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A Edward Scherer
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April 27, 2001

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: **Docket Nos. 50-206, 50-361 and 50-362**
2000 Annual Radiological Environmental Operating Report
San Onofre Nuclear Generating Station Units 1, 2 and 3

Gentlemen:

As required by Technical Specification (TS) Section D6.9.1.3 of Unit 1 Facility Operating License DPR-13, and TS Section 5.7.1.2 of Facility Operating Licenses NPF-10 and NPF-15 for Units 2 and 3, respectively, this letter transmits the 2000 Annual Radiological Environmental Operating Report (AREOR) for San Onofre Unit 1 and Units 2 and 3.

The AREOR covers the operation of San Onofre Units 1, and 2 and 3 during the calendar year 2000 and includes summaries, interpretations, and analysis of trends of the results of the Radiological Environmental Monitoring Program.

If you require any additional information, please let me know.

Sincerely,

RJ McWey for AES

Enclosure

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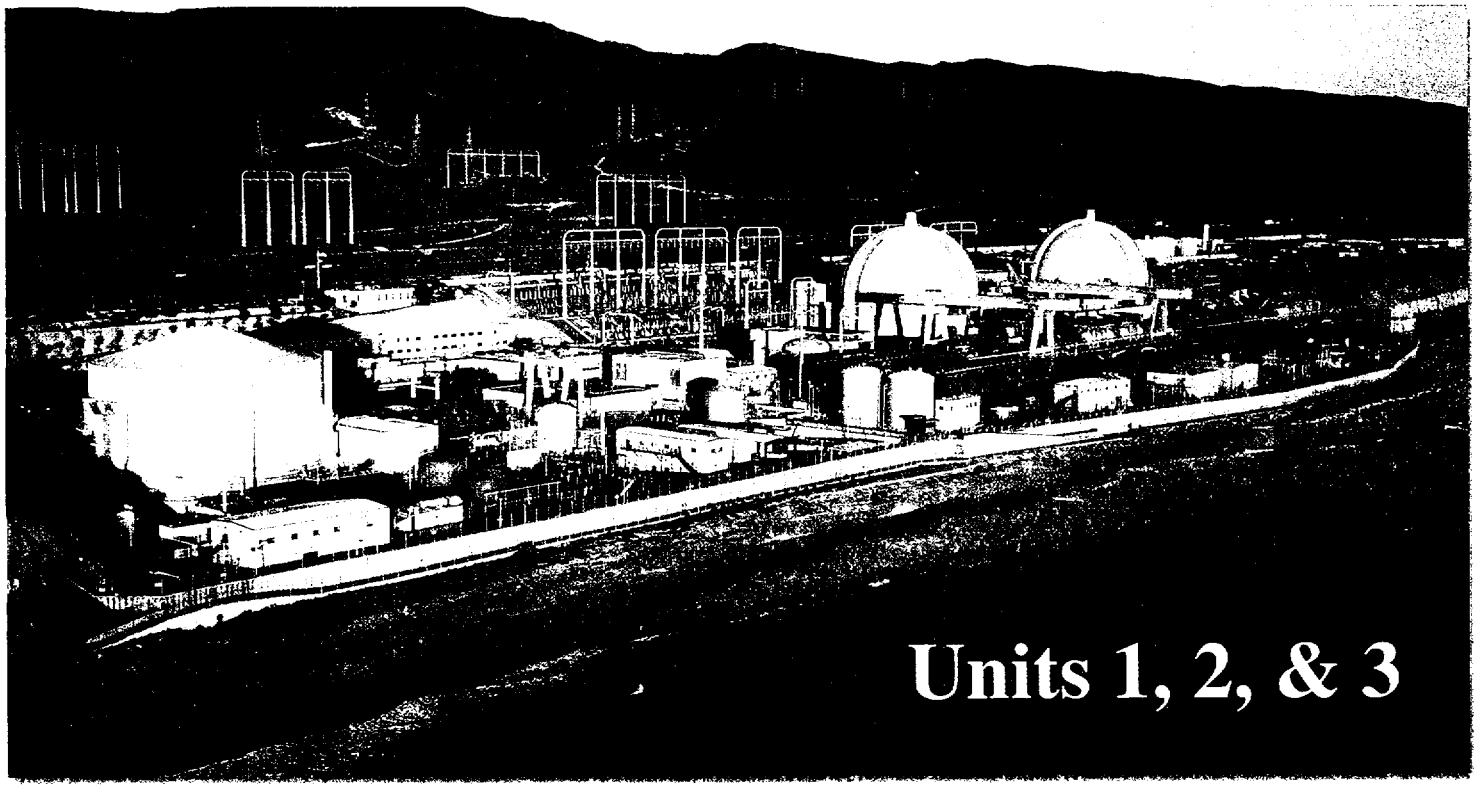
2000
Radiological Environmental Operating Report
San Onofre Nuclear Generating Station



Southern California Edison

An Edison International Company

San Diego Gas and Electric Company

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

April 2001

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

2000 ANNUAL

RADIOLOGICAL ENVIRONMENTAL

OPERATING REPORT

San Onofre Nuclear Generating Station

UNITS 1, 2, & 3

Southern California Edison

An *Edison International* Company

San Diego Gas and Electric Company

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APRIL 2001

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Executive Summary

The data from the San Onofre Nuclear Generating Station (SONGS) Radiological Environmental Monitoring Program (REMP) clearly indicates that SONGS had no measurable radiological environmental impact during 2000.

Preparation of the 2000 Annual Radiological Environmental Operating Report (AREOR) used the data reduction protocol described in NUREG/CR-4007. A meaningful analysis of data at, near, or below the detection limit must necessarily involve a consideration of the degrees of uncertainty associated with the data. Excluding naturally occurring radionuclides, approximately 5% of the 2000 SONGS REMP data set was above the critical level (1.64 sigma), which is characteristic of a database consisting entirely of values statistically equal to zero. The data above the critical level have been summarized in the Statistical Summary of REMP Data found in Appendix B. The plant related radionuclides (Cs-137 in soil and I-131 in kelp) detected at the 3 sigma (99%) confidence level may be attributable to fallout from nuclear weapons testing (Cs-137) and medical administrations of radionuclides (I-131). These isotopes have been detected at indicator as well as control locations in past years. The naturally occurring radionuclides (Be-7, K-40, and Th-228) detected at the 99% detection confidence level were observed in both control and indicator locations at substantially similar concentrations and are not related to the operation of SONGS. The balance of 2000 SONGS REMP database displays behavior statistically equal to a null set. Refer to Appendix B for a more detailed discussion.

INTRODUCTION

SONGS consists of three pressurized water nuclear reactors housed in separate containment buildings. Unit 1 attained initial criticality June 1967 and was permanently retired from service in November 1992. Unit 2 and Unit 3 attained initial criticality in July 1982 and August 1983, respectively, and have been in operation to date.

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

The REMP is conducted in accordance with Section 5.0 of the SONGS Unit 1 and 2/3 Offsite Dose Calculation Manuals (ODCM).

To conform with 10CFR Part 50, Appendix I, Section IV-B.2, measured radioactivity concentrations in the environmental samples have been compared against predicted (calculated) ones to evaluate the relationship between quantities of radioactive material released in effluents and resultant radiation doses to individuals from principal pathways of exposure.

This comparison was documented in Appendix D of the 1993 AREOR, issued April, 1994. During 2000 no plant related radionuclides attributable to the operation of SONGS were detected.

A land use census was performed in 2000 to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the monitoring program are made if required by the results of this census. Appendix F of the report identifies changes to the census and the resultant dose increase, if any, to individuals from principal pathways of exposures in conformance with 10CFR Part 50, Appendix I, Section IV. B.3.

OBJECTIVES

1. To fulfill the radiological environmental monitoring requirements of the ODCM and the Technical Specifications.

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

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

4. To verify that the operation of SONGS Units 1, 2 and 3 have no assessable detrimental effects on the health and safety of the public or the environment.

SAMPLE COLLECTION

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

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

SOURCES OF RADIOACTIVITY

Plant-specific radionuclides are produced in the normal operation of a nuclear power plant. Most of the fission products are retained within the fuel and its cladding. A small fraction of fission products such as cesium-137 (Cs-137) and iodine-131 (I-131), and activation products such as cobalt-60 (Co-60), are present in the primary reactor cooling system. Noble gases are also produced during the fission process.

Radioactive liquid and gaseous waste releases to the ocean and the atmosphere may contain very minute concentrations of plant-produced radionuclides. The airborne radioactive noble gases released are mostly xenon and krypton, which are inert (non-reactive). They do not concentrate in the body, but they may contribute to human radiation exposure as an immersion source for whole body exposure. Xenon-133 and xenon-135 are the major radioactive noble gases released to the atmosphere, and their calculated offsite beta and gamma air doses are less than 0.1 mrad per year.

The releases of iodines and particulates in the gaseous and liquid effluents are small. The major radionuclides of interest are I-131, Cs-134, Cs-137, Co-58, and Co-60. The total releases for these radionuclides were well below applicable regulatory limits.

Tritium (H-3), the radioactive isotope of hydrogen, is the predominant radionuclide in the liquid effluents and is also present in gaseous effluents. Tritium is produced in the reactor water (coolant) as a result of Boron activation and other nuclear reactions.

EXPOSURE PATHWAY

Figure 1 illustrates various exposure pathways resulting in radiation dose to the surrounding population from operation of a nuclear facility. Only a few pathways will have real dose potential and require detailed calculations.

a. External Exposure

External exposure to people during normal operations will include radioactive gases in gaseous effluent plumes, radionuclides deposited on soil, and vegetation, or shoreline sediments. Direct exposure from radionuclides in water during recreation or commercial fishing activity is insignificant. Accumulation in sediments has the greater potential as a source of exposure. Gamma dosimeters (TLDs) are the usual means of measuring direct radiation exposure since significant dose contributors are gamma-emitters.

b. Internal Exposure

The release of radioactivity in liquid effluents involves pathways such as fish consumption and direct exposure from the ocean water by swimming and the shoreline activities. Consumption of fish or crops from the area receiving liquid effluents and breathing contaminated air from the gaseous effluents releases are the most probable sources of internal exposure.

The doses calculated from gaseous effluent, tritium, radioiodines, and particulates of the gaseous effluent within a five-mile distance from the plant were summarized in Appendix D of the 1993 AREOR. Refer to the 1993 AREOR for detailed information on this analysis.

REGULATORY LIMITS, GUIDANCE, AND REQUIREMENTS

* 10CFR50

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

* 40CFR190

  The EPA has established environmental radiation protection standards for nuclear power plants in 40CFR190. The standards for normal operation recommended that the dose from all discharges of radioactivity should not exceed 25 mrem/yr. These limits are applicable to the sum of both liquid and gaseous effluents and direct radiation. The environmental doses calculated at SONGS are a small fraction of the dose limits established by the Environmental Protection Agency (EPA).

* 10CFR20

  10CFR20, Appendix B, Tables 2 and 3, "Effluent Concentrations" and "Concentration for release to Sewerage"

Guidance:

* Regulatory Guide 4.1

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

* Regulatory Guide 4.2

  Preparation of Environmental Reports for Nuclear Power Stations, 1976

* Regulatory Guide 4.8

  Environmental Technical Specifications for Nuclear Power Plants, 1975

* Regulatory Guide 4.13

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

* NUREG-0133

  Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants

* Regulatory Guide 1.109

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

* NUREG-1301

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

* ANSI N545 (TLD's)

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

* Regulatory Guide 4.15

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

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

DATA MANAGEMENT

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

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

The impact of SONGS on the surrounding environment was assessed through a series of analyses. These analyses included: data reduction, comparisons of indicator to control locations, and summary (Appendix B); comparison of operational to preoperational environmental data (Appendix D); summary of deviations from sampling requirements and corrective actions taken (Appendix E); and finally the results of the 2000 Land Use Census reports including changes in the Land Uses from the previous year (Appendix F).

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

Guide 4.15. A split sampling program was conducted in cooperation with the State of California Department of Health Services. Refer to Appendix C.

DETECTION LIMIT TERMINOLOGY

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

Critical level - Defined as 1.64 sigma. For a sufficiently large database of isotopically analyzed sample results, with the "true" activity being equal to zero, approximately 5% of the results should be above the critical level. The 2000 SONGS REMP data above the critical level have been summarized in the Statistical Summary of REMP Data found in Appendix B. Approximately 5% of the total listed analyses are above the critical level.

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

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

Three sigma (99% confidence level) - Sample analysis results above this level are "detected" with less than a 1 % probability of a "false positive."

CONCLUSION

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

Radiological environmental data collected throughout 2000 have been evaluated to determine the impact, if any, of San Onofre operations on the surrounding environment. To accomplish this, several methods of evaluation were employed, namely:

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

2. Environmental dose calculations and correlation of effluent releases with environmental concentrations (Refer to the 1993 AREOR).

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

4. Comparison of radioactivity in various media in 2000 against the levels observed in pre-operational years.

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

In comparing these findings to the conservatively-defined limits of the facility operating licenses, it is concluded that the radiological environmental impact of the operation of SONGS through 2000 has been negligible, and the resulting dose to man is negligible.

REFERENCES

1. 10CFR20, 10CFR50

2. 1993 Radiological Environmental Operating Report for San Onofre Nuclear Generating Station, April 30, 1994.

3. Land Use Census for SONGS Units l, 2 and 3 Radiological Environmental Monitoring Program, October 2000.

4. ODCM (Offsite Dose Calculation Manual) for SONGS Units 1, 2 and 3, Section 5.0, 1999.

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

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

APPENDIX A

SAMPLE TYPE AND SAMPLING LOCATION

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE * (miles)	DIRECTION * (Sector)
Direct Radiation ***			
1	City of San Clemente (Former SDG&E Offices)	5.7	NW
2	Camp San Mateo - MCB	3.5	N
3	Camp San Onofre - MCB	2.6	NE
4	Camp Horno - MCB	4.5	E
6	Old Route 101 (East-Southeast)	3.0	ESE
8	Noncommissioned Officers Beach Club	1.4	NW
10	Bluff (Adjacent to PIC #1)	0.7	WNW
11	Former Visitor's Center	0.4 **	NW
12	South of Switchyard	0.2 **	E
13	Southeast Site Boundary (Bluff)	0.4 **	ESE
15	Southeast Site Boundary (Office Building)	0.1 **	SSE
16	East Southeast Site Boundary	0.4 **	ESE
17	Transit Dose	---	---
18	Transit Dose	---	---
19	San Clemente Highlands	5.0	NNW
22	Former US Coast Guard Station - San Mateo Point	2.7	WNW
23	Samaritan Hospital - San Clemente	8.1	NW

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

** Distances are within the Units 2 & 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** Out of sequence Sample numbers due to program modifications

MCB Marine Corp Base Camp Pendleton

PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE * (miles)	DIRECTION * (Sector)
Direct Radiation (Continued) ***			
31	Aurora Park - Mission Viejo (CONTROL)	18.6	NNW
33	Camp Talega - MCB	5.7	N
34	San Onofre School - MCB	1.9	NW
35	Range 312 - MCB	4.7	NNE
36	Range 208C - MCB	4.2	NE
38	San Onofre State Beach Park	3.3	SE
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	NNW
41	Old Route 101 - East	0.3 **	E
44	Fallbrook Fire Station	17.7	E
46	San Onofre State Beach Park	0.9	SE
47	Camp Las Flores - MCB	8.6	SE
49	Camp Chappo - MCB	12.8	ESE
50	Oceanside Fire Station (CONTROL)	15.6	SE
53	San Diego County Operations Center	44.3	SE
54	Escondido Fire Station	31.8	ESE
55	San Onofre State Beach (Unit 1, West Southwest)	0.2 **	W

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

** Distances are within the Units 2 & 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** Out of sequence Sample numbers due to program modifications

MCB Marine Corp Base Camp Pendleton

PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE * (miles)	DIRECTION * (Sector)
Direct Radiation (Continued) ***			
56	San Onofre State Beach (Unit 1, Southwest)	0.2 **	W
57	San Onofre State Beach (Unit 2)	0.1 **	WSW
58	San Onofre State Beach (Unit 3)	0.1 **	S
59	SONGS Meteorological Tower	0.3 **	WNW
60	Transit Control Storage Area	---	---
61	Mesa - East Boundary (Adjacent to PIC #4)	0.7	N
62	MCB - Camp Pendleton (Adjacent to PIC #5)	0.6	NNE
63	MCB - Camp Pendleton (Adjacent to PIC #6)	0.6	NE
64	MCB - Camp Pendleton (Adjacent to PIC #7)	0.6	ENE
65	MCB - Camp Pendleton (Adjacent to PIC #8)	0.7	E
66	San Onofre State Beach (Adjacent to PIC #9)	0.6	ESE
67	Former SONGS Evaporation Pond (Adjacent to PIC #2)	0.6	NW
68	Range 210C - MCB	4.3	ENE
73	South Yard	0.4 **	ESE
74	Oceanside City Hall (Back-up CONTROL)	15.6	SE
75	Gate 25 MCB	4.6	SE
76	El Camino Real Mobil Station	4.6	NW
77	Area 62 Heavy Lift Pad	4.3	N
78	Sheep Valley	4.4	ESE

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

** Distances are within the Units 2 & 3 Site Boundary and are not required by Technical Specification.

*** Out of sequence Sample numbers due to program modifications

MCB Marine Corp Base Camp Pendleton

PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE * (miles)	DIRECTION * (Sector)
Airborne ***			
1	City of San Clemente (City Hall)	5.1	NW
7	AWS Roof	0.18 **	NW
9	State Beach Park	0.6	ESE
10	Bluff	0.7	WNW
11	Mesa EOF	0.7	NNW
12	Former SONGS Evaporation Pond	0.6	NW
13	Marine Corp Base (Camp Pendleton East)	0.7	E
14	Mesa Medical Facility	0.7	NNW
15	Oceanside City Hall (Control)	15.6	SE
Soil Samples			
1	Camp San Onofre	2.6	NE
2	Old Route 101 - East Southeast	3.0	ESE
3	Basilone Road / I-5 Freeway Off ramp	2.0	NW
5	Former Visitor's Center (East Site Boundary)	0.4 **	NW
6	Oceanside (CONTROL)	16.0	SE

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

** Distances are within the Units 2 & 3 Site Boundary (0.4 mile in all sectors) and not required by Technical Specification.

