

May 7, 2014

10 CFR 50.36(a)

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**
2013 Annual Radiological Environmental Operating Report
San Onofre Nuclear Generating Station (SONGS) 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 2013 Annual Radiological Environmental Operating Report (AREOR) for SONGS Units 1, 2 and 3.

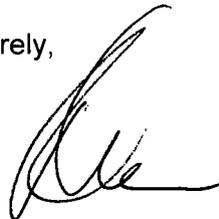
The AREOR covers the operation of SONGS during January 1, 2013 through December 31, 2013 and includes summaries, interpretations, and analyses of trends of the results of the Radiological Environmental Monitoring Program.

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

This letter does not contain any commitments.

If you require any additional information, please contact, Licensing Lead, Mr. Mark Morgan, at (949) 368-6745.

Sincerely,



FSME20
TE25
NM8526

Enclosure: 2013 Radiological Environmental Operating Report

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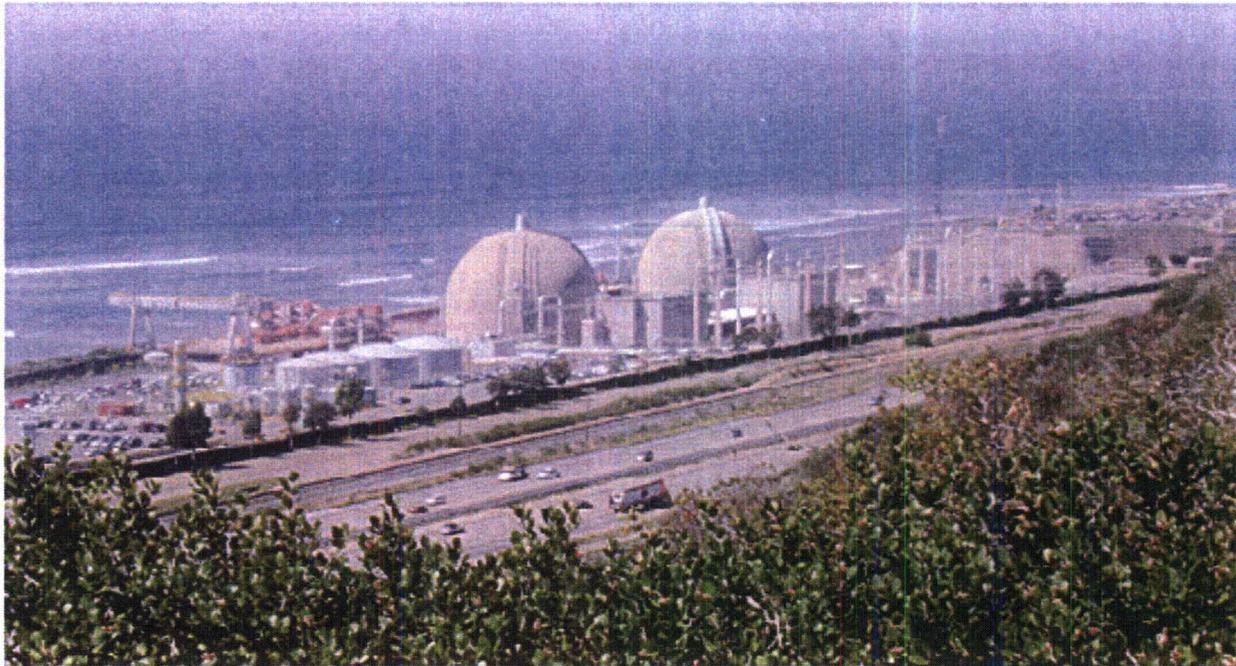
Enclosure

2013 Radiological Environmental
Operating Report

2013

**Radiological Environmental
Operating Report**

San Onofre Nuclear Generating Station



Southern California Edison
An Edison International Company

Docket Nos. 50-206, 50-361, 50-362 and 72-41

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

May 2014



2013 ANNUAL
RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT

San Onofre Nuclear Generating Station
(SONGS)

UNITS 1, 2, & 3

Southern California Edison
An Edison International Company

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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 2013. We further conclude that dose to a member of the general public attributable to all SONGS related radiological activities is below regulatory limits.

Preparation of the 2013 Annual Radiological Environmental Operating Report (AREOR) used the data reduction protocol described in NUREG/CR-4007. A meaningful analysis of data at, near, or below the detection limit must necessarily involve a consideration of the degrees of uncertainty associated with the data. The data have been summarized in the Statistical Summary of REMP Data found in Appendix B. The plant related radionuclides, including Cs-137 (cesium-137) in soil, as well as I-131 (iodine-131) in kelp, detected above the *a posteriori* MDC (minimum detectable concentration) are attributable to fallout from nuclear weapons testing (Cs-137) and medical administrations of radionuclides (I-131). These isotopes have been detected at indicator as well as control locations in past years. The naturally occurring radionuclides, including Be-7 (beryllium-7), K-40 (potassium-40), Th-228 (thorium-228), and Th-230 (thorium-230) were detected in both control and indicator locations at similar concentrations and are not related to the operation of SONGS. Refer to Appendix B for a more detailed discussion.

INTRODUCTION

SONGS consists of two pressurized water nuclear reactors housed in separate containment buildings. Unit 1 attained initial to criticality in June 1967, and was permanently retired from service in November 1992. The Unit 1 aboveground structures have been removed. Unit 2 attained initial criticality in July 1982 and Unit 3 in August 1983. Southern California Edison notified the Nuclear Regulatory Commission (NRC) on June 12, 2013, that it had permanently ceased operation of Units 2 and 3 on June 7, 2013. The notification, called a Certification of Permanent Cessation of Power Operations, sets the stage for SCE to begin preparations for decommissioning.

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 2013 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 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.
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 fulfill the radiological environmental monitoring requirements of the ODCM

SAMPLE COLLECTION

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

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

REGULATORY LIMITS, GUIDANCE, AND REQUIREMENTS

* 10CFR50

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

* 40CFR190

The Environmental Protection Agency (EPA) has established environmental radiation protection standards for nuclear power plants in 40CFR190. These limits are applicable to the sum of both liquid and gaseous effluents and direct radiation. As discussed in the 2013 SONGS Annual Radioactive Effluent Release Report, the dose to a member of the public as a result of the operation of SONGS is a small fraction of the dose standard established by the EPA.

* 10CFR20

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

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 Thermoluminescence 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 menu flags measurements exceeding the administrative levels (10% of the NRC reporting levels) established by SCE (Southern California Edison). 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 2013 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 inter-laboratory 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 2013 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 2013 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 2013 against the levels observed in preoperational 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 2013 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 1, 2 and 3 Radiological Environmental Monitoring Program, November, 2013.
3. SONGS Offsite Dose Calculation Manual (ODCM) Revision 7, Section 5.0, 2012.
4. SONGS Radiological Monitoring (RM) Procedures
 - SO123-RM-1, Radiological Environmental Monitoring Program
 - SO123-IX-1.10, Review, Analysis and Reporting of Radiological Environmental Monitoring Program (REMP) Data
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) |
|---|----------------------|------------------------|
| <i>Direct Radiation</i> | | |
| 1 City of San Clemente (Former SDG&E Offices) | 5.7 | NW |
| 2 Camp San Mateo – (MCB, Camp Pendleton) | 3.6 | N |
| 3 Camp San Onofre – (MCB, Camp Pendleton) | 2.8 | NE |
| 4 Camp Horno – (MCB, Camp Pendleton) | 4.4 | E |
| 6 Old El Camino Real (AKA Old Highway 101) | 3.0 | ESE |
| 8 Noncommissioned Officers' Beach Club | 1.4 | NW |
| 10 Bluff (Adjacent to PIC #1) | 0.7 | WNW |
| 11 Former Visitors' Center | 0.4 ** | NW |
| 12 South Edge of Switchyard | 0.2 ** | E |
| 13 Southeast Site Boundary (Bluff) | 0.4 ** | ESE |
| 15 Southwest Site Boundary (Office Building) | 0.1 ** | SSE |
| 16 East Southeast Site Boundary | 0.4 ** | ESE |
| 19 San Clemente Highlands | 4.9 | NNW |
| 22 Former US Coast Guard Station - San Mateo Point | 2.7 | WNW |
| 23 SDG&E Service Center Yard | 8.1 | NW |
| 31 Aurora Park - Mission Viejo | 18.6 | NNW |
| 33 Camp Talega – (MCB, Camp Pendleton) | 5.9 | N |
| 34 San Onofre School – (MCB, Camp Pendleton) | 1.9 | NW |
| 35 Range 312 – (MCB, Camp Pendleton) | 4.8 | NNE |
| 36 Range 208C – (MCB, Camp Pendleton) | 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 |
| 46 San Onofre State Beach Park | 1.0 | SE |
| 47 Camp Las Flores – (MCB, Camp Pendleton) | 8.6 | SE |

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 7. Direction determined from degrees true north.

** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)

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

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

MCB Marine Corps Base Camp Pendleton

PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

| TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications) | DISTANCE* (miles) | DIRECTION* (Sector) |
|---|----------------------|------------------------|
| <i>Direct Radiation</i> (Continued) | | |
| 49 Camp Chappo – MCB | 12.9 | ESE |
| 50 Oceanside Fire Station (Control) | 15.6 | SE |
| 53 San Diego County Operations Center | 44.2 | SE |
| 54 Escondido Fire Station | 31.8 | ESE |
| 55 San Onofre State Beach (U1 West) | 0.2 ** | WNW |
| 56 San Onofre State Beach (U1 West) | 0.2 ** | W |
| 57 San Onofre State Beach (Unit 2) | 0.1 ** | SW |
| 58 San Onofre State Beach (Unit 3) | 0.1 ** | S |
| 59 SONGS Meteorological Tower | 0.3 ** | WNW |
| 61 Mesa - East Boundary (Adjacent to PIC #4) | 0.7 | N |
| 62 MCB - Camp Pendleton (Adjacent to PIC #5) | 0.7 | NNE |
| 63 MCB - Camp Pendleton (Adjacent to PIC #6) | 0.6 | NE |
| 64 MCB - Camp Pendleton (Adjacent to PIC #7) | 0.6 | ENE |
| 65 MCB - Camp Pendleton (Adjacent to PIC #8) | 0.7 | E |
| 66 San Onofre State Beach (Adjacent to PIC #9) | 0.6 | ESE |
| 67 Former SONGS Evaporation Pond (Adjacent to PIC #2) | 0.6 | NW |
| 68 Range 210C – (MCB, Camp Pendleton) | 4.4 | ENE |
| 73 South Yard Facility | 0.4 ** | ESE |
| 74 Oceanside City Hall (Backup Control) | 15.6 | SE |
| 75 Gate 25 MCB | 4.6 | SE |
| 76 El Camino Real Mobil Station | 4.6 | NW |
| 77 Area 62 Heavy Lift Pad | 4.2 | N |
| 78 Horno Canyon (AKA Sheep Valley) | 4.4 | ESE |
| <i>Airborne</i> | | |
| 1 City of San Clemente (City Hall) | 5.1 | NW |
| 7 AWS Roof | 0.18 ** | NW |

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PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

| TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications) | DISTANCE* (miles) | DIRECTION* (Sector) |
|---|----------------------|------------------------|
| <i>Airborne</i> (Continued) | | |
| 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 |
| 16 San Luis Rey Substation (Control) | 16.7 | SE |
| <i>Soil Samples</i> *** | | |
| 1 Camp San Onofre | 2.8 | NE |
| 2 Old Route 101 – (East Southeast) | 3.0 | ESE |
| 3 Basilone Road / I-5 Freeway Off ramp | 2.0 | NW |
| 5 Former Visitors Center | 0.4 ** | NW |
| 7 Prince of Peace Abbey (Control) | 15 | SE |
| <i>Ocean Water</i> | | |
| 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 |
| <i>Drinking Water</i> | | |
| 4 Camp Pendleton Drinking Water Reservoir | 2.0 | NW |
| 5 Oceanside City Hall (Control) | 15.6 | SE |

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 7. Direction determined from degrees true north.

** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)

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MCB Marine Corps Base Camp Pendleton

PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

| TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications) | DISTANCE* (miles) | DIRECTION* (Sector) |
|---|----------------------|------------------------|
| <i>Shoreline Sediment (Beach Sand)</i> | | |
| 1 San Onofre State Beach (Southeast) | 0.6 | SE |
| 2 San Onofre Surfing Beach | 0.8 | WNW |
| 3 San Onofre State Beach (Southeast) | 3.5 | SE |
| 4 Newport Beach North End (Control) | 29.1 | NW |
| <i>Local Crops</i> | | |
| 2 Oceanside (Control) | 15-25 | SE to ESE |
| 6 SONGS Garden | 0.4 | NNW |
| <i>Non-Migratory Marine Animals</i> | | |
| 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 |
| <i>Kelp ****</i> | | |
| 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 |
| G Capistrano Beach Reef (not listed in the ODCM) | 8.9 to 9.1 | NW |
| H San Clemente Pier (not listed in the ODCM) | 5.7 to 5.8 | NW |
| I Wheeler North Artificial Reef (not listed in the ODCM) | 5.3 | WNW |
| <i>Ocean Bottom Sediments</i> | | |
| B Unit 1 Outfall | 0.8 | SSW |
| C Unit 2 Outfall | 1.6 | SW |
| D Unit 3 Outfall | 1.2 | SSW |
| E Laguna Beach (Control) | 17-19 | NW |
| F SONGS Up-coast | 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. 7. Direction determined from degrees true north.

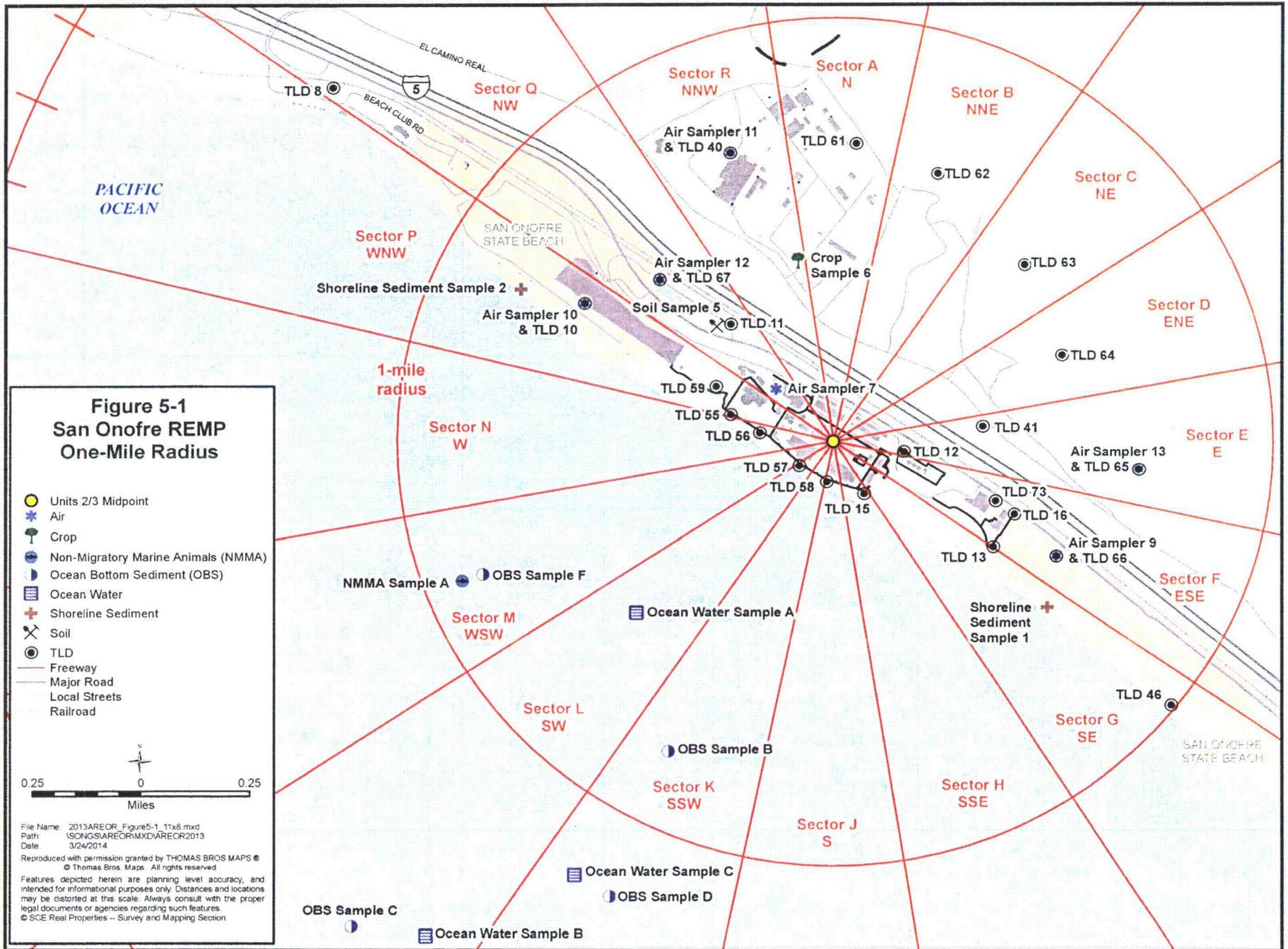
** Distances are within the Units 2/3 CAB/EAB (Controlled Area Boundary/Exclusion Area Boundary)

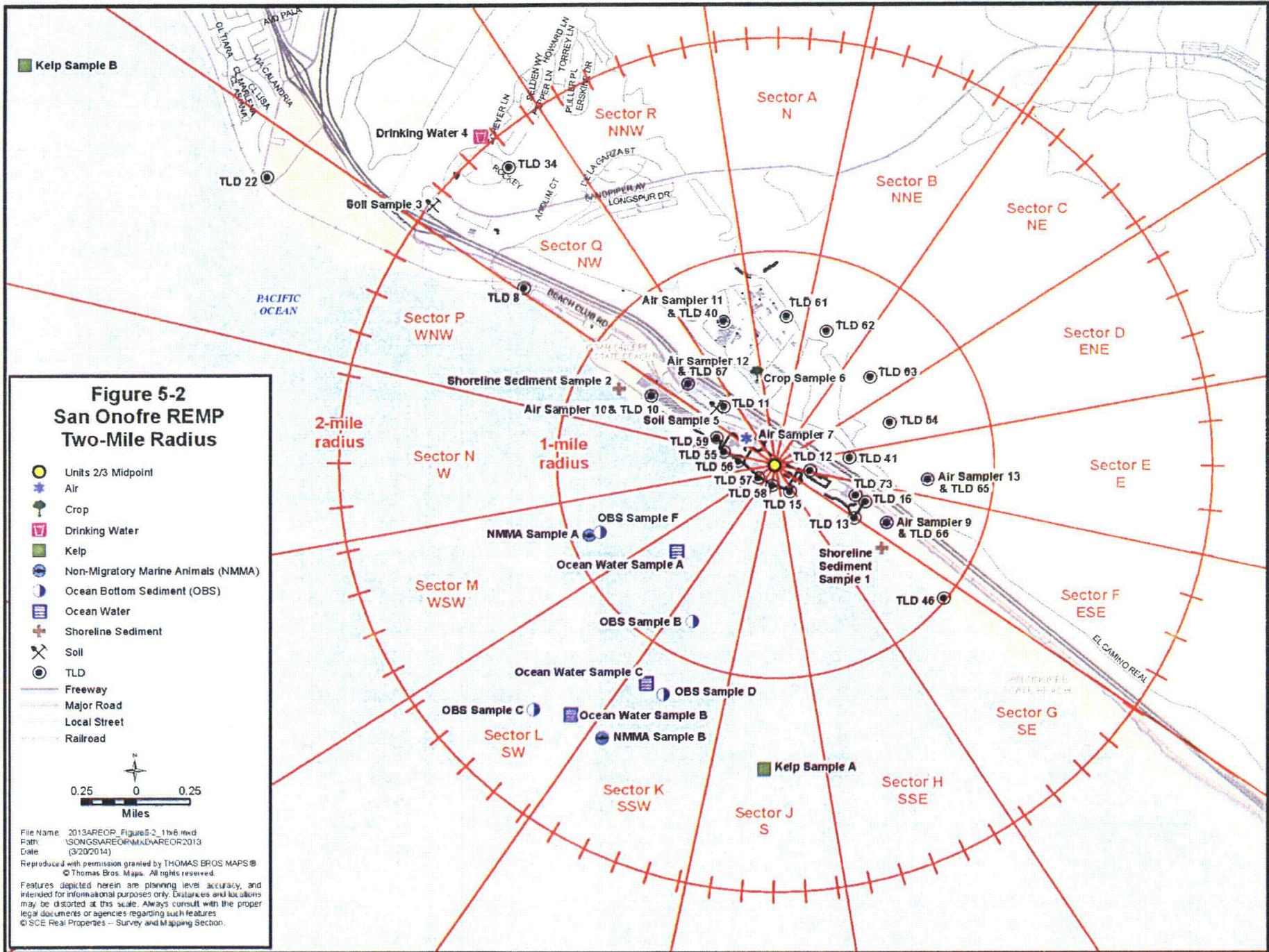
*** Soil samples are not required by Technical Specifications.

