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May 4, 2015

10 CFR 50.36a

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**
2014 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 2014 Annual Radiological Environmental Operating Report (AREOR) for SONGS Units 1, 2 and 3.

The AREOR covers the operation of SONGS during January 1, 2014 through December 31, 2014 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 have any questions or require additional information, please contact Mr. Mark Morgan at (949) 368-6745.

Sincerely,

Enclosure: 2014 San Onofre Nuclear Generating Station Annual Radiological Environmental Operating Report

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Enclosure

2014 San Onofre Nuclear Generating Station Annual Radiological Environmental Operating Report

2014 San Onofre Nuclear Generating Station Annual Radiological Environmental Operating Report
January through December
License Numbers: DPR-13, NPF-10, NPF-15

May 2015

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The Radiological Environmental Monitoring Program (REMP) encompasses numerous measures to assess the levels of radiation and radioactive materials identified in the local environment during the operational and post operational lifetime of the SONGS facility. The REMP charter and objective is to determine if radionuclides identified in the environment are attributable to plant operation, and if so, to determine that environmental levels measured agree with predicted levels in the soil, water, vegetation and foodstuffs using computer models.

This permits validation the computer model predictions using conservative assumptions on deposition and uptake, and actual measurements of effluent radionuclide concentrations in liquid and gaseous streams released from the plant. Generally, the model predicts concentrations in the environment that are too low to measure. However, the program is sensitive enough to detect radioactive material in the environment from nuclear accidents, for example, like Fukashima, as demonstrated in 2012 and 2013 where material transported by air and water across the Pacific Ocean was identified by the REMP program in air, and kelp samples.

To assure the program remains current and models all relevant exposure pathways to the local population, any changes in land or water use that would affect exposure pathways to the local population, are updated annually in the Land Use Census (LUC) Report. The 2014 Land Use Census is included as an attachment to this report. This effort assures that any changes that may impact the distribution of potential plant related activity to humans, through changes in the associated exposure pathways, are accounted for and the model updated.

This 2014 Annual Radiological Environmental Operating Report (AREOR) for the San Onofre Nuclear Generating Station (SONGS) presented here meets the Technical Specifications (TS) §5.7.1.2 of Facility Operating Licenses NPF-10 and NPF-15 for SONGS Units 2 and 3 respectively and the Independent Spent Fuel Storage Installation (ISFSI) facility. The 2014 AREOR covers SONGS operations from January 1, 2014 through December 31, 2014.

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Acronyms

AREOR	Annual Radiological Environmental Operating Report
a posteriori	after the fact
a priori	before the fact
Be-7	Beryllium-7
CAB	Controlled Area Boundary
CDPH	California Department of Public Health
CEAL	Contracted Environmental Analysis Laboratory
Cs-137	Cesium-137
EAB	Exclusion Area Boundary
EPA	U.S. Environmental Protection Agency
GPI	Groundwater Protection Initiative
H-3	Tritium, Hydrogen-3
I-131	Iodine-131
ISFSI	Independent Spent Fuel Storage Installation
K-40	Potassium-40
LLD	Lower Limit of Detection
LUC	Land Use Census
MDC	Minimum Detectable Concentration
NEI	Nuclear Energy Institute
NORM	Naturally Occurring Radioactive Material
NRC	U.S. Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
QA	Quality Assurance
QC	Quality Control
SAB	Site Area Boundary

Part I 2014 Annual Radiological Environmental Operating Report

A. Executive Summary/Introduction

On June 12, 2013, Southern California Edison (SCE) notified the Nuclear Regulatory Commission (NRC) that SCE had permanently ceased operation for both Units 2 and 3 on June 7, 2013. Due to the fact the spent fuel is stored on site, San Onofre continues to fulfill their regulatory commitment to monitor the environment and potential exposure pathways until termination of the license. San Onofre continues to operate with no adverse effect on the population or the environment. The exposure for people living in the surrounding area remains at less than 1 mrem per year. The Radiological Environmental Monitoring Program (REMP) at the site monitors known and predictable relationships between the current shutdown of the plant and the surrounding area. The REMP verifies that the operation of San Onofre has no impact offsite and is well within the state and federal regulations and guidelines. These programs are verified by the California Department of Public Health (CDPH) through the collection and analysis of samples and placement of the CDPH monitoring dosimeters and air samples. In addition the site participates in onsite and offsite inspections. This report describes the REMP conducted at San Onofre and covers the period from January 1, 2014 through December 31, 2014. The REMP is to produce scientifically defensible data to ensure that the site meets their license commitments as described in DPR-13, NPF-10, NPF-15, and the Offsite Dose Calculation Manual (ODCM).

The 2014 AREOR is divided into two parts. The first part addresses the executive summary, exposure pathways, site area description and implementation of the REMP. The second part discusses the regulatory requirements, methodology, type of samples obtained and associated locations, summary of sample results, quality control programs, and comparison of operational and pre-operational data, deviations from the ODCM sampling requirements, land use census, and TLD results for the Independent Spent Fuel Storage Installation (ISFSI).

B. Exposure Pathways

Exposure pathways are the different routes, or "pathways", by which people can potentially be exposed to radiation or radioactive materials (Figure 1).

The types of measurements made are divided into four pathways based upon how the results may affect the public. Airborne, waterborne, ingestion, and direct radiation are the four pathways that are sampled. Each pathway is described below.

- The airborne pathway is sampled in areas around SONGS by continuously drawing air through specialized filters and charcoal cartridges 24 hours a day, 7 days a week. Although both units at SONGS have been shut down since January 2012, these air samples continue to be collected on a weekly basis.
- The waterborne pathway includes samples taken from surface water, ground water, and drinking water. Also included in this pathway are water and sediment samples taken from the Pacific Ocean.
- The ingestion pathway includes broadleaf vegetation, agricultural products, and food products.
- The direct exposure pathway measures environmental radiation doses using thermoluminescent dosimeters (TLDs).

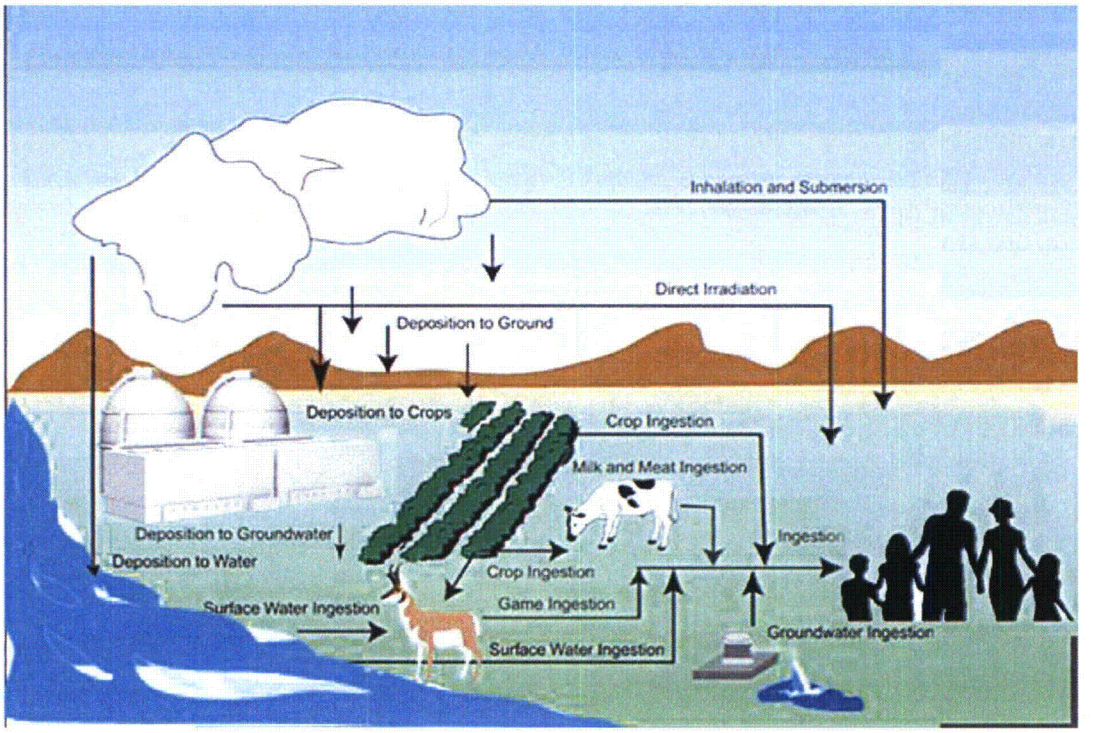

Figure 1. Examples of Exposure Pathways

The environment within a 45 mile radius as identified in the ODCM Section 5, is routinely monitored for radiation and radioactivity (Figure 2).

Sampling locations are selected based on weather, land use and water use information. Two types of sampling locations are used. The first type, control stations, are located in areas that are beyond the measurable influence of San Onofre. The sample results from these stations are used to explain radiation from other sources other than San Onofre. Indicator stations are the second type and are typically collected within a five (5) mile radius of the plant – the area assumed to be most likely impacted from plant operations. The samples collected from these indicator stations are used to assess the potential impact of effluents released (liquid and gaseous) and direct radiation from SONGS on the surrounding population and environment. Indicator stations are located in areas close to San Onofre where any plant effluent releases are most likely to be detected, if present. By comparing the results of samples collected in compass sectors most likely to be impacted by prevailing winds and comparing these results to the samples collected beyond the influence of plant activities (5 -45 miles), the net impact of SONGs can be assessed. SONGS' Radiological Environmental Monitoring Program is verified through collection and analysis of samples, through a rigorous Quality Control and Quality Assurance Program, and placement of the State of California's Department of Public Health monitoring dosimeters and other on-site and off-site inspections.

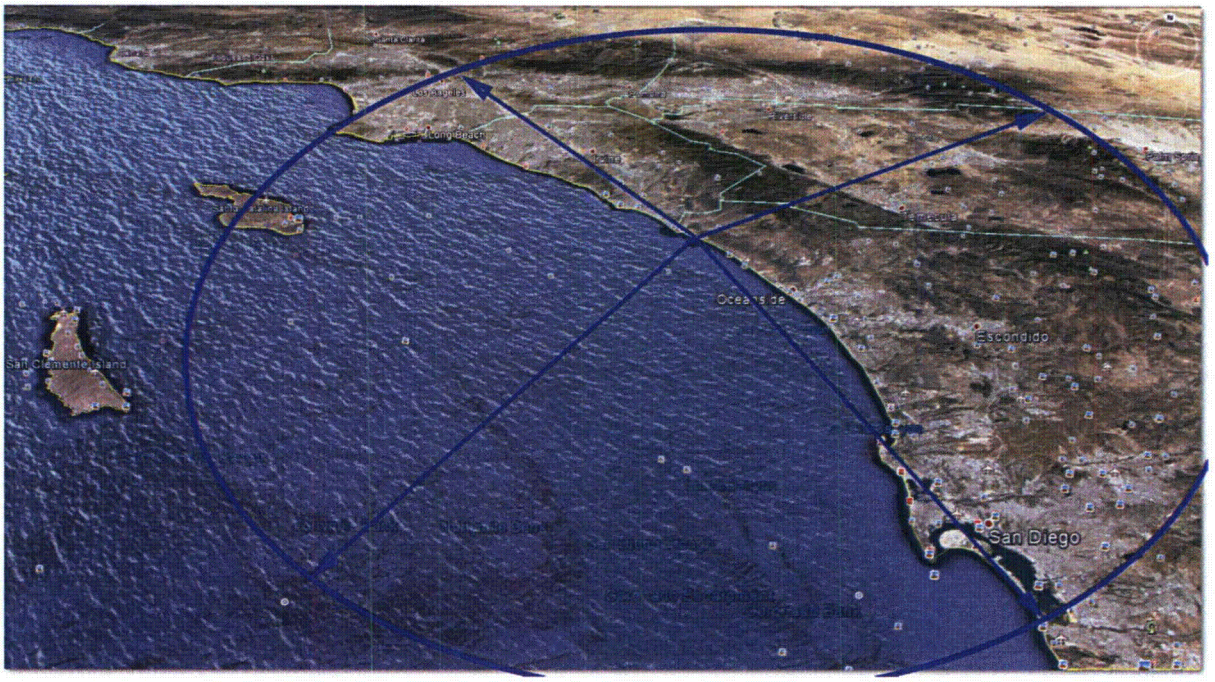

Figure 2. SONGS REMP 45 miles Radiological Environmental Monitoring Program radius

Prior to the construction of SONGS, measurements of the environment were collected and analyzed to determine the levels of natural radiation levels. The results of the sampling and monitoring are used as the pre-operational baseline. The results from the indicator stations are compared to both the pre-operational and control samples to gauge if changes in any radiation levels can be attributed to SONGS or other causes such as natural variations in the environment or man made contributions.

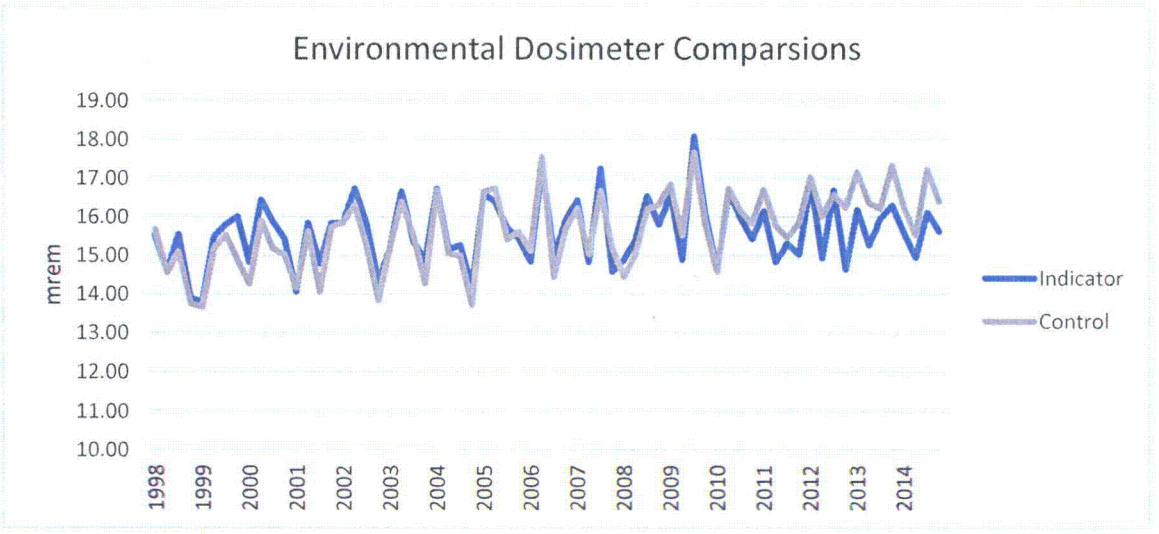

Figure 3. SONGS REMP TLD Readings, 1998 through current year 2014

Radioactivity levels in the SONGS REMP frequently fall below the minimum detection capabilities of state-of-the-art methods and scientific instruments. Samples with radiation levels that cannot be detected are below the Lower Limits of Detection. The United States Nuclear Regulatory Commission (NRC) requires that equipment used for radiological monitoring must be able to detect specified minimum limits for certain types of samples. This ensures that radiation measurements are sufficiently sensitive to detect small changes in the environment. Also, the NRC has a required reporting level. Licensed nuclear facilities must prepare a special report and increase their sampling if any measured radiation level is equal to or greater than this reporting level. No sample from SONGS has ever reached or exceeded this reporting level.

C. Site Area and Description

1. Location

San Onofre Nuclear Generating Station is located next to San Onofre State Beach, adjoining Camp Pendleton Marine Corps Base, in San Diego County, 64 miles south of Los Angeles, California. Over time there were three operating pressurized water reactors with a total rated capacity of 2664 net megawatts electrical.

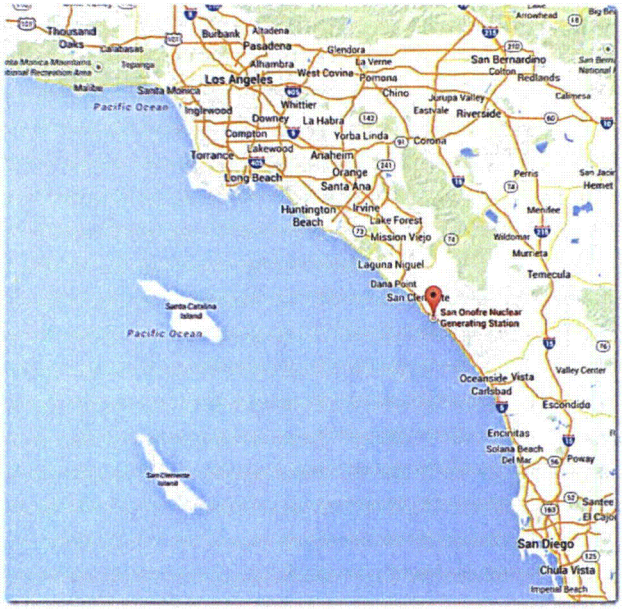

Figure 4. SONGS Location, SONGS is in San Diego County

Unit 1 was shut down in November of 1992 and has been decommissioned.

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. Although the NRC notification, called a Certification of Permanent Cessation of Power Operations, sets the stage for SCE to begin preparations for decommissioning, SONGS continues to fulfill its commitment to monitor the environment and exposure pathways. Unit 1, was rated at 410 net megawatts electrical, and was supplied by Westinghouse Electric Company. Unit 1 began commercial operation on January 1, 1968.

The unit was permanently shut down on November 30, 1992. By August 31, 2004, all fuel was transferred to the Independent Spent Fuel Storage Installation (ISFSI). By November 29, 2006, all remaining monitored effluent pathways were permanently removed from service. Unit 1 is owned by Southern California Edison (80%) and San Diego Gas and Electric (20%).

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

Effective December 29, 2006, the City of Anaheim had transferred its ownership interests in San Onofre Units 2 and 3 and the entitlement to the Units 2 and 3 output, to Southern California Edison Company, except that it retains its ownership interests in its spent nuclear fuel and Units 2 and 3's independent spent fuel storage installation located on the facility's site. In addition, the City of Anaheim

retains financial responsibility for its spent fuel and for a portion of the Units 2 and 3 decommissioning costs. The City of Anaheim remains a licensee for purposes of its retained interests and liabilities.

2. How SONGS Worked

The fundamental operation of a nuclear powered steam generating plant is to heat water to produce steam. In a fossil fuel or nuclear fueled steam generating station fuel is used to convert water into high-pressure steam. The steam is then directed through pipes to a turbine which spins a generator. In a fossil fuel plant, coal, lignite, oil or natural gas is burned in a boiler to produce the heat. In a nuclear plant, the reactor replaces the boiler and the "fissioning" or splitting of uranium atoms inside the reactor produces the heat.

The fuel for a nuclear reactor is uranium. It is formed into cylindrical ceramic pellets, each about the size of the end of your little finger. One pellet has the energy potential of about a ton of coal. Millions of these pellets are stacked in fuel rods that are arranged into assemblies that make up the core of the reactor. The use of uranium allows us to conserve natural gas, oil and coal and to avoid the associated production of greenhouse gases.

The fission process and generation of usable heat begins in a nuclear reactor when control rods in the core are withdrawn. In pressurized water reactors, like those at SONGS, the fuel rods heat water which circulates in sealed, stainless steel piping that pass through large heat exchangers called steam generators. The water in the reactor is under pressure to prevent boiling, allowing the water to achieve a higher temperature, and improve heat transfer efficiency between the primary and secondary systems (the secondary system is a clean water system used to generate steam that powers the turbines). This is why the SONGS Units 1, 2 and 3 reactors are called "pressurized water reactors."

To summarize, this superheated, pressurized water boils a separate supply of water (secondary side) in the steam generators to produce steam that is directed through the blades of a turbine generator to produce electricity. The steam is then fed to a condenser where a separate supply of cooling water from the reservoir turns it back into liquid that is then pumped back to the steam generator for reuse. A diagram of the plant water systems is shown in Figure 5.

In addition to its safety systems, SONGS has many built-in physical barriers that prevent the release of radioactive materials in the unlikely event of an accident. The most visible ones are the 200-foot-tall, domed containment buildings with steel-reinforced concrete walls four feet thick. Inside each of these massive structures, two more concrete walls provide another 11 feet of shielding. The reactor vessel itself has steel walls six inches thick, and the fuel pellets inside it are sheathed in hardened metal tubes.

Additional information on nuclear energy and the environment can be found on the website maintained by the Nuclear Energy Institute at http://www.nei.org.

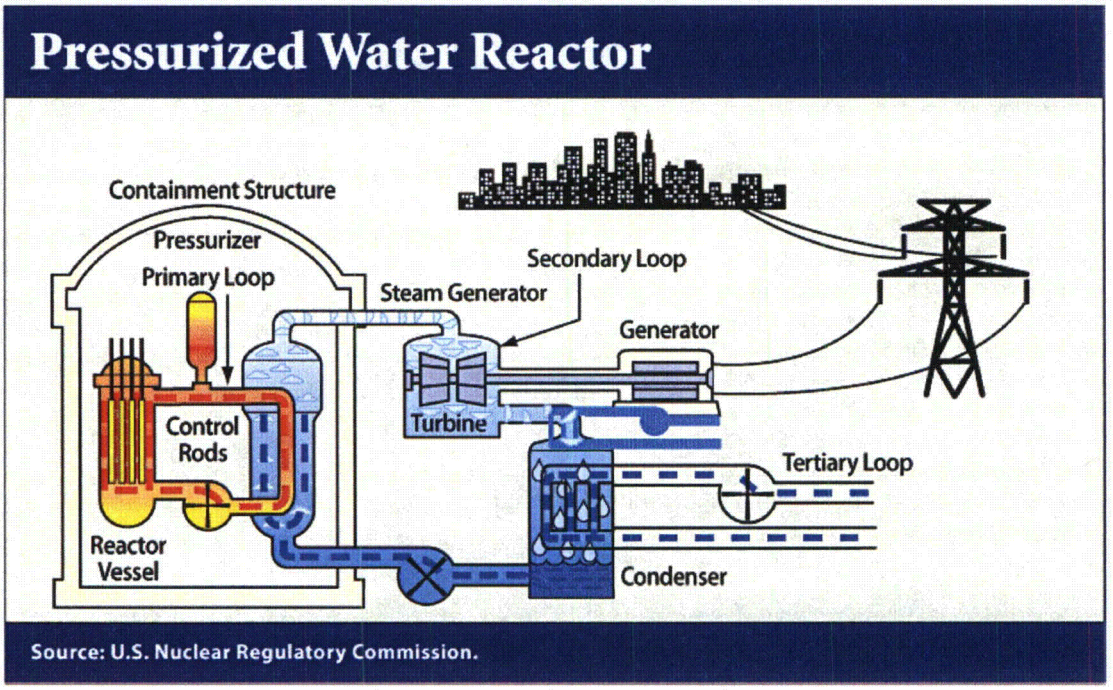

Figure 5. A diagram of a typical PWR plant water system

Figure 6. The Plant Site view looking South

D. Radiological Environmental Monitoring Introduction and Summary

The purpose of the radiological environmental monitoring is to measure radiation levels in the environment surrounding SONGS, and to identify and quantify levels of radioactivity or radiation that have a potential exposure pathway to a member of the general public. This is accomplished through a number of ways:

- Thermoluminescent Dosimeters (TLDs) are used to measure direct radiation levels
- Samples of environmental media
    - soil
    - shoreline sediment (beach sand)
    - air (particulate & iodine)
    - local crops
    - non-migratory marine species
    - kelp
    - drinking water
    - ocean water
    - ocean bottom sediments

All of the samples are analyzed for both naturally occurring and SONGS-plant related radionuclides. A detailed description of the 2014 sampling locations and location maps are included in Appendix A of this report.

Results are compared to the effluents released from the plant to confirm that concentrations expected in the environment, based on computer modelling, is actually within an acceptable range of what is actually measured. In 2014, only tritium and krypton-85 (a noble gas with an 11 year half-life) were released in gaseous effluent streams. Krypton -85 gas entrained in the water drained from the primary

and secondary systems of both units in the first quarter, was released to the monitored gaseous effluent stream during the same quarter. Subsequently, the water drained from these systems was treated for eventual permitted discharge in the 3rd and 4th quarters of 2014. No particulate activity containing activation or fission products was detected in gaseous effluent streams at any time in 2014. These activities are typical of a decommissioning nuclear power plant and are the result of being permanently shut down with termination of all fissioning of spent nuclear fuel currently stored in borated water in the spent fuel pools of Units 2 and 3. Gaseous tritium is released from tritiated water that evaporated from the spent fuel pools.

E. Sample Collection and Monitoring Results

1. Analysis of Results and Trends

Environmental samples from areas surrounding SONGS continue to indicate no discernable radiological impact from plant operation. A detailed discussion of the 2014 analytical results and discussions are presented in Part II of this report. Analytical values from offsite indicator sample stations continue to trend with the control stations. Measurements from onsite indicator samples continue to fluctuate within normal historical ranges. Average quarterly air particulate sample beta activity from the indicator stations and control station have been compared historically through 2014. The average of the indicators trends closely with the offsite control values. The comparison illustrates that plant operations are not having an impact on air particulate activity even at the Sensitive Indicator Stations. These stations are located near the site boundary downwind from the plant, based on the prevailing wind direction. The beta activity measured in the air particulate samples is from naturally occurring radioactive material such as Beryllium-7 from atmosphere production from cosmic rays. Gamma analyses are performed on quarterly composites of the air particulate samples to determine if any activity is from SONGS. The gamma analyses have revealed no radioactivity from SONGS.

Direct gamma radiation is monitored in the environment by thermoluminescent dosimeters located at 49 locations. The natural direct gamma radiation varies according to location because of differences in the natural radioactive materials in the soil, soil moisture content, and other factors. Table 16 shows the value of direct gamma radiation measured at all TLDs stations. The indicator stations are the remainder of the required stations. The values plotted are the averages for all of the stations according to type. Referring to Figure 3, "SONGS REMP TLD Readings 1998 trough current year 2014," indicate that there is no direct radiation impact to the population or environment from SONGS operations.

2. Land Use Census

Each year a Land Use Census is performed to ensure that any 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 changes in the use of the land. Appendix F of the report identifies changes to the census in 2014. While there were some changes noted in the land use census, these changes were not significant enough to impact off site dose to a member of the population, and therefore did not require changes to the current sampling protocol. Dose calculations are run on any new garden or land use to confirm the critical receptor used in the Annual Radioactive Effluent Release Report (ARERR) produces

the highest calculated dose. If the new receptor produces a higher calculated dose, it then becomes the new critical receptor.

3. Quality Assurance

To assure the accuracy and reproducibility of sample analytical results, a portion of the REMP is devoted to quality assurance. All REMP activities are assessed for compliance with the requirements in Regulatory Guide 4.15 Rev.1 including contractor performance in the collection and analysis of samples, and other activities to support the REMP. The quality assurance program's main aspects include process quality control, instrument quality control, comprehensive data reviews, cross-check analyses, and audits. By assessing the REMP routinely, the site's program, procedures and field and analytical personnel meet all minimum program and regulatory requirements.

Quality audits and independent technical reviews help to determine areas that need attention, when identified. These areas are addressed in accordance with the station's Corrective Action Program.

The measurement capabilities of the Radiological Laboratory are demonstrated by participating in an inter-laboratory measurement quality assurance and control program, as well as by submitting and assessing duplicate and split sample analyses results. A total of approximately 10% of the analyses performed are quality control samples, consisting of inter-laboratory measurement assurance program samples, duplicate samples, and split samples.

The inter-laboratory measurement assurance program provides samples that are similar in matrix and size to those measured by the Radiological Environmental Monitoring Program. This program assures that equipment calibrations and performance, as well as sample preparation methods utilized, accurately measure radioactive material in samples.

Duplicate sampling of the environment allows SONGS to estimate the repeatability of the sample collection, preparation, and analysis process. Splitting samples allows estimation of the precision and bias trends of the method of analysis without the added variables introduced by sampling. Generally, two samples split from the same original sample material should agree better than two separate samples collected in the same area and time period. The split sampling is performed with the California Department of Public Health Radiologic Health Branch. Split samples are collected and prepared in accordance with the site's REMP procedures. These split samples are independently analyzed by the CDPH-RHB. The general public can access these CDPH-RHB split sampling results via the internet at http://cdph.ca.gov/programs/Pages/RHB-RadReport.aspx.

In addition, the REMP samples are sent to an offsite contracted environmental authorized laboratory who is required to comply with quality assurance protocols specified in Regulatory Guide 4.15 Rev.1 when analyzing REMP samples.

4. Program Deviations

In addition to measurement accuracy, radiochemical measurements must meet sensitivity requirements at the Lower Level of Detection for environmental samples. Deviations from the sampling program or sensitivity requirements must be acknowledged and explained in Appendix E in this report.

Part II Radiological Environmental Monitoring Program

A. Analysis Technical Summary

The 2014 SONGS REMP was conducted in accordance with 10 CFR 50, Appendix A and I, 10 CFR § 50.36a, and Section 5.0 of the SONGS Offsite Dose Calculation Manual (ODCM). The data indicate that SONGS continued to have no measurable radiological environmental impact to a member of the general public during 2014. In addition, dose to a member of the general public attributable to SONGS related radiological activities was below regulatory limits and demonstrates compliance with 10 CFR 20, § 20.1301 and 1302 Dose Limits for Individual Members of the Public, and § 10 CFR 20.1101(b) which requires dose from the operation of nuclear power plants (NPPs) to members of the public be as low as reasonably achievable (ALARA).

The REMP data collected during 2014, as in previous years, continues to be near or within background levels. The data is summarized in the Statistical Summary of REMP Data found in Appendix B. The plant related radionuclides, including Cs-137 (Cesium-137) in soil, Sr-90 (Strontium-90) in deer, as well as I-131 (Iodine-131) in kelp, detected above the minimum detectable concentration (MDC) are attributable to fallout from nuclear weapons testing, and the Fukushima Daiichi nuclear power station in Japan (Cs-137) and medical administrations of radionuclides (I-131) and Mo/Tc-99 (Molybdenum/Technetium 99). These isotopes have been detected at indicator locations, as well as at 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) and U-234 (Uranium -234) 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.

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, Section L, for a discussion regarding the correlation of effluent to environmental concentrations.

A land use census was performed in 2014 to ensure that changes in the use of land 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.

B. Objectives

1. Characterize the radiological footprint outside of the power block resulting from the licensed operations and during decommissioning phases of SONGS Units 2 and 3.

2. To detect any significant increase in the concentration of radionuclides in existing critical receptor pathways, or if new critical receptor pathways have been identified in the land use census.

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

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

C. Sample Collection

Samples of 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 based on 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 are 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.

D. Regulatory Limits, Guidance, and Requirements

The Code of Federal Regulations, 10 CFR 50, Appendix I provides guidelines which established limits on releases of radioactivity to the environment and the resulting dose to the public. The limits are:

Table 1. Code of Federal Regulations, 10 CFR §50, Appendix I, Guidelines on Releases to the Environment

Source	NRC Limits for SONGS
Liquid Effluent	< or equal to 3 mrem/year to whole body < or equal to 10 mrem/year any organ
Gaseous Effluent	< or equal to 10 mrad/year
Noble Gases for both Gamma and Beta (Air Dose)	< or equal to 20 mrad/year < or equal to 15 mrem to any organ
Iodine-131, tritium and particulates with half-life Greater than 8 days	< or equal to 15 mrem to any organ

The EPA established environmental radiation protection standards for nuclear power plants in 40 CFR190. The standards for normal operation recommended that the dose from all discharges of radioactivity should not exceed the established limits. These limits are applicable to the sum of both liquid and gaseous effluents, and direct radiation. The limits are:

- 25 mrem/year to the whole body
- 75 mrem/year to the thyroid
- 25 mrem to any other organ

The doses calculated at SONGS are a small fraction of the dose limits established by the EPA

The EPA established limits for drinking water in 40 CFR141. The concentration levels' limits are:

Table 2. EPA established limits for drinking water in 40 CFR141

Gross Alpha	15 pCi/l
Gross Beta	50 pCi/l
Ra-226 and Ra-228 combined	5 pCi/l
Sr-90	8 pCi/l
Uranium	30 ug/l
Tritium	20,000 pCi/l* *Since SONGS is not a drinking water site, the tritium limit is 30,000 pCi/l.

These limits assumes that the concentration of man-made radionuclides ensures a 4 mrem total body or organ dose equivalents shall be calculated on the basis of 2 liters per day drinking water intake.

* 10CFR50

  The Code of Federal Regulations Title 10, Part 50, Appendix I, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion, "As Low As Reasonably Achievable" in Light Water Cooled Nuclear Power Reactor Effluents.

