	Cartridge	I-131	pCi	7.77E + 01	7.94E + 01	0.98[1]	Acceptable
E6584-278	1st/2009	Milk	Ce-141	pCi/L	9.78E + 01	9.49E + 01	1.03[1]	Acceptable
E6584-278	1st/2009	Milk	Co-58	pCi/L	1.23E + 02	1.19E + 02	1.03[1]	Acceptable
E6584-278	1st/2009	Milk	Co-60	pCi/L	1.50E + 02	1.42E + 02	1.05[1]	Acceptable
E6584-278	1st/2009	Milk	Cr-51	pCi/L	2.97E+ 02	3.05E + 02	0.97[1]	Acceptable
E6584-278	1st/2009	Milk	Cs-134	pCi/L	9.06E+ 01	9.37E + 01	0.97[1]	Acceptable
E6584-278	1st/2009	Milk	Cs-137	pCi/L	1.16E + 02	1.11E + 02	1.04[1]	Acceptable
E6584-278	1st/2009	Milk	Fe-59	pCi/L	1.16E + 02	7.61E + 00	1.16[1]	Acceptable
E6584-278	1st/2009	Milk	I-131	pCi/L	7.97E + 01	7.93E + 01	1.01[1]	Acceptable
E6584-278	1st/2009	Milk	Mn-54	pCi/L	1.33E + 02	1.28E + 02	1.04[1]	Acceptable
E6584-278	1st/2009	Milk	Zn-65	pCi/L	1.72E + 02	1.56E + 02	1.1[1]	Acceptable
E6585-278	1st/2009	Water	Ce-141	pCi/L	1.22E + 02	1.20E + 02	1.02[1]	Acceptable
E6585-278	1st/2009	Water	Co-58	pCi/L	1.59E + 02	1.51E + 02	1.05[1]	Acceptable
E6585-278	1st/2009	Water	Co-60	pCi/L	1.92E + 02	1.80E + 02	1.06[1]	Acceptable
E6585-278	1st/2009	Water	Cr-51	pCi/L	3.92E + 02	3.87E + 02	1.01[1]	Acceptable
E6585-278	1st/2009	Water	Cs-134	pCi/L	1.19E + 02	1.19E + 02	1.00[1]	Acceptable
E6585-278	1st/2009	Water	Cs-137	pCi/L	1.44E + 02	1.41E + 02	1.02[1]	Acceptable
E6585-278	1st/2009	Water	Fe-59	pCi/L	1.28E + 02	1.27E + 02	1.01[1]	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
E6585-278	1st/2009	Water	I-131	pCi/L	7.55E + 01	6.90E + 01	1.09[1]	Acceptable
E6585-278	1st/2009	Water	Mn-54	pCi/L	1.80E + 02	1.62E + 02	1.11[1]	Acceptable
E6585-278	1st/2009	Water	Zn-65	pCi/L	2.24E + 02	1.97E + 02	1.13[1]	Acceptable
RAD - 76	1st/2009	Water	Gross Alpha	pCi/L	51.3	52.3	27.3 – 65.5	Acceptable
RAD - 76	1st/2009	Water	Gross Beta	pCi/L	41.9	46.1	31.0 – 53.3	Acceptable
RAD - 76	1st/2009	Water	H-3	pCi/L	3760.0	4230	3610 - 4660	Acceptable
RAD - 76	1st/2009	Water	I-131	pCi/L	25.1	22.2	18.4 – 26.5	Acceptable
RAD - 76	1st/2009	Water	Sr-89	pCi/L	72.8	65	52.7 – 73.0	Acceptable
RAD - 76	1st/2009	Water	Sr-90	pCi/L	36.5	41.9	30.8 – 48.1	Acceptable
E6729-278	2nd/2009	Cartridge	I-131	pCi	9.27E + 01	9.55E + 01	0.97[1]	Acceptable
E6730-278	2nd/2009	Milk	Sr-89	pCi/L	8.51E + 01	1.12E + 02	0.76[1]	Acceptable
E6730-278	2nd/2009	Milk	Sr-90	pCi/L	1.09E + 01	1.67E + 01	0.65[1]	Not Acceptable
E6731-278	2nd/2009	Milk	Ce-141	pCi/L	2.84E + 02	2.84E + 02	1[1]	Acceptable
E6731-278	2nd/2009	Milk	Co-58	pCi/L	9.48E + 01	9.19E + 01	1.03[1]	Acceptable
E6731-278	2nd/2009	Milk	Co-60	pCi/L	3.15E + 02	3.12E + 02	1.01[1]	Acceptable
E6731-278	2nd/2009	Milk	Cr-51	pCi/L	4.04E + 02	4.00E + 02	1.01[1]	Acceptable
E6731-278	2nd/2009	Milk	Cs-134	pCi/L	1.58E + 02	1.66E + 02	0.95[1]	Acceptable
E6731-278	2nd/2009	Milk	Cs-137	pCi/L	1.92E + 02	1.92E + 02	1[1]	Acceptable
E6731-278	2nd/2009	Milk	Fe-59	pCi/L	1.23E + 02	1.22E + 02	1.01[1]	Acceptable
E6731-278	2nd/2009	Milk	I-131	pCi/L	8.98E + 01	1.02E + 02	0.88[1]	Acceptable
E6731-278	2nd/2009	Milk	Mn-54	pCi/L	1.42E + 02	1.37E + 02	1.04[1]	Acceptable
E6731-278	2nd/2009	Milk	Zn-65	pCi/L	1.79E + 02	1.75E + 02	1.02[1]	Acceptable
E6732-278	2nd/2009	Water	Ce-141	pCi/L	2.29E + 02	2.16E + 02	1.06[1]	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
E6732-278	2nd/2009	Water	Co-58	pCi/L	7.21E + 01	6.98E + 01	1.03[1]	Acceptable
E6732-278	2nd/2009	Water	Co-60	pCi/L	2.42E + 02	2.37E +02	1.02[1]	Acceptable
E6732-278	2nd/2009	Water	Cr-51	pCi/L	3.11E + 02	3.04E + 02	1.02[1]	Acceptable
E6732-278	2nd/2009	Water	Cs-134	pCi/L	1.37E + 02	1.26E + 02	1.09[1]	Acceptable
E6732-278	2nd/2009	Water	Cs-137	pCi/L	1.51E + 02	1.46E + 02	1.04[1]	Acceptable
E6732-278	2nd/2009	Water	Fe-59	pCi/L	9.04E + 01	9.29E + 01	0.97[1]	Acceptable
E6732-278	2nd/2009	Water	I-131	pCi/L	8.52E + 01	8.83E + 01	0.97[1]	Acceptable
E6732-278	2nd/2009	Water	Mn-54	pCi/L	1.07E + 02	1.04E + 02	1.03[1]	Acceptable
E6732-278	2nd/2009	Water	Zn-65	pCi/L	1.38E + 02	1.33E + 02	1.04[1]	Acceptable
MAPEP 09-GrF20	2nd/2009	Filter	Gross Alpha	Bq	0.069	0.35	>0.0 – 0.696	Acceptable
MAPEP 09-GrF20	2nd/2009	Filter	Gross Beta	Bq	0.297	0.28	0.140 – 0.419	Acceptable
MAPEP 09-GrW20	2nd/2009	Water	Gross Alpha	Bq/L	0.506	0.64	>0.0 – 1.270	Acceptable
MAPEP 09-GrW20	2nd/2009	Water	Gross Beta	Bq/L	1.337	1.27	0.64 – 1.91	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Co-57	Bq/kg	-0.30	0.00	-----	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Co-60	Bq/kg	3.6	4.113		Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Cs-134	Bq/kg	468	467	327 – 607	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Cs-137	Bq/kg	622	605	424 - 787	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Fe-55	Bq/kg	844.7	983	688 - 1278	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	K-40	Bq/kg	608.7	570	399 - 741	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Mn-54	Bq/kg	322.3	307	215 - 399	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Ni-63	Bq/kg	550.3	514.9	360.4 – 669.4	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Sr-90	Bq/kg	262.33	257	180 - 334	Acceptable
MAPEP 09-MaS20	2nd/2009	Soil	Zn-65	Bq/kg	261	242	169 - 315	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Co-57	Bq/L	18.8	18.9	13.2 – 24.6	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Co-60	Bq/L	16.8	17.21	12.05 – 22.37	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Cs-134	Bq/L	21.9	22.5	15.8 – 29.3	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Cs-137	Bq/L	0.0	0	-----	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Mn-54	Bq/L	15.1	14.66	10.26 – 19.06	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Ni-63	Bq/L	52.7	53.5	37.45 – 69.55	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Sr-90	Bq/L	7.43	7.21	5.05 – 9.37	Acceptable
MAPEP 09-MaW20	2nd/2009	Water	Zn-65	Bq/L	14.6	13.6	9.5 – 17.7	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Co-57	Bq	1.347	1.30	0.91 – 1.69	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Co-60	Bq	1.413	1.22	0.85 – 1.59	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Cs-134	Bq	2.763	2.93	2.05 – 3.81	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Cs-137	Bq	1.487	1.52	1.06 – 1.98	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Mn-54	Bq	2.403	2.27	1.5896 – 2.9522	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Sr-90	Bq	0.692	0.64	0.448 – 0.832	Acceptable
MAPEP 09-RdF20	2nd/2009	Filter	Zn-65	Bq	1.613	1.36	0.95 – 1.77	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Co-57	ug/sample	2.557	2.63	1.65 – 3.07	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Co-60	ug/sample	-0.010	0.00	----	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Cs-134	ug/sample	3.430	3.40	2.38 – 4.42	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Cs-137	ug/sample	0.907	0.93	0.65 – 1.21	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Mn-54	ug/sample	2.353	2.30	1.61 – 2.99	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Sr-90	ug/sample	1.160	1.26	0.882 – 1.638	Acceptable
MAPEP 09-RdV20	2nd/2009	Vegetation	Zn-65	ug/sample	1.350	1.35	0.948 - 1.760	Acceptable
E6843 - 278	3rd/2009	Cartridge	I-131	pCi	9.54E + 01	9.21E + 01	1.04[1]	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
E6844 - 278	3rd/2009	Milk	Sr-89	pCi/L	1.19E + 02	1.07E + 02	1.12[1]	Acceptable
E6844 - 278	3rd/2009	Milk	Sr-90	pCi/L	1.68E + 01	1.88E + 01	0.89[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Ce-141	pCi/L	2.83E + 02	2.75E + 02	1.03[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Co-58	pCi/L	1.04E + 02	9.94E + 01	1.05[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Co-60	pCi/L	1.58E + 02	1.60E + 02	0.99[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Cr-51	pCi/L	2.43E + 02	2.21E + 02	1.1[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Cs-134	pCi/L	1.23E + 02	1.23E + 02	1.00[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Cs-137	pCi/L	1.92E + 02	1.85E + 02	1.04[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Fe-59	pCi/L	1.64E + 02	1.47E + 02	1.11[1]	Acceptable
E6845 - 278	3rd/2009	Milk	I-131	pCi/L	1.01E + 02	9.86E + 01	1.02[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Mn-54	pCi/L	2.11E + 02	2.06E + 02	1.02[1]	Acceptable
E6845 - 278	3rd/2009	Milk	Zn-65	pCi/L	2.24E+ 02	2.04E + 02	1.1[1]	Acceptable
E6846 -278	3rd/2009	Water	Ce-141	pCi/L	2.72E + 02	2.64E + 02	1.03[1]	Acceptable
E6846 -278	3rd/2009	Water	Co-58	pCi/L	9.65E + 01	9.54E + 01	1.01[1]	Acceptable
E6846 -278	3rd/2009	Water	Co-60	pCi/L	1.56E + 02	1.54E + 02	1.01[1]	Acceptable
E6846 -278	3rd/2009	Water	Cr-51	pCi/L	2.21E + 02	2.12E + 02	1.04[1]	Acceptable
E6846 -278	3rd/2009	Water	Cs-134	pCi/L	1.18E + 02	1.18E + 02	1.00[1]	Acceptable
E6846 -278	3rd/2009	Water	Cs-137	pCi/L	1.86E + 02	1.77E + 02	1.05[1]	Acceptable
E6846 -278	3rd/2009	Water	Fe-59	pCi/L	1.48E + 02	1.41E + 02	1.05[1]	Acceptable
E6846 -278	3rd/2009	Water	I-131	pCi/L	1.02E + 02	9.84E + 01	[1]1.04	Acceptable
E6846 -278	3rd/2009	Water	Mn-54	pCi/L	2.11E + 02	1.98E + 02	1.07[1]	Acceptable
E6846 -278	3rd/2009	Water	Zn-65	pCi/L	2.19E + 02	1.95E + 02	1.12[1]	Acceptable
RAD - 78	3rd/2009	Water	Gross Alpha	pCi/L	43.8	55.3	28.9 – 69.0	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
RAD - 78	3rd/2009	Water	Gross Beta	pCi/L	53.6	64.7	44.8 – 71.3	Acceptable
RAD - 78	3rd/2009	Water	H-3	pCi/L	9440.0	10000	8690 - 11000	Acceptable
RAD - 78	3rd/2009	Water	I-131	pCi/L	28.4	26.3	21.8 – 31.0	Acceptable
RAD - 78	3rd/2009	Water	Sr-89	pCi/L	59.6	59.1	47.4 – 66.9	Acceptable
RAD - 78	3rd/2009	Water	Sr-90	pCi/L	33.7	37.4	27.4 – 43.1	Acceptable
MAPEP 09-GrF21	4th/2009	Filter	Gross Alpha	Bq	0.069	0.35	>0.0 – 0.696	Acceptable
MAPEP 09-GrF21	4th/2009	Filter	Gross Beta	Bq	0.297	0.28	0.140 – 0.419	Acceptable
MAPEP 09-GrW21	4th/2009	Water	Gross Alpha	Bq/L	0.982	1.05	>0.0 – 2.094	Acceptable
MAPEP 09-GrW21	4th/2009	Water	Gross Beta	Bq/L	7.277	7.53	3.77 – 11.30	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Co-57	Bq/kg	572.30	586.00	410 - 762	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Co-60	Bq/kg	332.3	327.000	229 - 425	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Cs-134	Bq/kg	0	0	-----	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Cs-137	Bq/kg	683	669	468 - 870	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Fe-55	Bq/kg	810.0	796	557 - 1035	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	K-40	Bq/kg	401.3	375	263 - 488	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Mn-54	Bq/kg	834.7	796	557 - 1035	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Ni-63	Bq/kg	640.0	680.0	476 - 884	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Sr-90	Bq/kg	423.30	455	319 - 592	Acceptable
MAPEP 09-MaS21	4th/2009	Soil	Zn-65	Bq/kg	1293	1178	825 - 1531	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Co-57	Bq/L	35.7	36.6	25.6 - 47.6	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Co-60	Bq/L	15.3	15.4	10.8 – 20.0	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Cs-134	Bq/L	31.6	32.2	22.5 – 41.9	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Cs-137	Bq/L	40.4	41.2	28.8 – 53.6	Acceptable