*** Out of sequence Sample numbers due to program modifications

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE * (miles)	DIRECTION * (Sector)
Ocean Water			
A	Station Discharge Outfall - Unit 1	0.6	SW
B	Outfall - Unit 2	1.5	SW
C	Outfall - Unit 3	1.2	SSW
D	Newport Beach (CONTROL)	30.0	NW
Drinking Water			
4	Camp Pendleton Drinking Water Reservoir	2.2	NNW
5	Oceanside City Hall (CONTROL)	15.6	SE
Shoreline Sediment (Beach Sand)			
1	San Onofre State Beach	0.6	SE
2	San Onofre Surfing Beach	0.8	WNW
3	San Onofre State Beach	3.5	SE
4	Newport Beach North End (CONTROL)	29.2	NW
Local Crops			
1	San Clemente Ranch	2.6	NW
2	Southeast of Oceanside (CONTROL)	15-25	SE to ESE
4	San Clemente Residence (Ola Vista)	4.4	NW
6	SONGS Garden	0.4	NNW

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

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION		DISTANCE * (miles)	DIRECTION * (Sector)
Non-Migratory Marine Animals			
A	Unit 1 Outfall	0.9	WSW
B	Units 2 and 3 Outfall	1.5	SSW
C	Laguna Beach (CONTROL)	18.2	NW
Kelp			
A	San Onofre Kelp Bed	1.5	S
B	San Mateo Kelp Bed	3.8	WNW
C	Barn Kelp Bed	6.3	SSE
D	Laguna Beach (CONTROL)	15.6	NW
Ocean Bottom Sediments			
A	Unit 1 Outfall (0.5 mile East)	0.6	W
B	Unit 1 Outfall (0.6 mile West)	0.8	SSW
C	Unit 2 Outfall	1.6	SW
D	Unit 3 Outfall	1.2	SSW
E	Laguna Beach (CONTROL)	18.2	NW

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

TABLE A-2

SECTOR AND DIRECTION DESIGNATION FOR REMP SAMPLE LOCATION MAP

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

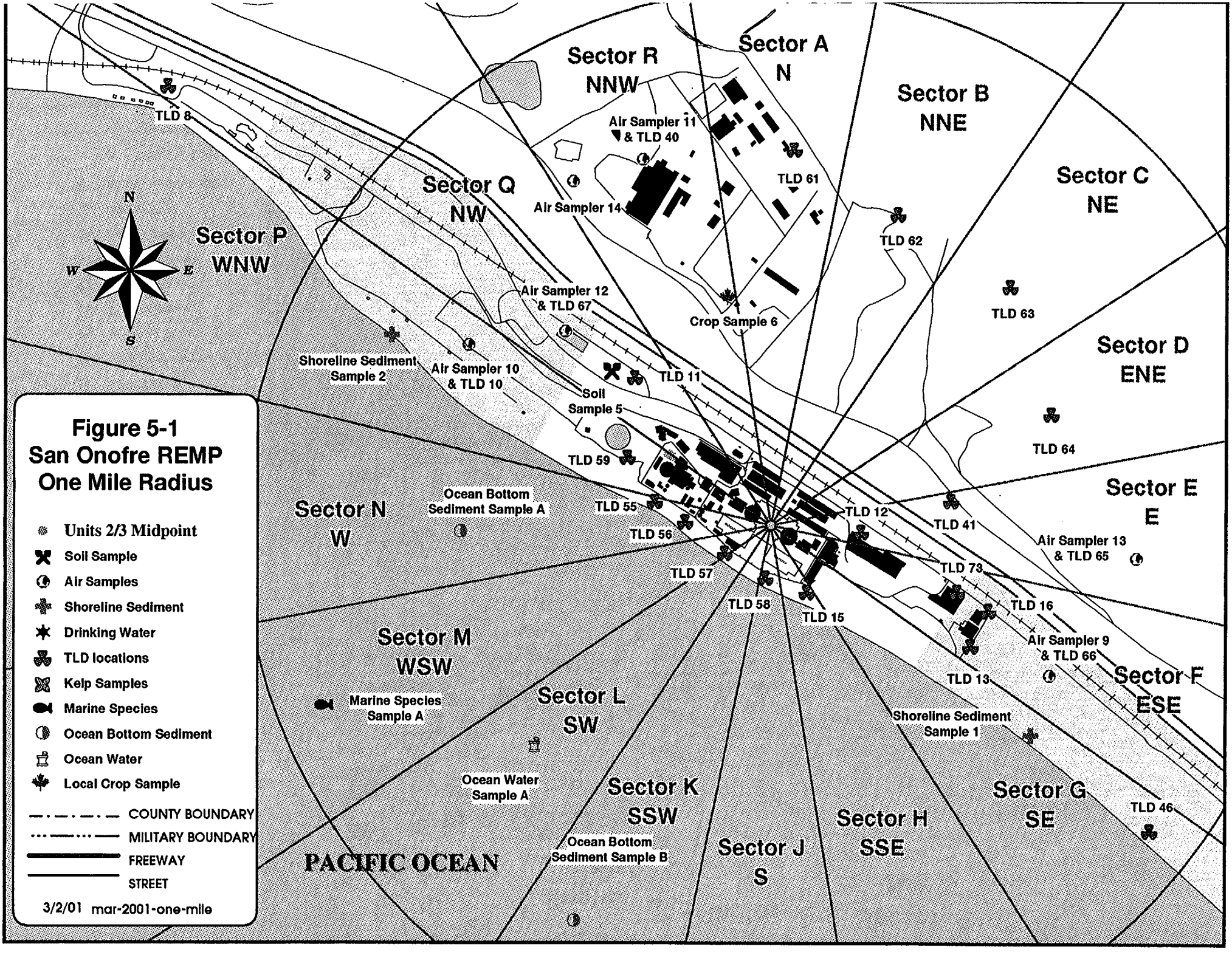
Figure 5-1
San Onofre REMP
One Mile Radius
Units 2/3 Midpoint
Soil Sample
Air Samples
Shoreline Sediment
Drinking Water
TLD locations
Kelp Samples
Marine Species
Ocean Bottom Sediment
Ocean Water
Local Crop Sample
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
STREET
3/2/01 mar-2001-one-mile
N
S
E
W
Sector R
NNW
Sector A
N
Sector B
NNE
Sector C
NE
Sector D
ENE
Sector E
E
Sector F
ESE
Sector G
SE
Sector H
SSE
Sector J
S
Sector K
SSW
Sector L
SW
Sector M
WSW
Sector N
W
Sector P
WNW
Sector Q
NW
PACIFIC OCEAN
TLD 8
Air Sampler 11
& TLD 40
Air Sampler 14
TLD 61
TLD 62
TLD 63
TLD 64
Air Sampler 12
& TLD 67
Crop Sample 6
Shoreline Sediment
Sample 2
Air Sampler 10
& TLD 10
TLD 11
Soil
Sample 5
TLD 59
Ocean Bottom
Sediment Sample A
TLD 55
TLD 56
TLD 57
TLD 58
TLD 15
TLD 12
TLD 41
Air Sampler 13
& TLD 65
TLD 73
TLD 16
Air Sampler 9
& TLD 66
TLD 13
Shoreline Sediment
Sample 1
TLD 46
Marine Species
Sample A
Ocean Water
Sample A
Ocean Bottom
Sediment Sample B

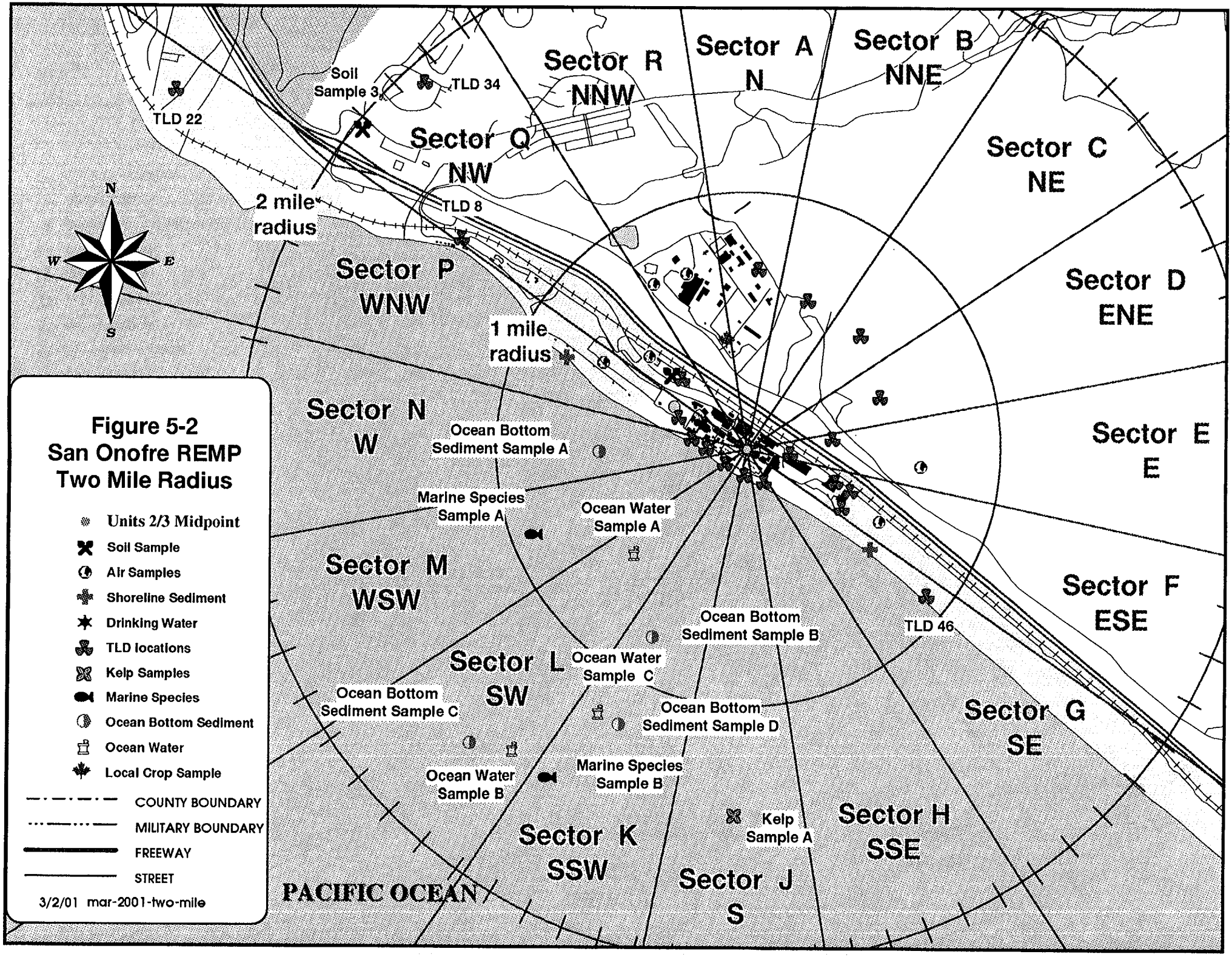
Figure 5-2
San Onofre REMP
Two Mile Radius
Units 2/3 Midpoint
Soil Sample
Air Samples
Shoreline Sediment
Drinking Water
TLD locations
Kelp Samples
Marine Species
Ocean Bottom Sediment
Ocean Water
Local Crop Sample
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
STREET
3/2/01 mar-2001-two-mile
N
S
E
W
Sector R
NNW
Sector A
N
Sector B
NNE
Sector C
NE
Sector D
ENE
Sector E
E
Sector F
ESE
Sector G
SE
Sector H
SSE
Sector J
S
Sector K
SSW
Sector L
SW
Sector M
WSW
Sector N
W
Sector P
WNW
Sector Q
NW
Soil Sample 3
TLD 34
TLD 22
TLD 8
TLD 46
2 mile radius
1 mile radius
Ocean Bottom Sediment Sample A
Marine Species Sample A
Ocean Water Sample A
Ocean Bottom Sediment Sample B
Ocean Water Sample C
Ocean Bottom Sediment Sample C
Ocean Bottom Sediment Sample D
Ocean Water Sample B
Marine Species Sample B
Kelp Sample A
PACIFIC OCEAN