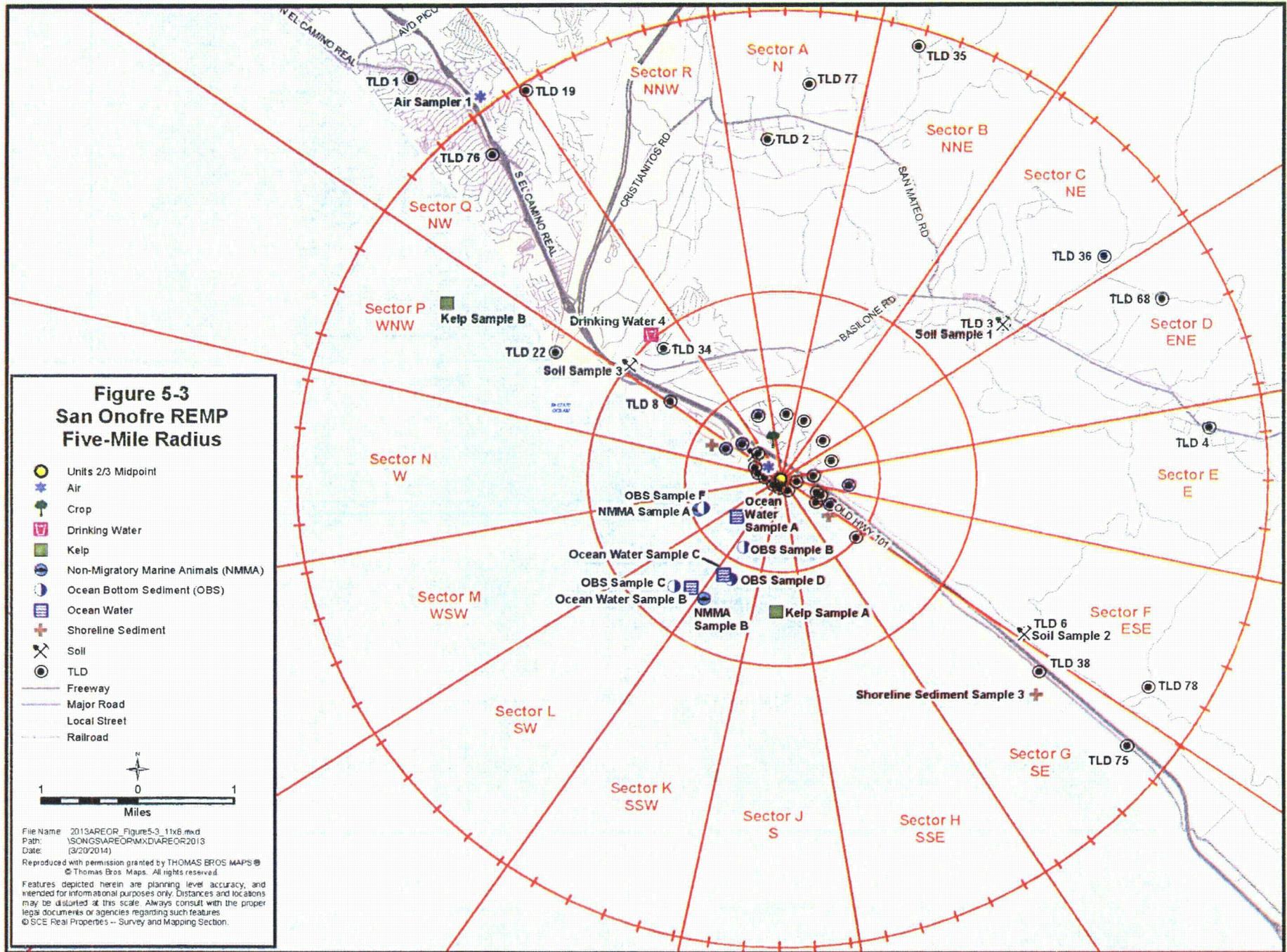
**** Kelp samples are not required by Technical Specifications.

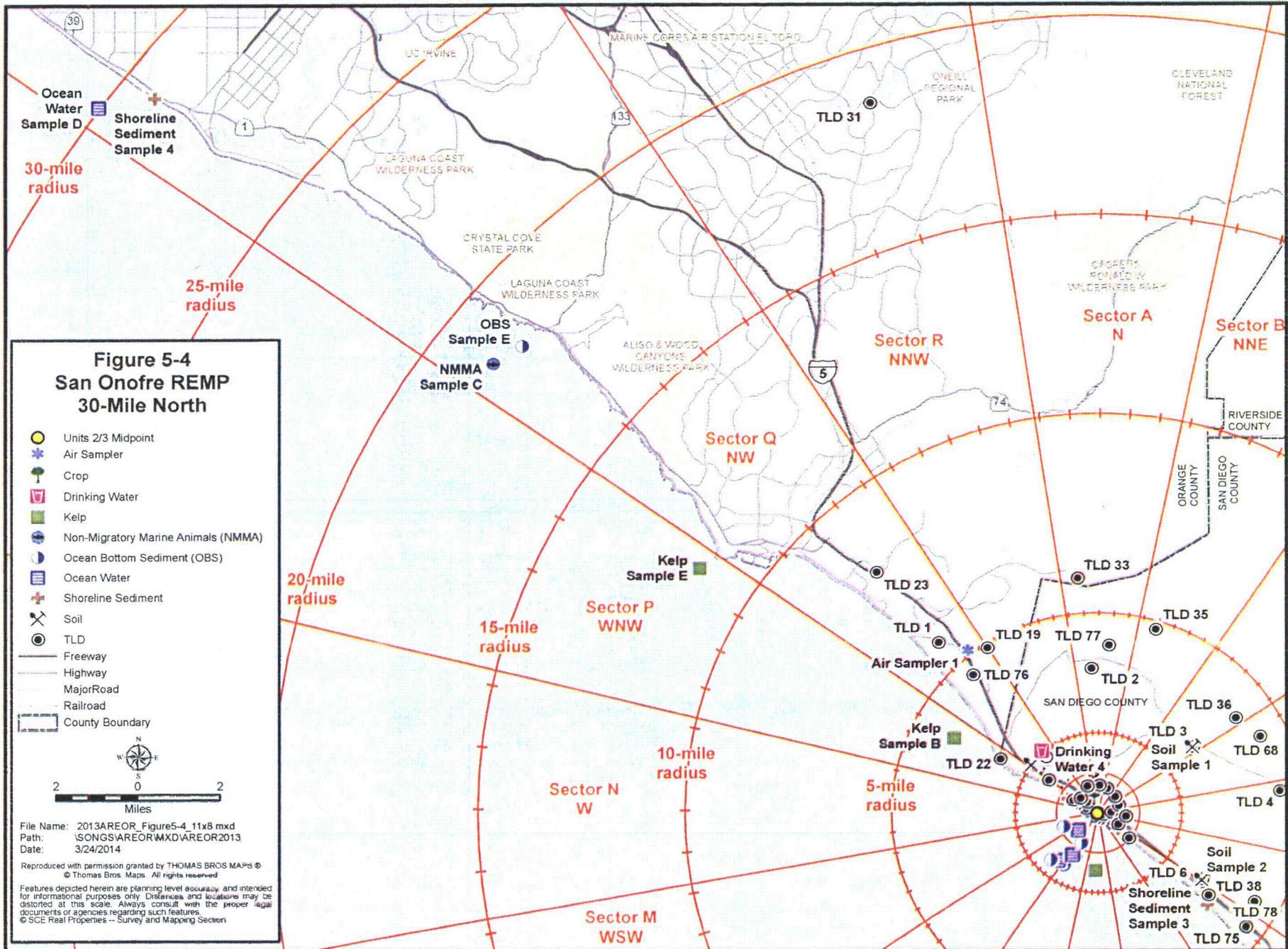
MCB Marine Corps Base Camp Pendleton

PIC Pressurized Ion Chamber









APPENDIX B
SUMMARY, RESULTS, AND DISCUSSIONS
OF 2013 ENVIRONMENTAL DATA

SUMMARY

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 2013 to December 2013 were evaluated. The 2013 REMP data were evaluated according to the criteria described in NUREG/CR-4007 and with the methodology described by Currie (1968).^{*} Excluding data attributable to factors external to SONGS, 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 2013 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 2013 appears in Table B-3.

The exceptions, summarized in Table B-2, include isotopically analyzed samples with station related activity reported and confirmed above the *a posteriori* MDC. The analysis results listed in Tables B-2 are attributable to sources external to SONGS (fallout from the nuclear accident at the Fukushima Daiichi Nuclear Power Station, or Chernobyl, residual fallout from legacy atmospheric nuclear weapons testing, and discharge of medically administered I-131 from the San Juan Sewage Plant outfall). All of the 2013 REMP sample results with detectable plant related radionuclides have known sources external to SONGS. The radionuclides included in Table B-2 include I-131 in kelp (attributable to medically administered I-131 discharged in sewerage from the San Juan outfall), and Cs-137 in soil, deer meat, and marine animal flesh (attributable to residual nuclear weapons testing fallout and to Fukushima accident). 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. Unit 2 was shut down for a planned refueling outage on January 9, 2012 and did not operate for the remainder of 2012 and Unit 3 was taken off-line after a steam generator tube leak on January 31, 2012. Cs-137 levels in marine animal flesh found in indicator samples closely mirror those found in control samples. We conclude that SONGS had a negligible radiological environmental impact during 2013.

Historical trending of data near and below the detection limits is necessarily limited. The concentration of radionuclides in the environs of SONGS has generally 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 occasionally showing levels 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 2013 ENVIRONMENTAL DATA

A. Direct Radiation

Calcium sulfate (CaSO_4) Thermoluminescent Dosimeters (TLDs) were placed at 49 locations and analyzed quarterly per ANSI-N545 standards. For each TLD location outside the exclusion area boundary a baseline value was computed using ten years of TLD data (2001 through 2010). The baseline is used to determine if radiation levels above the Lower Limit of Detection (LLD) for this media (5 mR per standard quarter and 10 mR per year) were observed during 2013.

TLDs located greater than five miles from SONGS are considered control TLDs. 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. All 2013 control location TLD readings were LLD and all 2013 indicator location readings outside the Exclusion Area Boundary (EAB) were LLD.

The data indicate detectable direct radiation measurements in the immediate vicinity of SONGS. However, the hypothetical maximum associated exposure to a member of the general public, adjusted for occupancy, is less than 1 mR per year as measured by this sample media. TLD station #73 had the highest measured REMP TLD annual baseline adjusted exposure in 2013. The occupancy adjusted exposure for #73 is less than 1 mR per year. Refer to Table B-1 for a summary of all 2013 SONGS REMP TLD data.

Figures 2A and 2B compare environmental radiation levels of indicator and control locations for the operational year 2013 and for previous years. These figures show the close correlation between the control and indicator location TLD exposure data.

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.

Neutron dosimeters were placed at REMP TLD station 55 and at selected locations around the Independent Spent Fuel Storage Installation (ISFSI). All of the neutron TLD data in 2013 were less than detectable.

Direct Radiation baseline evaluation and estimation of natural background

An in-depth analysis of the environmental radiation results for the period of 2001 through 2010 was completed for all the monitoring locations. It can be inferred that if the standard deviation was low and no additional exposure above background was identified at a particular station, the average of that station's radiation exposure results should be equal to natural background (baseline) at that location. The baseline results for REMP TLDs have been summarized with the annual and quarterly values in the 2013 TLD Data Table. Natural background radiation is variable and a minor shift in location can yield a measurable change in background radiation. Therefore if a TLD is moved the baseline (background) for that location may be affected.

The baseline environmental exposure analysis of the 2001 through 2010 environmental TLD results included an assessment of the standard deviation of the quarterly results at each location. This is an appropriate methodology to determine the ability to detect radiation exposure above background. The highest value of three standard deviations for all of the 2001 through 2010 quarterly measurements was 4.8 mR and the highest value was 9.7 mR for the annual results, providing justification for baseline or *a priori* LLDs of 5 mR per quarter and 10 mR per year. The quarterly and annual results expressed in the 2013 Table B-1 as values of positive exposure above background or as a notation of <LLD if the background is not exceeded.

An empirical determination of the background baseline for stations within the Exclusion Area Boundary (EAB) is not possible due to the known plant related radiological activities (storage and transport of radioactive materials) that occurred during the baseline calculation study period. The average of the non-EAB stations close to the beach was approximately 15.0 mR per quarter. A value of 15.0 mR per quarter was conservatively selected as the baseline for the REMP stations located within the EAB.

In 1980 the Department of Energy (DOE) conducted an Aerial Radiological Survey of SONGS and the surrounding area. A current value of baseline/background value of 15.0 mR per standard quarter within the SONGS EAB is consistent with the 1980 gamma exposure rates reported by the DOE for the areas immediately north and south of SONGS, taking into account the reduction in environmental radioactivity and background dose rates caused by the decay of atmospheric nuclear weapons testing fallout since 1980.

**TABLE B-1
2013 TLD Data**

| TLD # | Location | Distance Miles | Quarterly Baseline | 2013 Quarterly Results (mR) | | | | Baseline Adjusted 2013 Quarterly Results (mR) | | | | Annual Baseline (mR) | 2013 Annual Total (mR) | Baseline Adjusted 2013 Total |
|-------|---|----------------|--------------------|-----------------------------|----------------------|-------|-------|--|-------|-------|-------|----------------------|------------------------|------------------------------|
| | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | | |
| | | | | 1 | City of San Clemente | 5.7 | 17.5 | 18.16 | 17.65 | 17.59 | 18.54 | | | |
| 2 | Camp San Mateo – MCB | 3.5 | 18.6 | 19.6 | 18.72 | 19.19 | 19.92 | <LLD | <LLD | <LLD | <LLD | 74.4 | 77.43 | <LLD |
| 3 | Camp San Onofre – MCB | 2.6 | 16.4 | 17.4 | 16.11 | 16.38 | 17.72 | <LLD | <LLD | <LLD | <LLD | 65.5 | 67.61 | <LLD |
| 4 | Camp Horno – MCB | 4.5 | 18.1 | 18.38 | 17.37 | 18.05 | 18.58 | <LLD | <LLD | <LLD | <LLD | 72.3 | 72.38 | <LLD |
| 6 | Old Route 101 (ESE) | 3 | 11.4 | 12.1 | 11.04 | 10.49 | 11.71 | <LLD | <LLD | <LLD | <LLD | 45.6 | 45.34 | <LLD |
| 8 | Noncommissioned Officers' Beach Club | 1.4 | 15.4 | 17.43 | 15.23 | 16.17 | 16.71 | <LLD | <LLD | <LLD | <LLD | 61.8 | 65.54 | <LLD |
| 10 | Bluff (Adjacent to PIC #1) | 0.7 | 16.4 | 16.49 | 16.74 | 16.23 | 17.64 | <LLD | <LLD | <LLD | <LLD | 65.7 | 67.1 | <LLD |
| 19 | San Clemente Highlands | 5 | 17.8 | 17.68 | 18.16 | 17.67 | 18.54 | <LLD | <LLD | <LLD | <LLD | 71.3 | 72.05 | <LLD |
| 22 | Former US Coast Guard Station | 2.7 | 17.9 | 17.73 | 17.92 | 18.09 | 18.47 | <LLD | <LLD | <LLD | <LLD | 71.7 | 72.21 | <LLD |
| 23 | SDG&E Service Center Yard | 8.1 | 15.8 | 16.35 | 15.58 | 15.72 | 16.25 | <LLD | <LLD | <LLD | <LLD | 63.1 | 63.9 | <LLD |
| 31 | Aurora Park - Mission Viejo (Control) | 18.6 | 18.5 | 19.21 | 19.54 | 18.6 | 18.78 | <LLD | <LLD | <LLD | <LLD | 74.1 | 76.13 | <LLD |
| 33 | Camp Talega – MCB | 5.7 | 18.9 | 19.04 | 18.79 | 18.92 | 19.15 | <LLD | <LLD | <LLD | <LLD | 75.4 | 75.9 | <LLD |
| 34 | San Onofre School – MCB | 1.9 | 16.2 | 15.35 | 16.09 | 16.63 | 16.47 | <LLD | <LLD | <LLD | <LLD | 64.7 | 64.54 | <LLD |
| 35 | Range 312 – MCB | 4.7 | 16.9 | 15.96 | 14.91 | 15.25 | 15.63 | <LLD | <LLD | <LLD | <LLD | 67.5 | 61.75 | <LLD |
| 36 | Range 208C – MCB | 4.2 | 19.5 | 19.53 | 18.47 | 19.14 | 20.06 | <LLD | <LLD | <LLD | <LLD | 77.8 | 77.2 | <LLD |
| 38 | San Onofre State Beach Park | 3.3 | 14.3 | 13.36 | 13.44 | 14.82 | 14.69 | <LLD | <LLD | <LLD | <LLD | 57.2 | 56.31 | <LLD |
| 40 | SCE Training Center - Mesa (Adjacent to PIC #3) | 0.7 | 17.1 | 18.63 | 15.66 | 18.21 | 17.51 | <LLD | <LLD | <LLD | <LLD | 68.4 | 70.01 | <LLD |
| 44 | Fallbrook Fire Station | 17.7 | 14 | 14.51 | 14.01 | 13.45 | 15.36 | <LLD | <LLD | <LLD | <LLD | 56 | 57.33 | <LLD |
| 46 | San Onofre State Beach Park | 0.9 | 12.2 | 12.8 | 12.5 | 13.25 | 13.91 | <LLD | <LLD | <LLD | <LLD | 48.7 | 52.46 | <LLD |
| 47 | Camp Las Flores – MCB | 8.6 | 13.3 | 18.48 | 13.85 | 14.34 | 16.04 | 5.18 | <LLD | <LLD | <LLD | 53.1 | 62.71 | <LLD |
| 49 | Camp Chappo – MCB | 12.8 | 14.2 | 14.97 | 15.08 | 15.15 | 16.81 | <LLD | <LLD | <LLD | <LLD | 56.9 | 62.01 | <LLD |
| 50 | Oceanside Fire Station (Control) | 15.6 | 16.6 | 17.74 | 16.46 | 16 | 16.97 | <LLD | <LLD | <LLD | <LLD | 66.3 | 67.17 | <LLD |
| 53 | San Diego County Operations Center | 44.3 | 18.2 | 19.59 | 18.31 | 19.06 | 20.14 | <LLD | <LLD | <LLD | <LLD | 72.9 | 77.1 | <LLD |

**TABLE B-1
2013 TLD Data**

| FLD # | Location | Distance Miles | Quarterly Baseline | 2013 Quarterly Results (mR) | | | | Baseline Adjusted 2013 Quarterly Results (mR) | | | | Annual Baseline | 2013 Annual Total (mR) | Baseline Adjusted 2013 Total |
|-------|--|----------------|--------------------|-----------------------------|-------|-------|-------|--|------|------|------|-----------------|------------------------|------------------------------|
| | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | | |
| 54 | Escondido Fire Station | 31.8 | 16.1 | 16.79 | 17.2 | 17.08 | 18.61 | <LLD | <LLD | <LLD | <LLD | 64.4 | 69.68 | <LLD |
| 61 | Mesa - East Boundary (PIC #4) | 0.6 | 15.4 | 16.92 | 12.8 | 15.48 | 14.61 | <LLD | <LLD | <LLD | <LLD | 61.7 | 59.81 | <LLD |
| 62 | Camp Pendleton (PIC #5) | 0.6 | 13.2 | 13.51 | 11.77 | 13.15 | 13.18 | <LLD | <LLD | <LLD | <LLD | 50.4 | 51.61 | <LLD |
| 63 | Camp Pendleton (PIC #6) | 0.6 | 13.9 | 15.17 | 12.97 | 14.49 | 15.01 | <LLD | <LLD | <LLD | <LLD | 55.5 | 57.64 | <LLD |
| 64 | Camp Pendleton (PIC #7) | 0.6 | 15 | 15.97 | 13.88 | 15.64 | 15.07 | <LLD | <LLD | <LLD | <LLD | 60.1 | 60.65 | <LLD |
| 65 | Camp Pendleton (PIC #8) | 0.7 | 13.4 | 14.43 | 12.69 | 14.15 | 13.73 | <LLD | <LLD | <LLD | <LLD | 53.8 | 55 | <LLD |
| 66 | San Onofre State Beach (PIC #9) | 0.6 | 14 | 14.52 | 13.74 | 15.33 | 15.49 | <LLD | <LLD | <LLD | <LLD | 55.6 | 59.08 | <LLD |
| 67 | Former SONGS Evaporation Pond (PIC #2) | 0.6 | 16.9 | 17.2 | 16.98 | 18.49 | 18.36 | <LLD | <LLD | <LLD | <LLD | 67.7 | 71.03 | <LLD |
| 68 | Range 210C – MCB | 4.3 | 15 | 15.69 | 15.63 | 15.53 | 16.11 | <LLD | <LLD | <LLD | <LLD | 60.2 | 62.96 | <LLD |
| 74 | Oceanside City Hall (Backup Control) | 15.6 | 13.3 | 14.05 | 13.5 | 12.53 | 14.14 | <LLD | <LLD | <LLD | <LLD | 53.4 | 54.22 | <LLD |
| 75 | Gate 25 MCB | 4.6 | 15.9 | 16.15 | 15.68 | 15.86 | 16.5 | <LLD | <LLD | <LLD | <LLD | 63.6 | 64.19 | <LLD |
| 76 | El Camino Real Mobil Station | 4.6 | 17.3 | 17.76 | 17.86 | 17.65 | 17.63 | <LLD | <LLD | <LLD | <LLD | 69.4 | 70.9 | <LLD |
| 77 | Area 62 Heavy Lift Pad | 4.3 | 19.2 | 18.92 | 18.96 | 18.83 | 18.98 | <LLD | <LLD | <LLD | <LLD | 76.9 | 75.69 | <LLD |
| 78 | Horno Canyon | 4.4 | 11.1 | 12.02 | 11.53 | 10.77 | 11.58 | <LLD | <LLD | <LLD | <LLD | 44.6 | 45.9 | <LLD |
| | | | | | | | | | | | | | | |
| 11 | Former Visitors' Center | 0.4* | 15 | 15.49 | 15.56 | 17.29 | 16.37 | <LLD | <LLD | <LLD | <LLD | 60 | 64.71 | <LLD |
| 12 | South Edge of Switchyard | 0.2* | 15 | 17.32 | 15.87 | 18.54 | 16.82 | <LLD | <LLD | <LLD | <LLD | 60 | 68.55 | <LLD |
| 13 | Southeast Site Boundary (Bluff) | 0.4* | 15 | 21.21 | 19.78 | 20.95 | 20.4 | 6.21 | <LLD | 5.95 | 5.4 | 60 | 82.34 | 22.34 |
| 15 | Southeast Site Boundary (Office Bldg) | 0.1* | 15 | 18.62 | 17.28 | 19.09 | 18.02 | <LLD | <LLD | <LLD | <LLD | 60 | 73.01 | 13.01 |
| 16 | East Southeast Site Boundary | 0.4* | 15 | 21.12 | 23.78 | 21.97 | 20.79 | 6.12 | 8.78 | 6.97 | 5.79 | 60 | 87.66 | 27.66 |
| 41 | Old Route 101 – East | 0.3* | 15 | 16.37 | 15.64 | 15.37 | 16.56 | <LLD | <LLD | <LLD | <LLD | 60 | 63.94 | <LLD |

**TABLE B-1
2013 TLD Data**

| FLD # | Location | Distance Miles | Quarterly Baseline | 2013 Quarterly Results (mR) | | | | Baseline Adjusted 2013 Quarterly Results (mR) | | | | Annual Baseline (mR) | 2013 Annual Total (mR) | Baseline Adjusted 2013 Total |
|-------|----------------------------------|----------------|--------------------|-----------------------------|-------|-------|-------|---|------|-------|------|----------------------|------------------------|------------------------------|
| | | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | | |
| 55 | San Onofre State Beach (U1 West) | 0.2* | 15 | 17.28 | 16.77 | 19.56 | 18.55 | <LLD | <LLD | <LLD | <LLD | 60 | 72.16 | 12.16 |
| 56 | San Onofre State Beach (U1 West) | 0.2* | 15 | 16.8 | 15.76 | 19.28 | 17.93 | <LLD | <LLD | <LLD | <LLD | 60 | 69.77 | <LLD |
| 57 | San Onofre State Beach (Unit 2) | 0.1* | 15 | 16.83 | 16.02 | 17.28 | 16.39 | <LLD | <LLD | <LLD | <LLD | 60 | 66.52 | <LLD |
| 58 | San Onofre State Beach (Unit 3) | 0.1* | 15 | 16.71 | 15.45 | 17.82 | 16.45 | <LLD | <LLD | <LLD | <LLD | 60 | 66.43 | <LLD |
| 59 | SONGS Meteorological Tower | 0.3* | 15 | 18.93 | 17.82 | 20.43 | 19.15 | <LLD | <LLD | 5.43 | <LLD | 60 | 76.33 | 16.33 |
| 73 | South Yard Facility | 0.4* | 15 | 23.08 | 24.55 | 25.66 | 24.87 | 8.08 | 9.55 | 10.66 | 9.87 | 60 | 98.16 | 38.16 |
| | *Within Exclusion Area Boundary | | | | | | | | | | | | | |

*Station is within the Exclusion Area Boundary (EAB). The baseline has been estimated to be 15.0 mR within the EAB

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

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

B. Airborne Particulate, Iodine, and Composite Isotopic Analyses

Air particulate samples were collected on a weekly basis from seven indicator locations and from 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 0.0072 pCi/m³ to 0.0978 pCi/m³, averaging 0.0378 pCi/m³ of air. The concentrations of gross beta activity in the samples from the control location ranged from 0.0157 to 0.10 pCi/m³, averaging 0.0424 pCi/m³ of air. Figure 3D shows the close correlation between indicator and control gross beta activity level during 2013 at different locations.