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Acceptance Ratio/ Acceptance Range[1]	Evaluation
E6374-278	4th/2008	Cartridge	I-131	Pci	56.50	53.2	1.06	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Mn-54	Bq/L	0.07	0.00	----	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Ni-63	Bq/L	45.8	44.2	30.9 – 57.5	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Sr-90	Bq/L	16.40	12.99	9.09 – 16.89	Acceptable
MAPEP 09-MaW21	4th/2009	Water	Zn-65	Bq/L	28.9	26.9	18.8 – 35.0	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Co-57	Bq	6.730	6.48	4.54 -8.42	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Co-60	Bq	1.127	1.03	0.72 – 1.34	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Cs-134	Bq	0.034	0.00	-----	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Cs-137	Bq	1.397	1.40	0.98 – 1.82	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Mn-54	Bq	5.697	5.49	3.84 – 7.14	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Sr-90	Bq	0.778	0.84	0.585 – 1.086	Acceptable
MAPEP 09-RdF21	4th/2009	Filter	Zn-65	Bq	4.350	3.93	2.75 – 5.11	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Co-57	ug/sample	8.333	8.00	5.6 – 10.4	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Co-60	ug/sample	2.637	2.57	1.80 -3.34	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Cs-134	ug/sample	-0.014	0.00	----	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Cs-137	ug/sample	2.443	2.43	1.70 – 3.16	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Mn-54	ug/sample	8.407	7.90	5.5 -10.3	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Sr-90	ug/sample	1.577	1.78	1.25 – 2.31	Acceptable
MAPEP 09-RdV21	4th/2009	Vegetation	Zn-65	ug/sample	-0.029	0.00	-----	Acceptable

[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 2009 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 2009 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 2009. (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 millirem. 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 2009 operational year for Units 2/3, the routine indicator TLD locations ranged

from 10.65 to 24.94 millirem, averaging 17.26 millirem while the control locations ranged from 12.88 to 20.11 millirem with an average of 16.47 millirem.

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 2009 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 2009). 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 2009 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 2009 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 2009 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 2009 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 2009 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 2009**
****** **During January to December 2009 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 2009 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 2009 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 2009 had no impact on the environment as measured by this sample medium.

TABLE D-2

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 2009 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	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	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	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	< LLD	< LLD	< LLD	< LLD

* **PreOp = January 1979 to July 1982; Operational = January to December 2009. The species collected in 2009 were Bay Mussel, California Mussel, Black Perch, Blacksmith, Kelp Bass, Sheephead, and Spiny Lobster.**

** **During January to December 2009 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 2009 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	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	---	---	---	---

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	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	< LLD	< LLD	< LLD	< LLD

* **PreOp = January 1979 to July 1982; Operational = January to December 2009. The species collected in 2009 were Bay Mussel, California Mussel, Black Perch, Blacksmith, Kelp Bass, Sheephead, and Spiny Lobster.**

** **During January to December 2009 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 2009 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 2009**
** **Sea Hare and Keyhole Limpet samples were not collected in 2009**
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 2009 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 2009 four additional control sample locations were analyzed.

To assess the impact of SONGS operations on kelp, preoperational data were compared to 2009 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 2009 operational period, I-131 was detected in all samples. No other station related isotopes were detected in kelp samples during the 2009 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 location. These data support the conclusion that during the Units 2/3 operational period, the detection of I-131 in kelp is primarily due to factors external to SONGS.

K. Drinking Water

No plant related radionuclides were detected during the 2009 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	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	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	0.010 – 0.092	0.046	0.029 – 0.152	0.076
Cs-137	PreOp	0.004-0.009	0.006	<LLD	<LLD
All other measured	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	< LLD	< LLD	< LLD	< LLD

* **PreOp = January 1979 to July 1982; Operational = January to December 2009**
LLD Lower Limit of Detection for operational data are listed in Appendix B.

APPENDIX E

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

IN 2009

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 2009, 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 2009 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 2009 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): No deviations were observed

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

Air Sampler 13 (Camp Pendleton East): This sampler had 11.3 hours of down time due to external power outages.

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 2009 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 2009.

B. DIRECT RADIATION

TLD # 34 was not on station for the first quarter 2009. The TLD canister was found broken.

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 2009 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 and F-2 at the end of this appendix.

THE STUDY AREA

The study area includes half of the city of San Clemente (population estimated at 68,316 as of January 1, 2009), 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 2009 LUC and documentation notebook was conducted. Verification and revision of the 2009 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. Unnecessary information, not specified in the procedure, has been removed from the LUC report. Non-residential uses further away than the closest residence have been deleted.

2. Obsolete references to the distance from the Unit1 plant vent stack have been deleted.

3. San Onofre III housing was completed and occupied during 2009. This is the closest permanent structure residence for all age groups in Sectors Q and R.

4. LUC # R-R3 – Camp Mesa Dry Camping had an estimated occupancy of 3100 hours in 2009.

5. Age group data has been included for transient residences. Permanent residences are presumed to be occupied by all age groups. Permanent residences known to be occupied only by adults (Camp Pendleton barracks) are identified.

6. The San Onofre State Beach campground was occupied by only one surf camp in 2009. LUC # O-2C – Surfcamp.com and O-2B YMCA surf camp did not occupy camping spaces at San Onofre during 2009.

7. The Camp Pendleton hunting take for the period July 1, 2008 to June 30, 2009 is listed in Table 2 of the 2009 LUC. Per the base wildlife biologist, the exact location of a particular kill is not known. The reported take area should be interpreted as an estimate of approximate location. Thus a deer reported as taken in hunting area Alpha 2 may actually have been taken in an adjacent hunting area (such as Romeo 3 or Bravo 3). There are no changes to the estimated distances from SONGS to the nearest vegetation potentially consumed by deer for 2009.

TABLE F-1
2009 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	**8,030**
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 (See notes for Table 1)**	**1.4**	**FTR**
	R-Q3	San Mateo Point Housing	2.7	FTR
R	R-R2	SONGS Camp Mesa **(See notes for Table 1)**	0.4	**8,030**
	R-R3	SONGS Dry Camping PL12	0.7	**3,100**
	R-R1	**San Onofre III (See notes for Table 1)**	**1.3**	**FTR**

Bolt Text indicates changes from 2008 LUC Data as of 10-1-2009 FTR – Full Time Residence

TABLE F-2
2009 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 2008 LUC Data as of 10-1-2009 FTR – Full Time Residence

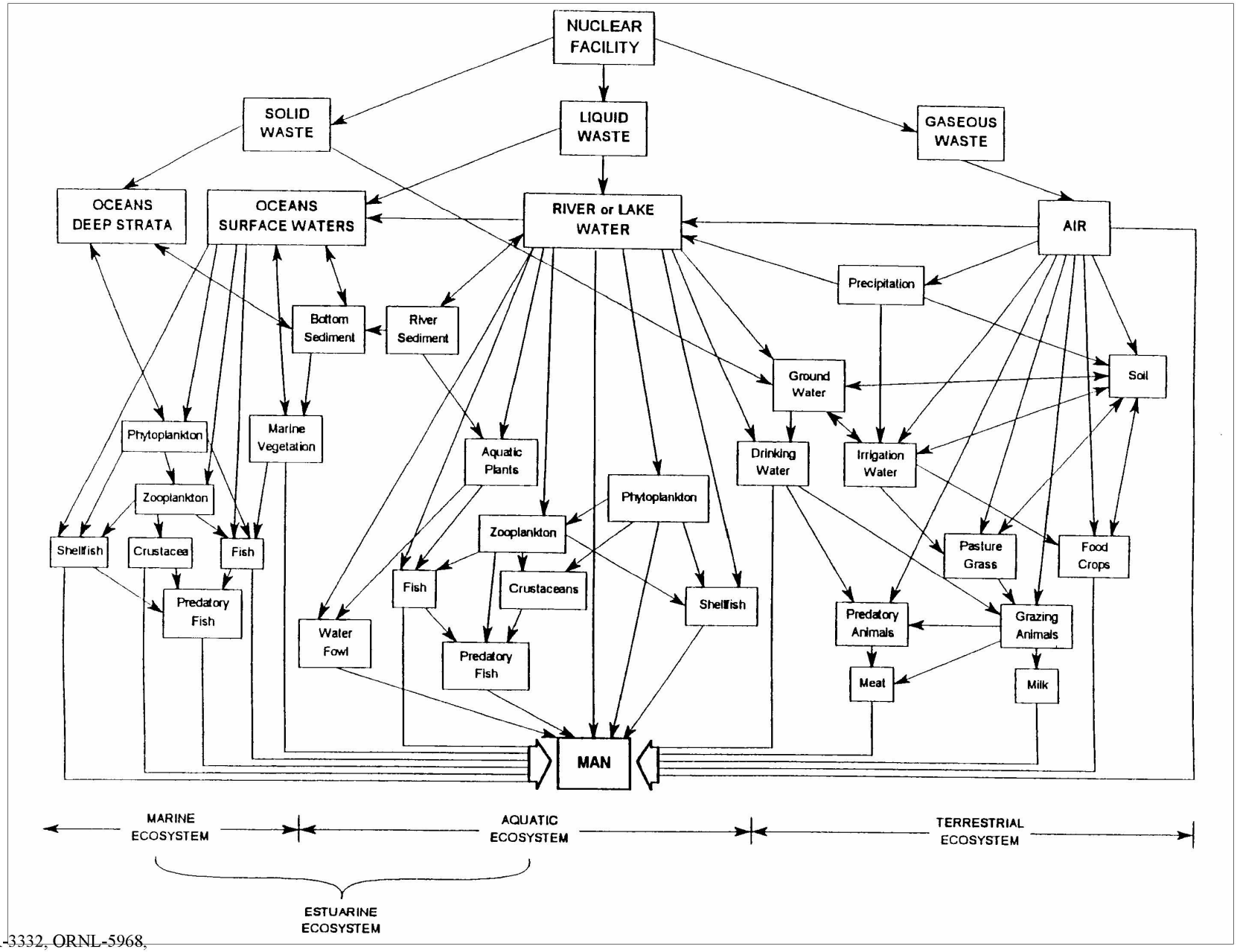
TABLE F-3
2009 SONGS Units 2/3 LUC Five-Mile Radius Summary Sheet

