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10 CFR 50, Appx. I

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
2024 Annual Radiological Environmental Operating Report
San Onofre Nuclear Generating Station (SONGS), Units 1, 2 and 3 and
Independent Spent Fuel Storage Installation**

In accordance with the San Onofre Nuclear Generating Station (SONGS) Licensee Controlled Specification 5.7.1.2, Southern California Edison (SCE) is submitting the 2024 Annual Radiological Environmental Operating Report (AREOR) for SONGS Units 1, 2 and 3. The AREOR covers the operation of SONGS during January 1, 2024 through December 31, 2024 and includes summaries, interpretations, and analyses of trends of the results of the Radiological Environmental Monitoring Program (REMP).

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

There are no commitments in this letter or the enclosure.

If you have any questions, please contact me at (949) 368-6274.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Morgan", with a stylized flourish extending from the end.

Enclosure: 2024 San Onofre Nuclear Generating Station Annual Radiological Environmental Operating Report

cc: J.D. Monninger, Regional Administrator, NRC Region IV
J. Fassel, California Department of Public Health

ENCLOSURE

**2024 San Onofre Nuclear Generating Station
Annual Radiological Environmental Operating Report**



Annual Radiological Environmental Operating Report 2024

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1.0 LIST OF ACRONYMS AND DEFINITIONS

1. Airborne Activity Sampling: Continuous sampling of air through the collection of particulates and radionuclides on filter media.
2. ARERR: Annual Radioactive Effluent Release Report
3. AREOR: Annual Radiological Environmental Operating Report
4. BWR: Boiling Water Reactor
5. CDPH: California Department of Public Health
6. Composite Sample: A series of single collected portions (aliquots) analyzed as one sample. The aliquots making up the sample are collected at time intervals that are very short compared to the composite period.
7. Control: A sampling station in a location not likely to be affected by plant effluents due to its distance and/or direction from the station.
8. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.
9. Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed using Thermoluminescent Dosimeters (TLD), Optically Stimulated Luminescence Dosimeters (OSLD) and pressurized ionization chambers.
10. DOE: Department of Energy
11. EDC: Environmental Dosimetry Company
12. EPA: Environmental Protection Agency
13. ERA: Environmental Resource Associates
14. GPI: Groundwater Protection Initiative
15. Grab Sample: A single discrete sample drawn at one point in time.
16. Indicator: A sampling location that is likely to be affected by plant effluents due to its proximity and/or direction from the plant.
17. Ingestion Pathway: The ingestion pathway includes milk, fish, drinking water and garden produce. Also sampled (under special circumstances) are other media such as vegetation or animal products when additional information about particular radionuclides is needed.
18. ISFSI: Independent Spent Fuel Storage Installation
19. LCS: Laboratory Control Spike

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20. LCSD: Laboratory Control Spike Duplicate
21. Lower Limit of Detection (LLD): An *a priori* measure of the detection capability of a radiochemistry measurement based on instrument setup, calibration, background, decay time, and sample volume. An LLD is expressed as an activity concentration. The MDA is used for reporting results. LLD are specified by a regulator, such as the NRC and are typically listed in the ODCM.
22. MAPEP: Mixed Analyte Performance Evaluation Program
23. MDA: Minimum Detectable Activity. For radiochemistry instruments, the MDA is the *a posteriori* minimum concentration that a counting system detects. The smallest concentration or activity of radioactive material in a sample that will yield a net count above instrument background and that is detected with 95% probability, with only five % probability of falsely concluding that a blank observation represents a true signal.
24. MDC: Minimum Detectable Concentration. Essentially synonymous with MDA for the purposes of radiological monitoring.
25. Mean: The sum of all of the values in a distribution divided by the number of values in the distribution, synonymous with average.
26. N/A: Not Applicable
27. NEI: Nuclear Energy Institute
28. NIST: National Institute of Standards and Technology.
29. NRC: Nuclear Regulatory Commission
30. ODCM: Offsite Dose Calculation Manual
31. OSLD: Optically Stimulated Luminescence Dosimeter
32. Picocurie (pCi): 3.7×10^{-2} disintegrations per second, or 2.22 disintegrations per minute.
33. pCi/L: picocuries / Liter
34. PWR: Pressurized Water Reactor
35. REMP: Radiological Environmental Monitoring Program
36. TLD: Thermoluminescent Dosimeter

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2.0 EXECUTIVE SUMMARY

San Onofre Nuclear Generating Station (SONGS) Radiological Environmental Monitoring Program (REMP) was established prior to the station becoming operational to provide information on background radiation present in the area. The goal of SONGS REMP is to evaluate the impact of the station on the environment. Environmental samples from different media are monitored as part of the program in accordance with specifications detailed in the Offsite Dose Calculation Manual (ODCM). The program compares data from Indicator locations near the plant, to Control locations farther away from the site to assess operation impacts.

The Annual Radiological Environmental Operating Report (AREOR) provides data obtained through analyses of environmental samples collected at SONGS for the reporting period of January 1st through December 31st, 2024. During that time period 620 analyses were performed on behalf of SONGS on 547 samples. In assessing all the data gathered for this report and comparing these results with 10-year average values, it was concluded that the operation of SONGS did not result in detection of plant related radionuclides in the environment.

2.1 Summary of Conclusions:

No measurable activities above background levels were detected in samples analyzed by the SONGS vendor laboratory. All values were consistent with historical results which indicate no adverse radiological environmental impacts associated with the operation of SONGS. Naturally occurring radionuclides are present in the Earth's crust and atmosphere and exist in detectable quantities throughout the world. It is common to detect naturally occurring radionuclides in many of the samples collected for REMP. Some examples of naturally occurring radionuclides that are frequently seen in samples are potassium-40, beryllium-7, actinium-228 (present as a decay product of radium-228), and radium-226. Additionally, some relatively long-lived anthropogenic radioisotopes, such as strontium-90 and cesium-137, are also seen in some REMP samples; these radionuclides exist in measurable quantities throughout the world as a result of fallout from historic atmospheric nuclear weapons testing. Detailed information on the exposure of the U.S. population to ionizing radiation can be found in NCRP Report No. 160 [1].

3.0 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) provides data on measurable levels of radiation and radioactive materials in the environment. This program also evaluates the relationship between quantities of radioactive materials released from the plant and resultant doses to individuals from principal pathways of exposure. In this capacity, REMP provides a check on the effluent release program and dispersion modeling to ensure that concentrations in the environment due to radioactive effluents conform to the “As Low as Is Reasonably Achievable” (ALARA) design objectives of 10 CFR 50, Appendix I [2], and implements the requirements of Section IV.B.2 and IV.B.3 of Appendix I. REMP is designed to conform to the Nuclear Regulatory Commission (NRC) Regulatory Guide 4.1 [3], NUREG 1301/1302 [4] [5], and the 1979 NRC Branch Technical Position [6].

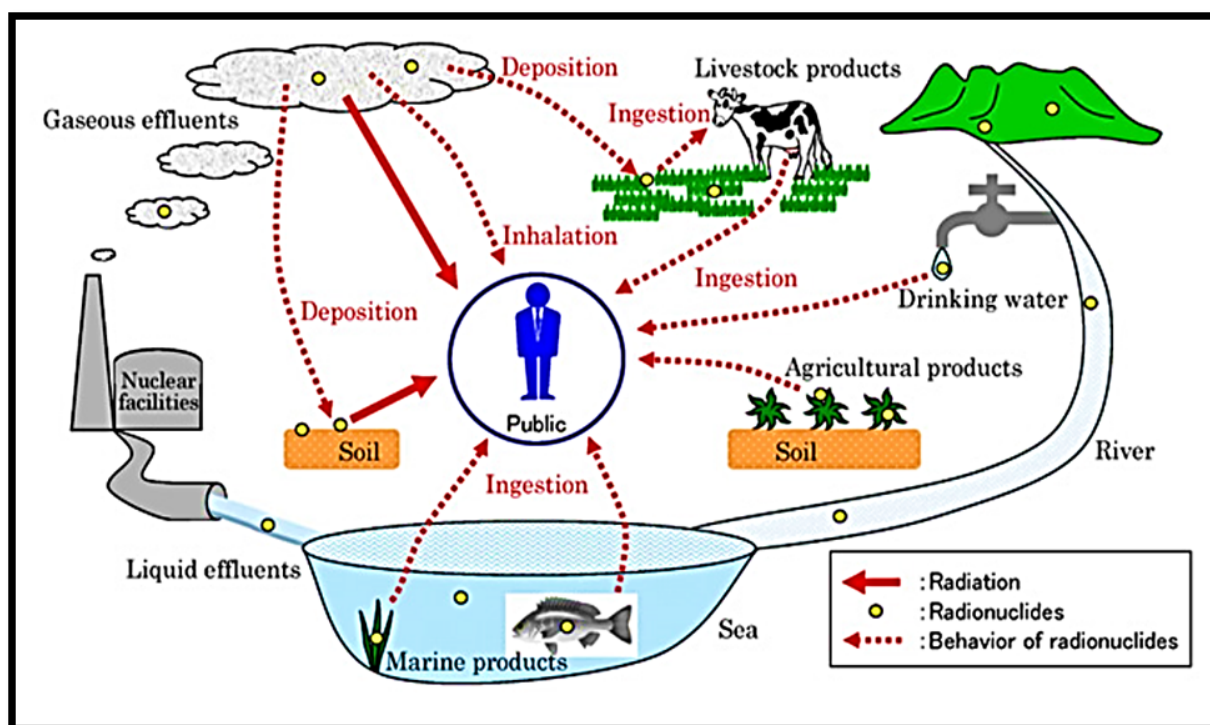


Figure 1: Potential exposure pathways to Members of the Public due to Plant Operations [7]

Quality assurance aspects of the sampling program and TLD data collection are conducted in accordance with Regulatory Guides 4.15 [8] and 4.13 [9]. REMP also adheres to the requirements of SONGS Licensee Controlled Specifications, and Offsite Dose Calculation Manual (ODCM). These governing documents dictate the environmental sampling, sample analysis protocols, data reporting and quality assurance requirements for the environmental monitoring program.

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The Annual Radiological Environmental Operating Report provides summaries of the environmental data from exposure pathways, interpretations of the data, and analyses of trends of the results. Routinely monitored pathways include ingestion, inhalation, and direct radiation. Routes of exposure are based on site specific information such as meteorology, receptor locations, and water usage around the plant.

4.0 SITE DESCRIPTION AND SAMPLE LOCATIONS

San Onofre Nuclear Generating Station is a commercial nuclear power plant that achieved initial criticality in 1967 for Unit 1. 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. At this time there are no operating reactors, but in the past, there were three operating pressurized water reactors with a total rated capacity of 2664 net megawatts electrical.

Unit 1 operated from 1968 to 1992 and has been partially decommissioned with all above-ground structures removed. The SONGS ISFSI is located in the area formerly occupied by Unit 1. Units 2 and 3 were operated from 1983 and 1984 until the units were permanently retired in 2013. Units 2 and 3 are under active decommissioning.

SONGS sampling media are selected based on site specific information such as meteorology, receptor locations, and water usage around the plant. Sampling and analysis frequencies are documented in the Offsite Dose Calculation Manual and site procedures. Required sampling, analysis frequencies and location of sample collected are captured in the following tables and figures:

- Table 1: Radiological Environmental Monitoring Program – Direct Radiation
- Table 2: Radiological Environmental Monitoring Program – Airborne
- Table 3: Radiological Environmental Monitoring Program – Waterborne
- Table 4: Radiological Environmental Monitoring Program – Ingestion
- Table 5: REMP Sampling Locations – Direct Radiation
- Figure 2: SONGS Nearby Terrestrial Locations (SONGS ODCM Figure 5-1)
- Figure 3: SONGS Terrestrial Samples, 1-Mile (SONGS ODCM Figure 5-2)
- Figure 4: SONGS Terrestrial Samples, 5-Miles (SONGS ODCM Figure 5-3)
- Figure 5: SONGS Terrestrial Samples, Control (SONGS ODCM Figure 5-4)
- Figure 6: SONGS Marine Samples, Near (SONGS ODCM Figure 5-5)
- Figure 7: SONGS Marine Samples, Far (SONGS ODCM Figure 5-6)

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REQUIREMENTS

Table 1: Radiological Environmental Monitoring Program – Direct Radiation

Requirement	Sample Location Description, Distance, and Direction	Sampling Collection Frequency	Type and Frequency of Analyses
<u>Direct Radiation</u> At least 30 Routine monitoring stations with two or more dosimeters placed as follows: An inner ring of stations, one in each compass sector in the general area of the site boundary. An outer ring of stations, one in each compass sector at approximately five miles from the site; and Special interest areas, such as population centers, nearby recreation areas, and control stations	See Table 5	Quarterly	Gamma dose/Quarterly

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Table 2: Radiological Environmental Monitoring Program – Airborne

Requirement	Sample Location Description, Distance, and Direction	Sampling Collection Frequency	Type and Frequency of Analyses
<u>Airborne Particulates</u> Samples from at least five locations: Three samples from offsite locations (in different sectors) of the highest calculated annual average ground level D/Q. One sample from the vicinity of a community having the highest calculated annual average D/Q. One sample from a control location, approximately 10 to 20 miles distant in the least prevalent wind direction.	AS-1 (APA 01): City of San Clemente (City Hall), 5.1 miles NW AS-9 (APA 09): State Beach Park, 0.6 miles ESE (Permanently Retired from Service) AS-10^a (APA 10): Bluff, 0.7 miles WNW AS-12 (APA 12): Former SONGS Evaporation Pond, 0.6 miles NW AS-13 (APA 13): Marine Corp Base (Camp Pendleton East), 0.7 miles E AS-16 (APA 16): San Luis Rey Substation (Control), 16.7 miles SE AS-20 (APA 20): E Site Boundary (Alt for AS-13), 0.2 miles E AS-21 (APA 21): ESE Site Boundary (Alt for AS-9), 0.4 miles ESE	Continuous sampler operation with sample collection weekly	Analyze weekly for gross beta. Perform gamma isotopic analysis on composite sample (by location)/Quarterly.

^a AS-10 is not required per REMP bases but has been maintained due to being collocated with a CDPH Air Sampler.

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Table 3: Radiological Environmental Monitoring Program – Waterborne

Requirement	Sample Location Description, Distance, and Direction	Sampling Collection Frequency	Type and Frequency of Analyses
Ocean Water One sample taken at a distance beyond significant influence of the discharge (control) and three samples within the vicinity of the discharge (indicator)	Ocean Water A (WSA 01): Station Discharge Outfall – Unit 1, 0.6 miles SW Ocean Water B (WSA 02): Outfall – Unit 2, 1.5 miles SW Ocean Water C (WSA 03): Outfall – Unit 3, 1.2 miles SSW Ocean Water D (WSA 04): Newport Beach (Control), 30.0 miles NW	Samples are collected monthly.	Gamma isotopic and H-3 /Monthly
Shoreline Sediment One sample taken at a distance beyond significant influence of the discharge (control) and three samples within the vicinity of the discharge (indicator)	Shoreline Sediment Sample 1 (SSA 01): San Onofre State Beach (Southeast), 0.6 miles SE Shoreline Sediment Sample 2 (SSA 02): San Onofre Surfing Beach, 0.8 WNW Shoreline Sediment Sample 3 (SSA 03): San Onofre State Beach (Southeast), 3.5 miles SE Shoreline Sediment Sample 4 (SSA 04): Newport Beach (North End) (Control), 29.2 miles NW	Semiannual	Gamma isotopic /Semiannually
Ocean Bottom Sediment One sample taken at a distance beyond significant influence of the discharge (control) and four samples within the vicinity of the discharge (indicator)	OBS Sample B (SEB 02): Unit 1 Outfall, 0.8 miles SSW OBS Sample C (SEB 03): Unit 2 Outfall, 1.6 miles SW OBS Sample D (SEB 04): Unit 3 Outfall, 1.2 miles SSW OBS Sample E (SEB 05): Laguna Beach (Control), 15-20 miles NW OBS Sample F (SEB 06): SONGS Upcoast, 0.9 miles WSW	Semiannual	Gamma isotopic /Semiannually

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Table 4: Radiological Environmental Monitoring Program – Ingestion

Requirement	Sample Location Description, Distance, and Direction	Sampling Collection Frequency	Type and Frequency of Analyses
Non-Migratory Marine Animal: Two recreationally important adult fish, one crustacean, and one mollusk from two locations in the vicinity of site discharge. One sample of same species in areas not influenced by plant discharge.	NMMA Sample A (MOA 01): Unit 1 Outfall, 0.9 miles WSW NMMA Sample B (MOA 02): Unit 2/3 Outfall, 1.5 miles SSW NMMA Sample C (MOA 03): Laguna Beach (Control), 15-20 miles WNW to NW	Semiannually if available	Gamma isotopic /Semiannually
Local Crops: One sample each of fleshy and leafy crops. One sample each of fleshy and leafy crops collected from the control location.	Local Crops 2 (TFB 02): Control (Vista/Oceanside), 15- 25 miles SE to ESE Local Crops 6 (TFB 06): SONGS Garden, 0.7 miles NNW	Semiannual	Gamma isotopic /Semiannually

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Table 5: REMP Sampling Locations – Direct Radiation

Site #	Location Type	Sector	Distance	Description
1 ^a	Special Interest	NW	5.7	City of San Clemente (Former SDG&E Offices)
2 ^a	Outer Ring	N	3.6	Camp San Mateo – (MCB, Camp Pendleton)
3 ^a	Special Interest	NE	2.8	Camp San Onofre – (MCB, Camp Pendleton)
4	Outer Ring	E	4.4	Camp Horno – (MCB, Camp Pendleton)
6 ^a	Outer Ring	ESE	3.0	Old El Camino Real (AKA Old Highway 101)
8	Special Interest	NW	1.4	Noncommissioned Officers' Beach Club
10 ^a	Inner Ring	WNW	0.7	Bluff (AS #10)
11	Inner Ring	NW	0.4	Former Visitors' Center
12	Special Interest	E	0.2*	South Edge of Switchyard
15	Special Interest	SSE	0.1*	Southeast Site Boundary
16 ^a	Special Interest	ESE	0.4*	East Southeast Site Boundary
19	Outer Ring	NNW	4.9	San Clemente Highlands
22 ^a	Outer Ring	WNW	2.7	Former US Coast Guard Station - San Mateo Point
34 ^a	Special Interest	NW	1.9	San Onofre School – (MCB, Camp Pendleton)
35	Outer Ring	NNE	4.8	Range 312 – (MCB, Camp Pendleton)
36	Outer Ring	NE	4.1	Range 208C – (MCB, Camp Pendleton)
40	Inner Ring	NNW	0.7	Mesa SONGS Garden
41	Special Interest	E	0.3	Old Route 101 – East
46	Inner Ring	SE	1.0	San Onofre State Beach Park

^a TLD is collocated with a CDPH TLD.

* TLD Location is within the SONGS Site Boundary.

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Table 5: REMP Sampling Locations – Direct Radiation

Site #	Location Type	Sector	Distance	Description
50 ^a	Special Interest	SE	15.6	Oceanside Fire Station (Control)
55	Special Interest	WNW	0.2*	San Onofre State Beach (U1 West)
56	Special Interest	W	0.2*	San Onofre State Beach (U1 West)
57	Special Interest	SW	0.1*	San Onofre State Beach (Unit 2)
58	Special Interest	S	0.1*	San Onofre State Beach (Unit 3)
61	Inner Ring	N	0.7	Mesa - East Boundary (Former PIC 4)
62	Inner Ring	NNE	0.7	MCB - Camp Pendleton (Former PIC 5)
63	Inner Ring	NE	0.6	MCB - Camp Pendleton (Former PIC 6)
64	Inner Ring	ENE	0.6	MCB - Camp Pendleton (Former PIC 7)
65	Inner Ring	E	0.7	MCB - Camp Pendleton (AS #13)
66	Inner Ring	ESE	0.6	San Onofre State Beach Park (AS #9)
68	Outer Ring	ENE	4.4	Range 210C – (MCB, Camp Pendleton)
73	Special Interest	ESE	0.4*	South Yard Facility
75	Outer Ring	SE	4.6	Gate 25 MCB
76	Outer Ring	NW	4.6	Former El Camino Real Mobil Station

^a TLD is collocated with a CDPH TLD.