* 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 2014 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"

E. 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 Institute, "American National Standard Performance, Testing, And Procedural Specifications for Thermoluminescence Dosimetry (Environmental Application), 1975

* Regulatory Guide 4.15 Rev 1

  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

F. Data Management

The tabulated data with means, ranges, and the fraction of positive results from all samples collected and analyzed are presented in Appendix B and were calculated and presented 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.

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

The impact of SONGS on the surrounding environment was assessed through a series of analyses. These analyses included: data reduction, comparisons of indicator to control locations, and summary (Appendix B); comparison of operational to preoperational environmental data (Appendix D); summary of deviations from sampling requirements and corrective actions taken (Appendix E); and the results of the 2014 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 Rev. 1. 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 Rev 1. Refer to Appendix C.

G. 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.

The ODCM Lower Limit of Detection (LLD) (from NUREG 1301)- The LLD the *a priori* (before the fact) lower limit of detection. This value is calculated for each matrix, anticipated radionuclide and based on typical or expected variables 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. It should be noted that these mandatory LLDs were developed for the principal radionuclides anticipated.

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, and counting efficiency, as determined by the most recent calibration, etc. The MDC is compared to the LLD to verify that the MDC achieved 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. This 95% detection confidence level has a conservative 5% false positive bias meaning that if 100 samples with zero radioactivity present were analyzed using this protocol, the results would falsely indicate that 5 samples showed positive results.

The 2014 SONGS REMP data required by the ODCM have been summarized in the Statistical Summary of REMP Data found in Appendix B.

H. 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 2014 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 2014 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 operation of SONGS through 2014 had no statistically significant radiological environmental impact on a member of the public, or the population as a whole.

I. References

1. 10CFR50, Appendix I
2. Land Use Census for SONGS Units I, 2 and 3 Radiological Environmental Monitoring Program, November, 2013.
3. SONGS Offsite Dose Calculation Manual (ODCM) Revision 7, Section 5.0, 2013.
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

TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)		DISTANCE* (miles)	DIRECTION* (Sector)
Table 3. Direct Radiation			
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
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

TYPE OF SAMPLE AND SAMPLING LOCATION (Omitted sample numbers are due to program modifications)		DISTANCE* (miles)	DIRECTION* (Sector)
Table 3. Direct Radiation			
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

Table 4. Radiological Environmental Monitoring Airborne Sample Locations			
1	City of San Clemente (City Hall)	5.1	NW
7	AWS Roof	0.18 **	NW
9	State Beach Park	0.6	ESE
10	Bluff	0.7	WNW
11	Mesa EOF	0.7	NNW
12	Former SONGS Evaporation Pond	0.6	NW
13	Marine Corp Base (Camp Pendleton East)	0.7	E
16	San Luis Rey Substation (Control)	16.7	SE

Table 5. Radiological Environmental Monitoring Soil Sample Locations ***			
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

Table 6. Radiological Environmental Monitoring Ocean Water Sample Locations			
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 required by the ODCM)	0.1	SW
52	Unit 3 Conduit (not required by the ODCM)	0.1	SSW

Table 7. Radiological Environmental Monitoring Drinking Water Sample Locations			
4	Camp Pendleton Drinking Water Reservoir	2.0	NW
5	Oceanside City Hall (Control)	15.6	SE

Table 8. Radiological Environmental Monitoring Sample Locations, Shoreline Sediment (Beach Sand)			
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)	29.2	NW

Table 9. Radiological Environmental Monitoring Sample Locations, Local Crops			
2	Oceanside (Control)	15-25	SE to ESE
6	SONGS Garden	0.4	NNW

Table 10. Radiological Environmental Monitoring Sample Locations, Non-Migratory Marine Animals			
A	Unit 1 Outfall	0.9	WSW
B	Units 2/3 Outfall	1.5	SSW
C	Laguna Beach (Control)	20-25	WNW to NW

Table 11. Radiological Environmental Monitoring Sample Locations, Kelp ****			
A	San Onofre Kelp Bed	1.5	S
B	San Mateo Kelp Bed	3.8	WNW
C	Barn Kelp Bed	6.3	SSE
E	Salt Creek (Control)	11 to 13	WNW to NW
G	Capistrano Beach Reef (not required by the ODCM)	8.9 to 9.1	NW
H	San Clemente Pier (not required by the ODCM)	5.7 to 5.8	NW
I	Wheeler North Artificial Reef (not required by the ODCM)	5.3	WNW

Table 12. Radiological Environmental Monitoring Sample Locations, Ocean Bottom Sediments			
B	Unit 1 Outfall	0.8	SSW
C	Unit 2 Outfall	1.6	SW
D	Unit 3 Outfall	1.2	SSW
E	Laguna Beach (Control)	20-25	NW
F	SONGS Up-coast	0.9	WSW
51	Unit 2 Conduit (not required by the ODCM)	0.1	SW
52	Unit 3 Conduit (not required by the ODCM)	0.1	SSW

* Distance (miles) and Direction (sector) are measured relative to Units 2/3 midpoint as described in the ODCM Rev. 8. Direction determined from degrees true north.

** Distances are within the Units 2/3 SAB/EAB (Site 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 13. Sector and Direction Designation for REMP Sample Location Map

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

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

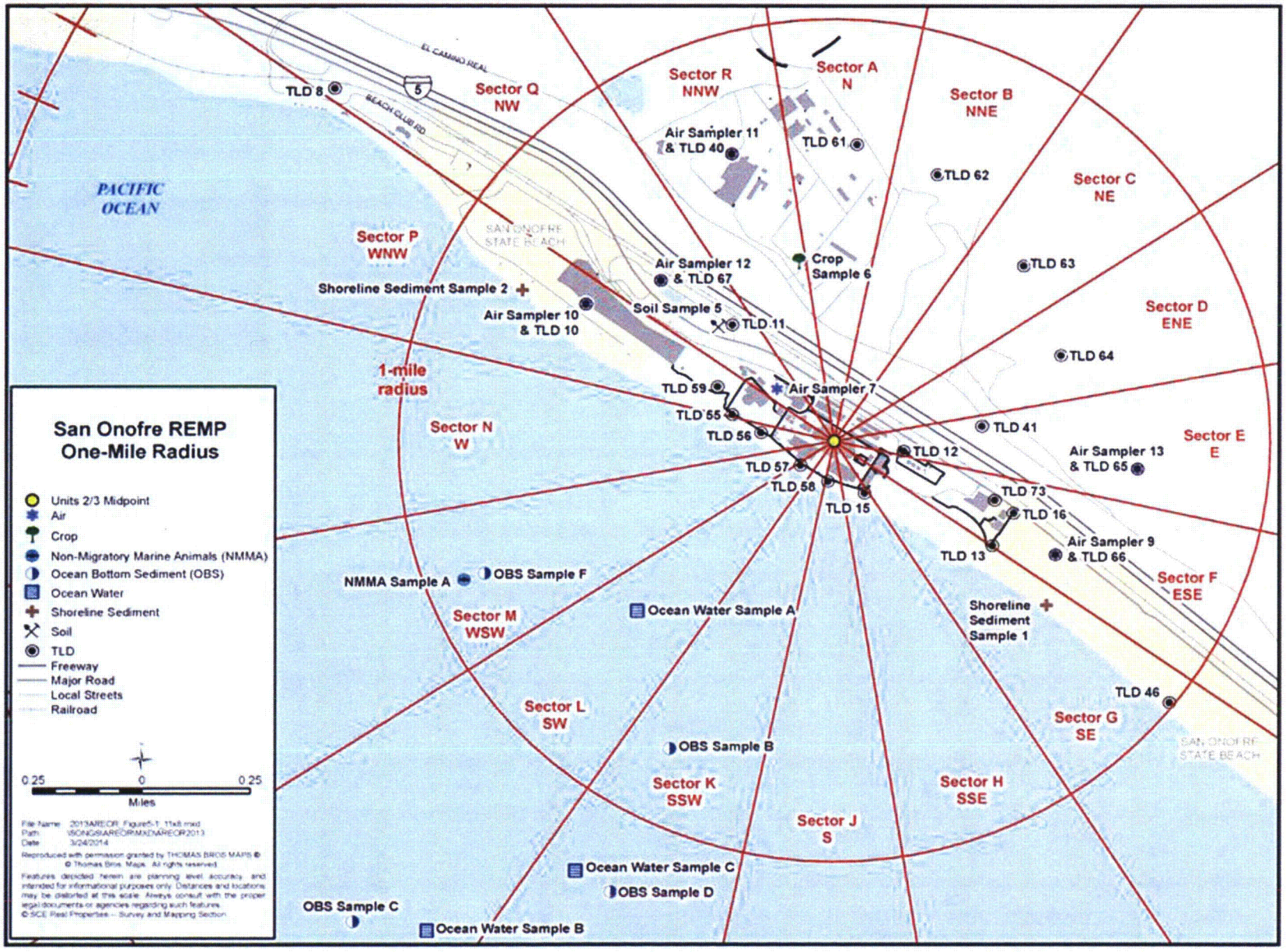

Figure 7. SONGS REMP One Mile Radius

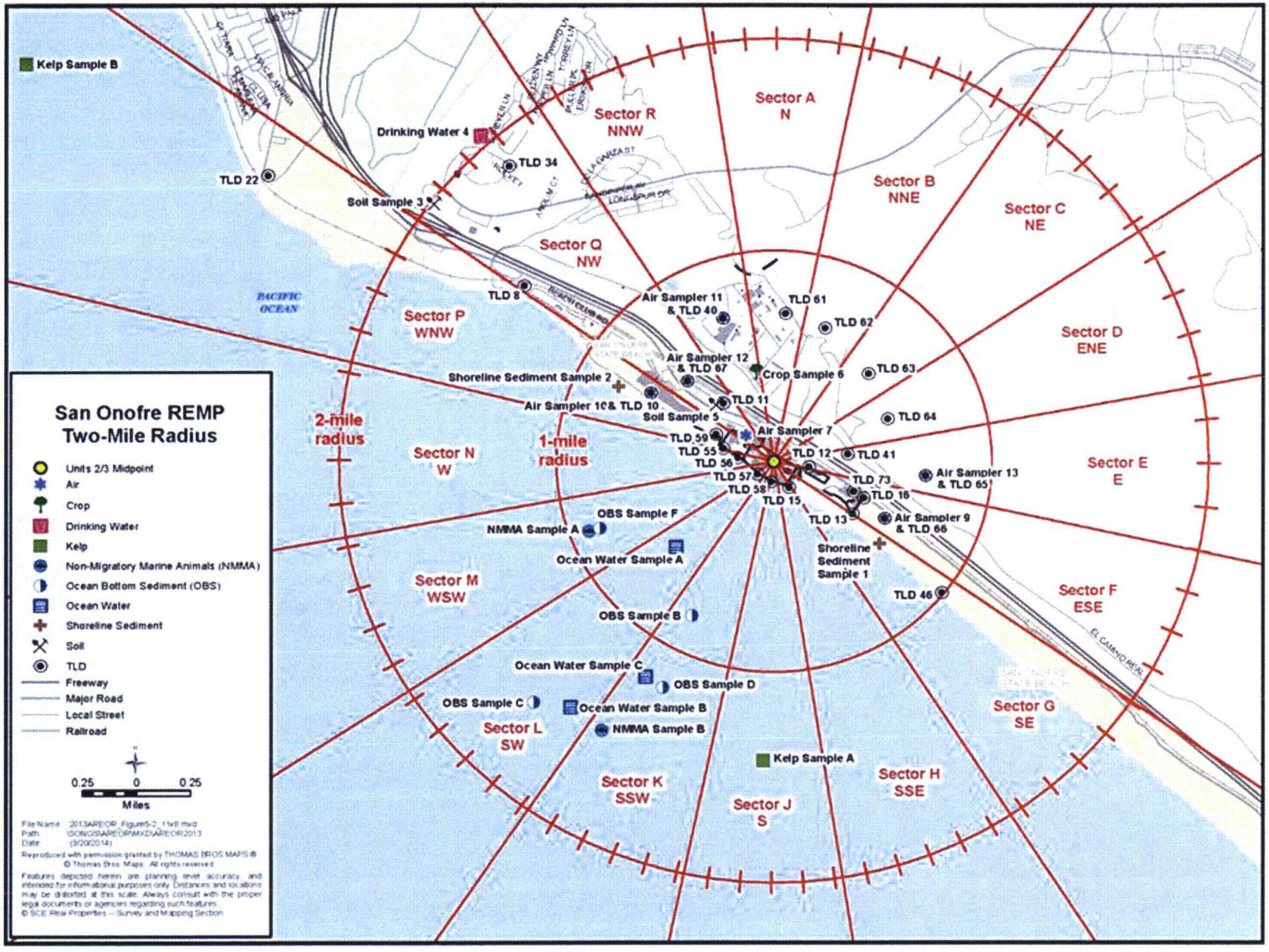

Figure 8. SONGS REMP Two-mile Radius

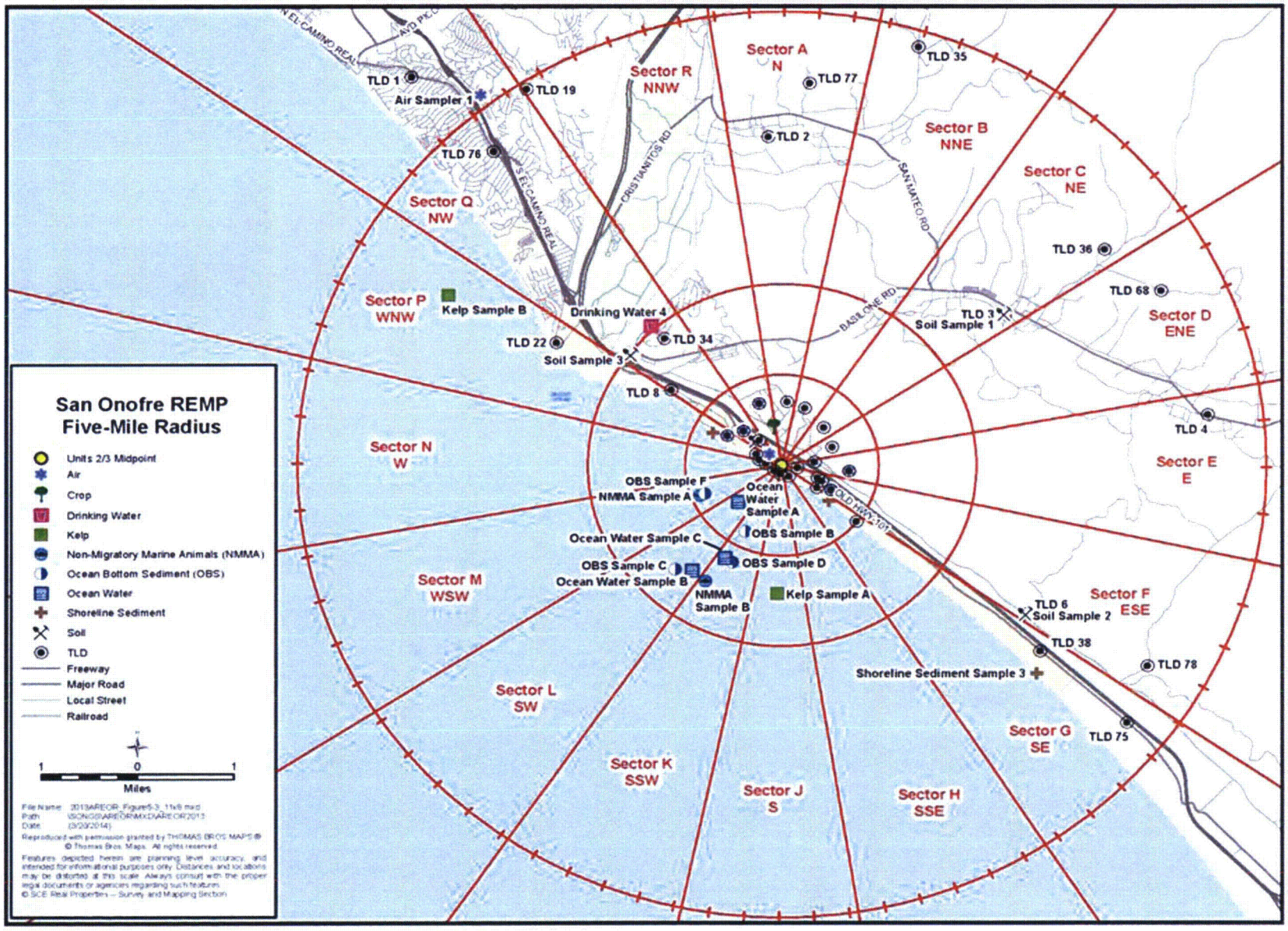

Figure 9. SONGS REMP Five-mile Radius

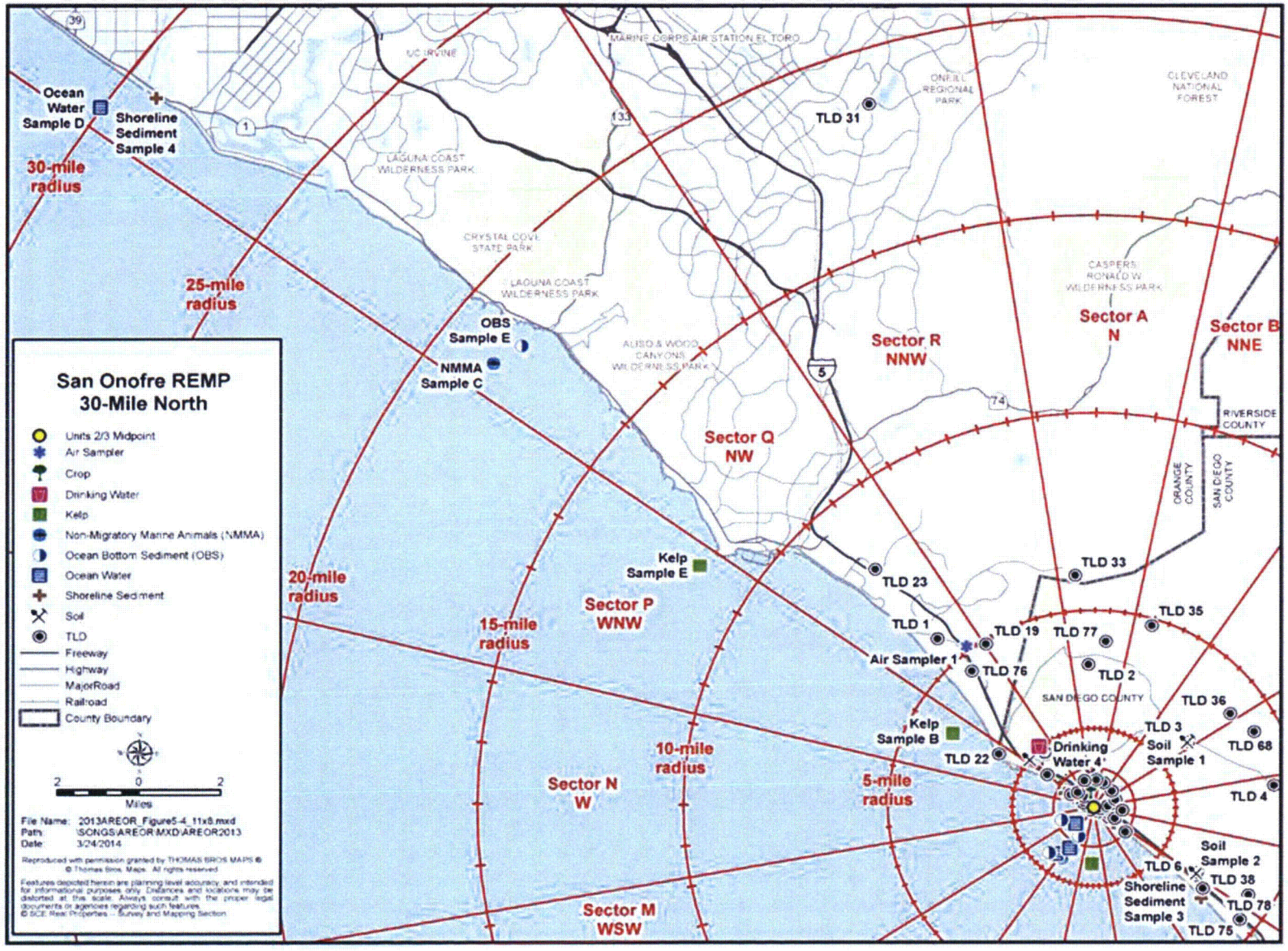

Figure 10. SONGS REMP 30-mile Radius North

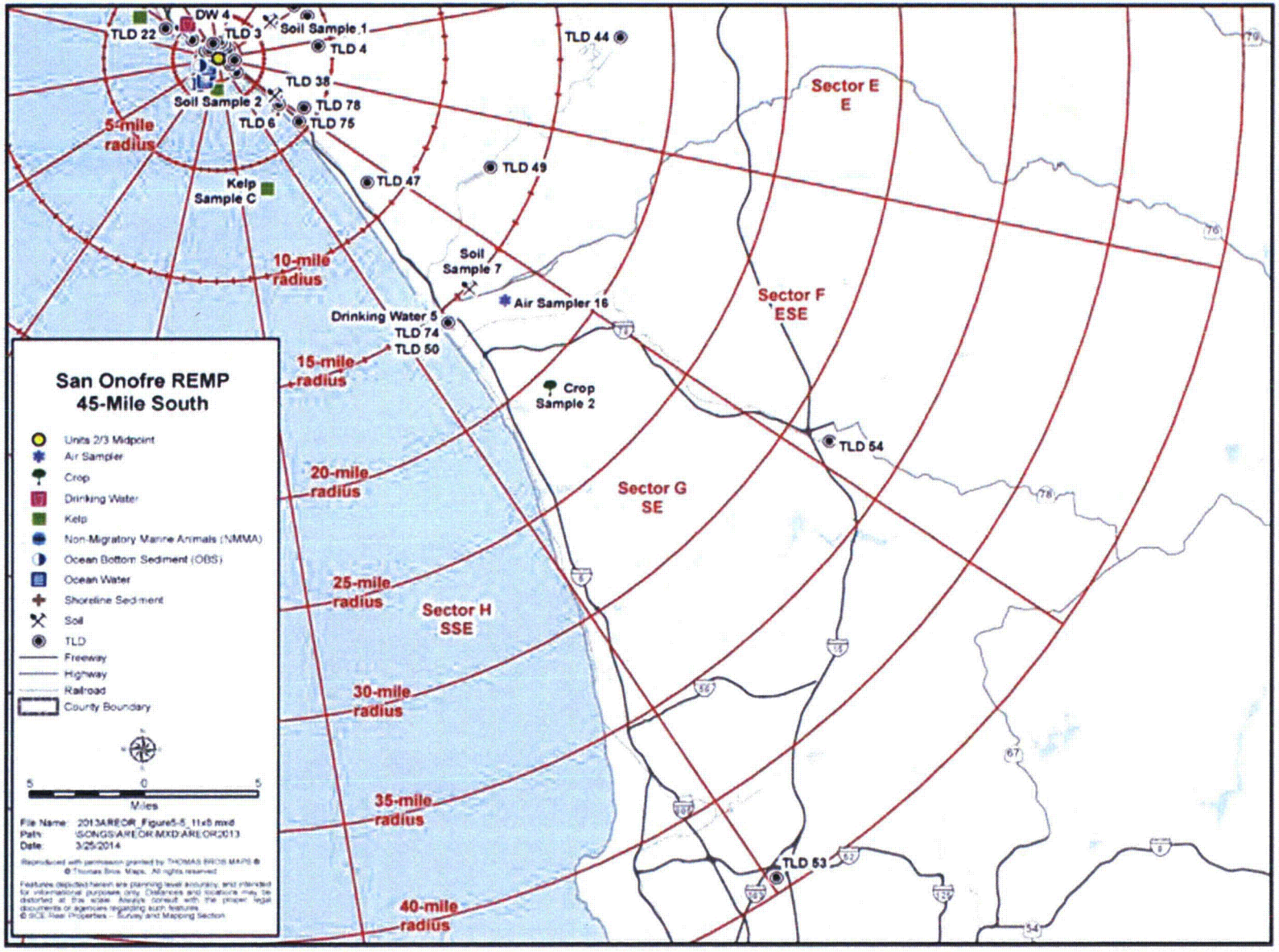

Figure 11. SONGS REMP 45-mile Radius South

Appendix B. Summary, Results, and Discussions of 2014 Environmental Data

Summary

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 1, 2014 through December 31, 2014 were evaluated. The 2014 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 the 1979 NRC Branch Technical Position for Reg. Guide 4.8. The 2014 SONGS REMP database, when examined in accordance with the Currie data reduction protocol, confirms that SONGS had no statistically significant radiological environmental impact. A summary of the type and number of REMP samples obtained in 2014 appears in Table 14.

The exceptions, found in Tables 16 through 30, include isotopically analyzed samples with activity reported above the *a posteriori* MDC. The analysis results listed in this report are attributable to sources external to SONGS (fallout from the nuclear accident at the Fukushima Daiichi Nuclear Power Station (Cs-137 and Sr-90 only: I-131 has all since decayed), or Chernobyl, residual fallout from legacy atmospheric nuclear weapons testing, and medically administered I-131 and other medical and industrial materials discharged from the San Juan Sewage Plant outfall). 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.

Results where the indicator and control locations were reported at levels below a posteriori MDC are not included in the data tables to keep them to a manageable size and facilitate digestion of the reports content.

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. Therefore, SONGS had no statistically significant radiological environmental impact during 2014.

Results and Discussions of 2014 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 were observed during 2014 (5 mrem per standard quarter and 10 mrem per year).

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 2014 control location TLD readings were below the LLD and all 2014 indicator location readings outside the Exclusion Area Boundary (EAB) were below the LLD.

The data indicate detectable direct radiation measurements only 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 mrem per year as measured by this sample media. TLD station #56 had the highest measured REMP TLD annual baseline adjusted exposure in 2014 (12 mrem, San Onofre State Beach, Unit 3). The occupancy adjusted exposure for #56 is less than 1 mrem per year. Refer to Table 16 for a summary of all 2014 SONGS REMP TLD data.

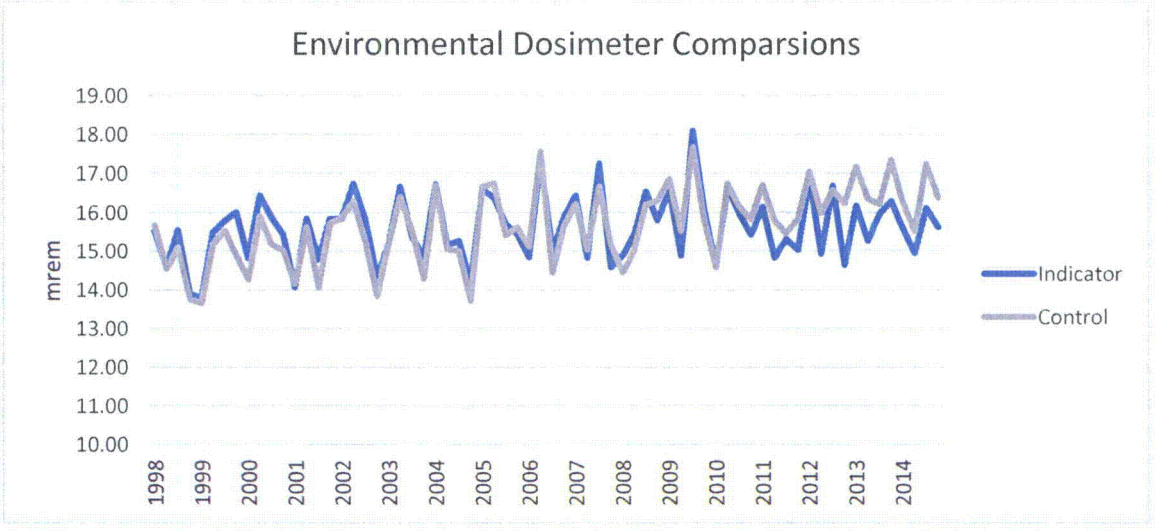

Figure 12. SONGS REMP 2014 TLD data comparing Control and Indicator TLDs

Figure 12 compares environmental radiation levels of indicator and control locations for the operational year 2014 and for previous years. These figures show the close correlation between the control and indicator location TLD exposure data.

Nine laboratory control TLDs were analyzed quarterly. TLD numbers 23, 31, 33, 46, 47, 49, 50, 53, and 54 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 2014 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 2014 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 mrem and the highest value was 9.7 mrem for the annual results, providing justification for baseline or *a priori* LLDs of 5 mrem per quarter and 10 mrem per year. The quarterly and annual results expressed in the 2014 Table 16 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 mrem per quarter. A value of 15.0 mrem 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 mrem 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 14. REMP Sample Analysis Summary for 2014

Medium	Analysis Type	Sampling Frequency	# of Locations	Total # of Analyses in 2014 [1]
Direct Radiation	Dosimetry	Quarterly	49	196
Airborne Particulates	Gross Beta	Weekly	8	406[2]
Charcoal Cartridge	I-131	Weekly	8	406[2]
Airborne Particulates	Gamma Scan	Quarterly	8	32
Ocean Water	Gamma, H-3	Monthly	4	52
Ocean Water	H-3	Quarterly	4	16
Drinking Water, Unfiltered	Gamma Scan, H-3 Gross Beta	Monthly	2 2 2	25 25 25
Shoreline Sediment	Gamma Scan	Semi-Annually	4	8
Ocean Bottom Sediment	Gamma Scan	Semi-Annually	7	14
Marine Species, Flesh	Gamma Scan	Semi-Annually	3	24
Crops	Gamma Scan	Semi-Annually	2	11
Kelp	Gamma Scan	Semi-Annually	8	16
Soil	Gamma 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 2014
2. Air sampler was out of service from July through October and is documented in Appendix E.