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	624
C	O-10	Camp San Onofre (STP #11)	2.2	2,000
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	2,256
	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
	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 2008 LUC Data as of 10-1-2009 FTR – Full Time Residence

APPENDIX G

FIGURES FOR 2009



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

Figure 1. Potential Radiation Exposure Pathways Leading to Man

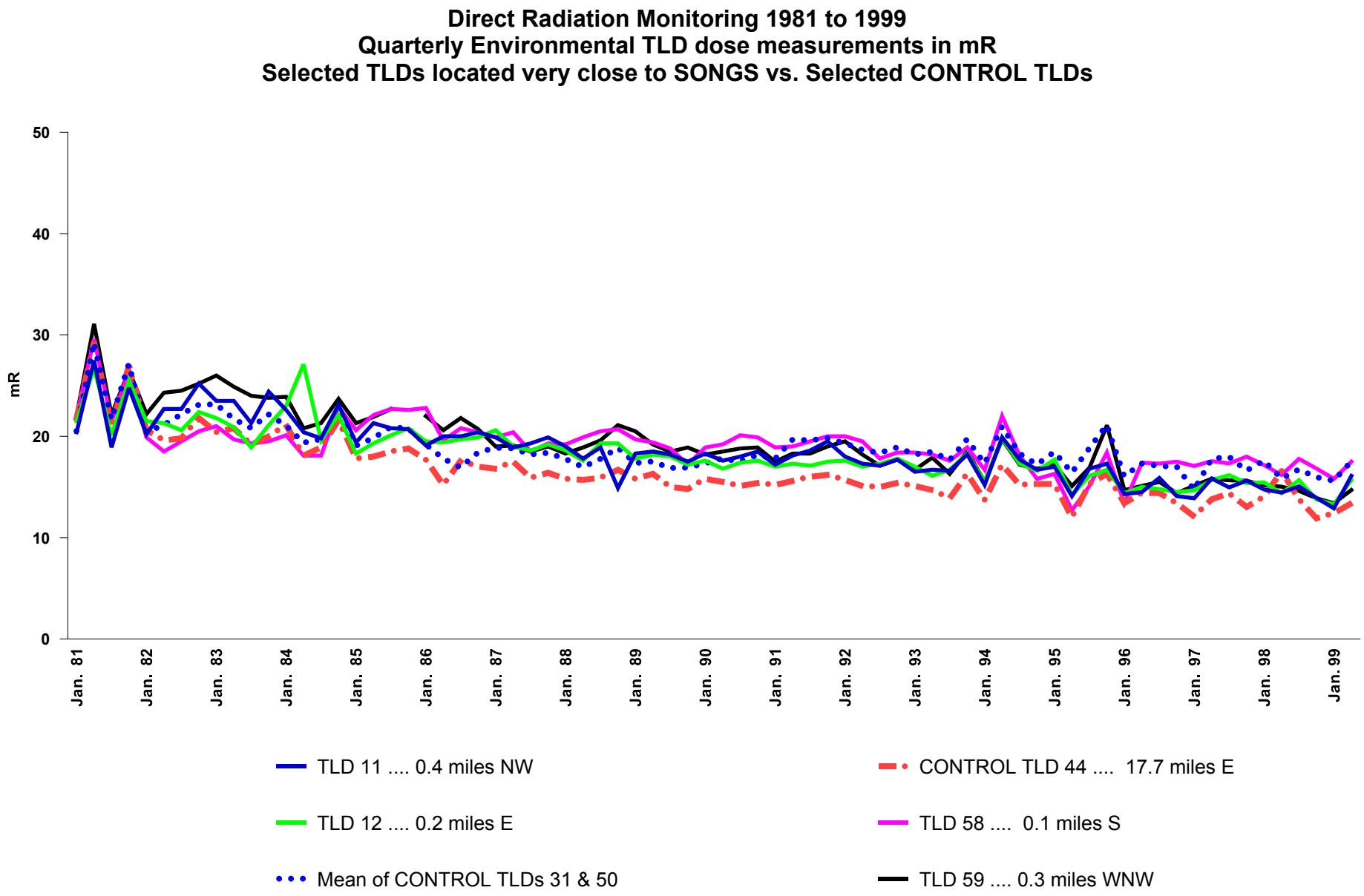

Direct Radiation Monitoring 1981 to 1999
Quarterly Environmental TLD dose measurements in mR
Selected TLDs located very close to SONGS vs. Selected CONTROL TLDs
mR
50
40
30
20
10
0
Jan. 81
Jan. 82
Jan. 83
Jan. 84
Jan. 85
Jan. 86
Jan. 87
Jan. 88
Jan. 89
Jan. 90
Jan. 91
Jan. 92
Jan. 93
Jan. 94
Jan. 95
Jan. 96
Jan. 97
Jan. 98
Jan. 99
TLD 11 .... 0.4 miles NW
CONTROL TLD 44 .... 17.7 miles E
TLD 12 .... 0.2 miles E
TLD 58 .... 0.1 miles S
Mean of CONTROL TLDs 31 & 50
TLD 59 .... 0.3 miles WNW

Figure 2A

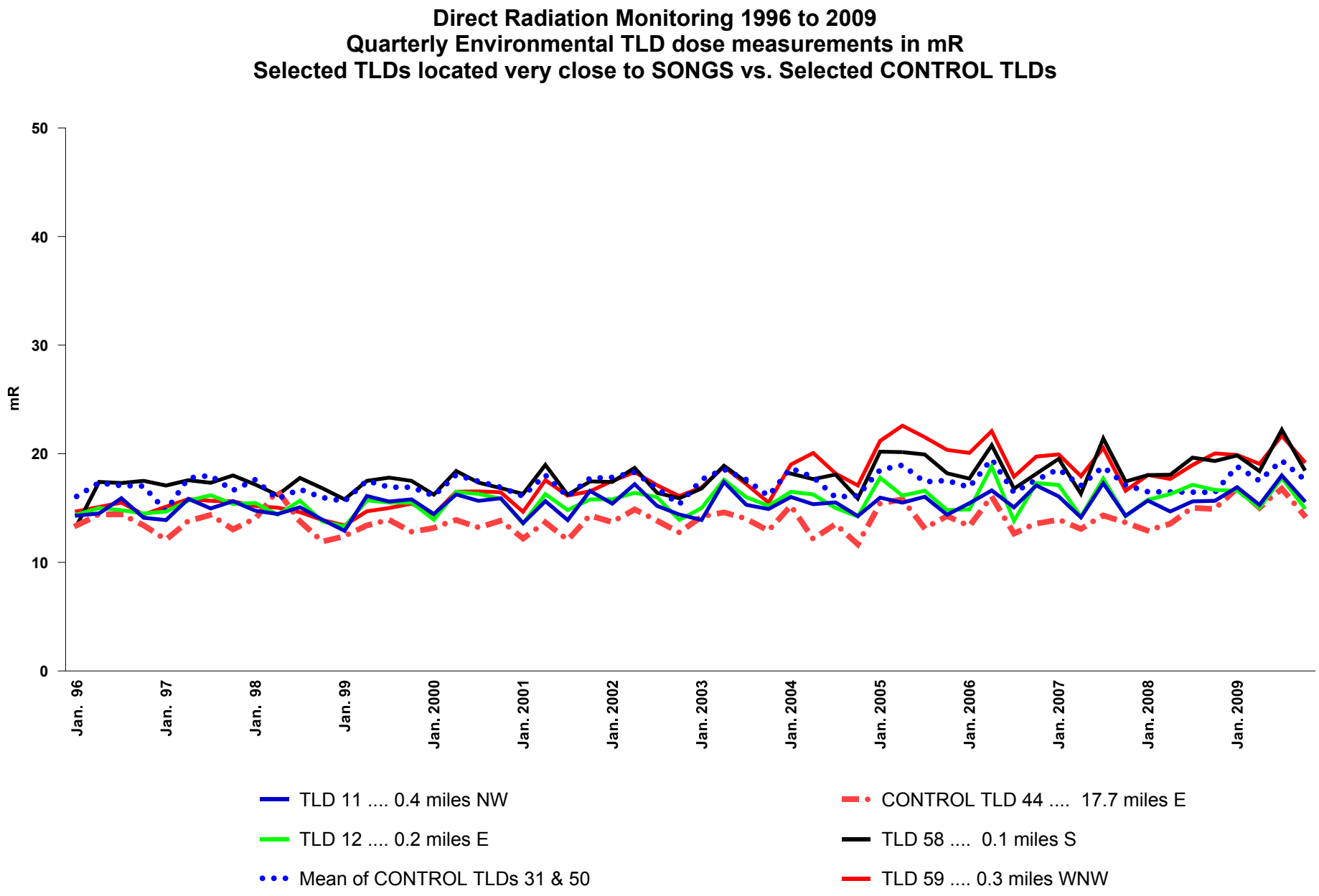

Direct Radiation Monitoring 1996 to 2009
Quarterly Environmental TLD dose measurements in mR
Selected TLDs located very close to SONGS vs. Selected CONTROL TLDs
mR
50
40
30
20
10
0
Jan. 96
Jan. 97
Jan. 98
Jan. 99
Jan. 2000
Jan. 2001
Jan. 2002
Jan. 2003
Jan. 2004
Jan. 2005
Jan. 2006
Jan. 2007
Jan. 2008
Jan. 2009
TLD 11 .... 0.4 miles NW
TLD 12 .... 0.2 miles E
Mean of CONTROL TLDs 31 & 50
CONTROL TLD 44 .... 17.7 miles E
TLD 58 .... 0.1 miles S
TLD 59 .... 0.3 miles WNW