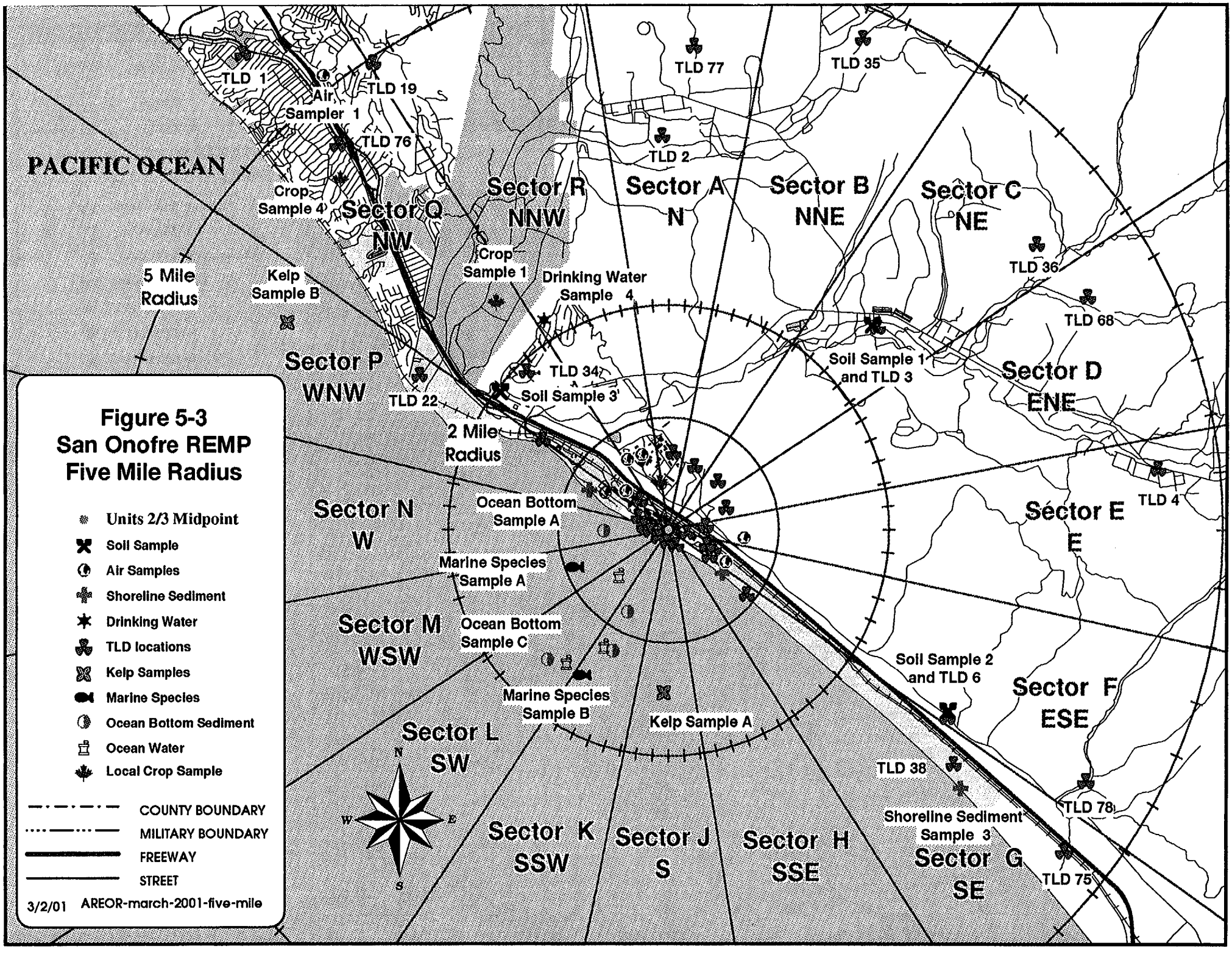

Figure 5-3
San Onofre REMP
Five Mile Radius

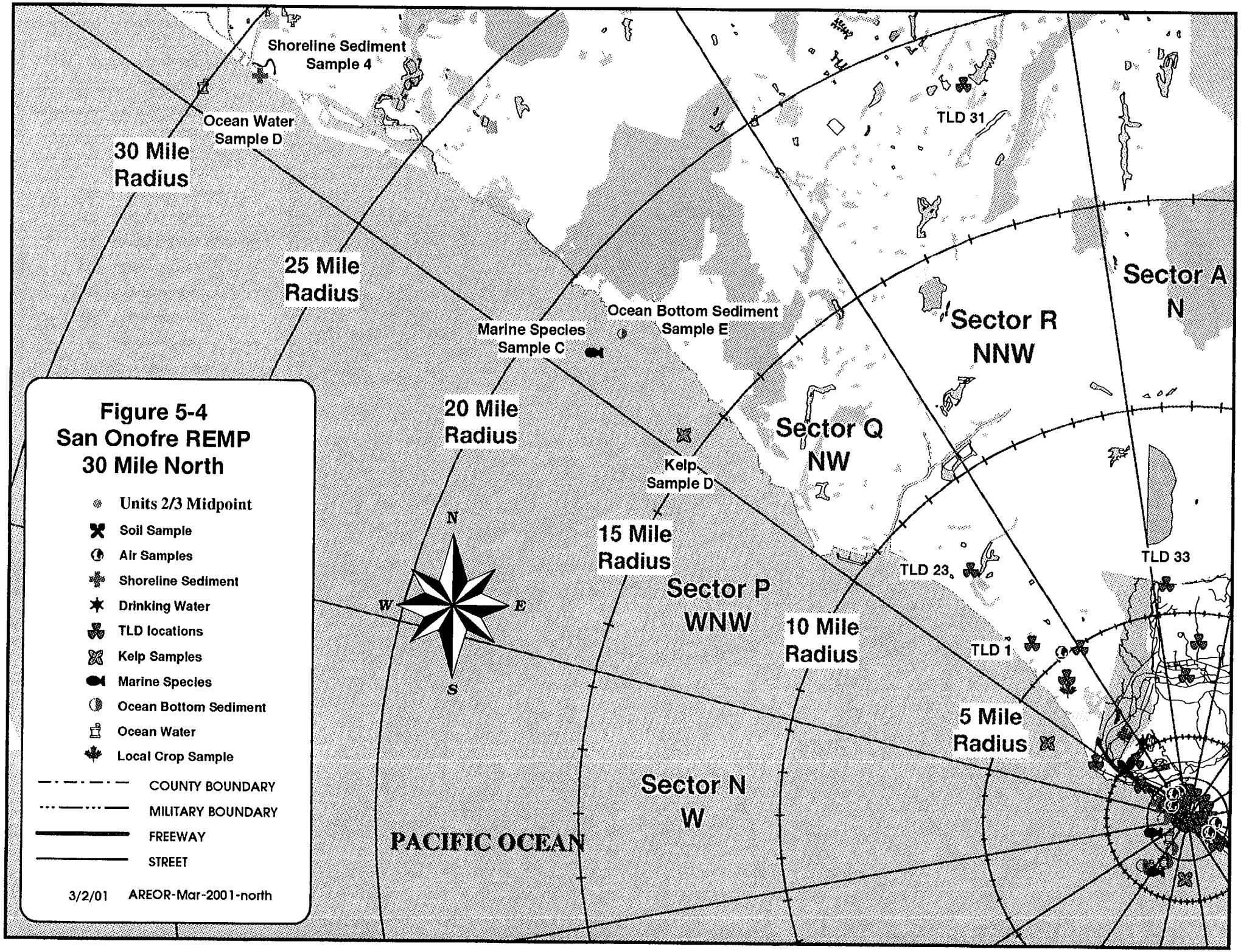

Figure 5-4
San Onofre REMP
30 Mile North

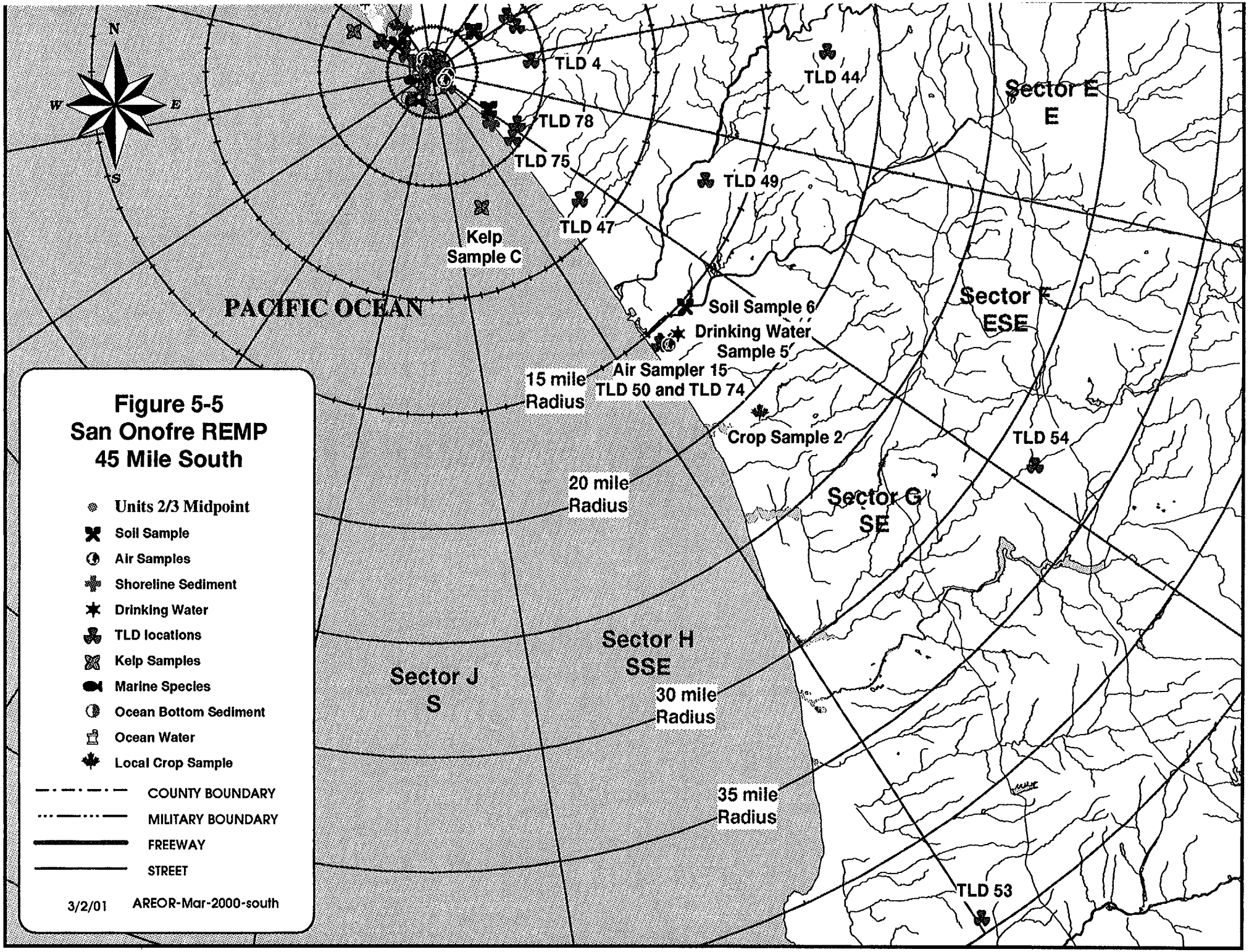

Figure 5-5
San Onofre REMP
45 Mile South

APPENDIX B

SUMMARY, RESULTS, AND DISCUSSIONS

OF 2000 ENVIRONMENTAL DATA

SUMMARY

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 2000 to December 2000 were evaluated. The 2000 REMP data were evaluated according to the criteria described in NUREG/CR-4007 and with the methodology described by Currie (1968).* The REMP data above the critical level (1.64 times one sigma) for selected radionuclides, were reduced and tabulated in the Statistical Summary of REMP Data in accordance with the format specified in Reg Guide 4.8. It should be noted that in an ideal database with the "true" value of each data point equal to zero, five (5)% of the values should be expected to be above the critical level. Excluding natural radionuclides (Be-7, K-40 and Th-228), approximately (5%) of the data listed in the Statistical Summary of REMP Data are above the critical level. Thus the 2000 SONGS REMP database, when examined in accordance with the Currie data reduction protocol, leads to the conclusion that SONGS had no statistically significant radiological environmental impact. A summary of the type and number of REMP samples obtained in 2000 appears in Table B-2.

As noted above, the SONGS REMP data base behaves substantially similar to a data base with values statistically indistinguishable from zero for station related isotopes. The exceptions, summarized in Table B-1, include ten (10) isotopically analyzed samples with station related activity reported above the *a posteriori* MDC. All sample values were significantly less than the NRC reporting levels. I-131 was detected in kelp and Cs-137 was detected in soil. These radionuclides have been detected in CONTROL as well as indicator locations in previous years. Cs-137 is commonly detected in environmental sediment samples because of fallout from weapons testing. Cs-137 has been intermittently detected in the indicator and in the CONTROL soil samples in past years and no correlation between Cs-137 level and proximity to the plant has been observed. The data strongly suggest that the low level Cs-137 in certain sediment samples is due to fallout and is not due to the operation of SONGS. I-131 is a medically administered radionuclide which is often detected in sewage plant outfalls, including those routed to the Pacific Ocean. I-131 has been detected in CONTROL and indicator Kelp samples in past years. The Kelp CONTROL sample I-131 level has typically been slightly higher than the indicator sample I-131 concentration, suggesting that the source of the I-131 is external to SONGS. We conclude that SONGS had a negligible radiological environmental impact during 2000.

Historical trending of data near and below the detection limits is necessarily limited. The concentration of radionuclides in the environs of SONGS has trended downward since the early to mid 1980s. In the past three years only a few REMP analysis results have been above the detection limit. These isotopes are detected in CONTROL as well as indicator locations and there are known sources for these radionuclides external to SONGS. The overall trend of the REMP data at SONGS is *de minimis* levels of anthropogenic radioactivity with occasional samples showing radioactivity above the *a posteriori* MDC. The 1993 AREOR included detailed historical data.

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

RESULTS AND DISCUSSIONS OF 2000 ENVIRONMENTAL DATA

A. Direct Radiation

The purpose of this program element was to measure the quarterly environmental gamma radiation in the vicinity of SONGS. To accomplish this task, calcium sulfate ($CaSO_4$) thermoluminescent dosimeters (TLDs) were placed at a minimum of 30 indicator and CONTROL locations. They were collected and analyzed quarterly in accordance with ANSI-N545 standards. TLDs within five miles of SONGS were considered indicator locations. TLDs located greater than five miles from SONGS were considered CONTROL locations. The indicator locations are selected as inner and outer rings for all three Units as required by Unit 1 and Units 2/3 Offsite Dose Calculation Manuals (ODCMs). Additional TLDs are placed at locations of interest such as schools and hospitals.

Six laboratory CONTROL TLDs were analyzed quarterly. TLD numbers 17, 18, and 60 are used for background dose normalization. TLDs #A and #B are used to compensate for transit dose. A fader TLD is used to compensate for the time and temperature dependent "fade" associated with this type of dosimeter.

After the samples were analyzed, the measured doses were corrected for pre and post field exposure times. The average indicator location dose was 17.6 mR with a range of 9.7 to 55.4 mR. The average CONTROL location dose was 15.1 mR with a range of 12.5 to 19.2 mR. The 2000 REMP TLD data has been grouped into four categories based on distance from SONGS for the purposes of trending any correlation between distance from SONGS and total annual dose.

2000 REMP TLD data (Average Dose vs. Distance from SONGS)

	Average Quarterly Dose in mR
TLDs < 0.5 miles from SONGS	21.5
TLDs > 0.5 miles AND < 1.0 mile from SONGS	14.5
TLDs > 1.0 mile AND < 5.0 miles from SONGS	16.3
TLDs > 5 miles from SONGS (CONTROL TLDs)	15.1

These data indicate no correlation between total dose and distance from SONGS. The variations in the average dose is approximately equal to the median one sigma variation of measurement (1.00 mR per quarter). Statistically, the CONTROL and indicator doses are equal. The indicator location at the Southeast Site Boundary (location # 13, at 0.4 miles ESE of Units 2/3 midpoint) had the highest TLD average in 2000. The operation of SONGS had no impact on the environment as measured by this sample medium.

Figures 2A & 2B compare environmental radiation levels of indicator and CONTROL locations for the operational year 2000 and for previous years. These figures show the close correlation between the CONTROL and indicator location TLD dose data.

Nonroutine Direct Radiation Samples

During 2000, seven additional TLD sample locations were installed to verify anomolous data from TLD #13. A duplicate QC TLD was installed adjacent to TLD #66. Refer to Appendix C for results. These TLDs were not required by the ODCM, but the sample results are included in the Statistical Summary of REMP Data.

B. Airborne Particulate, Iodine, and Composite Isotopic Analyses

Air particulate samples were collected on a weekly basis from eight indicator locations and from one CONTROL location. The samples were analyzed for gross beta activity, I-131, and composited quarterly for gamma isotopic analysis. Sample locations were selected according to the requirements of the Unit 1 and Units 2/3 Offsite Dose Calculation Manuals.

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

Nearly all gross beta activity analysis results were above the 3 sigma confidence level (99% probability of activity being present). The concentration of gross beta activity in the samples collected from the indicator locations ranged from 0.0031 to 0.073 pCi/m^3, averaging 0.0236 pCi/m^3 of air. The concentrations of gross beta activity in the samples from the CONTROL location ranged from 0.0045 to 0.062 pCi/m^3, averaging 0.0237 pCi/m^3 of air. The CONTROL and indicator locations gross beta data show a close correlation. Figure 3C shows the variation in gross beta activity level in 2000 at different locations. These graphs show a close correlation between the indicator and CONTROL location data.

Per the requirements of Unit 1 and Units 2/3 ODCM, Section 5, Table 5.1, an assessment was performed to determine whether the gross beta activity of the indicators exceeded 10 times the background (CONTROL location #15). The results showed that indicator locations maximum gross beta activity in air in 2000 was 0.073 pCi/m^3 and the CONTROL location average was 0.0237 pCi/m^3. No action was taken since the indicator location value did not exceed ten times the annual average gross beta activity of the CONTROL.

All samples analyzed for I-131 were less than the 3 sigma confidence level and all I-131 samples were less that the *a priori* lower limit of detection (LLD). The airborne indicator and CONTROL I-131 REMP samples taken in 2000 at SONGS were statistically indistinguishable from zero.

No samples yielded station related isotopic results confirmed above the *a posteriori*, MDC. The quarterly composite gamma spectral analysis analyses yielded only naturally occurring beryllium-7 (Be-7) at the 3 sigma confidence level. For station related isotopes the balance of the airborne gamma isotopic database is statistically indistinguishable from database with zero activity.

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

Nonroutine Airborne Particulate, Iodine, and Composite Isotopic Analyses

Air sampler 7, AWS Building Roof, is well within the Exclusion Area Boundary and is not required by the ODCM. This air sampler provides a basis for evaluating any airborne emissions that might impact workers in the major office area on the site. Those individuals are defined as members of the public according to 10 CFR 20.1003 and meet the dose limits of 10 CFR 20.1301. Air sample 7 was processed for particulate gross beta, I-131, and quarterly composite gamma isotopic analysis. Results are included in the Statistical Summary of REMP Data.

Air sampler 51, co-located with air sampler 9, has been used as a blind duplicate gross beta sample. Maintaining duplicate equipment has become impractical, therefore, collection at air sampler 51 was discontinued in August 2000.

Air sampler 30 was installed as a compensatory sampler for air sampler 13 which was out of service on two occassions in 2000.

C. Ocean Water

Monthly ocean water samples were collected from indicator locations in the vicinity of each station discharge and from the CONTROL location at Newport Beach. The samples were analyzed for naturally-occurring and SONGS-related gamma-emitting radionuclides. Quarterly composite ocean water samples were analyzed for tritium according to ODCM requirements. Naturally occurring potassium-40 (K-40) was detected in all ocean water samples obtained in 2000. No SONGS related radionuclides were detected in this sample medium during 2000.

Four non-routine ocean water samples were obtained from two locations, Unit 2 outfall conduit and Unit 3 outfall conduit. The conduit samples were collected to measure the radiological environmental effect potentially resulting from the minor conduit leakage

Throughout 2000 only naturally occurring K-40 was detected at the 99% confidence level in the monthly gamma spectral analyses of ocean water. No station related radionuclides were detected above the *a posteriori* MDC in this sample type during 2000.

Excluding K-40 the ocean water gamma isotopic database is statistically indistinguishable from a database with zero activity.

The data indicate that the operation of SONGS had no impact on the environment as measured by this sample medium.

D. Drinking Water

In 2000, drinking water samples were collected on a monthly basis from three indicator locations and from the Oceanside CONTROL location. Samples were analyzed for tritium, gross beta, and 28 naturally-occurring and SONGS-related gamma emitting radionuclides. There is no drinking water pathway for liquid effluent at SONGS.

No station related radionuclides were detected in drinking water during 2000. Excluding gross beta, the drinking water gamma isotopic database is statistically indistinguishable from a database with zero activity. The operation of SONGS had no impact on this sample medium.

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

E. Shoreline Sediment (Beach Sand)

Beach sand was collected semiannually in 2000 from three indicator locations and from a CONTROL location situated in Newport Beach. After collection, the samples were analyzed for 28 different plant-related and naturally-occurring radionuclides. Only naturally occurring K-40 and thorium-228 (Th-228) were detected at the 99% confidence level. No plant related radionuclides were reported above the *a posteriori* MDC. The operation of SONGS had no impact on the environment as measured by this sample medium.

F. Ocean Bottom Sediments

Ocean bottom sediments were collected in the vicinity of each of the three SONGS discharge locations and at the Newport Beach CONTROL location. The samples were analyzed by gamma-spectral analysis for 28 naturally-occurring and station-related radionuclides. K-40 and Th-228 were detected at the 99% confidence level in all ocean bottom sediment samples collected during 2000.

Four non-routine ocean bottom sediment samples were obtained from two locations, Unit 2 outfall conduit and Unit 3 outfall conduit. The conduit samples were collected to measure the radiological environmental effect potentially resulting from the minor conduit leakage. During 2000, all the conduit sample analysis results were below the MDC for station related radionuclides.

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

G. Non-Migratory Marine Species (Flesh)

Species of adult fish, crustacea and mollusks, were collected on a semi annual basis at the SONGS Unit 1 outfall, at the SONGS Units 2 and 3 outfall and from Laguna Beach. The flesh portion of each sample type was analyzed for 28 gamma-emitting station-related and naturally occurring radionuclides. The results were subsequently reported to Edison in terms of wet sample weights. Because results based on a wet sample weight are most useful for calculating doses, the results of sample analyses are summarized in terms of "as received" wet weights.

No plant related radionuclides were confirmed above the *a posteriori* MDC.

Naturally-occurring K-40 was detected in most samples at the 99% confidence level in all Marine Species samples collected during 2000. No plant related isotopes were reported above the *a posteriori* MDC. The operation of SONGS had no impact on the environment as measured by this sample medium. The potential dose to members of the public from consumption of marine species near SONGS is negligible.

H. Local Crops

Fleshy crops were collected semiannually in 2000 from the San Clemente Ranch, the SONGS garden, a San Clemente residence, and from a CONTROL location near Oceanside. The crop samples were analyzed quantitatively for 28 gamma-emitting radionuclides, both natural and plant related.

Naturally occurring Be-7 and K-40 were detected at the 99% confidence level in samples obtained from both CONTROL and indicator locations. No SONGS related isotopes were

reported above the *a posteriori* MDC. Based on these data, it was concluded that SONGS operations had no detectable impact on the environment as measured by this sample medium and that the potential dose to members of the public from consumption of crops near SONGS is negligible.

I. Soil

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

Soil samples were analyzed for 28 naturally-occurring and SONGS-related gamma-emitting radionuclides using gamma spectral analysis. All 2000 soil samples yielded naturally occurring K-40 and Th-228 above the 3 sigma (99%) confidence level. Cs-137, above the 99% confidence level, was detected in two indicator samples. Cs-137 is often detected in environmental sediment samples and the presence of Cs-137 is most likely related to nuclear weapons testing fallout.

Cs-137 and strontium-90 (Sr-90) were detected in soil profile analyses conducted in previous years. These radionuclides are mostly due to the nuclear weapons testing fallout depositing on soil and retention of these radionuclides due to their long half lives. The presence of Cs-137 in the CONTROL location in previous years supports the conclusion that the major source of this radionuclide is due to fallout deposition. Since the termination of atmospheric nuclear weapons testing the trend has continued downward in this sample media. Refer to the 1993 AREOR for a more detailed discussion of Cs-137 and other potentially SONGS related isotopes detected in soil. The Cs-137 activity can be attributed to atmospheric nuclear weapons tests and not SONGS operations. During 2000, the operation of SONGS had no impact on the environment as measured by this sample medium.

J. Kelp Sampling

Kelp was collected during April and October 2000 from the San Onofre, San Mateo, and from the Salt Creek alternate CONTROL location (~10 miles WNW). Upon collection, the samples were analyzed by gamma-spectral analysis for 28 different naturally-occurring and Station-related radionuclides. The radionuclides detected in 2000 were K-40 and I-131. K-40 is naturally occurring and not related to the operation of SONGS. I-131 was detected in two indicator locations, as well as the alternate CONTROL location. I-131 is often detected in Sewage Plant outfalls, including those routed to the Pacific Ocean. I-131 has been detected at both Indicator and CONTROL locations in previous years. The northern CONTROL location is too far away and in the predominantly upstream current direction for the I-131 activity to be attributable to SONGS. The presence of low levels of I-131 in both the indicator and the control locations suggest a source which is external to SONGS. The I-131 activity in Kelp data, graphically presented in Figure 4, shows a relatively close correlation between indicator and control locations over a 25 year period - further supporting the assessment that the likely source for this potentially plant related radionuclide is external to SONGS.

K. Non Routine Aquatic Kelp Samples

To ensure continuous availability of a control sample and to evaluate potential alternate control sample locations, six additional potential control samples were collected. These locations were approximately 20 to 50 miles SE of SONGS in the Southern California Bight.