Table 15. Summary of Nuclear Power Plant related Gamma Isotopic confirmed above MDC

Sample Media & location	Radionuclide	Sample Value	MDC (a posteriori)
Aquatic Kelp San Onofre Kelp Bed Station A 15APR14	I-131	(70 ± 21) E-3 pCi/g	19 E-3 pCi/g
Aquatic Kelp San Mateo Kelp Bed Station B 15APR14	I-131	(60 ± 18) E-3 pCi/g	20 E-3 pCi/g
Aquatic Kelp Barn Kelp Bed Station C 15APR14	I-131	(71 ± 16) E-3 pCi/g	16 E-3 pCi/g
Aquatic Kelp Salt Creek Bed Station E 15APR14	I-131	(100 ± 21) E-3 pCi/g	16 E-3 pCi/g
Aquatic Kelp San Onofre Kelp Bed Station A 10OCT14	I-131	(9 ± 11) E-3 pCi/g	14 E-3 pCi/g
Aquatic Kelp San Mateo Kelp Bed Station B 10OCT14	I-131	(8 ± 11) E-3 pCi/g	10 E-3 pCi/g
Aquatic Kelp Barn Kelp Bed Station C 10OCT14	I-131	(6 ± 7) E-3 pCi/g	10 E-3 pCi/g
Aquatic Kelp Salt Creek Bed Station E 10OCT14	I-131	(15 ± 7) E-3 pCi/g	10 E-3 pCi/g
Soil Camp San Onofre Location # 1 10SEP14	Cs-137	(86 ± 45) E-3 pCi/g	48 E-3 pCi/g
Soil Old El Camino Real Location # 2 10SEP14	Cs-137	(166 ± 46) E-3 pCi/g	46 E-3 pCi/g
Soil Basilone Road Location # 3 10SEP14	Cs-137	(38 ± 46) E-3 pCi/g	46 E-3 pCi/g
Soil Former Visitors Center Location # 5 10SEP14	Cs-137	(9 ± 39) E-3 pCi/g	60 E-3 pCi/g
Soil Prince of Peace Abbey Location # 7 10SEP14	Cs-137	(186 ± 122) E-3 pCi/g	98 E-3 pCi/g

Table 16. SONGS 2014 REMP TLD Data, not including ISFSI TLD Data

TLD #	Location	Distance Miles	Quarterly Baseline	2014 Quarterly Results (mrem)				Baseline Adjusted 2014 Quarterly Results (mrem)				Annual Baseline (mrem)	2014 Annual Total (mrem)	Baseline Adjusted
				1	2	3	4	1	2	3	4			
1	City of San Clemente	5.7	17.5	16.17	16.68	17.69	18.37	<LLD	<LLD	<LLD	<LLD	69.9	68.91	<LLD
2	Camp San Mateo – MCB	3.6	18.6	18.3	16.71	20.74	19.05	<LLD	<LLD	<LLD	<LLD	74.4	74.8	<LLD
3	Camp San Onofre – MCB	2.8	16.4	14.94	15.87	17.48	16.67	<LLD	<LLD	<LLD	<LLD	65.5	64.96	<LLD
4	Camp Horno – MCB	4.4	18.1	16.73	16.47	18.44	17.82	<LLD	<LLD	<LLD	<LLD	72.3	69.46	<LLD
6	Old Route 101 (ESE)	3.0	11.4	11.29	11.18	11.23	11.69	<LLD	<LLD	<LLD	<LLD	45.6	45.39	<LLD
8	Noncommissioned Officers' Beach Club	1.4	15.4	15.58	14.54	16.37	16.65	<LLD	<LLD	<LLD	<LLD	61.8	63.14	<LLD
10	Bluff (Adjacent to PIC #1)	0.7	16.4	16.21	15.34	15.5	16.07	<LLD	<LLD	<LLD	<LLD	65.7	63.12	<LLD
19	San Clemente Highlands	4.9	17.8	18.05	16.2	19.39	17.83	<LLD	<LLD	<LLD	<LLD	71.3	71.47	<LLD
22	Former US Coast Guard Station	2.7	17.9	19.09	16.58	18.37	18	<LLD	<LLD	<LLD	<LLD	71.7	72.04	<LLD
23	SDG&E Service Center Yard	8.1	15.8	14.88	14.96	15.73	16.28	<LLD	<LLD	<LLD	<LLD	63.1	61.85	<LLD
31	Aurora Park - Mission Viejo (Control)	18.6	18.5	17.95	18.1	18.86	18.45	<LLD	<LLD	<LLD	<LLD	74.1	73.36	<LLD
33	Camp Talega – MCB	5.9	18.9	18.24	16.62	19.06	18.43	<LLD	<LLD	<LLD	<LLD	75.4	72.35	<LLD
34	San Onofre School – MCB	1.9	16.2	15.78	15.58	16.45	16.15	<LLD	<LLD	<LLD	<LLD	64.7	63.96	<LLD
35	Range 312 – MCB	4.8	16.9	13.77	14.09	15.56	15.35	<LLD	<LLD	<LLD	<LLD	67.5	58.77	<LLD
36	Range 208C – MCB	4.1	19.5	18.26	18.14	20.23	18.78	<LLD	<LLD	<LLD	<LLD	77.8	75.41	<LLD
38	San Onofre State Beach Park	3.4	14.3	12.72	12.62	13.72	14.02	<LLD	<LLD	<LLD	<LLD	57.2	53.08	<LLD
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	17.1	18.01	16.62	17.35	16.24	<LLD	<LLD	<LLD	<LLD	68.4	68.22	<LLD
44	Fallbrook Fire Station	17.7	14	14.29	13.77	15.74	18	<LLD	<LLD	<LLD	<LLD	56	61.8	<LLD
46	San Onofre State Beach Park**	1.0	12.2	13.29	NA**	13.95	16.83	<LLD	NA	<LLD	<LLD	48.7	44.07	<LLD
47	Camp Las Flores – MCB	8.6	13.3	15.8	14.41	16.08	16.15	<LLD	<LLD	<LLD	<LLD	53.1	62.44	<LLD
49	Camp Chappo – MCB	12.9	14.2	15.84	14.77	16.79	15.35	<LLD	<LLD	<LLD	<LLD	56.9	62.75	<LLD
50	Oceanside Fire Station (Control)	15.6	16.6	16.33	15.4	15.93	18.78	<LLD	<LLD	<LLD	<LLD	66.3	66.44	<LLD

Table 16. SONGS 2014 REMP TLD Data, not including ISFSI TLD Data

TLD #	Location	Distance Miles	Quarterly Baseline	2014 Quarterly Results (mrem)				Baseline Adjusted 2014 Quarterly Results (mrem)				Annual Baseline (mrem)	2014 Annual Total (mrem)	Baseline Adjusted
				1	2	3	4	1	2	3	4			
53	San Diego County Operations Center	44.2	18.2	19.04	17.78	20.45	14.02	<LLD	<LLD	<LLD	<LLD	72.9	71.29	<LLD
54	Escondido Fire Station	31.8	16.1	16.84	15.69	18.99	16.24	<LLD	<LLD	<LLD	<LLD	64.4	67.76	<LLD
61	Mesa - East Boundary (PIC #4)	0.7	15.4	15.93	13.62	15.41	14.7	<LLD	<LLD	<LLD	<LLD	61.7	59.66	<LLD
62	Camp Pendleton (PIC #5)	0.7	13.2	13.55	11.91	12.2	12.99	<LLD	<LLD	<LLD	<LLD	50.4	50.65	<LLD
63	Camp Pendleton (PIC #6)	0.6	13.9	14.99	13.94	13.45	13.61	<LLD	<LLD	<LLD	<LLD	55.5	55.99	<LLD
64	Camp Pendleton (PIC #7)	0.6	15	16.32	14.85	14.66	15	<LLD	<LLD	<LLD	<LLD	60.1	60.83	<LLD
65	Camp Pendleton (PIC #8)	0.7	13.4	14.42	13.01	12.83	13.64	<LLD	<LLD	<LLD	<LLD	53.8	53.9	<LLD
66	San Onofre State Beach (PIC #9)	0.6	14	14.14	13.12	14.3	13.02	<LLD	<LLD	<LLD	<LLD	55.6	54.58	<LLD
67	Former SONGS Evaporation Pond (PIC #2)	0.6	16.9	16.3	16.76	17.45	16.38	<LLD	<LLD	<LLD	<LLD	67.7	66.89	<LLD
68	Range 210C – MCB	4.4	15	15.35	14.68	17.04	15.4	<LLD	<LLD	<LLD	<LLD	60.2	62.47	<LLD
74	Oceanside City Hall (Backup Control)	15.6	13.3	13.58	12.53	14.38	12.46	<LLD	<LLD	<LLD	<LLD	53.4	52.95	<LLD
75	Gate 25 MCB	4.6	15.9	16.19	14.9	16.7	16.44	<LLD	<LLD	<LLD	<LLD	63.6	64.23	<LLD
76	El Camino Real Mobil Station	4.6	17.3	16.93	17.1	18.36	18.36	<LLD	<LLD	<LLD	<LLD	69.4	70.75	<LLD
77	Area 62 Heavy Lift Pad	4.2	19.2	17.91	18.64	20.03	18.24	<LLD	<LLD	<LLD	<LLD	76.9	74.82	<LLD
78	Horno Canyon	4.4	11.1	11.46	10.98	11.86	11.31	<LLD	<LLD	<LLD	<LLD	44.6	45.61	<LLD
11	Former Visitors' Center	0.4*	15	15.74	13.96	16.63	15.49	<LLD	<LLD	<LLD	<LLD	60	61.82	<LLD
12	South Edge of Switchyard	0.2*	15	17.62	16.03	17.07	16.97	<LLD	<LLD	<LLD	<LLD	60	67.69	<LLD
13	Southeast Site Boundary (Bluff)	0.4*	15	21.36	15.45	15.82	19.3	6.36	<LLD	<LLD	<LLD	60	71.93	11.93
15	Southeast Site Boundary (Office Bldg.)	0.1*	15	17.63	15.89	16.87	17.78	<LLD	<LLD	<LLD	<LLD	60	68.17	<LLD
16	East Southeast Site Boundary	0.4*	15	16.49	15.29	15.53	15.32	<LLD	<LLD	<LLD	<LLD	60	62.63	<LLD
41	Old Route 101 – East	0.3*	15	17.02	13.77	15.62	15.42	<LLD	<LLD	<LLD	<LLD	60	61.83	<LLD
55	San Onofre State Beach (U1 West)	0.2*	15	18.32	16.31	18.45	17.83	<LLD	<LLD	<LLD	<LLD	60	70.91	10.91

Table 16. SONGS 2014 REMP TLD Data, *not including ISFSI TLD Data*

TLD #	Location	Distance Miles	Quarterly Baseline	2014 Quarterly Results (mrem)				Baseline Adjusted 2014 Quarterly Results (mrem)				Annual Baseline (mrem)	2014 Annual Total (mrem)	Baseline Adjusted
				1	2	3	4	1	2	3	4			
56	San Onofre State Beach (U1 West)	0.2*	15	18.37	17.41	17.79	18.38	<LLD	<LLD	<LLD	<LLD	60	71.95	11.95
57	San Onofre State Beach (Unit 2)	0.1*	15	16.3	14.35	15.96	15.76	<LLD	<LLD	<LLD	<LLD	60	62.37	<LLD
58	San Onofre State Beach (Unit 3)	0.1*	15	15.95	14.54	16.26	16.28	<LLD	<LLD	<LLD	<LLD	60	63.03	<LLD
59	SONGS Meteorological Tower	0.3*	15	19.33	17.37	20.3	17.84	<LLD	<LLD	5.3	<LLD	60	74.84	14.84
73	South Yard Facility	0.4*	15	20.99	20.07	21.87	18.67	5.99	5.07	6.87	<LLD	60	81.6	21.6
	*Within Exclusion Area Boundary													

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

** TLD Lost to Fire in May 2014, See Appendix E Deviations from ODCM Sampling Requirements for additional discussion

Quality Control Duplicate Direct Radiation Samples

Duplicate QC TLDs were installed adjacent to TLD #66 and TLD #67. The duplicate TLDs agreed closely with the indicator TLDs, the average being within 3% (see 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 placed 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 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 in Air

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 0.0113 pCi/m^3 to 2.44 pCi/m^3, averaging 0.0407 pCi/m^3 of air. The concentrations of gross beta activity in the samples from the control location ranged from 0.0186 to 0.120 pCi/m^3, averaging 0.0381 pCi/m^3 of air. Figure 18 shows the close correlation between indicator and control gross beta activity level during 2014 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 2014 was 2.44 pCi/m^3 and the 2014 control location average was 0.0381 pCi/m^3, which is less than 10 times background. No action was required by the ODCM.

Iodine-131 in Air

Approximately six percent (6%) of all indicator samples analyzed for I-131 were positive, as were 6% of the control samples. Of the positive results, the indicators showed a range of 0.0043 pCi/m^3 to .0286 pCi/m^3, with a mean of 0.0136 pCi/m^3. The ODCM Lower Limit of Detection is 0.07 pCi/m^3. Likewise, the 6% positive control results had a range of .0056 to 0068 pCi/m^3 with an average of 0.0062 pCi/m^3. In 2013 the indicator results were higher by an average of 1000 fold due to residual releases from the Fukashima Daiichi plant in Japan. I-131

has a very short half-life of eight (8) days, is a by-product of nuclear fission, and detectable releases from Japan ended in 2013. As both SONGS Units 2 and 3 have been shut down since January 2012, and the fuel transferred to spent fuel pools with high concentrations of boron to absorb neutron emissions which initiate the fission of uranium, no fission has occurred, and no iodine-131 would be expected in the atmosphere from SONGS. As the 2014 results are very close to the *a posteriori,* MDC for I-131 on charcoal filters, statistically these are near zero results. As the MDC is calculated in a manner that results in 5% false positives when the results are actually zero, the 6% positive results identified in indicator results *and* controls can be attributed to the conservative statistical bias introduced into the calculation to the MDC. Statistically, there were actually no positive iodine results for iodine cartridges containing air samples collected in 2014. No action is required by the ODCM.

Gamma Emitters in Air: Quarterly Composite Results

Quarterly composite gamma spectral analyses yielded naturally occurring beryllium-7 (Be-7) and potassium-40 (K-40) in particulate samples above the *a posteriori* MDC,. Near MDC levels of plant related activity (Cs-134, Cs-137, Co-60 and Mn-54) were also detected in indicator and some control samples. As these levels were near zero (~levels approximating one percent of the ODCM LLDs) at an overall frequency of less than 5%, these are considered false positives.

In conclusion, the operation of SONGS had no impact on the surrounding or distant population as measured by air sampling

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 2014, natural and plant related radionuclides were identified in the station outfalls. The plant related activity was attributed to the water remaining within the Reactor Coolant, Coolant Radwaste and Miscellaneous Liquid Radwaste Systems that was transferred to storage tanks, treated, processed and released in accordance with NRC regulations, the station's NRC license, the ODCM, station procedures, state regulations and the station's NPDES permits. Control locations also had low levels of radionuclides not found at indicator stations, such as Molybdenum-99, which, along with I-131, is also a radionuclide used in medical applications. Monthly ocean water samples were also analyzed for tritium, consistent with the State of California Department of Public Health (DPH) split sample program. Tritium levels were identified in the outfalls (indicators) in three (3) of the twelve (12) composited samples at an average concentration of 323 pCi/L and in one of the four control station composite samples at an average of 330 pCi/L. The ODCM LLD for tritium in ocean water is 3000 pCi/L. The EPA drinking water standard for tritium is 20,000 pCi/L, though ocean water is not drinking water. During 2014 all REMP ocean water sample results for plant related radionuclides were detectable, but well below the a priori LLD (Table 20)

The data indicate that the operation of SONGS had no measureable impact on the surrounding population or the environment.

D. Drinking Water

In 2014, 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 plant related radionuclides were detected in drinking water during 2014 at the ODCM LLD. All detectable results were well below the ODCM LLD and near or at the *a posteriori* MDC, including tritium. The measured gross beta activity is due exclusively to naturally occurring radionuclides. The operation of SONGS had no measurable impact on the surrounding population or the environment.

E. Shoreline Sediment (Beach Sand)

Beach sand was collected semiannually in 2014 from three indicator locations and one control location situated in Newport Beach. After collection, the samples were analyzed for plant related and naturally occurring radionuclides. Naturally occurring K-40, Tl-208, U-234, and Th-228 were detected in all samples. No plant related radionuclides were reported above the ODCM mandated *a priori* MDC. Medical, natural and plant related radionuclides were detected just above the *a posteriori* MDC for each radionuclide detected, and equally split between control and indicator locations. The operation of SONGS had no measurable impact on the environment as measured in beach sand.

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, Tl 208, Bi-214, Be-7, K-40, U-234, and Th-228 were detected in ocean bottom sediment samples collected during 2014.

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 2014, a small number (~10%) of the conduit sample analysis results were positive at levels just above the a posteriori MDC for station related radionuclides, and a small fraction of the ODCM mandated a priori LLD.

The operation of SONGS had no discernable impact on the environment as measured by ocean bottom sediments.

G. Non-Migratory Marine Species (Flesh)

Species of adult fish, crustacean and mollusks were collected on a semi-annual basis at the SONGS Unit I outfall, the SONGS Units 2/3 outfall and from the 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. Plant related radionuclides were detected just above the *a posteriori* MDC, but well below the ODCM mandated *a priori* LLD in both indicator and control samples. Note one indicator locations showed Cs-137 above the *a posteriori* MDC, attributable to Fukushima or weapons testing. Based on the numerous results near the MDC, some results are believed to be false positives.

Naturally-occurring K-40 was detected in all marine species samples collected during 2014. The operation of SONGS had no discernable impact on the surrounding population or the environment as indicated by the sample results for these samples.

H. Local Crops

Fleshy and leafy crops were collected semiannually in 2014 from the SONGS garden and from the control location 21 miles from SONGS Units 2/3 midpoint in sector F. Plant related radioactivity was detected in 2014 samples just above the *a posteriori* MDC and well below the mandated ODCM *a priori* LLDs in some indicator and some control samples. It is concluded that, in 2014 SONGS had no discernable impact on the surrounding population or the environment based on the results of these sample analyses.

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 the Prince of Peace Abbey. 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. 2014 soil samples yielded naturally occurring K-40, U-234 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. 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. Plant related activity was identified in both control and indicator stations at levels just above the *a posteriori* MDC and well below the ODCM mandated *a priori* LLDs. As most of these positive results were near the MDC during 2014, the operation of SONGS did not have a discernable impact on the surrounding population or the environment as indicated by radionuclide analysis results for these soil samples.

J. Kelp Sampling

Kelp was collected in April and October of 2014 from the San Onofre kelp beds, San Mateo Kelp Bed, Barn Kelp Bed, 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 2014 included K-40 and I-131. K-40 is naturally occurring and not related to the operation of SONGS. Iodine is a plant related radionuclide

created when fission reactions are used to superheat pressurized water used to boil secondary side water steam, however, once all the fuel was transferred to the spent fuel pools, the boron in the pool water mitigates the fission reaction, and Iodine is no longer created by fission, and this is why no I-131 was detected in gaseous or liquid effluents in 2014. Iodine-131 is also a radionuclide used in medicine and medical research.

I-131 was detected at indicator and control locations in previous years. I-131 data in ocean water samples near SONGS have been consistently indistinguishable radiologically from background. 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 above radiological background. I-131 in kelp data, graphically presented in Figure 13, shows a relatively close correlation between indicator and control locations over a 3 year period - further supporting the assessment that the likely source for this radionuclide is external to SONGS.

Refer to Figure 14 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.

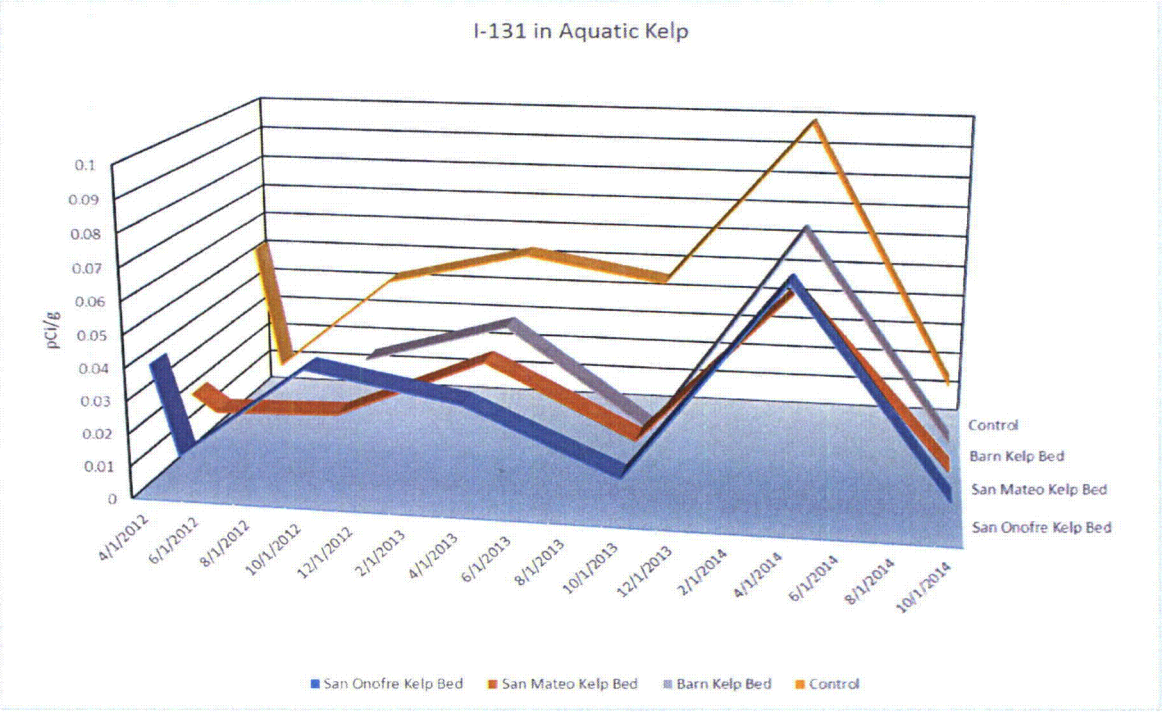

Figure 13. 2014 I-131 in Aquatic Kelp

K. Deer Sampling

Although deer meat is not considered a reliable human exposure pathway in the ODCM as it pertains to SONGS effluents, beginning in 2008 and continuing through 2014, samples of deer meat and bone harvested from road kill were analyzed for gamma emitting radionuclides such

as Cs-137 and beta emitters like Sr-90. This has been performed routinely as a courtesy to the Camp Pendleton Marine Corps Base, but is actually a poor indicator of exposure pathways to man when evaluating the impact of SONGS effluents reaching the environment. On January 29th, 2015, the Camp Pendleton Wildlife Biologist sent his 2014 Annual Report to the San Onofre' s Radiological Effluent and Environmental Specialist for review. The State Fish and Game Department allows 400 permitted tags for deer taken in the Camp Pendleton zone.

Records show a total of 86 deer were taken in the 2014 Camp Pendleton sport seasons by archery and rifle. Of that 86 deer taken, one taken and 27 lost to road kill were analyzed by SONGS for the presence of radionuclides. Cs-137 was detectable in very small concentration ranging from 0.0013 pCi/Kg to 0.0092 pCi/Kg, with the higher concentrations in deer tagged at a distance exceeding five miles from SONGS. Deer tagged closer to SONGS, within five miles, had lower concentrations, though statistically, all levels were near the minimum detectable activity. The same was true for identification of Sr-90 in deer ranging in concentration from 0.064 pCi/Kg to 0.35 pCi/Kg, with the higher concentrations found in deer more than five miles from the plant. Both Sr-90 and Cs-137 have half-lives on the order of 30 years, and can be attributed to weapons testing, and the Chernobyl and Fukushima Daiichi nuclear accidents.

Deer, mule deer in the case of SONGS data, roam freely typically in a four (4) square mile area. However, during times of limited food supply, (e.g., during droughts), they can roam as far as eighty miles (80) in search of food and territory. NUREG-1301 does not include sampling of deer meat as a standard sample media and it is not required by Technical Specifications for a number of reasons including those just mentioned. Information collected from deer meat sampling, unlike domesticated livestock, whose location is fixed and food source is known, is unreliable at best in terms of using it to correlate the environmental results to effluents released from the plant.

Again, this is due largely to the fact deer roam freely and consume a wide variety of vegetation*, and identifying what deer consume or where they consume it (e.g., which sector and distance from the plant) is nearly impossible. Additionally, the radionuclides identified in deer meat to date are widely found in the environment and originates from numerous sources including nuclear accidents, and atomic bomb testing and municipal waste.

The 2014 analysis results are indistinguishable from the control samples when adjusted for where the deer were reported taken (most were road kill). Within five miles of the plant the deer are considered indicator samples, and beyond 5 miles from the plant the deer are considered controls – as with all samples collected for REMP. However, as mentioned earlier, the REMP premise for sampling is based on knowing the samples are collected from locations where the host has been statically located. For the same reason, migratory fish, or migratory species of any nature, may be analyzed, but are unreliable for assessing the impact of plant effluents on man. Deer, as well as other migratory species, are not considered a reliable pathway for assessing the impact of SONGS effluents on man and will not be included in future sampling and analysis by the SONGS REMP, although performing analyses of deer for Camp Pendleton may continue as a courtesy.

*Radioactive material uptake by vegetation varies widely and is species dependent.

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.

REMP samples, both terrestrial and marine, indicated no accumulation of plant-related radioactivity in the environs. No samples exceeded investigation levels and, in fact, all samples with detectable activity were not statistically different from controls and were therefore attributed to non-plant-related sources such as past nuclear weapons fallout, Chernobyl, Fukushima, and medical iodine releases in sewage. As such, the operations of SONGS did not have any measurable effect on the environment.

The regulatory requirement to evaluate the relationship between quantities of radioactive materials released in effluents and the resultant radiation doses to individuals may be summarized by the following conclusion:

Effluent program releases are evaluated annually to determine the receptor(s) with the highest hypothetical dose. REMP samples collected through the year indicated no significant accumulation of plant-related radioactivity above control locations, therefore providing assurance that the effluent program projections are consistent with radiological environmental measurements. The concentrations of plant-related radioactivity in environmental samples were less than expected based on effluent release, further demonstrating program conservatism.

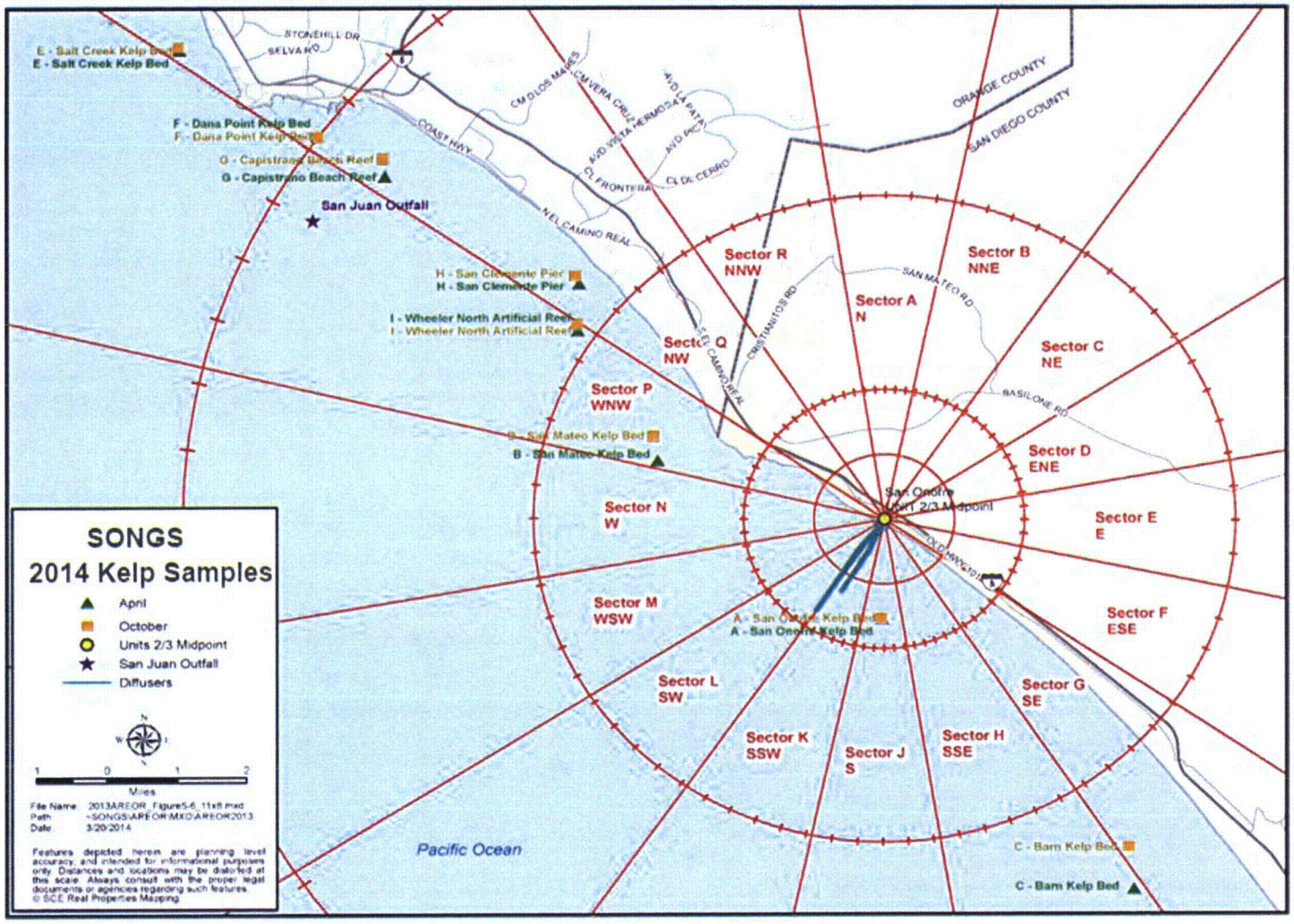

Figure 14. SONGS 2014 Kelp Sampling Zone

M. Statistical Summary of REMP Data For 2014

See following pages.

Table 17. Weekly Airborne Particulates Gross Beta Activity

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean (Range)		
Weekly Airborne Particulates Gross Beta Activity - Table 17 (pCi/cu.m)							
	Gross Beta 406	0.01	0.0345 (354/354) (0.0113 - 0.12)	San Luis Ray Substation (Control) 16.7 Mi. SE	0.0381 (42/42) (0.0176 - 2.44)	0.0381 (52/52) (0.0186 - 0.12)	0

Note: Power to Air Sampler #13 was terminated mid-week 7/25/14 causing high analytical result, sample 353710007 deleted from report result

Table 18. Weekly I-131 Activity

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean (Range)		
Weekly Radioiodine I-131 Activity - Table 18 (pCi/cu.m)							
	I-131 406	0.07	0.0136 (22/354) (0.0043 - 0.0286)	AWS Roof Parking 0.18 Mi. NW	0.0176 (3/52) (0.0117 - 0.0286)	0.0062 (2/52) (0.0056 - 0.0068)	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.

Table 19. Quarterly Compsite Airborne Particulates

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Quarterly Comp. Airborne Particulates Gamma - Table 19 (pCi/cu.m)							
Be-7	32		0.19 (28/28) (0.0894 - 0.25)	Former SONGS Evaporation Pond 0.6 Mi. NW	0.22 (4/4) (0.20 - 0.23)	0.21 (4/4) (0.18 - 0.23)	0
Co-60	32		4.41E-4 (1/28) (4.41E-4 - 4.41E-4)	City of San Clemente (City Hall) 5.1 Mi. NW	4.41E-4 (1/4) (4.41E-4 - 4.41E-4)	< LLD (0/4) (-)	0
Cs-134	32	0.05	6.37E-4 (2/28) (4.70E-4 - 8.03E-4)	Bluff 0.7 Mi. WNW	8.03E-4 (1/4) (8.03E-4 - 8.03E-4)	< LLD (0/4) (-)	0
Cs-137	32	0.06	9.92E-4 (1/28) (9.92E-4 - 9.92E-4)	State Beach Park 0.6 Mi. ESE	9.92E-4 (1/4) (9.92E-4 - 9.92E-4)	2.54E-4 (1/4) (2.54E-4 - 2.54E-4)	0
K-40	32		0.0089 (21/28) (0.0052 - 0.0123)	Marine Corp Base (Camp Pendleton East) 0.7 Mi. E	0.0108 (3/4) (0.0096 - 0.0123)	0.0075 (3/4) (0.0051 - 0.0097)	0
Mn-54	32		3.83E-4 (1/28) (3.83E-4 - 3.83E-4)	San Luis Rey Substation 16.7 Mi. SE	5.23E-4 (2/4) (3.34E-4 - 7.11E-4)	5.23E-4 (2/4) (3.34E-4 - 7.11E-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 2014.