Figure 2B

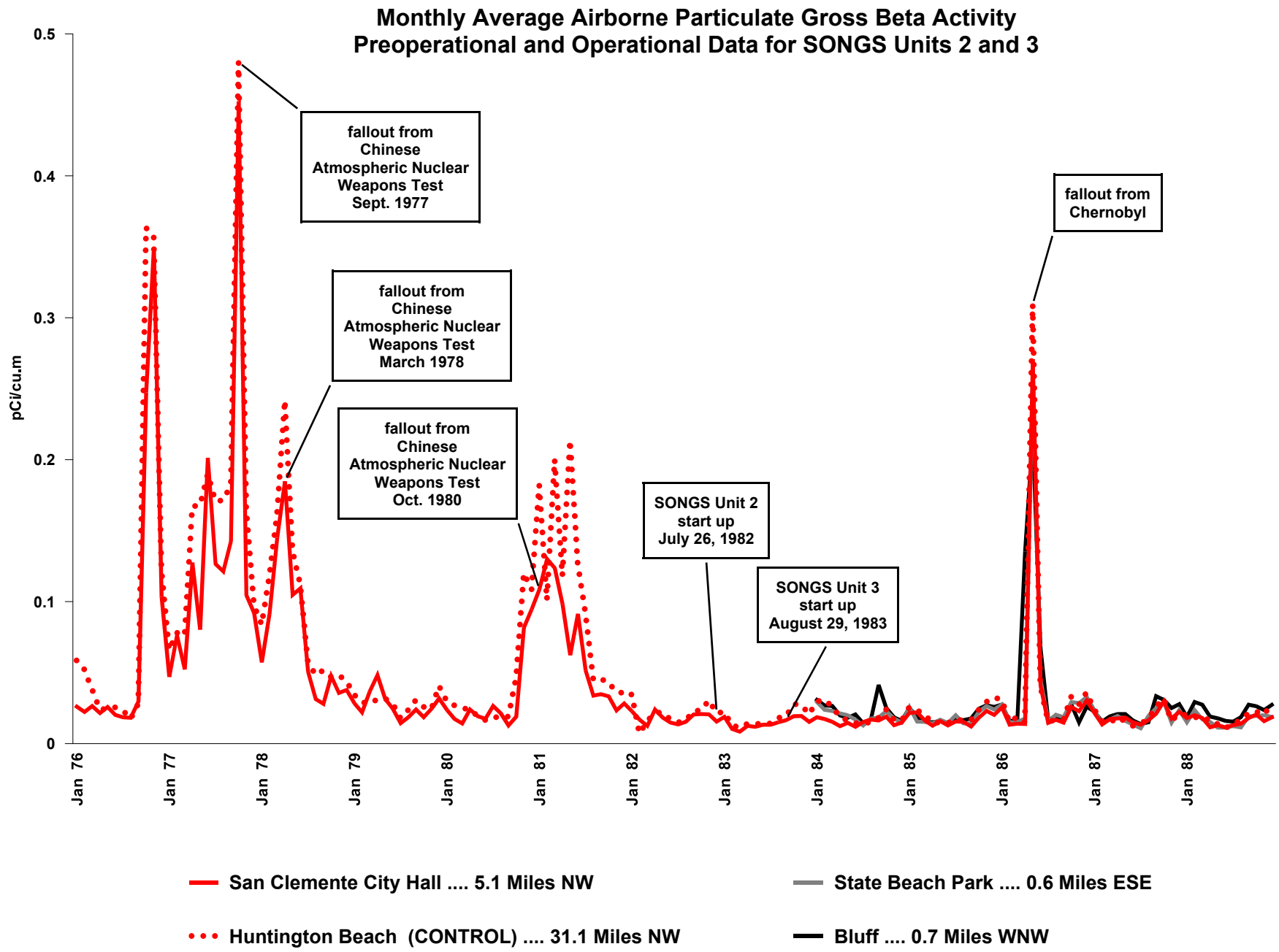

Monthly Average Airborne Particulate Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
pCi/cu.m
0.5
0.4
0.3
0.2
0.1
0
fallout from Chinese Atmospheric Nuclear Weapons Test Sept. 1977
fallout from Chinese Atmospheric Nuclear Weapons Test March 1978
fallout from Chinese Atmospheric 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

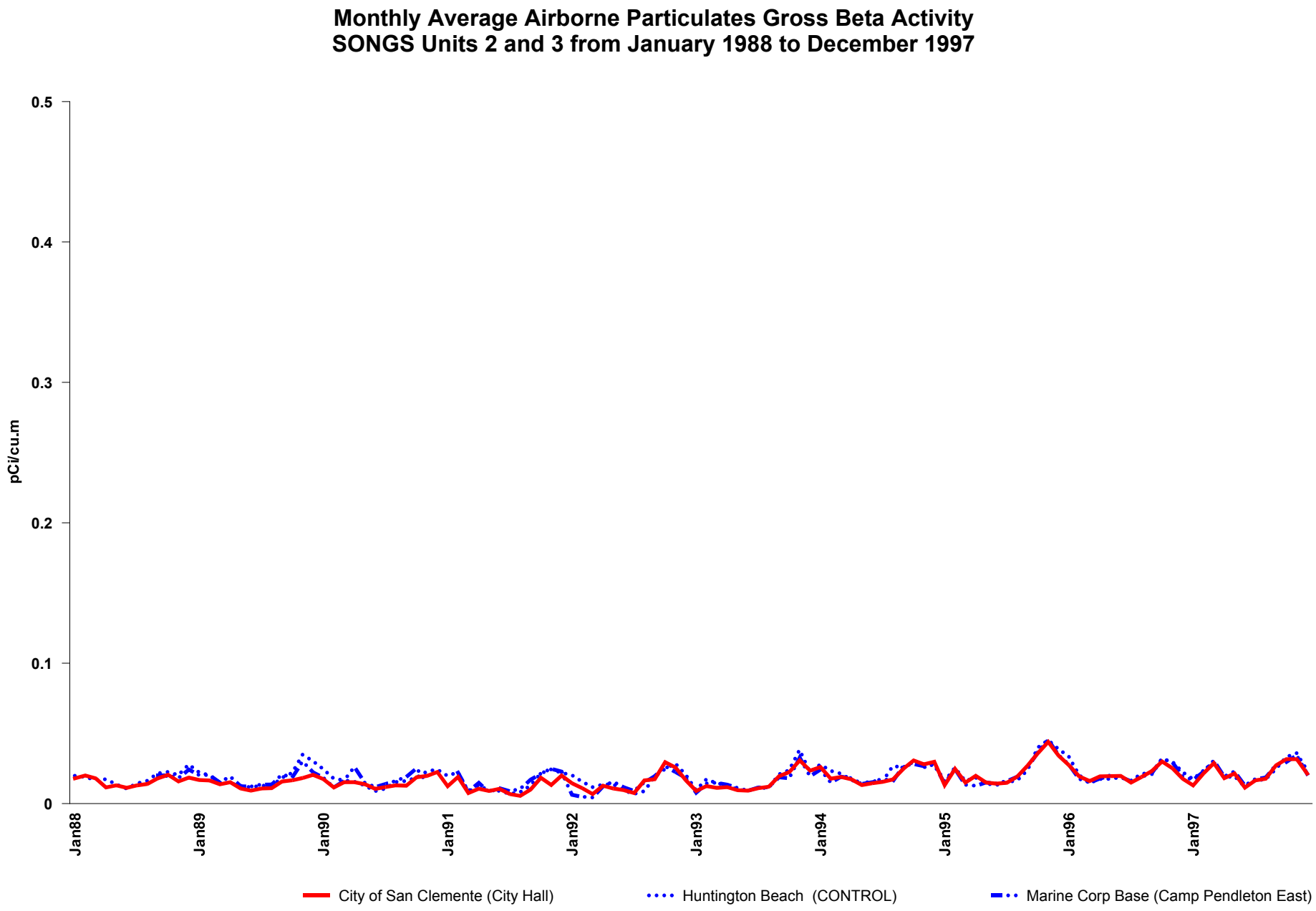

Monthly Average Airborne Particulates Gross Beta Activity
SONGS Units 2 and 3 from January 1988 to December 1997
pCi/cu.m
0.5
0.4
0.3
0.2
0.1
0
Jan88
Jan89
Jan90
Jan91
Jan92
Jan93
Jan94
Jan95
Jan96
Jan97
City of San Clemente (City Hall)
Huntington Beach (CONTROL)
Marine Corp Base (Camp Pendleton East)

Figure 3B

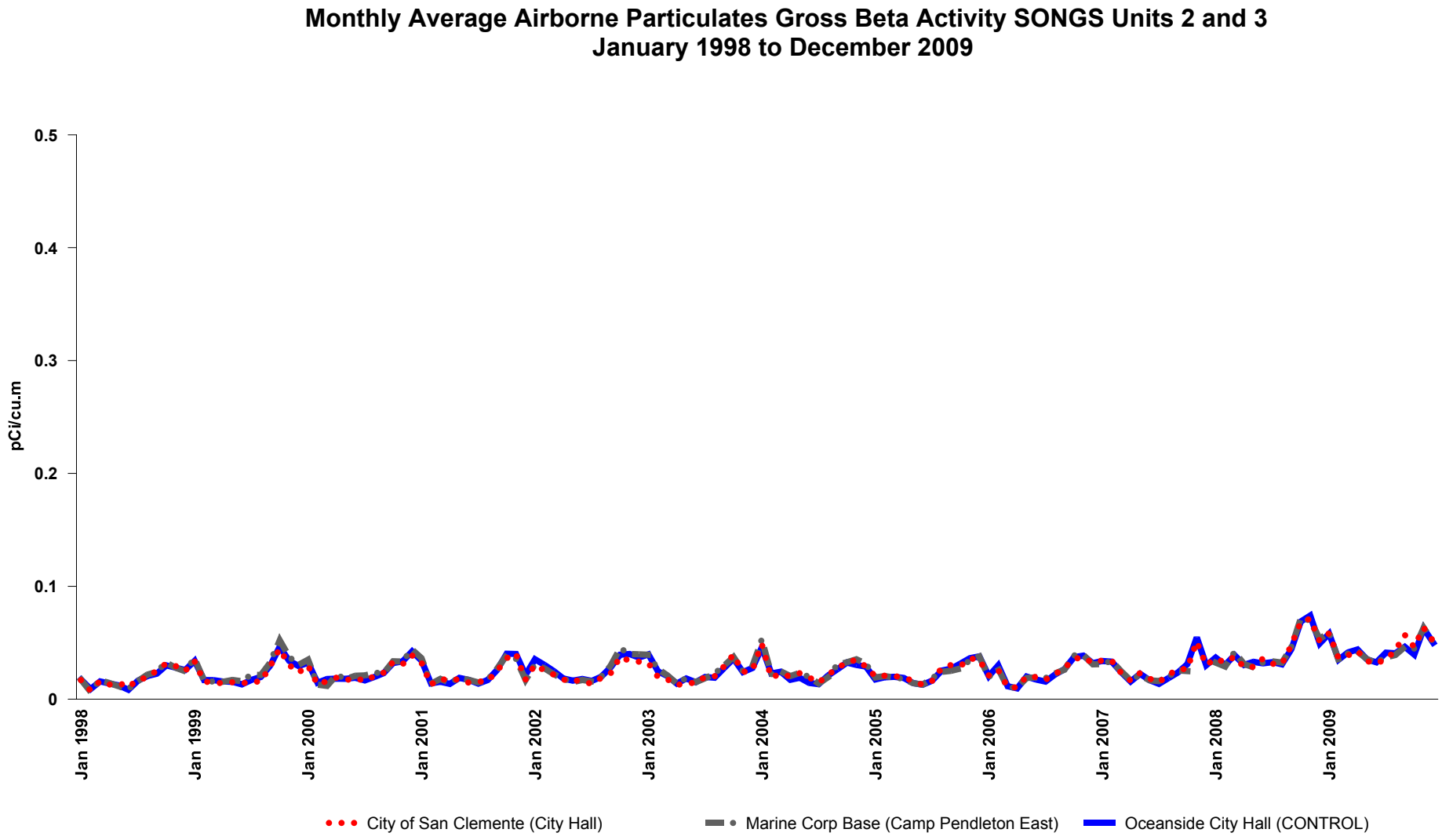

Monthly Average Airborne Particulates Gross Beta Activity SONGS Units 2 and 3
January 1998 to December 2009
pCi/cu.m
0.5
0.4
0.3
0.2
0.1
0
Jan 1998
Jan 1999
Jan 2000
Jan 2001
Jan 2002
Jan 2003
Jan 2004
Jan 2005
Jan 2006
Jan 2007
Jan 2008
Jan 2009
City of San Clemente (City Hall)
Marine Corp Base (Camp Pendleton East)
Oceanside City Hall (CONTROL)