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 #16). The results showed that indicator locations maximum gross beta activity in air in 2013 was 0.0978 pCi/m³ and the 2013 control location average was 0.0424 pCi/m³, which is less than 10 times background. No action was required by the ODCM.

Indicator samples analyzed for I-131 showed a range of 0.0035 pCi/m³ to 0.0365 pCi/m³, with a mean of 0.0120 pCi/m³, and control location average was less than LLD. No further action was required by the ODCM.

Quarterly composite gamma spectral analyses yielded naturally occurring beryllium-7 (Be-7) above the *a posteriori* MDC.

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

C. Ocean Water

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

Throughout 2013, 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. During 2013 all REMP ocean water sample results for plant related radionuclides were below the *a priori* LLD, and below the lower count specific *a posteriori* MDC. One quarterly composite tritium sample was below the *a priori* LLD but above the *a posteriori* MDC. The DPH monthly ocean water tritium sample results were all below the DPH reported Minimum Detectable Activity (MDA) for tritium and plant related radionuclides.

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

D. Drinking Water

In 2013, drinking water samples were collected on a monthly basis from one indicator location and from the Oceanside control location. Samples were also collected at San Clemente wells per request by the City of San Clemente whenever the wells were operating. 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 2013. The gross beta activity is due to naturally occurring radionuclides. The operation of SONGS had no impact on this sample medium.

E. Shoreline Sediment (Beach Sand)

Beach sand was collected semiannually in 2013 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 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 2013.

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 2013, all of the conduit sample analysis results were below the MDC for station related radionuclides.

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

G. Non-Migratory Marine Species (Flesh)

Species of adult fish, crustacean and mollusks, were collected on a semi-annual basis at the SONGS Unit 1 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. Note three samples, two indicator locations and one control, showed Cs-137 above the *a posteriori* MDC, attributable to Fukushima or weapons testing.

Naturally-occurring K-40 was detected in most marine species samples collected during 2013. 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 2013 from the SONGS garden and from the control location 21 miles from SONGS Units 2/3 midpoint in sector F. No plant related radioactivity was detected in 2013 samples. Refer to Table B-4. It is concluded that, in 2013 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 2013 soil samples yielded naturally occurring K-40 and Th-228. Cs-137 was detected in three (3) indicator samples, as well as the control sample. Cs-137 in environmental sediment samples is attributable to residual nuclear weapons testing fallout or to the Fukushima accident. Refer to Table B-2.

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 2013, the operation of SONGS did not have a measurable effect on the environment as measured by this sample medium.

J. Kelp Sampling

Kelp was collected in April and October of 2013 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 2013 included K-40 and I-131. K-40 is naturally occurring and not related to the operation of SONGS. Refer to Table B-2.

I-131 has been detected at indicator and control locations in previous years. The I-131 data ocean water samples near SONGS have been consistently less than detectable. The northern control locations are too far away and in the predominantly upstream current direction for the I-131 activity to be attributable to SONGS. The control kelp sample stations near the San Juan Sewage Plant outfall have consistently yielded the highest I-131 activity. The San Juan outfall has consistently yielded I-131 at detectable levels. Refer to Table B-2 for a complete list of the 2013 kelp samples with detectable I-131 activity and for the 2013 results for the San Juan Sewage Plant effluent sample I-131 analyses. I-131 in kelp data, graphically presented in Figure 4, shows a relatively close correlation between indicator and control locations over a 25 year period - further supporting the assessment that the likely source for this radionuclide is external to SONGS.

Refer to Figure 5-6 for the relative location of the kelp beds, the San Juan Sewage Plant outfall, and the SONGS outfalls. The data strongly support the conclusion that the I-131 detected in kelp is attributable to medically administered I-131 discharged through the San Juan Sewage Plant outfall and not to the operation of SONGS.

K. Deer Sampling

Deer meat and bone samples were collected in 2013 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 2013 analysis results indicate residual fallout, Cs-137 from external anthropogenic factors such as nuclear weapons testing and Chernobyl or Fukushima Dai-Ichi, are the most likely cause for the one above *a posteriori* MDC data point. The deer meat and bone gamma isotopic data indicate that effects from the operation of SONGS were not detected in this sample media. On February 2, 2014, the Camp Pendleton Wildlife Biologist sent his 2013 Annual Report to the San Onofre's Radiological Effluent and Environmental Specialist for review and notified her that he re-plotted some samples

and changed sample identifications (e.g. control to indicator). Based on this information, we were able to identify and change sample identifications in the REMP database as well as contacting the Certified Environmental Analytical Lab (CEAL) to correct the sample identifications so that the final analytical reports from the CEAL will match SONGS REMP database as well as the Wildlife Biologist's report . NN# 202756190 documented this discrepancy.

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 equivalent, leading to the conclusion that Cs-137 in soil is attributable to residual fallout from external anthropogenic factors such as nuclear weapons testing, Chernobyl, and Fukushima Dai-Ichi.

Data from 2013 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 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 data from air samplers close to SONGS, the data from air samplers further away, and the data from the Oceanside control sampler are statistically equal.

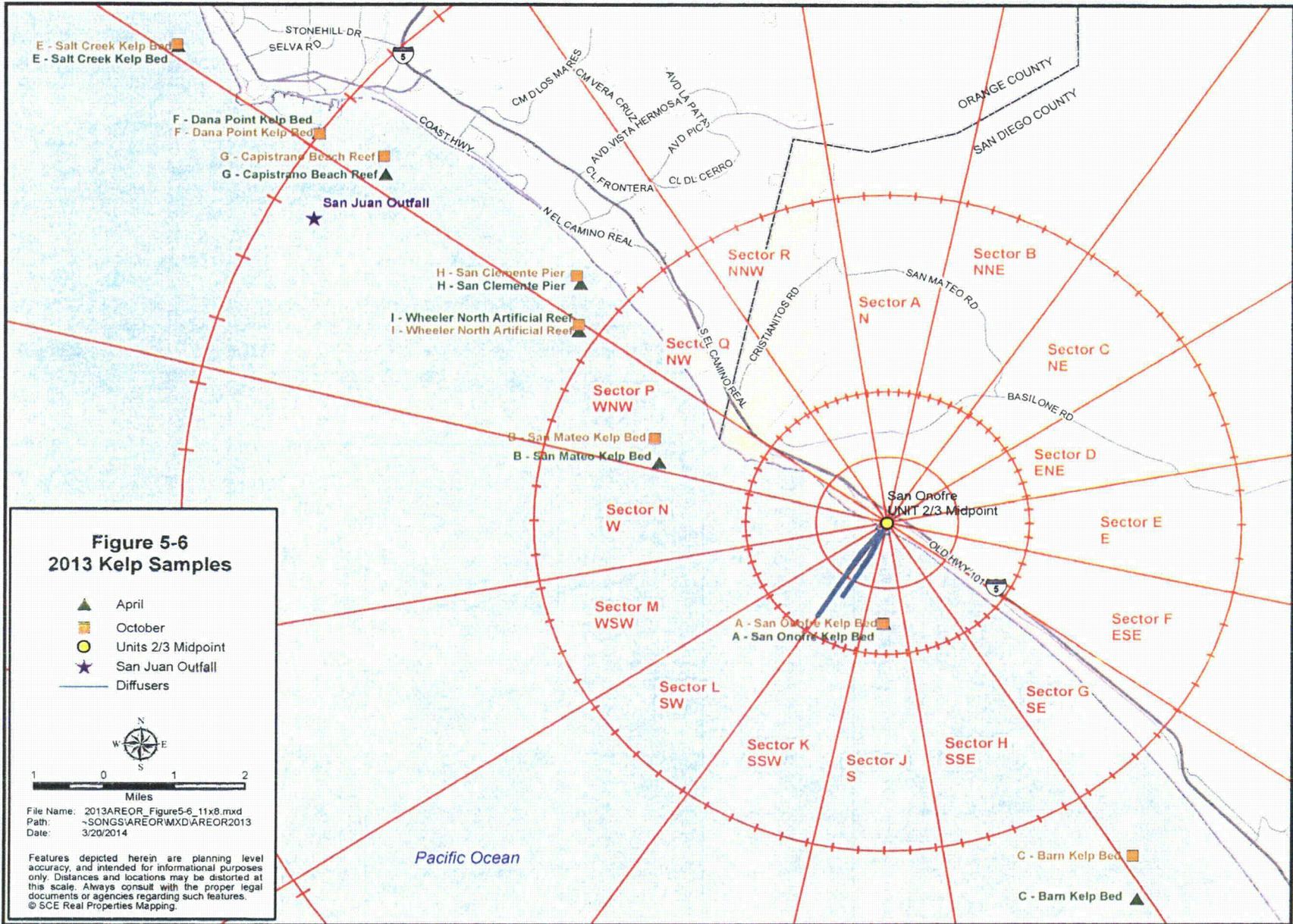


TABLE B-2**Summary of Nuclear Power Plant related Gamma Isotopic Analyses confirmed above MDC**

| Sample Media & location | Radionuclide | Sample Value | MDC (<i>a posteriori</i>) |
|--|---------------------|---------------------|----------------------------------|
| Aquatic Kelp San Onofre Kelp Bed Station A 23APR13 | I-131 | (31 ± 7) E-3 pCi/g | 8 E-3 pCi/g |
| Aquatic Kelp San Mateo Kelp Bed Station B 23APR13 | I-131 | (34 ± 9) E-3 pCi/g | 9 E-3 pCi/g |
| Aquatic Kelp Barn Kelp Bed Station C 23APR13 | I-131 | (37 ± 9) E-3 pCi/g | 8 E-3 pCi/g |
| Aquatic Kelp Salt Creek Bed Station E 23APR13 | I-131 | (53 ± 11) E-3 pCi/g | 11 E-3 pCi/g |
| Aquatic Kelp Dana Point Kelp Bed Station F 23APR13 | I-131 | (57 ± 9) E-3 pCi/g | 9 E-3 pCi/g |
| Aquatic Kelp Capistrano Beach Reef Station G 23APR13 | I-131 | (39 ± 8) E-3 pCi/g | 8 E-3 pCi/g |
| Aquatic Kelp San Clemente Pier Station H 23APR13 | I-131 | (36 ± 7) E-3 pCi/g | 7 E-3 pCi/g |
| Aquatic Kelp Wheeler North Artificial Reef Station I 23APR13 | I-131 | (30± 9) E-3 pCi/g | 8 E-3 pCi/g |
| Aquatic Kelp San Onofre Kelp Bed Station A 15OCT13 | I-131 | (11 ± 8) E-3 pCi/g | 10 E-3 pCi/g |
| Aquatic Kelp San Mateo Kelp Bed Station B 15OCT13 | I-131 | (12 ± 8) E-3 pCi/g | 11 E-3 pCi/g |
| Aquatic Kelp Salt Creek Bed Station E 15OCT13 | I-131 | (46 ± 11) E-3 pCi/g | 10 E-3 pCi/g |
| Aquatic Kelp Dana Point Kelp Bed Station F 15OCT13 | I-131 | (63 ± 9) E-3 pCi/g | 8 E-3 pCi/g |

TABLE B-2

Summary of Nuclear Power Plant related Gamma Isotopic Analyses confirmed above MDC

| Sample Media & location | Radionuclide | Sample Value | MDC (<i>a posteriori</i>) |
|--|---------------------|----------------------------------|----------------------------------|
| Aquatic Kelp Capistrano Beach Reef Station G 15OCT13 | I-131 | (54 ± 12) E-3 pCi/g | 11 E-3 pCi/g |
| Aquatic Kelp Wheeler North Artificial Reef Station I 15OCT13 | I-131 | (32 ± 12) E-3 pCi/g | 11 E-3 pCi/g |
| Soil Camp San Onofre Location # 1 18SEP13 | Cs-137 | (45 ± 33) E-3 pCi/g | 39 E-3 pCi/g |
| Soil Old El Camino Real Location # 2 18SEP13 | Cs-137 | (127 ± 27) E-3 pCi/g | 22 E-3 pCi/g |
| Soil Basilone Road Location # 3 18SEP13 | Cs-137 | (47 ± 33) E-3 pCi/g | 33 E-3 pCi/g |
| Soil Prince of Peace Abbey Location # 7 18SEP13 | Cs-137 | (184 ± 40) E-3 pCi/g | 32 E-3 pCi/g |
| Marine Animal Flesh Unit 1 Outfall, Blacksmith Station A 1OCT13 | Cs-137 | (8 ± 4) E-3 pCi/g | 4 E-3 pCi/g |
| Marine Animal Flesh Units 2&3 Outfall, Spiny Lobster Station B 1OCT13 | Cs-137 | (4 ± 3) E-3 pCi/g | 3 E-3 pCi/g |
| Marine Animal Flesh Laguna Beach, Sheephead Station C 8OCT13 | Cs-137 | (3 ± 3) E-3 pCi/g | 3 E-3 pCi/g |
| Deer Meat Control Location 25SEP13 | Cs-137 | (30 ± 29) E-3 pCi/m ³ | 27 E-3 pCi/m ³ |

TABLE B-3

REMP SAMPLE ANALYSIS SUMMARY FOR 2013

| Medium | Analysis Type | Sampling Frequency | # of Locations | Total # of Analyses in 2013¹ |
|----------------------------|----------------------|---------------------------|-----------------------|--|
| Direct Radiation | Dosimetry | Quarterly | 49 | 196 |
| Airborne Particulates | Gross Beta | Weekly | 8 | 424 |
| Charcoal Cartridge | I-131 | Weekly | 8 | 424 |
| Airborne Particulates | Ge (Li) Scan | Quarterly | 8 | 32 |
| Ocean Water | Ge (Li) Scan, H-3 | Monthly | 4 | 52 |
| Ocean Water | H-3 | Quarterly | 4 | 16 |
| Drinking Water, Unfiltered | Ge (Li) Scan, | Monthly | 2 | 25 |
| | H-3 | | 2 | 25 |
| | Gross Beta | | 2 | 25 |
| 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 | 11 |
| Kelp | Ge (Li) Scan | Semi-Annually | 8 | 16 |
| Soil | Ge (Li) Scan | Annually | 5 | 5 |

1. The total number of analyses listed above includes samples not required by the ODCM, including San Clemente drinking water well samples (collection requested by the City of San Clemente), additional ocean water samples, additional ocean bottom sediment samples, additional crop samples, and additional deer meat samples. The additional drinking water sample (San Clemente #2) was collected in October 2013

STATISTICAL SUMMARY OF REMP DATA FOR 2013

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2013 to 12/31/2013

| 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 | Annual Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements |
|--|---|--------------------------------|--------------------------------------|--|--------------------------------|----------------------------------|---|
| Quarterly Gamma Exposure – Table 1A (mR/std quarter) | | | | | | | |
| | Gamma 196 | 5 | 16.72 (152/152) (10.49 – 25.66) | South Yard Facility 0.4 Mi. ESE | 24.54 (4/4) (23.08 – 25.66) | 16.77 (44/44) (12.53 – 20.14) | 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.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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SAN DIEGO COUNTY, CALIFORNIA

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|---|---|--------------------------------|---------------------------------------|--|-----------------------------------|-----------------------------------|---|
| Weekly Airborne Particulates Gross Beta Activity – Table 2 (pCi/cu.m) | Gross Beta 424 | 0.01 | 0.0378 (371/371) (0.0072 – 0.0987) | San Luis Rey Substation 16.7 Mi. SE | 0.0424 (53/53) (0.0157 – 0.10) | 0.0424 (53/53) (0.0157 – 0.10) | 0 |

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Reporting Period: 1/1/2013 to 12/31/2013

| 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 | Annual Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements |
|--|---|--------------------------------|--------------------------------------|--|------------------------------------|--------------------------------|---|
| Weekly Radioiodine I-131 Activity – Table 3 (pCi/cu.m) | I-131 424 | 0.07 | 0.0120 (23/371) (0.0035-0.0365) | Bluff 0.7 Mi. WNW | 0.0147 (5/53) (0.0035 – 0.0365) | <LLD (0/53) (-) | 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 is attributable to the nuclear accident at the Fukushima Daiichi Nuclear Power Station.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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DOCKET NOS. 50-206, 50-361, 50-362

SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2013 to 12/31/2013

| 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 | Annual Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements |
|---|---|--------------------------------|---|--|--------------------------------------|--------------------------------|---|
| Quarterly Comp. Airborne Particulates Gamma – Table 4A (pCi/cu.m) | | | | | | | |
| | Be-7 | 32 | 0.22 (28/28) (0.17 – 0.28) | AWS Roof Parking 0.18 Mi. NW | 0.22 (4/4) (0.18 – 0.28) | 0.22 (4/4) (0.18 – 0.26) | 0 |
| | Cs-134 | 32 | 0.05 3.60E-4 (1/28) (3.60E-4 – 3.60E-4) | AWS Roof Parking 0.18 Mi. NW | 3.60E-4 (1/4) (3.60E-4 – 3.60E-4) | <LLD (0/4) (-) | 0 |
| | Cs-137 | 32 | 0.06 3.35E-4 (1/28) (3.35E-4 – 3.35E-4) | City of San Clemente 5.1 Mi. NW | 3.35E-4 (1/4) (3.35E-4 – 3.35E-4) | 3.76E-4 (1/4) (-) | 0 |

Be-7 (Beryllium 7) is a naturally occurring radioactive isotope produced by cosmic radiation. Be-7 was confirmed above the detection limit in all the SONGS air particulate quarterly composite samples analyzed in 2013.

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.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period: 1/1/2013 to 12/31/2013

| Medium or Pathway sampled (Unit of Measurement) | Type and Total Number of Analysis Performed | Lower Limit of Detection (LLD) | All Indicator Locations Mean (Range) | Location with Highest Annual Mean Name, Distance and Direction | Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements |
|---|---|--------------------------------|--------------------------------------|--|------------------------------------|------------------------------------|---|
| Monthly Ocean Water Gamma Spectral Analysis – Table 5 (pCi/l) | | | | | | | |
| Ba-140 | 52 | 15 | 2.66 (3/40) (2.08 – 3.10) | (B) Outfall – Unit 2 1.5 Mi. SW | 3.10 (1/12) (3.10 – 3.10) | <LLD (0/12) (-) | 0 |
| Co-58 | 52 | 15 | 0.97 (3/40) (0.73 – 1.22) | (D) Newport Beach 30 Mi. NW | 3.70 (1/12) (3.70 – 3.70) | 3.70 (1/12) (3.70 – 3.70) | 0 |
| Co-60 | 52 | 15 | 2.09 (3/40) (1.31 – 3.27) | (D) Newport Beach 30 Mi. NW | 2.17 (2/12) (2.16 – 2.18) | 2.17 (2/12) (2.16 – 2.18) | 0 |
| Cs-134 | 52 | 15 | 2.16 (4/40) (1.20 – 3.78) | (A) Station Discharge Outfall – Unit1 0.6 Mi. SW | 3.78 (1/12) (3.78 – 3.78) | 1.81 (1/12) (1.81 – 1.81) | 0 |
| Cs-137 | 52 | 18 | 2.02 (5/40) (1.16 – 4.59) | (C) Outfall – Unit 3 1.2 Mi. SSW | 4.59 (1/12) (4.59 – 4.59) | <LLD (0/12) (-) | 0 |
| Fe-59 | 52 | 30 | 5.14 (2/40) (2.42 – 7.86) | (B) Outfall – Unit 2 1.5 Mi. SW | 5.14 (2/12) (2.42 – 7.86) | <LLD (0/12) (-) | 0 |
| H-3 | 52 | 3000 | 229.00 (1/40) (229.00 – 229.00) | (D) Newport Beach 30 Mi. NW | 398.00 (1/12) (398.00 – 398.00) | 398.00 (1/12) (398.00 – 398.00) | 0 |
| I-131 | 52 | 15 | 1.59 (1/40) (1.59 – 1.59) | (C) Outfall – Unit 3 1.2 Mi. SSW | 1.59 (1/12) (1.59 – 1.59) | 1.24 (1/12) (1.24 – 1.24) | 0 |
| La-140 | 52 | 15 | 2.66 (3/40) (2.08 – 3.10) | (B) Outfall – Unit 2 1.5 Mi. SW | 3.10 (1/12) (3.10 – 3.10) | <LLD (0/12) (-) | 0 |
| Mn-54 | 52 | 15 | 0.89 (1/40) (0.89 – 0.89) | (C) Outfall – Unit 3 1.2 Mi. SSW | 0.89 (1/12) (0.89 – 0.89) | 0.82 (1/12) (0.82 – 0.82) | 0 |
| Nb-95 | 52 | 15 | 1.16 (2/40) (1.04 – 1.28) | (D) Newport Beach 30 Mi. NW | 1.61 (1/12) (1.61 – 1.61) | 1.61 (1/12) (1.61 – 1.61) | 0 |
| Zn-65 | 52 | 30 | 3.66 (1/40) (3.66 – 3.66) | (B) Outfall – Unit 2 1.5 Mi. SW | 3.66 (1/12) (3.66 – 3.66) | <LLD (0/12) (-) | 0 |
| Zr-95 | 52 | 15 | 2.25 (3/40) (1.63 – 2.80) | (B) Outfall – Unit 2 1.5 Mi. SW | 2.80 (1/12) (2.80 – 2.80) | 2.02 (1/12) (2.02 – 2.02) | 0 |

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 listed in the ODCM.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362

SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2013 to 12/31/2013

| Medium or Pathway sampled (Unit of Measurement) | Type and Total Number of Analysis Performed | Lower Limit of Detection (LLD) | All Indicator Locations Mean (Range) | Location with Highest Annual Mean Name, Distance and Direction | Mean (Range) | Control Locations Mean (Range) | Number of Non- routine Reported Measurements | |
|---|---|--------------------------------------|--|--|---|-----------------------------------|--|---|
| Quarterly Composite Ocean Water Tritium Activity – Table 7 (pCi/l) | H-3 | 16 | 3000 | 347.00 (1/12) (347.00 – 347.00) | (A) Station Discharge Outfall-Unit 1 0.6 Mi. SW | 347.00 (1/4) (347.00 – 347.00) | 281.67 (3/4) (270.00 – 303.00) | 0 |