TABLE B-1
Summary of SONGS related Gamma Isotopic Analyses confirmed above MDC

Sample Media & location	Radio-nuclide	Sample Value	MDC (*a posteriori*)
Aquatic Kelp Salt Creek Alternate CONTROL location Station D 10APR00	I-131	(74 ± 12) E-3 pCi/g	17 E-3 pCi/g
Aquatic Kelp San Mateo Kelp Bed Station B 10APR00	I-131	(49 ± 11) E-3 pCi/g	17 E-3 pCi/g
Aquatic Kelp San Onofre Kelp Bed Station A 10APR00	I-131	(91 ± 12) E-3 pCi/g	15 E-3 pCi/g
Aquatic Kelp San Mateo Station B 16OCT00	I-131	(135 ± 13) E-3 pCi/g	16 E-3 pCi/g
Aquatic Kelp Barn Kelp Bed; Station C 10APR00	I-131	(34 ± 10) E-3 pCi/g	15 E-3 pCi/g
Aquatic Kelp Salt Creek Alternate CONTROL location Station D 16OCT00	I-131	(118 ± 14) E-3 pCi/g	18 E-3 pCi/g
Soil Camp San Onofre Location # 1 13SEP00	Cs-137	(99 ± 25) E-3 pCi/g	33 E-3 pCi/g
Soil Old Route 101 Location # 2 13SEP00	Cs-137	(132 ± 22) E-3 pCi/g	23 E-3 pCi/g
Kelp San Onofre Station A 16OCT00	I-131	(141 ± 23) E-3 pCi/g	33 E-3 pCi/g
Barn Kelp Bed Station C 16OCT00	I-131	(98 ± 22) E-3 pCi/g	34 E-3 pCi/g

TABLE B-2

REMP SAMPLE ANALYSIS SUMMARY FOR 2000

Medium	Analysis Type	Sampling Frequency	# of Locations	Total # of Analysis in 2000
Direct Radiation	Dosimetry	Quarterly	56	202
Airborne Particulates	Gross Beta	Weekly	10	502
Charcoal Cartridge	I-131	Weekly	10	470
Airborne Particulates	Ge (Li) Scan	Quarterly	10	37
Ocean Water	Ge (Li) Scan	Monthly	6	52
Ocean Water	H-3	Quarterly	6	16
Drinking Water, Unfiltered	Ge (Li) Scan H-3 Gross Beta	Monthly	2 2 2	24 24 24
Shoreline Sediment	Ge (Li) Scan	Semi-Annually	4	8
Ocean Bottom Sediment	Ge (Li) Scan	Semi-Annually	7	14
Marine Species, Flesh	Ge (Li) Scan	Semi-Annually	3	24
Crops	Ge (Li) Scan	Semi-Annually	2	8
Kelp	Ge (Li) Scan	Semi-Annually	10	14
Soil	Ge (Li) Scan	Annually	5	5

STATISTICAL SUMMARY OF REMP DATA FOR 2000

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Produced on: 04/02/01

SAN ONOFRE NUCLEAR GENERATING STATION

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

REPORTING PERIOD: 1/1/00 To 12/31/00

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range) (1)(3)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range) (2)	Number of Nonroutine Reported Measurements (3)
TABLE 1A Quarterly Gamma Exposure (mR)							
	Gamma 202	5	17.61 (161/ 161) (9.74-55.40)	SE Site Boundary 0.4 Mi. ESE	55.40 (1/ 1) (55.40-55.40)	15.09 (44/ 44) (12.52-19.23)	9

(1) Indicator location data includes all TLD's less than 5 miles from SONGS.
(2) Control location data includes all TLD's greater than 5 miles from SONGS.
(3) Indicator location data includes seven (7) TLD locations in the immediate vicinity of TLD #13 which were deployed in the fourth quarter 2000 to confirm anomolous TLD #13 data.
(4) Indicator data includes QC duplicate TLD #200 (co-located wtih TLD #66)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Produced on : 04/02/01

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Weekly Airborne Paticulates Gross Beta Activity - Table 2 (pCi/cu.m)							
	Gross Beta 502	0.01	0.0236 (449/450) (0.0031 - 0.0727)	Marine Corp Base (Camp Pendleton East) 0.7 Mi. E	0.0253 (48/49) (0.0037 - 0.0700)	0.0237 (52/52) (0.0045 - 0.0620)	89

Nonroutine reported analysis results include the following auxiliary indicator sample locations:

Air Sampler # 7, AWS roof, is well within the Exclusion Area boundary and is not necessary to comply with ODCM requirements

Air Sampler # 51, Blind Duplicate, is not required by the ODCM, this sampler was discontinued in August 2000 due to emerging impracticality of maintaining duplicate sampling equipment.

Air Sampler # 30, compensatory sampler for out of service sampler # 13

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Produced on : 04/03/01

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Weekly Radioiodine I-131 Activity - Table 3 (pCi/cu.m)											
	I-131	470	0.07	0.0143 (0.0112 - 0.0219)	(20/418)	City of San Clemente, City Hall 5.1 Mi. NW	0.0166 (0.0114 - 0.0219)	(2/52)	0.0117 (0.0107 - 0.0128)	(3/52)	57

Nonroutine reported analysis results include the following auxiliary indicator sample locations:
Air Sampler # 7, AWS roof, is well within the Exclusion Area boundary and is not necessary to comply with ODCM requirements
Air Sampler # 30, compensatory sampler for out of service sampler # 13

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)	Control Locations Mean (Range)	Number of Nonroutine Reported Measurements
Quarterly Comp. Airborne Particulates Gamma - Table 4A (pCi/cu.m)							
	Be-7 37	0.035	0.0933 (33/33) (0.0527 - 0.13)	Marine Corp Base (Camp Pendleton East) 0.7 Mi. E	0.11 (4/4) (0.0988 - 0.12)	0.10 (4/4) (0.0853 - 0.12)	5
	Cs-134 37	0.05	0.0011 (1/33) (0.0011 - 0.0011)	Bluff 0.7 Mi. WNW	0.0011 (1/4) (0.0011 - 0.0011)	6.71E-4 (1/4) (6.71E-4 - 6.71E-4)	5
	Cs-137 37	0.06	3.25E-4 (1/33) (3.25E-4 - 3.25E-4)	Mesa EOF 0.7 Mi. NNW	3.25E-4 (1/4) (3.25E-4 - 3.25E-4)	3.13E-4 (1/4) (3.13E-4 - 3.13E-4)	5

Nonroutine reported analysis results include the following auxiliary indicator sample locations:
Air Sampler # 7, AWS roof, is well within the Exclusion Area boundary and is not necessary to comply with ODCM requirements
Air Sampler # 30, compensatory sampler for out of service sampler # 13

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Produced on : 04/03/01

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis - Table 5 (pCi/l)										
	Ba-140	52	15	3.29 (2.33 - 4.24)	(2/40)	(B) Outfall - Unit 2 1.5 Mi. SW	4.24 (4.24 - 4.24)	(1/12)	< LLD	(0/12)	4
	Co-58	52	15	< LLD	(0/40)		----	(0/2)	< LLD	(0/12)	4
	Co-60	52	15	1.71 (1.71 - 1.71)	(1/40)	Unit 3 Conduit 0.1 Mi. SSW	1.71 (1.71 - 1.71)	(1/2)	1.55 (1.55 - 1.55)	(1/12)	4
	Cs-134	52	15	3.33 (2.25 - 4.42)	(2/40)	(A) Station Discharge Outfall-Unit 1 0.6 Mi. SW	4.42 (4.42 - 4.42)	(1/12)	< LLD	(0/12)	4
	Cs-137	52	18	2.13 (2.13 - 2.13)	(1/40)	(B) Outfall - Unit 2 1.5 Mi. SW	2.13 (2.13 - 2.13)	(1/12)	< LLD	(0/12)	4
	Fe-59	52	30	6.19 (3.16 - 8.92)	(3/40)	(B) Outfall - Unit 2 1.5 Mi. SW	8.92 (8.92 - 8.92)	(1/12)	< LLD	(0/12)	4
	I-131	52	15	3.79 (3.79 - 3.79)	(1/40)	(C) Outfall - Unit 3 1.2 Mi. SSW	3.79 (3.79 - 3.79)	(1/12)	< LLD	(0/12)	4
	K-40	52	120	334.32 (273.00 - 450.30)	(39/40)	Unit 2 Conduit 0.1 Mi. SW	414.10 (377.90 - 450.30)	(2/2)	325.02 (282.60 - 354.20)	(12/12)	4
	La-140	52	15	3.78 (2.68 - 4.88)	(2/40)	(B) Outfall - Unit 2 1.5 Mi. SW	4.88 (4.88 - 4.88)	(1/12)	< LLD	(0/12)	4
	Mn-54	52	15	< LLD	(0/40)	(D) Newport Beach 30 Mi. NW	1.56 (1.56 - 1.56)	(1/12)	1.56 (1.56 - 1.56)	(1/12)	4
	Nb-95	52	15	1.77 (1.77 - 1.77)	(1/40)	(A) Station Discharge Outfall-Unit 1 0.6 Mi. SW	1.77 (1.77 - 1.77)	(1/12)	1.37 (1.37 - 1.37)	(1/12)	4

Nonroutine reported analysis results include sample # 51 (Unit 2 conduit) and sample # 52 (Unit 3 conduit). The nonroutine samples were collected twice per year. All other samples were collected monthly.

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Monthly Ocean Water Gamma Spectral Analysis - Table 5 (pCi/l)											
	Zn-65	52	30	< LLD	(0/40)		----	(0/2)	< LLD	(0/12)	4
	Zr-95	52	15	2.98 (2.98 - 2.98)	(1/40)	(D) Newport Beach 30 Mi. NW	3.80 (3.80 - 3.80)	(1/12)	3.80 (3.80 - 3.80)	(1/12)	4

Nonroutine reported analysis results include sample # 51 (Unit 2 conduit) and sample # 52 (Unit 3 conduit). The nonroutine samples were collected twice per year. All other samples were collected monthly.

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

Reporting Period : 1/1/00 To 12/31/00

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

Nonroutine ocean water samples # 51 and # 52 were not analyzed for Tritium

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Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis - Table 9A (pCi/l)											
	Ba-140	24	15	2.98 (2.98 - 2.98)	(1/12)	Camp Pendleton 2.2 Mi. NNW	2.98 (2.98 - 2.98)	(1/12)	< LLD	(0/12)	0
	Co-58	24	15	< LLD	(0/12)		---	(0/12)	< LLD	(0/12)	0
	Co-60	24	15	< LLD	(0/12)		---	(0/12)	< LLD	(0/12)	0
	Cs-134	24	15	1.49 (1.42 - 1.56)	(2/12)	Camp Pendleton 2.2 Mi. NNW	1.49 (1.42 - 1.56)	(2/12)	1.45 (1.45 - 1.45)	(1/12)	0
	Cs-137	24	18	< LLD	(0/12)		---	(0/12)	< LLD	(0/12)	0
	Fe-59	24	30	< LLD	(0/12)	Oceanside (Control) 15.6 Mi. SE	3.27 (2.59 - 3.96)	(2/12)	3.27 (2.59 - 3.96)	(2/12)	0
	Gross Beta	24	4	3.35 (2.00 - 5.00)	(8/12)	Oceanside (Control) 15.6 Mi. SE	4.69 (2.46 - 7.67)	(11/12)	4.69 (2.46 - 7.67)	(11/12)	0
	H-3	24	2000	807.82 (644.38 - 1079.37)	(4/12)	Camp Pendleton 2.2 Mi. NNW	807.82 (644.38 - 1079.37)	(4/12)	585.85 (585.85 - 585.85)	(1/12)	0
	I-131	24	15	< LLD	(0/12)		---	(0/12)	< LLD	(0/12)	0
	K-40	24	120	< LLD	(0/12)	Oceanside (Control) 15.6 Mi. SE	35.18 (35.18 - 35.18)	(1/12)	35.18 (35.18 - 35.18)	(1/12)	0
	La-140	24	15	3.43 (3.43 - 3.43)	(1/12)	Camp Pendleton 2.2 Mi. NNW	3.43 (3.43 - 3.43)	(1/12)	< LLD	(0/12)	0

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SAN DIEGO COUNTY, CALIFORNIA

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Monthly Drinking Water Analysis - Table 9A (pCi/l)											
	Mn-54	24	15	< LLD	(0/12)		----	(0/12)	< LLD	(0/12)	0
	Nb-95	24	15	4.04 (4.04 - 4.04)	(1/12)	Camp Pendleton 2.2 Mi. NNW	4.04 (4.04 - 4.04)	(1/12)	< LLD	(0/12)	0
	Zn-65	24	30	7.26 (7.26 - 7.26)	(1/12)	Oceanside (Control) 15.6 Mi. SE	12.92 (12.92 - 12.92)	(1/12)	12.92 (12.92 - 12.92)	(1/12)	0
	Zr-95	24	15	< LLD	(0/12)		----	(0/12)	< LLD	(0/12)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-annual Shoreline Sediment Gamma Spectral Analysis - Table 10 (pCi/g)											
	Cs-134	8	0.15	< LLD	(0/6)		----	(0/2)	< LLD	(0/2)	0
	Cs-137	8	0.18	0.0162 (0.0120 - 0.0212)	(3/6)	San Onofre Surfing Beach 0.8 Mi. WNW	0.0212 (0.0212 - 0.0212)	(1/2)	< LLD	(0/2)	0
	K-40	8	2.2	13.18 (7.57 - 17.30)	(6/6)	Newport Beach North End 29.2 Mi. NW	19.09 (18.83 - 19.35)	(2/2)	19.09 (18.83 - 19.35)	(2/2)	0
	Th-228	8	0.74	0.49 (0.23 - 1.32)	(6/6)	Newport Beach North End 29.2 Mi. NW	0.87 (0.64 - 1.11)	(2/2)	0.87 (0.64 - 1.11)	(2/2)	0

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Semi-annual Ocean Bottom Sediment Gamma Spectral Analysis - Table 11 (pCi/g)											
	Cs-134	14	0.15	0.0335 (0.0327 - 0.0344)	(2/12)	Unit 2 Conduit 0.1 Mi. SW	0.0344 (0.0344 - 0.0344)	(1/2)	< LLD	(0/2)	4
	Cs-137	14	0.18	0.0184 (0.0184 - 0.0184)	(1/12)	(E) Laguna Beach 18.2 Mi. NW	0.0217 (0.0217 - 0.0217)	(1/2)	0.0217 (0.0217 - 0.0217)	(1/2)	4
	K-40	14	2.2	16.87 (13.99 - 19.91)	(12/12)	(B) Unit 1 Outfall 0.8 Mi. SSW	19.65 (19.39 - 19.91)	(2/2)	18.90 (17.30 - 20.50)	(2/2)	4
	Th-228	14	0.74	0.42 (0.14 - 1.22)	(12/12)	(D) Unit 3 Outfall 1.2 Mi. SSW	0.85 (0.48 - 1.22)	(2/2)	0.41 (0.21 - 0.62)	(2/2)	4

Nonroutine reported analysis results include sample # 51 (Unit 2 conduit) and sample # 52 (Unit 3 conduit). All samples were collected on a semiannual basis

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 12A (pCi/g)											
Bay Mussel	Co-58	1	0.13	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Bay Mussel	Co-60	1	0.13	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Bay Mussel	Cs-134	1	0.13	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Bay Mussel	Cs-137	1	0.15	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Bay Mussel	Fe-59	1	0.26	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Bay Mussel	K-40	1	1.4	1.77 (1.77 - 1.77)	(1/1)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	1.77 (1.77 - 1.77)	(1/1)	< LLD	(0/0)	0
Bay Mussel	Mn-54	1	0.13	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Bay Mussel	Zn-65	1	0.26	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Black Perch	Co-58	4	0.13	< LLD	(0/2)		----	(0/1)	< LLD	(0/2)	0
Black Perch	Co-60	4	0.13	< LLD	(0/2)		----	(0/1)	< LLD	(0/2)	0
Black Perch	Cs-134	4	0.13	0.0173 (0.0173 - 0.0173)	(1/2)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0173 (0.0173 - 0.0173)	(1/1)	< LLD	(0/2)	0

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 12A (pCi/g)											
Black Perch	Cs-137	4	0.15	< LLD	(0/2)		----	(0/2)	< LLD	(0/2)	0
Black Perch	Fe-59	4	0.26	< LLD	(0/2)		----	(0/2)	< LLD	(0/2)	0
Black Perch	K-40	4	1.4	3.30 (3.11 - 3.48)	(2/2)	(A) Unit 1 Outfall 0.9 Mi. WSW	3.48 (3.48 - 3.48)	(1/1)	3.01 (2.75 - 3.26)	(2/2)	0
Black Perch	Mn-54	4	0.13	< LLD	(0/2)		----	(0/2)	< LLD	(0/2)	0
Black Perch	Zn-65	4	0.26	< LLD	(0/2)		----	(0/1)	< LLD	(0/2)	0
Keyhole Limpet	Co-58	2	0.13	< LLD	(0/0)		----	(0/2)	< LLD	(0/2)	0
Keyhole Limpet	Co-60	2	0.13	< LLD	(0/0)		----	(0/2)	< LLD	(0/2)	0
Keyhole Limpet	Cs-134	2	0.13	< LLD	(0/0)	(C) Laguna Beach 18.2 Mi. NW	0.0165 (0.0165 - 0.0165)	(1/2)	0.0165 (0.0165 - 0.0165)	(1/2)	0
Keyhole Limpet	Cs-137	2	0.15	< LLD	(0/0)		----	(0/2)	< LLD	(0/2)	0
Keyhole Limpet	Fe-59	2	0.26	< LLD	(0/0)		----	(0/2)	< LLD	(0/2)	0
Keyhole Limpet	K-40	2	1.4	< LLD	(0/0)	(C) Laguna Beach 18.2 Mi. NW	0.85 (0.57 - 1.13)	(2/2)	0.85 (0.57 - 1.13)	(2/2)	0

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 12A (pCi/g)											
Keyhole Limpet	Mn-54	2	0.13	< LLD	(0/0)	(C) Laguna Beach 18.2 Mi. NW	0.0175 (0.0175 - 0.0175)	(1/2)	0.0175 (0.0175 - 0.0175)	(1/2)	0
Keyhole Limpet	Zn-65	2	0.26	< LLD	(0/0)	(C) Laguna Beach 18.2 Mi. NW	0.0845 (0.0845 - 0.0845)	(1/2)	0.0845 (0.0845 - 0.0845)	(1/2)	0
Lobster	Co-58	6	0.13	0.0373 (0.0373 - 0.0373)	(1/4)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0373 (0.0373 - 0.0373)	(1/2)	< LLD	(0/2)	0
Lobster	Co-60	6	0.13	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Lobster	Cs-134	6	0.13	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Lobster	Cs-137	6	0.15	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Lobster	Fe-59	6	0.26	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Lobster	K-40	6	1.4	3.71 (3.14 - 4.19)	(4/4)	(A) Unit 1 Outfall 0.9 Mi. WSW	4.16 (4.13 - 4.19)	(2/2)	3.93 (3.88 - 3.97)	(2/2)	0
Lobster	Mn-54	6	0.13	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Lobster	Zn-65	6	0.26	< LLD	(0/4)	(C) Laguna Beach 18.2 Mi. NW	0.0499 (0.0499 - 0.0499)	(1/2)	0.0499 (0.0499 - 0.0499)	(1/2)	0
Sea Hare	Co-58	3	0.13	0.0269 (0.0269 - 0.0269)	(1/3)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0269 (0.0269 - 0.0269)	(1/2)	< LLD	(0/0)	0