Figure 3C

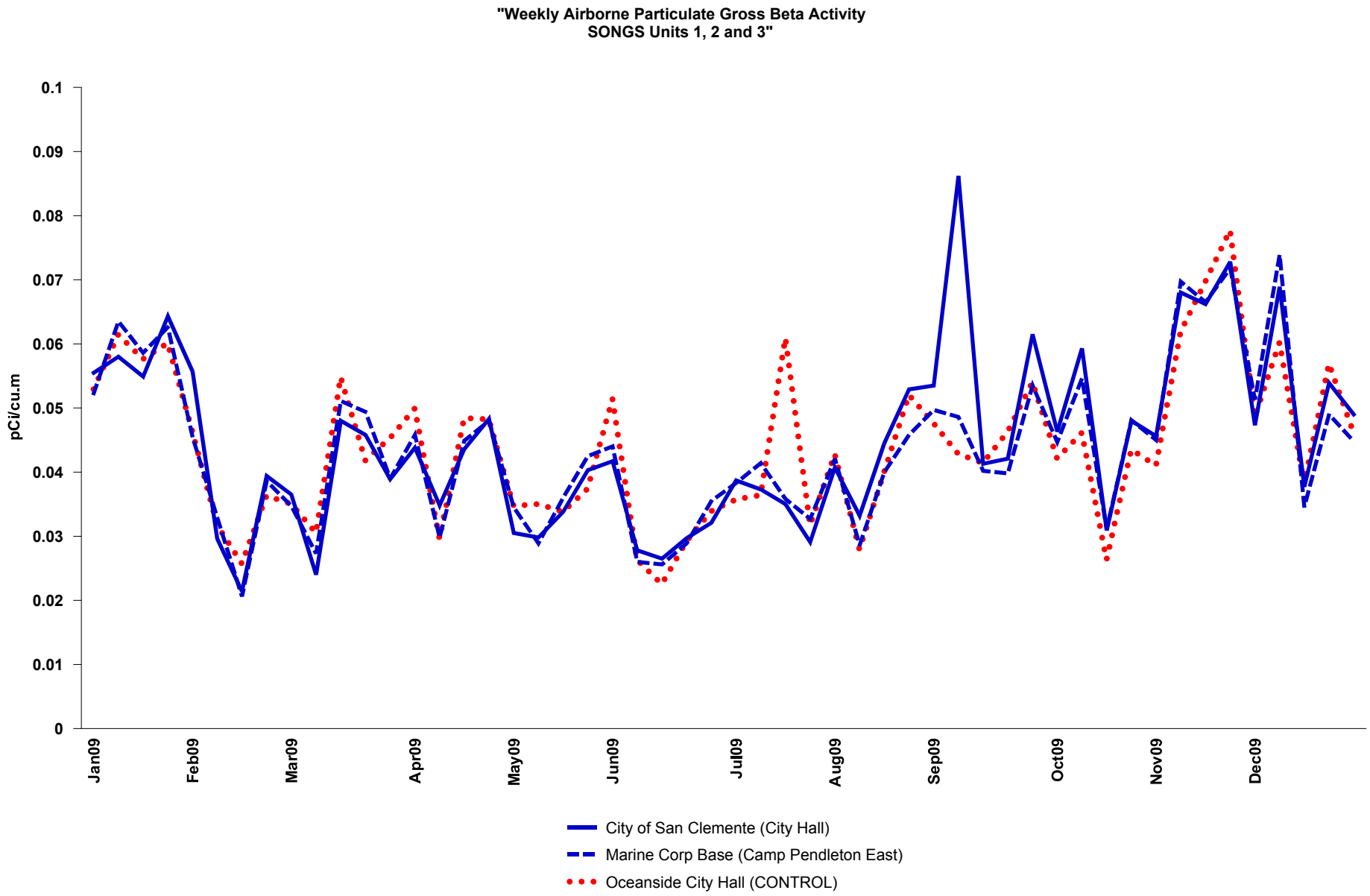

"Weekly Airborne Particulate Gross Beta Activity
SONGS Units 1, 2 and 3"
pCi/cu.m
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Jan09
Feb09
Mar09
Apr09
May09
Jun09
Jul09
Aug09
Sep09
Oct09
Nov09
Dec09
City of San Clemente (City Hall)
Marine Corp Base (Camp Pendleton East)
Oceanside City Hall (CONTROL)

Figure 3D

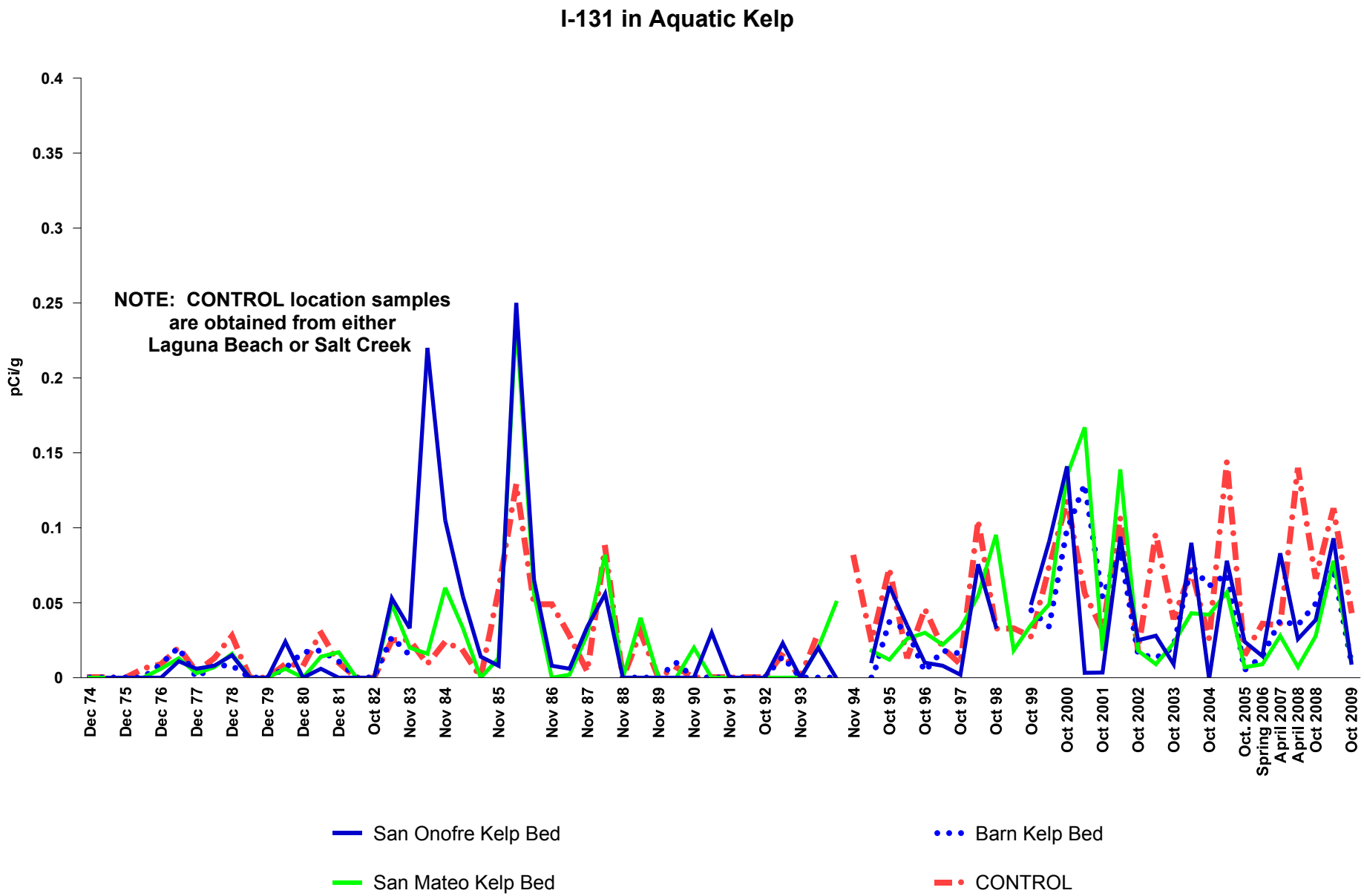

I-131 in Aquatic Kelp
pCi/g
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
NOTE: CONTROL location samples are obtained from either Laguna Beach or Salt Creek
Dec 74
Dec 75
Dec 76
Dec 77
Dec 78
Dec 79
Dec 80
Dec 81
Oct 82
Nov 83
Nov 84
Nov 85
Nov 86
Nov 87
Nov 88
Nov 89
Nov 90
Nov 91
Oct 92
Nov 93
Nov 94
Oct 95
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
San Onofre Kelp Bed
Barn Kelp Bed
San Mateo Kelp Bed
CONTROL

Figure 4

APPENDIX H

ERRATA TO THE 2008 AREOR

All data required by the ODCM in 2008 was reported in the 2008 AREOR. There are no errata to be appended to the 2008 AREOR.

APPENDIX I

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2009

APPENDIX I

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2009

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.

2009 Data from SCE TLDs

Location Number	Location Name	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
SCE -1 , NRC -7, DPH #2	San Clemente	18.45	17.95	18.9	18.98
SCE -2, NRC -23, DPH #8	Camp San Mateo	19.48	17.47	21.97	18.73
SCE -3, NRC -19, DPH #9	Camp San Onofre	17.33	14.92	18.95	16.15
SCE -6, DPH #10	Old Route 101 (East-Southeast)	13.16	11.04	12.52	11.91
SCE 10, NRC -12, DPH #6	San Onofre Surfing Beach	18.18	15.35	18.23	16.83
SCE 16, DPH #7*	ESE Site boundary	19.67	15.63	19.95	16.78
SCE 22, NRC 11, DPH #4	Coast Guard Station	18.99	16.34	20.49	18.79
SCE -34, NRC -14, DPH #5	San Onofre Elementary School	----*	14.65	17.73	15.6
SCE 41, NRC 25, DPH #11**	Old Route 101 (Unit 3)	17.04	14.55	17.44	15.49
SCE 50, NRC 32, DPH #13	Oceanside Fire Station	17.5	16.81	18.63	16.44

* 1 1st quarter 2009 TLD data for SCE-34 is not available

* 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 environmental 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 dose potentially attributable to the operation of the ISFSI.

An evaluation of the entire REMP TLD database yielded estimated background dose 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 dose rate is transit dose to and from the TLD lab. The transit dose 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 dose rate estimate. Using this information, we conclude that the dose rate at the CAB (10 CFR 72 Controlled Area Boundary) is less than detectable. The dose 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 2009 the storage of the original Steam Generators from Unit 2 near the ISFSI in the NIA (North Industrial Area) elevated the dose rate measurably in the immediate area of the ISFSI. The original steam generators did not affect the dose rate at the CAB/ EAB.

Environmental dose rates are variable. The REMP TLD data show a seasonal variability that does not appear to be related to any activities at SONGS. Data from the REMP indicator and control TLDs increase and decrease in a synchronous manner. The data support the conclusion that macro-environmental factors are the causative agents for the 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 7a. In addition to environmental factors, some non-ISFSI work activities at Unit 1 have elevated the pre-operational measured ISFSI TLD dose. 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 dose 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 dose for TLDs 301 to 315. Refer to Tables J-1 and J-2 which list all the REMP and ISFSI TLD data within the 10 CFR 72 Controlled Area Boundary and the 10 CFR 50 EAB (Exclusion Area Boundary).

The measured dose rate for the ISFSI TLDs close to the ISFSI is consistent with the dose rate expected from known radiological work activities. The elevated dose rate from TLDs 336,337 and 338 is due to the movement and storage of used fuel at the ISFSI.

The TLDs close to the ISFSI foundation (TLDs 306 to 315) all showed a decrease in measured dose after the commencement of used fuel storage in the ISFSI. Refer to Table J-1. This decrease in measured dose may be attributable to the aforementioned seasonal variability of environmental dose rates or it may be attributable to the decrease in non-ISFSI radioactive material work activity in the Unit 1 area.

In the fourth quarter 2008, 5 TLDs were placed on the perimeter fence west, southwest, and southeast of the ISFSI module. These TLDs (322, 323, 324, 325, and 326) showed the highest measured dose in 2009. The closest publicly accessible location SW of the ISFSI is the San Onofre Beach access road. The TLDs located along the access road measured a dose indistinguishable from background in 2009.

Starting in the fourth quarter 2009 neutron dosimeters were placed in ISFSI TLD canisters 311, 324, 325, and 326. The neutron signal from these TLDs is consistent with the projected neutron dose rates (calculation SCE-23-0508) and is consistent with known ISFSI radiological conditions. The measured ISFSI gamma TLD dose rates were also determined to be consistent with the calculated ISFSI dose rates and known radiological conditions.

We conclude that dose 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. We further conclude that dose to a member of the general public attributable to all SONGS related radiological activities at the CAB / EAB is below regulatory limits.