The term "< LLD," as used, 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

Table 20. Monthly Ocean Water

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SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis - Table 20 (pCi/l)											
	Ba-140	52	15	< LLD (-)	(0/40)	(D) Newport Beach 30 Mi. NW	4.61 (4.61 - 4.61)	(1/12)	4.61 (4.61 - 4.61)	(1/12)	0
	Be-7	52		29.03 (20.80 - 42.30)	(3/40)	(C) Outfall - Unit 3 1.2 Mi. SSW	42.30 (42.30 - 42.30)	(1/12)	36.35 (31.20 - 41.50)	(2/12)	0
	Ce-144	52		18.90 (8.19 - 28.40)	(4/40)	(A) Station Discharge Outfall-Unit 1 0.6 Mi. SW	28.40 (28.40 - 28.40)	(1/12)	21.20 (19.30 - 23.10)	(2/12)	0
	Co-58	52	15	2.18 (1.53 - 2.82)	(2/40)	(D) Newport Beach 30 Mi. NW	3.01 (3.01 - 3.01)	(1/12)	3.01 (3.01 - 3.01)	(1/12)	0
	Co-60	52	15	2.75 (2.33 - 3.54)	(4/40)	(A) Station Discharge Outfall-Unit 1 0.6 Mi. SW	3.54 (3.54 - 3.54)	(1/12)	< LLD (-)	(0/12)	0
	Cr-51	52		31.25 (29.60 - 32.90)	(2/40)	(C) Outfall - Unit 3 1.2 Mi. SSW	31.25 (29.60 - 32.90)	(2/12)	10.90 (10.90 - 10.90)	(1/12)	0
	Cs-134	52	15	1.95 (1.95 - 1.95)	(1/40)	(B) Outfall - Unit 2 1.5 Mi. SW	1.95 (1.95 - 1.95)	(1/12)	< LLD (-)	(0/12)	0
	Cs-137	52	18	3.26 (2.43 - 4.58)	(5/40)	Unit 2 Conduit 0.1 Mi. SW	4.58 (4.58 - 4.58)	(1/2)	< LLD (-)	(0/12)	0
	Fe-59	52	30	4.38 (2.98 - 5.78)	(2/40)	(C) Outfall - Unit 3 1.2 Mi. SSW	5.78 (5.78 - 5.78)	(1/12)	4.77 (3.58 - 5.95)	(2/12)	0
	H-3	52	3000	331.00 (242.00 - 367.00)	(4/40)	(B) Outfall - Unit 2 1.5 Mi. SW	367.00 (367.00 - 367.00)	(1/12)	321.00 (321.00 - 321.00)	(1/12)	0
	I-131	52	15	2.80 (2.33 - 3.27)	(2/40)	(B) Outfall - Unit 2 1.5 Mi. SW	2.80 (2.33 - 3.27)	(2/12)	< LLD (-)	(0/12)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis - Table 20 (pCi/l)							
K-40	52		347.18 (40/40) (279.00 - 403.00)	(B) Outfall - Unit 2 1.5 Mi. SW	355.08 (12/12) (279.00 - 395.00)	336.58 (12/12) (292.00 - 390.00)	0
La-140	52	15	< LLD (0/40) (-)	(D) Newport Beach 30 Mi. NW	4.61 (1/12) (4.61 - 4.61)	4.61 (1/12) (4.61 - 4.61)	0
Mn-54	52	15	1.51 (1/40) (1.51 - 1.51)	(A) Station Discharge Outfall-Unit 1 0.6 Mi. SW	1.51 (1/12) (1.51 - 1.51)	< LLD (0/12) (-)	0
Mo-99	52		192.00 (3/40) (88.00 - 368.00)	(D) Newport Beach 30 Mi. NW	450.00 (1/12) (450.00 - 450.00)	450.00 (1/12) (450.00 - 450.00)	0
Nb-95	52	15	2.84 (6/40) (2.18 - 3.64)	(C) Outfall - Unit 3 1.2 Mi. SSW	3.05 (1/12) (3.05 - 3.05)	1.15 (1/12) (1.15 - 1.15)	0
Zn-65	52	30	4.89 (1/40) (4.89 - 4.89)	(C) Outfall - Unit 3 1.2 Mi. SSW	4.89 (1/12) (4.89 - 4.89)	< LLD (0/12) (-)	0
Zr-95	52	15	3.87 (3/40) (3.17 - 4.57)	(D) Newport Beach 30 Mi. NW	7.90 (2/12) (6.90 - 8.90)	7.90 (2/12) (6.90 - 8.90)	0

Table 21. Quarterly Composite Ocean Water Tritium Activity

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Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean		Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean (Range)		
Quarterly Composite Ocean Water Tritium Activity - Table 21 (pCi/l)							
	H-3 16	3000	322.67 (3/12) (287.00 - 358.00)	(C) Outfall - Unit 3 1.2 Mi. SSW	358.00 (1/4) (358.00 - 358.00)	330.00 (1/4) (330.00 - 330.00)	0

Table 22. Monthly Drinking Water Analysis

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis - Table 22 (pCi/l)							
Ba-140	29	15	3.86 (4/17) (1.89 - 6.39)	Oceanside (Control) 15.6 Mi. SE	6.65 (1/12) (6.65 - 6.65)	6.65 (1/12) (6.65 - 6.65)	0
Be-7	29		23.10 (1/17) (23.10 - 23.10)	San Clemente Golf Course Well 3.3 Mi. NW	23.10 (1/5) (23.10 - 23.10)	22.30 (1/12) (22.30 - 22.30)	0
Ce-144	29		21.40 (1/17) (21.40 - 21.40)	San Clemente Golf Course Well 3.3 Mi. NW	21.40 (1/5) (21.40 - 21.40)	< LLD (0/12) (-)	0
Co-57	29		< LLD (0/17) (-)	Oceanside (Control) 15.6 Mi. SE	1.79 (1/12) (1.79 - 1.79)	1.79 (1/12) (1.79 - 1.79)	0
Co-60	29	15	1.77 (2/17) (1.46 - 2.07)	Camp Pendleton 2.2 Mi. NNW	2.07 (1/12) (2.07 - 2.07)	< LLD (0/12) (-)	0
Cr-51	29		17.10 (2/17) (14.90 - 19.30)	Oceanside (Control) 15.6 Mi. SE	25.70 (2/12) (20.80 - 30.60)	25.70 (2/12) (20.80 - 30.60)	0
Cs-134	29	15	1.87 (2/17) (1.52 - 2.21)	Oceanside (Control) 15.6 Mi. SE	3.38 (1/12) (3.38 - 3.38)	3.38 (1/12) (3.38 - 3.38)	0
Cs-137	29	18	1.20 (1/17) (1.20 - 1.20)	Oceanside (Control) 15.6 Mi. SE	1.79 (1/12) (1.79 - 1.79)	1.79 (1/12) (1.79 - 1.79)	0
Fe-59	29	30	3.93 (2/17) (3.46 - 4.40)	Oceanside (Control) 15.6 Mi. SE	6.14 (1/12) (6.14 - 6.14)	6.14 (1/12) (6.14 - 6.14)	0
Gross Beta	29	4	2.51 (11/17) (0.69 - 5.05)	San Clemente Golf Course Well 3.3 Mi. NW	4.33 (4/5) (3.75 - 5.05)	3.26 (9/12) (1.59 - 4.84)	0
H-3	29	2000	381.67 (3/17) (343.00 - 415.00)	San Clemente Golf Course Well 3.3 Mi. NW	415.00 (1/5) (415.00 - 415.00)	301.00 (1/12) (301.00 - 301.00)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis - Table 22 (pCi/l)							
I-131	29	15	4.07 (1/17) (4.07 - 4.07)	San Clemente Golf Course Well 3.3 Mi. NW	4.07 (1/5) (4.07 - 4.07)	3.51 (1/12) (3.51 - 3.51)	0
K-40	29		44.45 (2/17) (26.70 - 62.20)	Camp Pendleton 2.2 Mi. NNW	44.45 (2/12) (26.70 - 62.20)	33.33 (3/12) (27.30 - 39.30)	0
La-140	29	15	3.86 (4/17) (1.89 - 6.39)	Oceanside (Control) 15.6 Mi. SE	6.65 (1/12) (6.65 - 6.65)	6.65 (1/12) (6.65 - 6.65)	0
Mn-54	29	15	3.27 (1/17) (3.27 - 3.27)	Camp Pendleton 2.2 Mi. NNW	3.27 (1/12) (3.27 - 3.27)	< LLD (0/12) (-)	0
Mo-99	29		< LLD (0/17) (-)	Oceanside (Control) 15.6 Mi. SE	145.00 (1/12) (145.00 - 145.00)	145.00 (1/12) (145.00 - 145.00)	0
Nb-95	29	15	2.98 (5/17) (2.43 - 4.09)	San Clemente Golf Course Well 3.3 Mi. NW	2.98 (1/5) (2.98 - 2.98)	2.14 (2/12) (0.97 - 3.32)	0
Ru-103	29		2.33 (1/17) (2.33 - 2.33)	Camp Pendleton 2.2 Mi. NNW	2.33 (1/12) (2.33 - 2.33)	< LLD (0/12) (-)	0
Ru-106	29		27.37 (3/17) (25.20 - 30.40)	Camp Pendleton 2.2 Mi. NNW	28.45 (2/12) (26.50 - 30.40)	23.10 (2/12) (21.10 - 25.10)	0
Sb-124	29		6.40 (3/17) (4.67 - 9.27)	Camp Pendleton 2.2 Mi. NNW	7.26 (2/12) (5.25 - 9.27)	< LLD (0/12) (-)	0
Sb-125	29		6.67 (1/17) (6.67 - 6.67)	Camp Pendleton 2.2 Mi. NNW	6.67 (1/12) (6.67 - 6.67)	< LLD (0/12) (-)	0
Se-75	29		2.57 (1/17) (2.57 - 2.57)	Camp Pendleton 2.2 Mi. NNW	2.57 (1/12) (2.57 - 2.57)	< LLD (0/12) (-)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis - Table 22 (pCi/l)											
	Te (I)-132	29		10.86 (4.52 - 17.20)	(2/17)	Oceanside (Control) 15.6 Mi. SE	13.15 (12.80 - 13.50)	(2/12)	13.15 (12.80 - 13.50)	(2/12)	0
	Zn-65	29	30	6.44 (6.44 - 6.44)	(1/17)	Camp Pendleton 2.2 Mi. NNW	6.44 (6.44 - 6.44)	(1/12)	< LLD (-)	(0/12)	0
	Zr-95	29	15	5.90 (4.94 - 6.94)	(3/17)	San Clemente Golf Course Well 3.3 Mi. NW	6.38 (5.81 - 6.94)	(2/5)	< LLD (-)	(0/12)	0

This table is a statistical summary of the analysis results confirmed above the *a posteriori* MDC in 2014 (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.

Table 23. Semi-annual Shoreline Sediment

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Medium or Pathway sampled (Unit of Measurement)	Type and Number of Analysis Performed	Total	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name, Distance and Direction	Mean (Range)	Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-annual Shoreline Sediment Gamma Spectral Analysis - Table 23 (pCi/g)									
	Ba-140	8		< LLD (0/6) (-)	Newport Beach North Enc 29.2 Mi. NW	0.0252 (1/2) (0.0252 - 0.0252)	0.0252 (0.0252 - 0.0252)	(1/2)	0
	Be-7	8		0.56 (1/6) (0.56 - 0.56)	San Onofre State Beach 3.5 Mi. SE	0.56 (1/2) (0.56 - 0.56)	< LLD (-)	(0/2)	0
	Ce-141	8		0.0280 (1/6) (0.0280 - 0.0280)	San Onofre Surfing Beact 0.8 Mi. WNW	0.0280 (1/2) (0.0280 - 0.0280)	< LLD (-)	(0/2)	0
	Ce-144	8		0.12 (2/6) (0.0718 - 0.17)	San Onofre State Beach 0.6 Mi. SE	0.17 (1/2) (0.17 - 0.17)	< LLD (-)	(0/2)	0
	Co-58	8		0.0703 (1/6) (0.0703 - 0.0703)	San Onofre State Beach 3.5 Mi. SE	0.0703 (1/2) (0.0703 - 0.0703)	< LLD (-)	(0/2)	0
	Co-60	8		0.0251 (1/6) (0.0251 - 0.0251)	Newport Beach North Enc 29.2 Mi. NW	0.0396 (1/2) (0.0396 - 0.0396)	0.0396 (0.0396 - 0.0396)	(1/2)	0
	Cs-134	8	0.15	0.0405 (2/6) (0.0214 - 0.0595)	San Onofre Surfing Beact 0.8 Mi. WNW	0.0595 (1/2) (0.0595 - 0.0595)	0.0376 (0.0376 - 0.0376)	(1/2)	0
	Cs-137	8	0.18	< LLD (0/6) (-)	Newport Beach North Enc 29.2 Mi. NW	0.0398 (1/2) (0.0398 - 0.0398)	0.0398 (0.0398 - 0.0398)	(1/2)	0
	Fe-59	8		0.0460 (1/6) (0.0460 - 0.0460)	San Onofre Surfing Beact 0.8 Mi. WNW	0.0460 (1/2) (0.0460 - 0.0460)	< LLD (-)	(0/2)	0
	K-40	8		13.31 (6/6) (9.85 - 15.80)	Newport Beach North Enc 29.2 Mi. NW	19.25 (2/2) (18.40 - 20.10)	19.25 (18.40 - 20.10)	(2/2)	0
	La-140	8		< LLD (0/6) (-)	Newport Beach North Enc 29.2 Mi. NW	0.0252 (1/2) (0.0252 - 0.0252)	0.0252 (0.0252 - 0.0252)	(1/2)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-annual Shoreline Sediment Gamma Spectral Analysis - Table 23 (pCi/g)							
Mn-54	8		0.0829 (1/6) (0.0829 - 0.0829)	San Onofre Surfing Beacl 0.8 Mi. WNW	0.0829 (1/2) (0.0829 - 0.0829)	< LLD (0/2) (-)	0
Nb-95	8		0.0191 (1/6) (0.0191 - 0.0191)	Newport Beach North Enc 29.2 Mi. NW	0.0246 (1/2) (0.0246 - 0.0246)	0.0246 (1/2) (0.0246 - 0.0246)	0
Sb-124	8		0.0670 (1/6) (0.0670 - 0.0670)	San Onofre State Beach 3.5 Mi. SE	0.0670 (1/2) (0.0670 - 0.0670)	< LLD (0/2) (-)	0
Te (I) -132	8		0.0406 (2/6) (0.0210 - 0.0601)	San Onofre Surfing Beacl 0.8 Mi. WNW	0.0601 (1/2) (0.0601 - 0.0601)	< LLD (0/2) (-)	0
Tl-208	8		0.11 (6/8) (0.0558 - 0.17)	Newport Beach North Enc 29.2 Mi. NW	0.26 (2/2) (0.19 - 0.33)	0.26 (2/2) (0.19 - 0.33)	0
U-234	8		0.34 (6/6) (0.14 - 0.45)	Newport Beach North Enc 29.2 Mi. NW	0.45 (2/2) (0.32 - 0.59)	0.45 (2/2) (0.32 - 0.59)	0
Zr-95	8		< LLD (0/8) (-)	Newport Beach North Enc 29.2 Mi. NW	0.0524 (2/2) (0.0472 - 0.0575)	0.0524 (2/2) (0.0472 - 0.0575)	0

During 2014 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 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 2014 (K-40 and Th-228) as well as those radionuclides listed in the ODCM.

Table 24. Deer tissue and bone

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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		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean (Range)			
Deer meat / liver / bone Table 24 (pCi/g)									
Deer	Cs-134	30		0.0017 (1/3) (0.0017 - 0.0017)	Deer Control meat Mi.	0.0050 (5/27) (0.0025 - 0.0094)	0.0050 (5/27) (0.0025 - 0.0094)		0
Deer	Cs-137	30		< LLD (0/3) (-)	Deer Control meat Mi.	0.0038 (10/27) (0.0015 - 0.0092)	0.0038 (10/27) (0.0015 - 0.0092)		0
Deer	K-40	30		3.03 (3/3) (2.66 - 3.44)	Deer Control meat Mi.	3.19 (27/27) (2.42 - 3.62)	3.19 (27/27) (2.42 - 3.62)		0
Deer	Sr-90	30		0.0809 (2/3) (0.0640 - 0.0977)	Deer Control bone Mi.	0.17 (9/27) (0.0788 - 0.35)	0.17 (9/27) (0.0788 - 0.35)		0

One deer muscle / bone sample was confirmed above the *a posteriori* MDC. All samples contained naturally occurring K-40. Cs-137 was below the MDC.

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

Table 25. Semi-annual Ocean Bottome Sediment

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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		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean (Range)			
Semi-annual Ocean Bottom Sediment Gamma Spectral Analysis - Table 25 (pCi/g)									
	Ag-110m	14		0.0280 (1/12) (0.0280 - 0.0280)	Unit 2 Conduit 0.1 Mi. SW	0.0280 (1/2) (0.0280 - 0.0280)	< LLD (-)	(0/2)	0
	Be-7	14		0.29 (2/12) (0.20 - 0.38)	(F) SONGS Upcoast 0.9 Mi. WSW	0.38 (1/2) (0.38 - 0.38)	0.19 (0.19 - 0.19)	(1/2)	0
	Bi-214	14		0.64 (12/12) (0.32 - 1.01)	(F) SONGS Upcoast 0.9 Mi. WSW	0.96 (2/2) (0.90 - 1.01)	0.41 (0.39 - 0.43)	(2/2)	0
	Ce-144	14		0.10 (1/12) (0.10 - 0.10)	(D) Unit 3 Outfall 1.2 Mi. SSW	0.10 (1/2) (0.10 - 0.10)	< LLD (-)	(0/2)	0
	Co-60	14		0.0271 (1/12) (0.0271 - 0.0271)	(C) Unit 2 Outfall 1.6 Mi. SW	0.0271 (1/2) (0.0271 - 0.0271)	< LLD (-)	(0/2)	0
	Cr-51	14		0.27 (1/12) (0.27 - 0.27)	(E) Laguna Beach 18.2 Mi. NW	0.27 (1/2) (0.27 - 0.27)	0.27 (0.27 - 0.27)	(1/2)	0
	Cs-134	14	0.15	0.0503 (9/12) (0.0302 - 0.0928)	(B) Unit 1 Outfall 0.8 Mi. SSW	0.0762 (1/2) (0.0762 - 0.0762)	< LLD (-)	(0/2)	0
	Cs-137	14	0.18	0.0224 (2/12) (0.0210 - 0.0237)	(D) Unit 3 Outfall 1.2 Mi. SSW	0.0237 (1/2) (0.0237 - 0.0237)	< LLD (-)	(0/2)	0
	K-40	14		15.92 (12/12) (14.40 - 18.20)	Unit 2 Conduit 0.1 Mi. SW	17.65 (2/2) (17.10 - 18.20)	17.55 (17.40 - 17.70)	(2/2)	0
	Mn-54	14		0.0414 (1/12) (0.0414 - 0.0414)	Unit 2 Conduit 0.1 Mi. SW	0.0414 (1/2) (0.0414 - 0.0414)	< LLD (-)	(0/2)	0
	Nb-95	14		0.0297 (5/12) (0.0186 - 0.0545)	Unit 3 Conduit 0.1 Mi. SSW	0.0545 (1/2) (0.0545 - 0.0545)	< LLD (-)	(0/2)	0

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Semi-annual Ocean Bottom Sediment Gamma Spectral Analysis - Table 25 (pCi/g)							
Ru-103	14		0.0203 (1/12) (0.0203 - 0.0203)	(D) Unit 3 Outfall 1.2 Mi. SSW	0.0203 (1/2) (0.0203 - 0.0203)	< LLD (0/2) (-)	0
Ru-106	14		0.23 (1/12) (0.23 - 0.23)	Unit 3 Conduit 0.1 Mi. SSW	0.23 (1/2) (0.23 - 0.23)	< LLD (0/2) (-)	0
Se-75	14		0.0420 (2/12) (0.0351 - 0.0488)	(C) Unit 2 Outfall 1.6 Mi. SW	0.0488 (1/2) (0.0488 - 0.0488)	< LLD (0/2) (-)	0
Te (I) -132	14		< LLD (0/12) (-)	(E) Laguna Beach 18.2 Mi. NW	0.0536 (1/2) (0.0536 - 0.0536)	0.0536 (1/2) (0.0536 - 0.0536)	0
U-234	14		0.64 (12/12) (0.32 - 1.01)	(F) SONGS Upcoast 0.9 Mi. WSW	0.96 (2/2) (0.90 - 1.01)	0.41 (2/2) (0.39 - 0.43)	0

During 2014 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

Table 26. Semi-annual Non-migratory Marine Animals (flesh) Analysis

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 26 (pCi/g)								
Black Perch	Ag-108m	4		< LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0049 (1/2) (0.0049 - 0.0049)	0.0049 (1/2) (0.0049 - 0.0049)	0
Black Perch	Co-57	4		< LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0084 (1/2) (0.0084 - 0.0084)	0.0084 (1/2) (0.0084 - 0.0084)	0
Black Perch	Cr-51	4		0.11 (1/2) (0.11 - 0.11)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.11 (1/1) (0.11 - 0.11)	< LLD (0/2) (-)	0
Black Perch	Cs-137	4	0.15	0.0075 (1/2) (0.0075 - 0.0075)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0075 (1/1) (0.0075 - 0.0075)	< LLD (0/2) (-)	0
Black Perch	Fe-59	4	0.26	0.0135 (2/2) (0.0106 - 0.0164)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0164 (1/1) (0.0164 - 0.0164)	< LLD (0/2) (-)	0
Black Perch	K-40	4		3.46 (2/2) (3.15 - 3.77)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	3.77 (1/1) (3.77 - 3.77)	3.02 (2/2) (2.94 - 3.09)	0
Black Perch	Ru-106	4		< LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0507 (1/2) (0.0507 - 0.0507)	0.0507 (1/2) (0.0507 - 0.0507)	0
Black Perch	Sb-124	4		0.0208 (1/2) (0.0208 - 0.0208)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0208 (1/1) (0.0208 - 0.0208)	< LLD (0/2) (-)	0
Black Perch	Se-75	4		< LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0077 (1/2) (0.0077 - 0.0077)	0.0077 (1/2) (0.0077 - 0.0077)	0
Black Perch	Zr-95	4		< LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0095 (1/2) (0.0095 - 0.0095)	0.0095 (1/2) (0.0095 - 0.0095)	0
California Mussel	Be-7	6		< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0470 (1/2) (0.0470 - 0.0470)	0.0470 (1/2) (0.0470 - 0.0470)	0

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 26 (pCi/g)									
California Mussel	Co-60	6	0.13	0.0050 (1/4) (0.0050 - 0.0050)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0050 (1/2) (0.0050 - 0.0050)	< LLD (-)	(0/2)	0
California Mussel	Cr-51	6		0.0294 (1/4) (0.0294 - 0.0294)	(C) Laguna Beach 18.2 Mi. NW	0.0796 (1/2) (0.0796 - 0.0796)	0.0796 (0.0796 - 0.0796)	(1/2)	0
California Mussel	K-40	6		1.66 (4/4) (1.48 - 1.98)	(A) Unit 1 Outfall 0.9 Mi. WSW	1.73 (2/2) (1.48 - 1.98)	1.37 (1.26 - 1.48)	(2/2)	0
California Mussel	Mn-54	6	0.13	0.0049 (1/4) (0.0049 - 0.0049)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0049 (1/2) (0.0049 - 0.0049)	< LLD (-)	(0/2)	0
California Mussel	Nb-95	6		0.0055 (2/4) (0.0045 - 0.0065)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0065 (1/2) (0.0065 - 0.0065)	< LLD (-)	(0/2)	0
California Mussel	Ru-103	6		0.0064 (1/4) (0.0064 - 0.0064)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0064 (1/2) (0.0064 - 0.0064)	< LLD (-)	(0/2)	0
California Mussel	Sb-124	6		0.0078 (1/4) (0.0078 - 0.0078)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0078 (1/2) (0.0078 - 0.0078)	< LLD (-)	(0/2)	0
California Mussel	Zr-95	6		0.0179 (1/4) (0.0179 - 0.0179)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0179 (1/2) (0.0179 - 0.0179)	< LLD (-)	(0/2)	0
Kelp Bass	Ag-110m	2		0.0146 (1/2) (0.0146 - 0.0146)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0146 (1/1) (0.0146 - 0.0146)	< LLD (-)	(0/0)	0
Kelp Bass	K-40	2		3.43 (2/2) (3.18 - 3.68)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	3.68 (1/1) (3.68 - 3.68)	< LLD (-)	(0/0)	0
Kelp Bass	Sb-125	2		0.0113 (1/2) (0.0113 - 0.0113)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0113 (1/1) (0.0113 - 0.0113)	< LLD (-)	(0/0)	0

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 26 (pCi/g)								
Kelp Bass	Zr-95	2		0.0151 (1/2) (0.0151 - 0.0151)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0151 (1/1) (0.0151 - 0.0151)	< LLD (0/0) (-)	0
Sheephead	Ce-144	4		< LLD (0/2) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0420 (1/2) (0.0420 - 0.0420)	0.0420 (1/2) (0.0420 - 0.0420)	0
Sheephead	Cs-137	4	0.15	0.0084 (2/2) (0.0069 - 0.0099)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0099 (1/1) (0.0099 - 0.0099)	0.0064 (1/2) (0.0064 - 0.0064)	0
Sheephead	K-40	4		3.66 (2/2) (3.62 - 3.70)	(C) Laguna Beach 18.2 Mi. NW	3.72 (2/2) (3.62 - 3.82)	3.72 (2/2) (3.62 - 3.82)	0
Sheephead	Ru-106	4		0.0323 (1/2) (0.0323 - 0.0323)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0323 (1/1) (0.0323 - 0.0323)	< LLD (0/2) (-)	0
Sheephead	Sb-124	4		0.0067 (1/2) (0.0067 - 0.0067)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0067 (1/1) (0.0067 - 0.0067)	< LLD (0/2) (-)	0
Sheephead	Se-75	4		0.0045 (1/2) (0.0045 - 0.0045)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0045 (1/1) (0.0045 - 0.0045)	< LLD (0/2) (-)	0
Sand Bass	Cs-134	2	0.13	0.0112 (1/2) (0.0112 - 0.0112)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0112 (1/1) (0.0112 - 0.0112)	< LLD (0/0) (-)	0
Sand Bass	Cs-137	2	0.15	0.0061 (1/2) (0.0061 - 0.0061)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0061 (1/1) (0.0061 - 0.0061)	< LLD (0/0) (-)	0
Sand Bass	I-131	2		0.0091 (1/2) (0.0091 - 0.0091)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0091 (1/1) (0.0091 - 0.0091)	< LLD (0/0) (-)	0
Sand Bass	K-40	2		4.00 (2/2) (3.84 - 4.15)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	4.15 (1/1) (4.15 - 4.15)	< LLD (0/0) (-)	0

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					Name, Distance and Direction	Mean (Range)			
Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 26 (pCi/g)									
Sand Bass	Zr-95	2		0.0117 (1/2) (0.0117 - 0.0117)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0117 (1/1) (0.0117 - 0.0117)	< LLD (-)	(0/0)	0
Spiny Lobster	Ag-108m	6		< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0029 (1/2) (0.0029 - 0.0029)	0.0029 (0.0029 - 0.0029)	(1/2)	0
Spiny Lobster	Ag-110m	6		0.0035 (1/4) (0.0035 - 0.0035)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0035 (1/2) (0.0035 - 0.0035)	< LLD (-)	(0/2)	0
Spiny Lobster	Ba-140	6		0.0060 (1/4) (0.0060 - 0.0060)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0060 (1/2) (0.0060 - 0.0060)	< LLD (-)	(0/2)	0
Spiny Lobster	Ce-141	6		0.0051 (1/4) (0.0051 - 0.0051)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0051 (1/2) (0.0051 - 0.0051)	< LLD (-)	(0/2)	0
Spiny Lobster	Co-57	6		0.0020 (1/4) (0.0020 - 0.0020)	(C) Laguna Beach 18.2 Mi. NW	0.0044 (1/2) (0.0044 - 0.0044)	0.0044 (0.0044 - 0.0044)	(1/2)	0
Spiny Lobster	Co-60	6	0.13	0.0036 (1/4) (0.0036 - 0.0036)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0036 (1/2) (0.0036 - 0.0036)	< LLD (-)	(0/2)	0
Spiny Lobster	Fe-59	6	0.26	< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0142 (1/2) (0.0142 - 0.0142)	0.0142 (0.0142 - 0.0142)	(1/2)	0
Spiny Lobster	K-40	6		3.41 (4/4) (3.13 - 3.58)	(C) Laguna Beach 18.2 Mi. NW	3.98 (2/2) (3.89 - 4.07)	3.98 (3.89 - 4.07)	(2/2)	0
Spiny Lobster	La-140	6		0.0060 (1/4) (0.0060 - 0.0060)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0060 (1/2) (0.0060 - 0.0060)	< LLD (-)	(0/2)	0
Spiny Lobster	Mn-54	6	0.13	0.0036 (2/4) (0.0031 - 0.0041)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0041 (1/2) (0.0041 - 0.0041)	< LLD (-)	(0/2)	0

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 26 (pCi/g)								
Spiny Lobster	Se-75	6		< LLD (0/4) (-)	(C) Laguna Beach 18.2 Mi. NW	0.0057 (1/2) (0.0057 - 0.0057)	0.0057 (1/2) (0.0057 - 0.0057)	0
Spiny Lobster	Tl-208	6		0.0038 (1/4) (0.0038 - 0.0038)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0038 (1/2) (0.0038 - 0.0038)	< LLD (0/2) (-)	0
Spiny Lobster	Zr-95	6		0.0041 (1/4) (0.0041 - 0.0041)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0041 (1/2) (0.0041 - 0.0041)	< LLD (0/2) (-)	0

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

Table 27. Annual Soil Analysis – Depth 3"

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Annual Soil Analysis - Depth 3' - Table 27 (pCi/g)							
Be-7	5		0.25 (1/4) (0.25 - 0.25)	Basilone Road/ I-5 Freeway Off ramp 2 Mi. NW	0.25 (1/1) (0.25 - 0.25)	< LLD (0/1) (-)	0
Co-57	5		0.0198 (1/4) (0.0198 - 0.0198)	Camp San Onofre 2.6 Mi. NE	0.0198 (1/1) (0.0198 - 0.0198)	< LLD (0/1) (-)	0
Co-58	5		0.0252 (2/4) (0.0208 - 0.0295)	Prince of Peace Abbey 15 Mi. SE	0.0610 (1/1) (0.0610 - 0.0610)	0.0610 (1/1) (0.0610 - 0.0610)	0
Co-60	5		0.0394 (1/4) (0.0394 - 0.0394)	Old Route 101 - East Southeast 3 Mi. ESE	0.0394 (1/1) (0.0394 - 0.0394)	< LLD (0/1) (-)	0
Cr-51	5		0.21 (1/4) (0.21 - 0.21)	Old Route 101 - East Southeast 3 Mi. ESE	0.21 (1/1) (0.21 - 0.21)	< LLD (0/1) (-)	0
Cs-134	5	0.15	0.0549 (2/4) (0.0454 - 0.0644)	Camp San Onofre 2.6 Mi. NE	0.0644 (1/1) (0.0644 - 0.0644)	0.0573 (1/1) (0.0573 - 0.0573)	0
Cs-137	5	0.18	0.0966 (3/4) (0.0381 - 0.17)	Prince of Peace Abbey 15 Mi. SE	0.19 (1/1) (0.19 - 0.19)	0.19 (1/1) (0.19 - 0.19)	0
K-40	5		13.84 (4/4) (6.85 - 19.10)	Camp San Onofre 2.6 Mi. NE	19.10 (1/1) (19.10 - 19.10)	8.93 (1/1) (8.93 - 8.93)	0
Mn-54	5		0.0338 (1/4) (0.0338 - 0.0338)	Camp San Onofre 2.6 Mi. NE	0.0338 (1/1) (0.0338 - 0.0338)	< LLD (0/1) (-)	0
Mo-99	5		< LLD (0/4) (-)	Prince of Peace Abbey 15 Mi. SE	1.28 (1/1) (1.28 - 1.28)	1.28 (1/1) (1.28 - 1.28)	0
Ru-106	5		< LLD (0/4) (-)	Prince of Peace Abbey 15 Mi. SE	0.79 (1/1) (0.79 - 0.79)	0.79 (1/1) (0.79 - 0.79)	0

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Annual Soil Analysis - Depth 3' - Table 27 (pCi/g)							
	Sb-124 5		0.0583 (1/4) (0.0583 - 0.0583)	Old Route 101 - East Southeast 3 Mi. ESE	0.0583 (1/1) (0.0583 - 0.0583)	< LLD (0/1) (-)	0
	U-234 5		0.49 (4/4) (0.27 - 0.70)	Camp San Onofre 2.6 Mi. NE	0.70 (1/1) (0.70 - 0.70)	0.34 (1/1) (0.34 - 0.34)	0

Cs-137 (Cesium 137) was below the LLD in both indicators and the controls.

Table 28. Semi-annual Kelp Analysis

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Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Kelp Analysis - Table 28 (pCi/g)							
Ag-110m	8		< LLD (0/6) (-)	(E) Salt Creek (CONTROL) 11 Mi. NNW	0.0062 (1/2) (0.0062 - 0.0062)	0.0062 (1/2) (0.0062 - 0.0062)	0
Ba-140	8		0.0070 (2/6) (0.0062 - 0.0078)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0078 (1/2) (0.0078 - 0.0078)	< LLD (0/2) (-)	0
Ce-141	8		0.0113 (1/6) (0.0113 - 0.0113)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0113 (1/2) (0.0113 - 0.0113)	< LLD (0/2) (-)	0
Co-57	8		0.0063 (1/6) (0.0063 - 0.0063)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0063 (1/2) (0.0063 - 0.0063)	< LLD (0/2) (-)	0
Cr-51	8		0.0671 (1/6) (0.0671 - 0.0671)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0671 (1/2) (0.0671 - 0.0671)	< LLD (0/2) (-)	0
Cs-134	8	0.06	0.0071 (2/6) (0.0056 - 0.0086)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0071 (2/2) (0.0056 - 0.0086)	< LLD (0/2) (-)	0
Cs-137	8	0.08	0.0056 (2/6) (0.0047 - 0.0066)	(E) Salt Creek (CONTROL) 11 Mi. NNW	0.0071 (1/2) (0.0071 - 0.0071)	0.0071 (1/2) (0.0071 - 0.0071)	0
I-131	8	0.06	0.0434 (5/6) (0.0057 - 0.0711)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0602 (1/2) (0.0602 - 0.0602)	0.0573 (2/2) (0.0150 - 0.0995)	0
K-40	8		9.85 (6/6) (7.79 - 10.70)	(E) Salt Creek (CONTROL) 11 Mi. NNW	12.95 (2/2) (12.40 - 13.50)	12.95 (2/2) (12.40 - 13.50)	0
La-140	8		0.0070 (2/6) (0.0062 - 0.0078)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0078 (1/2) (0.0078 - 0.0078)	< LLD (0/2) (-)	0
Nb-95	8		< LLD (0/6) (-)	(E) Salt Creek (CONTROL) 11 Mi. NNW	0.0060 (1/2) (0.0060 - 0.0060)	0.0060 (1/2) (0.0060 - 0.0060)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Number of Analysis Performed	Total	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean Name. Distance and Direction	Mean (Range)	Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Kelp Analysis - Table 28 (pCi/g)									
	Se-75	8		0.0043 (1/6) (0.0043 - 0.0043)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0043 (1/2) (0.0043 - 0.0043)	< LLD (-)	(0/2)	0
	Te (I) -132	8		0.0203 (1/6) (0.0203 - 0.0203)	(A) San Onofre Kelp Bed 1.5 Mi. S	0.0203 (1/2) (0.0203 - 0.0203)	< LLD (-)	(0/2)	0
	U-234	8		< LLD (0/6) (-)	(E) Salt Creek (CONTROL) 11 Mi. NNW	0.0164 (1/2) (0.0164 - 0.0164)	0.0164 (0.0164 - 0.0164)	(1/2)	0
	Zn-65	8		0.0622 (1/6) (0.0622 - 0.0622)	(B) San Mateo Kelp Bed 3.8 Mi. WNW	0.0622 (1/2) (0.0622 - 0.0622)	< LLD (-)	(0/2)	0

During 2014, naturally occurring K-40 (6 of 6)-was confirmed above the *a posteriori* MDC in kelp samples. I-131 (iodine 131) was also confirmed above the *a posteriori* MDC in 3 of 6 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.