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SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2013 to 12/31/2013

| Medium or Pathway sampled (Unit of Measurement) | Type and Total Number of Analysis Performed | Lower Limit of Detection (LLD) | All Indicator Locations Mean (Range) | Location with Highest Annual Mean Name, Distance and Direction | Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements | |
|--|---|--------------------------------|--------------------------------------|--|------------------------------------|------------------------------------|---|---|
| Monthly Drinking Water Analysis – Table 9A (pCi/l) | | | | | | | | |
| | Ba-140 | 25 | 15 | <LLD (0/13) (-) | Oceanside (Control) 15.6 Mi. SE | 3.76 (3/12) (2.16 – 4.68) | 3.76 (3/12) (2.16 – 4.68) | 0 |
| | Co-58 | 25 | 15 | 1.02 (1/13) (1.02 – 1.02) | Oceanside (Control) 15.6 Mi. SE | 1.12 (1/12) (1.12 – 1.12) | 1.12 (1/12) (1.12 – 1.12) | 0 |
| | Co-60 | 25 | 15 | 2.09 (2/13) (1.58 – 2.60) | Camp Pendleton 2.2 Mi. NNW | 2.09 (2/12) (1.58 – 2.60) | <LLD (0/12) (-) | 0 |
| | Cs-134 | 25 | 15 | <LLD (0/13) (-) | Oceanside (Control) 15.6 Mi. SE | 2.77 (4/12) (2.48 – 3.04) | 2.77 (4/12) (2.48 – 3.04) | 0 |
| | Cs-137 | 25 | 18 | 1.87 (1/13) (1.87 – 1.87) | Oceanside (Control) 15.6 Mi. SE | 2.40 (2/12) (0.98 – 3.82) | 2.40 (2/12) (0.98 – 3.82) | 0 |
| | Fe-59 | 25 | 30 | 5.21 (1/13) (5.21 – 5.21) | Camp Pendleton 2.2 Mi. NNW | 5.21 (1/12) (5.21 – 5.21) | <LLD (0/12) (-) | 0 |
| | Gross Beta | 20 | 4 | 1.81 (7/13) (0.89 – 2.61) | Oceanside (Control) 15.6 Mi. SE | 3.01 (9/12) (2.27 – 4.42) | 3.01 (9/12) (2.27 – 4.42) | 0 |
| | H-3 | 25 | 3000 | 336.00 (1/13) (336.00 – 336.00) | Camp Pendleton 2.2 Mi. NNW | 336.00 (1/12) (336.00 – 336.00) | 322.00 (1/12) (322.00 – 322.00) | 0 |
| | I-131 | 25 | 15 | 4.35 (1/13) (4.35 – 4.35) | Camp Pendleton 2.2 Mi. NNW | 4.35 (1/12) (4.35 – 4.35) | 2.00 (2/12) (1.36 – 2.36) | 0 |
| | K-40 | 25 | | 37.30 (2/13) (23.00 – 51.60) | Camp Pendleton 2.2 Mi. NNW | 51.60 (1/12) (51.60 – 51.60) | 37.40 (1/12) (37.40 – 37.40) | 0 |
| | La-140 | 25 | 15 | <LLD (0/13) (-) | Oceanside (Control) 15.6 Mi. SE | 3.76 (3/12) (2.16 – 4.68) | 3.76 (3/12) (2.16 – 4.68) | 0 |
| | Mn-54 | 25 | 15 | 1.11 (1/13) (1.11 – 1.11) | Camp Pendleton 2.2 Mi. NNW | 1.11 (1/12) (1.11 – 1.11) | <LLD (0/12) (-) | 0 |
| | Nb-95 | 25 | 15 | 2.70 (7/13) (1.71 – 3.43) | Camp Pendleton 2.2 Mi. NNW | 2.70 (7/12) (1.71 – 3.43) | 1.87 (1/12) (1.87 – 1.87) | 0 |
| | Zn-65 | 25 | 30 | 2.77 (2/13) (2.46 – 3.07) | Oceanside (Control) 15.6 Mi. SE | 3.20 (2/12) (3.03 – 3.37) | 3.20 (2/12) (3.03 – 3.37) | 0 |
| | Zr-95 | 25 | 15 | 4.68 (1/13) (4.68 – 4.68) | Camp Pendleton 2.2 Mi. NNW | 4.68 (1/12) (4.68 – 4.68) | <LLD (0/12) (-) | 0 |

During 2013 gross beta was confirmed above the *a posteriori* MDC in some drinking water samples. Gross beta is attributable to naturally occurring radionuclides e.g. K-40. All the other analysis results were less than detectable for SONGS related radionuclides.

This table is a statistical summary of the analysis results confirmed above the *a posteriori* MDC in 2013 (Gross Beta) as well as those radionuclides listed in the ODCM.

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

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362

SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2013 to 12/31/2013

| 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 | Annual Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements | |
|---|---|--------------------------------|--------------------------------------|--|---|-----------------------------------|---|---|
| Semi-annual Shoreline Sediment Gamma Spectral Analysis – Table 10 (pCi/g) | | | | | | | | |
| | Cs-134 | 8 | 0.15 | 0.0614 (5/6) (0.0320 - 0.11) | Newport Beach North End 29.2 Mi. NW | 0.0870 (1/2) (0.0870 – 0.0870) | 0.0870 (1/2) (0.0870 – 0.0870) | 0 |
| | Cs-137 | 8 | 0.18 | 0.0205 (1/6) (0.0205 – 0.0205) | San Onofre Surfing Beach 0.8 Mi. WNW | 0.0205 (1/2) (0.0205 – 0.0205) | <LLD (0/2) (-) | 0 |
| | K-40 | 8 | | 12.97 (6/6) (2.74 – 21.40) | San Onofre Surfing Beach 0.8 Mi. WNW | 18.55 (2/2) (15.70 – 21.40) | 18.55 (2/2) (17.70 – 19.40) | 0 |
| | Th-228 | 8 | | 0.94 (6/6) (0.23 – 2.10) | San Onofre State Beach 3.5 Mi. SE | 1.87 (2/2) (1.64 – 2.10) | 1.03 (2/2) (0.37 – 1.68) | 0 |

During 2013 naturally occurring Ac-228, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-230, Th-232, Tl-208, U-234, and K-40 were detected 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 2013 (K-40 and Th-228) as well as those radionuclides listed in the ODCM.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

DOCKET NOS. 50-206, 50-361, 50-362

SAN DIEGO COUNTY, CALIFORNIA

Reporting Period: 1/1/2013 to 12/31/2013

| 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 | Annual Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements |
|---|---|--------------------------------|--------------------------------------|--|-------------------------------------|-------------------------------------|---|
| Deer Meat Analysis – Table 10A (pCi/l) | Cs-137 23 | | <LLD (0/11) (-) | Deer Control Meat Mi | 00.0027 (3/12) (0.0018 – 0.0033) | 00.0027 (3/12) (0.0018 – 0.0033) | 0 |

One deer muscle / bone sample was confirmed above the *a posteriori* MDC. All samples contained naturally occurring K-40. Cs-137 is attributable to residual weapons testing fallout.

Control Deer samples are 5miles or greater from the midpoint of Unit 2 and Unit 3.

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| Medium or Pathway sampled (Unit of Measurement) | Type and Total Number of Analysis Performed | Lower Limit of Detection (LLD) | All Indicator Locations Mean (Range) | Location with Highest Annual Mean Name, Distance and Direction | Mean (Range) | Control Locations Mean (Range) | Number of Non-routine Reported Measurements |
|---|---|--------------------------------|--------------------------------------|--|-----------------------------------|-----------------------------------|---|
| Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis – Table 11 (pCi/g) | | | | | | | |
| | Cs-134 14 | 0.15 | 0.0560 (6/12) (0.0338 – 0.0822) | (E) Laguna Beach 18.2 Mi. NW | 0.0929 (1/2) (0.0929 - 0.0929) | 0.0929 (1/2) (0.0929 - 0.0929) | 0 |
| | Cs-137 14 | 0.18 | 0.0481 (3/12) (0.0219 – 0.0943) | (B) Unit 1 Outfall 0.8 Mi. SSW | 0.0943 (1/2) (0.0943 – 0.0943) | <LLD (0/2) (-) | 0 |
| | K-40 14 | | 16.06 (12/12) (13.00 – 18.20) | (E) Laguna Beach 18.2 Mi. NW | 18.70 (2/2) (18.30 - 19.10) | 18.70 (2/2) (18.30 - 19.10) | 0 |
| | Th-228 14 | | 0.83 (12/12) (0.33 - 1.57) | (F) SONGS Up-coast 0.9 Mi. WSW | 1.36 (2/2) (1.14 - 1.57) | 0.42 (2/2) (0.32 - 0.52) | 0 |

During 2013 naturally occurring Ac-228, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-230, Th-232, Tl-208, U-234, Th-228 and K-40 were detected above the *a posteriori* MDC in most ocean bottom 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 2013 (K-40 and Th-228) as well as those radionuclides listed in the ODCM

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Reporting Period: 1/1/2013 to 12/31/2013

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|---|---|--------------------------------|--------------------------------------|--|-----------------------------------|-----------------------------------|---|
| Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g) | | | | | | | |
| Black Perch | Co-58 4 | 0.13 | < LLD (0/2) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| Black Perch | Co-60 4 | 0.13 | < LLD (0/2) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| Black Perch | Cs-134 4 | 0.13 | 0.0021 (1/2) (0.0021 – 0.0021) | (B) Units 2 and 3 Outfall 1.5 Mi. SSW | 0.0021 (1/1) (0.0021 – 0.0021) | < LLD (0/2) (-) | 0 |
| Black Perch | Cs-137 4 | 0.15 | 0.0029 (1/2) (0.0029 - 0.0029) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0029 (1/1) (0.0029 - 0.0029) | 0.0022 (2/2) (0.0022 - 0.0023) | 0 |
| Black Perch | Fe-59 4 | 0.26 | <LLD (0/2) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| Black Perch | K-40 4 | | 3.26 (2/2) (3.25 - 3.26) | (C) Laguna Beach 18.2 Mi. WSW | 3.31 (2/2) (3.20 - 3.41) | 3.31 (2/2) (3.20 - 3.41) | 0 |
| Black Perch | Mn-54 4 | 0.13 | <LLD (0/2) (-) | | ---- (0/2) (-) | <LLD (0/2) (-) | 0 |
| Black Perch | Zn-65 4 | 0.26 | < LLD (0/2) (-) | | ---- (0/2) (-) | <LLD (0/2) (-) | 0 |
| Blacksmith | Co-58 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Blacksmith | Co-60 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Blacksmith | Cs-134 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Blacksmith | Cs-137 1 | 0.15 | 0.0076 (1/1) (0.0076 – 0.0076) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0076 (1/1) (0.0076 – 0.0076) | < LLD (0/0) (-) | 0 |
| Blacksmith | Fe-59 1 | 0.26 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Blacksmith | K-40 1 | | 3.49 (1/1) (3.49 – 3.49) | (A) Unit 1 Outfall 0.9 Mi. WSW | 3.49 (1/1) (3.49 – 3.49) | < LLD (0/0) (-) | 0 |
| Blacksmith | Mn-54 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Blacksmith | Zn-65 1 | 0.26 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |

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Reporting Period: 1/1/2013 to 12/31/2013

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|---|---|--------------------------------|--------------------------------------|--|-----------------------------------|--------------------------------|---|
| Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g) | | | | | | | |
| California Mussel | Co-58 6 | 0.13 | <LLD (0/4) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| California Mussel | Co-60 6 | 0.13 | < LLD (0/4) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| California Mussel | Cs-134 6 | 0.13 | <LLD (0/4) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| California Mussel | Cs-137 6 | 0.15 | <LLD (0/4) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| California Mussel | Fe-59 6 | 0.26 | 0.0034 (1/4) (0.0034 – 0.0034) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0034 (1/2) (0.0034 – 0.0034) | < LLD (0/2) (-) | 0 |
| California Mussel | K-40 6 | | 1.48 (4/4) (0.72 - 2.00) | (A) Unit 1 Outfall 0.9 Mi. WSW | 1.84 (2/2) (1.67 - 2.00) | 1.59 (2/2) (1.36 – 1.82) | 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 |
| Kelp Bass | Co-58 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Kelp Bass | Co-60 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Kelp Bass | Cs-134 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Kelp Bass | Cs-137 1 | 0.15 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Kelp Bass | Fe-59 1 | 0.26 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Kelp Bass | K-40 1 | | 3.42 (1/1) (3.42 - 3.42) | (A) Unit 1 Outfall 0.9 Mi. WSW | 3.42 (1/1) (3.42 - 3.42) | < LLD (0/0) (-) | 0 |
| Kelp Bass | Mn-54 1 | 0.13 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Kelp Bass | Zn-65 1 | 0.26 | <LLD (0/1) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |

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|---|---|--------------------------------|--------------------------------------|--|-----------------------------------|-----------------------------------|---|
| Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g) | | | | | | | |
| Sheephead | Co-58 4 | 0.13 | < LLD (0/2) (-) | | ---- (0/2) (-) | <LLD (0/2) (-) | 0 |
| Sheephead | Co-60 4 | 0.13 | <LLD (0/2) (-) | (C) Laguna Beach 18.2 Mi. NW | 0.0039 (1/2) (0.0039 – 0.0039) | 0.0039 (1/2) (0.0039 – 0.0039) | 0 |
| Sheephead | Cs-134 4 | 0.13 | < LLD (0/2) (-) | | ---- (0/2) (-) | <LLD (0/2) (-) | 0 |
| Sheephead | Cs-137 4 | 0.15 | 0.0032 (1/2) (0.0032 – 0.0032) | (C) Laguna Beach 18.2 Mi. NW | 0.0032 (2/2) (0.0031 – 0.0033) | 0.0032 (2/2) (0.0031 – 0.0033) | 0 |
| Sheephead | Fe-59 4 | 0.26 | <LLD (0/2) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| Sheephead | K-40 4 | | 3.54 (2/2) (3.43 – 3.65) | (B) Units 2 and 3 Outfall 1.5Mi. SSW | 3.54 (2/2) (3.43 – 3.65) | 3.46 (2/2) (3.34 – 3.58) | 0 |
| Sheephead | Mn-54 4 | 0.13 | < LLD (0/2) (-) | | ---- (0/2) (-) | <LLD (0/2) (-) | 0 |
| Sheephead | Zn-65 4 | 0.26 | <LLD (0/2) (-) | | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| Sand Bass | Co-58 2 | 0.13 | <LLD (0/2) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Sand Bass | Co-60 2 | 0.13 | 0.0038 (1/2) (0.0038 – 0.0038) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0038 (1/1) (0.0038 – 0.0038) | < LLD (0/0) (-) | 0 |
| Sand Bass | Cs-134 2 | 0.13 | <LLD (0/2) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Sand Bass | Cs-137 2 | 0.15 | 0.0055 (2/2) (0.0034 – 0.0076) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0076 (1/1) (0.0076 – 0.0076) | < LLD (0/0) (-) | 0 |
| Sand Bass | Fe-59 2 | 0.26 | <LLD (0/2) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Sand Bass | K-40 2 | | 3.39 (2/2) (3.08 - 3.69) | (B) Units 2 and 3 Outfall 1.5Mi. SSW | 3.69 (1/1) (3.69 - 3.69) | < LLD (0/0) (-) | 0 |
| Sand Bass | Mn-54 2 | 0.13 | <LLD (0/2) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |
| Sand Bass | Zn-65 2 | 0.26 | <LLD (0/2) (-) | | ---- (0/1) (-) | < LLD (0/0) (-) | 0 |

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|---|---|--------------------------------|--------------------------------------|--|-----------------------------------|--------------------------------|---|
| Semi-Annual Non-Migratory Marine Animals (Flesh) Analysis – Table 12A (pCi/g) | | | | | | | |
| Spiny Lobster | Co-58 6 | 0.13 | 0.0022 (1/4) (0.0022 – 0.0022) | (A) Unit 1 Outfall 0.9 Mi. WSW | ---- (0/1) (-) | <LLD (0/2) (-) | 0 |
| Spiny Lobster | Co-60 6 | 0.13 | 0.0042 (1/4) (0.0042 - 0.0042) | (B) Units 2 and 3 Outfall 1.5Mi. SSW | 0.0042 (1/2) (0.0042 – 0.0042) | <LLD (0/2) (-) | 0 |
| Spiny Lobster | Cs-134 6 | 0.13 | < LLD (0/4) (-) | | ---- (0/2) (-) | <LLD (0/2) (-) | 0 |
| Spiny Lobster | Cs-137 6 | 0.15 | 0.0041 (3/4) (0.0026 – 0.0051) | (B) Units 2 and 3 Outfall 1.5Mi. SSW | 0.0045 (1/2) (0.0045 – 0.0045) | <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 | | 3.32 (4/4) (3.08 – 3.65) | (C) Laguna Beach 18.2 Mi. NW | 3.66 (2/2) (3.62 – 3.70) | 3.66 (2/2) (3.62 – 3.70) | 0 |
| Spiny Lobster | Mn-54 6 | 0.13 | 0.0015 (1/4) (0.0015 – 0.0015) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0015 (1/2) (0.0015 – 0.0015) | <LLD (0/2) (-) | 0 |
| Spiny Lobster | Zn-65 6 | 0.26 | 0.0046 (1/4) (0.0046 – 0.0046) | (A) Unit 1 Outfall 0.9 Mi. WSW | 0.0046 (1/2) (0.0046 – 0.0046) | < LLD (0/2) (-) | 0 |

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

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|---|---|--------------------------------|--------------------------------------|--|-----------------------------------|-----------------------------------|---|
| Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g) | | | | | | | |
| Bok Choi | Be-7 1 | | < LLD (0/0) (-) | South East of Oceanside 22 Mi. SE | 0.10 (1/1) (0.10 – 0.10) | 0.10 (1/1) (0.10 – 0.10) | 0 |
| Bok Choi | Cs-134 1 | 0.06 | < LLD (0/0) (-) | South East of Oceanside 22 Mi. SE | 0.0040 (1/1) (0.0040 – 0.0040) | 0.0040 (1/1) (0.0040 – 0.0040) | 0 |
| Bok Choi | Cs-137 1 | 0.08 | < LLD (0/0) (-) | South East of Oceanside 22 Mi. SE | 0.0043 (1/1) (0.0043 – 0.0043) | 0.0043 (1/1) (0.0043 – 0.0043) | 0 |
| Bok Choi | I-131 1 | 0.06 | < LLD (0/0) (-) | All results <LLD | ---- (0/1) (-) | < LLD (0/1) (-) | 0 |
| Bok Choi | K-40 1 | | < LLD (0/0) (-) | South East of Oceanside 22 Mi. SE | 3.53 (1/1) (3.53 – 3.53) | 3.53 (1/1) (3.53 – 3.53) | 0 |
| Lettuce | Cs-134 2 | 0.06 | < LLD (0/0) (-) | All results <LLD | ---- (0/2) (-) | < LLD (0/2) (-) | 0 |
| Lettuce | Cs-137 2 | 0.08 | < LLD (0/0) (-) | All results <LLD | ---- (0/2) (-) | ---- (0/2) (-) | 0 |
| Lettuce | I-131 2 | 0.06 | < LLD (0/0) (-) | All results <LLD | ---- (0/2) (-) | ---- (0/2) (-) | 0 |
| Lettuce | K-40 2 | | < LLD (0/0) (-) | South East of Oceanside 22 Mi. SE | 3.93 (2/2) (3.50 – 4.36) | 3.93 (2/2) (3.50 – 4.36) | 0 |
| Sorrel | Be-7 3 | | 0.15 (2/2) (0.11 – 0.19) | South East of Oceanside 22 Mi. SE | 0.18 (1/1) (0.18 – 0.18) | 0.18 (1/1) (0.18 – 0.18) | 0 |
| Sorrel | Cs-134 3 | 0.06 | 0.0050 (1/2) (0.0050 – 0.0050) | SONGS Garden 0.4 Mi. NNW | 0.0050 (1/2) (0.0050 – 0.0050) | < LLD (0/1) (-) | 0 |
| Sorrel | Cs-137 3 | 0.08 | < LLD (0/2) (-) | All results <LLD | ---- (0/1) (-) | < LLD (0/1) (-) | 0 |
| Sorrel | I-131 3 | 0.06 | < LLD (0/2) (-) | All results <LLD | ---- (0/1) (-) | < LLD (0/1) (-) | 0 |
| Sorrel | K-40 3 | | 4.60 (2/2) (4.51 – 4.68) | SONGS Garden 0.4 Mi. NNW | 4.60 (2/2) (4.51 – 4.68) | 3.33 (1/1) (3.33 – 3.33) | 0 |
| Tomato | Cs-134 5 | 0.06 | 0.0098 (1/2) (0.0098 – 0.0098) | SONGS Garden 0.4 Mi. NNW | 0.0098 (1/2) (0.0098 – 0.0098) | 0.0035 (1/3) (0.0035 – 0.0035) | 0 |
| Tomato | Cs-137 5 | 0.08 | < LLD (0/2) (-) | South East of Oceanside 22 Mi. SE | 0.0098 (1/3) (0.0098 – 0.0098) | 0.0098 (1/3) (0.0098 – 0.0098) | 0 |

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|---|---|--------------------------------|--------------------------------------|--|-----------------------------|--------------------------------|---|
| Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g) | | | | | | | |
| Tomato | I-131 5 | 0.06 | < LLD (0/2) (-) | All results <LLD | ---- (0/3) (-) | < LLD (0/3) (-) | 0 |
| Tomato | K-40 5 | | 2.20 (2/2) (1.98 – 2.42) | SONGS Garden 0.4 Mi. NNW | 2.20 (2/2) (1.98 – 2.42) | 1.85 (3/3) (1.69 – 2.10) | 0 |

During 2013, naturally occurring K-40 (potassium 40) was confirmed above the *a posteriori* MDC in all local crop samples and Be-7 (Beryllium 7) was confirmed above the *a posteriori* MDC in some Bok Choi and Sorrel samples only.

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 data in this table includes Cs-134, Cs-137, and I-131 analysis results greater than the MDC attributable to fallout from the nuclear accident at Fukushima.

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|--|---|--------------------------------|--------------------------------------|--|------------------------------------|-----------------------------------|---|---|
| Annual Soil Analysis – Depth 3 " Table 14 (pCi/g) | | | | | | | | |
| | Cs-134 | 5 | 0.15 | 0.0382 (3/4) (0.0302 - 0.514) | Camp San Onofre 2.6 Mi. NE | 0.0514 (1/1) (0.0514 - 0.0514) | 0.0185 (1/1) (0.0185 - 0.0185) | 0 |
| | Cs-137 | 5 | 0.18 | 0.0730 (3/4) (0.0447 - 0.13) | Prince of Peace Abbey 15 Mi. SE | 0.18 (1/1) (0.18 - 0.18) | 0.18 (1/1) (0.18 - 0.18) | 0 |
| | K-40 | 5 | | 15.78 (4/4) (7.10 - 21.90) | Camp San Onofre 2.6 Mi. NE | 21.90 (1/1) (21.90 - 21.90) | 3.79 (1/1) (3.79 - 3.79) | 0 |
| | Th-228 | 5 | | 0.58 (4/4) (0.17 - 0.93) | Camp San Onofre 2.6 Mi. NE | 0.93 (1/1) (0.93 - 0.93) | 0.18 (1/1) (0.18 - 0.18) | 0 |

During 2013, naturally occurring K-40, Ac-228, Bi-214, Pb-212, Pb-214, Ra-226, Ra-228, Th-230, Th-232, Tl-208, and U-234 were detected above the *a posteriori* MDC in most shoreline sediment samples.