TABLE J-1
ISFSI TLD DATA

ISFSI TLD Number Location	2001	2002				2003				2004			
	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr (1)	1st Qtr	2nd Qtr	3rd Qtr (2)	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
TLD 301 (3)	17.3	18.42	17.91	18.51	24.56	17.23	18.47	17.09	17.39	18.86	18	17.7	15.49
TLD 302 (3)	20.28	20.67	19.59	19.46	125.78	20.32	20.77	19.3	21.97	23.57	26.37	20.02	19.11
TLD 303 (3)	18.96	18.82	18.26	18.11	156.89	20.45	25.74	26.56	27.06	28.54	29.98	24.59	24.72
TLD 304 (3)	18.06	19.1	18.28	17.95	64.53	19.57	28.34	33.25	31.8	34.72	33.22	29.74	28.44
TLD 305 (3)	18.99	20.49	19.68	19.82	147.33								
TLD 306 (3)	17.23	18.56	16.91	17.07	29.6	19.03	19.75	17.3	17.27	18.85	17.31	15.7	16.08
TLD 307 (3)	17.34	19.61	17.68	17.36	23.35	24.07	20.3	16.24	16.82	18.07	17.62	15.53	15.11
TLD 308 (3)	18.75	20.11	18.9	18.68	27.22	21.82	21.31	18.35	18.73	20.55	21.72	18.11	15.82
TLD 309 (3)	18.74	23.09	23.43	24.43	30.53	21.78	20.49	18.44	16.85	20.15	21.44	18.72	17.34
TLD 310 (3)	19.79	25.82	23.47	21.49	25.8	20.74	19.05	18.96	17.59	21.17	21.28	18.19	17.15
TLD 311 (3)	21.29	29.93	25.33	26.43	26.61	25.24	23.59	21.8	19.99	19.06	20.43	18.04	17.52
TLD 312 (3)	21.86	34.08	28.45	30.07	26.45	28.46	27.71	19.88	16.15	15.5	13.87	15.23	13.35
TLD 313 (3)	24.95	36.84	28.78	26.49	25.44	25.78	26.34	25.6	23.4	22.87	21.14	20.68	20.0
TLD 314 (3)	20.67	22.28	20.15	19.58	18.8	19.74	20.23	19.3	19.85	18.84	19.06	17.68	15.83
TLD 315 (3)	23.37	25.7	22.77	22.58	20.82	24.06	23.18	22.77	21.49	20.89	21.36	19.26	18.13
TLD 316 (4)	16.96	18.81	17.83	16.29	18.01	16.72	17.76	16.01	14.97	16.68	19.06	15.15	14.45
TLD 317 (4)	18.07	19.87	20.62	17.95	18.43	16.86	18.82	17.12	16.02	17.41	17.51	16.96	14.94
TLD 318 (4)	17.86	18.91	19.59	18.4	18.3	17.62	19.01	17.72	16.95	18.15	18.31	16.34	16.37
TLD 319 (4)	17.78	19.76	20.01	19.02	18.35	19.14	19.54	18.57	15.88	17.22	19.19	16.48	16.54
TLD 320 (4)	17.83	19.39	19.11	18.34	18.25	17.78	19.41	17.8	16.94	16.36	19.18	16.34	15.93
TLD 321 (4)	18.52	19.84	20.45	18.67	19.41	19.83	21.1	18.46	17.82	18.89	20.8	16.92	15.5
TLD 336										39.12	31.35	30.77	24.63
TLD 337										36.03	49.65	65.77	47.51
TLD 338										45.83	38.84	36.06	30.27

(1) Large Component Removal and start of the long term storage of the Unit 1 Reactor Vessel.
(2) Fuel loaded into the ISFSI pad September 2003.
(3) These TLDs are in an area where radiological materials have been stored or transported.
(4) These TLDs are not in the proximity of radiological activities.

TABLE J-1
ISFSI TLD DATA

ISFSI TLD Number Location	2005				2006				2007				2008			
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
TLD 301 (3)	22.05	33.23	31.2	27.44	31.54	26.99	20.41	18.96	18.11	15.62	19.39	15.76	16.09	15.69	17.96	17.59
TLD 302 (3)	31.04	45.99	41	40.43	40.3	35.93	28.72	20.75	19.98	17.1	20.76	16.98	17.43	19.22	19.57	19.55
TLD 303 (3)	33.14	49.45	41.54	38.53	39.16	34.51	29.14	25.08	24.93	21.13	20.21	18.09	18.2	21.83	20.85	20.74
TLD 304 (3)	34.63	42.62	41.1	37.05	36.66	37.95	29.07	29.71	27.48	25.27	21.85	16.89	17.64	19.77	20.4	19.6
TLD 306 (3)	19.92	20.4	20.44	19.24	19.68	24.01	17.65	18.5	19.04	15.95	19.56	17.00	17.42	18.59	19.04	19.55
TLD 307 (3)	20.26	24.94	22.08	20.98	21.48	23.22	16.98	16.66	16.93	14.97	19.26	19.07	17.72	25.3	27.32	24.1
TLD 308 (3)	21.81	25.3	23.88	23.1	23.42	23.89	18.01	17.82	18.00	14.94	20.56	20.41	18.42	19.22	19.72	20.14
TLD 309 (3)	22.1	20.61	19.53	18.14	18.95	22.54	17.08	19.25	17.83	16.86	19.76	19.09	17.09	19.56	20.43	19.67
TLD 310 (3)	20.66	20.91	21.08	20.26	20.27	24.21	17.92	19.01	19.21	17.36	20.63	19.22	17.03	19.33	19.54	19.95
TLD 311 (3)	21.85	20.94	20.61	19.35	19.48	23.91	17.82	19.49	19.51	16.88	19.27	18.08	16.88	18.23	19.26	18.04
TLD 312 (3)	16.88	15.67	15.57	13.81	14.99	19.36	16.18	16.08	15.29	13.47	15.84	14.24	13.13	13.72	14.6	14.62
TLD 313 (3)	26.97	26.36	26.45	25.93	26.33	33.12	36.28	25.34	22.97	20.26	20.33					
TLD 314 (3)	21.79	20.26	20.83	20.05	20.67	28.09	45.96	24.18	18.31	15.54	17.7	17.12	15.92	16.31	17.84	18.8
TLD 315 (3)	22.84	20.28	20.61	19.65	20.61	28.62	36.53	22.32	18.54	16.36	18.67	18.36	16.57	16.91	17.82	18.52
TLD 316 (4)	19.02	18.62	19.70	19.50	19.34	21.30	14.77	16.59	17.15	13.08	16.18	15.76	14.54	15.08	17.16	17.54
TLD 317 (4)	20.04	21.48	21.19	19.89	21.21	23.92	17.57	16.77	17.54	14.28	17.21	15.88	15.08	16.02	17.53	16.71
TLD 318 (4)	21.56	19.82	19.23	18.44	19.22	23.38	16.96	17.93	20.25	15.77	20.37	17.59	17.95	17.15	18.90	18.58
TLD 319 (4)	20.94	19.42	19.02	18.13	18.23	21.76	15.88	16.45	19.86	15.11	18.31	17.52	16.75	16.99	18.58	17.58
TLD 320 (4)	21.89	19.91	20.42	19.54	20.39	23.05	17.29	17.10	19.68	15.64	18.66	16.89	17.17	16.73	18.80	17.51
TLD 321 (4)	21.34	20.15	20.83	20.12	20.75	23.67	17.90	18.03	20.48	16.71	18.91	17.94	17.06	17.38	19.21	18.39
TLD 322																17.84
TLD 323																18.14
TLD 324																21.3
TLD 325																18.37
TLD 326																21.09
TLD 336	39.5	63.71	67.54	73.3	78.47	51.74	61.25	34.02	60.62	61.1	64.19					
TLD 337	54.46	64.07	59.43	68.36	62.62	92.87	116.8	44.67	54.8	39.09	43.46					
TLD 338	40.18	44.51	42.75	46.49	42.78	45.02	51.58	36.63	34.45	26.48	29.42					

(1) Large Component Removal and start of the long term storage of the Unit 1 Reactor Vessel.
(2) Fuel loaded into the ISFSI pad September 2003.
(3) These TLDs are in an area where radiological materials have been stored or transported.
(4) These TLDs are not in the proximity of radiological activities.

TABLE J-1
ISFSI TLD DATA

ISFSI TLD Number Location	2009	2009	2009	2009
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
TLD 301 (3)	17.48	17.07	19.32	27.07
TLD 302 (3)	19.22	18.31	22.4	50.95
TLD 303 (3)	21.41	20.36	22.6	41.75
TLD 304 (3)	20.67	19.63	22.09	35.49
TLD 306 (3)	20.31	18.69	20.8	25.33
TLD 307 (3)	20.16	16.56	18.76	21.19
TLD 308 (3)	20.5	19.45	20.78	20.96
TLD 309 (3)	20.3	19.6	21.79	20.41
TLD 310 (3)	20.27	19.46	21.35	20.04
TLD 311 (3)	19.62	18.48	21.41	19.03
TLD 312 (3)	15.32	14.29	16.41	14.9
TLD 313 (3)				
TLD 314 (3)	19.21	17.84	21.12	18.76
TLD 315 (3)	18.94	17.77	18.81	18.33
TLD 316 (4)	17.04	15.87	17.79	18.03
TLD 317 (4)	17	15.69	16.92	19.34
TLD 318 (4)	20.16	17.15	19.51	18.65
TLD 319 (4)	19.18	17.39	19.7	18.86
TLD 320 (4)	18.18	16.58	19.83	18.55
TLD 321 (4)	19.2	17.75	20.04	19.07
TLD 322	19.12	17.92	20.4	19.02
TLD 323	20.09	19.45	20.92	21.74
TLD 324	24.28	24.14	25.55	35.08
TLD 325	20.79	22.4	27.74	106.39
TLD 326	26.29	28.3	30.26	38.73
TLD 336				
TLD 337				
TLD 338				

(1) Large Component Removal and start of the long term storage of the Unit 1 Reactor Vessel.
(2) Fuel loaded into the ISFSI pad September 2003.
(3) These TLDs are in an area where radiological materials have been stored or transported.
(4) These TLDs are not in the proximity of radiological activities.