Table 29. Semi-Annual Local Crops

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/2014 To 12/31/2014

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis - Table 29 (pCi/g)							
Sorrel	Be-7	4	0.27 (1/2) (0.27 - 0.27)	SONGS Garden 0.4 Mi. NNW	0.27 (1/2) (0.27 - 0.27)	0.12 (1/2) (0.12 - 0.12)	0
Sorrel	Cs-134	4	0.06 < LLD (0/2) (-)		--- (0/2) (-)	< LLD (0/2) (-)	0
Sorrel	Cs-137	4	0.08 < LLD (0/2) (-)		--- (0/2) (-)	< LLD (0/2) (-)	0
Sorrel	I-131	4	0.06 < LLD (0/2) (-)		--- (0/2) (-)	< LLD (0/2) (-)	0
Sorrel	K-40	4	4.73 (2/2) (4.55 - 4.90)	SONGS Garden 0.4 Mi. NNW	4.73 (2/2) (4.55 - 4.90)	3.21 (2/2) (2.31 - 4.11)	0
Tomato	Be-7	4	< LLD (0/2) (-)		--- (0/2) (-)	< LLD (0/2) (-)	0
Tomato	Cs-134	4	0.06 < LLD (0/2) (-)		--- (0/2) (-)	< LLD (0/2) (-)	0
Tomato	Cs-137	4	0.08 0.0031 (1/2) (0.0031 - 0.0031)	South East of Oceanside 22 Mi. SE	0.0086 (1/2) (0.0086 - 0.0086)	0.0086 (1/2) (0.0086 - 0.0086)	0
Tomato	I-131	4	0.06 < LLD (0/2) (-)		---- (0/2) (-)	< LLD (0/2) (-)	0
Tomato	K-40	4	2.33 (2/2) (2.19 - 2.47)	SONGS Garden 0.4 Mi. NNW	2.33 (2/2) (2.19 - 2.47)	2.03 (2/2) (1.66 - 2.40)	0

During 2014, 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 Sorrel samples. The term "< LLD," used above, indicates that all analysis results were less than the critical level (1.64 x one sigma). The critical level is used to determine if a bias exists in the database and is not used to determine if a particular analysis result should be considered as other than background.

Appendix C. Summary of Quality Control Programs

A. Summary

All REMP samples are collected, shipped, and analyzed in accordance with NRC Regulatory Guide 4.15 Rev. 1. 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 2014 the CEAL was General Engineering Laboratory (GEL). The CEAL for REMP TLDs was Stanford Dosimetry.

B. 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 2014 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. Rev.1.

C. 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.

Table 30. 2014 Quarterly Duplicate TLD Data Comparsions

TLD #	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER
TLD 66	14.1 ± 0.77	13.1 ± 0.88	14.3 ± 0.88	13.0 ± 0.59
TLD 200	15.2 ± 1.01	13.5 ± 0.71	14.1 ± 1.00	13.5 ± 0.67

Data is reported as mrem per standard quarter ± 1 sigma

D. Annual Duplicate TLDs

Table 31. 2014 An annual duplicate TLD package is collocated with TLD 67

TLD 67 average exposure in mrem per standard quarter (July 2013 to July 2014)	TLD 201 (annual duplicate) exposure in mrem per standard quarter (July 2013 to July 2014)
16.7	15.9

Table 32. PIC data converted to mrem per standard quarter to the 4th Quarter co-located 2014 TLD data

Comparison of Pressurized Ion Chamber and Thermoluminescent Dosimeter 2014 Quarterly Measurements			
PIC 3	PIC 4	PIC 5	PIC 8
17.8	16.0	15.3	16.0
TLD 40	TLD 61	TLD 63	TLD 65
18.2	15.5	13.2	14.1

E. Calibration of Air Sampler Volume Meters

Air samplers undergo annual calibration 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.

F. Analytical Laboratory Cross Check Program Summary

See following pages.

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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

First Quarter 2014
(Ref. Date 20-Mar-2014)

L. Tk 16 May 14

Levan Tkavadze, Nuclear Metrologist Date

ANA Form002 Rev. —

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E10846	I-131	7.83E+01 pCi	1.05E+00	7.52E+01 pCi	1.26E+00	1.04
I-131						
Cartridge						
GEL ID						
345134001						
E10847	Sr-89	9.14E+01 pCi/L	9.12E-01	9.17E+01 pCi/L	1.53E+00	1.00
Sr-89/90	Sr-90	1.27E+01 pCi/L	2.71E-01	1.51E+01 pCi/L	2.52E-01	0.84
Milk						
GEL ID						
345134002						
E10848	I-131	9.81E+01 pCi/L	3.82E+00	9.85E+01 pCi/L	1.65E+00	1.00
Gamma	Ce-141	1.21E+02 pCi/L	3.61E+00	1.19E+02 pCi/L	1.98E+00	1.02
Milk	Cr-51	5.19E+02 pCi/L	2.12E+01	4.91E+02 pCi/L	8.20E+00	1.06
	Cs-134	1.79E+02 pCi/L	3.77E+00	2.10E+02 pCi/L	3.51E+00	0.85
	Cs-137	2.55E+02 pCi/L	3.95E+00	2.53E+02 pCi/L	4.22E+00	1.01
	Co-58	2.58E+02 pCi/L	4.02E+00	2.68E+02 pCi/L	4.47E+00	0.96
GEL ID	Mn-54	3.01E+02 pCi/L	4.20E+00	2.97E+02 pCi/L	4.96E+00	1.01
345134003	Fe-59	2.24E+02 pCi/L	6.55E+00	2.19E+02 pCi/L	3.65E+00	1.02
	Zn-65	3.45E+02 pCi/L	8.37E+00	3.23E+02 pCi/L	5.39E+00	1.07
	Co-60	3.39E+02 pCi/L	4.73E+00	3.37E+02 pCi/L	5.63E+00	1.01

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E10849	I-131	9.24E+01 pCi/L	3.70E+00	8.99E+01 pCi/L	1.50E+00	1.03
Gamma	Ce-141	8.19E+01 pCi/L	4.34E+00	7.71E+01 pCi/L	1.29E+00	1.06
Water	Cr-51	3.32E+02 pCi/L	1.79E+01	3.19E+02 pCi/L	5.32E+00	1.04
	Cs-134	1.27E+02 pCi/L	3.65E+00	1.36E+02 pCi/L	2.28E+00	0.93
	Cs-137	1.69E+02 pCi/L	3.74E+00	1.64E+02 pCi/L	2.74E+00	1.03
	Co-58	1.75E+02 pCi/L	3.45E+00	1.74E+02 pCi/L	2.90E+00	1.01
GEL ID	Mn-54	2.08E+02 pCi/L	3.95E+00	1.93E+02 pCi/L	3.22E+00	1.08
345134004	Fe-59	1.68E+02 pCi/L	6.15E+00	1.42E+02 pCi/L	2.37E+00	1.18
	Zn-65	2.25E+02 pCi/L	6.85E+00	2.10E+02 pCi/L	3.50E+00	1.07
	Co-60	2.31E+02 pCi/L	4.05E+00	2.19E+02 pCi/L	3.65E+00	1.06

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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

Second Quarter 2014
(Ref. Date12-Jun-2014)

L. Tk 31 Jul 14

Levan Tkavadze, Nuclear Metrologist Date

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E10897	I-131	8.73E+01 pCi	2.42E+00	8.54E+01 pCi	1.43E+00	1.02
I-131 Cartridge						
GEL ID 350708001						
E10898	Sr-89	9.84E+01 pCi/L	8.92E-01	9.13E+01 pCi/L	1.52E+00	1.08
Gamma	Sr-90	1.44E+01 pCi/L	3.19E-01	1.45E+01 pCi/L	2.43E-01	0.99
Milk						
GEL ID 350708002						
E10899	I-131	9.89E+01 pCi/L	5.68E+00	9.09E+01 pCi/L	1.52E+00	1.09
Gamma	Ce-141	1.38E+02 pCi/L	5.62E+00	1.24E+02 pCi/L	2.07E+00	1.12
Milk	Cr-51	2.68E+02 pCi/L	2.55E+01	2.53E+02 pCi/L	4.23E+00	1.06
	Cs-134	1.58E+02 pCi/L	5.58E+00	1.62E+02 pCi/L	2.71E+00	0.97
GEL ID	Cs-137	1.27E+02 pCi/L	5.01E+00	1.20E+02 pCi/L	2.00E+00	1.06
350708003	Co-58	1.20E+02 pCi/L	4.53E+00	1.12E+02 pCi/L	1.88E+00	1.07
	Mn-54	1.67E+02 pCi/L	5.01E+00	1.56E+02 pCi/L	2.60E+00	1.07
	Fe-59	1.02E+02 pCi/L	7.95E+00	1.02E+02 pCi/L	1.71E+00	1.00
	Zn-65	2.68E+02 pCi/L	1.07E+01	2.52E+02 pCi/L	4.22E+00	1.06
	Co-60	2.42E+02 pCi/L	5.52E+00	2.24E+02 pCi/L	3.74E+00	1.08

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E10900	I-131	1.13E+02 pCi/L	5.10E+00	9.83E+01 pCi/L	1.64E+00	1.15
Gamma	Ce-141	1.52E+02 pCi/L	4.52E+00	1.43E+02 pCi/L	2.40E+00	1.06
Water	Cr-51	3.62E+02 pCi/L	2.71E+01	2.94E+02 pCi/L	4.91E+00	1.23
	Cs-134	1.69E+02 pCi/L	4.61E+00	1.88E+02 pCi/L	3.14E+00	0.90
GEL ID	Cs-137	1.48E+02 pCi/L	4.79E+00	1.39E+02 pCi/L	2.32E+00	1.06
350708004	Co-58	1.34E+02 pCi/L	4.14E+00	1.30E+02 pCi/L	2.17E+00	1.03
	Mn-54	1.88E+02 pCi/L	4.78E+00	1.80E+02 pCi/L	3.01E+00	1.04
	Fe-59	1.29E+02 pCi/L	7.94E+00	1.19E+02 pCi/L	1.98E+00	1.09
	Zn-65	3.29E+02 pCi/L	9.86E+00	2.93E+02 pCi/L	4.89E+00	1.12
	Co-60	2.74E+02 pCi/L	5.46E+00	2.60E+02 pCi/L	4.34E+00	1.05

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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

Third Quarter 2014
(Ref. Date 11-Sep-2014)

L. Tk 4 Nov 14

Levan Tkavadze, Nuclear Metrologist Date

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E10993	I-131	9.47E+01 pCi	4.04E+00	8.99E+01 pCi	1.50E+00	1.05
I-131						
Cartridge						
GEL ID						
356613001						
E10994	Sr-89	9.73E+01 pCi/L	7.80E+00	9.69E+01 pCi/L	1.62E+00	1.00
Sr-89/90	Sr-90	1.31E+01 pCi/L	1.28E+00	1.64E+01 pCi/L	2.74E-01	0.80
Milk						
GEL ID						
356613002						
E10995	I-131	1.04E+02 pCi/L	5.52E+00	9.76E+01 pCi/L	1.63E+00	1.07
Gamma	Ce-141	1.28E+02 pCi/L	6.48E+00	1.26E+02 pCi/L	2.11E+00	1.01
Milk	Cr-51	3.12E+02 pCi/L	2.50E+01	2.88E+02 pCi/L	4.82E+00	1.08
	Cs-134	1.51E+02 pCi/L	8.69E+00	1.58E+02 pCi/L	2.63E+00	0.96
	Cs-137	2.03E+02 pCi/L	9.82E+00	1.93E+02 pCi/L	3.23E+00	1.05
	Co-58	1.44E+02 pCi/L	8.21E+00	1.43E+02 pCi/L	2.39E+00	1.01
GEL ID	Mn-54	1.49E+02 pCi/L	8.58E+00	1.42E+02 pCi/L	2.37E+00	1.05
356613003	Fe-59	1.82E+02 pCi/L	1.89E+01	1.58E+02 pCi/L	2.64E+00	1.15
	Zn-65	7.41E+01 pCi/L	9.60E+00	7.30E+01 pCi/L	1.22E+00	1.01
	Co-60	3.14E+02 pCi/L	1.42E+01	2.97E+02 pCi/L	4.97E+00	1.06

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E10996	I-131	1.02E+02 pCi/L	5.44E+00	9.88E+01 pCi/L	1.65E+00	1.03
Gamma	Ce-141	1.30E+02 pCi/L	6.61E+00	1.25E+02 pCi/L	2.09E+00	1.04
Water	Cr-51	2.75E+02 pCi/L	2.22E+01	2.86E+02 pCi/L	4.78E+00	0.96
	Cs-134	1.45E+02 pCi/L	8.34E+00	1.56E+02 pCi/L	2.61E+00	0.93
	Cs-137	1.94E+02 pCi/L	9.22E+00	1.92E+02 pCi/L	3.20E+00	1.01
	Co-58	1.43E+02 pCi/L	8.51E+00	1.42E+02 pCi/L	2.37E+00	1.01
GEL ID	Mn-54	1.46E+02 pCi/L	8.88E+00	1.41E+02 pCi/L	2.35E+00	1.04
356613004	Fe-59	1.66E+02 pCi/L	1.70E+01	1.57E+02 pCi/L	2.62E+00	1.06
	Zn-65	7.55E+01 pCi/L	8.49E+00	7.24E+01 pCi/L	1.21E+00	1.04
	Co-60	3.09E+02 pCi/L	1.38E+01	2.95E+02 pCi/L	4.92E+00	1.05

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RESULTS OF ENVIRONMENTAL

CROSS CHECK PROGRAM

GEL LABORATORIES, LLC

Fourth Quarter 2014
(Ref. Date 04-Dec-2014)

L. Tk 2 Feb 15

Levan Tkavadze, Nuclear Metrologist **Date**

ANA Form002 Rev ---

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E11057	I-131	8.70E+01 pCi	1.27E+00	9.89E+01 pCi	1.65E+00	0.88
I-131						
Cartridge						
GEL ID						
362565001						
E11058	Sr-89	9.09E+01 pCi/L	1.46E+00	9.57E+01 pCi/L	1.60E+00	0.95
Sr-89/90	Sr-90	1.39E+01 pCi/L	4.22E-01	1.56E+01 pCi/L	2.60E-01	0.89
Milk						
GEL ID						
362565002						
E11059	I-131	9.34E+01 pCi/L	4.60E+00	9.51E+01 pCi/L	1.59E+00	0.98
Gamma	Ce-141	2.33E+02 pCi/L	3.59E+00	2.19E+02 pCi/L	3.66E+00	1.06
Milk	Cr-51	4.22E+02 pCi/L	2.23E+01	4.06E+02 pCi/L	6.78E+00	1.04
	Cs-134	1.50E+02 pCi/L	4.05E+00	1.64E+02 pCi/L	2.75E+00	0.91
	Cs-137	2.16E+02 pCi/L	4.20E+00	1.98E+02 pCi/L	3.30E+00	1.09
	Co-58	1.32E+02 pCi/L	3.54E+00	1.30E+02 pCi/L	2.17E+00	1.02
GEL ID	Mn-54	2.39E+02 pCi/L	4.46E+00	2.25E+02 pCi/L	3.76E+00	1.06
362565003	Fe-59	1.80E+02 pCi/L	6.57E+00	1.75E+02 pCi/L	2.91E+00	1.03
	Zn-65	3.32E+02 pCi/L	8.58E+00	2.97E+02 pCi/L	4.95E+00	1.12
	Co-60	2.49E+02 pCi/L	4.76E+00	2.35E+02 pCi/L	3.92E+00	1.06

SAMPLE	ANALYSIS	GEL VALUE	UNCERTAINTY (1 Sigma)	EZA VALUE	UNCERTAINTY (1 Sigma)	RATIO GEL: EZA
E11060	I-131	1.11E+02 pCi/L	4.66E+00	9.53E+01 pCi/L	1.59E+00	1.16
Gamma	Ce-141	3.02E+02 pCi/L	3.71E+00	2.84E+02 pCi/L	4.74E+00	1.06
Water	Cr-51	5.43E+02 pCi/L	2.42E+01	5.26E+02 pCi/L	8.78E+00	1.03
	Cs-134	1.90E+02 pCi/L	4.10E+00	2.13E+02 pCi/L	3.56E+00	0.89
	Cs-137	2.58E+02 pCi/L	4.27E+00	2.57E+02 pCi/L	4.28E+00	1.01
	Co-58	1.73E+02 pCi/L	3.90E+00	1.68E+02 pCi/L	2.81E+00	1.03
GEL ID	Mn-54	3.06E+02 pCi/L	4.47E+00	2.92E+02 pCi/L	4.87E+00	1.05
362565004	Fe-59	2.51E+02 pCi/L	7.95E+00	2.26E+02 pCi/L	3.78E+00	1.11
	Zn-65	4.20E+02 pCi/L	8.73E+00	3.84E+02 pCi/L	6.42E+00	1.09
	Co-60	3.24E+02 pCi/L	4.58E+00	3.04E+02 pCi/L	5.08E+00	1.06

Fourth Quarter 2014 (Ref. Date 04-Dec-2014) EZA Cust.# 278 Table Page 2 of 2

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 2014 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 2014 operational data are possible for each of the following exposure pathways: (1) direct radiation, (2) air particulates (inhalation), and (3) ocean water (marine pathway for ingestion). 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.

Currently the 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. There are no indications of adverse effects from SONGS on the environment.

A. Direct Radiation

SONGS Units 2/3:

The direct radiation measurements for the SONGS REMP were made by TLDs on a quarterly collection cycle at 38 indicator locations and 11 control locations in 2014. (See Appendix I for ISFSI TLD data). The TLDs were located 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 mrem. The preoperational indicator average was 25.3 mrem. The preoperational control range was 19.3 to 30.1mrem and the control mean was 23.1 mrem. During the 2014 operational year for Units 2/3, the routine indicator TLD locations ranged from 11.0 to 21.9 mrem, averaging 16.1 mrem while the control locations ranged from 15.4 to 18.9 mrem with an average of 17.5 mrem. Outside the EAB all of the control and indicator TLD data are less than the calculated detection limit above the baseline background for each TLD location (5 mrem per standard quarter). 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 2014 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 TLD.

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.

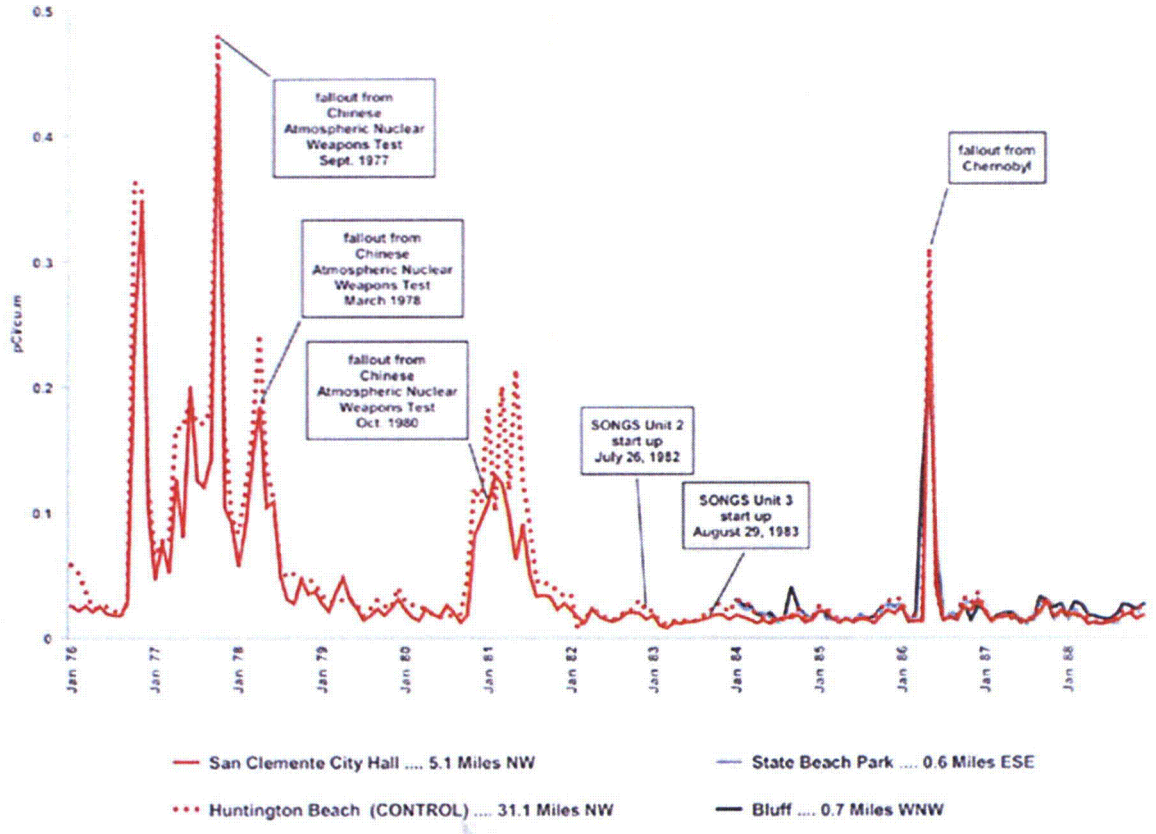


Figure 15. Monthly Average Airborne Particulates Gross Beta Preoperational and Operational Data for Units 2 and 3, January 1976 trough Decmeber 1988.

Figure 1, Figure 15, Figure 16 and Figure 17 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 2014). 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 Daiichi Accident. The graphs (Figure 16, Figure 17 and Figure 18) 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 show in 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.

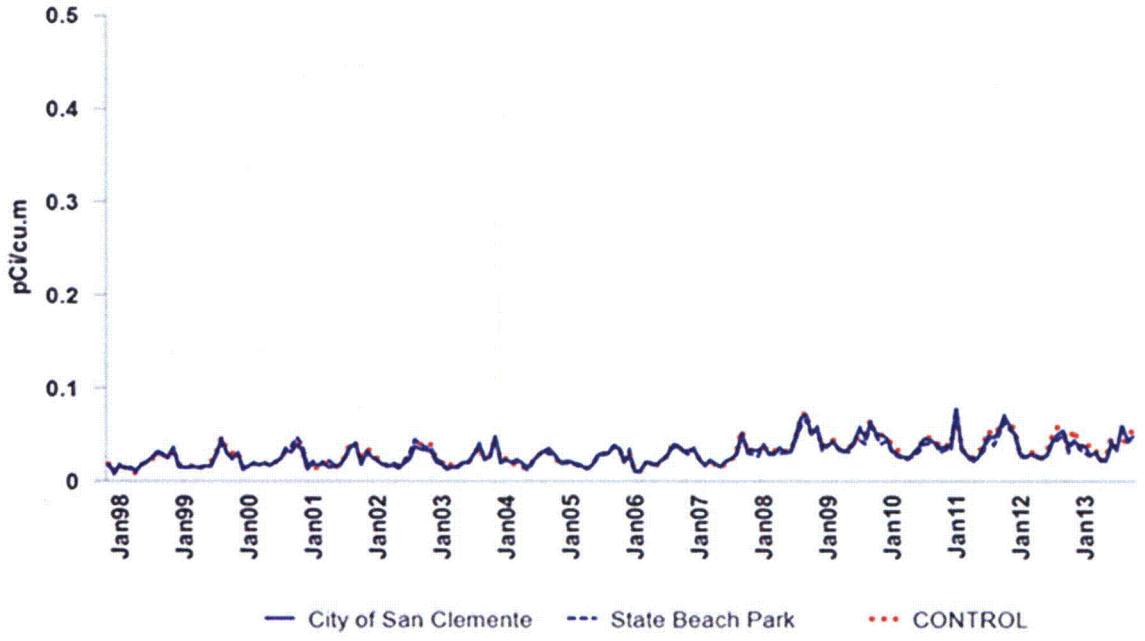


Figure 16. Monthly Average Airborne Particles Gross Beta SONGS Unit 2 and 3 Jan 98 through Dec 13

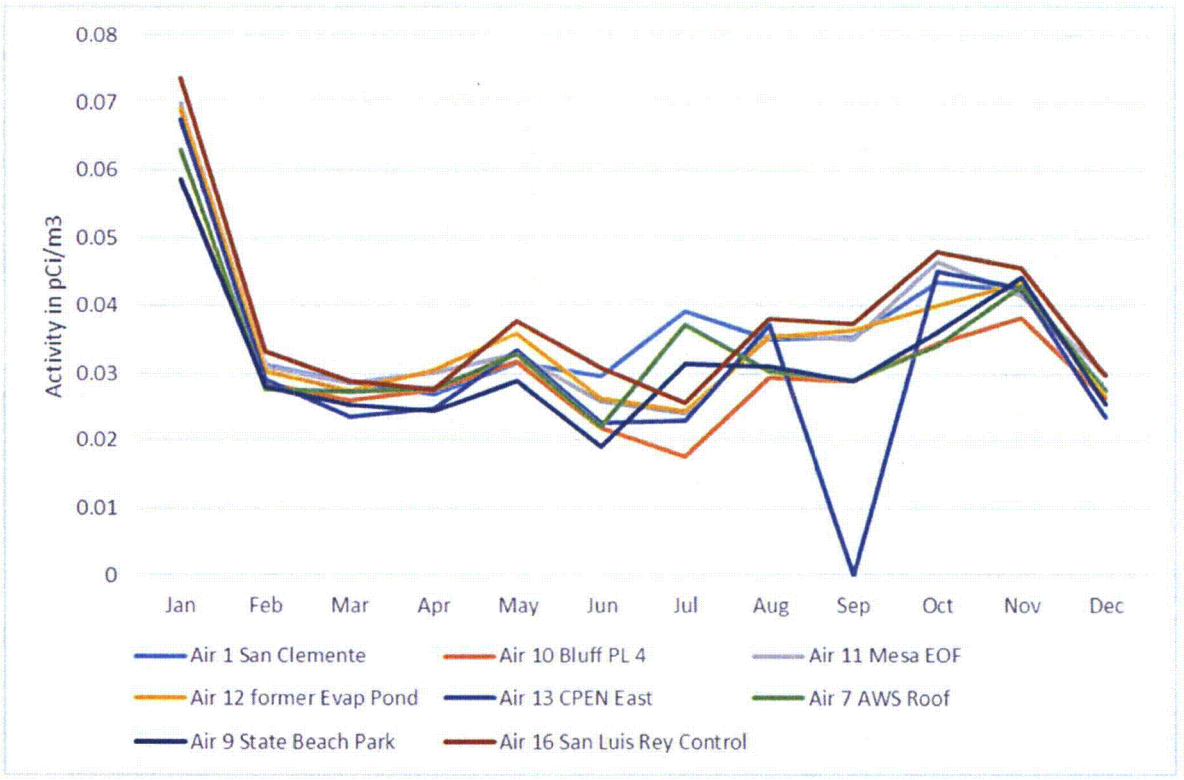


Figure 17. 2014 Average Monthly Airborne Particles Gross Beta Activity SONGS Units 2 and 3
Note: The dip from air sampler #13 was due to the air sampler being out of service from July to October 2014 due to loss of power.

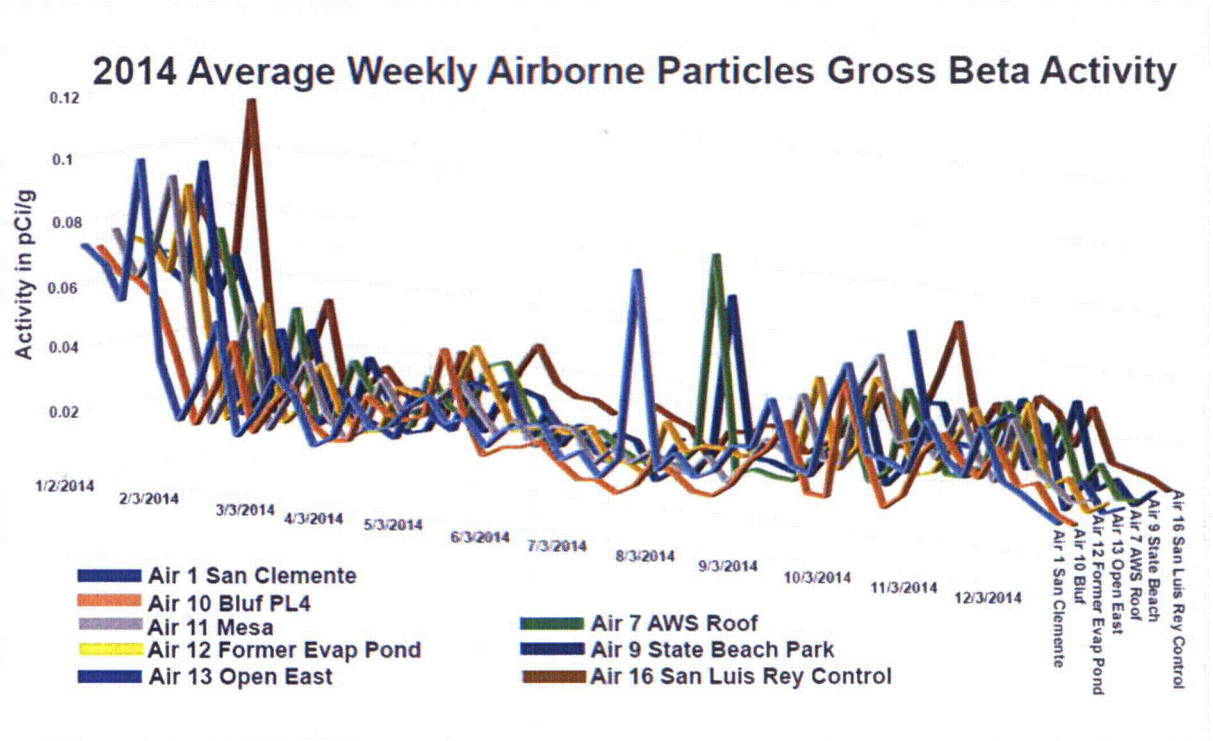


Figure 18. SONGS 2014 Average Weekly Airborne Particulate Gross Beta Activity

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 in 2014.

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-l34, 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.

The data for all other SONGS related radionuclides at all ocean water locations during the 2014 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 2014 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 2014 operational period. Thus the impact of SONGS on the environment as measured by the shoreline sediment is considered to be no different than that of natural background.

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 34.

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.

(Co-58) was detected in nine samples. The concentration of Co-58 in the samples ranged from 0.013 to 1.16 pCi/g, averaging 0.20 pCi/g. Cobalt-60 (Co-60) was measured in 15 of the 28 samples. The concentration of Co-60 in the sample ranged from 0.014 to 8.l pCi/g, averaging 0.79 pCi/g. Cs-137 was also detected in 16 of the 28 samples. The concentrations of Cs-137 in the samples ranged from 0.014 to 0.090 pCi/g, averaging 0.039 pCi/g. Cerium-144 (Ce-144) was found in two samples. The concentration of Ce-144 in the samples was 0.06 and 0.26 pCi/g, respectively.

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

for these radionuclides, and no increase in levels for these radionuclides was detected during the operational period.

The concentration of station-related radionuclides in all ocean bottom sediment samples analyzed in 2014 was below the *a posteriori* MDC. Therefore, the operation of SONGS Units 2/3 has had a negligible impact upon ocean bottom sediments.