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Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 12A (pCi/g)											
Sea Hare	Co-60	3	0.13	< LLD	(0/3)		----	(0/2)	< LLD	(0/0)	0
Sea Hare	Cs-134	3	0.13	0.0287 (0.0287 - 0.0287)	(1/3)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0287 (0.0287 - 0.0287)	(1/1)	< LLD	(0/0)	0
Sea Hare	Cs-137	3	0.15	< LLD	(0/3)		----	(0/1)	< LLD	(0/0)	0
Sea Hare	Fe-59	3	0.26	< LLD	(0/3)		----	(0/1)	< LLD	(0/0)	0
Sea Hare	K-40	3	1.4	2.36 (1.36 - 4.01)	(3/3)	(A) Unit 1 Outfall 0.9 Mi. WSW	2.68 (1.36 - 4.01)	(2/2)	< LLD	(0/0)	0
Sea Hare	Mn-54	3	0.13	< LLD	(0/3)		----	(0/1)	< LLD	(0/0)	0
Sea Hare	Zn-65	3	0.26	< LLD	(0/3)		----	(0/1)	< LLD	(0/0)	0
Sheephead	Co-58	6	0.13	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Sheephead	Co-60	6	0.13	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Sheephead	Cs-134	6	0.13	0.0259 (0.0259 - 0.0259)	(1/4)	(A) Unit 1 Outfall 0.9 Mi. WSW	0.0259 (0.0259 - 0.0259)	(1/2)	< LLD	(0/2)	0
Sheephead	Cs-137	6	0.15	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0

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Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 12A (pCi/g)											
Sheephead	Fe-59	6	0.26	< LLD	(0/4)	(C) Laguna Beach 18.2 Mi. NW	0.0392 (0.0392 - 0.0392)	(1/2)	0.0392 (0.0392 - 0.0392)	(1/2)	0
Sheephead	K-40	6	1.4	2.90 (1.70 - 4.12)	(4/4)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	3.47 (2.82 - 4.12)	(2/2)	3.44 (3.37 - 3.51)	(2/2)	0
Sheephead	Mn-54	6	0.13	< LLD	(0/4)		----	(0/2)	< LLD	(0/2)	0
Sheephead	Zn-65	6	0.26	0.15 (0.15 - 0.15)	(1/4)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.15 (0.15 - 0.15)	(1/2)	< LLD	(0/2)	0
Sand Bass	Co-58	2	0.13	0.0234 (0.0234 - 0.0234)	(1/2)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0234 (0.0234 - 0.0234)	(1/1)	< LLD	(0/0)	0
Sand Bass	Co-60	2	0.13	< LLD	(0/2)		----	(0/1)	< LLD	(0/0)	0
Sand Bass	Cs-134	2	0.13	0.0207 (0.0207 - 0.0207)	(1/2)	(B) Units 2 and 3 Outfall 1.5 Mi. SSW	0.0207 (0.0207 - 0.0207)	(1/1)	< LLD	(0/0)	0
Sand Bass	Cs-137	2	0.15	< LLD	(0/2)		----	(0/1)	< LLD	(0/0)	0
Sand Bass	Fe-59	2	0.26	< LLD	(0/2)		----	(0/1)	< LLD	(0/0)	0
Sand Bass	K-40	2	1.4	3.78 (3.64 - 3.91)	(2/2)	(A) Unit 1 Outfall 0.9 Mi. WSW	3.91 (3.91 - 3.91)	(1/1)	< LLD	(0/0)	0
Sand Bass	Mn-54	2	0.13	< LLD	(0/2)		----	(0/1)	< LLD	(0/0)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

Produced on : 04/03/01

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi Annual Non-migratory Marine Animals (Flesh) Analysis - Table 12A (pCi/g)											
Sand Bass	Zn-65	2	0.26	< LLD	(0/2)	----		(0/1)	< LLD	(0/0)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g)											
Cabbage	Cs-134	1	0.06	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Cabbage	Cs-137	1	0.08	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Cabbage	I-131	1	0.06	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Cabbage	K-40	1	0.85	< LLD	(0/0)	South East of Oceanside 22 Mi. SE	2.83 (2.83 - 2.83)	(1/1)	2.83 (2.83 - 2.83)	(1/1)	0
Sorrel	Cs-134	2	0.06	0.0081 (0.0081 - 0.0081)	(1/2)	SONGS Garden 0.4 Mi. NNW	0.0081 (0.0081 - 0.0081)	(1/2)	< LLD	(0/0)	0
Sorrel	Cs-137	2	0.08	< LLD	(0/2)		----	(0/2)	< LLD	(0/0)	0
Sorrel	I-131	2	0.06	< LLD	(0/2)		----	(0/2)	< LLD	(0/0)	0
Sorrel	K-40	2	0.85	3.34 (3.31 - 3.37)	(2/2)	SONGS Garden 0.4 Mi. NNW	3.34 (3.31 - 3.37)	(2/2)	< LLD	(0/0)	0
Squash	Cs-134	1	0.06	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Squash	Cs-137	1	0.08	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Squash	I-131	1	0.06	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g)											
Squash	K-40	1	0.85	< LLD	(0/0)	South East of Oceanside 22 Mi. SE	1.61 (1.61 - 1.61)	(1/1)	1.61 (1.61 - 1.61)	(1/1)	0
Tomato	Cs-134	2	0.06	0.0194 (0.0194 - 0.0194)	(1/1)	SONGS Garden 0.4 Mi. NNW	0.0194 (0.0194 - 0.0194)	(1/1)	< LLD	(0/1)	0
Tomato	Cs-137	2	0.08	< LLD	(0/1)		----	(0/1)	< LLD	(0/1)	0
Tomato	I-131	2	0.06	< LLD	(0/1)		----	(0/1)	< LLD	(0/1)	0
Tomato	K-40	2	0.85	1.44 (1.44 - 1.44)	(1/1)	South East of Oceanside 22 Mi. SE	2.22 (2.22 - 2.22)	(1/1)	2.22 (2.22 - 2.22)	(1/1)	0
Turnip Greens	Cs-134	1	0.06	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Turnip Greens	Cs-137	1	0.08	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Turnip Greens	I-131	1	0.06	< LLD	(0/0)		----	(0/1)	< LLD	(0/1)	0
Turnip Greens	K-40	1	0.85	< LLD	(0/0)	South East of Oceanside 22 Mi. SE	3.04 (3.04 - 3.04)	(1/1)	3.04 (3.04 - 3.04)	(1/1)	0
Zucchini	Cs-134	1	0.06	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0
Zucchini	Cs-137	1	0.08	< LLD	(0/1)		----	(0/1)	< LLD	(0/0)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Local Crops Gamma Spectral Analysis - Table 13A (pCi/g)											
Zucchini	K-40	1	0.85	2.60 (2.60 - 2.60)	(1/1)	SONGS Garden 0.4 Mi. NNW	2.60 (2.60 - 2.60)	(1/1)	< LLD	(0/0)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Annual Soil Analysis - Depth 3' - Table 14 (pCi/g)											
	Cs-134	5	0.15	0.0164 (0.0164 - 0.0164)	(1/4)	Camp San Onofre 2.6 Mi. NE	0.0164 (0.0164 - 0.0164)	(1/1)	< LLD	(0/1)	0
	Cs-137	5	0.18	0.12 (0.0988 - 0.13)	(2/4)	Old Route 101 - East Southeast 3 Mi. ESE	0.13 (0.13 - 0.13)	(1/1)	< LLD	(0/1)	0
	K-40	5	2.2	13.54 (7.32 - 16.41)	(4/4)	Camp San Onofre 2.6 Mi. NE	16.41 (16.41 - 16.41)	(1/1)	10.93 (10.93 - 10.93)	(1/1)	0
	Th-228	5	0.74	0.58 (0.34 - 0.70)	(4/4)	Former Visitor's Center (East Site Boundary) 0.4 Mi. NW	0.70 (0.70 - 0.70)	(1/1)	0.67 (0.67 - 0.67)	(1/1)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

SAN ONOFRE NUCLEAR GENERATING STATION

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

Reporting Period : 1/1/00 To 12/31/00

Medium or Pathway sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean (Range)		Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean (Range)		Control Locations Mean (Range)		Number of Nonroutine Reported Measurements
Semi-Annual Kelp Analysis - Table 15 (pCi/g)											
Macrocystis p.	I-131	14	0.0001	0.0914 (0.0337 - 0.14)	(6/6)	(A) San Onofre Kelp Bed 1.5 Mi. S	0.12 (0.0912 - 0.14)	(2/2)	0.0615 (0.0199 - 0.12)	(4/8)	6
Macrocystis p.	K-40	14	0.85	9.36 (7.43 - 11.78)	(6/6)		11.72 (11.72 - 11.72)	(1/1)	10.35 (8.19 - 11.72)	(8/8)	6
Macrocystis p.	Th-228	14	0.19	0.0135 (0.0097 - 0.0173)	(4/6)	(A) San Onofre Kelp Bed 1.5 Mi. S	0.0157 (0.0157 - 0.0157)	(1/2)	0.0151 (0.0151 - 0.0151)	(1/8)	6

Nonroutine reported analysis results include six exploratory alternate control sample locations.

APPENDIX C

SUMMARY OF 2000 QUALITY CONTROL PROGRAMS

All REMP samples are collected, shipped, and analyzed in accordance with NRC Regulatory Guide 4.15. Marine radiological environmental samples are collected by a vendor, Ogden Environmental Services, per the vendor's Quality Assurance manual. REMP sample analysis is performed by the Contracted Environmental Analysis Laboratory (CEAL) in accordance with the Laboratory Quality Assurance Plan. During 2000 the CEAL was Duke Engineering Services.

INTERLABORATORY CROSS-CHECK PROGRAM:

The CEAL participates in a number of independent cross check programs, including the National Institute of Standards and Technology (NIST) and Analytics cross-check programs. A summary of the available 2000 Analytics cross check data is included in Table C-1. The CEAL's performance meets the criteria described in Reg Guide 4.15. The acceptance criteria was met for nearly all cross-check samples. Discrepancies were resolved by the CEAL through a formal condition report evaluation process.

SPLIT SAMPLING PROGRAM WITH DHS

The California Department of Health Services (DHS) supervises the performance of split and duplicate sampling of selected media at the NRC licensed nuclear power plants in California. Radiochemical analysis is performed by the Sanitation and Radiation Laboratory (SRL); TLD processing is performed by a contractor. According to the 1997 report, the latest data available, there are no discrepancies between the DHS data and SONGS' data.

COMPARISON OF TLD AND PIC DATA

The SONGS REMP measures direct radiation at the various indicator and CONTROL locations with Thulium doped $CaSO_4$ Panasonic Thermoluminescient Dosimeters (TLDs). The TLDs are collected quarterly and the corresponding dose is measured by the contracted laboratory. Transit dose and fade is compensated for in the reported results. A number of the REMP TLDs are located adjacent to Pressurized Ion Chamber (PIC) direct radiation dose rate meters. Data from the PICs is fed into a central processing unit with readouts near the control room. The PICs serve to provide real time monitoring of the radiation dose rates in the inner ring of SONGS. PIC data from the first quarter of 2000 were assembled and the average dose rate was converted to a quarterly total dose. The resulting PIC measured total quarterly dose compare favorably to the measured TLD total quarterly dose as shown in the tables below.

TLD phosphors tend to over-respond to the lower energy levels and the TLD package has a thin lead shielding to compensate for this over-response. The complete TLD packages meet the requirements of ANSI N545. The energy response data for the PICs was reviewed for this report. The PIC energy response is relatively linear above ~75kEV.

FIRST QUARTER 2000 PIC / TLD DATA COMPARISON

	PIC-1 & TLD 10	PIC-2 & TLD 67	PIC-3 & TLD 40	PIC-4 & TLD 61	PIC-7 & TLD 64	PIC-8 & TLD 65	PIC-9 & TLD 66
Average PIC Dose Rate in mR/hour	7.68E-3	8.14E-3	7.95E-3	7.32E-3	7.27E-3	6.55E-3	6.35E-3
PIC total quarterly dose in mR (90day)	16.77	17.78	17.36	15.99	15.88	14.20	13.87
TLD measured quarterly dose in mR +/- one sigma (empirical)	15.53 +/- 0.97	15.84 +/- 0.92	16.52 +/- 1.49	13.89 +/- 0.83	13.44 +/- 0.82	12.33 +/- 0.81	12.97 +/- 0.80

DUPLICATE TLDS

Starting in the third quarter of 2000, SONGS deployed a duplicate TLD package in the same location and canister as TLD 66. The quarterly dose measured by these separate TLD packages is nearly identical.

DUPLICATE TLD DATA COMPARISON

	3RD QUARTER	4TH QUARTER
TLD 66	13.88 +/- 0.42	13.73 +/- 0.61
TLD 200	13.81 +/- 0.53	13.66 +/- 0.59

CALIBRATION OF AIR SAMPLER VOLUME METERS

The Shop Services and Instrumentation Division of SCE performs an annual calibration procedure using standards referenced to NIST on all REMP air sampler gas meters. When the gas meters are removed from service, the meter is calibrated and the calibration reports are reviewed for bias. This is an *a posteriori* review of the gas meter performance to evaluate method bias and to identify possible outlier analysis results. In 2000, four (4) gas meters failed to meet this criterion at all calibrated flow rates. A review of the affected gross beta data has revealed no meaningful anomalies. Thus no discernable impact to the REMP database or conclusions resulted from use of the out of tolerance gas meters.

TABLE C-1

2000 ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Ratio CEAL Analytics	Evaluation
E1994-162	4th / 99	Filter	Sr-89	pCi/L	107	114	0.94	Agreement
E1994-162	4th / 99	Filter	Sr-90	pCi/L	52	54	0.96	Agreement
E1995-162	4th / 99	Filter	Gross Alpha	pCi/L	19	20	0.95	Agreement
E1995-162	4th / 99	Filter	Gross Beta	pCi/L	134	123	1.09	Agreement
E1996-162	4th / 99	Water	H-3	pCi/L	6940	8015	0.87	Agreement
E1997-162	4th / 99	Milk	I-131LL	pCi/L	77	77	1.00	Agreement
E1997-162	4th / 99	Milk	I-131	pCi/L	76	77	0.99	Agreement
E1997-162	4th / 99	Milk	Ce-141	pCi/L	127	117	1.09	Agreement
E1997-162	4th / 99	Milk	Cr-51	pCi/L	268	322	0.83	Non-Agree*
E1997-162	4th / 99	Milk	Cs-134	pCi/L	136	138	0.99	Agreement
E1997-162	4th / 99	Milk	Cs-137	pCi/L	112	106	1.06	Agreement
E1997-162	4th / 99	Milk	Co-58	pCi/L	117	121	0.97	Agreement
E1997-162	4th / 99	Milk	Mn-54	pCi/L	109	111	0.98	Agreement
E1997-162	4th / 99	Milk	Fe-59	pCi/L	113	104	1.09	Agreement
E1997-162	4th / 99	Milk	Zn-65	pCi/L	214	206	1.04	Agreement
E1997-162	4th / 99	Milk	Co-60	pCi/L	155	146	1.06	Agreement
E2127-162	1st / 00	Water	I-131LL	pCi/L	76.63	74	1.04	Agreement
E2127-162	1st / 00	Water	I-131	pCi/L	70	74	0.95	Agreement
E2127-162	1st / 00	Water	Ce-141	pCi/L	426	427	1.00	Agreement
E2127-162	1st / 00	Water	Cr-51	pCi/L	205	238	0.86	Agreement
E2127-162	1st / 00	Water	Cs-134	pCi/L	135	139	0.97	Agreement

* CR-98-09 Issued

TABLE C-1

2000 ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Ratio CEAL Analytics	Evaluation
E2127-162	1st / 00	Water	Cs-137	pCi/L	126	128	0.98	Agreement
E2127-162	1st / 00	Water	Co-58	pCi/L	46	44	1.05	Agreement
E2127-162	1st / 00	Water	Mn-54	pCi/L	165	159	1.04	Agreement
E2127-162	1st / 00	Water	Fe-59	pCi/L	94	92	1.02	Agreement
E2127-162	1st / 00	Water	Zn-65	pCi/L	191	196	0.97	Agreement
E2127-162	1st / 00	Water	Co-60	pCi/L	117	116	1.01	Agreement
E2128-162	1st / 00	Water	Gross Alpha	pCi/L	60	82	0.73	Non-Agree*
E2128-162	1st / 00	Water	Bross Beta	pCi/L	223	210	1.06	Agreement
E2129-162	1st / 00	Water	U-234	pCi/L	62	57	1.09	Agreement
E2129-162	1st / 00	Water	U-235	pCi/L	2.5	2.7	0.93	Agreement
E2129-162	1st / 00	Water	U-238	pCi/L	64	59	1.08	Agreement
E2129-162	1st / 00	Water	Pu-238	pCi/L	80	73	1.10	Agreement
E2129-162	1st / 00	Water	Pu-239	pCi/L	69	62	1.11	Agreement
E2129-162	1st / 00	Water	Ra-226	pCi/L	87	89	0.98	Agreement
E2129-162	1st / 00	Water	Ra-228	pCi/L	77	66	1.17	Non-Agree*
E2130-162	1st / 00	Milk	I-131LL	pCi/L	86	84	1.02	Agreement
E2130-162	1st / 00	Milk	I-131	pCi/L	84	84	1.00	Agreement
E2130-162	1st / 00	Milk	Ce-141	pCi/L	483	460	1.05	Agreement
E2130-162	1st / 00	Milk	Cr-51	pCi/L	279	256	1.09	Agreement
E2130-162	1st / 00	Milk	Cs-134	pCi/L	145	150	0.97	Agreement

* CR-99-11 Issued

TABLE C-1

2000 ANALYTICS CROSS-CHECK PROGRAM SUMMARY

Sample Number	Quarter / Year	Sample Media	Analyte / Nuclide	Units	Reported Value	Known Value	Ratio CEAL Analytics	Evaluation
E2130-162	1st / 00	Milk	Cs-137	pCi/L	138	138	1.00	Agreement
E2130-162	1st / 00	Milk	Co-58	pCi/L	43	47	0.91	Agreement
E2130-162	1st / 00	Milk	Mn-54	pCi/L	166	171	0.97	Agreement
E2130-162	1st / 00	Milk	Fe-59	pCi/L	103	99	1.04	Agreement
E2130-162	1st / 00	Filter	Zn-65	pCi/L	197	208	0.95	Agreement
E2130-162	1st / 00	Filter	Co-60	pCi/L	124	125	0.99	Agreement
E2131-162	1st / 00	Filter	Sr-89	pCi/L	90	90	1.00	Agreement
E2131-162	1st / 00	Filter	Sr-90	pCi/L	57	59	0.97	Agreement
A12265-162	3rd / 99	Liquid	Sr-89	μCi/cc	1.83E-03	1.88E-03	0.97	Agreement
A12265-162	3rd / 99	Liquid	Sr-90	μCi/cc	3.64E-04	3.99E-04	0.91	Agreement
A12264-162	3rd / 99	Liquid	Fe-55	μCi/cc	4.38E-04	4.46E-04	0.98	Agreement
A12580-162	4th / 99	Liquid	Sr-89	μCi/cc	3.72E-03	3.83E-03	0.97	Agreement
A12580-162	4th / 99	Liquid	Sr-90	μCi/cc	2.12E-04	2.19E-04	0.97	Agreement
A12579-162	4th / 99	Liquid	Fe-55	μCi/cc	5.37E-04	5.85E-04	0.92	Agreement
A12317-162	1st / 00	Liquid	Sr-89	μCi/cc	4.61E-03	4.73E-03	0.97	Agreement
A12317-162	1st / 00	Liquid	Sr-90	μCi/cc	2.99E-04	3.08E-04	0.97	Agreement
A12316-162	1st / 00	Liquid	Fe-55	μCi/cc	3.97E-04	4.47E-04	0.89	Agreement
A13243-162	2nd / 00	Liquid	Sr-89	μCi/cc	1.40E-03	1.47E-03	0.95	Agreement
A13243-162	2nd / 00	Liquid	Sr-90	μCi/cc	1.39E-04	1.36E-04	1.02	Agreement
A13242-162	2nd / 00	Liquid	Fe-55	μCi/cc	4.32E-04	4.89E-04	0.88	Agreement

APPENDIX D

COMPARISON OF OPERATIONAL TO PREOPERATIONAL DATA AND ANALYSIS OF TRENDS

Comparison of Operational to Preoperational Data and Analysis of Trends

Unit 1 became critical on June 14, 1967 and was permanently retired from service on November 30, 1992. Unit 2 attained initial criticality on July 26, 1982. Unit 3 attained initial criticality on August 29, 1983. Unit 2 underwent a 40 day refueling outage and operated the remainder of the year 2000. Unit 3 was operational the entire year of 2000.