TABLE J-2
REMP TLDs WITHIN THE EAB

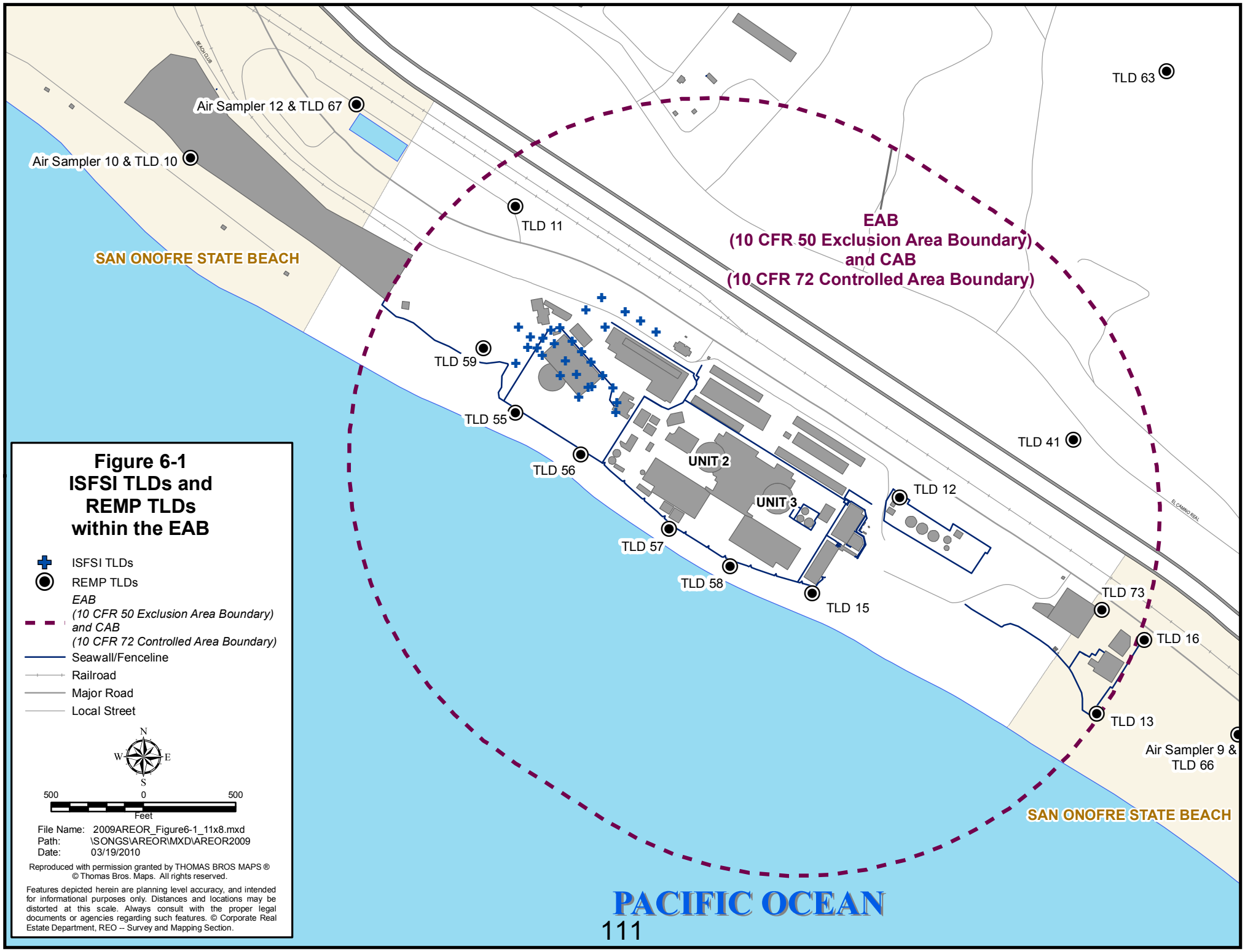
REMP TLD Number Location	2001				2002				2003				2004			
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr (1)	1st Qtr	2nd Qtr	3rd Qtr (2)	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
11	13.61	15.63	13.89	16.57	15.39	17.2	15.17	14.38	13.89	17.43	15.29	14.93	16.02	15.35	15.52	14.26
12	13.59	16.28	14.81	15.79	15.75	16.4	16.01	13.93	14.96	17.64	16.04	15.19	16.49	16.25	15.01	14.22
13	28.13	33.16	38.84	31.06	31.03	37.64	38.2	22.62	27.26	28.38	33.11	21.08	21.67	20.34	22.45	22.84
15	15.63	18.37	16.07	17.76	17.32	20.82	16.79	15.63	16.52	19.11	15.44	16.36	17.37	16.23	19.52	16.95
16	17.46	18.16	19.61	17.66	17.14	18.25	17.91	13.61	15.04	18.48	17.77	15.53	19.27	17.62	16.31	15.37
41	13.51	16.47	14.3	14.63	15.24	17.41	15.13	13.32	15.98	16.41	14.32	15.03	16.26	14.45	14.85	13.85
55	17.11	19.37	15.93	18.98	20.11	19.89	17.67	17.84	18.08	19.86	18.04	18.2	20.06	16.67	18.67	16.72
56	16.39	19.17	15.57	18.77	18.11	20.12	17.31	17.05	17.84	19.71	17.11	17.26	19.12	17.63	17.63	16.69
57	15.88	18.51	16.29	19.19	17.96	19.09	16.03	15.8	16.18	17.44	16.69	15.85	17.8	16.64	15.56	16.69
58	16.29	18.97	16.22	17.45	17.4	18.65	16.39	15.88	16.75	18.94	17.39	(3)	18.17	17.66	18.08	15.88
59	14.65	17.56	16.14	16.54	17.45	18.31	17.12	16.11	16.88	18.79	17.23	15.51	19.0	20.07	18.18	17.08
73	22.97	25.29	22.41	22.71	22.94	23.48	24.9	21.47	22.1	23.91	22.53	22.47	23.02	22.02	23.64	20.67

TABLE J-2
REMP TLDs WITHIN THE EAB

REMP TLD Number Location	2005				2006				2007				2008			
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
11	15.96	15.49	16.04	14.38	15.44	16.62	15.06	17.08	16.07	14.14	17.28	14.29	15.68	14.68	15.61	15.66
12	17.79	16.14	16.59	14.81	14.87	18.82	13.82	17.3	17.12	14.21	17.7	14.75	15.76	16.28	17.14	16.66
13	24.28	29.32	25.68	17.95	23.52	31.94	34.84	28.16	32.85	24.77	27.52	30.7	28.29	28.45	24.57	28.26
15	20.94	19.06	19.29	17.7	18.84	20.97	18.69	20.14	21.28	18.98	21.51	18.99	20.06	20.67	19.78	21.31
16	22.12	18.18	17.2	16.16	15.78	20.39	19.88	20.84	22.69	18.43	19.25	17.58	18.36	17.3	17.2	18.92
41	16.66	17.04	15.45	14.47	14.76	17.71	14.95	15.84	16.12	14.82	17.12	14.98	14.32	15.14	16.62	15.46
55	21.64	21.73	19.07	20.51	20.95	21.69	18.44	16.78	19.99	16.64	20.34	15.34	18.53	19.4	18.38	18.89
56	20.66	21.39	19.59	18.75	20.7	22.99	18.84	17.76	19.5	16.73	19.76	15.79	16.78	19.01	17.75	18.63
57	21.4	21.79	19.86	19.1	18.73	21.63	17.7	18.41	20.02	16.89	21.00	16.84	18.71	19.37	18.22	18.69
58	20.19	20.15	19.93	18.2	17.71	20.78	16.78	18.16	19.53	16.32	21.4	17.44	18.03	18.06	19.64	19.33
59	21.18	22.58	21.52	20.35	20.07	22.08	17.89	19.74	19.94	17.93	20.53	16.59	18.04	17.67	18.96	20.03
73	26.83	24.81	23.35	22.34	21.12	23.52	24.27	25.2	26.60	22.96	24.05	20.37	24.05	22.59	21.95	22.48

TABLE J-2
REMP TLDs WITHIN THE EAB

REMP TLD Number Location	2009	2009	2009	2009
	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
11	16.92	15.29	17.99	15.7
12	16.6	15.02	17.78	15.05
13	24.39	18.67	22.93	20.76
15	21.62	19.66	21.95	19.94
16	19.67	15.63	19.95	16.78
41	17.04	14.55	17.44	15.49
55	18.41	16.78	21.17	18.81
56	19.87	17.01	20.15	18.44
57	19.14	17.83	21.53	19.09
58	19.84	18.39	22.21	18.6
59	19.88	19.06	21.66	19.3
73	24.34	23.3	24.94	20.15
77	18.56	18.46	23.54	19.63


Air Sampler 12 & TLD 67
Air Sampler 10 & TLD 10
TLD 63
TLD 11
EAB
(10 CFR 50 Exclusion Area Boundary)
and CAB
(10 CFR 72 Controlled Area Boundary)
SAN ONOFRE STATE BEACH
TLD 59
TLD 55
TLD 56
UNIT 2
UNIT 3
TLD 41
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: 2009AREOR_Figure6-1_11x8.mxd
Path: \SONGS\AREOR\MXD\AREOR2009
Date: 03/19/2010
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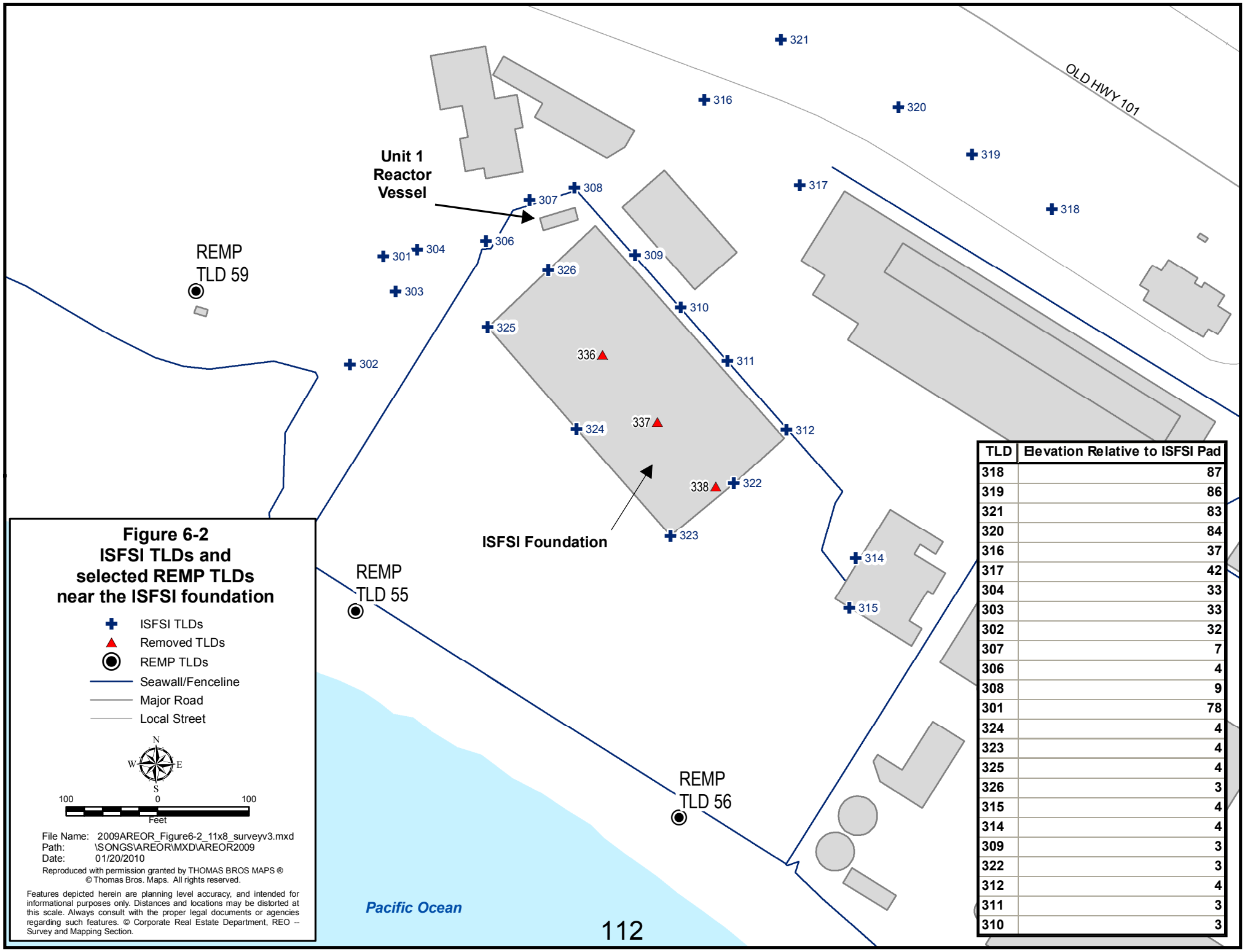