Table 33. Shoreline Sediements Concentration (pCi/g, wet weight). Preoperational and Operational Data* SONGS Unit 2 and 3

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

Table 34. Ocean Bottom Sediments Concentration (pCi/g, wet weight). Preoperational and Operational Data* SONGS Unit 2 and 3

		INDICATOR		CONTROL	
Radionuclide	Period	Range	Average	Range	Average
Mn-54	PreOp	0.0150-0.49	0.129	<LLD	<LLD
Co-58	PreOp	0.013-1.160	0.199	<LLD	<LLD
Co-60	PreOp	0.014-8.100	0.788	<LLD	<LLD
Ag-110m	PreOp	<LLD-0.020	<LLD	<LLD	<LLD
Cs-137	PreOp	0.014-0.090	0.039	<LLD	<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 Operational	< LLD < LLD	< LLD < LLD	< LLD < LLD	< LLD < LLD

* PreOp = January 1979 to July 1982; Operational - January to December 2014

** During January to December 2014 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 2014 operational periods for Units 2/3 are summarized in Table 35 and Table 37. 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). Radionuclides analyzed but not included in Table 35 and Table 37 were below the lower limits of detection for both the preoperational and operational periods.

During the 2014 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 2014 had no impact on the environment as measured by this exposure pathway.

Table 35. Marine Species Concentration (pCi/g, wet weight) Preoperational and Operational Data* SONGS Unit 2 and 3

Sheephead Flesh**					
		INDICATOR		CONTROL	
Radionuclide	Period	Range	Average	Range	Average
Co-58	PreOp	0.016-0.030	0.023	<LLD	<LLD
Co-60	PreOp	0.005-0.044	0.017	<LLD	<LLD
Ag-110m	PreOp	<LLD-0.004	<LLD	<LLD	<LLD
Cs-137	PreOp	0.004-0.018	0.007	0.005-0.012	0.007
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD
Black Perch Flesh**					
		INDICATOR		CONTROL	
Radionuclide	Period	Range	Average	Range	Average
Co-58	PreOp	0.009-0.011	0.010	<LLD	<LLD
Co-60	PreOp	0.004-0.045	0.017	<LLD	<LLD
Ag-110m	PreOp	0.002-0.009	0.006	<LLD	<LLD
Cs-137	PreOp	0.003-0.015	0.008	0.004-0.014	0.009
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

* PreOp = January 1979 to July 1982; Operational = January to December 2014. The species collected in 2014 were California Mussel, Black Perch, Blacksmith, Sheephead, Kelp Bass, Barred Sand Bass, and Spiny Lobster.

** During January to December 2014 all station related Radionuclides from all sample locations were < LLD

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

Table 36. Marine Species Concentrations (pCi/g, wet weight) Preoperational and Operational Data* SONGS Unit 2 and 3

Mussel Flesh (Bay or California)**

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

Spiny Lobster Flesh**

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

* PreOp = January 1979 to July 1982; Operational = January to December 2014. The species collected in 2014 were California Mussel, Black Perch, Blacksmith, Sheephead, Kelp Bass, Barred Sand Bass, and Spiny Lobster.

** During January to December 2014 all station related Radionuclides from all sample locations were < LLD

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

Table 37. Marine Species Concentration (pCi/g, wet weight) Preoperational and Operational Data* SONGS Unit 2 and 3*

Sea Hare Flesh**					
		INDICATOR		CONTROL	
Radionuclide	Period	Range	Average	Range	Average
Co-57	PreOp	0.006-0.017	0.009	<LLD	<LLD
Co-58	PreOp	0.006-12.4	1.233	<LLD	<LLD
Co-60	PreOp	0.016-2.000	0.448	0.003-0.027	0.013
Zn-65	PreOp	<LLD-0.10	<LLD	<LLD	<LLD
Ag-110m	PreOp	0.018-0.50	0.138	0.020-0.039	0.030
Cs-137	PreOp	<LLD-0.004	<LLD	<LLD-0.005	<LLD
All other measured SONGS related Radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD
Keyhole Limpet (Flesh)**					
		INDICATOR		CONTROL	
Radionuclide	Period	Range	Average	Range	Average
Co-58	PreOp	0.007-0.101	0.054	<LLD-0.190	<LLD
Co-60	PreOp	0.021-0.040	0.033	<LLD-0.022	0.022
Ag-110m	PreOp	0.033-0.101	0.054	0.005-0.042	0.022
Cs-137	PreOp	<LLD	<LLD	<LLD-0.005	<LLD
All other measured SONGS related Radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

* PreOp = January 1979 to July 1982; Operational = January to December 2014

** Sea Hare and Keyhole Limpet samples were not collected in 2014

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 exposure pathway.

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.

The operation of SONGS had no impact on the environment as measured by this exposure pathway.

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 2014 four additional control sample locations were analyzed.

To assess the impact of SONGS operations on kelp, preoperational data were compared to 2014 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 2014 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 2014 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 detected in kelp since 1977, there is no evidence that the concentration of I-131 or other station related radionuclides are a result of operations at SONGS. The presence of I-131 in kelp is due to the sewer release of medical administrations of radioisotopes 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.

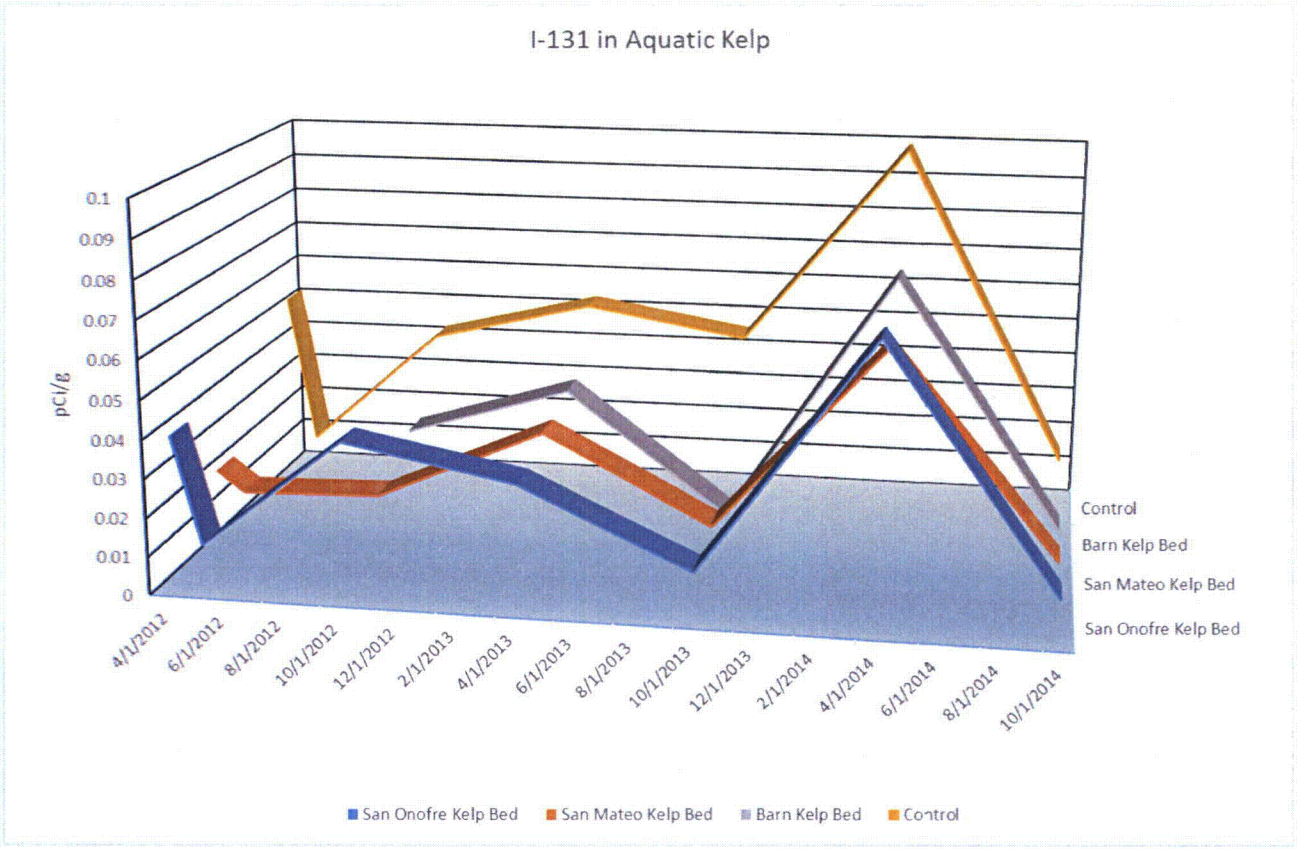


Figure 19. SONGS 2014 graph of concentration I-131 in Aquatic Kelp

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

SONGS Units 2/3:

Due to its location on the beach there is no drinking water pathway for SONGS. Nevertheless, drinking water samples from Oceanside and Camp Pendleton were collected and analyzed. No plant related radionuclides were detected during the 2014 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. The operation of SONGS had no impact on the environment as measured by this exposure pathway.

Table 38. Soil Preoperational And 2014 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	<0.10
Cs-137	Operational	0.009 – 0.166	0.075	0.186	0.186
All other measured SONGS related radionuclides	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

Table 39. 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	0.005– 0.1	0.032	0.001 – 0.100	0.046
Cs-137	PreOp	0.004-0.071	0.027	<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 2014

LLD Lower Limit of Detection for operational data are listed in Appendix B.

Appendix E. Deviations from ODCM Sampling Requirements In 2014

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 2014, 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 2014 ODCM deviations had no meaningful impact on the REMP database and did not compromise the validity of the reported conclusions.

Part ITerrestrial Sampling

A. Air Sampling

At SONGS, there are a total of 7 Indicator and 1 Control Air Samplers.

Downtime for each air sampler in 2014 was due to weekly sample collection, annual Preventative Maintenance (PM), and the changeouts for the flow meters/pumps of approximately 46 minutes for each sampler.

Weekly Change Out:	Approximately 0.5 minutes X 52 = 26 minutes
Annual PM:	Approximately 15 Minutes
Annual Flow meter/Pump Change out:	Approximately 5 Minutes

Down Times in the excess of 1 hours are addressed below for each ODCM required air sample.

1) During the week of March 9, 2014, air samplers had one hour difference between operating and elapsed time, due to Daylight Savings Time change. In addition, the week of November 2, 2014, air samplers had one hour difference between operating and elapsed time, due to the end of Daylight Savings Time.
2) Air Sampler #9 (State Beach Park)
    a. During the weekly air sample collection on March 4, 2014, there was a 17.3 hour difference between the operating time and elapsed time. This difference was due to a loss of power preventing the air sampler from operating. The sample media was collected, processed and analyzed in accordance with Environmental Procedure. The discrepancy was documented on the chain of custody prior to sending samples to the offsite vendor for analysis. There was no plant related activity detected on the sample media. The power was restored and air sampler continued to perform the required ODCM Section 5.0 surveillance. This event is documented in the site's corrective action program, (NN# 202798185)
    b. During the weekly air sample collection on August 5, 2014, there was a 2 hour difference between the operating time and elapsed time. The loss of power coincides with the loss of the 12 KV Gary Line due to inadvertent contact by a Southern California Edison boom truck. The power was restored and the air sampler continued to operate and perform the required ODCM Section 5.0 requirement. The sample media was collected and processed in accordance with Environmental procedure and the discrepancy was documented on the chain of custody prior to sending

samples to the off-site vendor for analysis. This event is documented in the site's corrective action program (NN# 202978767

3) Air Sampler #13 (Camp Pendleton East)
   a. During the weekly air sample collection on July 29, 2014, the air sampler was found off. It was determined that a contractor hired by the Corporate Real Estate had demolished a building that supplied power to the air sampler as well to PICs sometime on July 23rd or 24th. The corrective action was to have San Diego Gas and Electric and Southern California Edison Transmission and Distribution install a pole mounted transformer on the south east corner of San Onofre Mesa on October 13, 2014. The power was placed back in-service and the air sampler is operating and performing the required ODCM Section 5.0 requirement. The sample media was collected and processed in accordance to Environmental Procedure and the discrepancy was documented on the chain of custody prior to sending samples to off-site vendor for analysis. This event was documented in the site's corrective action program. (NN# 202969551)
4) Air Sampler #10 (Bluff located in Parking Lot 4)
   a. During the weekly air sample collection on August 5, 2014, there was a 2 hour difference between the operating time and elapsed time. The loss of power coincides with the loss of the 12 KV Gary Line due to inadvertent contact by a Southern California Edison boom truck. The power was restored and the air sampler continued to operate and perform the required ODCM Section 5.0 requirement. The sample media was collected and processed in accordance with Environmental procedure and the discrepancy was documented on the chain of custody prior to sending samples to the off-site vendor for analysis. This event is documented in the site's corrective action program (NN# 202978767)
   b. On December 4, 2014, Environmental was notified at 0930 that power was terminated in parking lot #4. The Environmental Technician checked out the air sampler and determined there was no power. Based on elapsed time the power was terminated approximately at 0800. Maintenance was notified and the power was restored. The sampler was verified to be operating and performing the required ODCM Section 5.0 requirement. The sample media was collected and processed in accordance with Environmental Procedure and the discrepancy was documented on the chain of custody prior to sending samples to off-site vendor for analysis. This event is documented in the site's corrective action program (NN# 2031130598)
   c. A flow meter was found operating past the M&TE calibration expiration date on 1/14/2014. The flow meter was granted an extension on 11/26/2013, due to the site obtaining a vendor to maintain the M&TE program. This was due to the closure of the Southern California Edison's Shop Services Instrumentation Division (SSID). An extent of condition was performed and it was noted that three other flow meters were going to expire within the next month. The maintenance contract manager granted extensions based on the availability of calibrated flow meters and resolved the M&TE program issues. Also, the personnel involved in this event were coached to communicate with the Radiological Effluent and Environmental Specialist that whenever the M&TE is approaching a due date, the flow meters need to be extended or changed out. This event is documented in the site's corrective action program. (NN# 202786117)

In all these events, the Radiological Effluent and Environmental Specialist reviewed previous and post event's data to verify no deviations were noted and that all ODCM LLDs were met. Per ODCM Table 5-2, there were no challenges to the reporting levels for radioactivity concentrations. This is documented

in the site's corrective action program for tracking programmatic events in the 2014 AREOR. (NN# 202794860)

B. Direct Radiation

Thermoluminescent Dosimeters (TLD)

There was one (1) ODCM deviation noted. During the 2nd quarter TLD change out, it was noted that TLD # 46, San Onofre State Beach Park was burned up by a fire that occurred in May 2014. The TLD canister and the 3rd quarter TLD was replaced in the same location. Radiological Effluent and Environmental Specialist reviewed the 1st and 3rd quarter TLD and there were no noted deviations in the sample results. This is documented in the site's corrective action program. (NN# 202953351)

Pressurized Ion Chamber (PIC)

In the ODCM, under Section 5.0, it states that Pressurized Ion Chambers (PICs) are required to be functional. Throughout 2014, per the site's corrective action program, several notifications were written to document the PICS out of service. (Reference NN# 202956521, NN# 202964226, NN# 202964607, NN# 202969362, NN# 203087208, NN# 203140726 and NN# 203159094) The longest that the PICs were OOS was the week of July 29, 2914, when the PICs (3-8) power supply was terminated due to demolition of buildings at the MESA. The power was turned back on October 13th after the installation of a transformer. Compensatory action was implemented during the extended time when these PICs were not functional. (NN# 202969551)

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

Non-Migratory Marine Animals were collected from the specified ODCM sample location when samples were available at that location. In April 2014, the vendor issued a supplier deviation request (SDR) due to storm fronts and poor underwater visibility that prevented the vendor from collecting the non-migratory marine animals. The SDR was approved by the Radiological Effluent and Environmental Specialist. The vendor was allowed to sample alternate locations as well as extending the time frame into May. All the required non-migratory marine animals were collected by May 22, 2014. This event was documented in the site's corrective action program (NN# 202902265). These alternate locations were selected based on sample availability and proximity to the specified sample location. 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

A. 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 changes in the use of unrestricted areas and to permit modifications in monitoring program for evaluating doses to individuals from principle pathways of exposure."[1] In addition, Regulatory Guide 4.15, Rev. 1, section C3 requires that "written procedures should prepared, reviewed, and approved for activities involved in carrying out the monitoring program." The 2014 LUC was conducted to comply with the surveillance requirement as defined in the Offsite Dose Calculation Manual (ODCM) Section 5.2. The Radiological Environmental Monitoring Program Procedure SO123-IX-1.20 Rev. 7, Land Use Census, establishes the method of documenting and verifying land use census results obtained in compliance to San Onofre's Technical Specifications and ODCM.

B. 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 United States Marine Corps (USMC) 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 land area substantially inhibit significant land use changes.

C. 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.

D. The Land Use Census Scope

The land area around SONGS includes both Orange and San Diego Counties. The Orange County portion includes a portion of the city of San Clemente (population estimated to be 64,874 as of January 2014) and the San Clemente State Park. The San Diego County portion includes much of the Marine Corps Base Camp Pendleton, San Onofre State Beach and Park, and SONGS itself.

The LUC map is divided into 16 geographical sectors: A, B, C, D, E, F, G, H, J, K, L, M, N, P, Q and R. The ODCM surveillance requirement is performed by identifying the location of the nearest garden greater than 500 square feet, nearest milk animals, nearest residence, and other identified land uses in each of the sixteen (16) geographical sectors within a distance of five (5) miles from San Onofre Units 2 and 3. In addition, the land use census aids in detecting changes in the presence of hazardous manufacturing and handling facilities within the five (5) mile radius. The methodology consists of reviewing data from the previous LUC reports and verifying if any information has changed. The LUC is conducted and updated at least once per 12 months between the dates of June 1 and October 1. Also, non-residential usage such as fire stations, Camp Mesa, surf camps and other potential pathways of exposure to an individual are identified due to the fact that these usages are closer to full time residence based on information provided by the appropriate point of contact or agency.

Sectors A, B, C, D, E, and F include land 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, therefore no land use possible. Sectors P, Q, and R include a section of San Clemente and part of Camp Pendleton.

E. Research Methodology

Completion of the 2014 SONGS Land Use Census required conversations and meetings with agencies and individuals, field research, and Geographical Information System (GIS) work detailing the findings on study area land use maps. Environmental personnel conducted a review of the previous 2013 LUC and associated documentation notebook. Then the data was verified and if changes were noted, then the changes were reflected in the 2014 land use census.

This was accomplished by contacting the point of contact for the appropriate agency, organization, or military base which possesses knowledge on the land usage.

The following agencies and organizations were contacted:

- SCE Real Properties, for Aerial Photography
- California Highway Patrol
- Orange County Agricultural Commissioner
- State of California Department of Parks and Recreation, including San Onofre State Beach
- United States Border Patrol
- USMC Base, Camp Pendleton
- City of San Clemente

In cases where it was deemed appropriate, letters requesting information were sent to organizations. The United States Border Patrol did not respond to our inquiries due to national security so an "estimated hours of occupancy" value of 2400 hours was utilized. It was determined that military personnel would have complete control over the land uses within their jurisdiction. Communication provided by the point of contact from Camp Pendleton and other agencies (State Parks, California Highway Patrol, etc.) was considered final and complete evidence of a change or no change to the LUC. Agency contact and documentation were completed in compliance with the Land Use Census procedure.

Southern California Edison (SCE) Corporate Real Properties coordinated aerial photography performed on June 3, 2014. The photographs were compared and analyzed for changes against the survey information gathered during the 2013 LUC. The aerial photographs were examined for the presence of garden-like areas and significant construction. The candidate gardens were converted to street addresses and the properties were inspected from the street. If the existence of a garden could not be determined from the street then a garden was presumed to exist at that address. If the location was closer to SONGS than the previously identified gardens in that sector, then it was added to the LUC

1. Field Research

During and after the completion of the preliminary research, field research was undertaken to confirm initial findings and obtain further information necessary to complete the land use census. Field research was initiated in June 2014. After a thorough examination of the aerial photographs, a vegetable garden search was completed in September 2014.

2. Data and Methodology Summary

An examination of the aerial photographs and a field survey was conducted to determine if new land uses existed in the study area. The appropriate individual or organization was identified for each existing and new LUC location. The individual or organization was contacted to determine the use and occupancy for that location. For each LUC location, the appropriate individual was asked to provide an estimate of annual occupancy based on personal knowledge of the location. The information gathered is summarized in Table 1. Additional information, not required by the ODCM, has been included in Table 2 for historical trending purposes.

3. Documentation Notebook

Throughout the study, records of contacts and findings were maintained in accordance with the Land Use Census Procedure. A documentation notebook has been prepared and is retained in the Radiological Effluents and Environmental files with the aerial photographs. The notebook provides telephone notes, agency contacts, Southern California Edison (SCE) memoranda, and any correspondence. The notebook's records are retained at SONGS.

F. 2014 Land Use Census Observations and Changes

The follow observations were noted:

- One new garden was identified in 2014.
- No land uses with the potential to affect SONGS were identified in 2014.

1. Chemical and Toxic Waste

The presence of manufacturing facilities, chemical plants, and toxic waste sites was researched to provide information in detecting any hazardous chemicals, etc. which could impede the operation of SONGS through fire, explosion, or chemical spills. Some manufacturing is located in the northeastern section of the city of San Clemente and is outside the study area. No such uses are allowed to exist in the commercial and residential areas of the city of San Clemente within the study area. In Camp Pendleton, there are no designated manufacturing or chemical use areas within the 5 mile radius of the plant based conversation with Camp Pendleton's Director of Community Plans and Liaison Office.

This type of survey is referenced in the Nuclear Regulatory Commission (NRC) Inspection Manual, temporary instruction 2515/112, dated 05/31/91, and is required by the Land Use Census Procedure SO123-IX-1.29, Section 1.1.2.

2. Milk Animals

No dairies or other facilities producing milk for human consumption were identified in 2014.

3. Meat Animals

No agricultural meat animals were identified during the 2014 LUC. The only known meat animal pathway land uses is recreational hunting. Deer graze year round on Camp Pendleton.

4. Growing Season for fleshy and leafy vegetables

Leafy vegetable samples are available at the SONGS garden year round. Fleshy vegetables were available approximately eight months during 2014 at the SONGS garden.

5. Summary of Changes

1. LUC # G-18 – A new garden was identified 4.1 miles from Units 2/3 in Sector Q.
2. LUC # R-P4 – Parking Lot 4 was not occupied in 2014 and is no longer considered a residence.
3. LUC # R-A2 & R-R2 – SONGS Camp Mesa was not occupied in 2014 and is no longer considered a residence.
4. LUC # R-R3 - SONGS Dry Camping PL12 was not occupied in 2014 and is no longer considered a residence.
5. LUC # O-2D –Summer Soul Surf Camp operated a day camp at Dog Patch beach in San Onofre Beach, with a maximum estimated occupancy of 440 hours.
6. Updated Camp Pendleton hunting take data for the period July 1, 2013 to June 30, 2014 is listed in Table 45. 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 from July 1, 2013 through June 30, 2014.

Table 40. Distance to Nearest Vegetation typically consumed by Deer

Sector 2/3	Distance Units 2/3
P	0.3
Q	0.3
R	0.2
A	0.1
B	0.1
C	0.1
D	0.1
E	0.2
F	0.3
G	0.1

Table 41. SONGS 2014 Land Use Census Data

Units 2/3 Sector	LUC #	Residence	Miles from U2/3	hours of Maximum Occupancy	LUC #	Gardens	Miles from U2/3	LUC #	Other Specified Uses	Miles from U2/3	hours of Maximum Occupancy
A	R-A1	Camp San Mateo	3.6	FTR				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	R-C2	Camp San Onofre Fire Station #7 52 Area	2.4	FTR				O-10	Camp San Onofre (STP #11)	2.2	2,000
	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				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
	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	G-3	4130 Calle Isabella	2.8	O-6	Surf Beach (Lifeguard)	0.5	800
	R-P2	San Mateo Point housing	2.7	FTR	G-14	4090 Calle Isabella	2.9	3	Trestles Beach Lookout tower	1.8	500
	R-P1	Cotton point Estates	2.7	FTR				**O-2D**	**Summer Soul Surf Camp**	**0.5**	**440**
	R-P5	Contractor overnight parking in Lot 4	0.6	**0**							
Q	R-Q5	SORB Resident Employee	1.1	FTR	G-8	2240 Ave Salvador	4.1	O-3	State Park Office Trailer	0.69	2,000
	R-Q2	San Onofre III housing	1.4	FTR	G-5	1706 S Ola Vista	4.4	5	Surf Beach Guard Shack	0.7	1,500
	R-Q3	San Mateo Point Housing	2.7	FTR	G-6	1315 S Ola Vista	4.6	18	SORB Lifeguard Tower	1.2	2,000
					G-15	130 Calle del Pacifico	4	1A	SORB Campground Check-in	1.3	2,000
					G-16	432 Ave Crespi	3.8				
					G-18	**115 Ave San Pablo**	**4.1**				
R	R-R1	San Onofre III housing	1.3	FTR	G-10	SONGS Garden	0.4				
					G-17	788 Ave Salvador	4.9				

Bold Text indicates a change from the 2013 LUC **Data as of 9-30-2014** **FTR - Full Time Residence**

*Unable to verified that there were no changes from the 2013 LUC in "Estimated Hours of Occupancy" due to unavailable data.

Table 42. SONGS 2014 Land Use Data Historical Data

Units 2/3 Sector	LUC #	Residence	Miles from U2/3	Estimated hours of Maximum Occupancy	LUC #	Gardens	Miles from U2/3	LUC #	Other Specified Uses	Miles from U2/3	Estimated hours of Maximum Occupancy
A	**R-A2**	**SONGS Camp Mesa**	**0.4**	**FTR**				24	Cristianitos Fire Station	5	3,984
B											
C											
D											
E											
F											
G								O-2C	SurfCamp.com State Beach Surf Camp	2.3	
									did not occupy San Onofre Park in 2014		
	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-P5**	**Contractor overnight parking in Lot 4**	**0.6**	**1040**							
Q	11	State Parks Main Offices	3.5	FTR	14	Inactive	4.3	7	SORB Clubhouse (permanently closed per USMC)		
						3 W San Antonio		8	USMC Exchange & Commissary	1.7	2,000
					16	Inactive	4.1	9	Basilone Road USMC Entry Gate	2	520
						147 W Junipero		12	San Mateo Campground	2.9	4,380
								17	Beach Concession (Pier Shack and Grill)	4.5	2,600
								13	Beach Concession (Califia Beach Café)	3.9	1,200
R	20	Sea Ridge Estates	4.5	FTR				19	Camp San Mateo (STP#12)	3.7	2,000
	R-R3	**SONGS Dry Camping PL12**	**0.7**	**2136**				21	Cristianitos USMC Entry Gate	4.1	520
	R-R2	**SONGS Camp Mesa (See notes for Table 1)**	**0.4**	**FTR**				23	Cristianitos USMC Gas Station	4.1	2,000

Bold Text indicates a change from the 2013 LUC Data as of 9-30-2014 FTR - Full Time Residence

NOTES FOR TABLES 41 AND 42

RESIDENCES

Table 43. Residences

LUC#	Description
R-A1	CAMP SAN MATEO (barracks)-This is an employment and an FTR land use location for persons 17 and older.
R-A2 R-R2	CAMP MESA-Former FTR and is permanently closed.
R-C2	CAMP SAN ONOFRE FIRE STATION-This is an employment and FTR land use location for persons 18 and older.
R-C1 R-C3 R-D1	CAMP SAN ONOFRE (barracks)-This is an employment and FTR land use locations for persons 17 and older.
R-E1	CAMP HORNO (barracks)-This is an employment and a FTR land use location for persons 17 and older.
R-P1	COTTON POINT ESTATES-This is a FTR for all age groups.
R-P2 R-Q3	SAN MATEO POINT HOUSING-This is a FTR for all age groups.
R-Q2 R-R1	SAN ONOFRE III housing-This permanent housing development is a FTR for all age groups.
R-P3	SAN ONOFRE RECREATION BEACH (SORB)-This is a FTR for SORB
R-Q5	SORB Employees and campground hosts (age 18 & over). This is also a non-employment land use location (camping) for all age groups. A person or family may camp at SORB for a maximum of 60 days per calendar year.
R-P4	Contract Worker in Parking Lot 4-This was a 6 month residence for a contract worker that slept in personal vehicle in between shifts until 4/1/2013 (NN 202649118). This is an inactive residence.

VEGETABLE GARDENS

One new garden was identified in 2014 (G-18 4.1 Sector Q). As per SO123-IX-1.20 step 6.2 gardens identified are presumed to grow both leafy and fleshy vegetables for human consumption.

Table 44. Other LUC Locations Closer than the Closest residence

O-1	SAN ONOFRE STATE BEACH GUARD SHACK-this is an employment land use location for persons 18 and older.
O-2	SAN ONOFRE BEACH CAMPGROUND-This is a non-employment (recreational) and use location for all age groups.
O-2A	ENDLESS SUMMER SURF CAMP/CAMPGROUND HOST-The Endless summer Surf Camp and the State Parks Campground host are located in spaces 100 to 103. The maximum occupancy for persons age 18 and older is 4380 hours. The maximum occupancy for persons 17 and younger is 360 hours. This is both an employment and a non-employment land use location.
O-2B	YMCA Surf Camp
O-2C	Summer Soul Surf Camp- Summer Soul Surf Camp is a day camp that takes place at Dog Patch beach in San Onofre Beach. The maximum occupancy for persons age 18 and older is 440 hours. The maximum occupancy for 17 and younger is 40 hours.
O-3	STATE PARK OFFICE TRAILER-This is an employment land use location for persons 18 and older.
O-5	CAMP HORNO MOTOR POOL-This is an employment land use location for persons 17 and older.
O-6	SURF BEACH (LIFEGUARD)-This is an employment land use location for persons 18 and older.
O-8	CAMP SAN MATEO MOTOR POOL-This is an employment land use location for persons 17 and older.
O-9	USMC CP SANITARY LANDFILL-This is an employment land use location for persons 18 and older.
O-10	CAMP SAN ONOFRE WASTE WATER TREATMENT PLANT (STP #11)-This is an employment land use location for persons 18 and older.
R-C2	SAN ONOFRE FIRE STATION #7 52 AREA-This is an employment land use location for persons 18 and older.
1A	SORB CAMPGROUND CHECKIN-This is an employment land use location for persons 18 and older.
3	TRESTLES BEACH LOOKOUT TOWER-This is an employment land use location for persons 18 and older.
5	SURF BEACH GUARD SHACK-This is an employment land use location for persons 18 and older.
18	SORB LIFEGUARD TOWER-This is an employment land use location for persons 18 and older.
22	SCE Land Uses-Are occupied by unmonitored SCE workers
31A	BORDER PATROL CHECKPOINT-This is an employment land use location for persons 18 and older.
31B	HIGHWAY PATROL WEIGH STATIONS-These are employment land use
32	Locations for persons 18 and older.

Table 44 Notes:

Table 44 locations are not mapped. Table 44 contains locations included per SO123-IX-1.20, step 6.3. SONGS Camp Mesa is no longer a residence and is permanently closed. The "other specified uses" locations listed in Table 44 are further away from the midpoint of Units 2/3 that is closest to the full time residence (all age groups) in the corresponding sector. The residences listed in Table 44 are not the closest full time residence in the corresponding sector. Table 44 has been retained for historical trending purposes and are not required by the ODCM.

Table 45. Camp Pendleton Hunting Take Data, 1 July 2013 to 30 June 2014

Area	Deer Hunter Effort	Sm Game Hunter Effort	Deer	Coyote	Dove	Quail	Rabbit	Squirrel	Pigeon
	Hours	Hours							
Alpha-1 B(3),C(3.2)	100	55.2	1	1	0	0	0	1	0
Alpha-2 E(0.8),D(0.8),C(3)	52.8	28.8	1	0	0	0	4	0	0
Alpha-3 D(2.2)	187.2	241.6	7	0	0	0	7	26	0
Bravo-2 B(3.8), A(4.2)	369.6	31.2	3	1	0	0	0	0	0
Bravo-3 B(1.6),A(1.8),R(1.8)	232.8	66.4	0	1	1	0	6	2	0
Romeo-1 E(1)	320	60	6	0	0	0	0	0	0
Romeo-2 E(2.6)	457.6	5.6	6	0	0	0	0	0	0
Romeo-3 E(1.4), F(1.5)	363.2	31.2	7	0	0	0	0	0	0
Papa-2 F(5)	224.8	79.2	5	1	0	0	0	0	0
Totals	**2308**	**599.2**	**36**	**4**	**1**	**0**	**17**	**29**	**0**

1. The total hunting hours includes time attributable to multiple individuals. This value bounds the maximally exposed individual.