Cs-137 (Cesium 137) was detected in three samples and the control and is attributable to fallout from nuclear weapons testing, Chernobyl, or Fukushima.

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|---|---|--------------------------------|--------------------------------------|--|---|-----------------------------------|---|---|
| Semi-Annual Kelp Analysis – Table 15 (pCi/g) | | | | | | | | |
| | Cs-134 | 16 | 0.06 | 0.0036 (1/6) (0.0036 – 0.0036) | Capistrano Beach Reef (G) 8.9 Mi. NW | 0.0068 (1/2) (0.0068 - 0.0068) | 0.0057 (2/10) (0.0046 – 0.0068) | 0 |
| | Cs-137 | 16 | 0.08 | 0.0054 (2/6) (0.0045 – 0.0063) | (B) San Mateo Kelp Bed 3.8 Mi. WNW | 0.0054 (2/2) (0.0045 – 0.0063) | 0.0046 (5/10) (0.0032 – 0.0069) | 0 |
| | I-131 | 16 | 0.06 | 0.0250 (5/6) (0.0108 - 0.0369) | Dana Point Kelp Bed (F) 10.0 Mi. NW | 0.0601 (2/2) (0.0569 – 0.0632) | 0.0457 (9/10) (0.0303 – 0.0632) | 0 |
| | K-40 | 16 | | 10.54 (6/6) (7.42 – 13.10) | San Clemente Pier (H) 5.7 Mi. NW | 12.20 (2/2) (11.70 – 12.70) | 11.06 (10/10) (8.85 – 12.70) | 0 |

During 2013, naturally occurring K-40 (16 of 16)-was confirmed above the *a posteriori* MDC in kelp samples. I-131 (iodine 131) was also confirmed above the *a posteriori* MDC in 9 of 10 control kelp samples. I-131 is known to be a constituent of sewage plant discharges due to medically administered I-131. The activity of I-131 in the control sample (Salt Creek – about 11 miles up coast from SONGS) has historically been higher than the I-131 activity in kelp closer to SONGS.

APPENDIX C
SUMMARY OF QUALITY CONTROL PROGRAMS

All REMP samples are collected, shipped, and analyzed in accordance with NRC Regulatory Guide 4.15. Marine radiological environmental samples are collected by a vendor, MBC Environmental, per the vendors Quality Assurance manual. REMP sample analysis is performed by the Contracted Environmental Analysis Laboratory (CEAL) in accordance with the Laboratory Quality Assurance Plan. During 2013 the CEAL was General Engineering Laboratory (GEL). The CEAL for REMP TLDs was Stanford Dosimetry.

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.

Per the 2013 Annual Environmental QA Report, the CEAL was provided eighty-nine (89) individual environmental analyses. The accuracy of each result reported to Eckert& Ziegler Analytics, Inc. is measured by the ratio of GEL's result to the known value. All results fell within GEL's acceptance criteria (100%)

The CEAL's performance meets the criteria described in Reg. Guide 4.15.

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

| | 1 ST QUARTER | 2 ND QUARTER | 3 RD QUARTER | 4 TH QUARTER |
|---------|-------------------------|-------------------------|-------------------------|-------------------------|
| TLD 66 | 14.5 ± 0.88 | 13.7 ± 0.63 | 15.3 ± 0.68 | 15.5 ± 0.84 |
| TLD 200 | 14.2 ± 0.88 | 13.7 ± 0.79 | 15.0 ± 0.76 | 13.1 ± 0.67 |

- 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 exposure in mR per standard quarter (July 2012 to July 2013) | TLD 201 (annual duplicate) exposure in mR per standard quarter (July 2012 to July 2013) |
|--|--|
| 17.0 | 15.9 |

COMPARISON OF TLD TO PIC DATA,

| | | | |
|----------------|----------------|----------------|----------------|
| PIC 3 17.8 | PIC 4 16.0 | PIC 5 15.3 | PIC 8 16.0 |
| TLD 40 18.2 | TLD 61 15.5 | TLD 63 13.2 | TLD 65 14.1 |

PIC data converted to mR per standard quarter compared to the 4th Quarter co-located 2013 TLD data.

CALIBRATION OF AIR SAMPLER VOLUME METERS

The Shop Services and Instrumentation Division (SSID) of SCE perform 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. No anomalies in post calibration occurred

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|---|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10469 | I-131 | 9.38E+01 pCi | 7.86E-01 | 9.27E+01 pCi | 1.55E+00 | 1.01 |
| I-131 Cartridge | | | | | | |
| GEL ID 321788001 | | | | | | |
| ***** | | | | | | |
| E10470 | Sr-89 | 1.07E+02 pCi/L | 1.05E+00 | 9.97E+01 pCi/L | 1.66E+00 | 1.07 |
| Sr-89/90 w/maf* | Sr-90 | 1.18E+01 pCi/L | 2.79E-01 | 1.10E+01 pCi/L | 1.84E-01 | 1.07 |
| Milk | | | | | | |
| GEL ID 321788002 | | | | | | |
| *w/maf = with mixed activation/fission products | | | | | | |
| ***** | | | | | | |
| E10471 | I-131 | 1.12E+02 pCi/L | 3.54E+00 | 1.00E+02 pCi/L | 1.67E+00 | 1.12 |
| Gamma | Ce-141 | 2.00E+02 pCi/L | 4.70E+00 | 1.87E+02 pCi/L | 3.13E+00 | 1.07 |
| Milk | Cr-51 | 5.09E+02 pCi/L | 2.56E+01 | 4.72E+02 pCi/L | 7.88E+00 | 1.08 |
| | Cs-134 | 2.06E+02 pCi/L | 4.50E+00 | 2.14E+02 pCi/L | 3.57E+00 | 0.96 |
| | Cs-137 | 2.83E+02 pCi/L | 4.62E+00 | 2.66E+02 pCi/L | 4.44E+00 | 1.07 |
| | Co-58 | 2.19E+02 pCi/L | 4.37E+00 | 2.08E+02 pCi/L | 3.47E+00 | 1.05 |
| GEL ID | Mn-54 | 2.21E+02 pCi/L | 4.61E+00 | 2.08E+02 pCi/L | 3.48E+00 | 1.06 |
| 321788003 | Fe-59 | 2.78E+02 pCi/L | 7.95E+00 | 2.52E+02 pCi/L | 4.21E+00 | 1.10 |
| | Zn-65 | 3.39E+02 pCi/L | 9.17E+00 | 3.01E+02 pCi/L | 5.02E+00 | 1.13 |
| | Co-60 | 4.02E+02 pCi/L | 5.84E+00 | 4.00E+02 pCi/L | 6.68E+00 | 1.01 |
| ***** | | | | | | |

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|-----------|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10472 | I-131 | 1.12E+02 pCi/L | 3.39E+00 | 9.28E+01 pCi/L | 1.55E+00 | 1.21 |
| Gamma | Ce-141 | 1.88E+02 pCi/L | 3.76E+00 | 1.79E+02 pCi/L | 3.00E+00 | 1.05 |
| Water | Cr-51 | 4.84E+02 pCi/L | 2.37E+01 | 4.52E+02 pCi/L | 7.55E+00 | 1.07 |
| | Cs-134 | 1.96E+02 pCi/L | 4.60E+00 | 2.05E+02 pCi/L | 3.42E+00 | 0.96 |
| | Cs-137 | 2.71E+02 pCi/L | 4.59E+00 | 2.54E+02 pCi/L | 4.25E+00 | 1.07 |
| | Co-58 | 2.03E+02 pCi/L | 4.04E+00 | 1.99E+02 pCi/L | 3.33E+00 | 1.02 |
| GEL ID | Mn-54 | 2.15E+02 pCi/L | 4.16E+00 | 1.99E+02 pCi/L | 3.33E+00 | 1.08 |
| 321788004 | Fe-59 | 2.67E+02 pCi/L | 7.06E+00 | 2.41E+02 pCi/L | 4.03E+00 | 1.11 |
| | Zn-65 | 3.14E+02 pCi/L | 8.02E+00 | 2.88E+02 pCi/L | 4.81E+00 | 1.09 |
| | Co-60 | 3.92E+02 pCi/L | 5.34E+00 | 3.83E+02 pCi/L | 6.39E+00 | 1.02 |
| ***** | | | | | | |

¹ The acceptable ratio is $\pm 25\%$ of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|---|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10577 | I-131 | 9.16E+01 pCi | 1.15E+00 | 8.96E+01 pCi | 1.50E+00 | 1.02 |
| I-131 Cartridge | | | | | | |
| GEL ID 327682001 | | | | | | |
| ***** | | | | | | |
| E10578 | Sr-89 | 9.27E+01 pCi/L | 9.09E-01 | 9.50E+01 pCi/L | 1.59E+00 | 0.98 |
| Sr-89/90 w/maf* | | | | | | |
| Milk | | | | | | |
| Sr-90 | | | | | | |
| 1.20E+01 pCi/L | | | | | | |
| 2.55E-01 | | | | | | |
| 1.70E+01 pCi/L | | | | | | |
| 2.85E-01 | | | | | | |
| 0.70 | | | | | | |
| GEL ID 327682002 | | | | | | |
| ***** | | | | | | |
| *w/maf = with mixed activation/fission products | | | | | | |
| ***** | | | | | | |
| E10579 | I-131 | 9.86E+01 pCi/L | 3.29E+00 | 9.55E+01 pCi/L | 1.59E+00 | 1.03 |
| Gamma | | | | | | |
| Ce-141 | | | | | | |
| 9.44E+01 pCi/L | | | | | | |
| 2.72E+00 | | | | | | |
| 9.04E+01 pCi/L | | | | | | |
| 1.51E+00 | | | | | | |
| 1.04 | | | | | | |
| Milk | | | | | | |
| Cr-51 | | | | | | |
| 2.58E+02 pCi/L | | | | | | |
| 1.92E+01 | | | | | | |
| 2.50E+02 pCi/L | | | | | | |
| 4.18E+00 | | | | | | |
| 1.03 | | | | | | |
| Cs-134 | | | | | | |
| 1.21E+02 pCi/L | | | | | | |
| 3.56E+00 | | | | | | |
| 1.25E+02 pCi/L | | | | | | |
| 2.09E+00 | | | | | | |
| 0.97 | | | | | | |
| GEL ID | | | | | | |
| Cs-137 | | | | | | |
| 1.49E+02 pCi/L | | | | | | |
| 3.86E+00 | | | | | | |
| 1.51E+02 pCi/L | | | | | | |
| 2.52E+00 | | | | | | |
| 0.99 | | | | | | |
| 327682003 | | | | | | |
| Co-58 | | | | | | |
| 9.44E+01 pCi/L | | | | | | |
| 3.15E+00 | | | | | | |
| 9.40E+01 pCi/L | | | | | | |
| 1.57E+00 | | | | | | |
| 1.00 | | | | | | |
| Mn-54 | | | | | | |
| 1.80E+02 pCi/L | | | | | | |
| 4.11E+00 | | | | | | |
| 1.72E+02 pCi/L | | | | | | |
| 2.87E+00 | | | | | | |
| 1.05 | | | | | | |
| Fe-59 | | | | | | |
| 1.36E+02 pCi/L | | | | | | |
| 5.60E+00 | | | | | | |
| 1.20E+02 pCi/L | | | | | | |
| 2.00E+00 | | | | | | |
| 1.14 | | | | | | |
| Zn-65 | | | | | | |
| 2.39E+02 pCi/L | | | | | | |
| 9.01E+00 | | | | | | |
| 2.17E+02 pCi/L | | | | | | |
| 3.63E+00 | | | | | | |
| 1.10 | | | | | | |
| Co-60 | | | | | | |
| 1.77E+02 pCi/L | | | | | | |
| 4.50E+00 | | | | | | |
| 1.75E+02 pCi/L | | | | | | |
| 2.93E+00 | | | | | | |
| 1.01 | | | | | | |
| ***** | | | | | | |

Second Quarter 2013 (Ref. Date 13-Jun-2013)

EZA Cust.# 278

Table Page 1 of 2

¹ The acceptable ratio is $\pm 25\%$ of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|-----------|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10580 | I-131 | 9.33E+01 pCi/L | 3.19E+00 | 9.54E+01 pCi/L | 1.59E+00 | 0.98 |
| Gamma | Ce-141 | 1.15E+02 pCi/L | 2.92E+00 | 1.10E+02 pCi/L | 1.84E+00 | 1.04 |
| Water | Cr-51 | 3.40E+02 pCi/L | 2.01E+01 | 3.06E+02 pCi/L | 5.10E+00 | 1.11 |
| | Cs-134 | 1.48E+02 pCi/L | 4.17E+00 | 1.53E+02 pCi/L | 2.55E+00 | 0.97 |
| GEL ID | Cs-137 | 1.83E+02 pCi/L | 3.60E+00 | 1.84E+02 pCi/L | 3.08E+00 | 0.99 |
| 327682004 | Co-58 | 1.13E+02 pCi/L | 3.10E+00 | 1.15E+02 pCi/L | 1.91E+00 | 0.99 |
| | Mu-54 | 2.09E+02 pCi/L | 3.92E+00 | 2.10E+02 pCi/L | 3.50E+00 | 1.00 |
| | Fe-59 | 1.51E+02 pCi/L | 6.06E+00 | 1.46E+02 pCi/L | 2.44E+00 | 1.03 |
| | Zn-65 | 2.86E+02 pCi/L | 8.71E+00 | 2.65E+02 pCi/L | 4.43E+00 | 1.08 |
| | Co-60 | 2.25E+02 pCi/L | 4.35E+00 | 2.14E+02 pCi/L | 3.57E+00 | 1.05 |
| ***** | | | | | | |

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|---|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10625 | I-131 | 8.57E+01 pCi | 1.41E+00 | 7.96E+01 pCi | 1.33E+00 | 1.08 |
| I-131 Cartridge | | | | | | |
| GEL ID 333416001 | | | | | | |
| ***** | | | | | | |
| E10626 | Sr-89 | 9.33E+01 pCi/L | 1.07E+00 | 9.60E+01 pCi/L | 1.60E+00 | 0.97 |
| Sr-89/90 w/maf* | | | | | | |
| Milk | | | | | | |
| GEL ID 333416002 | | | | | | |
| *w/maf = with mixed activation/fission products | | | | | | |
| ***** | | | | | | |
| E10627 | I-131 | 1.00E+02 pCi/L | 3.38E+00 | 9.83E+01 pCi/L | 1.64E+00 | 1.02 |
| Gamma | | | | | | |
| Cr-51 | | | | | | |
| 3.09E+02 pCi/L | | | | | | |
| 2.57E+01 | | | | | | |
| 2.77E+02 pCi/L | | | | | | |
| 4.63E+00 | | | | | | |
| 1.11 | | | | | | |
| Milk | | | | | | |
| Cs-134 | | | | | | |
| 1.46E+02 pCi/L | | | | | | |
| 4.46E+00 | | | | | | |
| 1.72E+02 pCi/L | | | | | | |
| 2.88E+00 | | | | | | |
| 0.85 | | | | | | |
| Cs-137 | | | | | | |
| 1.33E+02 pCi/L | | | | | | |
| 4.07E+00 | | | | | | |
| 1.31E+02 pCi/L | | | | | | |
| 2.19E+00 | | | | | | |
| 1.02 | | | | | | |
| Co-58 | | | | | | |
| 1.04E+02 pCi/L | | | | | | |
| 3.47E+00 | | | | | | |
| 1.08E+02 pCi/L | | | | | | |
| 1.80E+00 | | | | | | |
| 0.97 | | | | | | |
| GEL ID | | | | | | |
| Mn-54 | | | | | | |
| 1.44E+02 pCi/L | | | | | | |
| 4.08E+00 | | | | | | |
| 1.39E+02 pCi/L | | | | | | |
| 2.32E+00 | | | | | | |
| 1.04 | | | | | | |
| 333416003 | | | | | | |
| Fe-59 | | | | | | |
| 1.43E+02 pCi/L | | | | | | |
| 7.30E+00 | | | | | | |
| 1.30E+02 pCi/L | | | | | | |
| 2.18E+00 | | | | | | |
| 1.10 | | | | | | |
| Zn-65 | | | | | | |
| 2.86E+02 pCi/L | | | | | | |
| 7.58E+00 | | | | | | |
| 2.66E+02 pCi/L | | | | | | |
| 4.45E+00 | | | | | | |
| 1.07 | | | | | | |
| Co-60 | | | | | | |
| 2.01E+02 pCi/L | | | | | | |
| 4.66E+00 | | | | | | |
| 1.96E+02 pCi/L | | | | | | |
| 3.27E+00 | | | | | | |
| 1.03 | | | | | | |
| ***** | | | | | | |

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|-----------|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10628 | I-131 | 1.01E+02 pCi/L | 3.01E+00 | 9.79E+01 pCi/L | 1.63E+00 | 1.03 |
| Gamma | Cr-51 | 2.80E+02 pCi/L | 1.73E+01 | 2.51E+02 pCi/L | 4.18E+00 | 1.12 |
| Water | Cs-134 | 1.42E+02 pCi/L | 3.66E+00 | 1.56E+02 pCi/L | 2.60E+00 | 0.91 |
| | Cs-137 | 1.19E+02 pCi/L | 3.51E+00 | 1.18E+02 pCi/L | 1.97E+00 | 1.01 |
| | Co-58 | 9.80E+01 pCi/L | 3.11E+00 | 9.73E+01 pCi/L | 1.62E+00 | 1.01 |
| GEL ID | Mn-54 | 1.29E+02 pCi/L | 3.29E+00 | 1.25E+02 pCi/L | 2.09E+00 | 1.03 |
| 333416004 | Fe-59 | 1.23E+02 pCi/L | 5.64E+00 | 1.18E+02 pCi/L | 1.97E+00 | 1.04 |
| | Zn-65 | 2.62E+02 pCi/L | 7.23E+00 | 2.41E+02 pCi/L | 4.02E+00 | 1.09 |
| | Co-60 | 1.87E+02 pCi/L | 4.11E+00 | 1.77E+02 pCi/L | 2.96E+00 | 1.06 |
| ***** | | | | | | |

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

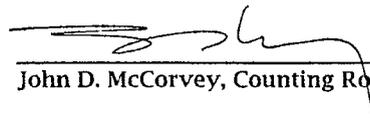
 **Eckert & Ziegler**
Analytics

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

Tel 404-352-8677
Fax 404-352-2837

**RESULTS OF ENVIRONMENTAL
CROSS CHECK PROGRAM
GEL LABORATORIES, LLC**

Fourth Quarter 2013
(Ref. Date 05-Dec-2013)



John D. McCorvey, Counting Room Manager 11 Feb 14
Date

ANA Form002 Rev ...

¹ The acceptable ratio is $\pm 25\%$ of the known value for Analytics.

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|---|----------|----------------|-----------------------|----------------|-----------------------|----------------|
| ***** | | | | | | |
| E10734 | I-131 | 8.15E+01 pCi | 1.16E+00 | 7.99E+01 pCi | 1.33E+00 | 1.02 |
| I-131 Cartridge | | | | | | |
| GEL ID 338823001 | | | | | | |
| ***** | | | | | | |
| E10735 | Sr-89 | 8.15E+01 pCi/L | 8.47E-01 | 9.38E+01 pCi/L | 1.57E+00 | 0.87 |
| Sr-89/90 w/maf* | | | | | | |
| | Sr-90 | 1.42E+01 pCi/L | 2.62E-01 | 1.29E+01 pCi/L | 2.15E-01 | 1.10 |
| Milk | | | | | | |
| GEL ID 338823002 | | | | | | |
| *w/maf = with mixed activation/fission products | | | | | | |
| ***** | | | | | | |
| E10736 | I-131 | 9.58E+01 pCi/L | 4.14E+00 | 9.61E+01 pCi/L | 1.60E+00 | 1.00 |
| Gamma | | | | | | |
| | Ce-141 | 1.15E+02 pCi/L | 3.30E+00 | 1.10E+02 pCi/L | 1.83E+00 | 1.05 |
| Milk | | | | | | |
| | Cr-51 | 3.13E+02 pCi/L | 2.30E+01 | 2.97E+02 pCi/L | 4.95E+00 | 1.06 |
| | Cs-134 | 1.25E+02 pCi/L | 4.53E+00 | 1.42E+02 pCi/L | 2.37E+00 | 0.88 |
| | Cs-137 | 1.28E+02 pCi/L | 4.42E+00 | 1.26E+02 pCi/L | 2.11E+00 | 1.01 |
| | Co-58 | 1.09E+02 pCi/L | 3.93E+00 | 1.12E+02 pCi/L | 1.87E+00 | 0.97 |
| GEL ID 338823003 | | | | | | |
| | Mn-54 | 1.76E+02 pCi/L | 4.69E+00 | 1.68E+02 pCi/L | 2.81E+00 | 1.05 |
| | Fe-59 | 1.16E+02 pCi/L | 7.49E+00 | 1.10E+02 pCi/L | 1.84E+00 | 1.05 |
| | Zn-65 | 7.92E+02 pCi/L | 1.19E+01 | 7.41E+02 pCi/L | 1.24E+01 | 1.07 |
| | Co-60 | 1.39E+02 pCi/L | 4.04E+00 | 1.47E+02 pCi/L | 2.45E+00 | 0.95 |
| ***** | | | | | | |

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

TABLE C-1

ANALYTICS CROSS-CHECK PROGRAM SUMMARY

| SAMPLE | ANALYSIS | GEL VALUE | UNCERTAINTY (1 Sigma) | EZA VALUE | UNCERTAINTY (1 Sigma) | RATIO GEL: EZA |
|-----------|----------|----------------|--------------------------|----------------|--------------------------|----------------------|
| ***** | | | | | | |
| E10737 | I-131 | 9.73E+01 pCi/L | 3.23E+00 | 9.24E+01 pCi/L | 1.54E+00 | 1.05 |
| Gamma | Ce-141 | 9.02E+01 pCi/L | 2.69E+00 | 8.88E+01 pCi/L | 1.48E+00 | 1.02 |
| Water | Cr-51 | 2.61E+02 pCi/L | 1.99E+01 | 2.40E+02 pCi/L | 4.01E+00 | 1.09 |
| | Cs-134 | 1.01E+02 pCi/L | 3.14E+00 | 1.15E+02 pCi/L | 1.92E+00 | 0.88 |
| | Cs-137 | 1.01E+02 pCi/L | 3.19E+00 | 1.02E+02 pCi/L | 1.70E+00 | 0.99 |
| | Co-58 | 9.56E+01 pCi/L | 2.84E+00 | 9.06E+01 pCi/L | 1.51E+00 | 1.05 |
| GEL ID | Mn-54 | 1.41E+02 pCi/L | 3.80E+00 | 1.36E+02 pCi/L | 2.27E+00 | 1.04 |
| 338823004 | Fe-59 | 9.14E+01 pCi/L | 4.92E+00 | 8.91E+01 pCi/L | 1.49E+00 | 1.03 |
| | Zn-65 | 6.61E+02 pCi/L | 9.36E+00 | 6.00E+02 pCi/L | 1.00E+01 | 1.10 |
| | Co-60 | 1.14E+02 pCi/L | 3.19E+00 | 1.19E+02 pCi/L | 1.98E+00 | 0.96 |
| ***** | | | | | | |

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 2013 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 2012 operational data are possible for each of the following exposure pathways to man: (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.