A variety of environmental samples were analyzed and the analytical results (January 1, 1979 to July 31, 1982) were compared with the 2000 operational data obtained for SONGS Units 2 and 3, which is the subject post-operational period for SONGS Unit 1.

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

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

All of the measurements obtained from the SONGS Unit 1 operational Radiological Environmental Monitoring Program (REMP) during the period from January 1979 to July 1982 are used as the preoperational baseline for SONGS Units 2 and 3. This is in accordance with San Onofre Units 2/3, Environmental Report, Operating License Stage, Appendix 6A, Pre-operational Radiological Environmental Monitoring, May 31, 1978. Comparisons of preoperational data to 2000 operational data are possible for each of the exposure pathways to man, namely: (1) direct radiation, (2) air particulates (inhalation), and (3) ocean water (waterborne). Comparisons can also be made between preoperational and operational data for ocean bottom sediment data to ascertain if there has been any significant increase in radioactivity in ocean bottom sediments in the vicinity of the SONGS Units 2 and 3 outfalls.

A. Direct Radiation

SONGS Unit 1:

No direct radiation data were obtained in the preoperational period of 1964 to 1967 to compare with the operational data.

SONGS Units 2 and 3:

Direct radiation measurements were made quarterly at 45 indicator locations and 11 CONTROL locations in 2000. Direct radiation samples (TLDs) were collected at a number of inner and outer ring locations as specified by the ODCMs. During the preoperational period from January 1979 to July 31, 1982, the indicator stations ranged from 16.1 to 46.6 millirem.

The preoperational indicator average was 25.3. The preoperational CONTROL range was 19.3 to 30.1 and the CONTROL mean was 23.1. During the 2000 operational year for Units 2 and 3, the indicator TLD locations ranged from 9.7 to 55.4 millirem, averaging 17.6 millirem while the CONTROL locations ranged from 12.5 to 19.2 millirem with an average of 15.1 millirem.

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

The average direct radiation doses were larger at both indicator and CONTROL locations during the preoperational period than during the 2000 operational period for SONGS Units 2 and 3. The larger average observed during the preoperational time span may be attributable to Communist Chinese atmospheric nuclear weapons tests on March 14, 1978 and on October 15, 1980. The large average of annual direct radiation levels seen at most TLD sample locations during 1986 and 1987 is attributable to the Chernobyl Nuclear Power Plant accident that occurred April 26, 1986.

Figures 2A & 2B compare the environmental radiation levels of selected indicator and CONTROL locations during the operational and preoperational periods. From 1979 to 2000 a decreasing trend can be observed, due to the curtailment of atmospheric nuclear weapons testing and the decay of residual fallout. Simultaneous variation in the radiation levels at both the CONTROL and indicator locations show that the variations are due to factors external to SONGS. The operation of SONGS had no impact on the environment as measured by this sample medium.

B. Air Particulates

SONGS Unit l:

Before SONGS Unit 1 attained initial criticality, samples of air particulate gross beta activity were collected from indicator and CONTROL locations. During the preoperational period of 1964-1967, detectable gross beta activity at the indicator locations ranged from 0.030 to 3.810 pCi/m^3, averaging 0.253 pCi/m^3. The CONTROL location of Huntington Beach (HBGS) had an average gross beta activity of 0.306 ranging from 0.04 to 2.77 pCi/m^3. During 2000, the gross beta activity at the indicator locations ranged from 0.003 to 0.073 pCi/m^3, and averaging 0.024 pCi/m^3. The Oceanside CONTROL location gross beta activity ranged from 0.005 to 0.062 pCi/m^3 with an average of 0.024 pCi/m^3. The decrease in activity levels between 1965 and 2000 is ascribed to the curtailment of atmospheric nuclear weapons testing and the resultant decrease in fallout. Refer to figure 3C. There was a close correlation between indicator and CONTROL locations in 2000. The operation of SONGS had no impact on the environment as measured by this sample medium.

Valid comparisons of preoperational data to the 2000 postoperational data are difficult to make because the preoperational background levels are elevated by a factor of about ten due to the atmospheric nuclear weapons testing fallout.

SONGS Units 2 and 3:

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

Figures 3A and 3B compare the monthly average gross beta particulate in air activity levels of selected indicator locations with the CONTROL location over a period of 25 years (January 1976 to December 2000). The data clearly show a close correlation between the indicator and control locations for the entire time period covered. The various spike increases in gross beta activity at all sample locations are closely grouped and timed to coincide with known events external to SONGS with worldwide radiological impact. These events include: Communist Chinese atmospheric nuclear weapons testing on September 17, 1977; March 14, 1978; October 15, 1980; and the April 1986 Chernobyl accident. The graphs (Figures 3A and 3B) show that the environmental levels of gross beta remained substantially similar at both the indicator and the CONTROL locations over an extended period of time, with both CONTROL and indicator locations showing simultaneous variations of equal magnitude. The fluctuations in gross beta activity are not attributable to SONGS and are the result of other environmental phenomena and seasonal variations.

The Communist Chinese testing of October 1980 deposited a large amount of radioactivity in California and raised the background level. During this period the highest gross beta activity was observed at the Huntington Beach CONTROL station (0.29 pCi/m^3 on the collection period ending May 11, 1981). The dispersion of the radioactive plume and its travel throughout the country affected the environmental levels at all the locations being studied. The fallout from the weapons testing raised the background radiation level in this sample medium by approximately one order of magnitude. The decrease in gross beta activity level after mid-1981 is ascribed to the curtailment of the Chinese weapons testing. Since the end of the weapons testing the overall trend of the data has been a decrease in the annual average gross beta particulate in air activity to a level of approximately 0.02 pCi/m^3.

C. Radioiodine

SONGS Unit 1:

No preoperational data is available. All 2000 data was below both the *a priori* LLD (0.07 pCi/m^3) and the lower, count specific, *a posteriori* MDC.

SONGS Units 2 and 3:

Most of the preoperational and all of the 2000 operational data for I-131 level were below the detection limit.

D. Ocean Water

SONGS Unit 1:

No samples were obtained for the preoperational period of SONGS Unit 1.

SONGS Units 2 and 3:

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

During the preoperational period, naturally-occurring potassium-40 was detected in each of the samples collected from both indicator and CONTROL locations. Other gamma-emitting radionuclides were detected in only one ocean water sample. In May 1980, Co-58, Co-60, Cs-134, and Cs-137 were detected in an ocean water sample collected from the SONGS Unit 1 outfall. Concentrations of the radionuclides in this sample were 11, 6, 380, and 430 pCi/l, respectively. Tritium was also detected in two of the ocean water samples collected in May 1980 from the SONGS Unit 2 outfall and from the Newport Beach CONTROL location. Reduction in effluent activity through programmatic changes at Unit 1 may have reduced activity levels in ocean water.

For tritium and all SONGS related radionuclides the data collected at all locations during the 2000 operational period was below both the *a priori* LLD and the lower *a posteriori* MDC. We conclude that the operation of SONGS had no impact on the environment as measured by this sample medium.

E. Shoreline Sediments (Sand)

SONGS Unit 1:

Shoreline Sediment samples were not collected during the preoperational period for SONGS 1.

SONGS Units 2 and 3:

Beach sand is collected semiannually from three indicator locations and from a CONTROL location situated at Newport Beach. The samples are analyzed for 28 naturally-occurring and plant-related radionuclides.

To assess the impact of SONGS operations on this environmental medium, preoperational data were compared to 2000 operational data. The radionuclide detected in shoreline sediment in the preoperational time frame was Cs-137 with a range of 0.012 to 0.022 pCi/g, averaging 0.019 in 5 sediment samples. One CONTROL sample with a Cs-137 activity of 0.032 pCi/g was observed in July 1979. The presence of Cs-137 in both CONTROL and indicator locations during the preoperational period leads to the conclusion that the root cause is external to SONGS and is most likely attributable to atmospheric nuclear weapons testing. No SONGS-related radionuclides were detected in shoreline sediment during the 2000 operational period, thus the impact of SONGS on the environment as measured by the sample medium is considered to be negligible.

F. Ocean Bottom Sediments

SONGS Unit 1:

Ocean bottom sediment samples were not collected during the preoperational phase of Unit 1, and, therefore, no comparison can be made. However, operational data for SONGS 1 did not reveal the presence of any significant radioactivity in the sediment samples.

SONGS Units 2 and 3:

During the preoperational and operational periods, representative samples of ocean bottom sediments were collected semiannually from each of the Station discharge outfalls and from a CONTROL station in Laguna Beach. The samples were analyzed for naturally occurring and SONGS related radionuclides. The results of the analyses are listed in Table D-1B. It is clear in surveying the data that the concentration of each of the radionuclides has decreased with time or has been consistently below the lower limit of detection.

SONGS-related radionuclides were also detected in samples collected during preoperational period. Manganese-54 (Mn-54) was detected in 5 of the 28 samples. The concentrations of Mn-54 in these samples ranged from 0.015 to 0.49 pCi/g, averaging 0.13 pCi/g. Cobalt-58 (Co-58) was detected in nine samples. The concentration of Co-58 in the samples ranged from 0.013 to 1.16 pCi/g, averaging 0.20 pCi/g. Cobalt-60 (Co-60) was measured in 15 of the 28 samples. The concentration of Co-60 in the sample ranged from 0.014 to 8.1 pCi/g, averaging 0.79 pCi/g. Cs-137 was also detected in 16 of the 28 samples. The concentrations of Cs-137 in the samples ranged from 0.014 to 0.090 pCi/g, averaging 0.039 pCi/g. Cerium-144 (Ce-144) was found in two samples. The concentration of Ce-144 in the samples was 0.06 and 0.26 pCi/g, respectively.

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

The concentration of station-related radionuclides in all ocean bottom sediment samples analyzed in 2000 was below the *a priori* LLD as well as below the lower *a posteriori* MDC. We conclude that operation of SONGS Units 2 and 3 has had a negligible impact upon this environmental medium.

TABLE D-1A

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

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

TABLE D-1B

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

		INDICATOR		CONTROL	
Radionuclide**	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	0.0150-0.49	0.129	<LLD	<LLD
Co-58	PreOp	0.013-1.160	0.199	<LLD	<LLD
Co-60	PreOp	0.014-8.100	0.788	<LLD	<LLD
Ag-110m	PreOp	<LLD-0.020	<LLD	<LLD	<LLD
Cs-137	PreOp	0.014-0.090	0.039	<LLD-0.043	<LLD
Ce-144	PreOp	0.060-0.260	0.160	<LLD	<LLD
All other measured SONGS related radionuclides (1)	PreOp	< LLD	< LLD	< LLD	< LLD
	Operational	< LLD	< LLD	< LLD	< LLD

* PreOp = January 1979 to July 1982; Operational - January to December 2000
** During January to December 2000 all station related Radionuclides from all sample locations were < LLD
LLD Lower limits of detection for operational data are listed in Appendix B.

G. Marine Species (Flesh)

SONGS Unit 1:

Marine species were not collected during the preoperational period for SONGS Unit 1. No comparison with operational data is possible.

SONGS Units 2 and 3:

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

Results for several marine species for both the preoperational and 2000 operational periods for Units 2 and 3 are summarized in Table D-2. The marine species used for purposes of comparison include: sheephead (a fish), black perch (a fish), bay mussel (a mollusk), spiny lobster (a crustacea), sea hare (a mollusk), and keyhole limpet (a mollusk). Radionuclides analyzed but not included in Table D-2 were below the lower limits of detection for both the preoperational and operational periods.

During the 2000 operational period, no SONGS related radionuclides were detected at either the *a priori* LLD or the lower *a posteriori* MDC. The data indicate no accumulation trends. The operation of SONGS Units 2 and 3 in 2000 had no impact on the environment as measured by this sample medium.

TABLE D-2

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 2000 OPERATIONAL DATA (SONGS UNITS 2/3)

Sheephead Flesh**

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

Black Perch Flesh**

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

* PreOp = January 1979 to July 1982; Operational - January to December 2000
** During January to December 2000 all station related Radionuclides from all sample locations were < LLD
LLD Lower limits of detection for operational data are listed in Appendix B.

TABLE D-2

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

Bay Mussel Flesh**

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

Spiny Lobster Flesh**

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

* PreOp = January 1979 to July 1982; Operational - January to December 2000
** During January to December 2000 all station related Radionuclides from all sample locations were < LLD
LLD Lower limits of detection for operational data are listed in Appendix B.

TABLE D-2

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

Sea Hare Flesh**

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

Keyhole Limpet (Flesh)**

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

* PreOp = January 1979 to July 1982; Operational - January to December 2000
** During January to December 2000 all station related Radionuclides from all sample locations were < LLD
LLD Lower limits of detection for operational data are listed in Appendix B.

H. Local Crops

SONGS Unit 1:

During the preoperational phase of Unit 1, local crops were collected semiannually from both indicator and CONTROL locations, and subsequently analyzed for Sr-90. The range was 0.008 to 0.030 pCi/g wet weight. The average Sr-90 value was 0.022 pCi/g wet weight. Sr-90 is a common fission product likely due to atmospheric weapons tests.

During the 2000 operational period only naturally occurring radionuclides were detected in the crop samples.

SONGS Units 2 and 3:

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

In the 2000 operational period, only naturally occurring radionuclides were detected in the crop samples. The data indicate that the concentration of SONGS related radionuclides have decreased over time in this sample medium. This decrease is attributable to the termination of atmospheric nuclear weapons testing. The operation of SONGS had no impact on the environment as measured by this sample medium.

I. Soil

SONGS Unit 1:

No soil data were available for Unit 1 preoperational phase so a comparison cannot be made. However, gamma isotopic analysis of soil does not show any significant level of radioactivity. No accumulation pattern of plant-related radionuclides in the soil has been observed in the last 20 years.

SONGS Units 2 and 3:

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

J. Kelp

SONGS Unit 1:

Samples of kelp were not collected and analyzed during the preoperational period for SONGS Unit 1. No comparison with operational data is possible.

SONGS Units 2 and 3:

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

To assess the impact of SONGS operations on kelp, preoperational data were compared to 2000 operational data in Table D-4. Radionuclides detected during the preoperational period for SONGS Units 2 and 3 include Mn-54, Co-60, Zr-95, I-131, and Cs-137.

During the 2000 operational period, I-131 was detected in eight (8) samples obtained. No other station related isotopes were detected in kelp samples during the 2000 operational period. Figure 4 (I-131 in Kelp) shows a close correlation between indicator and control sample locations over a 25 year period.

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

K. Drinking Water

No plant related radionuclides were detected during the 2000 operational period. Gross beta activity was detected during both the operational and preoperational periods at both the indicator and the CONTROL locations. No trends have been noted. There is no drinking water pathway for SONGS. The operation of SONGS had no impact on the environment as measured by this sample medium.

TABLE D-3

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

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Sr-90	PreOp	0.02-0.08	0.044	<LLD-0.03	<LLD
Cs-137	PreOp	0.02-0.20	0.096	<LLD-0.06	<LLD
Cs-137	Operational	< LLD-0.112	0.076	<LLD	<LLD
All other measured	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	< LLD	< LLD	< LLD	< LLD

TABLE D-4

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

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD-0.005	<LLD	<LLD	<LLD
Co-60	PreOp	0.006-0.009	0.008	<LLD	<LLD
Zr(Nb)-95	PreOp	0.014-0.090	0.046	0.018-0.053	0.036
I-131	PreOp	0.006-0.024	0.013	0.008-0.030	0.014
I-131	Operational	.018-0.050	0.037	0.027-0.033	0.030
Cs-137	PreOp	0.004-0.009	0.006	<LLD	<LLD
All other measured	PreOp	< LLD	< LLD	< LLD	< LLD
SONGS related radionuclides	Operational	< LLD	< LLD	< LLD	< LLD

* PreOp = January 1979 to July 1982; Operational - January to December 2000
LLD Lower limits of detection for operational data are listed in Appendix B.

APPENDIX E

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

IN 2000

DEVIATIONS FROM THE ODCM SAMPLING REQUIREMENTS

Deviations from the Offsite Dose Calculation Manual (ODCM) sampling requirements are identified below in accordance with section 5.0 of the ODCM. With one exception, the performance standard for environmental data collection of 95% was met for all sample types. During 2000, the ODCM specified *a priori* LLD was achieved for most REMP samples obtained. Deviations from the ODCM were associated with external factors not within the control of REMP personnel such as limited availability of Marine Samples at the locations specified in the ODCM. These minor unavoidable deviations from the ODCM had no meaningful impact on the REMP database and did not compromise the validity of the reported conclusions.

PART I TERRESTRIAL SAMPLING

A. WEEKLY AIR SAMPLING

Downtime for each air sampler in 2000 due to weekly sample collection, annual preventive maintenance (PM) and the annual gas meter change out was approximately 46 minutes for each sampler.

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

Down times in excess of 1 hour are described below for each air sample. Air sampler availability remains well above 95%.

Air Sampler 1 (City of San Clemente):

A power outage caused 12.3 hours of down time in August 2000.

Air Sampler 9:

No deviations were observed.

Air Sampler 10 (Bluff):

Out of service for 7 hours during 2000 due to power outage.