* TLD Location is within the SONGS Site Boundary.

6.0 MAPS OF COLLECTION SITES

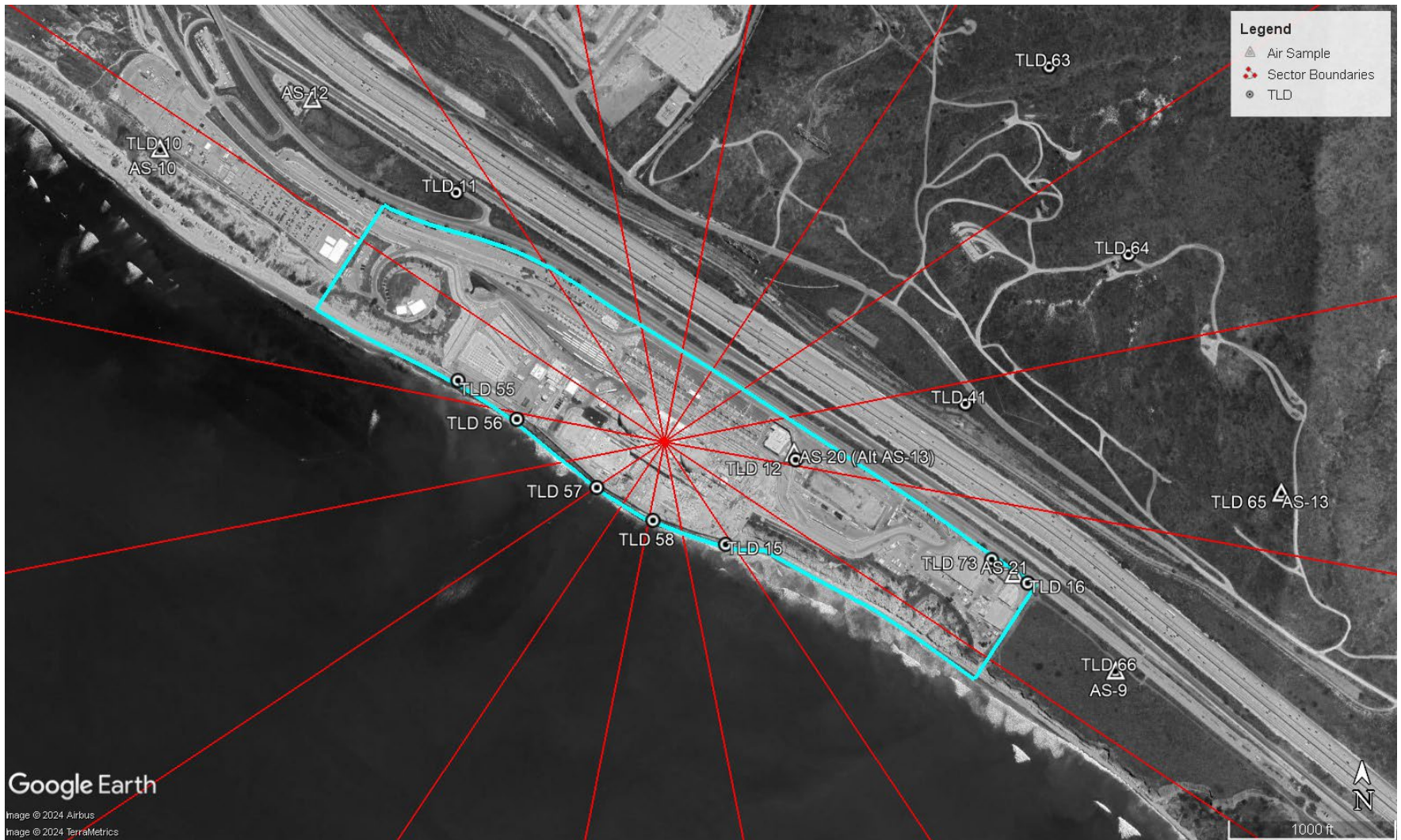


Figure 2: SONGS Nearby Terrestrial Locations (SONGS ODCM Figure 5-1)

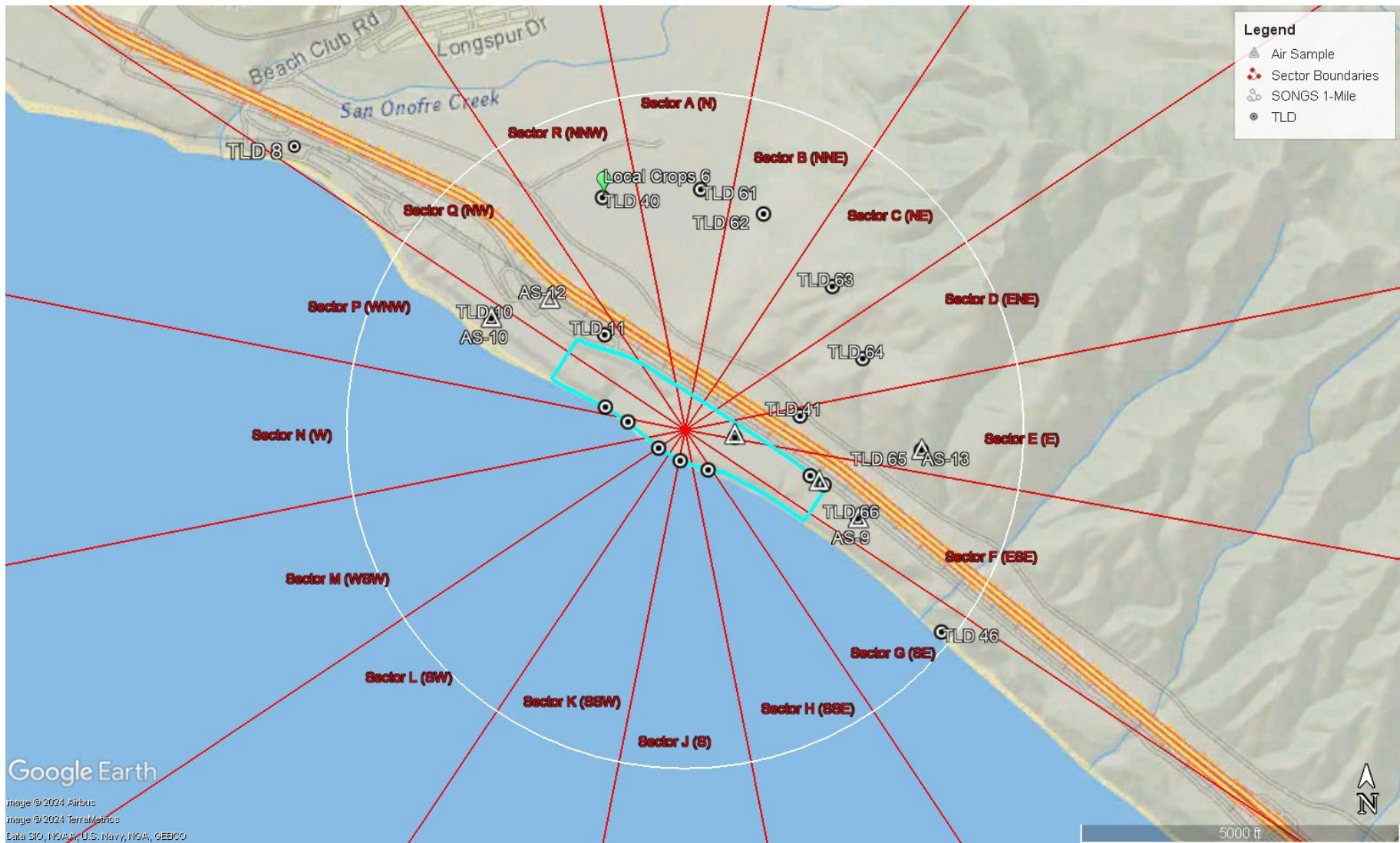


Figure 3: SONGS Terrestrial Samples, 1-Mile (SONGS ODCM Figure 5-2)

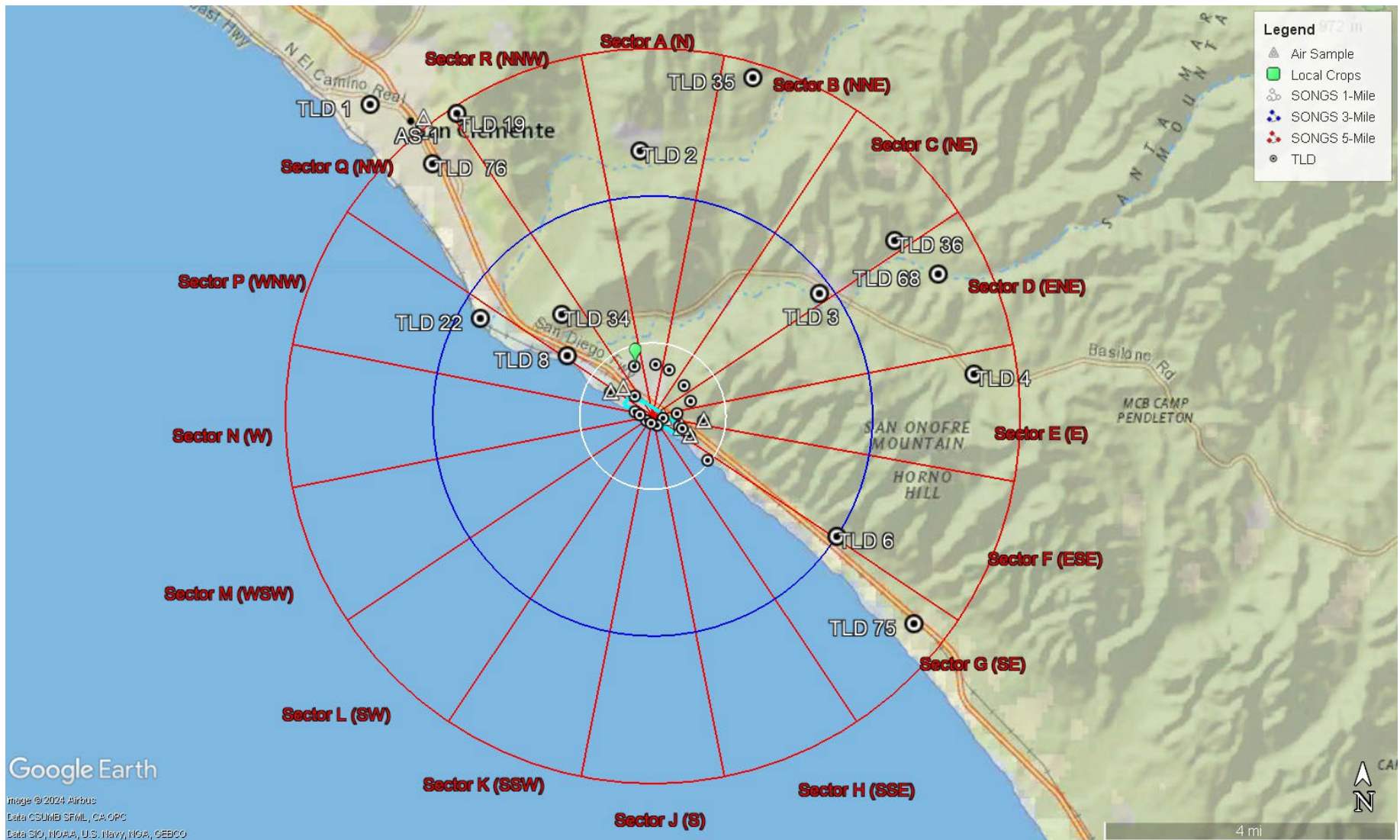


Figure 4: SONGS Terrestrial Samples, 5-Miles (SONGS ODCM Figure 5-3)

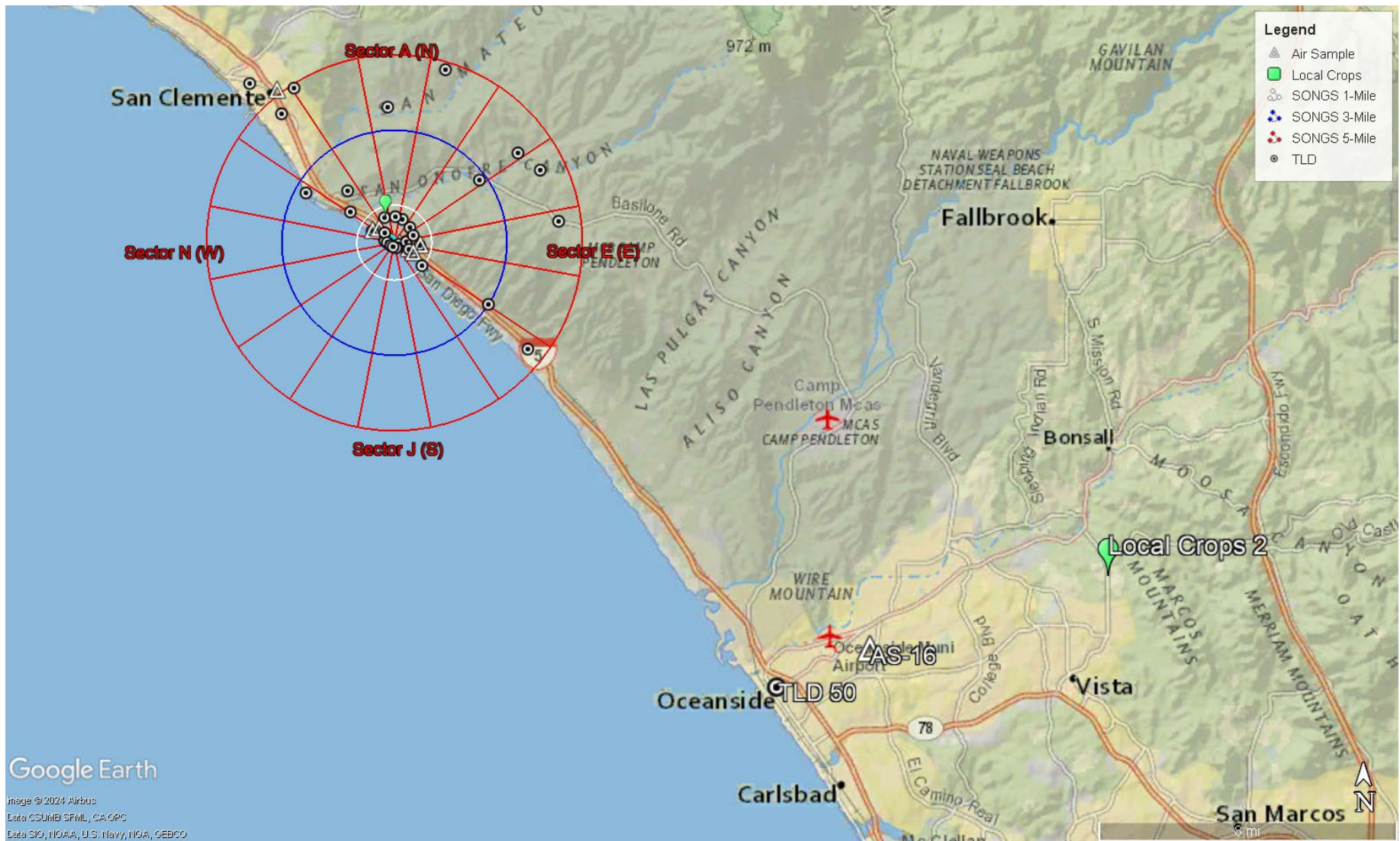


Figure 5: SONGS Terrestrial Samples, Control (SONGS ODCM Figure 5-4)

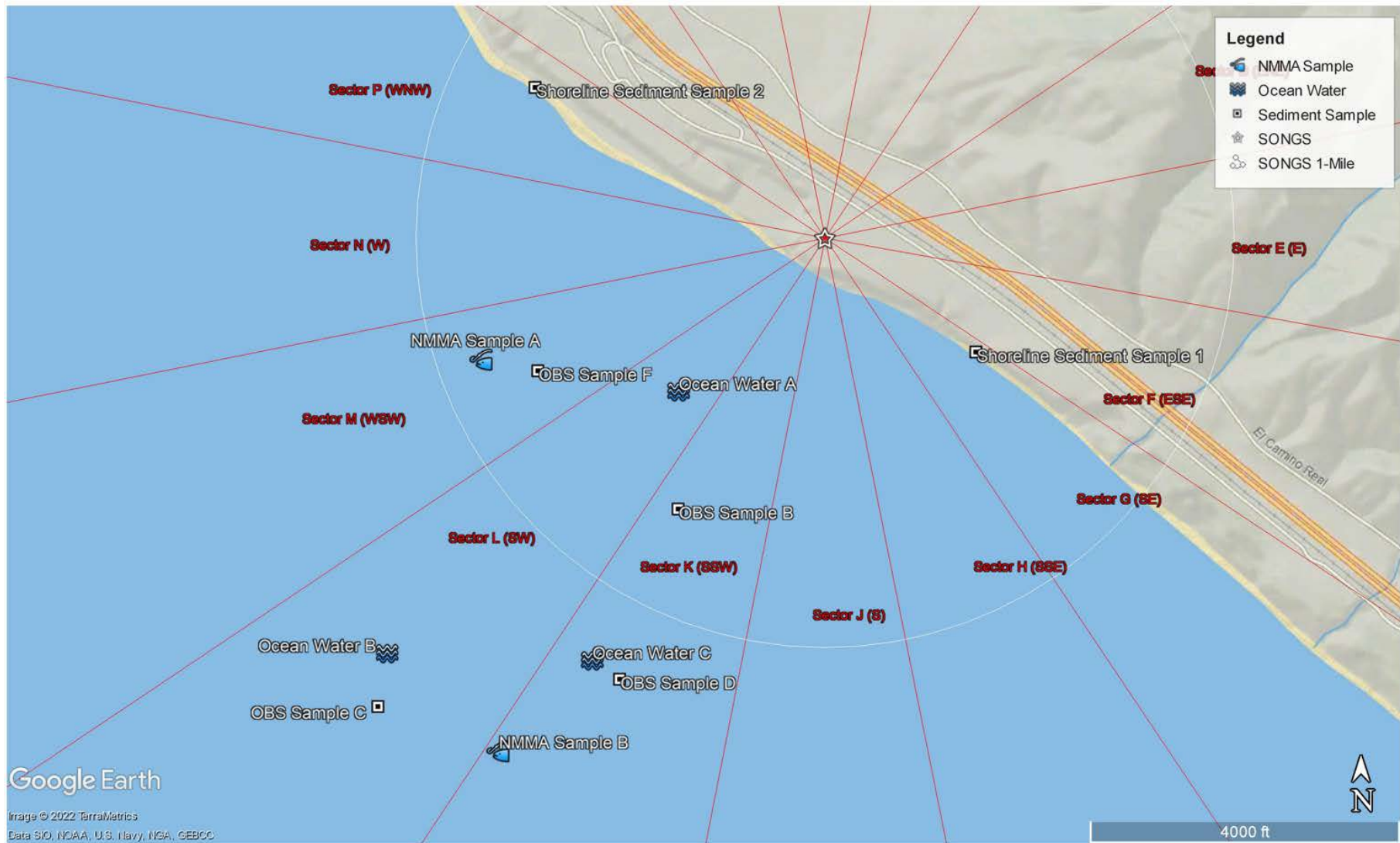


Figure 6: SONGS Marine Samples, Near (SONGS ODCM Figure 5-5)