Preoperational data are 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 2013. (See Appendix I for ISFSI TLD data). Direct radiation samples (TLDs) were collected at a number of inner and outer ring locations as specified by the ODCM. During the preoperational period from January 1979 to July 31, 1982, the indicator stations ranged from 16.1 to 46.6 mR. The preoperational indicator average was 25.3 mR. The preoperational control range was 19.3 to 30.1 and the control mean was 23.1 mR. During the 2013 operational year for Units 2/3, the routine indicator TLD locations ranged from 10.5 to 25.7 mR, averaging 16.7 mR while the control locations ranged from 12.5 to 20.1 mR with an average of 16.8 mR. Outside the EAB all of the control and indicator TLD data are less than the calculated detection limit (5 mR per standard quarter) above the baseline background for each TLD location. Refer to Appendix B for a detailed discussion of the REMP TLD data.

Factors such as meteorology, local geology, 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 2013 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 are attributable to the Chernobyl Nuclear Power Plant accident that occurred April 26, 1986.

Figure 2A and 2B compare the environmental radiation levels of selected indicator and control locations. Simultaneous variation in the radiation levels at both the control and indicator locations shows that the variations are due to factors external to SONGS. Outside the EAB the operation of SONGS had no detectable 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 36 years (January 1976 to December 2012). 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; the April 1986 Chernobyl accident and the March 11, 2011 Fukushima Dai-Ichi 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 factors external to SONGS.

C. Radioiodine

SONGS Units 2/3:

Most of the preoperational data for I-131 level were below the detection limit. Southern California Edison notified the Nuclear Regulatory Commission (NRC) on June 12, 2013, that it had permanently ceased operation of Units 2 and 3 on June 7, 2013. The notification, called a Certification of Permanent Cessation of Power Operations, sets the stage for SCE to begin preparations for decommissioning. SONGS had no effect on the environment as measured by the radioiodine cartridge data.

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, 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-134, and Cs-137 were detected in an ocean water sample collected from the SONGS Unit 1 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. One of the quarterly ocean water composite samples from the Unit 1 outfall had 347 pCi/l of tritium in December 2013 compared to the average value of 282 pCi/l of tritium in the control sample from Newport Beach.

The data for all other SONGS related radionuclides at all ocean water locations during the 2013 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 2012 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 2013 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 8.1 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 2013 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

| Radionuclide** | Period | INDICATOR | | CONTROL | |
|--|---------------|------------------|----------------|----------------|----------------|
| | | 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

| Radionuclide | Period | INDICATOR | | CONTROL | |
|--|---------------|------------------|----------------|----------------|----------------|
| | | 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 2013

** During January to December 2013 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 four species of adult fish, crustacean 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 2013 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 (a fish), black perch (a fish), bay mussel (a mollusk), spiny lobster (a crustacean), 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 2013 operational period, no SONGS related radionuclides were detected above the *a priori* LLD. Several samples in both the control and indicator locations were found above the *a posteriori* MDC. The data indicate no accumulation trends. The operation of SONGS Units 2/3 in 2013 had no impact on the environment as measured by this sample medium.

TABLE D-2
MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL
AND 2013 OPERATIONAL DATA (SONGS UNITS 2/3)*

Sheephead Flesh**

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|-------------|-------------|---------|-------------|---------|
| | | 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**

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|-------------|-------------|---------|-------------|---------|
| | | 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 2013. The species collected in 2013 were California Mussel, Black Perch, Blacksmith, Sheephead, Kelp Bass, Barred Sand Bass, and Spiny Lobster.

** During January to December 2013 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 2013 OPERATIONAL DATA (SONGS UNITS 2/3)*

Mussel Flesh (Bay or California)**

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|-------------|-------------|---------|---------|---------|
| | | 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 | < LLD | < LLD | < LLD | < LLD |

Spiny Lobster Flesh**

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|-------------|-------------|---------|-------------|---------|
| | | 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 2013. The species collected in 2013 were California Mussel, Black Perch, Blacksmith, Sheephead, Kelp Bass, Barred Sand Bass, and Spiny Lobster.

** During January to December 2013 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 2013 OPERATIONAL DATA (SONGS UNITS 2/3)*

Sea Hare Flesh**

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|-------------|-------------|---------|-------------|---------|
| | | 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)**

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|-------------|-------------|---------|-------------|---------|
| | | 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 2013

** Sea Hare and Keyhole Limpet samples were not collected in 2013

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.

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 at Salt Creek. After collection, the samples are analyzed by gamma-spectral analysis for naturally-occurring and SONGS-related radionuclides. During 2013 four additional control sample locations were analyzed.

To assess the impact of SONGS operations on kelp, preoperational data were compared to 2012 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 2013 operational period, I-131 was detected in five of six indicator samples and nine of ten control samples. No other station related isotopes were detected in kelp samples during the 2013 operational period. Figure 4 (I-131 in Kelp) shows a close correlation between indicator and control sample locations over an extended period of time.

Although I-131 activity has been randomly detected in kelp since 1977, there is no evidence that the concentration of I-131 or other station related radionuclides in kelp is increasing near SONGS. I-131 in kelp is due to the sewer release of medical administrations, since it has been detected consistently in control as well as indicator locations. Since 1988 the concentration of I-131, when detected, has typically been highest at the control locations. These data support the conclusion that during the Units 2/3 operational period, the detection of I-131 in kelp is due to factors external to SONGS. Moreover, with the permanent shutdown of both Units 2 and 3, the production of I-131 ceased. With a short 8 day half-life, SONGS can no longer contribute I-131 to the environment.

K. Drinking Water

No plant related radionuclides were detected during the 2013 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

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|---------------|------------------|----------------|----------------|----------------|
| | | 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-0.18 | < LLD | 0.18 | 0.18 |
| 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

| Radionuclide | Period | INDICATOR | | CONTROL | |
|-----------------------------|---------------|------------------|----------------|----------------|----------------|
| | | 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 | 0.011– 0.037 | 0.025 | 0.030 – 0.063 | 0.046 |
| 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 2013
 LLD Lower Limit of Detection for operational data are listed in Appendix B.

APPENDIX E
DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS
IN 2013

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 2013, 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 2013 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 2013 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.

1) During the week of March 12, 2013, Air Samples #1 (City of San Clemente), #9 (State Beach Park, #12 (Former SONGS Evaporation Pond), #13 (Marine Corps Base, Camp Pendleton East) and #16 (San Luis Rey Substation, control) were noted to have down time greater than 1 hour. This was attributed to the Daylight Savings Time Change.

2) Air Sampler # 16 (San Luis Rey Substation)

- During the week of 4/30/2013, Station # 16, experienced a down time of 153.34 hours due to pump failure during the collection period. The pump was replaced on 4/30/2013 at 1436.
- On May 21, 2013, there was a loss of power for 9.4 hours.

3) Air Sampler # 9 (State Beach Park) failed and was replaced.

In all these events, the Radiological Effluent and Environmental Specialist reviewed previous and post events' data to verify that no deviations were noticed. Per the ODCM Table-2 there were no challenges to the reporting levels for radioactivity concentrations. This is documented in NN# 202352077-003

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. Due to the two pumps failure in 2013 the Environmental Effluent and Environmental Specialist is maintaining an Air Sampler change out schedule.

B. DIRECT RADIATION

No deviations were observed.

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

The regulatory basis for conducting a Land Use Census (LUC) is identified in 10CFR50, Appendix I, Sec IV.B.3. The purpose of the LUC is to identify exposure pathways which could lead to the highest potential of radiation exposure to humans. The 2013 LUC was conducted in accordance with Section 5.2 of the Offsite Dose Calculation (ODCM) and per the Radiological Environmental Monitoring Program (REMP) Land Use Census Procedure, SO123-IX-1.20. The methodology consists of reviewing data from the previous LUC and verifying the information which may be subject to change. The LUC is reviewed and updated annually. Information on how long a person or persons located at non-residential use (e.g. Fire Station, Camp Mesa) closer than the closest residence is also estimated by the appropriate person or agency.

Executive Summary

The land area around San Onofre Nuclear Generating Station (SONGS) is not subject to significant change due to the nature of the land uses. The area around SONGS is divided into sixteen (16) geographical sectors. The Pacific Ocean and Marine Corps Base Camp Pendleton comprise 13 of the 16 sectors surrounding SONGS. The City of San Clemente (a mature municipal area) and coastline comprise the remaining three sectors. Therefore, the characteristics of the local area substantially inhibit significant land use changes.

Definition of Uses

Residence is defined as any structure (single-family house, apartment, mobile home, barracks or similar unit) that is occupied by an individual(s) or resident(s) for three months or longer in a given 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, campground hosts, 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 are cows, goats, and sheep whose milk is used in dairy products for human consumption.

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

Fresh, leafy vegetables include, but are not limited to, lettuce, cabbage and spinach.

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

The Study Scope

The study area includes both Orange and San Diego counties. The Orange County portion includes a portion of the city of San Clemente (population estimated to be 64,542 as of May

2013) and the San Clemente State Park. The San Diego County portion includes much of the Camp Pendleton USMC base, San Onofre State Beach and Park, and SONGS itself.

The LUC map is divided into 16 sectors; A, B, C, D, E, F, G, H, J, K, L, M, N, P, Q, and R. The ODCM requires that the LUC identify the nearest residences, milk animals, meat animals, and vegetable gardens of at least 500 square feet, and other specified uses (campgrounds, employment, etc.) in each of the sectors within five miles of SONGS. Sectors A, B, C, D, E, and F include land almost exclusively within the boundaries of Marine Corps Base Camp Pendleton. The study area in sector G includes the area along the coast south of SONGS. Sectors H, J, K, L, M, and N are the Pacific Ocean; no land use possible. Sectors P, Q, and R include the City of San Clemente and part of Camp Pendleton.

Methodology

A review of the 2013 LUC and documentation notebook was conducted. Verification & revision of the 2013 data was accomplished by inquiry to the cognizant agency, organization, or individual possessing direct knowledge of the item being verified.

A vegetable garden census was performed by examining aerial photographs. Locations which appeared to correspond to garden locations were converted to street addresses. The identified locations were compared with the addresses evaluated in previous LUCs. Two new gardens were identified in 2013.

The closest residence was established in each sector by aerial photo review and by correspondence with USMC Camp Pendleton. The meat and milk animal survey was performed by contacting the natural resources office on Camp Pendleton and the Orange County Agriculture Department. Information on other uses was obtained by contacting the appropriate organizations.

The 2013 Land Use Census survey was prepared per SONGS procedure SO123-IX-1.20, revision 6.

Summary of Changes

1. LUC # G-16 – A new garden was identified 3.8 miles from Units 2/3 in Sector Q.
2. LUC # G-17 - A new garden was identified 4.9 miles from Units 2/3 in Sector R.
3. LUC # G-14 – A historical garden was active in 2013, 2.9 miles from Units 2/3 in Sector P.
4. LUC # R-P4 – Contract worker was sleeping in personally owned vehicle parked in Parking Lot 4 in between shifts for six months until 4/1/2013.
5. LUC # R-A2 & R-R2 – SONGS Camp Mesa decreased occupancy to 1008 hours for 2013.
6. LUC # R-C2 – Camp San Onofre Fire Station #7 52 Area was a Full Time Residence (FTR) in 2013. Remodeling was completed and personnel currently live on site full time.
7. LUC # R-R3 - SONGS Dry Camping PL12 was not occupied in 2013.

8. LUC # O-2B – YMCA Surf Camp operated an overnight summer surf camp during 2013 at San Onofre State Park, group space #1, with a maximum estimated occupancy of 576 hours.
9. Updated Camp Pendleton hunting take data for the period July 1, 2012 to June 30, 2013 is listed in Table 3. Per the USMC 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 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 2013.

**TABLE F-1
2013 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 | 1008 |
| B | | | | |
| C | R-C2 | Camp San Onofre Fire Station #7 52 Area | 2.4 | FTR |
| | R-C1 | Camp san Onofre Barracks 524101 | 2.8 | FTR |
| | R-C3 | Camp San Onofre Barracks | 2.6 | 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 | FTR |
| | R-P2 | San Mateo Point housing | 2.7 | FTR |
| | R-P1 | Cotton point Estates | 2.7 | FTR |
| | R-P5 | Contractor overnight parking in Lot 4 | 0.6 | 1040 |
| Q | R-Q5 | SORB Resident Employee | 1.1 | FTR |
| | R-Q2 | San Onofre III housing | 1.4 | FTR |
| | R-Q3 | San Mateo Point Housing | 2.7 | FTR |
| R | R-R2 | SONGS Camp Mesa (See notes for Table 1) | 0.4 | 1008 |
| | R-R3 | SONGS Dry Camping PL12 | 0.7 | 0 |
| | R-R1 | San Onofre III housing | 1.3 | FTR |

Bold Text indicates changes from 2012 LUC Data as of 9-30-2013 FTR – Full Time Residence

TABLE F-2
2013 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 | 4130 Calle Isabella | 2.8 |
| | G-14 | 4090 Calle Isabella | 2.9 |
| Q | G-8 | 2240 Ave Salvador | 4.1 |
| | G-5 | 1706 S Ola Vista | 4.4 |
| | G-6 | 1315 S Ola Vista | 4.6 |
| | G-15 | 130 Calle del Pacifico | 4 |
| | G-16 | 432 Ave Crespi | 3.8 |
| R | G-10 | SONGS Garden | 0.4 |
| | G-17 | 788 Ave Salvador | 4.9 |

Bold Text indicates changes from 2012 LUC Data as of 9-30-2013 FTR – Full Time Residence

**TABLE F-3
2013 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 | 816 |
| C | O-10 | Camp San Onofre (STP #11) | 2.2 | 2,000 |
| D | | | | |
| E | O-5 | Camp Horno Motor Pool | 4.0 | 2,500 |
| F | O-1 | San Onofre State Beach Guard Shack | 0.8 | 1,500 |
| | 31A | Border Patrol Checkpoint (NB) | 1.9 | 2,400 |
| | 31B | Hwy Patrol Weigh Station (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 | Endless Summer Surf Camp (see notes) / Campground Host | 2.8 | 4,380 |
| | O-2B | YMCA Surf Camp (see notes) | 2 | 576 |
| <p>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> | | | | |
| P | O-6 | Surf Beach (Lifeguard) | 0.5 | 800 |
| | 3 | Trestles Beach Lookout tower | 1.8 | 500 |
| Q | O-3 | State Park Office Trailer | 0.69 | 2,000 |
| | 5 | Surf Beach Guard Shack | 0.7 | 1,500 |
| | 18 | SORB Lifeguard Tower | 1.2 | 2,000 |
| | 1A | SORB Campground Check-in | 1.3 | 2,000 |
| R | | | | |

Bold Text indicates changes from 2012 LUC Data as of 9-30-2013 FTR – Full Time Residence

APPENDIX G
FIGURES FOR 2013

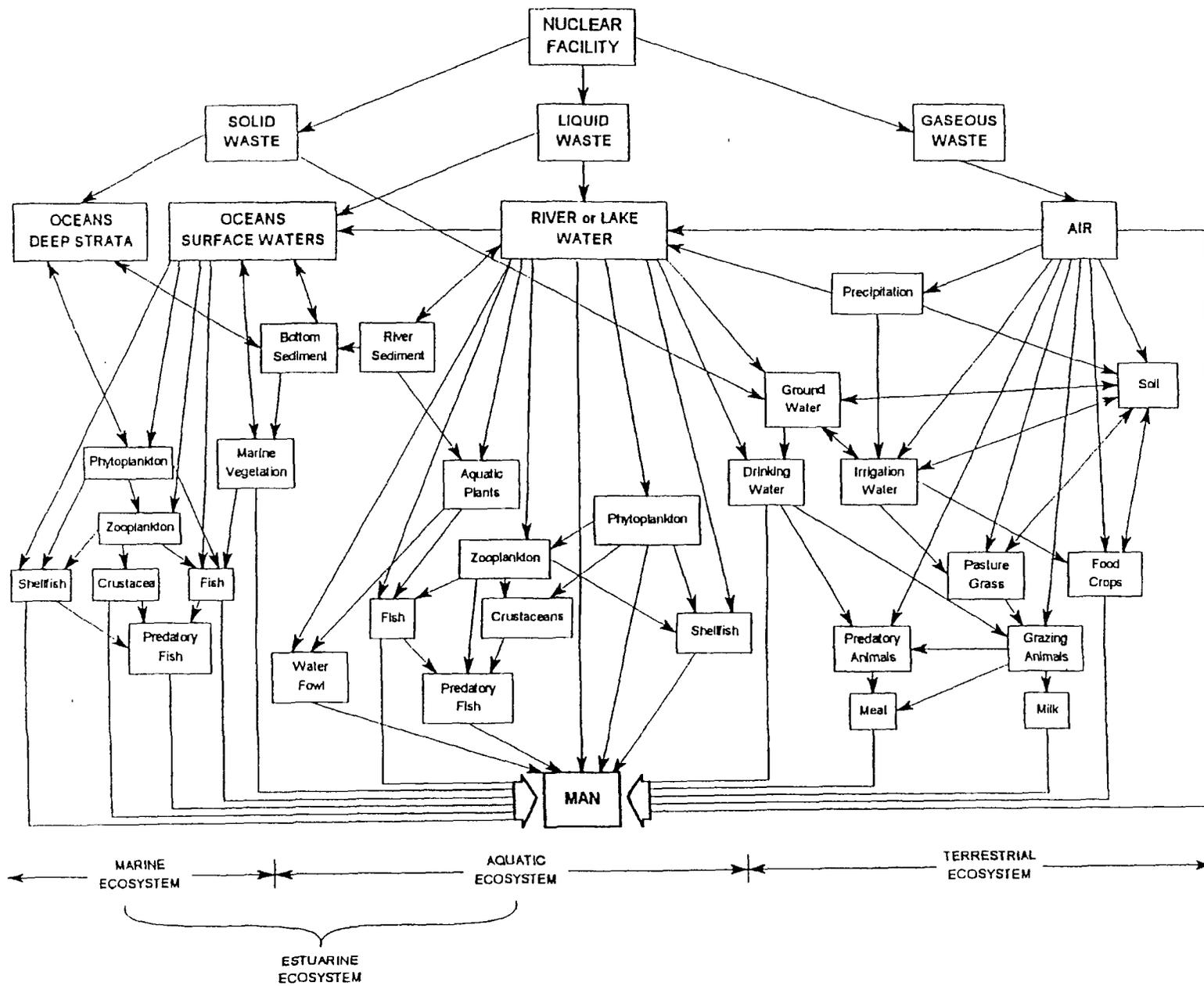


Figure 1. Potential Radiation Exposure Pathways Leading to Man

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

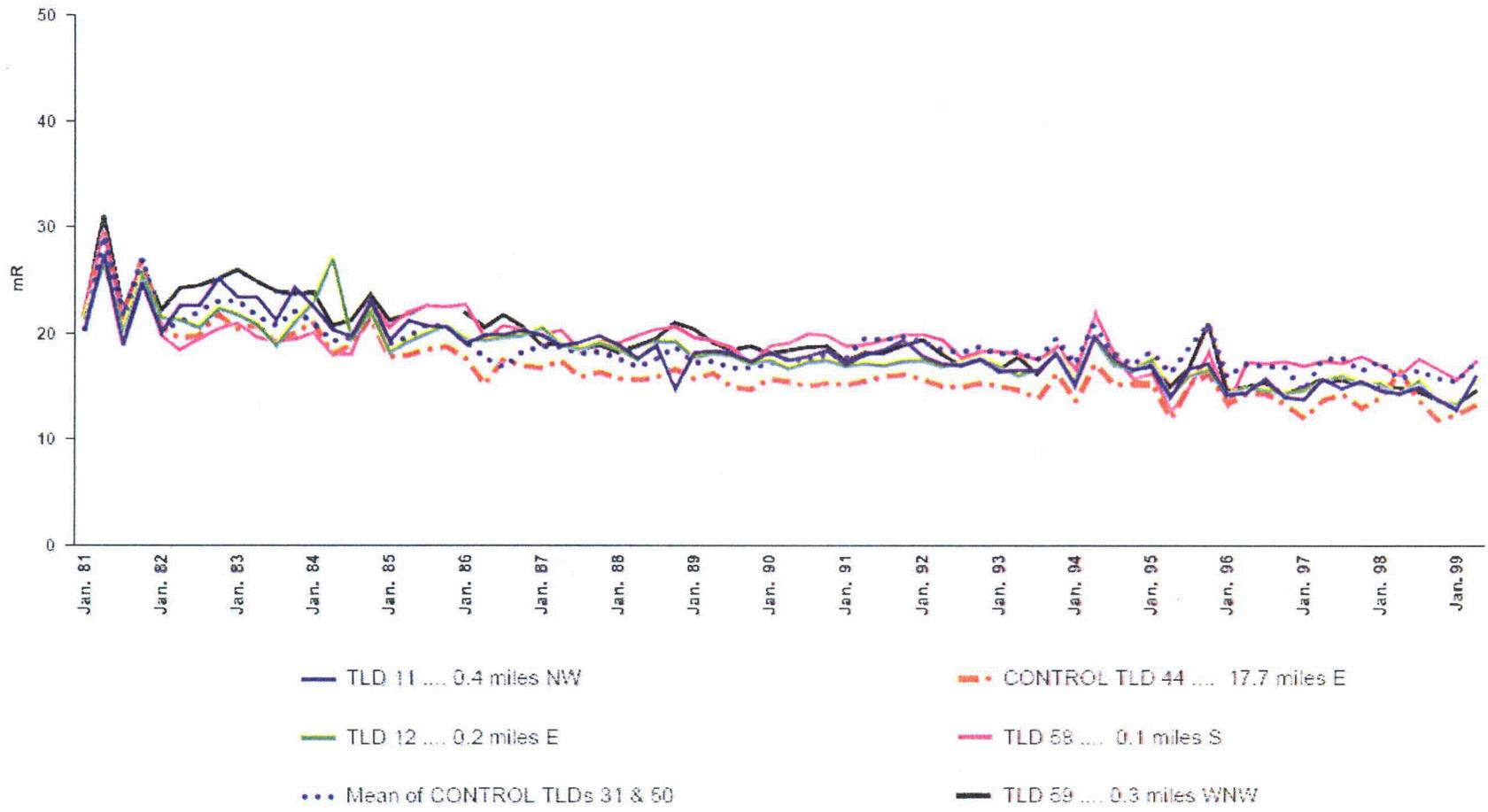


Figure 2A

Direct Radiation Monitoring 1998 to 2013
Quarterly Environmental TLD measurements in mR
Selected TLDs located very close to SONGS vs. Selected CONTROL TLDs