Air Sampler 11 (EOF):

No deviations were observed.

Air Sampler 12 (Former SONGS Evaporation Pond):

Out of service for 7 hours due to power outage.

Air Sampler 13 (Camp Pendleton East):

Out of service for 23 days, 8.6 hours in March and 389.5 hours in August 2000 due to external power supply interruptions. The availability for air sampler 13 during 2000 was 89%.

Air Sampler 14 (Mesa Medical Facility):

No deviations were observed.

Air Sampler 15 (Oceanside CONTROL):

No deviations were observed.

Summary of Air Sampler Corrective Actions

The useful life of the vacuum pump motor assemblies is estimated to be five years based on the recommendation of the manufacturer and upon experience. If the internal components (motor and control valve) are replaced the useful life may be extended. During 2000 the REMP air samplers experienced no down time attributable to motor or vacuum pump assembly failure.

B. DIRECT RADIATION

No deviations were observed.

C. LOCAL CROPS

No deviations were observed.

D. SHORELINE SEDIMENTS

No deviations were observed.

E. DRINKING WATER

No deviations were observed.

F. SOIL

No deviations were observed.

PART II MARINE SAMPLING

A. NON-MIGRATORY MARINE ANIMALS

Samples were collected from the specified ODCM sample location when samples were available at that location. When the specified sample type was not available at the ODCM listed location alternate locations were selected based on sample availability and proximity to the specified sample location. All indicator samples were obtained within two miles of the associated outfall. In some cases the indicator species is not the same as the control species due to limited availability at the indicator location.

Some of the non-migratory marine species samples were not available at the locations specified in the ODCM. Listed below are those samples which were obtained from substitute locations. All listed locations are relative to the midpoint of Units 2/3 during 2000:

Sample Date	Sample Type	Actual Sample Location	ODCM Specified Sample Location
April 2000	Sample A Unit 1 lobster Sample A Unit 1 sheephead and sand bass Sample A Unit 1 aplysia (sea hare)	1.2 miles SSW 1.2 miles SSW 0.5 miles WNW	U1 Outfall 0.9 miles WSW
April 2000	Sample B Units 2/3 lobster Sample B Units 2/3 sheephead & sand bass Sample B Units 2/3 mytilus (bay mussel)	1.8 miles S 1.4 miles SW 1.2 miles SSW	U2/3 Outfall 1.5 miles SSW
April 2000	Sample C North CONTROL all species	17.0 miles NW	Laguna Beach (Control) 18.2 miles NW
October 2000	Sample A Unit 1(lobster, sheephead, and black perch) Sample A Unit 1 aplysia (sea hare)	0.9 miles SW 0.6 miles W	U1 Outfall 0.9 miles WSW
October 2000	Sample B Units 2/3 (sea hare)	0.6 miles W	U2/3 Outfall 1.5 miles SSW
October 2000	Sample C North CONTROL all species	17.0 miles NW	Laguna Beach (Control) 18.2 miles NW

B. OCEAN WATER SAMPLING

Sample A Outfall-Unit 1

All samples taken 0.6 miles SW (No deviations)

Sample B Outfall-Unit 2

The monthly 2000 ocean water samples were taken in the range of 1.4 to 1.6 miles SW. Unit 2 outfall is through an extended diffuser line which is about 0.5 miles long, stretching from approximately 1.1 to 1.6 miles from SONGS. The diffuser line is located in Sector L (SW) very close to the border of Sector M (SSW). All 2000 samples were taken close to the Unit 2 discharge and meet the intent of the REMP sampling requirements.

Sample C Outfall-Unit 3

The 2000 ocean water samples were taken in the range of 1.2 to 1.3 miles SSW. The Unit 3 diffuser portion of the outfall extends approximately 0.7 miles to 1.2 miles from the midpoint of Units 2/3. The samples were obtained from an area very close to the Unit 3 diffusers. The intent of the REMP indicator sampling requirements were met.

Sample D Newport Beach (CONTROL)

No deviations were observed.

The ODCM Specified locations for ocean water samples are as follows:

Sample A	Station Discharge Outfall Unit 1	0.6 miles SW
Sample B	Outfall Unit 2	1.5 miles SW
Sample C	Outfall Unit 3	1.2 miles SSW
Sample D	Newport Beach (CONTROL)	30.0 miles NW

C. OCEAN BOTTOM SEDIMENTS

Sample A Unit 1 Outfall - The April 2000 sample was obtained 0.9 miles WSW from Units 2/3 midpoint. The October 2000 sample was also obtained 0.9 miles WSW.

Sample B Unit 1 Outfall - No deviations were observed.

Sample C Unit 2 Outfall - No deviations were observed.

Sample D Unit 3 Outfall - No deviations were observed.

Sample E Laguna Beach (CONTROL) - Both the April and October 2000 samples were obtained from a location 17.0 miles NW.

Actual sample location depends on sediment availability which is a function of seasons, currents, and other macro environmental factors. The actual exact sample location has been determined for each of the past four years via a Differential Global Positioning System (DGPS) receiver. Variations in the location of available ocean bottom sediment have caused deviations from the ODCM.

D. KELP

Sample A San Onofre Kelp Bed - The April 2000 kelp was obtained 1.5 miles SW at the San Onofre Kelp Bed. The October 2000 sample was obtained from a location 1.4 miles S from Units 2/3. The ODCM specified location is 1.5 miles S.

Sample B San Mateo Kelp Bed - The April 2000 sample was obtained from a location 3.1 miles WNW from Units 2/3 midpoint. The October 2000 sample was obtained from a location 2.6 miles W from Units 2/3 midpoint. The ODCM specified location is 3.8 miles WNW.

Sample C Barn Kelp - The April 2000 Barn Kelp sample was obtained 6.3 miles SSE. The October 2000 sample was obtained 6.5 miles S from the midpoint of Units 2/3. The ODCM location is 6.3 miles SSE.

Sample D Laguna Beach (CONTROL) - The Laguna beach bed was not in bloom during 2000. A CONTROL sample was obtained from the Salt Creek alternate CONTROL location. The April 2000 sample was obtained 11.8 miles WNW. The October 2000 sample was obtained 11.7 miles WNW. The ODCM specified location is 15.6 miles NW.

Kelp is intermittently available at the various local kelp forests. Sea urchin population, El Nino and La Nina weather phenomena and other macro-environmental factors determine Kelp sample availability. Samples were obtained from the kelp canopy closest to the ODCM specified location.

PART III NON ROUTINE SAMPLES OBTAINED DURING 2000

Direct Radiation Samples:

In order to verify anomolous data from TLD#3 (ESE site boundary), seven additional TLD were deployed in the area along the site boundary fence east of TLD13. Data from these TLD are included in the Statistical Summary of REMP Data found in Appendix B.

Air Samples:

Air sampler 7 provides a basis for evaluating any airborne emissions that might impact workers in the major office area at SONGS. Air sampler 51 was installed to provide a duplicate gross beta sample in accordance with Reg. Guide 4.15. Air sampler #30 was established as a compensatory measure for out of service sampler #13.

Air Sampler 7	AWS Roof	0.2 miles NW
Air Sampler 51	Blind Duplicate	0.6 miles ESE
Air Sampler 30	Compensatory #13	0.2 miles E

Ocean Water and Ocean Bottom Sediment Samples:

There is a minor leak in both the Unit 2 and Unit 3 outfall conduit. In order to ensure that no detectable radiological environmental impact results from this discharge, ocean water and an ocean bottom sediment sample were obtained from near the vicinity of each leak. Data from these samples is included in the Statistical Summary of REMP Data found in Appendix B.

Unit 2 Conduit	0.1 miles SW
Unit 3 Conduit	0.1 miles SSW

APPENDIX F

LAND USE CENSUS

INTRODUCTION

Southern California Edison conducted the annual 2000 Land Use Census (LUC) in accordance with section 5.2 of the Offsite Dose Calculation Manual (ODCM). The purpose of the LUC is to identify important radiological pathways to humans. The LUC identifies the nearest residences, milk animals, meat animals, gardens of at least 500 square feet that produce fleshy or leafy vegetables, and other specified uses (campgrounds, employment, etc.) in each of the meteorological landward sectors within five miles of SONGS. Results are summarized in Table F-1 and F-2 at the end of this appendix.

THE STUDY AREA

The study area includes half of the city of San Clemente (population estimated at 50,302 as of January 1, 2000), the San Clemente State Park, U.S. Marine Corps Base Camp Pendleton (MCB), San Onofre State Beach and Park, the San Clemente Ranch, the former U. S. Coast Guard Station at San Mateo Point, and SONGS.

METHODOLOGY

A review of the 1999 LUC and documentation notebook was conducted. Verification and revision of the 1999 data was accomplished by inquiry to the cognizant agency, organization, or individual possessing direct knowledge of the item being verified.

The garden census was performed by examining aerial photographs taken August 3, 2000. The photographic image areas which appeared to correspond to likely garden locations were converted to street addresses. The identified locations and residences were visited and the occupants interviewed to determine if a vegetable garden was present. Two (2) previously identified gardens (> 500 sq ft) growing leafy vegetables within the study area, were deleted from the LUC. Edison personnel planted a garden on site to ensure sample availability.

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

DEFINITIONS

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

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

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

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

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

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

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

SUMMARY OF CHANGES FROM THE 1998 CENSUS

1. Hunting. The 2000 LUC includes revised base hunting take and range information.

2. New military housing project at the Old San Mateo Point Coast Guard Staition was fully occupied by 202 residents as of September 30, 2000.

3. The populations of the City of San Clemente increased to 50,302 as of January 1, 2000.

4. Gardens - LUC #G-7 & LUC #G-4 are no longer active gardens.

5. Outage residents - (see R-R2, A-R2) occupied the onsite full hookup camping facility (Camp Mesa) as of September 15, 2000. Dependents and children are permitted in this facility. It is 0.4 miles from Units 2/3 in Sector R. Estimated maximum occupancy at 2250 hours for 2000.

6. Outage residents dry camping (Parking Lot 12) - Use of the dry camping facility started in August 2000. Dependents and children are not allowed in this area. It is 0.7 miles from Units 2/3 in Sector R. Estimate maximum occupancy of 2400 hours for 2000 calendar year (worker occupying site for 120 hours per week). See LUC #R-R3.

TABLE F-1
2000 SONGS Units 2/3 LUC Five Mile Radius Summary Sheet

Land Use Sector (22-1/2°)	Nearest Residence (2,000 Hrs/Yr)		Closest Other Specified Uses			Nearest Meat Animals	
	Location (Miles)	Description (LUC#)	Location (Miles)	Description (LUC#)	Max Rept Person Exp (Hrs/Yr)	Location (Miles)	Description
West Northwest (P)	2.7	San Mateo Point Housing (R-P2)	0.5	Surf Beach (O-6)	667	--	NONE
Northwest (Q)	1.2	Maintenance Yard on 51 (R-Q1)	0.6	State Park Office Trailer (O-3)	400	--	NONE
North Northwest (R)	0.4	Camp Mesa Outage Residents (R-R2)	2.6	San Clemente Ranch Packing (O-7)	3,500	1.8	Hunting (Dove)
North (A)	0.4	Camp Mesa (R-A2)	3.6	Camp San Mateo Motor Pool (O-8)	2,000	1.8	Hunting (Dove)
North Northeast (B)	--	--	2.1	Sanitary Landfill (O-9)	2,000	1.6	Hunting (Dove)
Northeast (C)	2.5	Camp San Onofre Fire Station (R-C2)	2.2	Camp San Onofre Sewage Treatment Plant (O-10)	2,000	1.0	Hunting (Deer)
East Northeast (D)	3.0	Camp San Onofre (R-D1)	3.7	Camp Horno Sewage Treatment Plant (O-4)	2,000	0.8	Hunting (Deer)
East (E)	4.1	Camp Horno (R-E1)	4.0	Camp Horno Motor Pool (O-5)	2,000	0.8	Hunting (Deer)
East Southeast (F)	--	--	0.8	San Onofre State Beach Entrance Guard Shack (O-1)	1,500	1.5	Hunting (Deer)
Sotheast (G)	--	--	0.9	San Onofre Beach Campground (O-2)	720	--	NONE

Notes: All distances are in miles from SONGS 2/3 site reference point (midpoint between SONGS Units 2 & 3 containment buildings). All sectors include 22-1/2° with "A" sector centered on True North. Sectors H, J, K, L, M, and N are oceanward sectors and land uses are not applicable. A "residence" is a location occupied by an individual 2,000 hours or more in a year.
** Denotes change from 1999 LUC.

TABLE F-1
2000 SONGS Units 2/3 LUC Five Mile Radius Summary Sheet

Land Use Sector (22-1/2°)	Nearest Leafy Vegetable Garden		Nearest Fleshy Vegetable Garden	
	Location (Miles)	Description (LUC#)	Location (Miles)	Description (LUC#)
West Northwest (P)	2.8	Old Nixon Estate (G-3)	2.8	Old Nixon Estate (G-3)
Northwest (Q)	4.1	Residence 2240 Avenida San Salvador (G-8)	2.2	San Clemente Ranch (G-2)
North Northwest (R)	0.4	SONGS Garden (G-10)	0.4	SONGS Garden (G-10)
North (A)	--	--	--	--
North Northeast (B)	--	--	--	--
Northeast (C)	--	--	--	--
East Northeast (D)	--	--	--	--
East (E)	--	--	--	--
East Southeast (F)	--	--	--	--
Sotheast (G)	--	--	--	--

Note: All distances are in miles from SONGS 2/3 site reference point (midpoint between SONGS Units 2 & 3 containment buildings). All sectors include 22-1/2° with "A" sector centered on True North. Sectors H, J, K, L, M, and N are oceanward sectors and land uses are not applicable. A "residence" is a location occupied by an individual 2,000 hours or more in a year.

TABLE F-2
2000 SONGS Unit 1 Land Use Census Summary Sheet (Five-Mile Radius)

Land Use Sector (22-1/2°)	Nearest Residence (2,000 Hrs/Yr)		Closest Other Specified Uses			Nearest Meat Animals	
	Location (Miles)	Description (LUC#)	Location (Miles)	Description (LUC#)	Max Rept Person Exp (Hrs/Yr)	Location (Miles)	Description
West Northwest (P)	2.5	San Mateo Point Housing (R-P2)	0.4	Surf Beach (O-6)	667	--	NONE
Northwest (Q)	1.0	Maintenance Yard on 51 (R-Q1)	0.5	State Park Office Trailer (O-3)	400	--	NONE
North Northwest (R)	1.2	San Onofre Mobile Homes (R-R1)	2.4	San Clemente Ranch Packing (O-7)	3,500	1.6	Hunting (dove)
North (A)	0.6	Parking Lot 12 Dry Camping (R-R3) **	3.5	Camp San Mateo Motor Pool (O-7)	2,000	1.7	Hunting (dove)
North Northeast (B)	0.3	Camp Mesa (R-R2) **	2.1	Sanitary Landfill (O-9)	2,000	1.6	Hunting (dove)
Northeast (C)	2.6	Camp San Onofre Fire Station (R-C2)	2.3	Camp San Onofre Sewage Treatment Plant (O-10)	2,000	1.1	Hunting (deer)
East Northeast (D)	3.0	Camp San Onofre (R-D1)	3.8	Camp Horno Sewage Treatment Plant (O-4)	2,000	1.0	Hunting (deer)
East (E)	4.2	Camp Horno (R-E1)	4.2	Camp Horno Motor Pool (O-5)	2,000	1.0	Hunting (deer)
East Southeast (F)	--	--	1.0	San Onofre State Beach Entrance Guard Shack (O-1)	1,500	1.7	Hunting (deer)
Sotheast (G)	--	--	1.1	San Onofre Beach Campground (O-2)	720	--	NONE

Notes:
All distances are in miles from the midpoint of SONGS Unit 1 Plant Vent Stack.
All sectors include 22-1/2° with "A" sector centered on True North.
A "residence" is a location occupied by an individual 2,000 hours or more in a year.
Sectors H, J, K, L, M, and N are oceanward sectors and land uses are not applicable.
** Denotes change from 1999 LUC

TABLE F-2
2000 SONGS Unit 1 Land Use Census Summary Sheet (Five-Mile Radius)

Land Use Sector (22-1/2°)	Nearest Leafy Vegetable Garden		Nearest Fleshy Vegetable Garden	
	Location (Miles)	Description (LUC#)	Location (Miles)	Description (LUC#)
West Northwest (P)	2.6	Old Nixon Estate (G-3)	2.6	Old Nixon Estate (G-3)
Northwest (Q)	3.9	2240 Avenida San Salvador (G-8)	2.0	San Clemente Ranch (G-2)
North Northwest (R)	--	--	2.1	San Clemente Ranch (G-1)
North (A)	--	--	--	--
North Northeast (B)	0.3	SONGS Garden (G-10)	0.3	SONGS Garden (G-10)
Northeast (C)	--	--	--	--
East Northeast (D)	--	--	--	--
East (E)	--	--	--	--
East Southeast (F)	--	--	--	--
Sotheast (G)	--	--	--	--

Notes: All distances are in miles from SONGS Unit 1 Plant Vent Stack.
All sectors include 22-1/2° with "A" sector centered on True North.