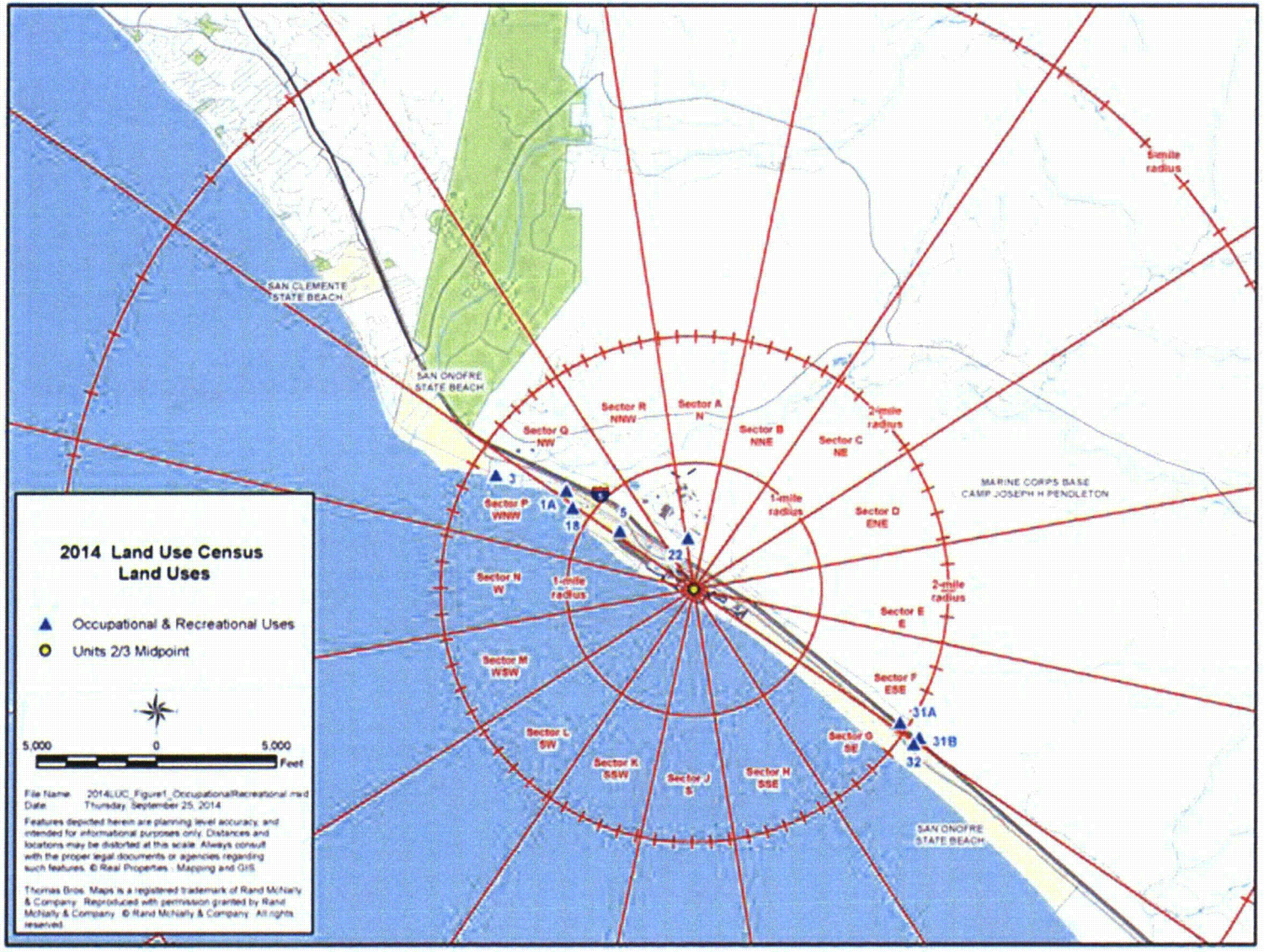


Figure 20. 2014 SONGS Land Use Census (LUC) Land Uses Map

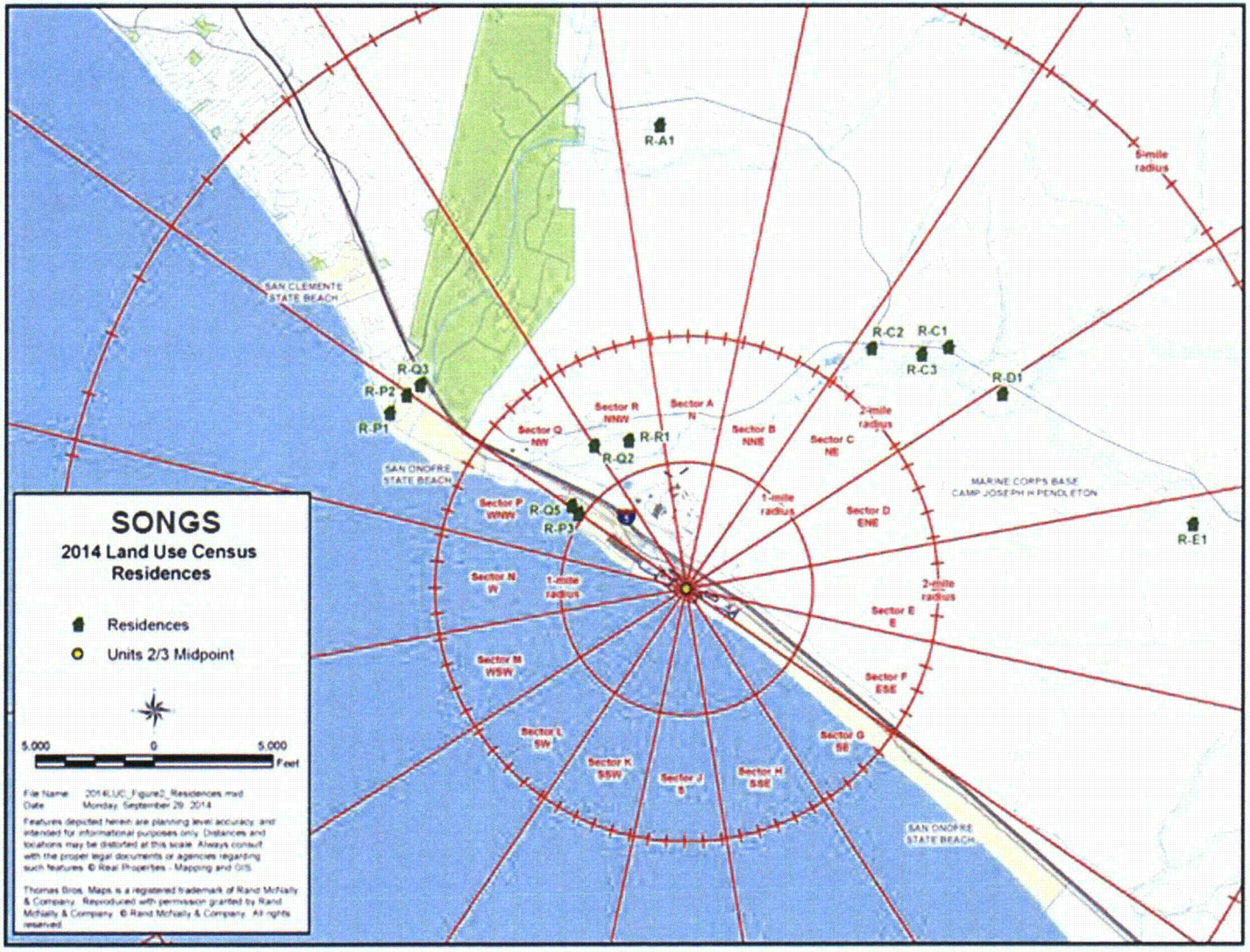


Figure 21. 2014 SONGS LUC Residences

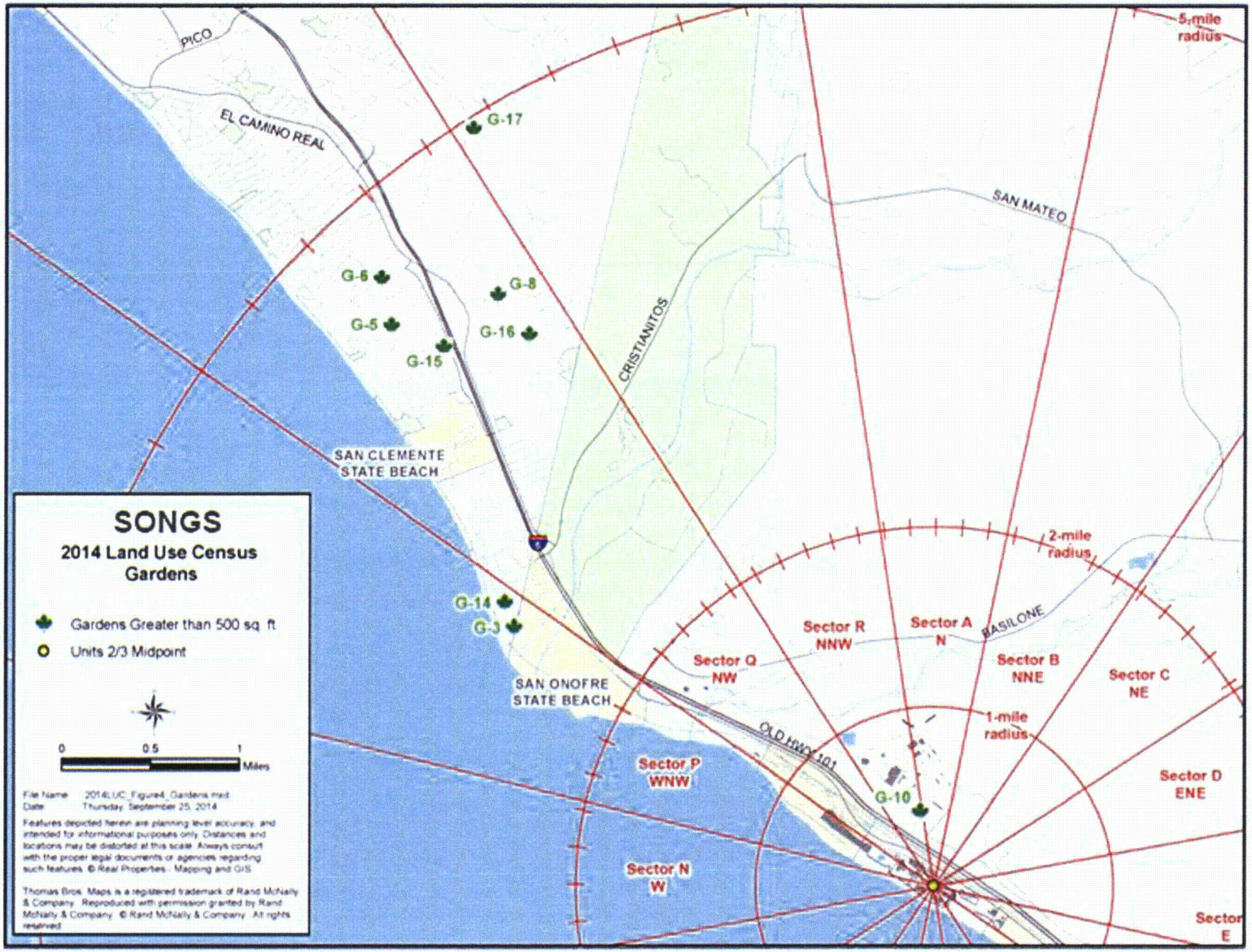


Figure 22. 2014 LUC Gardens

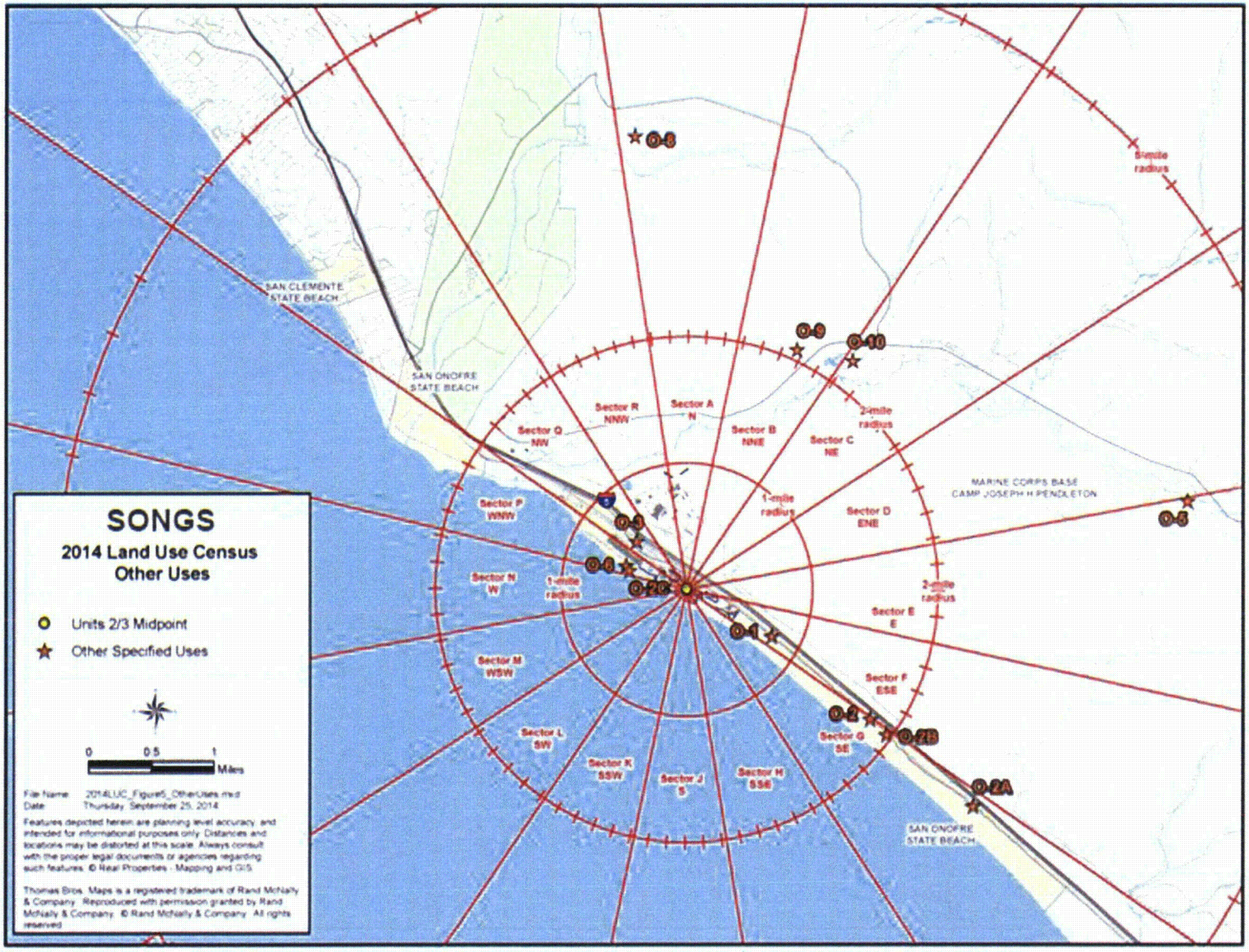


Figure 23. 204 LUC Other Use

Appendix G. Figures for 2014

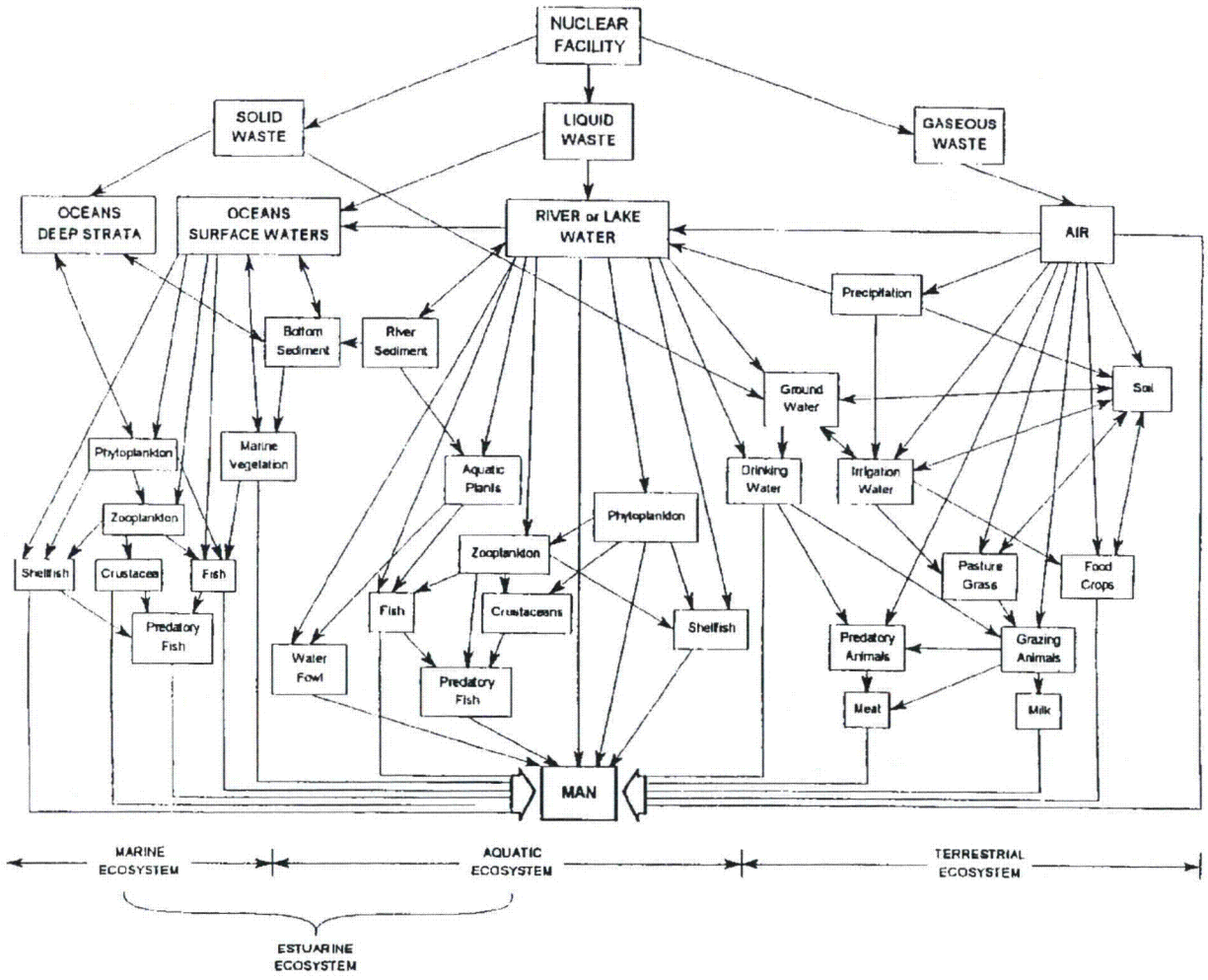


Figure 24. Pontential Radiation Exposure Pathways Leading to Man

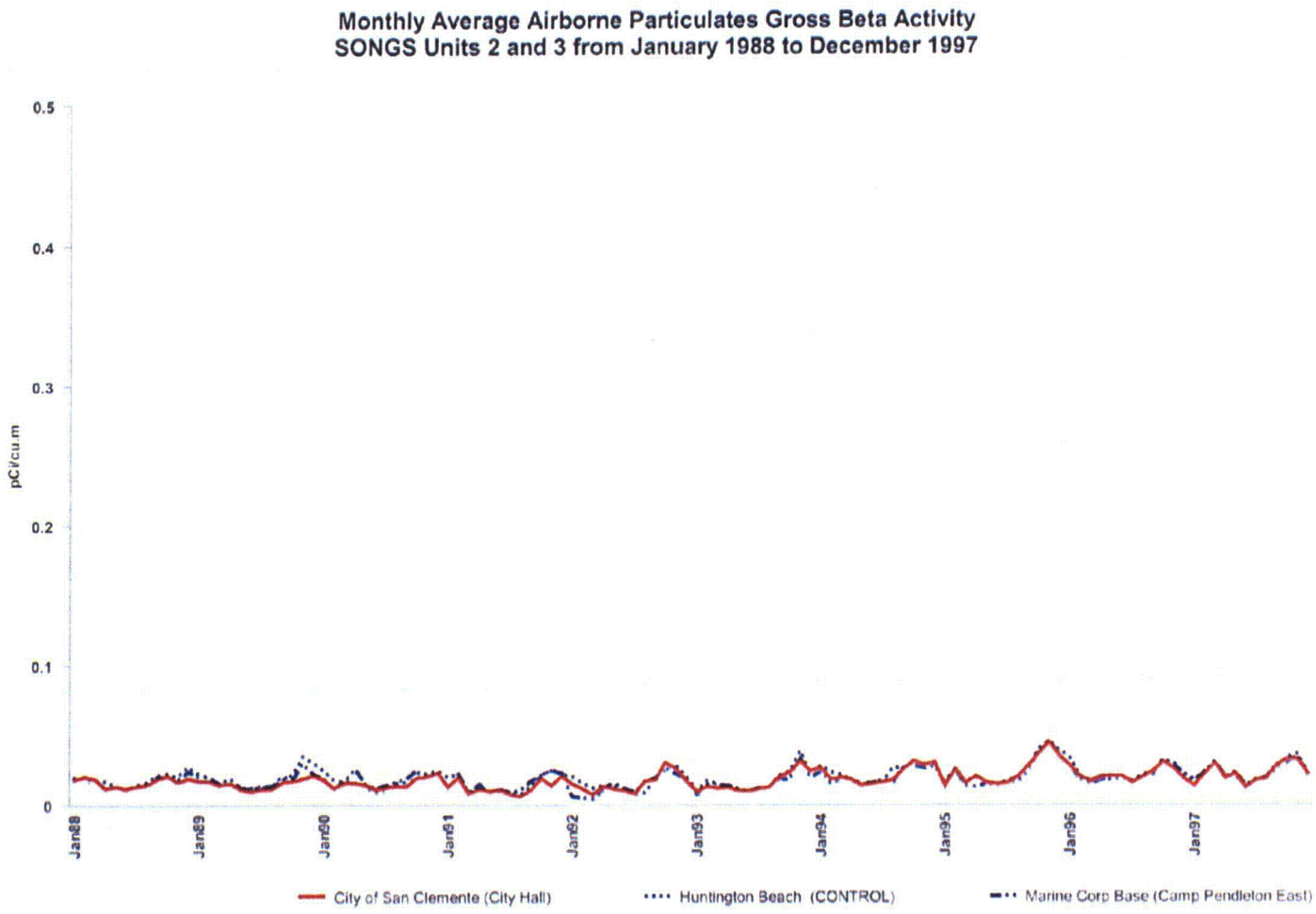


Figure 25. Monthly Average Airborne Particles Gross Beta SONGS Unit 2 and 3, Jan 1988 to Dec 1997

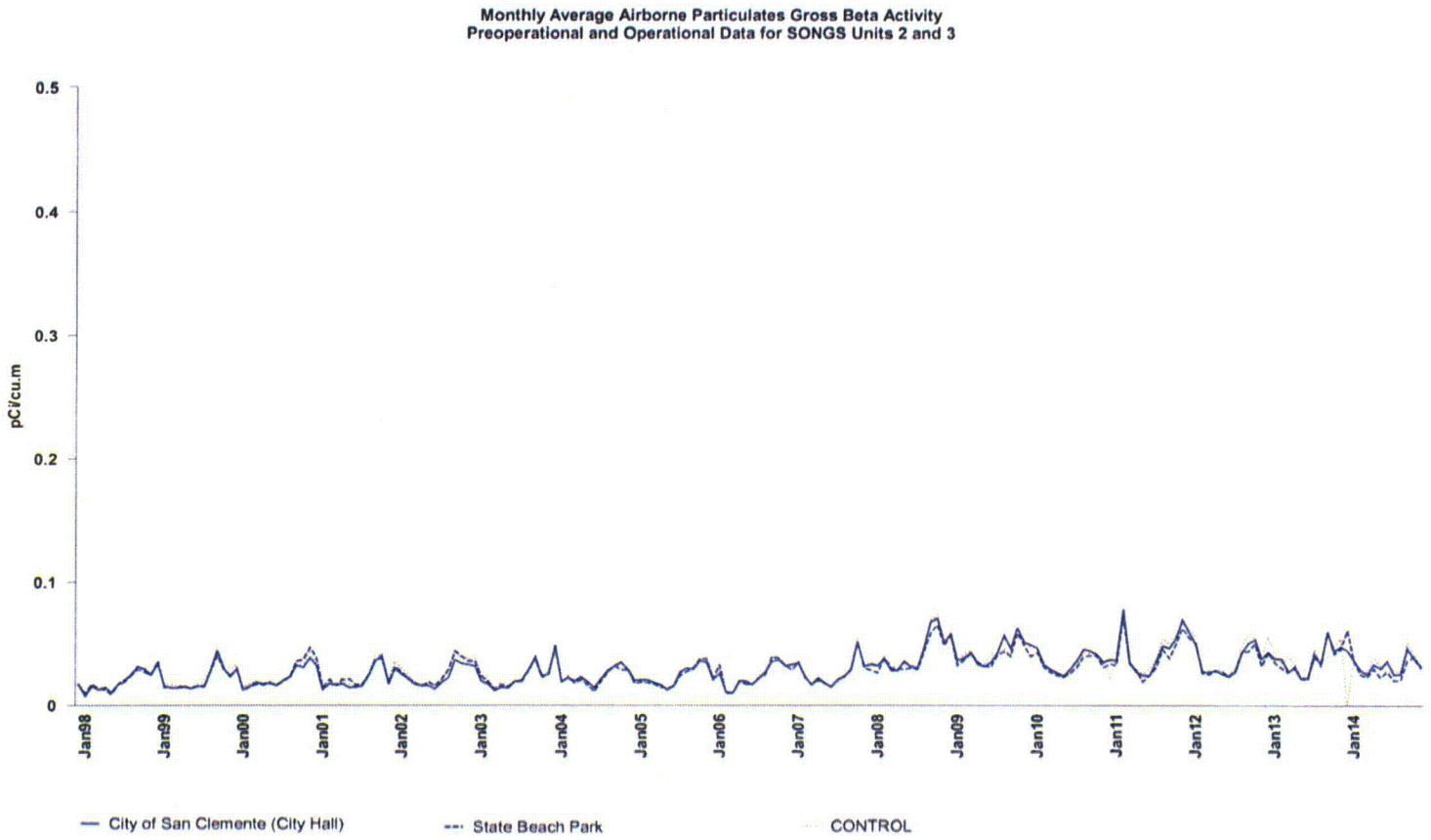


Figure 26. Monthly Average Airborne Particles Gross Deta Activity SONGS Units 2 and 3, Jan. 1998 to Dec. 2014

In 1998, the control sample point was changed to Oceanside City Hall due to selling of the Huntington Beach Plant. In 2009, the control was changed to San Luis Rey.

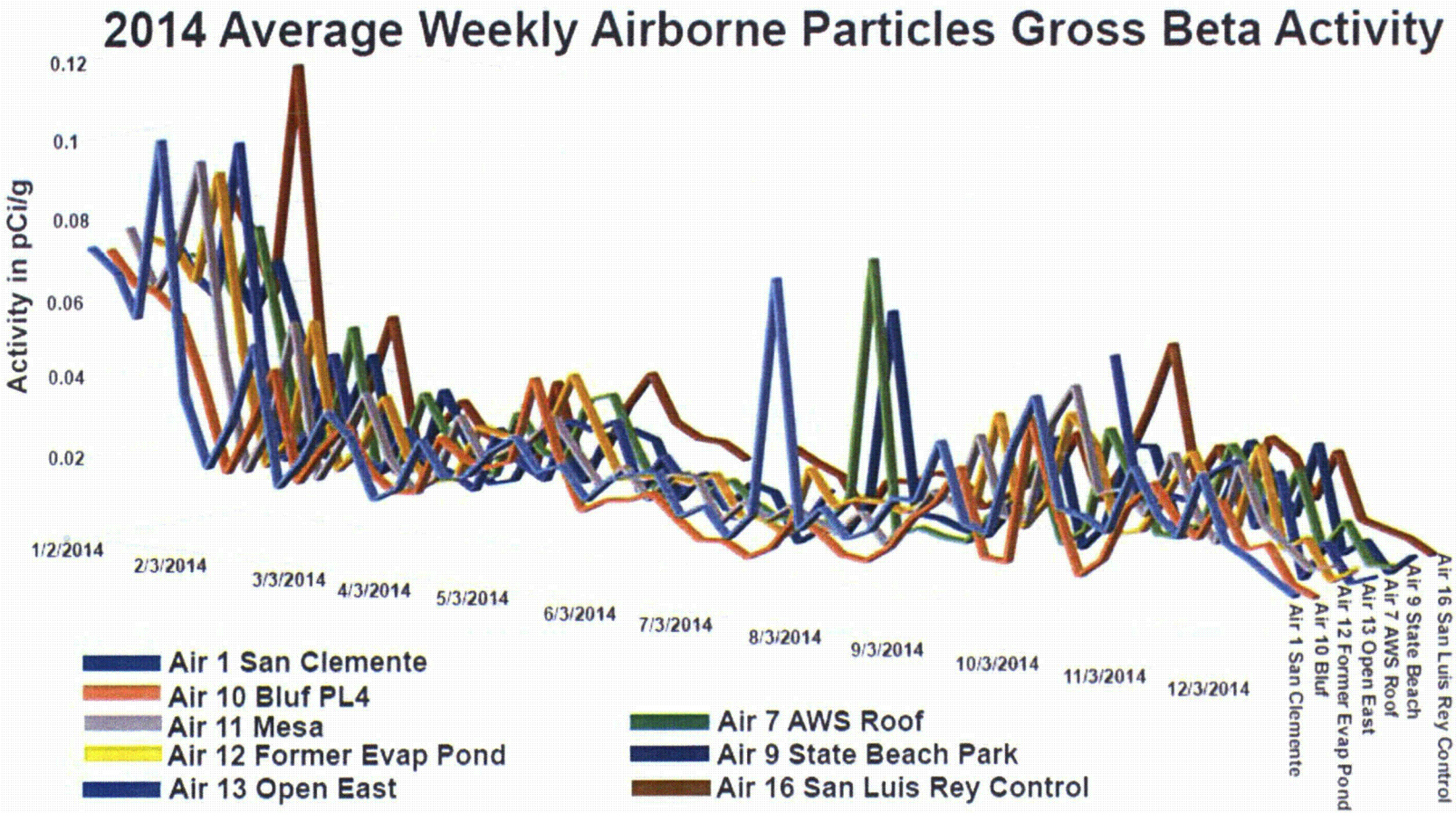
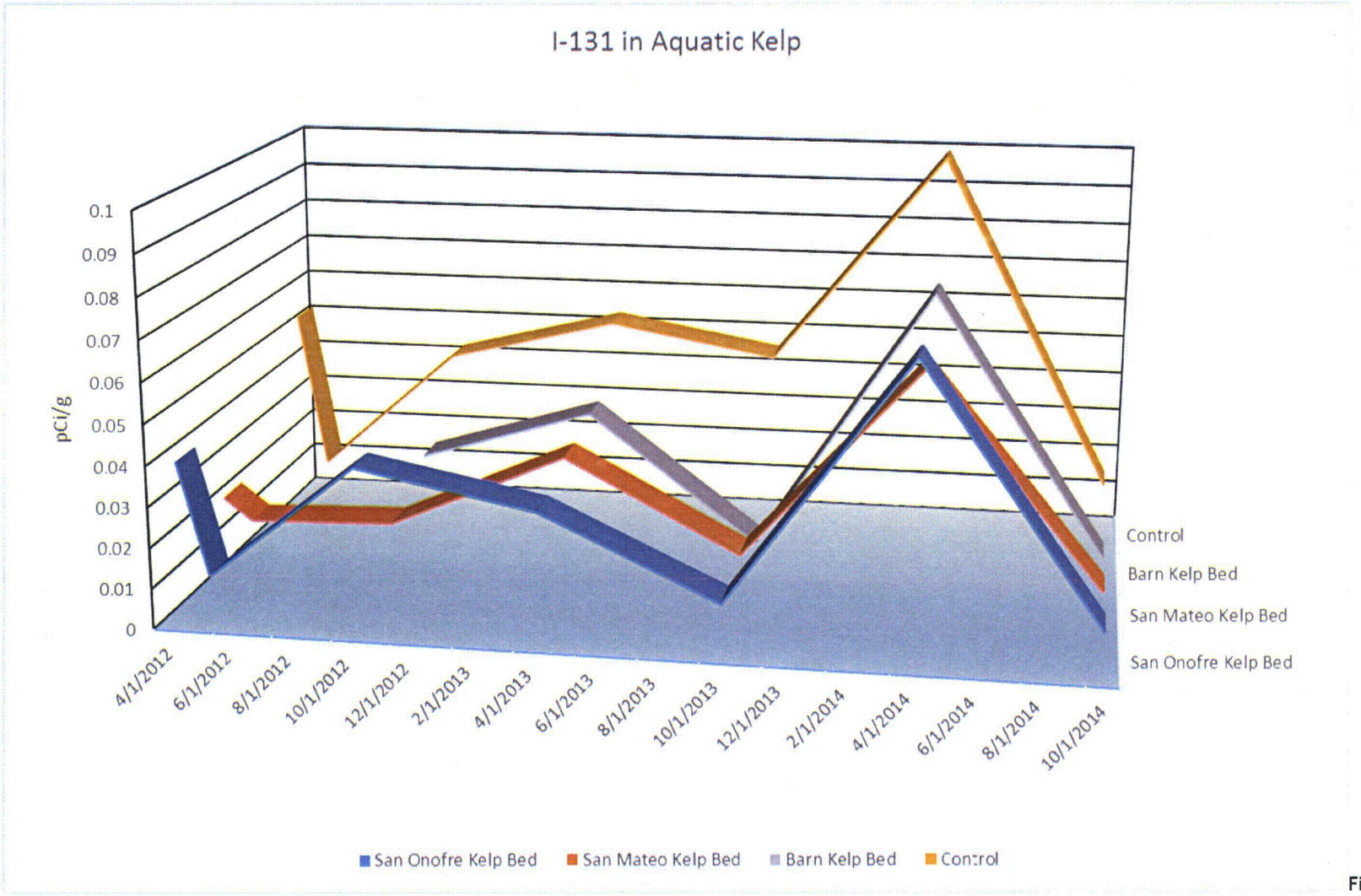


Figure 27. 2014 Weekly Average Gross Beta Acticity (pCi/m3)



Figure

Figure 28. 2014 I-131 in Aquatic Kelp

Appendix H. Errata to the 2013 AREOR

NN# 202794860-003

On July 15, 2014, NRC Inspector reviewed the 2013 Annual Radiological Environmental Operating Release Report and noted that page 12 was missing from the copy he downloaded from the NRC Adams Website. San Onofre's Nuclear Regulatory Affairs (NRA) verified that the approved/signed copy sent to the NRC did contain page 12 in the report.
The page missing from ADAMS on the NRC website is included on the next page of this Appendix H.