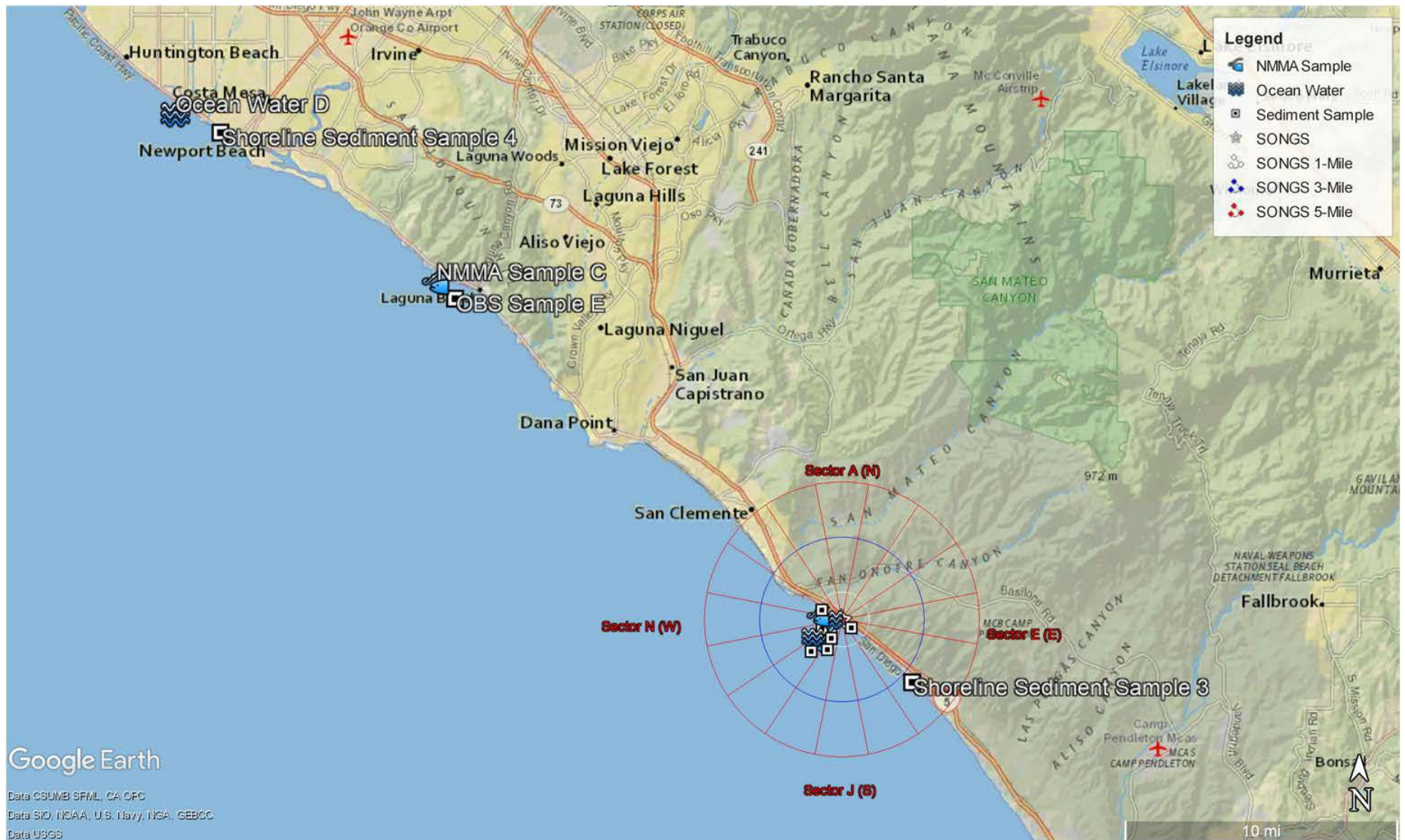


Figure 7: SONGS Marine Samples, Far (SONGS ODCM Figure 5-6)

7.0 REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Table 6: Reporting Levels for Radioactivity Concentrations in Environmental Samples

Radionuclide	Water (pCi/L)	Air Particulates or Gases (pCi/m ³)	Marine Animals (pCi/Kg-wet)	Local Crops (pCi/Kg-wet)
H-3	30,000 ⁽¹⁾			
Mn-54	1,000		30,000	
Co-58	1,000		30,000	
Co-60	300		10,000	
Zn-65	300		20,000	
Cs-134	30	10	1,000	1,000
Cs-137	50	20	2,000	2,000

Table 7: Maximum Values for the Limit of Detection

Radionuclide	Water (pCi/L)	Air Particulates or Gases (pCi/m ³)	Marine Animals (pCi/Kg-wet)	Local Crops (pCi/Kg-wet)	Sediment (pCi/Kg-dry)
Gross Beta		0.01			
H-3	3,000 ⁽²⁾				
Mn-54	15		130		
Co-58, Co-60	15		130		
Zn-65	30		260		
Cs-134	15	0.05	130	60	150
Cs-137	18	0.06	150	80	180

¹ Reporting Level value of 30,000 pCi/l selected for H-3 based on NUREG-1301 guidance for plants where no drinking water pathway exists.

² Maximum LLD value of 3,000 pCi/l selected for H-3 based on NUREG-1301 guidance for plants where no drinking water pathway exists.

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8.0 SAMPLING PROGRAM, PROGRAM MODIFICATION AND INTERPRETATION OF RESULTS

At most nuclear stations, data was collected prior to plant operation to determine background radioactivity levels in the environment. Annual data is routinely compared to preoperational and/or 10-year average values to determine if changes in the environs are present. Strict comparison is difficult to make due to fallout from historical nuclear weapon testing. Cesium-137 can be routinely found in environmental samples as a result of above ground nuclear weapons testing. It is important to note, levels of Cs-137 in environment are observed to fluctuate, for example as silt distributions shift due to natural erosion and transport processes, Cs-137 may or may not be observed in sediment samples. Results from samples collected and analyzed during the year, 2024, are described and interpreted below. The REMP sample results are statistically summarized in Attachment 1 and complete results are presented in Attachment 2 and Attachment 4.

In the following sections, results from direct radiation, air, water, and food products analyzed as part of REMP in 2024 will be discussed. Sampling program descriptions and deviations will also be discussed.

8.1 Environmental Direct Radiation Dosimetry Results

Dose is measured as net exposure (field reading less transit reading) normalized to 91-day quarters. Data is treated and analyzed consistent with ANSI/HPS N13.37-2014 [10], which compares the measured dose for each location to the baseline background dose for that location. Environmental dose rates vary by location, depending on geological and land use considerations, and remain relatively constant for any given location (unless land use changes). Some facilities observe seasonal variation in environmental doses. Baseline Background Doses have been determined for both quarterly and annual measurements at each location using historical field measurements.

ANSI/HPS N13.37-2014 uses the concept of minimum differential dose (MDD), which is the minimum facility-related dose that can be detected above background. Due to natural background variations and measurement sensitivities and uncertainties, minimum differential dose is not zero. MDD is calculated based on statistical performance of the dosimetry system in the environment and is site specific.

Normalized doses that exceed the Minimum Differential Dose value above the Baseline Background Dose are considered to indicate Facility-Related Dose; a quality assurance review is performed to verify that any results indicating Facility-Related Dose are accurate.

During the calendar year 2024, a total of 34 locations were monitored and the data was analyzed in accordance with the requirements in Table 1: Radiological Environmental Monitoring Program – Direct Radiation. Attachment 4: Environmental Direct Radiation Dosimetry Results, provides the annual direct radiation dosimetry analysis.

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There was no detectable direct radiation dose to Members of the Public from SONGS. Facility-Related Doses, measured at TLDs 12, 15, 58, and 73 during 2024 were related to the storage of radioactive material awaiting shipment. Facility-Related Dose at TLD 55 was due to the ISFSI and was consistent with previous years.

In all cases, the occupancy-adjusted dose to Members of the Public at or beyond the Site Boundary was <1 mrem per year and is reported as Not Detected in accordance with ANSI/HPS N13.37-2014.

As the project moves into a high-volume waste generation phase dose rates will be closely monitored to ensure that stored radioactive material does not adversely impact Facility-Related Dose measurements in the future.

8.2 Air Particulate Sample Results

Air particulate filters were collected from locations specified in Table 2: Radiological Environmental Monitoring Program – Airborne. During the calendar year 2024, a total of 314 samples were collected and analyzed for gross beta and gamma emitters. Particulate samplers are used to continuously collect airborne particulates on a filter. The samples are analyzed for gross beta activity following filter changeout which occurs weekly. Gamma isotopic analysis is also performed on the samples collected at each location and is analyzed quarterly.

All gross beta analyses of air particulate filters detected gross beta activity at levels consistent with previous years. All air particulate quarterly gamma composite samples were below detection limit except for naturally occurring radionuclides. Naturally occurring beryllium-7 was detected on all control and indicator samples at concentrations consistent with previous years.

Location APA 09 sample pump lost power as of 12/12/23 and was unable to be put back in operation during the remainder of 2023 and all of 2024. Location APA 13 lost power as of approximately 1/7/24 and was unable to be fully repaired until 8/15/24. The sample for AS-13 covering the week of 1/2/24 through 1/9/24 has been reported as a partial sample. Refer to Table 9: Sample Deviation Summary for more information.

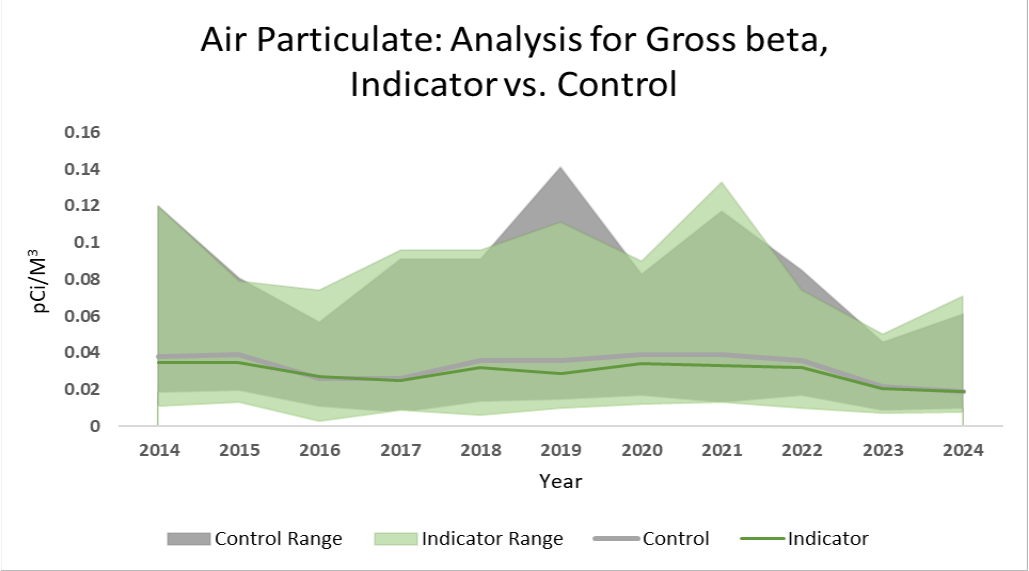


Figure 8: Air Particulate: Analysis for Gross Beta, Average for All Indicator vs. Control Location

Air particulate results from this monitoring period, 2024, were compared to 10-year average as shown in Figure 8, and there were no significant changes in the baseline.

8.3 Waterborne Sample Results

8.3.1 Ocean Water

Ocean water samples are collected monthly from a control location at a distance beyond significant influence of the discharge and at three indicator locations within the vicinity of the discharge. Monthly samples are analyzed for gamma emitters and tritium. During the calendar year 2024, a total of 48 ocean water samples were collected and analyzed in accordance with the requirements in the ODCM and shown in Table 3: Radiological Environmental Monitoring Program – Waterborne. Naturally occurring potassium-40 was identified in all ocean water samples from indicator and control locations with concentrations consistent in previous years. There has been no detectable tritium in any ocean water samples in 2024 or the previous 10 years. Therefore, no trend has been established above the detection limit to plot on a trending graph.

8.3.2 Shoreline Sediment

Shoreline sediment collections were made in March and September 2024 and analyzed for gamma-emitting isotopes. Samples are collected at both indicator and control locations. A total of eight shoreline samples were analyzed in accordance with requirements in the ODCM and shown in Table 3: Radiological Environmental Monitoring Program – Waterborne.

Naturally occurring potassium-40 was identified in all shoreline sediment samples from indicator and control locations with concentrations consistent in previous years.

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8.3.3 Ocean Bottom Sediment

Ocean Bottom sediment collections were made in April and October 2024 and analyzed for gamma-emitting isotopes. Samples are collected at both indicator and control locations. A total of 10 ocean bottom sediment samples were analyzed in accordance with requirements in the ODCM and shown in Table 3: Radiological Environmental Monitoring Program – Waterborne.

Naturally occurring potassium-40 was identified in all ocean bottom sediment samples from indicator and control locations with concentrations consistent in previous years. Other naturally occurring radionuclides such as actinium-228, radium-226, thorium-228, and thorium-232 were also identified in indicator and control samples at concentrations consistent with previous years.

8.4 Ingestion Pathway Sample Results

8.4.1 Non-Migratory Marine Animal

A total of 24 non-migratory marine animal samples were collected in 2024. These samples were analyzed for gamma emitting radionuclides in edible portions, in accordance with requirements of the ODCM and summarized in Table 4: Radiological Environmental Monitoring Program – Ingestion. These samples are collected from the indicator and control areas as required by the ODCM.

Naturally occurring potassium-40 was identified in all non-migratory marine animal samples from indicator and control locations at concentrations consistent with previous years.

8.4.2 Local Crops

A total of eight local crop samples were analyzed in 2024 for gamma emitting radionuclides in accordance with requirements of the ODCM, as summarized in Table 4: Radiological Environmental Monitoring Program – Ingestion. The Control location for crop samples for 2024 was Bonsall Farms in Vista, CA, 21 mi ESE of SONGS.

Naturally occurring potassium-40 was identified in all local crop samples from indicator and control locations with concentrations consistent in previous years.

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9.0 LAND USE CENSUS

An annual land use census is required by the Offsite Dose Calculation Manual and is performed to ensure that changes in the use of areas at or beyond the site boundary are identified and modifications to REMP are made if required by changes in land use. The land use census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR 50 [2]. NUREG-1301/1302 Control 3.12.2 specifies that "a Land Use Census shall be conducted and shall identify within a distance of 8 km (5 mi.) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence and the nearest garden of greater than 50 m² (500 ft²) producing broad leaf vegetation. Note, per NUREG-1301/1302, Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census.

A Land Use Census was conducted during the calendar year, 2024, within the growing season to identify changes in land use, receptor locations, and new exposure pathways. The nearest receptor results for the 2024 Land Use Census are listed in Table 8: Land Use Census – Nearest Receptors within 5 miles. In summary, the highest D/Q locations for nearest garden, nearest residence and nearest milk animal did not change following the 2024 census.

The land use census remained consistent with 2023, with the primary change being removal of garden location in Sector Q (G-Q1). Residences identified were the same locations as previous years. Other Use locations were the same with only a minor change to full-time employment at the Former SONGS Mesa facility.

Table 8: Land Use Census – Nearest Receptors within 5 miles				
Sector	Direction	Nearest Residence (Miles)	Nearest Garden (Miles)	Other Specified Uses (Miles)
A	N	3.6		0.5
B	NNE			2.1
C	NE	2.4		2.2
D	ENE	3.0		
E	E	4.1		4.0
F	ESE			0.8
G	SE	2.1		1.8
H	SSE	Sectors H through N are seaward sectors without significant land uses.		
J	S			
K	SSW			
L	SW			
M	WSW			
N	W			
P	WNW	1.0	2.8	0.5
Q	NW	1.1		0.6
R	NNW	1.3	4.9	0.7

10.0 SAMPLE DEVIATIONS, ANOMALIES AND UNAVAILABILITY

Sampling and analysis are performed for media types addressed in the Offsite Dose Calculation Manual. Sampling and analysis challenges may be experienced due to a multitude of reasons including environmental factors, loss of TLDs, contamination of samples, etc. To aid classification of sampling and analysis challenges experienced in 2024, the following three terms are used to describe the issues: Sample Anomalies, Sample Deviation, and Unavailable Samples.

Media that experienced downtime (i.e., air samplers or water samplers) during a surveillance period are classified as “Sample Deviation”. “Sample Anomalies” are defined as errors that were introduced to a sample once it arrived in the laboratory, errors that prevents the sample from being analyzed as it normally would, or may have altered the outcome of the analysis (i.e., cross contamination, human error).

“Sample Unavailability” is defined as sample collection with no available sample (i.e., food crop, TLD).

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Reported instances of not complying with SONGS REMP requirements in 2024 were classified as Sample Deviations (due to air sampler functionality) or Sample Unavailability (due to Missing TLDs), and the issues were input into SONGS corrective action program. AS-9 experienced significant issues with power availability during 2023. Initial work to resolve the issue involved changing outlets, switches, wiring connections, and breakers associated with the problem circuit. These actions were thought to have resolved the issue in August 2023. Periodic breaker trips were observed again starting in October and progressively worsened. Due to inaccessibility of the buried power cables, the line was not able to be directly repaired or replaced. A compensatory sampler (AS-21) was established as close as feasible to the ESE site boundary (in the direction of AS-9) 0.4 miles from plant center (vs. 0.6 mi for AS-9). The location can be identified near TLD 16 on the maps and table in the AREOR.

AS-9 was not able to be restored to service due to complications with resolving buried power line issues on State Park property. Alternative sample location AS-21 was permanently established to replace AS-9. Non-Functionality is reported for the entire year for AS-9; however, AS-21 was in service during the entire period. AS-21 was added to the ODCM on 8/19/24, restoring compliance.

Significant issues were also encountered with power for AS-13 during 2024. The transmission line required repair and road conditions on Camp Pendleton limited access to the area throughout the spring. Upon repairing the transmission issue, the sampler ran one week then lost power due to a blown fuse in the supply circuit. The fuse was replaced and components feeding to the air sampler were replaced (including the local transformer and all wiring to the outlet) to ensure that electrical issues are resolved. AS-20 was in service from 1/9/24 to 8/20/24 and provided an alternative sample location in the E sector; this sample location was added to the ODCM on 8/19/24 to make it a permanent backup location to avoid non-compliance if a similar issue occurs at AS-13 in the future.

The second quarter sample for TLD 55 was missing in the field. The TLD container was not at the monitoring location. The site is considering methods to increase security of these samples.

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All required samples were collected and analyzed as scheduled except for the following:

Table 9: Sample Deviation Summary				
Sample Type and Analysis	Location	Collection Date or Period	Reason for not conducting REMP sampling as required by ODCM	Plans for preventing reoccurrence
Airborne Particulate	AS-9	1/2/24 – 12/31/24	Buried power line failed and could not be repaired. Sampler downtime from 12/12/23 to 1/2/24 reported in 2023 AREOR for this same outage.	Established an alternative sample location AS-21 and revised ODCM to incorporate (ODCM revised 8/19/24).
Airborne Particulate	AS-13	1/2/24 – 7/15/24	Transmission line failure. The repair was delayed due to inaccessible road conditions. A partial sample has been reported for week of 1/2/24-1/9/24 with 115 hr. runtime (~68% of a week).	Established sampling at alternative location AS-20.
Airborne Particulate	AS-13	7/23/24 – 8/15/24	Sampler was found without power. A fuse on the transmission system had blown. A partial sample has been reported for the week of 8/13/24-8/20/24 with 113 hr. runtime (~67% of a week).	AS-20 was sampled as an alternative sample location until power could be restored. Electricians replaced local transformer, wiring, and outlet feeding AS-13.
TLD	TLD-55	2Q24	Sample was missing in the field	Replaced TLD and verified installation was mechanically secure

11.0 OTHER SUPPLEMENTAL INFORMATION

11.1 NEI 07-07 Onsite Radiological Groundwater Monitoring Program

San Onofre Nuclear Generating Station has developed a Groundwater Protection Initiative (GPI) program in accordance with NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document [11]. The purpose of the GPI is to ensure timely detection and an effective response to situations involving inadvertent radiological releases to groundwater in order to prevent migration of licensed radioactive material off-site and to quantify impacts on decommissioning. It is important to note, samples and results taken in support of NEI 07-07 on-site groundwater monitoring program are separate from the Radiological Environmental Monitoring Program (REMP). Results of the NEI 07-07 Radiological Groundwater Monitoring Program for onsite groundwater wells are provided in the ARERR.