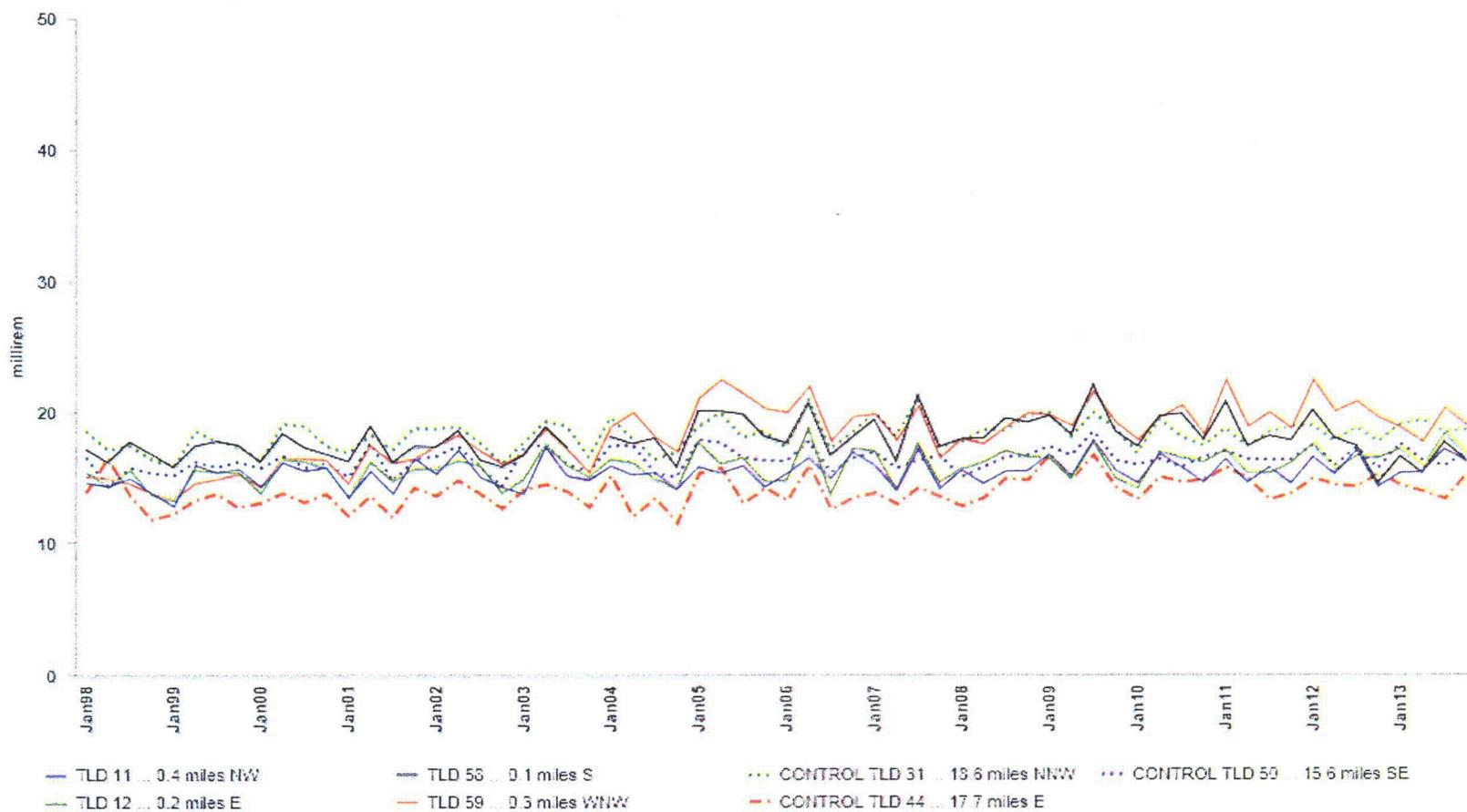
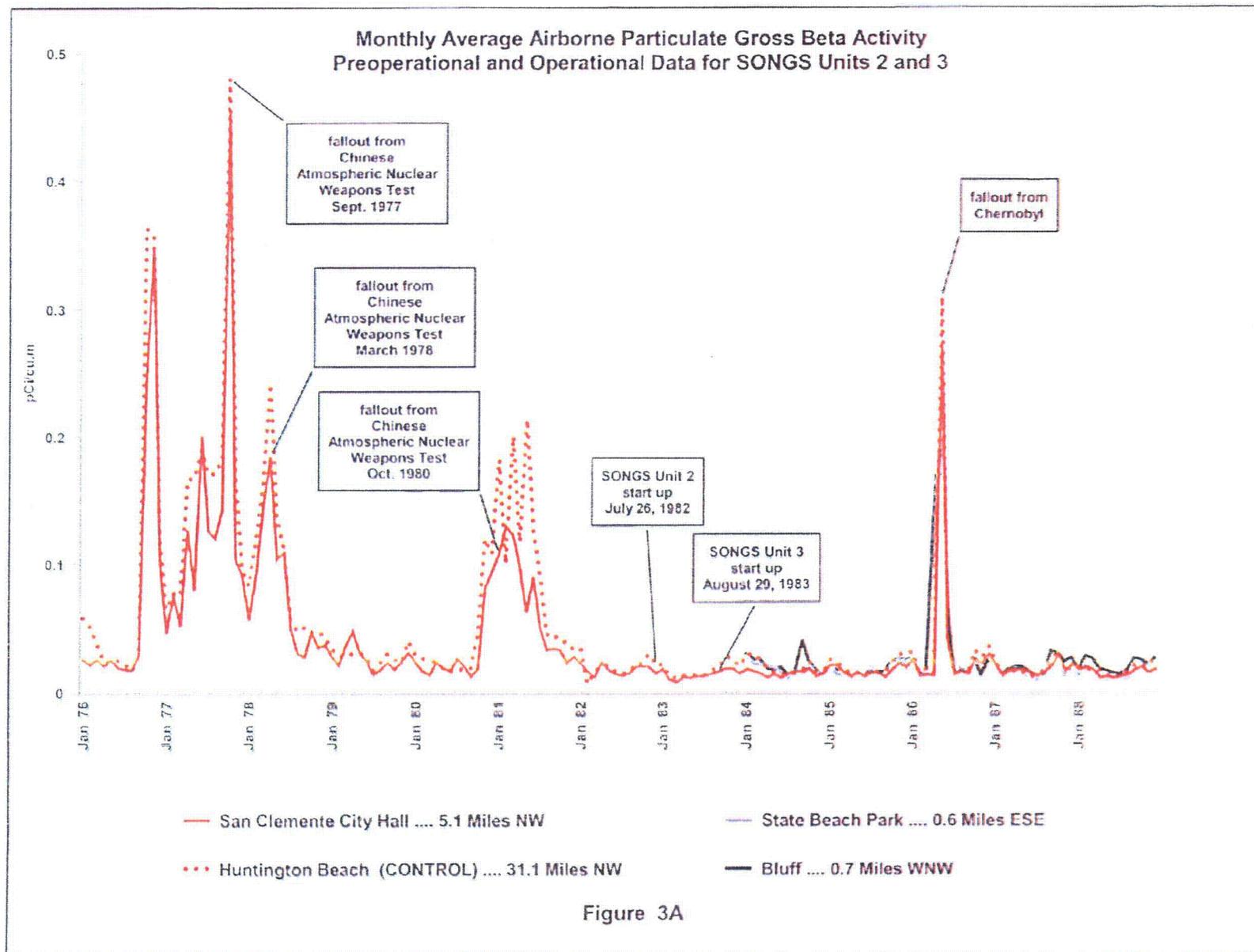


Figure 2B



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

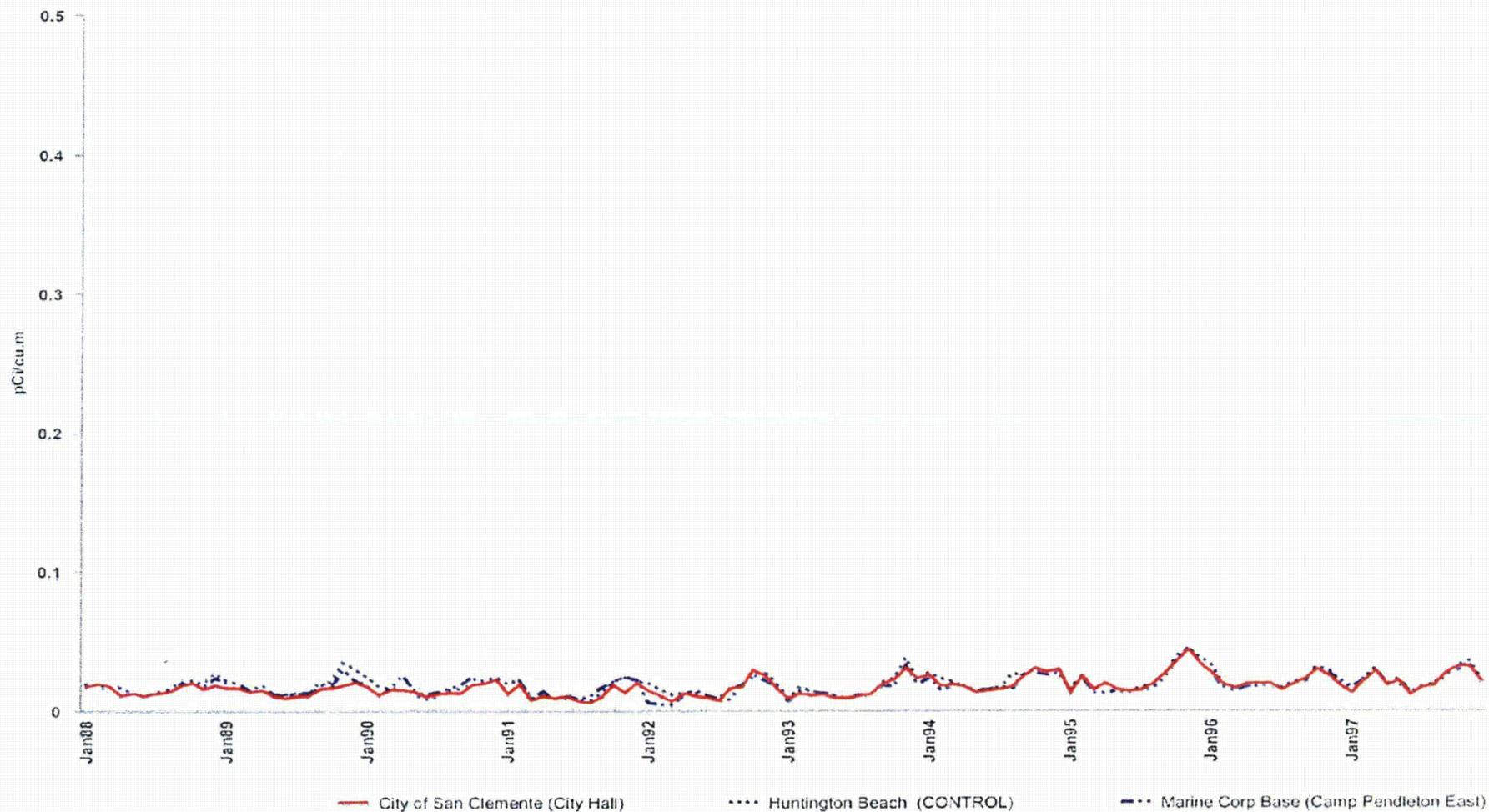


Figure 3B

Monthly Average Airborne Particles Gross Beta Activity SONGS Units 2 and 3 January 1998 to December 2013

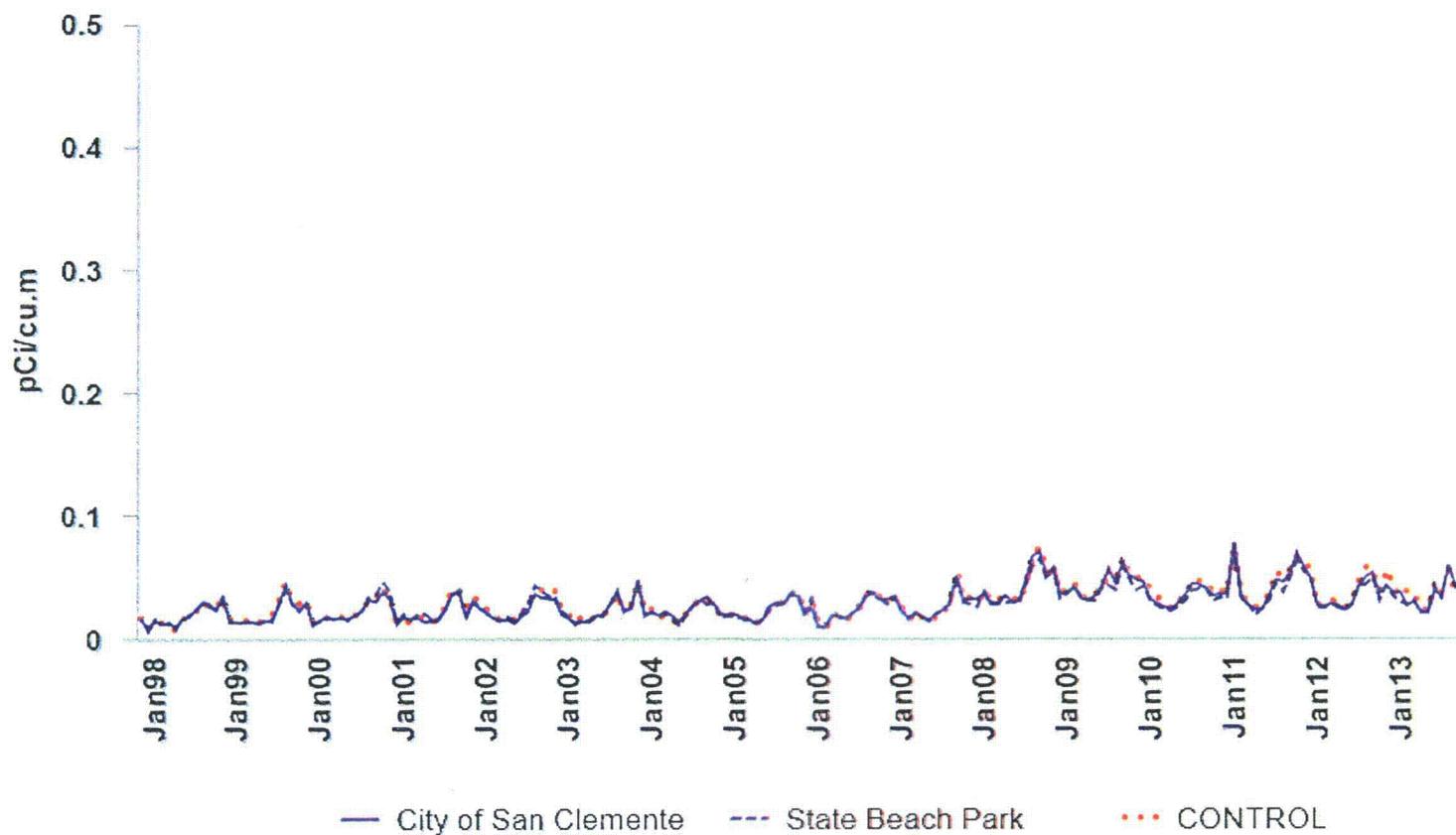


Figure 3C

Weekly Airborne Particulate Gross Beta Activity January 2011 to December 2013

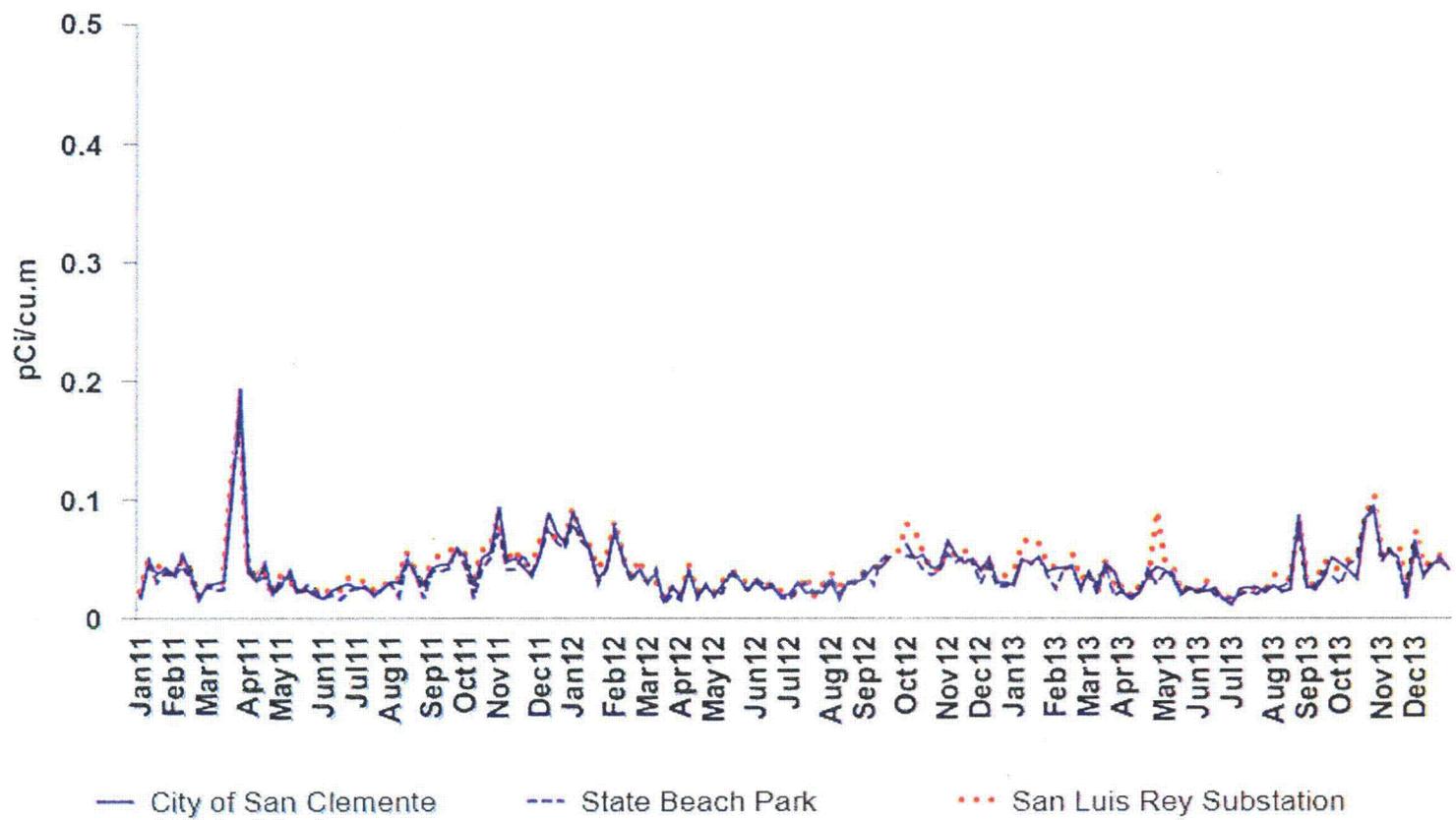


Figure 3D

I-131 in Aquatic Kelp

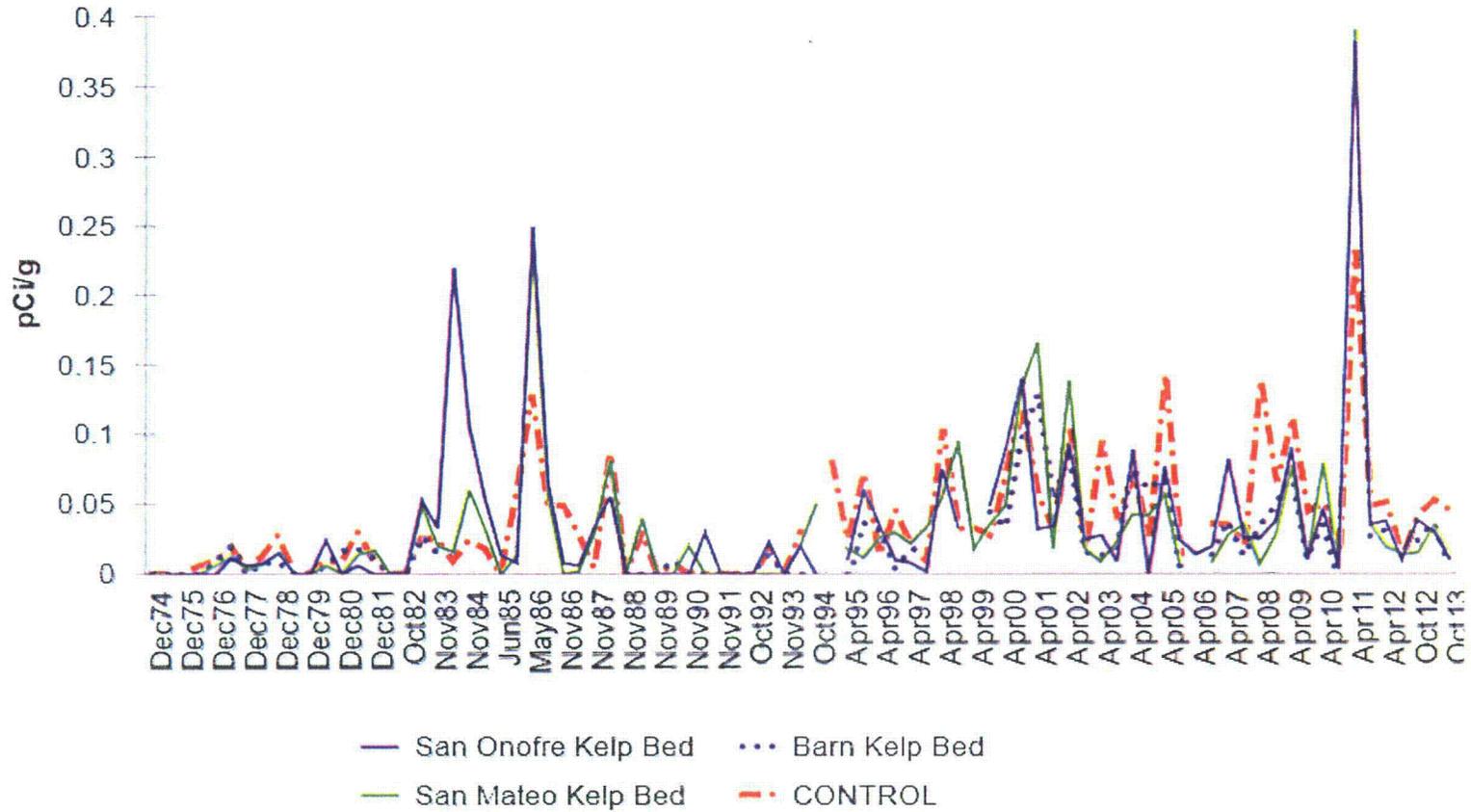


Figure 4

APPENDIX H
ERRATA TO THE 2012 AREOR

All data required by the ODCM in 2012 was reported in the 2012 AREOR. There are no errata to be appended to the 2012 AREOR.