TABLE A-2

SECTOR AND DIRECTION DESIGNATION FOR REMP SAMPLE LOCATION MAP

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

Appendix I. REMP TLDs Co-Located With DPH TLDs During 2014

REMP TLDs CO-LOCATED WITH DPH TLDs DURING 2014

California Department of Public Health (CDPH) 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 CDPH dosimeters are reported below. For the TLD results generated by the CDPH access http://cdph.ca.gov/programs/Pages/RHB-RadReport.aspx

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

Table 46. 2014 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	14	7	12	15
SCE -2, NRC -23, DPH #8	Camp San Mateo	15	9	13	14
SCE -3, NRC -19, DPH #9	Camp San Onofre	11	7	12	11
SCE -6, DPH #10	Old Route 101 (East-Southeast)	5	3	5	5
SCE 10, NRC -12, DPH #6	San Onofre Surfing Beach	15	6	11	11
SCE 22, NRC 11, DPH #4	Coast Guard Station	15	9	12	14
SCE -34, NRC -14, DPH #5	San Onofre Elementary School	14	7	7	15
SCE 50, NRC 32, DPH #13	Oceanside Fire Station	10	8	11	11

Note: Requirements in the standard Technical Specifications (TS) adopted under the TS Improvement Program include reporting results of TLDs that are co-located with NRC dosimeters. The NRC dosimeters were exchanged by the CDPH under contract with the NRC. This contract expired in December 1997 and the NRC TLDs were no longer being deployed around SONGS.

See Appendix I of the "1997 Radiological Environmental Operating Report", April, 1998

Appendix J. Independent Spent Fuel Storage Installation (ISFSI) TLD Data

Summary

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 mrem/std. quarter. However, some local variability within the Controlled Area Boundary/Exclusion Area Boundary 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 mrem/standard quarter and 10 mrem/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. The ISFSI TLD data gathered to date appears to follow a similar seasonal variability (Figure 30). 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.

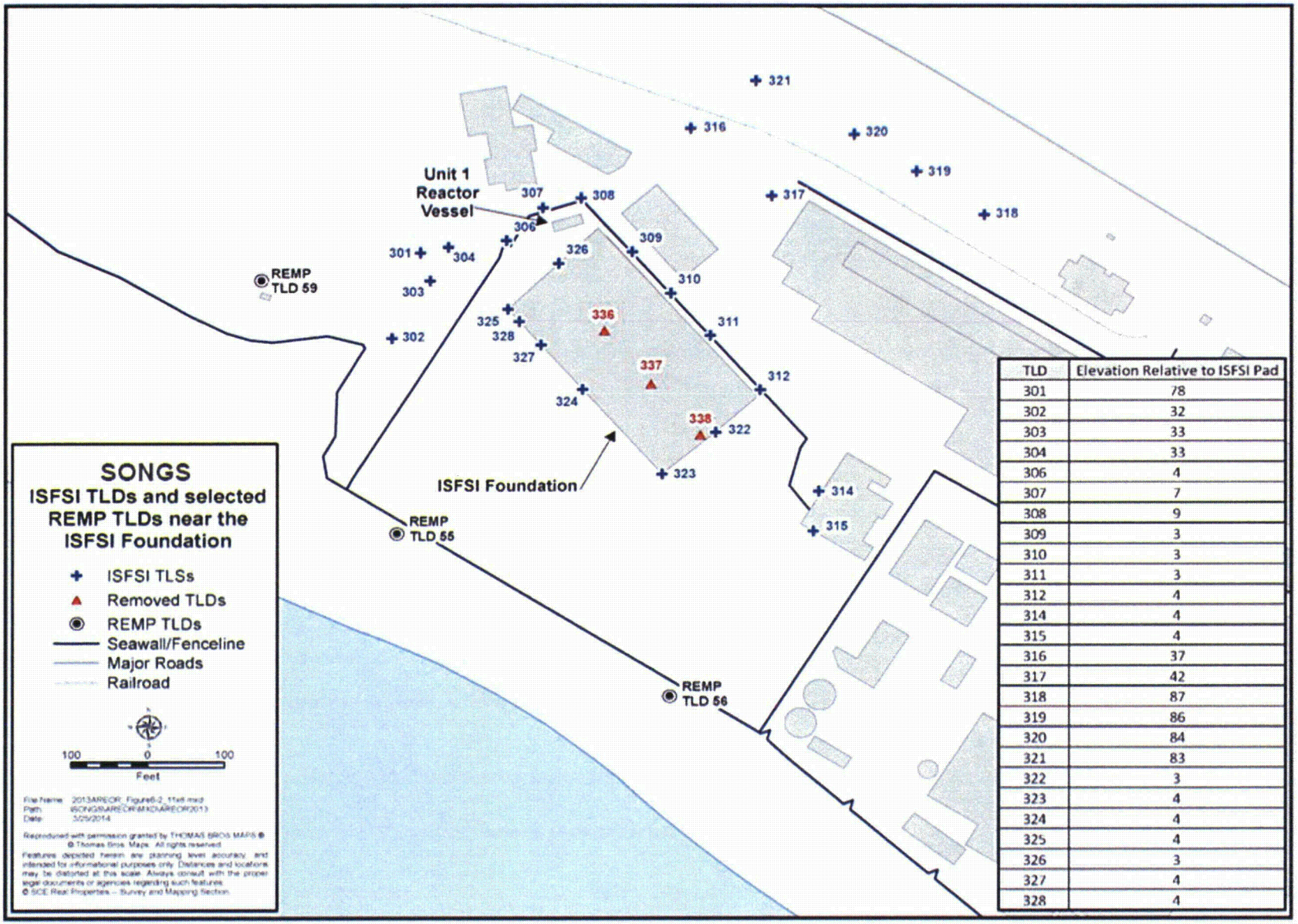
In the second quarter of 2011 additional TLDs 327 and 328 were placed along the fence on the southwest side of the ISFSI. These TLDs had the highest readings in 2013, and 2014. The closest publicly accessible location is SW of the ISFSI along the San Onofre Beach access road, outside the plant's perimeter. The background corrected annual exposures for the access road TLDs 55 and 56 were 12 and 10 mrem, respectively in 2013 and 11 and 12 mrem respectively in 2014. 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 2014 neutron exposure there are 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 mrem 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 (0.25 mSv (25 mrem) to the whole body, 0.75 mSv (75 mrem) to the thyroid and 0.25 mSv (25 mrem) to any other critical organ, 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.

Therefore, 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 47. 2014 ISFSI TLD Data	Quarterly	2014 Quarterly Results (mrem)				Background adjusted 2014 Quarterly Results (mrem)				Annual	2014 Annual
Location	Background	1	2	3	4	1	2	3	4	Baseline	Total (mrem)
ISFSI 301	15	17.53	17.38	19.19	16.97	<LLD	<LLD	<LLD	<LLD	60	71.07
ISFSI 302	15	27.09	29.38	21.31	20.13	12.09	14.38	6.31	5.13	60	97.91
ISFSI 303	15	26.53	26.15	22.04	19.39	11.53	11.15	7.04	<LLD	60	94.11
ISFSI 304	15	23.68	23.48	21.22	20.13	8.68	8.48	6.22	5.13	60	88.51
ISFSI 306	15	18.47	19.25	21.74	20.28	<LLD	<LLD	6.74	5.28	60	79.74
ISFSI 307	15	15.95	16.83	17.77	15.86	<LLD	<LLD	<LLD	<LLD	60	66.41
ISFSI 308	15	16.74	17.7	19.79	18.87	<LLD	<LLD	<LLD	<LLD	60	73.1
ISFSI 309	15	18.22	18.96	20.93	19.82	<LLD	<LLD	5.93	<LLD	60	77.93
ISFSI 310	15	17.89	19.01	21.35	20	<LLD	<LLD	6.35	<LLD	60	78.25
ISFSI 311	15	17.32	17.89	19.8	19.23	<LLD	<LLD	<LLD	<LLD	60	74.24
ISFSI 312	15	13.11	14.27	15.66	14.99	<LLD	<LLD	<LLD	<LLD	60	58.03
ISFSI 314	15	15.92	17.22	17.47	17.5	<LLD	<LLD	<LLD	<LLD	60	68.11
ISFSI 315	15	16.38	17.02	17.72	17.95	<LLD	<LLD	<LLD	<LLD	60	69.07
ISFSI 316	15	14.74	13.49	15.44	14.51	<LLD	<LLD	<LLD	<LLD	60	58.18
ISFSI 317	15	16.39	15.42	16.99	16.75	<LLD	<LLD	<LLD	<LLD	60	65.55
ISFSI 318	15	18.3	16.78	19.97	18.31	<LLD	<LLD	<LLD	<LLD	60	73.36
ISFSI 319	15	18.45	17.74	19.39	17.99	<LLD	<LLD	<LLD	<LLD	60	73.57
ISFSI 320	15	17.36	16.56	19.4	17.06	<LLD	<LLD	<LLD	<LLD	60	70.38
ISFSI 321	15	18.89	16.94	18.98	18.35	<LLD	<LLD	<LLD	<LLD	60	73.16
ISFSI 322	15	15.72	18.28	16.18	18.88	<LLD	<LLD	<LLD	<LLD	60	69.06
ISFSI 323	15	18.57	18.81	20.02	19.66	<LLD	<LLD	5.02	<LLD	60	77.06
ISFSI 324	15	30.48	30.55	23.35	21.82	15.48	15.55	8.35	6.82	60	106.2
ISFSI 325	15	39.33	41.97	23.22	25.46	24.33	26.97	8.22	10.46	60	129.98
ISFSI 326	15	22.29	22.17	24.29	25.51	7.29	7.17	9.29	10.51	60	94.26
ISFSI 327	15	118.92	118.05	47.9	43.52	103.92	103.05	32.9	28.52	60	328.39
ISFSI 328	15	77.92	68.71	47.95	34.84	62.92	53.71	32.95	19.84	60	229.42
55 San Onofre State Beach (U1 West)	15	18.32	16.31	18.45	17.83	<LLD	<LLD	<LLD	<LLD	60	70.91
56 San Onofre State Beach (U1 West)	15	18.37	17.41	17.79	18.38	<LLD	<LLD	<LLD	<LLD	60	71.95
57 San Onofre State Beach (Unit 2)	15	16.3	14.35	15.96	15.76	<LLD	<LLD	<LLD	<LLD	60	62.37
58 San Onofre State Beach (Unit 3)	15	19.33	17.34	20.3	17.84	<LLD	<LLD	5.3	<LLD	60	74.81
59 SONGS Meteorological Tower	15	17.53	17.38	19.19	16.97	<LLD	<LLD	<LLD	<LLD	60	71.07



TLD	Elevation Relative to ISFSI Pad
301	78
302	32
303	33
304	33
306	4
307	7
308	9
309	3
310	3
311	3
312	4
314	4
315	4
316	37
317	42
318	87
319	86
320	84
321	83
322	3
323	4
324	4
325	4
326	3
327	4
328	4

Figure 29. SONGS ISFSI and selected REMP TLD Locations

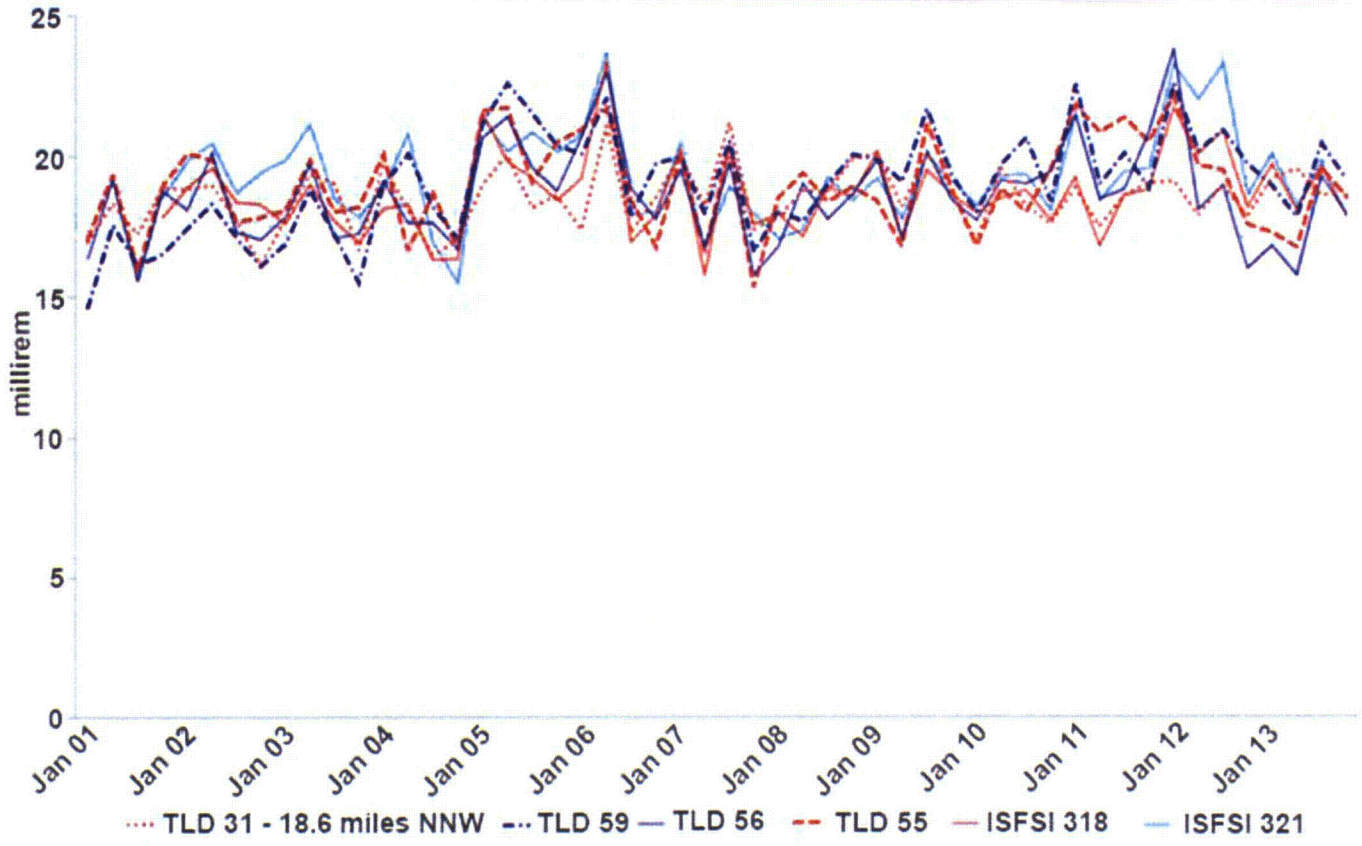


Figure 30. SONGS 2001 through 2013 Plot of selected TLD monitors from ISFSI and REMP, 318, 321, 31, 55, 56, and 59.

SONGS 2014 Plot of Selected TLD Monitors: ISFSI 318, and REMP 31, 55, 56 and 59

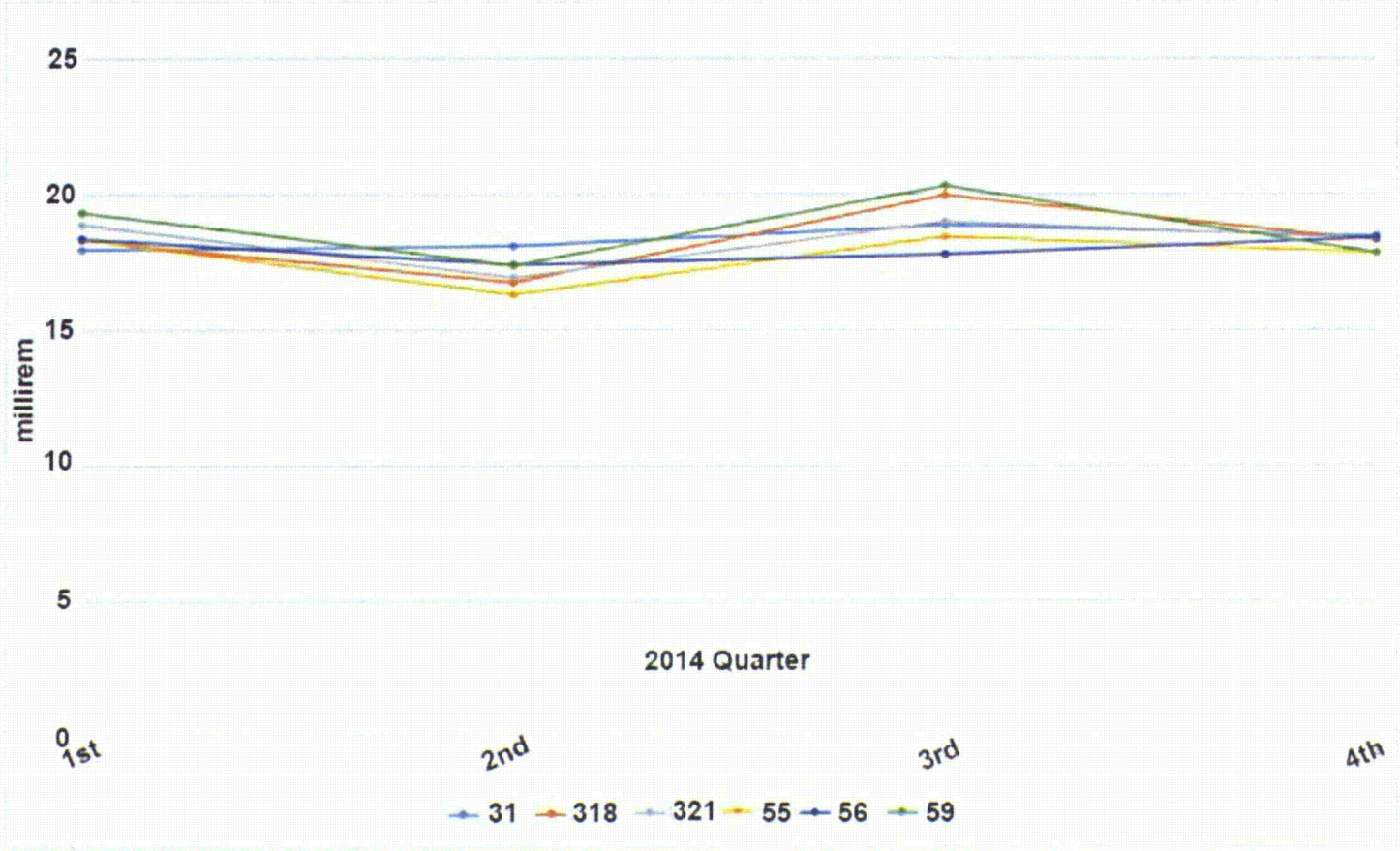


Figure 31. SONGS 2014 Plot of Selected TLD Monitors, ISFSI 318, and REMP 31, 55, 56, and 59.

Appendix K. Offsite Ground Water Sampling

Offsite Drinking Water Data

All investigations have shown that there are no drinking water pathways at SONGS. This information is documented in a memorandum dated 1/31/2007, titled "Radiological Impacts from SONGS Drinking Water Exposure Pathway. Figure 33 illustrates the Groundwater Well location and the flow of the groundwater. Therefore, the operation of SONGS had no impact on drinking water wells in the vicinity of SONGS.

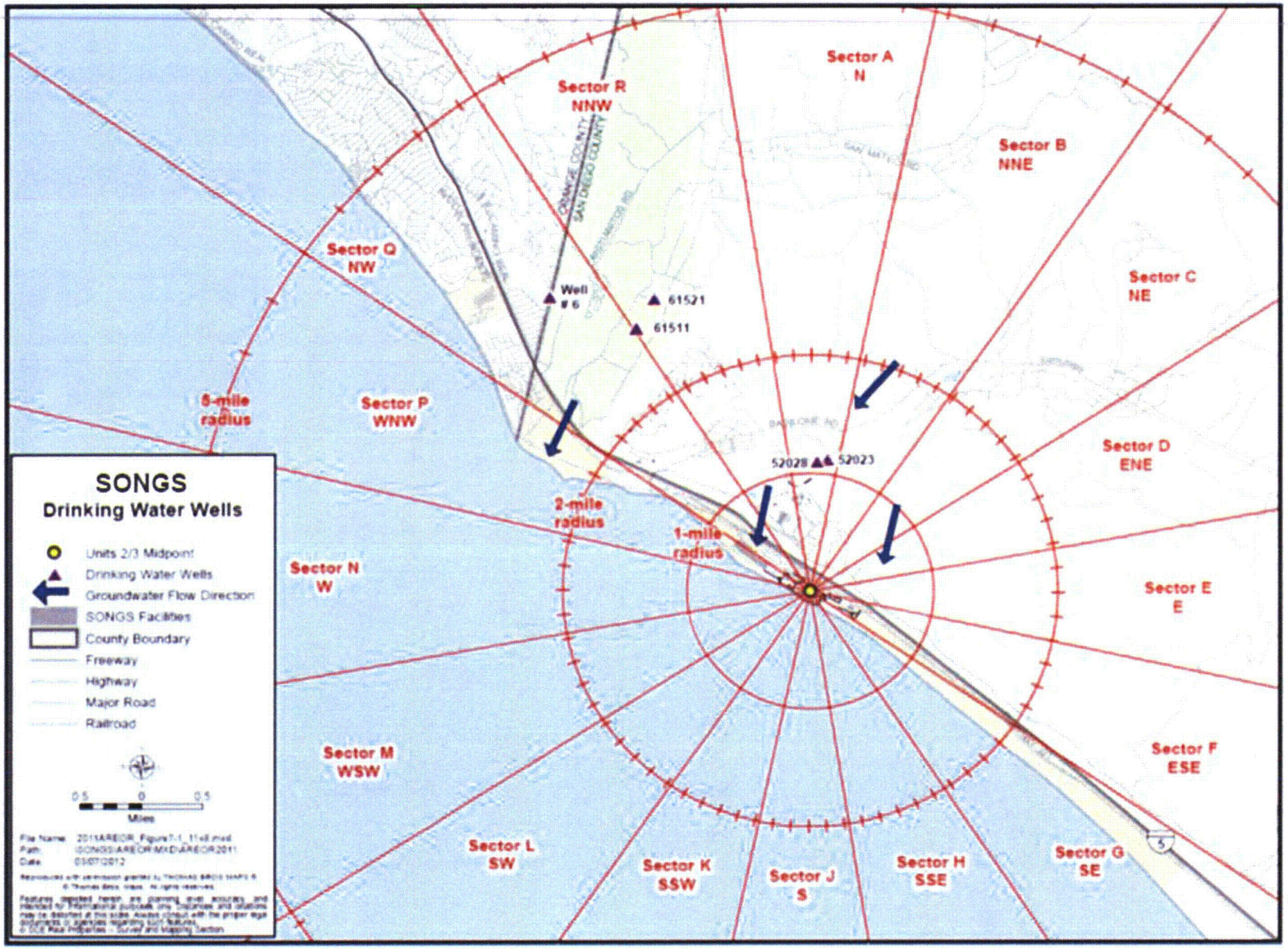


Figure 32. Cloest Drinking Water Wells

Glossary

ALARA (As Low As is Reasonably Achievable) means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Cosmogenic nuclides (or cosmogenic isotopes) are rare isotopes created when a high-energy cosmic ray interacts with the nucleus of an atom. These isotopes are produced within Earth materials such as rocks or soil, in Earth's atmosphere, and in extraterrestrial items such as meteorites. Radioactive isotopes beryllium-7 and beryllium-10 fall into this series of three light elements (lithium, beryllium, boron) formed mostly by cosmic ray spallation nucleosynthesis, both of these nuclides have half-lives too short for them to have been formed before the formation of the Solar System, and thus they cannot be primordial nuclides. Since the cosmic ray spallation route is the only possible source of beryllium-7 and beryllium-10 occurrence naturally in the environment, they are therefore cosmogenic.

Here is a list of radioisotopes formed by the action of cosmic rays on the atmosphere; the list also contains the production mode of the isotope.

Table 48. Isotopes formed by the action of cosmic rays on the air

Isotope	Mode of formation	Isotope	Mode of formation
^{3}H (tritium)	^{14}N (n, $^{12}C)^{3}H$	^{32}Si	Spallation (Ar)
^{7}Be	Spallation (N and O)	^{32}P	Spallation (Ar)
^{10}Be	Spallation (N and O)	^{34m}Cl	Spallation (Ar)
^{11}C	Spallation (N and O)	^{35}S	Spallation (Ar)
^{14}C	^{14}N (n, p) ^{14}C	^{36}Cl	^{35}Cl (n, γ)^{36}Cl
^{18}F	^{18}O (p, n)^{18}F and Spallation (Ar)	^{37}Ar	^{37}Cl (p, n)^{37}Ar
^{22}Na	Spallation (Ar)	^{38}Cl	Spallation (Ar)
^{24}Na	Spallation (Ar)	^{39}Ar	^{38}Ar (n, γ)^{39}Ar
^{28}Mg	Spallation (Ar)	^{39}Cl	^{40}Ar (n, np)^{39}Cl & spallation (Ar)
^{31}Si	Spallation (Ar)	^{41}Ar	^{40}Ar (n, γ)^{41}Ar
		^{81}Kr	^{80}Kr (n, γ) ^{81}Kr

Decay Series: There are three naturally occurring decay series of heavy elements that transform into a series of various radioactive elements by releasing energy in the form of particles, (such as alpha or beta), and/or gamma rays to end in a stable form of non-radioactive Lead. All three decay series start with extremely long lived radioactive, heavy elements that can be measured in geologic time units. They are Uranium-238 with an approximate half-life of 4.5 billion years, Uranium -235 with a half-life of about 700 million years, and Thorium- 232 with a half-life of 14 billion years. All three series contain some more well-known radioactive species, Radium and Radon.

Distinguishable from background means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

Dose is the amount of radiation that is absorbed by a person's body. In the radiation field the term dose is sometimes used interchangeably with dose equivalent, which is defined as the rem and described below.

Half-life is a measure of how fast half the mass of a radioactive element will transform itself into another element. Each radioactive element has its own unique rate of transformation. Consequently, if a radioactive element, such as Iodine-131 has a half-life of 8 days, then in 8 days half of the original amount of Iodine-131 will be gone; in another 8 days half of that half will be left and so on.

Gamma Spectroscopy is a scientific method used to analyze gamma rays emanating from radioactive elements. The analytical system determines the gamma ray energy which acts as a "fingerprint" for specific radioactive materials. For example, Potassium-40 (K-40) has a very, distinctive gamma energy at 1460 keV. This uniqueness allows the instrument to positively identify the K-40 1460 energy as its own unique fingerprint. A keV is an abbreviation for kilo electron volt, which is a measure of energy at the atomic level. A kilo is a scientific prefix for the multiplier 1,000.

Gross Beta is a simple screening technique employed to measure the total number of beta particles emanating from a potentially radioactive sample, with higher values usually indicating that the sample contains natural and/or man-made radioactive elements. High values would prompt further analyses to identify the radioactive species. A beta is a negatively charged particle that is emitted from the nucleus of an atom with a mass equal to that of an orbiting electron.

Liquid Scintillation is an analytical technique by which Tritium and many other radioactive contaminants in water are measured. A sample is placed in a special glass vial that already contains a special scintillation cocktail. The vial is sealed and the container vigorously shaken to create a homogeneous mix. When the tritium transforms or decays it emits a very low energy beta particle. The beta interacts with the scintillating medium and produces a light pulse that is counted by the instrument. Although a different scintillation cocktail is used, this is basically how radon in well water is measured.

mrem or millirem is one thousandth (1/1000) of a rem. The rem is defined below.

milliRoentgen (mR) is one thousandth (1/1000) of a Roentgen, which` is defined below.

pCi/kg is an acronym for a pico-curie per kilogram, which is a concentration unit that defines how much radioactivity is present in a unit mass, such as a kilogram. A "pico" is a scientific prefix for an exponential term that is equivalent to one trillionth (1/1,000,000,000,000).

pCi/L is an acronym for a pico-curie per liter, which is a concentration unit that defines how much radioactivity is present in a unit volume, such as a liter.

Rem is an acronym for roentgen equivalent man. It is a conventional unit of dose equivalent that is based on how much of the radiation energy is absorbed by the body multiplied by a quality factor, which is a measure of the relative hazard of energy transfer by different particles, (alpha, beta, neutrons, protons, etc.), gamma rays or x-rays. In comparison the average natural background radiation dose equivalent to the United States population is estimated to be 292 millirems per year, or 0.8 millirem per day, with 68 % of that dose coming from radon. A millirem is one thousandth,

(1/1000), of a rem.

Roentgen is a special unit of exposure named after the discoverer of X-Rays, Wilhelm Roentgen. It is a measure of how much ionization is produced in the air when it is bombarded with X-Rays or Gamma Rays. Ionization is described as the removal of an orbital electron from an atom.

Skyshine is radiation from a radioactive source that bounces off air molecules in the sky, much like a cue ball does off the banking of a billiard table, and is scattered/redirected back down to the earth.

Thermoluminescent Dosimeters (TLD) are very small plastic-like phosphors or crystals that are placed in a small plastic cage and mounted on trees, posts, etc. to absorb any radiation that impinges on the material. Special readers are then used to heat the plastic to release the energy that was stored when the radiation was absorbed by the plastic. The energy released is in the form of invisible light and that light is counted by the TLD reader. The intensity of the light emitted from the crystals is directly proportional to the amount of radiation that the TLD phosphor was exposed to.

Site Area Boundary is defined as that line beyond which the land is not owned, leased, or otherwise controlled by the licensee; from ODCM definition.

Tritium (Hydrogen-3 or H-3) is a name given to the radioactive form of Hydrogen usually found in nature. All radioactive elements are represented as a combination of their chemical symbol and their mass number. Therefore, Tritium, which is a heavy form of the Hydrogen molecule with one proton and two neutrons in the nucleus of its atom, is abbreviated and represented by its chemical symbol, H, for Hydrogen and 3 for the number of particles in its nucleus, or mass number. Similarly, other radioactive elements, such as Potassium-40, can be represented and abbreviated as K-40.