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11.2 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

Per 10 CFR 72.126, SONGS implemented an area monitoring TLD program in the vicinity of the ISFSI.

An evaluation of historical REMP TLD data yielded an estimated background exposure rate of approximately 15.8 mrem/std. quarter (91 days).

Environmental exposure rates are variable and small changes in TLD location can measurably change the data. SONGS REMP TLD data show an environmental seasonal variability that is not related to any activities at SONGS. The ISFSI TLD data gathered to date follow a similar seasonal variability.

The measured exposure rates for the TLDs close to the ISFSI are consistent with the exposure rates expected from known radiological work activities and storage of spent fuel and radioactive material in the ISFSI.

The 2024 neutron TLDs identified low levels of neutron radiation from the ISFSI. Neutron TLDs were added to several locations around the ISFSI prior to the off load of spent fuel from Units 2 & 3 to obtain neutron dose information. Currently, neutron dosimeters are collocated with ISFSI TLDs 311, 326, 339-344, and REMP TLD 55.

A dose equivalent conversion factor for the TLD neutron signal based on a similar ISFSI facility at another site was adopted to estimate the neutron dose rate at SONGS. This conversion factor is being applied to the SONGS TLD results to provide an estimate of the neutron dose equivalent being measured. The neutron dose has been included in the quarterly results for these locations in Table 26: ISFSI TLD Data. The results from all locations at the fence around the ISFSI pad show that the dose to a member of the public, when adjusted for occupancy, would be less than one (1) mrem per year. The results for the ISFSI data are listed in Attachment 5: ISFSI TLD Data. The locations of the ISFSI TLDs are shown in Figure 9: SONGS ISFSI TLD Location Map.

11.3 Corrections to Previous Reports

There were no corrections to previous reports found in 2024.

11.4 ISFSI Location Map



Figure 9: SONGS ISFSI TLD Location Map

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Attachment 1: Data Table Summary
Table 10: SONGS Data Summary Table

Medium or Pathway Sampled (Units)	Type, Total Number of Analyses performed (e.g., I-131, 400)		Lower Limit of Detection (LLD)	Indicator Mean ³ (f ⁴) [Range ³]	Location with Highest Annual Mean		Control Mean ³ (f ⁴) [Range ³]	Number of Nonroutine Reported Measurements
					Name Distance and Direction	Mean ³ (f ⁴) [Range ³]		
Direct Radiation (mrem/qtr.)	Gamma Dose, 135		N/A	16.7 (131/131) [10.0-43.1]	TLD 73 0.4 mi. ESE	30.1 (4/4) [20.7-43.1]	16.7 (4/4) [15.6-17.8]	0
Air Particulates (pCi/m ³)	Gross Beta, 314		0.01	0.018 (262/262) [0.008-0.071]	APA 13 0.7 mi. E	0.025 (22/22)* [0.011-0.071]	0.019 (52/52) [0.010-0.061]	0
	Gamma, 25	Cs-134	0.05	< LLD (0/21)	-	< LLD	< LLD (0/4)	0
		Cs-137	0.06	< LLD (0/21)	-	< LLD	< LLD (0/4)	0
Ocean Water (pCi/L)	Tritium, 48		500	< LLD (0/36)	-	< LLD	< LLD (0/12)	0
	Gamma, 48	Mn-54	15	< LLD (0/36)	-	< LLD	< LLD (0/12)	0
		Co-58	15	< LLD (0/36)	-	< LLD	< LLD (0/12)	0
		Co-60	15	< LLD (0/36)	-	< LLD	< LLD (0/12)	0
		Zn-65	30	< LLD (0/36)	-	< LLD	< LLD (0/12)	0
		Cs-134	15	< LLD (0/36)	-	< LLD	< LLD (0/12)	0
		Cs-137	18	< LLD (0/36)	-	< LLD	< LLD (0/12)	0

* Station APA 13 is the location with the highest annual mean due to it only having 5 months of data. Refer to Sample Deviation Summary Table 9.

³ Mean and range are based on detectable measurements only.

⁴ Fraction of detectable measurements at specified locations is indicated in parentheses.

Table 10: SONGS Data Summary Table

Medium or Pathway Sampled (Units)	Type, Total Number of Analyses performed (e.g., I-131, 400)		Lower Limit of Detection (LLD)	Indicator Mean ³ (f ⁴) [Range ³]	Location with Highest Annual Mean		Control Mean ³ (f ⁴) [Range ³]	Number of Nonroutine Reported Measurements
					Name Distance and Direction	Mean ³ (f ⁴) [Range ³]		
Shoreline Sediment (pCi/kg-dry)	Gamma, 8	Cs-134	150	< LLD (0/6)	-	< LLD	< LLD (0/2)	0
		Cs-137	180	< LLD (0/6)	-	< LLD	< LLD (0/2)	0
Ocean Bottom Sediment (pCi/kg-dry)	Gamma, 10	Cs-134	150	< LLD (0/8)	-	< LLD	< LLD (0/2)	0
		Cs-137	180	< LLD (0/8)	-	< LLD	< LLD (0/2)	0
Non-Migratory Marine Animal (pCi/kg-wet)	Gamma, 24	Mn-54	130	< LLD (0/16)	-	< LLD	< LLD (0/8)	0
		Co-58	130	< LLD (0/16)	-	< LLD	< LLD (0/8)	0
		Co-60	130	< LLD (0/16)	-	< LLD	< LLD (0/8)	0
		Zn-65	260	< LLD (0/16)	-	< LLD	< LLD (0/8)	0
		Cs-134	130	< LLD (0/16)	-	< LLD	< LLD (0/8)	0
		Cs-137	150	< LLD (0/16)	-	< LLD	< LLD (0/8)	0
Local Crop (pCi/kg-wet)	Gamma, 8	Cs-134	60	< LLD (0/4)	-	< LLD	< LLD (0/4)	0
		Cs-137	80	< LLD (0/4)	-	< LLD	< LLD (0/4)	0

³ Mean and range are based on detectable measurements only.

⁴ Fraction of detectable measurements at specified locations is indicated in parentheses.

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Attachment 2: Complete Data Table for All Analysis Results Obtained In 2024

Note: Throughout Attachment 2, bold data entries are for the reported concentration, either the measured value or the MDC.

Table 11: Weekly Air Particulate Gross Beta (pCi/m³)

Date	APA 01 (Indicator)	APA 10 (Indicator)	APA 12 (Indicator)	APA 13 (Indicator)	APA 16 (Control)	APA 20* (Indicator)	APA 21** (Indicator)
1/9/2024	0.0112 ± 0.0030	0.0127 ± 0.0028	0.0128 ± 0.0029	0.0156 ± 0.0039 ^(b)	0.0146 ± 0.0031	(a)	0.0136 ± 0.0029
1/16/2024	0.0193 ± 0.0032	0.0184 ± 0.0030	0.0192 ± 0.0031	(a)	0.0167 ± 0.0029	0.0180 ± 0.0033	0.0162 ± 0.0028
1/23/2024	0.0181 ± 0.0030	0.0131 ± 0.0027	0.0180 ± 0.0030	(a)	0.0163 ± 0.0030	0.0154 ± 0.0031	0.0162 ± 0.0029
1/30/2024	0.0179 ± 0.0029	0.0219 ± 0.0032	0.0149 ± 0.0028	(a)	0.0168 ± 0.0030	0.0137 ± 0.0030	0.0161 ± 0.0028
2/6/2024	0.0139 ± 0.0026	0.0149 ± 0.0028	0.0131 ± 0.0027	(a)	0.0153 ± 0.0029	0.0139 ± 0.0030	0.0148 ± 0.0028
2/13/2024	0.0098 ± 0.0025	0.0103 ± 0.0026	0.0118 ± 0.0028	(a)	0.0106 ± 0.0028	0.0123 ± 0.0032	0.0122 ± 0.0028
2/20/2024	0.0160 ± 0.0028	0.0114 ± 0.0026	0.0143 ± 0.0028	(a)	0.0157 ± 0.0030	0.0144 ± 0.0031	0.0133 ± 0.0027
2/27/2024	0.0110 ± 0.0026	0.0125 ± 0.0028	0.0126 ± 0.0028	(a)	0.0142 ± 0.0030	0.0135 ± 0.0032	0.0100 ± 0.0026
3/5/2024	0.0103 ± 0.0024	0.0106 ± 0.0025	0.0126 ± 0.0027	(a)	0.0110 ± 0.0026	0.0123 ± 0.0029	0.0106 ± 0.0025
3/12/2024	0.0141 ± 0.0027	0.0105 ± 0.0025	0.0150 ± 0.0028	(a)	0.0127 ± 0.0027	0.0168 ± 0.0032	0.0122 ± 0.0026
3/19/2024	0.0151 ± 0.0028	0.0165 ± 0.0030	0.0158 ± 0.0029	(a)	0.0165 ± 0.0031	0.0145 ± 0.0031	0.0158 ± 0.0029
3/26/2024	0.0196 ± 0.0031	0.0200 ± 0.0033	0.0208 ± 0.0033	(a)	0.0236 ± 0.0035	0.0234 ± 0.0038	0.0179 ± 0.0030
4/2/2024	0.0112 ± 0.0026	0.0116 ± 0.0028	0.0100 ± 0.0025	(a)	0.0115 ± 0.0028	0.0115 ± 0.0029	0.0104 ± 0.0025
4/9/2024	0.0141 ± 0.0027	0.0122 ± 0.0029	0.0140 ± 0.0029	(a)	0.0175 ± 0.0033	0.0134 ± 0.0031	0.0144 ± 0.0029
4/16/2024	0.0159 ± 0.0028	0.0195 ± 0.0033	0.0173 ± 0.0030	(a)	0.0166 ± 0.0032	0.0179 ± 0.0034	0.0158 ± 0.0029
4/23/2024	0.0161 ± 0.0029	0.0167 ± 0.0032	0.0198 ± 0.0032	(a)	0.0195 ± 0.0034	0.0191 ± 0.0036	0.0157 ± 0.0029
4/30/2024	0.0103 ± 0.0025	0.0117 ± 0.0028	0.0131 ± 0.0028	(a)	0.0115 ± 0.0029	0.0137 ± 0.0032	0.0111 ± 0.0026
5/7/2024	0.0156 ± 0.0028	0.0176 ± 0.0032	0.0178 ± 0.0031	(a)	0.0177 ± 0.0032	0.0183 ± 0.0034	0.0151 ± 0.0028
5/14/2024	0.0180 ± 0.0029	0.0147 ± 0.0028	0.0170 ± 0.0029	(a)	0.0198 ± 0.0033	0.0173 ± 0.0032	0.0164 ± 0.0028
5/21/2024	0.0133 ± 0.0029	0.0124 ± 0.0030	0.0165 ± 0.0032	(a)	0.0151 ± 0.0033	0.0126 ± 0.0032	0.0151 ± 0.0030
5/28/2024	0.0113 ± 0.0027	0.0096 ± 0.0028	0.0113 ± 0.0028	(a)	0.0140 ± 0.0032	0.0113 ± 0.0031	0.0109 ± 0.0027

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Table 11: Weekly Air Particulate Gross Beta (pCi/m³)

Date	APA 01 (Indicator)	APA 10 (Indicator)	APA 12 (Indicator)	APA 13 (Indicator)	APA 16 (Control)	APA 20* (Indicator)	APA 21** (Indicator)
6/4/2024	0.0130 ± 0.0028	0.0115 ± 0.0029	0.0171 ± 0.0032	(a)	0.0103 ± 0.0028	0.0121 ± 0.0031	0.0112 ± 0.0026
6/11/2024	0.0109 ± 0.0025	0.0093 ± 0.0026	0.0097 ± 0.0025	(a)	0.0121 ± 0.0029	0.0111 ± 0.0024	0.0083 ± 0.0023
6/18/2024	0.0102 ± 0.0027	0.0117 ± 0.0030	0.0104 ± 0.0028	(a)	0.0147 ± 0.0033	0.0121 ± 0.0027	0.0110 ± 0.0027
6/25/2024	0.0145 ± 0.0031	0.0130 ± 0.0032	0.0136 ± 0.0031	(a)	0.0133 ± 0.0031	0.0140 ± 0.0029	0.0144 ± 0.0030
7/2/2024	0.0122 ± 0.0027	0.0142 ± 0.0032	0.0134 ± 0.0029	(a)	0.0100 ± 0.0027	0.0125 ± 0.0026	0.0125 ± 0.0027
7/9/2024	0.0169 ± 0.0030	0.0185 ± 0.0033	0.0181 ± 0.0032	(a)	0.0205 ± 0.0033	0.0164 ± 0.0028	0.0145 ± 0.0028
7/16/2024	0.0168 ± 0.0030	0.0182 ± 0.0034	0.0148 ± 0.0030	(a)	0.0174 ± 0.0033	0.0129 ± 0.0026	0.0166 ± 0.0030
7/23/2024	0.0123 ± 0.0028	0.0149 ± 0.0032	0.0149 ± 0.0031	0.0106 ± 0.0026	0.0153 ± 0.0028	0.0117 ± 0.0025	0.0102 ± 0.0025
7/30/2024	0.0136 ± 0.0028	0.0105 ± 0.0028	0.0139 ± 0.0029	(a)	0.0108 ± 0.0024	0.0122 ± 0.0025	0.0105 ± 0.0025
8/6/2024	0.0151 ± 0.0029	0.0113 ± 0.0029	0.0136 ± 0.0029	(a)	0.0118 ± 0.0027	0.0136 ± 0.0028	0.0130 ± 0.0027
8/13/2024	0.0180 ± 0.0030	0.0257 ± 0.0038	0.0197 ± 0.0032	(a)	0.0189 ± 0.0031	0.0198 ± 0.0032	0.0219 ± 0.0032
8/20/2024	0.0194 ± 0.0032	0.0186 ± 0.0035	0.0164 ± 0.0031	0.0220 ± 0.0047 ^(b)	0.0170 ± 0.0031	0.0185 ± 0.0032	0.0201 ± 0.0032
8/27/2024	0.0163 ± 0.0031	0.0177 ± 0.0035	0.0160 ± 0.0032	0.0171 ± 0.0034	0.0163 ± 0.0032	(a)	0.0140 ± 0.0029
9/3/2024	0.0207 ± 0.0033	0.0211 ± 0.0037	0.0257 ± 0.0037	0.0231 ± 0.0038	0.0257 ± 0.0037	(a)	0.0204 ± 0.0034
9/10/2024	0.0236 ± 0.0036	0.0241 ± 0.0034	0.0279 ± 0.0039	0.0308 ± 0.0042	0.0305 ± 0.0040	(a)	0.0281 ± 0.0038
9/17/2024	0.0168 ± 0.0031	0.0153 ± 0.0028	0.0178 ± 0.0032	0.0190 ± 0.0036	0.0170 ± 0.0031	(a)	0.0176 ± 0.0032
9/24/2024	0.0175 ± 0.0033	0.0122 ± 0.0027	0.0186 ± 0.0034	0.0170 ± 0.0031	0.0182 ± 0.0033	(a)	0.0152 ± 0.0031
10/1/2024	0.0225 ± 0.0036	0.0211 ± 0.0033	0.0297 ± 0.0040	0.0245 ± 0.0036	0.0249 ± 0.0037	(a)	0.0224 ± 0.0036
10/8/2024	0.0267 ± 0.0038	0.0215 ± 0.0032	0.0266 ± 0.0038	0.0208 ± 0.0033	0.0261 ± 0.0037	(a)	0.0226 ± 0.0036
10/15/2024	0.0323 ± 0.0041	0.0248 ± 0.0034	0.0319 ± 0.0040	0.0294 ± 0.0038	0.0305 ± 0.0040	(a)	0.0277 ± 0.0038
10/22/2024	0.0257 ± 0.0037	0.0224 ± 0.0033	0.0260 ± 0.0038	0.0268 ± 0.0036	0.0238 ± 0.0035	(a)	0.0269 ± 0.0038

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Table 11: Weekly Air Particulate Gross Beta (pCi/m³)

Date	APA 01 (Indicator)	APA 10 (Indicator)	APA 12 (Indicator)	APA 13 (Indicator)	APA 16 (Control)	APA 20* (Indicator)	APA 21** (Indicator)
10/29/2024	0.0340 ± 0.0043	0.0273 ± 0.0036	0.0303 ± 0.0041	0.0369 ± 0.0042	0.0361 ± 0.0043	(a)	0.0273 ± 0.0039
11/5/2024	0.0142 ± 0.0030	0.0157 ± 0.0030	0.0192 ± 0.0036	0.0179 ± 0.0032	0.0206 ± 0.0034	(a)	0.0188 ± 0.0033
11/12/2024	0.0302 ± 0.0040	0.0302 ± 0.0038	0.0306 ± 0.0037	0.0260 ± 0.0037	0.0314 ± 0.0040	(a)	0.0321 ± 0.0040
11/19/2024	0.0160 ± 0.0033	0.0172 ± 0.0032	0.0190 ± 0.0032	0.0181 ± 0.0033	0.0155 ± 0.0031	(a)	0.0207 ± 0.0035
11/26/2024	0.0201 ± 0.0034	0.0242 ± 0.0035	0.0257 ± 0.0035	0.0251 ± 0.0035	0.0253 ± 0.0036	(a)	0.0295 ± 0.0039
12/3/2024	0.0261 ± 0.0038	0.0271 ± 0.0036	0.0267 ± 0.0035	0.0297 ± 0.0039	0.0250 ± 0.0034	(a)	0.0265 ± 0.0037
12/10/2024	0.0595 ± 0.0053	0.0575 ± 0.0050	0.0617 ± 0.0050	0.0713 ± 0.0057	0.0614 ± 0.0051	(a)	0.0694 ± 0.0056
12/17/2024	0.0184 ± 0.0033	0.0190 ± 0.0032	0.0198 ± 0.0031	0.0189 ± 0.0032	0.0204 ± 0.0032	(a)	0.0203 ± 0.0033
12/24/2024	0.0262 ± 0.0038	0.0233 ± 0.0034	0.0228 ± 0.0032	0.0263 ± 0.0037	0.0347 ± 0.0040	(a)	0.0178 ± 0.0031
12/31/2024	0.0163 ± 0.0032	0.0111 ± 0.0026	0.0124 ± 0.0026	0.0166 ± 0.0031	0.0156 ± 0.0030	(a)	0.0115 ± 0.0027

- (a) Refer to Sample Deviation Summary Table 9
(b) Partial Sample. Refer to Sample Deviation Summary Table 9

*Station APA 20 (located near TLD 12) was put into service as a replacement air station when APA 13 was temporarily removed from service in 2024.

**Station APA 21 (located near TLD 16) was put into service as a replacement air station when APA 09 was removed from service in 2023.