APPENDIX I

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2013

APPENDIX I

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2013

California Department of Public Health (DPH) also maintains a TLD program in the environs of SONGS. Per DPH (Department of Public Health) request the results of (TLDs) that are co-located with DPH dosimeters are reported below.

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.

2013 Data from SCE TLDs (mR/ standard quarter)

| Location Number | Location Name | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
|------------------------------|-----------------------------------|---------|---------|---------|---------|
| SCE -1 , NRC -7, DPH #2 | San Clemente | 18.2 | 17.7 | 17.6 | 18.5 |
| SCE -2, NRC -23, DPH #8 | Camp San Mateo | 19.6 | 18.7 | 19.2 | 19.9 |
| SCE -3, NRC -19, DPH #9 | Camp San Onofre | 17.4 | 16.1 | 16.4 | 17.7 |
| SCE -6, DPH #10 | Old Route 101 (East-Southeast) | 12.1 | 11.0 | 10.5 | 11.7 |
| SCE 10, NRC -12, DPH #6 | San Onofre Surfing Beach | 16.5 | 16.7 | 16.2 | 17.6 |
| SCE 16, DPH #7* | ESE Site boundary | 21.1 | 23.8 | 22.0 | 20.8 |
| SCE 22, NRC 11, DPH #4 | Coast Guard Station | 17.7 | 17.9 | 18.1 | 18.5 |
| SCE -34, NRC -14, DPH #5 | San Onofre Elementary School | 15.4 | 16.1 | 16.6 | 16.5 |
| SCE 41, NRC 25, DPH #11** | Old Route 101 (Unit 3) | 16.4 | 15.6 | 15.4 | 16.6 |
| SCE 50, NRC 32, DPH #13 | Oceanside Fire Station | 17.7 | 16.5 | 16.0 | 17.0 |

* 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

Independent Spent Fuel Storage Installation (ISFSI) TLD Data

Independent Spent Fuel Storage Installation (ISFSI) TLD Data

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

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

Environmental exposure rates are variable and small changes in TLD location can measurably change the data. The REMP TLD data show a seasonal variability that does not appear to be related to any activities at SONGS. The data support the conclusion that macro-environmental factors are the causative agents for the seasonal variations. Refer to Figure 2a and 2b. The ISFSI TLD data gathered to date appears to follow a similar seasonal variability. Refer to Figures 6-1, 6-2, and 6a. In addition to environmental factors, some non-ISFSI work activities at Unit 1 have elevated the pre-operational measured ISFSI TLD exposure. The storage and transport of radioactive materials and waste near the location of the ISFSI foundation area in 2001 and 2002 appears to have elevated the exposure rates of TLDs 306 to 315. In addition, the movement of the Unit 1 reactor vessel in October 2002 caused a noticeable increase in the measured exposure for TLDs 301 to 315. The measured exposure rate for the ISFSI TLDs close to the ISFSI is consistent with the exposure rate expected from known radiological work activities. The elevated exposure rate from TLDs 301, 302, 303, 304, 323, 324, 325, 326, 327 and 328 is primarily due to the movement and storage of used fuel at the ISFSI.

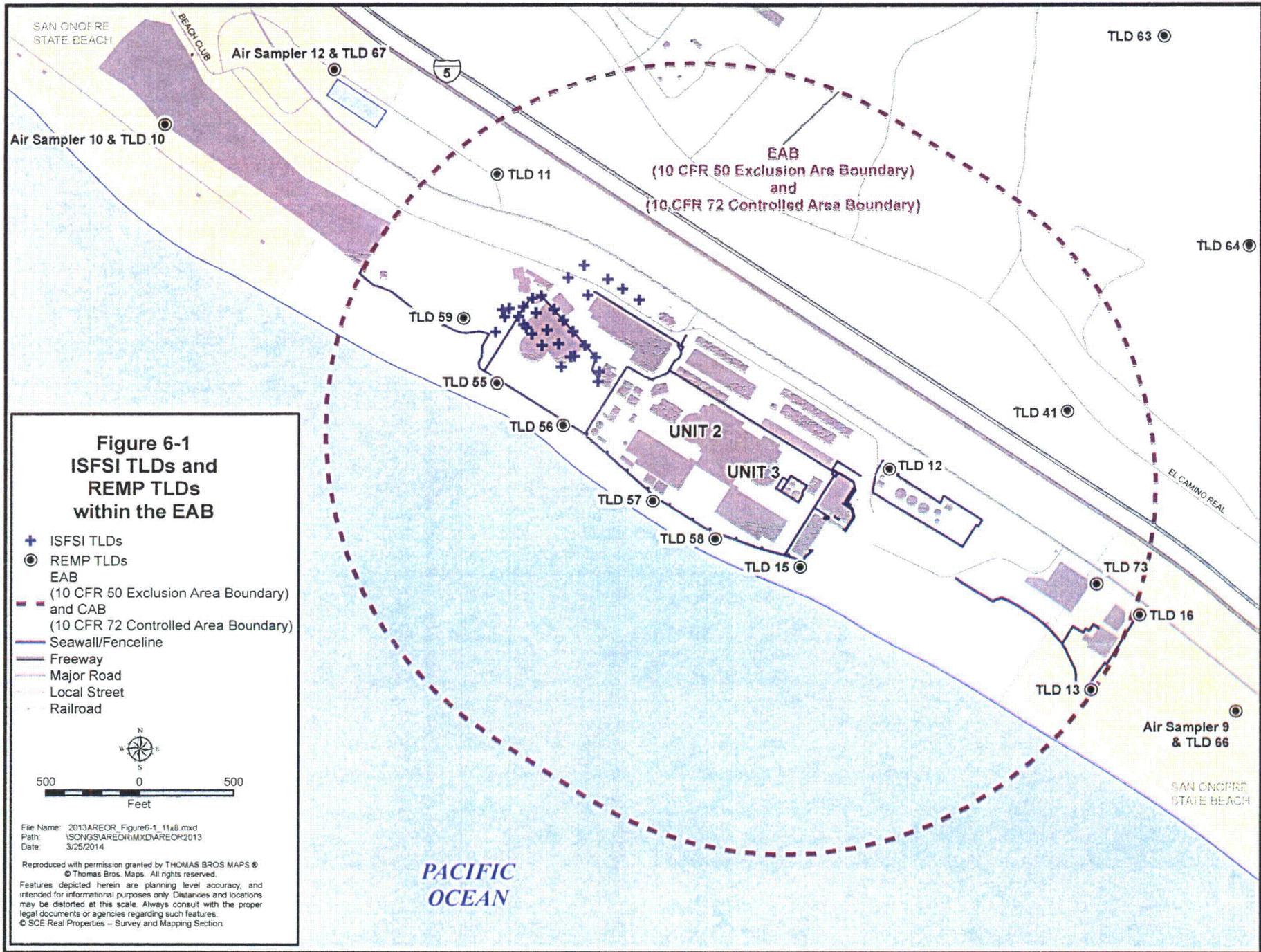
In the second quarter of 2011 additional TLDs 327 and 328 were placed along the fence on the southwest side of the ISFSI. These TLDs had the highest readings in 2013. The closest publicly accessible location is SW of the ISFSI along the San Onofre Beach access road, outside the plant's perimeter. The background corrected annual exposure for the access road TLDs 55 and 56 was 12 and 10 mR, respectively in 2013. Assuming a maximum occupancy of 300 hours per year the dose to a member of the general public is < 1 mrem per year at this location as measured by the REMP TLDs.

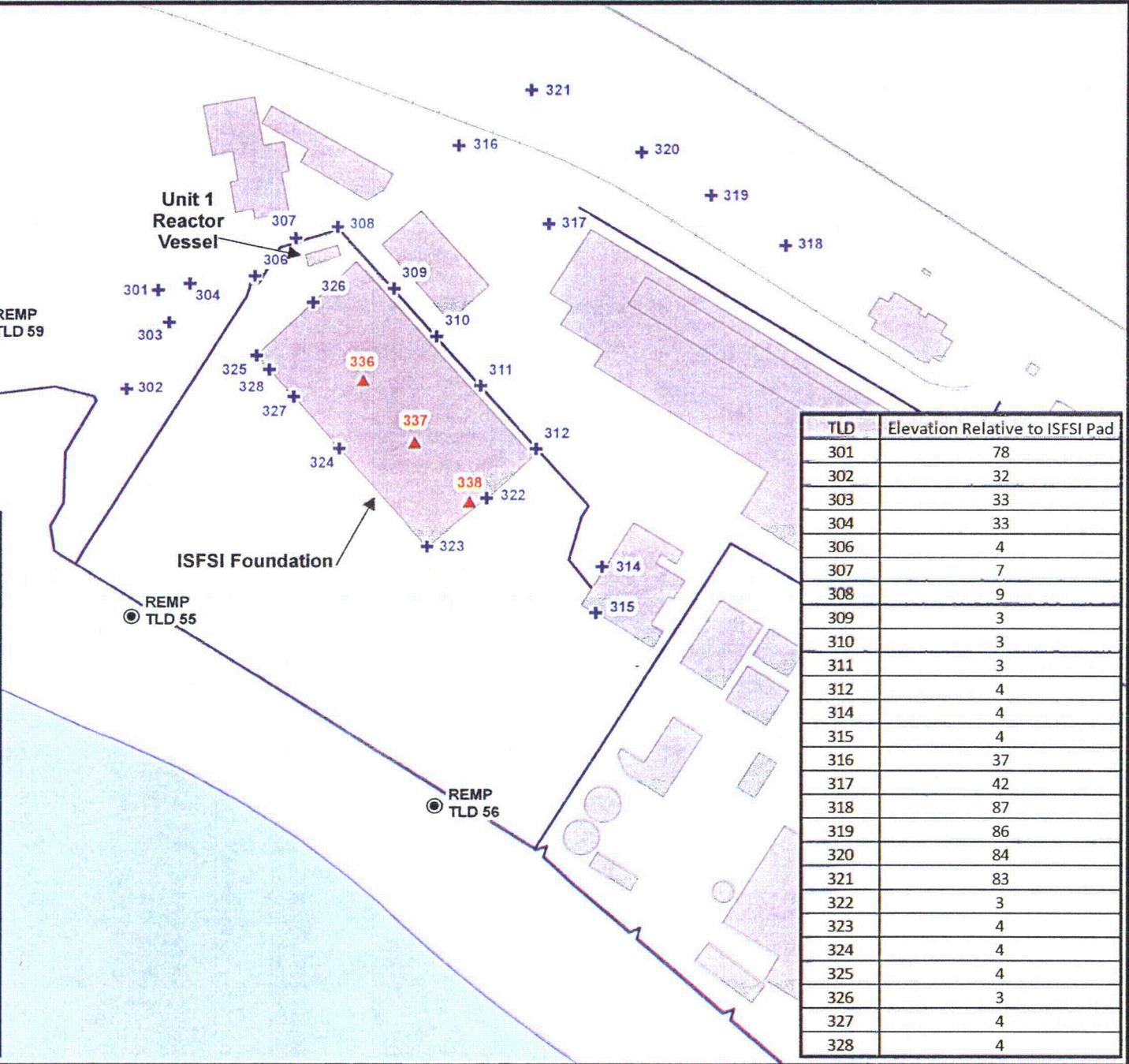
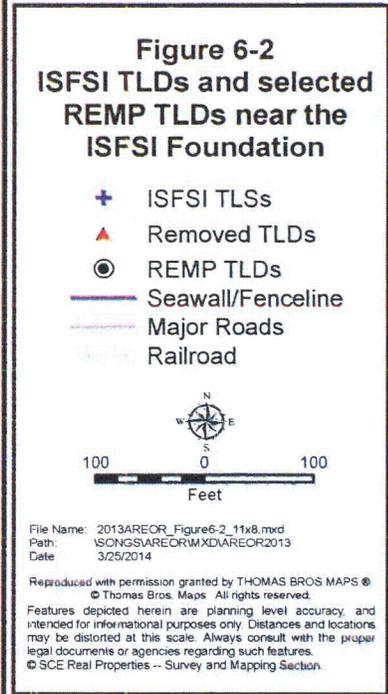
Starting in the fourth quarter 2010 neutron dosimeters were placed in ISFSI TLD canisters 311, 324, 325, and 326. In the second quarter 2011 neutron dosimeters were also placed adjacent to TLDs 327 and 328. The 2013 neutron exposure is below measurable levels for spent fuel in storage. Neutron exposure during fuel transfer is measurable at the fence surrounding the storage facility at low levels, typically a few mR per quarter. These measurements demonstrate that the neutron exposure is bounded by the projected neutron dose rates in calculation SCE-23-0508, is well within the limits specified in 10CFR72.104, and is consistent with known ISFSI radiological conditions. The measured ISFSI gamma TLD exposure rates were also determined to be consistent with the calculated ISFSI dose rates and known radiological conditions.

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

Table J-1 ISFSI TLD DATA

| Location | Quarterly Background | 2013 Quarterly Results (mR) | | | | Background adjusted 2013 Quarterly Results (mR) | | | | Annual Baseline | 2013 Annual Total (mR) |
|-------------------------------------|----------------------|-----------------------------|--------|--------|--------|--|--------|--------|--------|-----------------|------------------------|
| | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | | |
| ISFSI 301 | 15 | 20.97 | 18.39 | 19.52 | 18.51 | 5.97 | <LLD | <LLD | <LLD | 60 | 77.39 |
| ISFSI 302 | 15 | 30.42 | 29.24 | 29.43 | 28.59 | 15.42 | 14.24 | 14.43 | 13.59 | 60 | 117.68 |
| ISFSI 303 | 15 | 28.49 | 28.34 | 27.11 | 26.58 | 13.49 | 13.34 | 12.11 | 11.58 | 60 | 110.52 |
| ISFSI 304 | 15 | 25.46 | 23.28 | 24.10 | 24.21 | 10.46 | 8.28 | 9.10 | 9.21 | 60 | 97.05 |
| ISFSI 306 | 15 | 20.57 | 20.04 | 21.09 | 20.03 | 5.57 | 5.04 | 6.09 | 5.03 | 60 | 81.73 |
| ISFSI 307 | 15 | 18.29 | 17.50 | 17.48 | 17.08 | <LLD | <LLD | <LLD | <LLD | 60 | 70.35 |
| ISFSI 308 | 15 | 19.81 | 19.49 | 19.76 | 18.64 | <LLD | <LLD | <LLD | <LLD | 60 | 77.70 |
| ISFSI 309 | 15 | 19.67 | 19.41 | 19.35 | 18.45 | <LLD | <LLD | <LLD | <LLD | 60 | 76.88 |
| ISFSI 310 | 15 | 20.55 | 19.30 | 19.42 | 19.22 | 5.55 | <LLD | <LLD | <LLD | 60 | 78.49 |
| ISFSI 311 | 15 | 19.53 | 18.53 | 19.23 | 18.48 | <LLD | <LLD | <LLD | <LLD | 60 | 75.77 |
| ISFSI 312 | 15 | 15.35 | 14.28 | 14.83 | 14.31 | <LLD | <LLD | <LLD | <LLD | 60 | 58.77 |
| ISFSI 314 | 15 | 17.24 | 16.88 | 17.67 | 17.37 | <LLD | <LLD | <LLD | <LLD | 60 | 69.16 |
| ISFSI 315 | 15 | 18.58 | 17.33 | 17.95 | 17.41 | <LLD | <LLD | <LLD | <LLD | 60 | 71.27 |
| ISFSI 316 | 15 | 15.48 | 15.26 | 16.84 | 14.52 | <LLD | <LLD | <LLD | <LLD | 60 | 62.10 |
| ISFSI 317 | 15 | 16.21 | 15.70 | 17.59 | 15.63 | <LLD | <LLD | <LLD | <LLD | 60 | 65.13 |
| ISFSI 318 | 15 | 19.71 | 18.09 | 19.64 | 17.90 | <LLD | <LLD | <LLD | <LLD | 60 | 75.34 |
| ISFSI 319 | 15 | 19.15 | 18.44 | 19.91 | 18.69 | <LLD | <LLD | <LLD | <LLD | 60 | 76.19 |
| ISFSI 320 | 15 | 19.70 | 18.31 | 19.58 | 17.05 | <LLD | <LLD | <LLD | <LLD | 60 | 74.64 |
| ISFSI 321 | 15 | 20.05 | 18.18 | 19.81 | 17.84 | 5.05 | <LLD | <LLD | <LLD | 60 | 75.88 |
| ISFSI 322 | 15 | 21.55 | 16.89 | 18.44 | 19.12 | 6.55 | <LLD | <LLD | <LLD | 60 | 76.00 |
| ISFSI 323 | 15 | 24.24 | 20.17 | 21.65 | 20.03 | 9.24 | 5.17 | 6.65 | 5.30 | 60 | 86.36 |
| ISFSI 324 | 15 | 73.51 | 68.82 | 69.87 | 58.21 | 58.51 | 53.82 | 54.87 | 43.21 | 60 | 270.41 |
| ISFSI 325 | 15 | 38.92 | 43.70 | 45.80 | 45.41 | 23.92 | 28.70 | 30.80 | 30.41 | 60 | 173.83 |
| ISFSI 326 | 15 | 26.38 | 22.97 | 26.84 | 26.46 | 11.38 | 7.97 | 11.84 | 11.46 | 60 | 102.65 |
| ISFSI 327 | 15 | 129.87 | 147.48 | 146.67 | 146.83 | 114.87 | 132.48 | 131.67 | 131.83 | 60 | 570.85 |
| ISFSI 328 | 15 | 61.11 | 75.52 | 73.75 | 72.22 | 46.11 | 60.52 | 58.75 | 57.22 | 60 | 282.60 |
| 55 San Onofre State Beach (U1 West) | 15 | 17.28 | 16.77 | 19.56 | 18.55 | <LLD | <LLD | <LLD | <LLD | 60 | 72.16 |
| 56 San Onofre State Beach (U1 West) | 15 | 16.80 | 15.76 | 19.28 | 17.93 | <LLD | <LLD | <LLD | <LLD | 60 | 69.77 |
| 57 San Onofre State Beach (Unit 2) | 15 | 16.83 | 16.02 | 17.28 | 16.39 | <LLD | <LLD | <LLD | <LLD | 60 | 66.52 |
| 58 San Onofre State Beach (Unit 3) | 15 | 16.71 | 15.45 | 17.82 | 16.45 | <LLD | <LLD | <LLD | <LLD | 60 | 66.43 |
| 59 SONGS Meteorological Tower | 15 | 18.93 | 17.82 | 20.43 | 19.15 | <LLD | <LLD | 5.43 | <LLD | 60 | 76.33 |





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

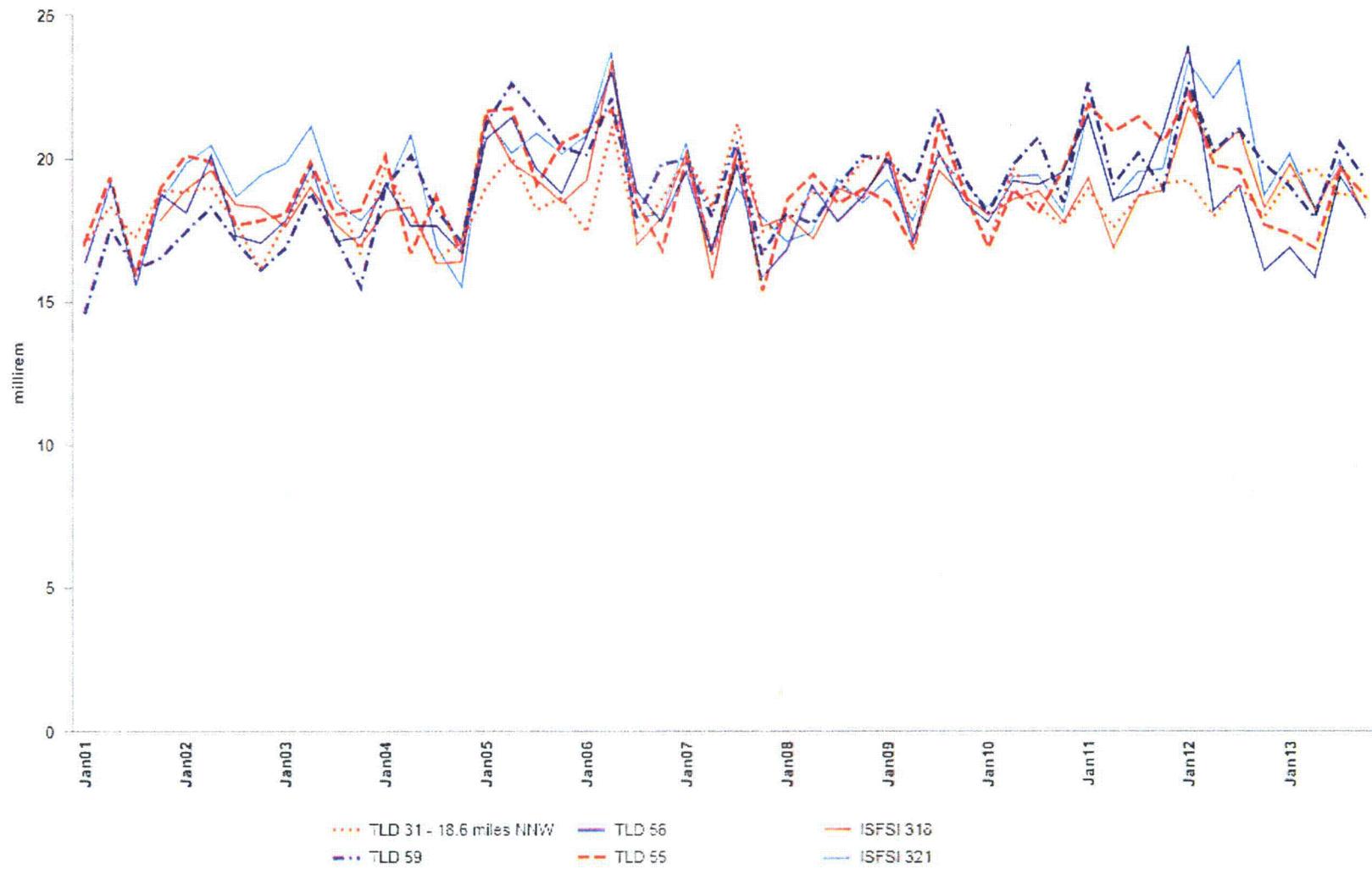


Figure 6A

Appendix K
Offsite Ground Water Sampling

Offsite Drinking Water Data

No drinking water pathway exists at SONGS, per the Groundwater Model Report 2010, prepared by Parsons. In 2013, monthly ground water samples were taken at Camp Pendleton and Oceanside. The analysis results were less than detectable for tritium and plant related gamma emitters. See table 9A for analysis.

Figure 7-1 illustrates the Groundwater Well location and the flow of the groundwater. We conclude that the operation of SONGS had no impact on drinking water wells in the vicinity of SONGS.