Figure 6-2
ISFSI TLDs and selected REMP TLDs near the ISFSI foundation

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

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

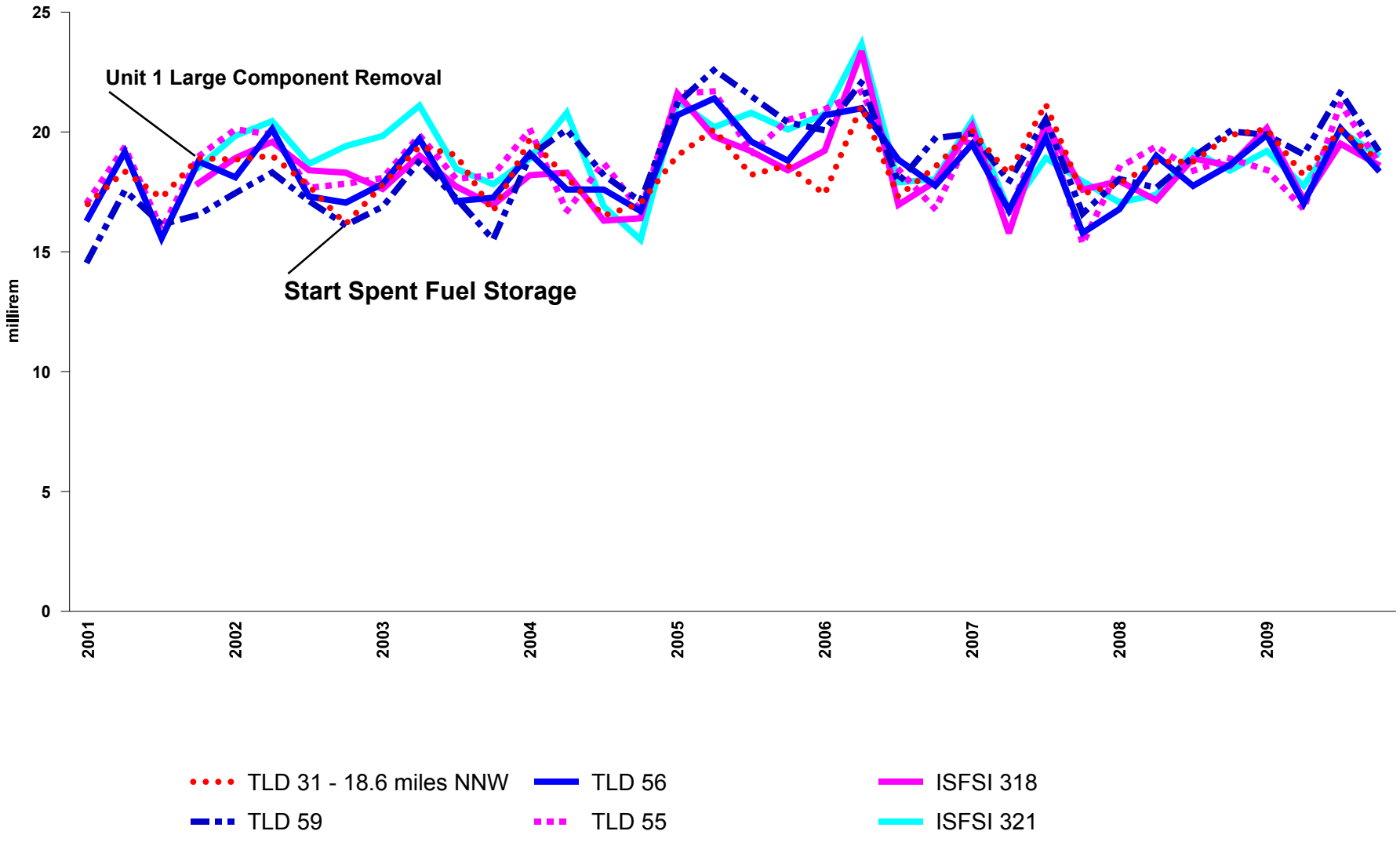

Direct Radiation Monitoring
ISFSI & Selected REMP TLDs - Quarterly Gamma Exposure (mR/ std quarter)
Unit 1 Large Component Removal
Start Spent Fuel Storage
millirem
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
TLD 31 - 18.6 miles NNW
TLD 56
ISFSI 318
TLD 59
TLD 55
ISFSI 321

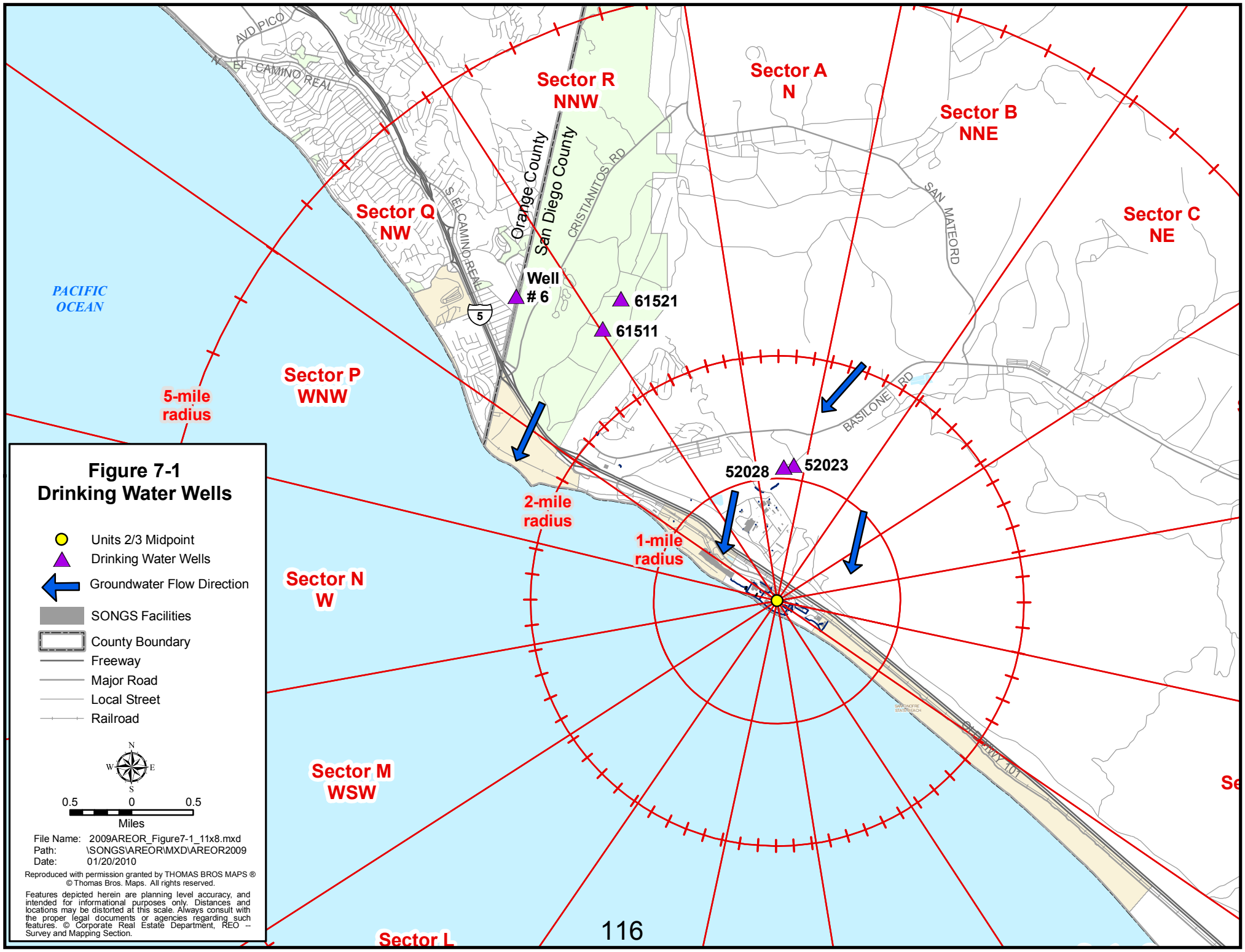
Figure 6A

Appendix K

Local Drinking Water Wells

Local Drinking Water Well Data

No drinking water pathway exists at SONGS. Refer to Figures 7-1 and 7.2 for a general indication of groundwater flow in the vicinity of SONGS.
In accordance with the GPI (Groundwater Protection Initiative) samples were collected the SONGS GPI monitoring wells (see figure 7-2). The analysis results for PA-1, PA-2, PA-3, PA-4, OCA-1, OCA-2, and OCA-3 were less than the *a posteriori* MDC (Minimum Detectable Concentration) and the for all plant related radionuclides during 2009. The analysis results for wells NIA-1 and NIA-2 were all less that the *a priori* (LLD) for all plant related radionuclides. Tritium was detected in wells NIA-1 and NIA-2 at a level below *a priori* (LLD) , but above the lower, analysis specific *a posteriori* MDC (Minimum Detectable Concentration). We conclude that the operation of SONGS had no affect on drinking water wells in the vicinity of SONGS.


Sector R
NNW
Sector A
N
Sector B
NNE
Sector C
NE
Sector Q
NW
Sector P
WNW
Sector N
W
Sector M
WSW
Sector L
Se
PACIFIC
OCEAN
Orange County
San Diego County
AVD PICO
N EL CAMINO REAL
S EL CAMINO REAL
CRISTIANITOS RD
SAN MATEORD
BASILONE RD
HWY 101
Well
6
61521
61511
52028
52023
5-mile
radius
2-mile
radius
1-mile
radius
Figure 7-1
Drinking Water Wells
Units 2/3 Midpoint
Drinking Water Wells
Groundwater Flow Direction
SONGS Facilities
County Boundary
Freeway
Major Road
Local Street
Railroad
N
W
E
S
0.5
0
0.5
Miles
File Name: 2009AREOR_Figure7-1_11x8.mxd
Path: \SONGS\AREOR\MXD\AREOR2009
Date: 01/20/2010
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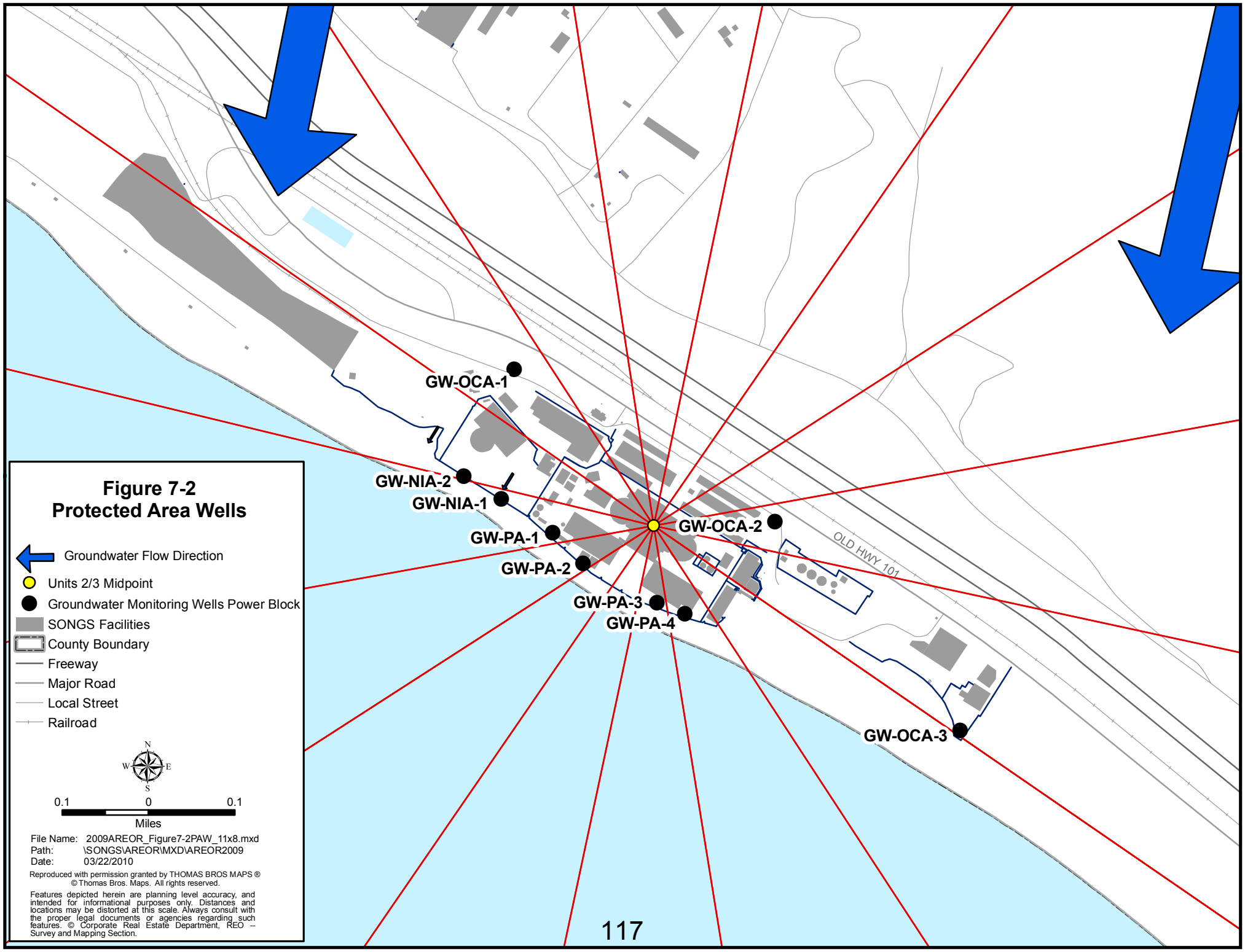
GW-OCA-1
GW-NIA-2
GW-NIA-1
GW-PA-1
GW-PA-2
GW-PA-3
GW-PA-4
GW-OCA-2
GW-OCA-3
OLD HWY 101
Figure 7-2
Protected Area Wells
Groundwater Flow Direction
Units 2/3 Midpoint
Groundwater Monitoring Wells Power Block
SONGS Facilities
County Boundary
Freeway
Major Road
Local Street
Railroad
N
W
E
S
0.1
0
0.1
Miles
File Name: 2009AREOR_Figure7-2PAW_11x8.mxd
Path: \SONGS\AREOR\MXD\AREOR2009
Date: 03/22/2010
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