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Table 12: Quarterly Air Particulate Gamma Isotopic (pCi/m³)

Station	Nuclide	Q1			Q2			Q3			Q4		
		Activity	Error	MDC	Activity	Error	MDC	Activity	Error	MDC	Activity	Error	MDC
APA 01	Cs-134	-7.17E-04 ± 1.26E-03		1.89E-03	-1.76E-05 ± 8.20E-04		1.33E-03	-2.21E-04 ± 1.73E-03		3.16E-03	4.07E-04 ± 1.11E-03		1.94E-03
	Cs-137	1.56E-04 ± 1.07E-03		1.78E-03	8.52E-04 ± 7.57E-04		1.51E-03	-2.13E-04 ± 1.28E-03		2.37E-03	3.05E-04 ± 1.09E-03		1.86E-03
APA 10	Cs-134	-3.11E-04 ± 9.12E-04		1.40E-03	6.56E-04 ± 1.24E-03		2.20E-03	-8.05E-04 ± 8.95E-04		1.18E-03	5.32E-04 ± 1.02E-03		1.85E-03
	Cs-137	9.55E-04 ± 6.66E-04		1.37E-03	1.34E-03 ± 1.03E-03		2.00E-03	-2.07E-04 ± 8.03E-04		1.25E-03	-9.30E-04 ± 7.88E-04		9.50E-04
APA 12	Cs-134	-3.38E-04 ± 9.71E-04		1.47E-03	-1.36E-04 ± 1.36E-03		2.53E-03	-2.03E-03 ± 1.21E-03		1.29E-03	-3.86E-04 ± 9.05E-04		1.35E-03
	Cs-137	-2.94E-04 ± 8.21E-04		1.27E-03	7.89E-04 ± 1.20E-03		2.42E-03	3.73E-04 ± 1.04E-03		1.80E-03	6.81E-04 ± 8.97E-04		1.67E-03
APA 13	Cs-134	(a)			(a)			-1.13E-03 ± 2.45E-03		4.25E-03^(b)	5.56E-04 ± 1.40E-03		2.87E-03
	Cs-137	(a)			(a)			-3.14E-04 ± 2.02E-03		3.72E-03^(b)	2.18E-04 ± 1.59E-03		3.01E-03
APA 16	Cs-134	-2.62E-04 ± 1.38E-03		2.51E-03	-1.08E-04 ± 1.04E-03		1.67E-03	-4.15E-04 ± 1.02E-03		1.54E-03	1.59E-04 ± 1.08E-03		1.83E-03
	Cs-137	-9.04E-05 ± 1.11E-03		2.07E-03	7.86E-05 ± 7.60E-04		1.28E-03	5.20E-04 ± 8.33E-04		1.53E-03	-1.89E-04 ± 8.07E-04		1.25E-03
APA 20	Cs-134	5.36E-04 ± 1.47E-03		2.56E-03	3.39E-04 ± 1.11E-03		1.93E-03	2.71E-04 ± 1.40E-03		2.77E-03^(b)	(a)		
	Cs-137	-9.89E-04 ± 1.16E-03		1.55E-03	3.64E-04 ± 8.49E-04		1.51E-03	8.42E-04 ± 1.01E-03		2.23E-03^(b)	(a)		
APA 21	Cs-134	-1.30E-05 ± 1.08E-03		1.76E-03	-8.09E-05 ± 9.28E-04		1.51E-03	-5.98E-04 ± 8.79E-04		1.20E-03	-8.47E-04 ± 1.13E-03		1.61E-03
	Cs-137	1.42E-04 ± 7.87E-04		1.32E-03	5.68E-04 ± 8.94E-04		1.60E-03	5.59E-04 ± 1.09E-03		1.93E-03	8.63E-05 ± 9.86E-04		1.65E-03

(a) Refer to Sample Deviation Summary Table 9

(b) Partial Sample. Refer to Sample Deviation Summary Table 9

Table 13: Monthly Ocean Water Gamma Isotopic (pCi/L)

Station	Collection Date	H-3	Mn-54	Co-58	Co-60	Zn-65	Cs-134	Cs-137
WSA 01	January	-98.2 ± 251 < 431	0.36 ± 5.90 < 9.85	3.15 ± 6.14 < 10.8	0.52 ± 6.31 < 10.6	5.08 ± 11.0 < 19.2	1.50 ± 5.83 < 10.0	-2.19 ± 5.79 < 8.95
	February	6.38 ± 292 < 480	-2.77 ± 6.39 < 9.74	-0.40 ± 5.79 < 9.51	3.61 ± 5.88 < 11.4	-16.8 ± 15.4 < 18.5	0.61 ± 6.80 < 11.5	-0.62 ± 5.56 < 8.66
	March	50.2 ± 239 < 384	-2.82 ± 3.32 < 5.40	1.75 ± 3.30 < 7.00	3.84 ± 5.13 < 11.1	6.64 ± 9.12 < 19.2	0.35 ± 3.95 < 7.74	0.09 ± 3.61 < 7.03
	April	127 ± 267 < 418	-1.52 ± 5.02 < 7.81	-2.12 ± 5.68 < 8.82	4.74 ± 5.28 < 10.2	-8.18 ± 13.4 < 20.2	-1.41 ± 6.55 < 10.4	1.12 ± 6.16 < 10.5
	May	-38.1 ± 286 < 477	-2.45 ± 5.25 < 7.65	-0.39 ± 5.51 < 8.93	6.09 ± 6.07 < 12.4	-20.2 ± 14.8 < 17.4	-1.30 ± 6.63 < 10.5	0.48 ± 5.52 < 9.40
	June	-21.6 ± 279 < 463	2.56 ± 4.86 < 8.73	1.32 ± 4.63 < 8.02	-2.47 ± 6.30 < 9.64	-2.74 ± 12.1 < 18.7	-1.69 ± 7.04 < 11.2	-0.35 ± 4.91 < 8.06
	July	34.1 ± 276 < 449	0.23 ± 2.92 < 5.83	-1.06 ± 3.21 < 5.93	2.79 ± 4.04 < 8.73	0.88 ± 6.56 < 13.2	-0.67 ± 3.43 < 6.51	-0.42 ± 3.63 < 6.58
	August	-107 ± 273 < 469	-1.43 ± 4.53 < 7.26	1.13 ± 3.88 < 6.78	-1.93 ± 5.88 < 9.26	4.46 ± 8.47 < 15.1	0.99 ± 4.87 < 8.08	5.01 ± 4.48 < 8.38
	September	-32.3 ± 253 < 423	1.89 ± 4.99 < 8.68	-5.32 ± 5.26 < 7.29	0.75 ± 5.75 < 10.1	-8.64 ± 12.5 < 18.8	-7.26 ± 7.09 < 10.1	-0.37 ± 5.73 < 9.42
	October	135 ± 280 < 438	-0.54 ± 5.04 < 8.28	1.47 ± 6.09 < 10.1	-5.19 ± 6.37 < 9.81	1.76 ± 13.4 < 22.5	-1.66 ± 6.35 < 10.0	-2.54 ± 5.92 < 9.40
	November	143 ± 263 < 407	7.67 ± 7.40 < 13.9	-3.23 ± 7.32 < 11.0	-3.90 ± 8.47 < 12.5	-19.5 ± 18.3 < 24.7	5.78 ± 8.02 < 14.6	-5.93 ± 7.31 < 10.4
	December	17.7 ± 269 < 439	-0.45 ± 5.63 < 9.28	-4.60 ± 5.89 < 8.45	3.40 ± 6.39 < 11.9	2.90 ± 15.2 < 25.5	-1.90 ± 7.63 < 11.7	3.25 ± 5.48 < 9.97

Result entries are organized in the format below.

Activity ± Error < MDA

Table 13: Monthly Ocean Water Gamma Isotopic (pCi/L)

Station	Collection Date	H-3	Mn-54	Co-58	Co-60	Zn-65	Cs-134	Cs-137
WSA 02	January	80.1 ± 279 < 446	-0.87 ± 5.97 < 9.61	2.70 ± 5.79 < 10.2	-5.02 ± 5.63 < 6.84	3.71 ± 13.4 < 22.8	-1.52 ± 7.48 < 12.0	-3.60 ± 6.20 < 9.44
	February	-144 ± 279 < 483	0.36 ± 4.40 < 8.59	7.13 ± 4.87 < 11.1	-1.63 ± 4.63 < 8.34	-3.38 ± 11.7 < 20.9	0.23 ± 4.85 < 9.45	-6.18 ± 5.51 < 8.31
	March	21.0 ± 233 < 380	1.43 ± 4.85 < 9.59	2.84 ± 4.96 < 10.1	3.80 ± 5.59 < 12.0	-7.88 ± 10.8 < 17.7	0.41 ± 5.33 < 10.3	2.88 ± 4.90 < 9.80
	April	-60.6 ± 243 < 411	-1.59 ± 5.65 < 8.81	-4.19 ± 5.04 < 6.59	1.81 ± 6.95 < 12.1	1.48 ± 15.3 < 26.0	4.25 ± 5.91 < 11.3	-3.50 ± 6.25 < 8.95
	May	-57.0 ± 283 < 476	2.39 ± 6.68 < 11.8	-3.20 ± 6.33 < 9.59	-2.25 ± 7.58 < 11.7	1.68 ± 16.3 < 26.9	-4.07 ± 6.09 < 8.74	2.30 ± 6.83 < 11.7
	June	-144 ± 264 < 460	2.42 ± 4.33 < 8.65	-1.45 ± 4.45 < 7.90	-1.64 ± 4.47 < 8.18	-5.04 ± 11.3 < 19.2	2.88 ± 5.18 < 10.3	-2.20 ± 3.88 < 6.77
	July	-69.2 ± 269 < 455	-1.03 ± 3.71 < 6.92	0.26 ± 3.41 < 6.86	0.30 ± 3.82 < 7.79	4.69 ± 6.92 < 15.9	-0.22 ± 3.67 < 7.26	2.94 ± 3.57 < 7.75
	August	-34.4 ± 272 < 453	-0.67 ± 3.06 < 5.66	-0.63 ± 2.45 < 4.62	2.35 ± 4.08 < 8.30	0.92 ± 6.67 < 13.0	-0.47 ± 2.77 < 5.31	0.52 ± 3.51 < 6.50
	September	339 ± 293 < 424	-2.01 ± 4.37 < 6.80	2.94 ± 4.12 < 7.66	1.16 ± 3.84 < 6.87	1.88 ± 9.27 < 15.7	-2.17 ± 4.86 < 7.17	-0.16 ± 4.30 < 6.97
	October	-51.4 ± 260 < 437	-0.93 ± 4.38 < 7.94	1.84 ± 4.16 < 8.25	-4.93 ± 5.20 < 8.05	-10.2 ± 9.95 < 15.6	1.90 ± 5.00 < 9.70	-1.64 ± 4.56 < 7.79
	November	-91.8 ± 228 < 392	-0.56 ± 5.91 < 9.69	1.26 ± 6.67 < 11.5	2.85 ± 6.76 < 12.3	-28.6 ± 15.4 < 13.2	0.46 ± 7.18 < 12.2	-4.88 ± 7.41 < 10.9
	December	-22.0 ± 263 < 437	0.23 ± 6.11 < 9.97	-0.93 ± 5.30 < 8.41	-3.60 ± 6.24 < 9.16	1.66 ± 11.8 < 19.9	-10.0 ± 7.07 < 9.43	-1.02 ± 5.38 < 8.64

Result entries are organized in the format below.

Activity ± Error < MDA

Table 13: Monthly Ocean Water Gamma Isotopic (pCi/L)

Station	Collection Date	H-3	Mn-54	Co-58	Co-60	Zn-65	Cs-134	Cs-137
WSA 03	January	64.5 ± 259 < 416	1.38 ± 5.84 < 11.2	3.18 ± 4.32 < 9.31	3.99 ± 4.31 < 10.2	-9.02 ± 13.0 < 21.6	-1.68 ± 5.02 < 9.16	5.82 ± 5.64 < 11.5
	February	-258 ± 268 < 485	0.47 ± 2.97 < 5.78	-1.43 ± 2.55 < 4.46	-0.66 ± 2.76 < 5.38	-11.1 ± 8.96 < 13.2	-1.74 ± 3.58 < 6.29	-2.24 ± 3.37 < 5.82
	March	30.4 ± 233 < 378	4.73 ± 5.14 < 9.61	-1.42 ± 5.07 < 7.96	2.03 ± 5.58 < 9.80	-10.4 ± 13.7 < 19.4	-1.37 ± 6.36 < 10.2	4.63 ± 6.16 < 11.1
	April	59.9 ± 230 < 368	-0.08 ± 6.93 < 11.6	-0.37 ± 5.44 < 8.99	0.59 ± 6.15 < 10.4	-2.90 ± 14.7 < 23.0	-0.80 ± 5.74 < 9.34	-1.76 ± 6.10 < 9.40
	May	-135 ± 279 < 482	-0.54 ± 5.05 < 8.13	-1.99 ± 5.01 < 7.66	1.77 ± 5.37 < 9.48	-1.13 ± 12.3 < 20.3	4.63 ± 6.89 < 12.3	1.75 ± 5.51 < 9.56
	June	34.8 ± 286 < 466	0.67 ± 3.86 < 6.60	-1.05 ± 3.14 < 5.02	-0.15 ± 3.73 < 6.19	-14.1 ± 9.33 < 12.0	-1.06 ± 3.98 < 6.15	-3.02 ± 3.93 < 5.80
	July	211 ± 297 < 454	-0.58 ± 2.55 < 4.41	1.91 ± 2.51 < 4.68	0.62 ± 2.73 < 5.05	-2.92 ± 5.63 < 9.35	-1.65 ± 2.85 < 4.80	1.56 ± 2.59 < 4.79
	August	10.9 ± 280 < 460	-0.40 ± 3.53 < 5.81	1.18 ± 4.57 < 7.93	-1.63 ± 4.36 < 6.74	-7.79 ± 10.1 < 14.4	1.83 ± 4.49 < 7.71	-0.58 ± 4.22 < 6.75
	September	121 ± 276 < 433	-3.50 ± 5.28 < 7.69	1.16 ± 5.75 < 9.96	3.00 ± 6.00 < 11.1	-13.7 ± 14.4 < 18.8	3.36 ± 5.75 < 10.4	-2.94 ± 4.37 < 5.92
	October	-113 ± 256 < 443	1.34 ± 5.75 < 9.95	-3.97 ± 5.99 < 9.02	4.33 ± 7.50 < 13.6	4.45 ± 16.3 < 24.2	1.67 ± 7.21 < 12.0	-7.86 ± 6.83 < 9.35
	November	-77.4 ± 234 < 400	-3.85 ± 4.91 < 8.23	2.60 ± 5.74 < 11.3	1.84 ± 5.97 < 11.9	-7.92 ± 11.5 < 19.2	-3.78 ± 4.94 < 8.33	2.50 ± 5.21 < 10.1
	December	32.2 ± 263 < 427	3.35 ± 3.87 < 7.15	0.95 ± 4.49 < 7.60	-1.80 ± 4.62 < 7.05	-7.57 ± 8.35 < 11.7	1.24 ± 4.69 < 8.02	2.01 ± 4.44 < 7.84

Result entries are organized in the format below.

Activity ± Error < MDA

Table 13: Monthly Ocean Water Gamma Isotopic (pCi/L)

Station	Collection Date	H-3	Mn-54	Co-58	Co-60	Zn-65	Cs-134	Cs-137
WSA 04	January	-84.8 ± 238 < 407	-0.40 ± 5.67 < 9.33	-2.54 ± 5.94 < 9.29	3.30 ± 4.81 < 9.11	-6.50 ± 14.3 < 21.7	-0.40 ± 6.30 < 10.4	-0.52 ± 5.74 < 9.21
	February	46.7 ± 295 < 479	4.23 ± 5.54 < 10.5	4.33 ± 5.13 < 10.0	-1.03 ± 4.30 < 6.43	2.12 ± 10.4 < 17.8	-2.77 ± 6.09 < 9.15	7.88 ± 6.68 < 12.9
	March	56.2 ± 240 < 385	-0.90 ± 5.34 < 8.53	0.22 ± 4.92 < 8.17	-1.78 ± 6.47 < 9.86	-5.06 ± 14.4 < 22.0	1.49 ± 4.96 < 8.64	-2.93 ± 6.32 < 9.80
	April	-105 ± 238 < 412	-5.35 ± 6.14 < 8.36	3.86 ± 5.91 < 11.1	-3.39 ± 6.68 < 9.46	9.41 ± 12.0 < 23.2	-2.17 ± 6.25 < 9.67	-6.31 ± 7.40 < 10.2
	May	-225 ± 271 < 484	0.94 ± 6.10 < 10.4	1.68 ± 5.49 < 9.67	-0.14 ± 7.45 < 12.2	0.77 ± 13.0 < 21.9	-3.79 ± 6.69 < 9.98	-1.35 ± 6.85 < 10.8
	June	131 ± 297 < 467	-0.79 ± 2.92 < 4.56	0.34 ± 2.76 < 4.52	-1.41 ± 3.46 < 5.50	-5.29 ± 7.11 < 10.7	1.96 ± 2.99 < 5.21	2.22 ± 3.03 < 5.33
	July	-106 ± 265 < 454	0.76 ± 3.31 < 5.65	-1.26 ± 3.07 < 4.95	1.13 ± 3.19 < 5.54	3.20 ± 6.48 < 11.2	0.87 ± 3.35 < 5.55	-0.44 ± 3.18 < 5.13
	August	-37.1 ± 276 < 460	0.40 ± 5.43 < 8.85	-2.16 ± 4.72 < 6.97	7.41 ± 5.42 < 11.3	-13.2 ± 12.3 < 16.2	3.83 ± 5.62 < 10.1	5.61 ± 5.81 < 10.8
	September	2.16 ± 258 < 424	0.07 ± 3.16 < 5.92	0.05 ± 2.81 < 5.36	2.27 ± 3.79 < 8.00	-2.56 ± 7.82 < 14.1	1.19 ± 3.48 < 6.88	-0.89 ± 3.55 < 6.43
	October	22.2 ± 277 < 453	0.48 ± 5.57 < 9.25	-0.36 ± 5.71 < 9.33	1.13 ± 6.83 < 11.7	20.0 ± 17.4 < 28.6	-2.01 ± 5.94 < 9.37	-1.88 ± 6.29 < 10.2
	November	-52.4 ± 235 < 396	2.59 ± 6.77 < 12.1	-3.87 ± 5.46 < 7.65	-3.35 ± 7.17 < 10.4	-1.65 ± 14.2 < 22.5	-0.66 ± 6.56 < 10.3	1.04 ± 5.67 < 9.64
	December	-123 ± 251 < 437	-0.47 ± 4.90 < 8.07	-3.06 ± 3.79 < 5.22	0.46 ± 5.67 < 9.56	-4.85 ± 12.5 < 19.0	6.03 ± 5.40 < 10.3	-2.43 ± 5.26 < 7.97

Result entries are organized in the format below.

Activity ± Error
< MDA

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Table 14: Semi-Annual Shoreline Sediment Gamma Isotopic (pCi/kg Dry)

Station	Nuclide	March			September		
		Activity	Error	MDC	Activity	Error	MDC
SSA 01	Cs-134	2.72E+01	± 4.66E+01	8.25E+01	3.49E+01	± 5.53E+01	1.11E+02
	Cs-137	1.80E+01	± 4.57E+01	7.88E+01	-9.93E+00	± 5.14E+01	8.92E+01
SSA 02	Cs-134	4.17E+00	± 4.34E+01	7.35E+01	1.23E+01	± 3.17E+01	6.00E+01
	Cs-137	-1.34E+01	± 3.96E+01	6.13E+01	-3.80E+00	± 2.83E+01	5.11E+01
SSA 03	Cs-134	1.65E+01	± 2.38E+01	4.38E+01	5.57E+00	± 4.85E+01	7.99E+01
	Cs-137	-1.13E+01	± 2.56E+01	3.92E+01	2.38E+01	± 4.60E+01	8.02E+01
SSA 04	Cs-134	-9.70E+00	± 4.25E+01	6.88E+01	3.13E+01	± 5.38E+01	9.37E+01
	Cs-137	-6.58E-01	± 4.03E+01	6.53E+01	2.53E+00	± 4.68E+01	7.81E+01

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Table 15: Semi-Annual Ocean Bottom Sediment Gamma Isotopic (pCi/kg Dry)

Station	Nuclide	April			October		
		Activity	Error	MDC	Activity	Error	MDC
SEB 02	Cs-134	5.91E+01	± 4.12E+01	7.96E+01	1.57E+01	± 4.26E+01	8.09E+01
	Cs-137	2.74E+01	± 3.88E+01	6.74E+01	1.70E+01	± 4.32E+01	7.80E+01
SEB 03	Cs-134	5.03E+01	± 4.12E+01	7.68E+01	3.35E+01	± 4.09E+01	7.35E+01
	Cs-137	1.32E+01	± 3.80E+01	6.39E+01	-1.79E+01	± 4.45E+01	6.96E+01
SEB 04	Cs-134	4.67E+01	± 3.35E+01	6.41E+01	1.72E+01	± 4.49E+01	7.72E+01
	Cs-137	-1.58E+01	± 3.28E+01	5.05E+01	4.49E+01	± 3.85E+01	7.18E+01
SEB 05	Cs-134	1.38E+01	± 4.90E+01	8.34E+01	-4.68E+01	± 5.76E+01	9.65E+01
	Cs-137	-3.77E+01	± 4.42E+01	6.58E+01	-4.70E+01	± 5.40E+01	8.44E+01
SEB 06	Cs-134	2.77E+01	± 4.77E+01	9.12E+01	1.07E+02	± 6.53E+01	1.36E+02
	Cs-137	-3.57E+01	± 4.89E+01	7.95E+01	2.63E+01	± 6.19E+01	1.12E+02

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Table 16: Semi-Annual Marine Animal Gamma Isotopic (pCi/kg Wet)

Station	Date	Species	Mn-54	Co-58	Co-60	Zn-65	Cs-134	Cs-137
MOA 01	April	Sheephead	0.52 ± 34.1 < 56.8	-31.1 ± 33.0 < 44.1	25.1 ± 33.9 < 66.8	-13.7 ± 84.6 < 132	-12.5 ± 42.3 < 67.1	11.3 ± 28.6 < 49.9
		California Mussel	24.7 ± 38.2 < 68.5	35.1 ± 43.1 < 78.1	42.8 ± 43.1 < 82.1	-56.3 ± 91.5 < 136	-35.7 ± 46.0 < 69.3	1.43 ± 38.5 < 63.0
		Spiny Lobster	0.12 ± 38.7 < 63.7	-12.4 ± 35.6 < 55.3	25.3 ± 41.0 < 75.0	-18.8 ± 97.8 < 155	11.7 ± 44.7 < 76.2	13.5 ± 39.6 < 68.3
		Black Perch	8.69 ± 29.1 < 51.2	1.42 ± 29.4 < 49.7	11.0 ± 40.7 < 71.1	-202 ± 101 < 103	-13.1 ± 34.5 < 54.1	10.4 ± 34.0 < 58.1
	October	Spiny Lobster	24.7 ± 47.8 < 101	14.8 ± 48.3 < 99.1	-26.0 ± 52.1 < 106	-12.1 ± 104 < 198	-56.2 ± 47.9 < 71.2	5.90 ± 71.5 < 129
		California Mussel	32.6 ± 39.1 < 75.0	0.39 ± 37.1 < 62.4	43.6 ± 40.7 < 86.0	-1.29 ± 96.1 < 156	22.1 ± 38.1 < 69.6	11.2 ± 32.7 < 57.6
		Barred Sand Bass	-27.8 ± 36.4 < 61.1	-26.5 ± 42.8 < 73.7	6.68 ± 41.5 < 81.5	-67.8 ± 86.4 < 141	6.29 ± 43.5 < 83.4	-4.83 ± 46.1 < 81.3
		Kelp Bass	-13.7 ± 38.1 < 68.7	32.0 ± 39.8 < 84.1	-66.6 ± 53.3 < 86.4	-193 ± 126 < 179	6.63 ± 42.5 < 83.3	-4.76 ± 45.1 < 79.9

Result entries are organized in the format below.

Activity ± Error < MDA

Table 16: Semi-Annual Marine Animal Gamma Isotopic (pCi/kg Wet)

Station	Date	Species	Mn-65	Co-58	Co-60	Zn-65	Cs-134	Cs-137
MOA 02	April	Spiny Lobster	22.7 ± 39.5 < 70.2	12.3 ± 35.1 < 60.8	11.6 ± 51.6 < 89.8	-225 ± 112 < 112	-30.2 ± 45.5 < 64.4	5.06 ± 38.3 < 64.6
		Black Perch	-10.3 ± 23.9 < 42.7	-18.6 ± 25.4 < 42.7	9.38 ± 26.8 < 58.7	-10.4 ± 62.6 < 115	-12.2 ± 33.1 < 59.3	-4.13 ± 28.5 < 53.4
		California Mussel	14.3 ± 30.1 < 54.1	5.71 ± 32.8 < 56.2	-13.5 ± 40.7 < 61.9	53.1 ± 71.8 < 125	-1.13 ± 37.6 < 62.3	6.39 ± 32.1 < 53.9
		Sheephead	1.56 ± 34.5 < 57.9	6.17 ± 38.8 < 66.4	16.2 ± 43.6 < 78.0	-60.8 ± 100 < 143	12.8 ± 36.2 < 64.4	5.39 ± 41.5 < 68.8
	October	Sheephead	12.2 ± 40.0 < 75.3	-17.2 ± 32.3 < 56.2	-14.0 ± 36.5 < 72.1	-153 ± 83.0 < 109	-8.97 ± 38.6 < 69.7	43.7 ± 39.0 < 77.0
		California Mussel	-8.86 ± 36.5 < 57.1	-7.78 ± 31.3 < 48.6	9.99 ± 38.6 < 67.7	-45.6 ± 71.8 < 101	18.1 ± 38.2 < 68.7	30.4 ± 34.3 < 66.1
		Black Perch	-7.17 ± 36.9 < 59.3	3.85 ± 44.3 < 75.0	31.3 ± 39.7 < 78.2	-1.60 ± 81.0 < 131	4.58 ± 44.5 < 75.8	10.1 ± 40.3 < 68.8
		Spiny Lobster	20.7 ± 39.5 < 70.3	18.9 ± 43.8 < 76.6	14.3 ± 50.3 < 87.2	-38.6 ± 104 < 159	10.8 ± 47.6 < 80.6	-16.9 ± 43.9 < 67.8

Result entries are organized in the format below.

Activity ± Error
< MDA

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Table 16: Semi-Annual Marine Animal Gamma Isotopic (pCi/kg Wet)

Station	Date	Species	Mn-65	Co-58	Co-60	Zn-65	Cs-134	Cs-137
MOA 03	April	Black Smith	16.3 ± 23.0 < 51.4	-4.29 ± 24.2 < 46.2	22.5 ± 34.5 < 76.5	-34.1 ± 78.6 < 136	-21.6 ± 30.8 < 52.1	10.4 ± 32.4 < 64.2
		California Mussel	29.0 ± 38.1 < 75.9	26.9 ± 41.2 < 80.4	113 ± 51.8 < 116	-74.7 ± 86.9 < 140	-0.98 ± 45.0 < 82.6	-20.9 ± 42.3 < 70.9
		Sheephead	3.11 ± 43.0 < 82.8	33.4 ± 40.0 < 86.3	-25.6 ± 47.4 < 80.2	-57.8 ± 95.1 < 161	17.8 ± 51.5 < 102	-28.0 ± 43.0 < 70.8
		Spiny Lobster	2.38 ± 34.7 < 58.5	-9.06 ± 38.0 < 60.9	35.1 ± 37.1 < 75.8	-25.4 ± 76.9 < 114	6.08 ± 40.1 < 68.8	11.0 ± 42.0 < 71.0
	October	California Mussel	-15.8 ± 21.2 < 36.1	10.8 ± 17.3 < 37.9	22.3 ± 24.8 < 55.5	-57.2 ± 54.5 < 83.3	-3.33 ± 21.1 < 40.3	-13.8 ± 24.7 < 41.3
		Sheephead	8.75 ± 44.0 < 85.8	-21.4 ± 45.4 < 80.4	78.8 ± 55.9 < 128	-89.8 ± 105 < 170	-21.7 ± 53.5 < 95.3	14.7 ± 48.7 < 91.9
		Spiny Lobster	-17.1 ± 34.7 < 53.9	-10.6 ± 28.8 < 45.2	39.4 ± 41.7 < 79.5	-20.4 ± 88.1 < 138	20.7 ± 30.9 < 57.3	-8.81 ± 32.8 < 51.5
		Barred Sand Bass	-5.76 ± 34.4 < 55.8	8.85 ± 34.1 < 59.8	9.48 ± 47.7 < 82.2	-122 ± 103 < 128	-33.0 ± 38.8 < 50.7	9.08 ± 32.7 < 56.2

Result entries are organized in the format below.

Activity ± Error < MDA

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Table 17: Semi-Annual Local Crops Gamma Isotopic (pCi/kg Wet)

Station	Date	Description	Cs-134			Cs-137		
			Activity	Error	MDC	Activity	Error	MDC
TFB 02	April	Lettuce	3.42E-01	± 1.08E+01	2.06E+01	3.56E+00	± 8.79E+00	1.79E+01
		Tomato	-2.37E+00	± 1.58E+01	2.54E+01	-4.80E+00	± 1.27E+01	1.99E+01
	December	Kale	5.71E+00	± 1.20E+01	2.51E+01	-4.42E+00	± 1.27E+01	2.21E+01
		Tomato	3.35E+00	± 8.99E+00	1.59E+01	8.80E-01	± 1.04E+01	1.74E+01
TFB 06	March	Tomato	3.47E+00	± 1.18E+01	2.30E+01	1.04E+00	± 1.19E+01	2.16E+01
		Sorrel	-5.06E+00	± 1.17E+01	1.86E+01	-3.89E-02	± 1.05E+01	1.71E+01
	December	Tomato	-1.63E+00	± 1.94E+01	3.06E+01	6.61E-01	± 1.77E+01	2.91E+01
		Sorrel	-2.33E-01	± 1.34E+01	2.55E+01	-8.20E-01	± 1.40E+01	2.49E+01

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Attachment 3: Cross Check Intercomparison Program

Participation in cross check intercomparison studies is mandatory for laboratories performing analyses of REMP samples satisfying the requirements in the Offsite Site Dose Calculation Manual. Intercomparison studies provide a consistent and effective means to evaluate the accuracy and precision of analyses performed by a laboratory. Study results should fall within specified control limits and results that fall outside the control limits are investigated and corrected.

1.0 Teledyne Brown Engineering Inc. (TBE) participated in the following proficiency testing studies provided by Eckert Ziegler Analytics, DOE's Mixed Analyte Performance Evaluation Program (MAPEP), and/or Environmental Resource Associates (ERA), in 2024. The Laboratory's intercomparison program results for 2024 are summarized below.

For the TBE laboratory, 152 out of 167 analyses performed met the specified acceptance criteria. Fifteen analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. A summary is found below:

- I. NCR 24-02: ERA March MRAD-40 study with Air Particulate AM-241 evaluated as "Not Acceptable." TBE reported 38.8 pCi/filter and the known value returned at 55.0 pCi/filter (range 39.3-73.3). The root cause investigation determined that the sample was not logged into the system correctly and therefore not prepared with the required tracer. To correct and prevent recurrence, personnel involved are to utilize a template to ensure all analyses are logged as required and the QA Manager will perform sample log review as a back up to ensure accuracy. Acceptable results returned in a later sample study, supporting effectiveness of corrective action.

- II. NCR 24-03: ERA March MRAD-40 air particulate study GR-B evaluated as "Not Acceptable." TBE reported 42.1 pCi/filter and the known value returned at 22.2 pCi/filter (range 13.5-33.5). The root cause investigation determined that alpha-to-beta crosstalk was more significant than normal which caused the beta activity to report falsely high data. To correct and prevent recurrence, personnel involved are to adjust the alpha-to-beta crosstalk via correction calculation measures when high alpha activities are observed. Acceptable results returned in a later sample study, supporting effectiveness of corrective action.

- III. NCR 24-05: ERA April RAD-137 water study GR-A evaluated as "Not Acceptable." TBE reported 35.2 pCi/L and the known value returned at 52.6 pCi/L (range 39.6-65.6). The root cause investigation determined that the provided samples contained a solids content that was significantly higher than the typical client samples tested by the laboratory. A set aliquot volume for prior ERA samples was used and not adjusted to account for the sudden increase in solid content. To correct and prevent recurrence, new sample types were ordered from ERA that used Am-241 to better reflect client sample testing and acceptable results were achieved. Acceptable results returned in a later sample study, supporting effectiveness of corrective action.

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- IV. NCR 24-06: E&Z Analytics March E14092 air particulate study Co-60 evaluated as "Not Acceptable." TBE reported 168 pCi and the known value returned at 126 pCi. Additionally, March E14093 soil Ce-141 evaluated as "Not Acceptable." TBE reported 0.106 pCi/g and the known value returned at 0.071pCi/g. The root cause investigation was unable to determine any anomaly thus no proposed corrective action. No recurrence has occurred.
- V. CAR 24-02 (CAR 23-31): MAPEP February 24-MaS50 soil study Fe-55 evaluated as "Not Acceptable." TBE reported 297 Bq/Kg and the known value returned at 650 Bq/Kg (range 455-845). The root cause investigation suspects that the current analytical procedure is not sufficient to add the interferences added to the sample by MAPEP. This investigation is still ongoing (See NCR 24-16) as the suggested corrective action did not provide desired results.
- VI. NCR 24-08: MAPEP February 24-MaS50 soil study Ni-63 evaluated as "Not Acceptable." TBE reported 1070 Bq/Kg and the known value returned at 1530 Bq/Kg (range 1071-1989). The root cause investigation suspected that the sample contained added interferences that are not typically seen in client samples. All QC efforts associated with the sample were acceptable and no anomalies found, even after reanalysis. To correct and prevent recurrence, samples suspected of additional interferences will include the addition of Ni-59 tracer to determine yield results when calculating results. TBE analytical procedure TBE-2013 was updated to include this change.
- VII. NCR 24-09: MAPEP February 24-MaSU50 urine study Zn-65 evaluated as "Not Acceptable." The root cause investigation determined that the sample was spiked lower than TBE's typical detection limit and client requirements. The report was revised by MAPEP indicating "Not Evaluated," resulting in this nuclide to not be considered a failure.
- VIII. NCR 24-10: MAPEP February 24-MaW50 water study Tc-99 evaluated as "Not Acceptable." TBE reported 9.95 Bq/L and the known value returned 7.47Bq/L (range 5.23-9.71). The root cause investigation suspects Thorium interference that was not removed during the column separation process of the analytical procedure; however, it cannot be confirmed as all QC efforts associated with the sample were acceptable and with no anomalies found. To potentially correct and prevent recurrence, an additional rinse step was added to the procedure. Acceptable results returned in a later sample study, supporting effectiveness of corrective action.
- IX. NCR 24-11: MAPEP February 24-RdV50 vegetation study Sr-90 evaluated as "Not Acceptable." TBE reported 0.276 Bq/sample and the known value returned 0.529 Bq/sample (range 0.370-0.688). The root cause investigation determined a laboratory accident resulting in a spilled (loss) of sample. No corrective action was performed as the cause was an unintentional sample spill.

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- X. NCR 24-14: ERA September MRAD-41 air particulate study U-234/238 evaluated as "Not Acceptable." TBE reported 14.0/14.2 pCi/filter and the known value returned at 31.1/30.9 pCi/filter (range 23.1-36.9). The root cause investigation determined that the laboratory technician placed double the amount of tracer in the sample by error. To correct and prevent recurrence, samples that have been digested/leached with carrier/tracer added will have a label placed over the cap indicating it has already been added. Additionally, the beaker that aliquot is put in should have markings to indicate carrier/tracer has already been added to the sample.
- XI. NCR 24-15: ERA September MRAD-41 water study Fe-55 evaluated as "Not Acceptable." TBE reported 615 pCi/L and the known value returned at 1230 pCi/L (range 723-1790). The root cause is still under investigation.
- XII. NCR 24-16: MAPEP August 24-MaS50 soil study Fe-55 evaluated as "Not Acceptable." TBE did not report a value and the known value returned 780 Bq/Kg (range 546-1014). The root cause is still under investigation.
- XIII. NCR 24-17: MAPEP August 24-RdV51 vegetation study Sr-90 evaluated as "Not Acceptable." TBE reported 0.95 Bq/sample and the known value returned 2.39 Bq/sample (range 1.67-3.11). The root cause is still under investigation.

The Interlaboratory Comparison Program provides evidence of "in control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

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Table 18: Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Ratio of TBE to Analytics Result	Evaluation ^(b)
March 2024	E14089	Milk	Sr-89	pCi/L	79.6	78.2	1.02	A
			Sr-90	pCi/L	12.6	11.9	1.06	A
	E14090	Milk	Ce-141	pCi/L	75.6	85.0	0.89	A
			Co-58	pCi/L	-0.069	Not Measured		
			Co-60	pCi/L	139	158	0.88	A
			Cr-51	pCi/L	212	230	0.92	A
			Cs-134	pCi/L	167	198	0.84	A
			Cs-137	pCi/L	158	171	0.93	A
			Fe-59	pCi/L	81.1	86.5	0.94	A
			I-131	pCi/L	80.9	90.8	0.89	A
			Mn-54	pCi/L	173	183	0.95	A
			Zn-65	pCi/L	165	176	0.93	A
	E14091	Charcoal	I-131	pCi	90.1	90.3	1.00	A
	E14092	AP	Ce-141	pCi	68.1	67.5	1.01	A
			Co-58	pCi	1.73	Not Measured		
			Co-60	pCi	168	126	1.34	N ^(IV)
			Cr-51	pCi	182	183	0.99	A
			Cs-134	pCi	157	157	1.00	A
			Cs-137	pCi	132	136.0	0.97	A
			Fe-59	pCi	70.3	68.6	1.02	A
			Mn-54	pCi	144	145	0.99	A
			Zn-65	pCi	125	140	0.89	A
	E14093	Soil	Ce-141	pCi/g	0.106	0.071	1.48	N ^(IV)
			Co-58	pCi/g	-0.005	Not Measured		
			Co-60	pCi/g	0.121	0.133	0.91	A
			Cr-51	pCi/g	0.198	0.194	1.02	A
			Cs-134	pCi/g	0.206	0.166	1.24	W
			Cs-137	pCi/g	0.207	0.209	0.99	A
			Fe-59	pCi/g	0.063	0.073	0.87	A
			Mn-54	pCi/g	0.140	0.153	0.91	A
			Zn-65	pCi/g	0.149	0.148	1.01	A
	E14094	AP	Sr-89	pCi	83.9	90.6	0.93	A
			Sr-90	pCi	11.7	13.8	0.85	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(IV) See item IV. on page 48, above

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Table 18: Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Ratio of TBE to Analytics Result	Evaluation ^(b)
September 2024	E14095	Milk	Sr-89	pCi/L	88.0	92.3	0.95	A
			Sr-90	pCi/L	12.4	15.2	0.82	A
	E14096	Milk	Ce-141	pCi/L	124	124	1.00	A
			Co-58	pCi/L	154	150	1.03	A
			Co-60	pCi/L	232	236	0.98	A
			Cr-51	pCi/L	284	274	1.04	A
			Cs-134	pCi/L	180.0	187	0.96	A
			Cs-137	pCi/L	126	127	0.99	A
			Fe-59	pCi/L	127.0	113	1.12	A
			I-131	pCi/L	85.3	89.0	0.96	A
			Mn-54	pCi/L	162	162	1.00	A
			Zn-65	pCi/L	294	275	1.07	A
	E14097	Charcoal	I-131	pCi	98.8	92.6	1.07	A
	E14098	AP	Ce-141	pCi	82.0	76.7	1.07	A
			Co-58	pCi	91.0	92.6	0.98	A
			Co-60	pCi	180	146	1.23	W
			Cr-51	pCi	208	170	1.22	W
			Cs-134	pCi	116	116	1.00	A
			Cs-137	pCi	83.1	78.9	1.05	A
			Fe-59	pCi	75.6	70.2	1.08	A
			Mn-54	pCi	101	100	1.01	A
			Zn-65	pCi	167	170	0.98	A
	E14099	Soil	Ce-141	pCi/g	0.224	0.222	1.01	A
			Co-58	pCi/g	0.249	0.268	0.93	A
			Co-60	pCi/g	0.420	0.423	0.99	A
			Cr-51	pCi/g	0.492	0.492	1.00	A
			Cs-134	pCi/g	0.278	0.336	0.83	A
			Cs-137	pCi/g	0.276	0.295	0.94	A
			Fe-59	pCi/g	0.233	0.204	1.14	A
			Mn-54	pCi/g	0.279	0.290	0.96	A
			Zn-65	pCi/g	0.538	0.494	1.09	A
	E14100	AP	Sr-89	pCi	79.8	82.7	0.96	A
			Sr-90	pCi	12.0	13.6	0.88	A
	E14197	Liquid	Gr-A (Am241)	pCi/L	47.6	50.1	0.95	A
			Gr-B (Cs137)	pCi/L	248	270	0.92	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

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Table 19: DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptable Range	Evaluation ^(b)
February 2024	24-MaS50	Soil	Fe-55	Bq/kg	297	650	455 - 845	N ^(V)
			Ni-63	Bq/kg	1070	1530	1071 - 1989	N ^(VI)
			Tc-99	Bq/kg	325	336	235 - 437	A
			Th-228	Bq/kg	34.6	48.8	34.2 - 63.4	W
			Th-230	Bq/kg	49.7	54.0	38.0 - 70.0	A
			Th-232	Bq/kg	36.4	45.1	31.6 - 58.6	A
	24-MaSU50	Urine	Cs-134	Bq/L	1.12	1.36	0.95-1.77	A
			Cs-137	Bq/L	2.00	2.23	1.56-2.90	A
			Co-57	Bq/L	1.06	1.26	0.88 - 1.64	A
			Co-60	Bq/L	2.26	2.38	1.67 - 3.09	A
			K-40	Bq/L	-1.80	NR	-	
			Mn-54	Bq/L	1.44	1.51	1.06 - 1.96	A
			U-234	Bq/L	0.00101		(1)	A
			U-238	Bq/L	0.00228		(1)	A
			Zn-65	Bq/L	-0.42	0.84	0.59-1.09	NE ^(VII)
	24-MaW50	Water	Ni-63	Bq/L	0.338	0.80	(2)	A
			Tc-99	Bq/L	9.95	7.47	5.23 - 9.71	N ^(VIII)
	24-RdV50	Vegetation	Cs-134	Bq/sample	2.80	3.67	2.57 - 4.77	W
			Cs-137	Bq/sample	2.21	2.57	1.80 - 3.34	A
			Co-57	Bq/sample	2.23	2.53	1.77 - 3.29	A
			Co-60	Bq/sample	2.42	2.96	2.07 - 3.85	A
			Mn-54	Bq/sample	0.033		(1)	A
			Sr-90	Bq/sample	0.276	0.529	0.370 - 0.688	N ^(IX)
			Zn-65	Bq/sample	6.83	8.02	5.61 - 10.43	A
August 2024	24-MaS51	Soil	Fe-55	Bq/kg	(XII)	780	546-1014	N ^(XII)
			Ni-63	Bq/kg	1140.00	1450.00	1015 - 1885	W
			Tc-99	Bq/kg	155.00	171.00	120 - 222	A
			Th-228	Bq/kg	38.00	43.30	30.3 - 56.3	A
			Th-230	Bq/kg	46.10	44.00	30.8 - 57.2	A
			Th-232	Bq/kg	38.90	42.60	29.8 - 55.4	A
August 2024	24-MaW51	Water	Ni-63	Bq/L	0.60	-	(1)	A
			Tc-99	Bq/L	11.90	11.20	7.8 - 14.6	A

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test

(2) Sensitivity evaluation

(V) See item V. on page 48, above.

(VI) See item VI. on page 48, above.

(VII) Not Evaluated, re-reported as false positive by MAPEP.

(VIII) See item VIII. on page 48, above.

(IX) See item IX. on page 48, above.

(XII) See item XII. on page 49, above.

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Table 19: DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptable Range	Evaluation ^(b)
	24-RdV51	Vegetation	Cs-134	Bq/sample	3.12	2.89	2.02 - 3.76	A
			Cs-137	Bq/sample	2.18	1.91	1.34 - 2.48	A
			Co-57	Bq/sample	0.00	-	(1)	A
			Co-60	Bq/sample	2.24	2.01	1.41 - 2.61	A
			Mn-54	Bq/sample	3.76	3.53	2.47 - 4.59	A
			Sr-90	Bq/sample	0.95	2.39	1.67 - 3.11	N ^(XIII)
			Zn-65	Bq/sample	10.30	9.13	6.39 - 11.87	A

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test

(2) Sensitivity evaluation

(XIII) See item XIII. on page 49, above.

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Table 20: ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptable Range	Evaluation ^(b)
March 2024	MRAD-40	Water	Am-241	pCi/L	101	139	95.4 - 178	A
			Fe-55	pCi/L	2185	2480	1460- 3610	A
			Pu-238	pCi/L	62.0	70.4	42.3 - 91.2	A
			Pu-239	pCi/L	61.2	76.5	47.3 - 94.3	A
		Soil	Am-241	pCi/kg	NR	1880	1020 - 2660	
			Pu-238	pCi/kg	667	512	255 - 778	A
			Pu-239	pCi/kg	562	545	297 - 784	A
			Sr-90	pCi/kg	4050	3630	1130 - 5650	A
			U-234	pCi/kg	3040	4360	2040 - 5710	A
			U-238	pCi/kg	3270	4320	2370 - 5800	A
		AP	Am-241	pCi/filter	38.8	55.0	39.3 - 73.3	N ^(I)
			Fe-55	pCi/filter	387	386	141 - 616	A
			Pu-238	pCi/filter	45.9	41.1	31.0 - 50.5	A
			Pu-239	pCi/filter	54.9	56.1	41.9 - 67.7	A
			U-234	pCi/filter	11.1	11.6	8.60 - 13.6	A
			U-238	pCi/filter	12.8	11.5	8.68 - 13.7	A
			GR-A	pCi/filter	116	95.9	50.1 - 158	A
			GR-B	pCi/filter	42.1	22.2	13.5 - 33.5	N ^(II)
		Water	Ba-133	pCi/L	62.8	65.9	50.1 - 81.7	A
			Cs-134	pCi/L	51.0	57.8	42.8 - 72.8	A
			Cs-137	pCi/L	153	186	149 - 223	A
			Co-60	pCi/L	92.1	98.8	79.7 - 118	A
			Zn-65	pCi/L	208	240	188 - 292	A
			GR-A	pCi/L	35.2	52.6	39.6 - 65.6	N ^(III)
			GR-B	pCi/L	49	46.5	33.9 - 59.1	A
			U-Nat	pCi/L	56.0	59.3	52.8-65.8	A
			H-3	pCi/L	19,000	21,300	18,200 - 24,400	A
			Sr-89	pCi/L	48.9	52.2	37.8 - 66.6	A
			Sr-90	pCi/L	32.6	37.6	32.0 - 43.2	A
			I-131	pCi/L	21.8	25.1	21.7 - 28.5	A
September 2024	MRAD-41	Water	Am-241	pCi/L	108.0	117.0	80.3-150	A
			Fe-55	pCi/L	615	1230	723-1790	N ^(X1)
			Pu-238	pCi/L	99	103	61.9-133	A
			Pu-239	pCi/L	123	133	82.3-164	A

(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(b) ERA evaluation:

A = Acceptable - Reported value falls within the Acceptance Limits

N = Not Acceptable - Reported value falls outside of the Acceptance Limits

(I) See item I. on page 47, above.

(II) See item II. on page 47, above.

(III) See item III. on page 47, above.

(XI) See item XI. on page 49, above.

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Table 21: ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptable Range	Evaluation ^(b)
September 2024		Soil	Am-241	pCi/kg	1320	1110	599-1570	A
			Pu-238	pCi/kg	1380	1860	928-2830	A
			Pu-239	pCi/kg	796	1030	561-1480	A
			Sr-90	pCi/kg	3240	4730	1470-7370	A
			U-234	pCi/kg	2540	2860	1340-3750	A
			U-238	pCi/kg	2390	2840	1560-3810	A
		AP	Am-241	pCi/filter	27.0	29.1	20.8-38.8	A
			Fe-55	pCi/filter	644	800	292-1280	A
			Pu-238	pCi/filter	22.3	21.5	16.2-26.4	A
			Pu-239	pCi/filter	30.6	32.4	24.2-39.1	A
			U-234	pCi/filter	14.0	31.1	23.1-36.4	N ^(X)
			U-238	pCi/filter	14.2	30.9	23.3-36.9	N ^(X)
			GR-A	pCi/filter	80.0	72.4	37.8-119	A
			GR-B	pCi/filter	57.5	47.9	29.0-72.4	A
October 2024	RAD-139	Water	Ba-133	pCi/L	30.3	27.4	15.5-39.3	A
			Cs-134	pCi/L	73.3	80.2	63.0-97.4	A
			Cs-137	pCi/L	46.6	46.3	23.3-69.3	A
			Co-60	pCi/L	44.2	45.3	31.6-59.0	A
			Zn-65	pCi/L	104	114.0	75.0-153	A
			GR-A	pCi/L	47.6	51.7	38.9-64.5	A
			GR-B	pCi/L	44.2	48.1	35.2-61.0	A
			U-Nat	pCi/L	28.3	26.90	23.6-30.2	A
			H-3	pCi/L	4,690	5,320	3870-6770	A
			Sr-89	pCi/L	57.5	44.2	30.6-57.8	A
			Sr-90	pCi/L	37.3	35.6	30.2-41.0	A
			I-131	pCi/L	28.3	26.3	22.7-29.9	A

(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(b) ERA evaluation:

A = Acceptable - Reported value falls within the Acceptance Limits

N = Not Acceptable - Reported value falls outside of the Acceptance Limits

(X) See item X. on page 49, above.

2.0 Stanford Dosimetry performs the environmental TLD analyses noted in this report. Stanford Dosimetry performs the requested analyses under its Quality Assurance Program which meets the requirement of 10 CFR 50, Appendix B, ASME NQA-1, Regulatory Guide 4.15 Revision 1 and Regulatory Guide 4.13 Revision 2 (Environmental Dosimetry – Performance Standards, Testing and Data Analysis).

Results of performance tests conducted are summarized and discussed in the following sections. Summaries of the performance tests for the reporting period are given below.

Table 22: Percentage of Individual Dosimeters that passed EDC Internal Criteria provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons only. During this period 100% (72/72) of the individual dosimeters, evaluated against these criteria, met the tolerance limits for accuracy and 100% (72/72) met the criterion for precision.

Table 22: Percentage of Individual Dosimeters that passed EDC Internal Criteria
January – December 2024^{(1), (2)}

Dosimeter Type	Number Tested	% Passed Bias Criteria	% Passed Precision Criteria
Panasonic Environmental	72	100	100

⁽¹⁾This table summarizes results of tests conducted by EDC.

⁽²⁾Environmental dosimeter results are free in air.

Table 23: Mean Dosimeter Analyses Summary January – December 2024^{(1), (2)} provides the bias and standard deviation results for each group (N=6) of dosimeters evaluated against the internal tolerance criteria. Overall, 100% (12/12) of the dosimeter sets, evaluated against the internal tolerance performance criteria, met these criteria.

Table 23: Mean Dosimeter Analyses Summary January – December 2024^{(1), (2), (3)}

Process Date	Exposure Level	Mean Bias %	Standard Deviation %	Tolerance Limit +/-15%
5/05/2024	37	-0.3	2.2	Pass
5/08/2024	51	2.2	1.5	Pass
5/15/2024	83	2.5	2.2	Pass
7/30/2024	27	1.1	1.8	Pass
8/06/2024	63	6.6	1.2	Pass
9/25/2024	95	-3.1	1.8	Pass
10/24/2024	42	4.9	2.6	Pass
10/30/2024	73	6.8	1.6	Pass
11/27/2024	107	-6.7	1.6	Pass
01/20/2025	32	1.9	1.0	Pass
01/26/2025	47	2.8	1.5	Pass
01/29/2025	117	2.6	2.1	Pass

⁽¹⁾This table summarizes results of tests conducted by EDC for TLDs issued in 2024.

⁽²⁾Environmental dosimeter results are free in air.

⁽³⁾ N=6

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Table 24: Summary of Independent Dosimeter Testing January – December 2024^{(1),(2)} presents the independent blind spike results for dosimeters processed during this annual period. All results passed the performance acceptance criterion.

Table 24: Summary of Independent Dosimeter Testing January – December 2024^{(1),(2)}

Issuance Period	Client	Mean Bias %	Standard Deviation %	Pass / Fail
1 st Qtr. 2024	Millstone	-.1	0.2	Pass
2 nd Qtr.2024	Seabrook	1.7	2.8	Pass
2 nd Qtr. 2024	Millstone	-4.3	0.9	Pass
3 rd Qtr. 2024	SONGS	-9.7	1.4	Pass
3 rd Qtr. 2024	Millstone	-1.4	2.5	Pass
4 th Qtr.2024	Millstone	1.5	1.4	Pass
4 th Qtr.2024	Seabrook	3.8	1.5	Pass

⁽¹⁾Performance criteria are +/- 15%.

⁽²⁾Blind spike irradiations using Cs-137

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Attachment 4: Environmental Direct Radiation Dosimetry Results

Table 25: Environmental Direct Radiation Dosimetry Results

Monitoring Location	Quarterly Baseline, B _Q (mrem)	B _Q + MDD _Q (mrem)	Normalized Quarterly Monitoring Data, M _Q (mrem)				Quarterly Facility Dose, F _Q =M _Q -B _Q (mrem, or "ND" if F _Q ≤ MDD _Q)				Annual Baseline, B _A (mrem)	B _A + MDD _A (mrem)	Annual Monitoring Data, M _A (mrem)	Annual Facility Dose, F _A =M _A -B _A (mrem, or "ND" if F _A ≤ MDD _A)	Annual** Dose to Member of Public ^e (mrem)
			1	2	3	4	1	2	3	4					
1	18.4	23.4	17.1	18.4	18.0	18.8	ND	ND	ND	ND	73.6	83.6	72.3	ND	ND
2	19.6	24.6	15.4	16.3	16.9	20.2	ND	ND	ND	ND	78.2	88.2	68.9	ND	ND
3	17.2	22.2	15.3	16.2	16.3	18.3	ND	ND	ND	ND	69.0	79.0	66.2	ND	ND
4	19.0	24.0	16.7	17.5	17.4	18.3	ND	ND	ND	ND	76.1	86.1	69.8	ND	ND
6	12.0	17.0	10.2	10.7	10.0	10.6	ND	ND	ND	ND	47.9	57.9	41.5	ND	ND
8	16.2	21.2	14.7	15.5	15.2	16.4	ND	ND	ND	ND	64.8	74.8	61.9	ND	ND
10	17.2	22.2	14.9	15.7	15.8	17.2	ND	ND	ND	ND	69.0	79.0	63.6	ND	ND
11*	15.8	20.8	15.0	15.4	15.6	17.1	ND	ND	ND	ND	63.1	73.1	63.2	ND	ND
12*,a,b	15.8	20.8	19.6	21.6	20.0	22.6	ND	5.8	ND	6.8	63.1	73.1	83.8	20.7	ND
15*,a	15.8	20.8	16.4	19.2	19.3	20.3	ND	ND	ND	ND	63.1	73.1	75.1	12.1	ND
16*,a,b	15.8	20.8	15.9	16.1	15.8	17.2	ND	ND	ND	ND	63.1	73.1	64.9	ND	ND
19	18.7	23.7	18.3	19.0	17.6	19.2	ND	ND	ND	ND	74.8	84.8	74.1	ND	ND
22	18.8	23.8	16.9	19.0	17.9	19.5	ND	ND	ND	ND	75.3	85.3	73.4	ND	ND
34	17.0	22.0	16.5	16.7	16.4	17.8	ND	ND	ND	ND	68.1	78.1	67.5	ND	ND
35	17.8	22.8	14.3	15.0	13.8	16.1	ND	ND	ND	ND	71.1	81.1	59.2	ND	ND
36	20.5	25.5	17.6	18.4	19.5	20.8	ND	ND	ND	ND	82.0	92.0	76.4	ND	ND
40	18.0	23.0	15.7	17.8	17.4	19.3	ND	ND	ND	ND	71.9	81.9	70.3	ND	ND
41	15.8	20.8	15.0	15.9	15.2	17.2	ND	ND	ND	ND	63.1	73.1	63.3	ND	ND
46	12.8	17.8	12.0	13.4	11.8	13.4	ND	ND	ND	ND	51.3	61.3	50.6	ND	ND
50	17.4	22.4	16.1	17.3	15.6	17.8	ND	ND	ND	ND	69.8	79.8	66.7	ND	ND
55*,a,c	15.8	20.8	20.1	Missing	18.5	19.8	ND	N/A	ND	ND	63.1	73.1	80.2 [#]	17.1	ND
56*,a	15.8	20.8	17.0	17.9	17.6	18.5	ND	ND	ND	ND	63.1	73.1	71.1	ND	ND

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Table 25: Environmental Direct Radiation Dosimetry Results

Monitoring Location	Quarterly Baseline, B _Q (mrem)	B _Q + MDD _Q (mrem)	Normalized Quarterly Monitoring Data, M _Q (mrem)				Quarterly Facility Dose, F _Q =M _Q -B _Q (mrem, or "ND" if F _Q ≤ MDD _Q)				Annual Baseline, B _A (mrem)	B _A + MDD _A (mrem)	Annual Monitoring Data, M _A (mrem)	Annual Facility Dose, F _A =M _A -B _A (mrem, or "ND" if F _A ≤ MDD _A)	Annual** Dose to Member of Public ^e (mrem)
			1	2	3	4	1	2	3	4					
57 ^{*,a}	15.8	20.8	17.3	18.0	16.7	18.0	ND	ND	ND	ND	63.1	73.1	70.0	ND	ND
58 ^{*,a}	15.8	20.8	17.5	17.4	18.4	20.0	ND	ND	ND	ND	63.1	73.1	73.2	10.2	ND
61	16.2	21.2	14.1	14.7	14.3	16.3	ND	ND	ND	ND	64.8	74.8	59.4	ND	ND
62	13.9	18.9	11.8	12.6	11.8	13.5	ND	ND	ND	ND	55.5	65.5	49.7	ND	ND
63	14.6	19.6	13.3	13.4	13.3	14.0	ND	ND	ND	ND	58.4	68.4	54.0	ND	ND
64	15.8	20.8	14.6	14.6	14.8	15.5	ND	ND	ND	ND	63.1	73.1	59.5	ND	ND
65	14.1	19.1	11.9	13.9	12.3	12.9	ND	ND	ND	ND	56.3	66.3	50.9	ND	ND
66	14.7	19.7	12.7	14.3	13.6	15.0	ND	ND	ND	ND	58.9	68.9	55.6	ND	ND
68	15.8	20.8	14.9	17.2	15.7	17.3	ND	ND	ND	ND	63.1	73.1	65.2	ND	ND
73 ^{*,b,d}	15.8	20.8	30.0	43.1	26.6	20.7	14.2	27.3	10.8	ND	63.1	73.1	120.4	57.3	ND
75	16.7	21.7	16.2	15.3	14.8	16.0	ND	ND	ND	ND	66.9	76.9	62.3	ND	ND
76	18.2	23.2	16.9	17.5	17.0	18.3	ND	ND	ND	ND	72.7	82.7	69.6	ND	ND

Highlighted results include any indicated neutron dose, estimated using a neutron signal (Rn) conversion factor of 10.5 Rn/rem.

* Indicates that the station is within the site boundary. The baseline has been estimated to be 15.8 mrem per standard 91-day quarter within the site boundary.

** Dose to members of the public is based on estimated annual occupancy times.

For missing TLD results, the average of the available quarterly data points is substituted for the missing data when calculating Annual Monitoring Data (M_A).

a The dose to members of the public is based on a beach annual occupancy time of 300 hours per year near the SONGS sea wall.

b This location is not accessible to members of the general public.

c A neutron dosimeter was collocated with REMP TLD 55 and selected ISFSI TLDs. The estimated neutron dose was added to the gamma dose. M_A may differ from the sum of quarterly doses (M_Q) due to difference in detection of quarterly and annual neutron dose.

d The dose to members of the public is based on an annual occupancy time of 20 hours per year for transit along road near TLD 73.

MDD_Q = Quarterly Minimum Differential Dose = 5 mrem

MDD_A = Annual Minimum Differential Dose = 10 mrem

ND = Not Detected, where M_Q ≤ (B_Q+MDD_Q) or M_A ≤ (B_A+MDD_A)

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Attachment 5: ISFSI TLD Data

The TLD data presented below is for ISFSI TLD locations. These locations are not accessible to the public and do not represent a dose pathway for Members of the Public that are outside of the Site Boundary. The data is presented for trending purposes, as discussed in 11.2 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

Table 26: ISFSI TLD Data

Monitoring Location ^a	Quarterly Baseline, B ^Q (mrem)	B _Q + MDD _Q (mrem)	Normalized Quarterly Monitoring Data, M _Q (mrem)				Quarterly Facility Dose, F _Q =M _Q -B _Q (mrem, or "ND" if F _Q ≤ MDD _Q)				Annual Baseline, B _A (mrem)	B _A + MDD _A (mrem)	Annual Monitoring Data, M _A (mrem)	Annual Facility Dose, F _A =M _A -B _A (mrem, or "ND" if F _A ≤ MDD _A)	Annual ^a Dose to Member of Public ^b (mrem)
			1	2	3	4	1	2	3	4					
301	15.8	20.8	18.4	17.9	18.9	18.6	ND	ND	ND	ND	63.1	73.1	73.8	10.7	-
302	15.8	20.8	21.8	21.5	22.4	22.4	6.0	5.8	6.6	6.7	63.1	73.1	88.1	25.1	-
303	15.8	20.8	23.1	20.9	22.6	22.5	7.3	5.1	6.8	6.7	63.1	73.1	89.0	25.9	-
304	15.8	20.8	21.1	19.7	21.8	21.3	5.3	ND	6.1	5.5	63.1	73.1	83.9	20.8	-
307	15.8	20.8	19.5	18.1	19.2	19.4	ND	ND	ND	ND	63.1	73.1	76.2	13.1	-
308	15.8	20.8	18.3	17.6	18.6	18.5	ND	ND	ND	ND	63.1	73.1	72.9	ND	-
309	15.8	20.8	19.1	19.1	19.3	20.0	ND	ND	ND	ND	63.1	73.1	77.5	14.5	-
310	15.8	20.8	20.5	20.2	20.3	21.3	ND	ND	ND	5.5	63.1	73.1	82.3	19.2	-
311 ^c	15.8	20.8	19.7	19.6	20.0	19.8	ND	ND	ND	ND	63.1	73.1	79.1	16.1	-
312	15.8	20.8	15.7	16.4	17.6	16.3	ND	ND	ND	ND	63.1	73.1	65.9	ND	-
314	15.8	20.8	19.9	20.6	21.7	20.3	ND	ND	5.9	ND	63.1	73.1	82.4	19.4	-
315	15.8	20.8	18.6	18.2	18.1	19.2	ND	ND	ND	ND	63.1	73.1	74.0	11.0	-
316	15.8	20.8	16.3	15.8	16.6	17.3	ND	ND	ND	ND	63.1	73.1	66.0	ND	-
317	15.8	20.8	19.5	19.2	19.5	18.9	ND	ND	ND	ND	63.1	73.1	77.1	14.0	-
318	15.8	20.8	18.9	20.4	23.3	21.5	ND	ND	7.6	5.8	63.1	73.1	84.2	21.1	-
319	15.8	20.8	19.5	20.4	22.1	21.1	ND	ND	6.3	5.3	63.1	73.1	83.0	19.9	-
320	15.8	20.8	19.8	19.8	21.0	21.4	ND	ND	5.3	5.7	63.1	73.1	82.0	19.0	-
321	15.8	20.8	19.8	18.4	19.5	21.0	ND	ND	ND	5.2	63.1	73.1	78.7	15.6	-
326 ^c	15.8	20.8	23.2	24.4	23.0	23.6	7.4	8.6	7.2	7.8	63.1	73.1	95.5	32.4	-

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Table 26: ISFSI TLD Data

Monitoring Location ^a	Quarterly Baseline, B ^Q (mrem)	B ^Q + MDD ^Q	Normalized Quarterly Monitoring Data, M _Q (mrem)				Quarterly Facility Dose, F _Q =M _Q -B _Q (mrem, or "ND" if F _Q ≤ MDD _Q)				Annual Baseline, B _A (mrem)	B _A + MDD _A (mrem)	Annual Monitoring Data, M _A (mrem)	Annual Facility Dose, F _A =M _A -B _A (mrem, or "ND" if F _A ≤ MDD _A)	Annual ^a Dose to Member of Public ^b (mrem)
			1	2	3	4	1	2	3	4					
339 ^c	15.8	20.8	21.4	22.4	23.3	23.5	5.6	6.7	7.5	7.7	63.1	73.1	92.0	28.9	-
340 ^c	15.8	20.8	19.0	19.1	19.6	21.5	ND	ND	ND	5.8	63.1	73.1	83.1	20.1	-
341 ^c	15.8	20.8	20.9	20.4	21.2	22.8	5.2	ND	5.4	7.0	63.1	73.1	88.0	24.9	-
342 ^c	15.8	20.8	24.2	23.4	24.3	24.8	8.4	7.7	8.6	9.0	63.1	73.1	97.0	33.9	-
343 ^c	15.8	20.8	21.7	21.2	22.4	22.2	5.9	5.4	6.7	6.4	63.1	73.1	87.4	24.3	-
344 ^c	15.8	20.8	19.5	19.9	20.1	20.4	ND	ND	ND	ND	63.1	73.1	79.9	16.8	-

Highlighted results include any indicated neutron dose, estimated using a neutron signal (Rn) conversion factor of 10.5 Rn/rem.

a ISFSI TLDs (SCE-301 through SCE-344) are placed around the ISFSI pad, and not in locations accessible to the general public.

b Public dose is not applicable for those TLDs that are not accessible to the general public.

c Station has a collocated neutron dosimeter package. The neutron dose is estimated using a neutron signal conversion factor measured at a similar ISFSI installation. M_A may differ from the sum of quarterly doses (M_Q) due to difference in detection of quarterly and annual neutron dose.

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Attachment 6: CDPH Collocated samples

The CDPH participates in a comprehensive radiological environmental split sampling program in conjunction with SONGS. In 2024, the CDPH acquired split samples, collected by an independent third party, from the following SONGS media: non-migratory marine animals, kelp, ocean water gamma emitters, and ocean water tritium. The CDPH also conducts parallel air sampling and terrestrial direct radiation (TLD) measurement efforts at SONGS, (refer to Table 30 for a discussion of the CDPH TLD data).

CDPH Air Sampling Gross Beta and quarterly gamma analysis results were similar to the SONGS results for the same media. As expected, both the CDPH Drinking Water and Radiation Laboratory (DWRL) and the SONGS contracted Teledyne found a gross beta signal above the detection limit. Both labs detected naturally occurring Be-7 in the quarterly composite gamma particulate media samples.

Since ocean water tritium and non-migratory marine animals have the potential for human consumption, their raw data are tabulated below. Thirteen split sample analyses for marine species were conducted. Analysis methodologies are different in that the SONGS contracted laboratory reported results based on sample wet weight, where the CDPH lab reported results based on sample dry weight. The labs did not detect anthropogenic radionuclides in the split samples with the exception of low-level Cs-137 in some non-migratory marine animals. The variability in the detection of positive results is due to the low activity of the samples, the differences in sample processing, the uncertainty of isotope detection and detection limits at low concentrations. Considering the variables involved, the CDPH results are not unexpected and remain consistent with the SONGS results.

Radiological split sampling is performed by SONGS to demonstrate repeatability of the sample collection, preparation, and analysis process. Split sample analysis is performed for the evaluation of the precision and bias trends of the method of analysis without the added variables introduced by sampling. The 2024 CDPH data resulted in similar conclusions to the 2024 SONGS REMP data.

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Table 27: CDPH and SONGS Split Sample Tritium in Ocean Water

SPLIT SAMPLE LOCATION		Sample Date	SONGS tritium data		CDPH tritium data	
			H-3 result ± 2 sigma (pCi/L)	MDC	H-3 result ± uncertainty (pCi/L)	MDC
A	Station Discharge Outfall - Unit 1	1/15/2024	-98.2 ± 251	431	49.3 ± 154	262
		2/15/2024	6.38 ± 292	480	64.5 ± 154	262
		3/18/2024	50.2 ± 239	384	65.7 ± 122	207
		4/16/2024	127 ± 267	418	76.6 ± 123	207
		5/15/2024	-38.1 ± 286	477	97.3 ± 124	209
		6/18/2024	-21.6 ± 279	463	71.5 ± 123	209
		7/16/2024	34.1 ± 276	449	-16.1 ± 121	209
		8/20/2024	-107 ± 273	469	-30.8 ± 124	214
		9/17/2024	-32.3 ± 253	423	63.6 ± 132	224
		10/16/2024	135 ± 280	438	46.2 ± 131	224
		11/18/2024	143 ± 263	407	195 ± 132	218
		12/16/2024	17.7 ± 269	439	-54 ± 125	218
B	Outfall - Unit 2	1/15/2024	80.1 ± 279	446	-22.8 ± 152	262
		2/15/2024	-144 ± 279	483	-81.6 ± 151	262
		3/18/2024	21.0 ± 233	380	43.8 ± 122	207
		4/16/2024	-60.6 ± 243	411	-7.29 ± 120	207
		5/15/2024	-57.0 ± 283	476	19.8 ± 122	209
		6/18/2024	-144 ± 264	460	17.9 ± 122	209
		7/16/2024	-69.2 ± 269	455	53.7 ± 123	209
		8/20/2024	-34.4 ± 272	453	47.2 ± 126	214
		9/17/2024	339 ± 293	424	36.6 ± 131	224
		10/16/2024	-51.4 ± 260	437	40.4 ± 131	224
		11/18/2024	-91.8 ± 228	392	74.4 ± 129	218
		12/16/2024	-22.0 ± 263	437	166 ± 131	218

Note that the EPA drinking water maximum permissible tritium activity is 20,000 pCi / liter. Both labs only detected naturally occurring radionuclides in ocean water. No plant-related radionuclides were reported above the MDC.

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Table 27: CDPH and SONGS Split Sample Tritium in Ocean Water

SPLIT SAMPLE LOCATION		Sample Date	SONGS tritium data		CDPH tritium data	
			H-3 result ± 2 sigma (pCi/L)	MDC	H-3 result ± uncertainty (pCi/L)	MDC
C	Outfall - Unit 3	1/15/2024	64.5 ± 259	416	-94.9 ± 150	262
		2/15/2024	-258 ± 268	485	22.8 ± 153	262
		3/18/2024	30.4 ± 233	378	-31 ± 119	207
		4/16/2024	59.9 ± 230	368	10.9 ± 121	207
		5/15/2024	-135 ± 279	482	-9.01 ± 121	209
		6/18/2024	34.8 ± 286	466	48.3 ± 123	209
		7/16/2024	211 ± 297	454	28.6 ± 122	209
		8/20/2024	10.9 ± 280	460	-16.3 ± 124	214
		9/17/2024	121 ± 276	433	-3.85 ± 130	224
		10/16/2024	-113 ± 256	443	59.7 ± 132	224
		11/18/2024	-77.4 ± 234	400	57.7 ± 128	218
		12/16/2024	32.2 ± 263	427	7.44 ± 127	218
D	Newport Beach (Control)	1/15/2024	-84.8 ± 238	407	-17.1 ± 152	262
		2/15/2024	46.7 ± 295	479	-7.59 ± 152	262
		3/18/2024	56.2 ± 240	385	-16.4 ± 120	207
		4/16/2024	-105 ± 238	412	27.4 ± 121	207
		5/15/2024	-225 ± 271	484	14.4 ± 122	209
		6/18/2024	131 ± 297	467	44.7 ± 123	209
		7/16/2024	-106 ± 265	454	-46.5 ± 120	209
		8/20/2024	-37.1 ± 276	460	-29 ± 124	214
		9/17/2024	2.16 ± 258	424	73.2 ± 132	224
		10/16/2024	22.2 ± 277	453	119 ± 133	224
		11/18/2024	-52.4 ± 235	396	35.4 ± 128	218
		12/16/2024	-123 ± 251	437	7.44 ± 127	218

Note that the EPA drinking water maximum permissible tritium activity is 20,000 pCi / liter. Both labs only detected naturally occurring radionuclides in ocean water. No plant-related radionuclides were reported above the MDC.

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Table 28: Non-migratory Marine Animals analysis results – Potassium-40

SPLIT SAMPLE LOCATION		Sample Date	Sample Type	Dry/Wet Weight Ratio (g _{dry} /g _{wet})	Nuclide	SONGS data (wet weight)		CDPH data (dry weight)	
						Gamma result +/- 2 sigma (pCi/g)	MDC (pCi/g)	Gamma result +/- uncertainty (pCi/g)	MDC (pCi/g)
A	Outfall – Unit 1	4/3/2024	Fish	0.23	Potassium-40	3.16 ± 0.87	0.50	17.0 ± 0.9	0.4
B	Outfall – Units 2 & 3	4/3/2024	Fish	0.23	Potassium-40	3.77 ± 1.06	0.77	20.9 ± 1.0	0.4
		4/3/2024	Crustacean	0.265	Potassium-40	3.24 ± 0.96	0.41	14.0 ± 0.7	0.3
		4/3/2024	Mollusk	0.213	Potassium-40	2.34 ± 0.70	0.47	12.2 ± 0.7	0.6
		10/11/2024	Mollusk	0.191	Potassium-40	1.98 ± 0.99	0.46	11.4 ± 0.7	0.4
		10/11/2024	Crustacean	0.261	Potassium-40	2.76 ± 0.90	0.43	15.8 ± 0.8	0.4
		10/11/2024	Fish	0.259	Potassium-40	4.38 ± 0.97	0.65	18.6 ± 0.9	0.3
C	Laguna Beach – Control	4/22/2024	Mollusk	0.184	Potassium-40	2.54 ± 0.88	0.73	12.7 ± 0.7	0.5
		4/22/2024	Fish	0.231	Potassium-40	3.93 ± 1.13	0.79	17.5 ± 0.9	0.4
		4/22/2024	Crustacean	0.259	Potassium-40	3.08 ± 0.90	0.47	12.6 ± 0.7	0.4
		10/23/2024	Mollusk	0.203	Potassium-40	2.11 ± 0.71	0.39	11.9 ± 0.7	0.4
		10/23/2024	Fish	0.229	Potassium-40	4.03 ± 1.18	0.72	18.0 ± 0.9	0.4
		10/23/2024	Crustacean	0.279	Potassium-40	2.36 ± 0.73	0.47	17.1 ± 0.9	0.5

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Table 29: Non-migratory Marine Animals analysis results – Cesium-137

SPLIT SAMPLE LOCATION		Sample Date	Sample Type	Dry/Wet Weight Ratio (g _{dry} /g _{wet})	Nuclide	SONGS data (wet weight)		CDPH data (dry weight)	
						Gamma result +/- 2 sigma (pCi/g)	MDC (pCi/g)	Gamma result +/- uncertainty (pCi/g)	MDC (pCi/g)
A	Outfall – Unit 1	4/3/2024	Fish	0.23	Cesium-137	0.0113 ± 0.0286	0.0499	0.0189 ± 0.0102	0.0161
B	Outfall – Units 2 & 3	4/3/2024	Fish	0.23	Cesium-137	0.0054 ± 0.0415	0.0688	0.0297 ± 0.0124	0.0194
		4/3/2024	Crustacean	0.265	Cesium-137	0.0051 ± 0.0383	0.0646	0.0185 ± 0.0062	0.0113
		4/3/2024	Mollusk	0.213	Cesium-137	0.0064 ± 0.0321	0.0539	0.0059 ± 0.0094	0.0158
		10/11/2024	Mollusk	0.191	Cesium-137	0.0304 ± 0.0343	0.0661	0.0303 ± 0.0123	0.0192
		10/11/2024	Crustacean	0.261	Cesium-137	-0.0169 ± 0.0439	0.0678	0.0011 ± 0.0070	0.0115
		10/11/2024	Fish	0.259	Cesium-137	0.0437 ± 0.0390	0.0770	0.0214 ± 0.0093	0.0146
C	Laguna Beach - Control	4/22/2024	Mollusk	0.184	Cesium-137	-0.0209 ± 0.0423	0.0709	0.0036 ± 0.0092	0.0152
		4/22/2024	Fish	0.231	Cesium-137	-0.0280 ± 0.0430	0.0708	0.0103 ± 0.0083	0.0134
		4/22/2024	Crustacean	0.259	Cesium-137	0.0110 ± 0.0420	0.0710	0.0089 ± 0.0067	0.0115
		10/23/2024	Mollusk	0.203	Cesium-137	-0.0138 ± 0.0247	0.0413	0.0065 ± 0.0071	0.0122
		10/23/2024	Fish	0.229	Cesium-137	0.0147 ± 0.0487	0.0919	0.0217 ± 0.0133	0.0214
		10/23/2024	Crustacean	0.279	Cesium-137	-0.0088 ± 0.0328	0.0515	0.0097 ± 0.0075	0.0130

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CDPH maintains a TLD program in the environs of SONGS. Per CDPH request, the 2024 exposure results from the CDPH dosimeters are reported in Table 30, below. The Location Numbers refer to the current SONGS Decommissioning Solutions (SDS) alphanumeric location identifier and the current CDPH location number.

The CDPH TLD program does not conform to the same environmental dosimeter standard Reg. Guide 4.13 (ANSI N13.37-2014) used to generate direct radiation data for the SONGS REMP TLD program. The CDPH reports results in different units of measurement and is therefore not technically equivalent to the SONGS TLD data set. The different methodologies and the different units of measurement make it unsuitable to directly compare individual REMP data to the corresponding individual CDPH TLD data. However, the CDPH results are consistent with the conclusion that beyond the Site Boundary there is no detectable direct radiation that is attributable to SONGS.

Table 30: 2024 State of California Data from the CDPH TLD program (mR/Qtr.)

Location Numbers	Location Name	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
SDS-1, CDPH #2	City of San Clemente	31	31	32	31
SDS-22, CDPH #4	Former US Coast Guard Station – San Mateo Point	29	29	32	32
SDS-34, CDPH #5	San Onofre Elementary School	28	29	27	29
SDS-10, CDPH #6	Bluff (Adjacent to PIC #1) (San Onofre Surfing Beach)	31	29	29	29
SDS-16, CDPH #7	East Southeast Site Boundary	26	27	25	26
SDS-2, CDPH #8	Camp San Mateo	28	33	35	31
SDS-3, CDPH #9	Camp San Onofre	29	30	29	29
SDS-6, CDPH #10	Old El Camino Real (Old Highway 101) (ESE)	23	24	21	20
SDS-50, CDPH #13	Oceanside Fire Station	30	N/A	29	29