APPENDIX G

FIGURES FOR 2000

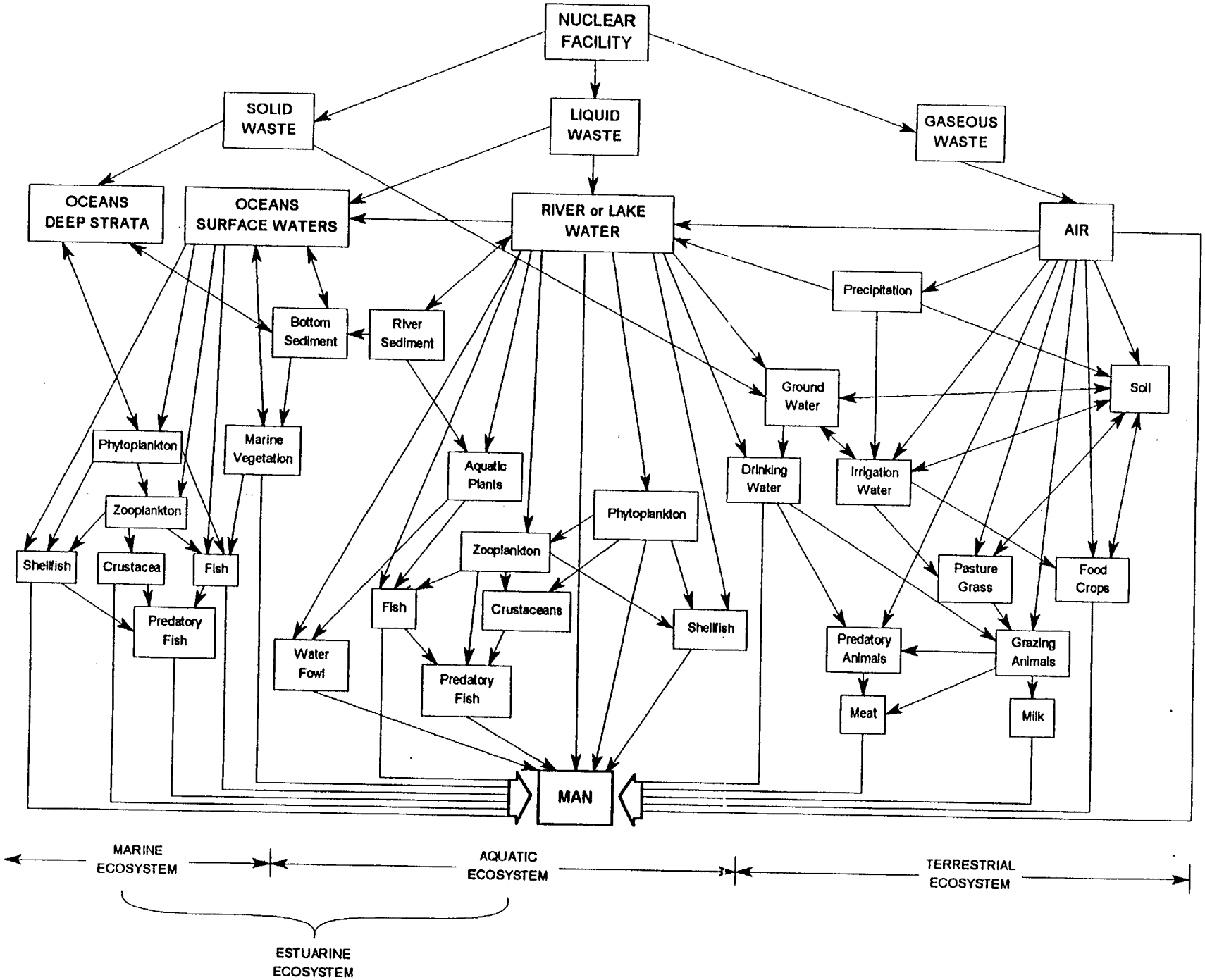

Figure 1. Potential Radiation Exposure Pathways Leading to Man

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

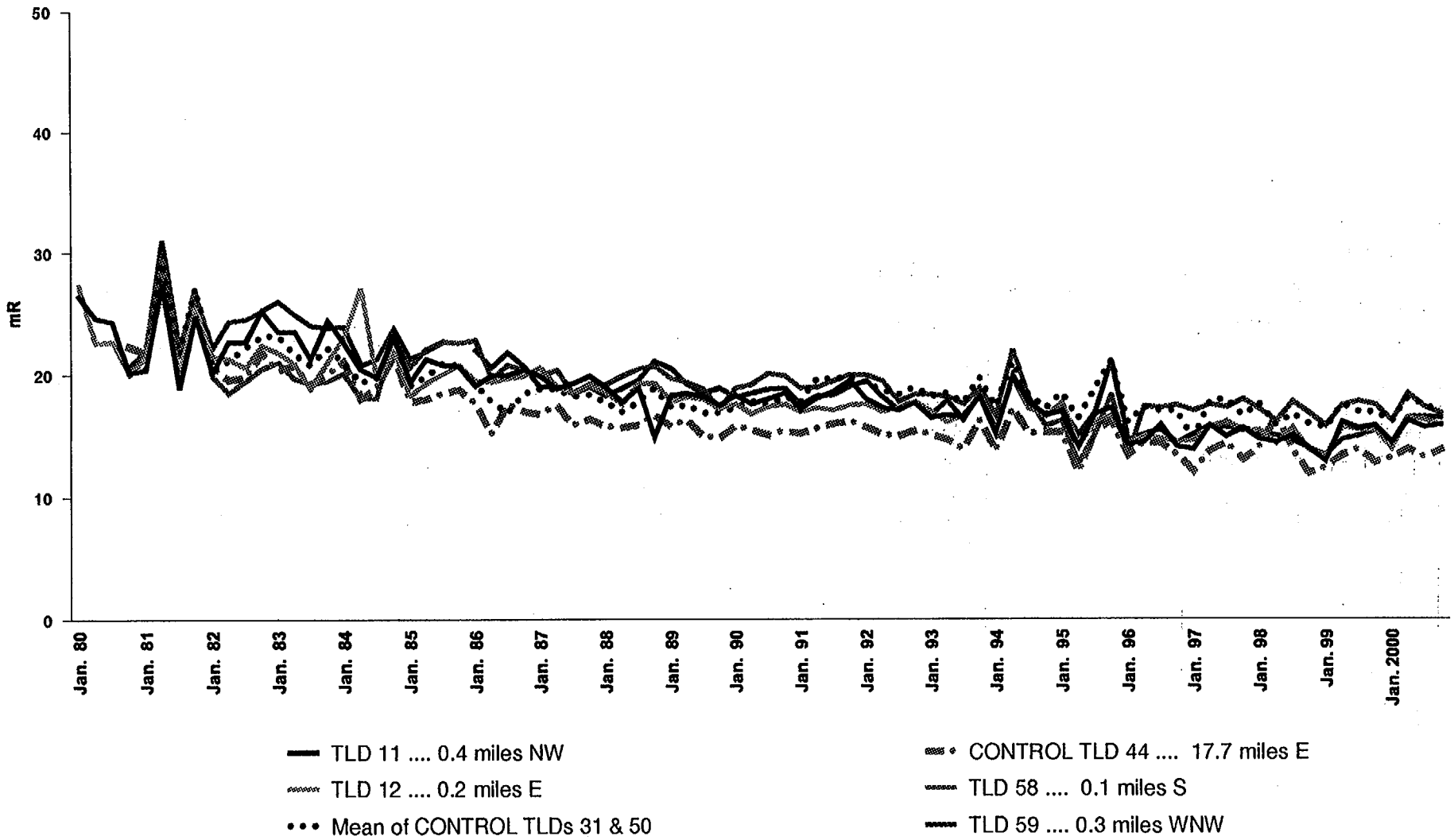

Figure 2A

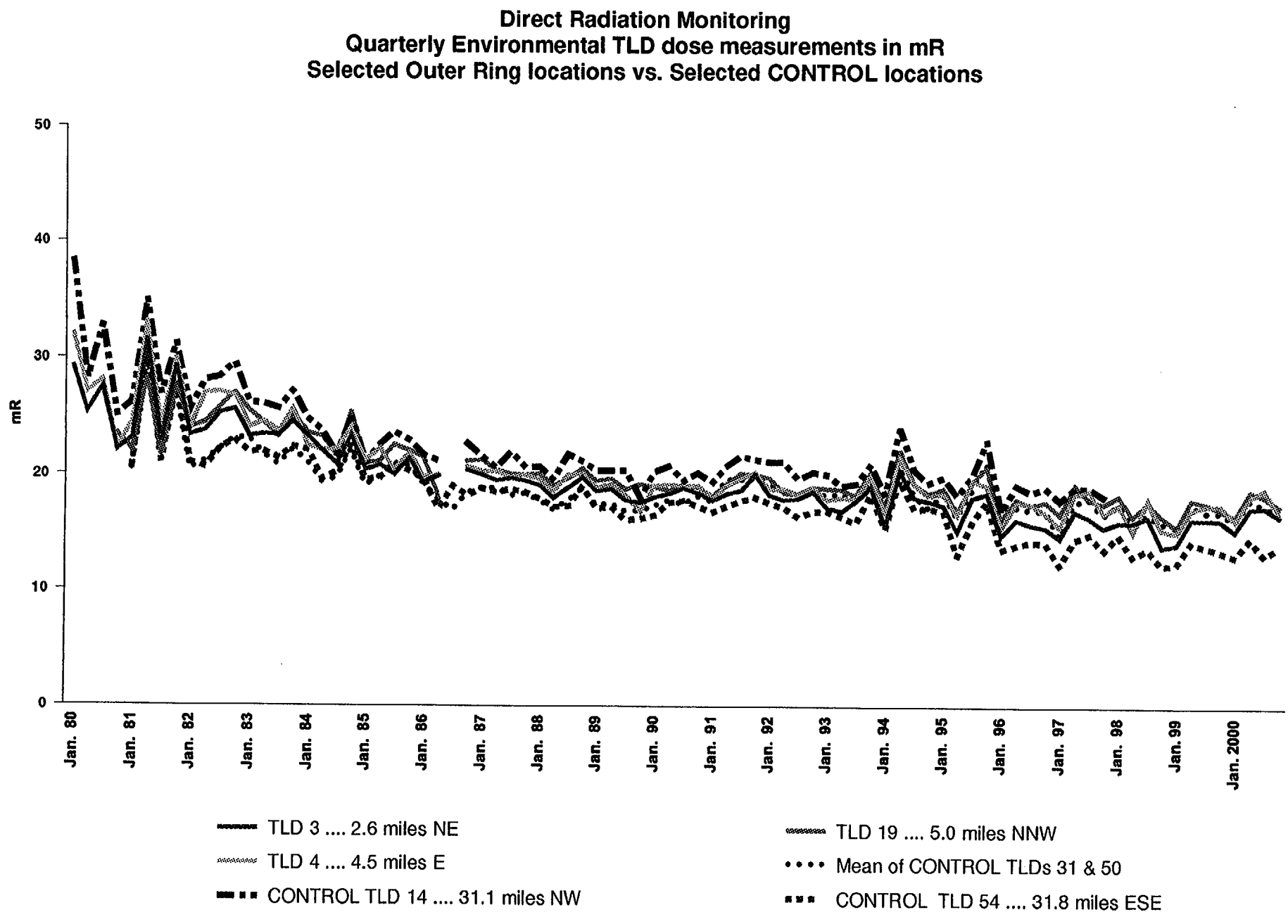
Direct Radiation Monitoring
Quarterly Environmental TLD dose measurements in mR
Selected Outer Ring locations vs. Selected CONTROL locations
mR
50
40
30
20
10
0
Jan. 80
Jan. 81
Jan. 82
Jan. 83
Jan. 84
Jan. 85
Jan. 86
Jan. 87
Jan. 88
Jan. 89
Jan. 90
Jan. 91
Jan. 92
Jan. 93
Jan. 94
Jan. 95
Jan. 96
Jan. 97
Jan. 98
Jan. 99
Jan. 2000
TLD 3 .... 2.6 miles NE
TLD 4 .... 4.5 miles E
CONTROL TLD 14 .... 31.1 miles NW
TLD 19 .... 5.0 miles NNW
Mean of CONTROL TLDs 31 & 50
CONTROL TLD 54 .... 31.8 miles ESE

Figure 2B

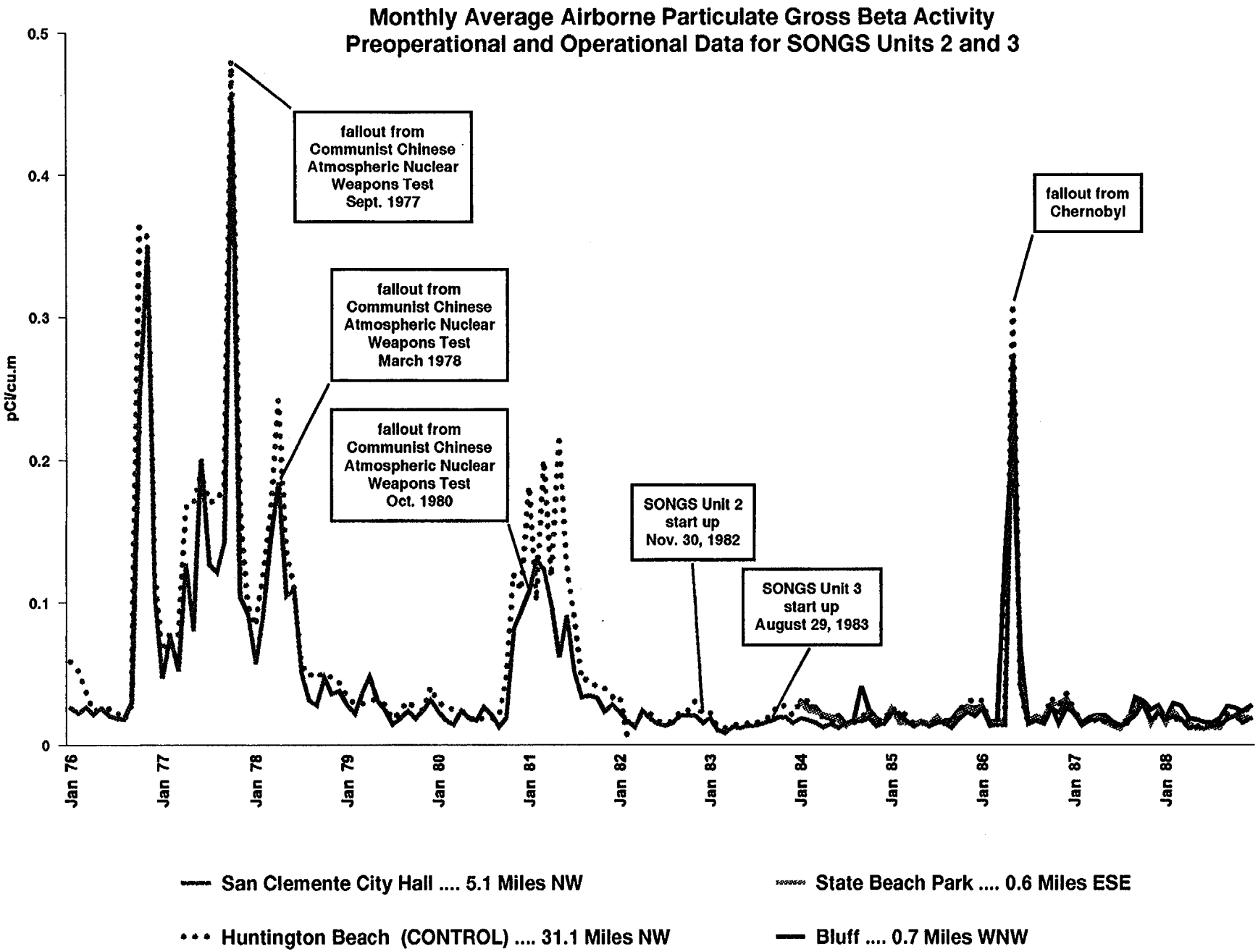
Monthly Average Airborne Particulate Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
pCi/cu.m
0.5
0.4
0.3
0.2
0.1
0
fallout from Communist Chinese Atmospheric Nuclear Weapons Test Sept. 1977
fallout from Communist Chinese Atmospheric Nuclear Weapons Test March 1978
fallout from Communist Chinese Atmospheric Nuclear Weapons Test Oct. 1980
SONGS Unit 2 start up Nov. 30, 1982
SONGS Unit 3 start up August 29, 1983
fallout from Chernobyl
Jan 76
Jan 77
Jan 78
Jan 79
Jan 80
Jan 81
Jan 82
Jan 83
Jan 84
Jan 85
Jan 86
Jan 87
Jan 88
San Clemente City Hall .... 5.1 Miles NW
State Beach Park .... 0.6 Miles ESE
Huntington Beach (CONTROL) .... 31.1 Miles NW
Bluff .... 0.7 Miles WNW

Figure 3A

Monthly Average Airborne Particulates Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
from January 1989 to December 2000

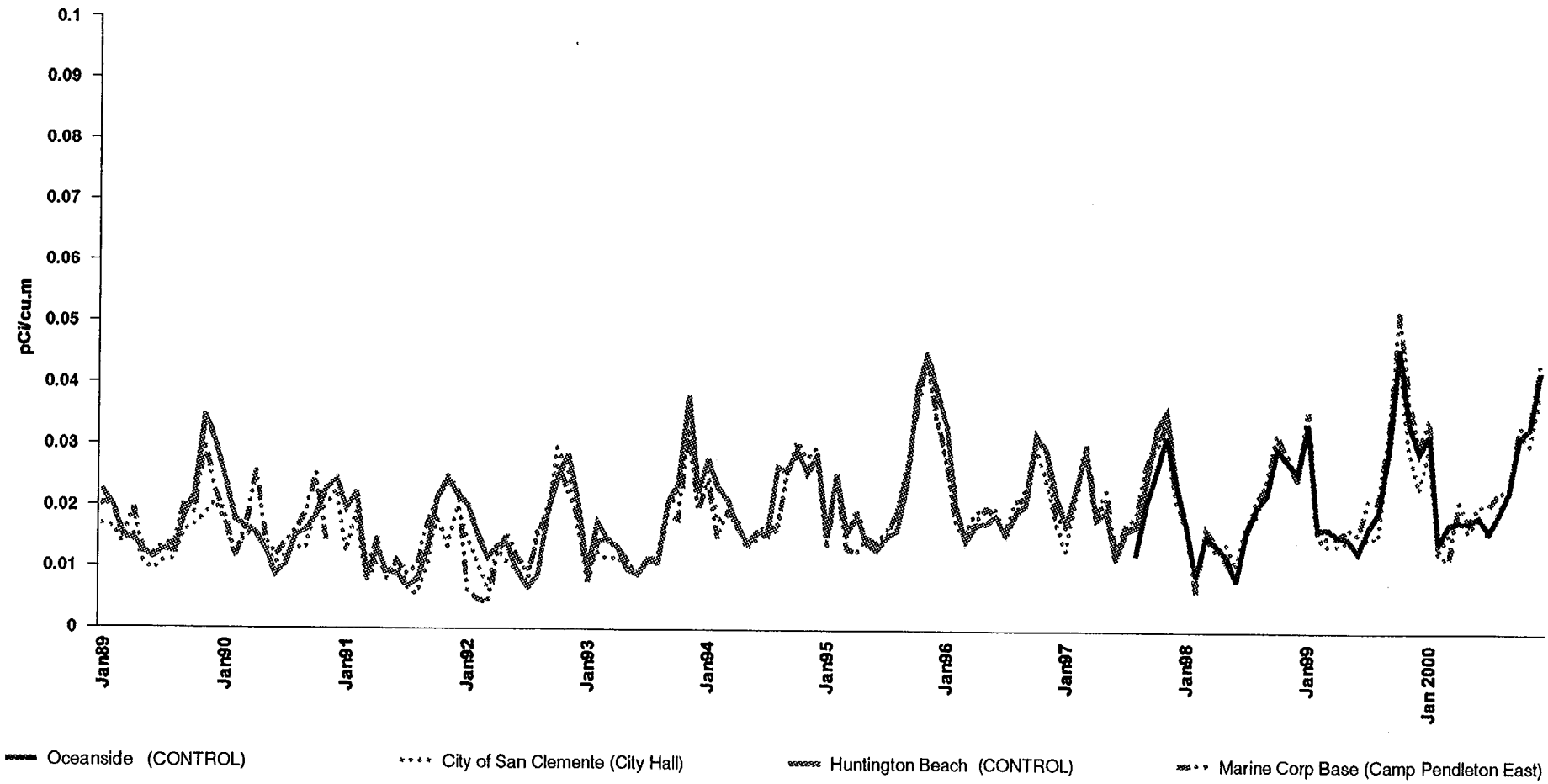

Figure 3B

2000 Weekly Airborne Particulate Gross Beta Activity
SONGS Units 1, 2 and 3

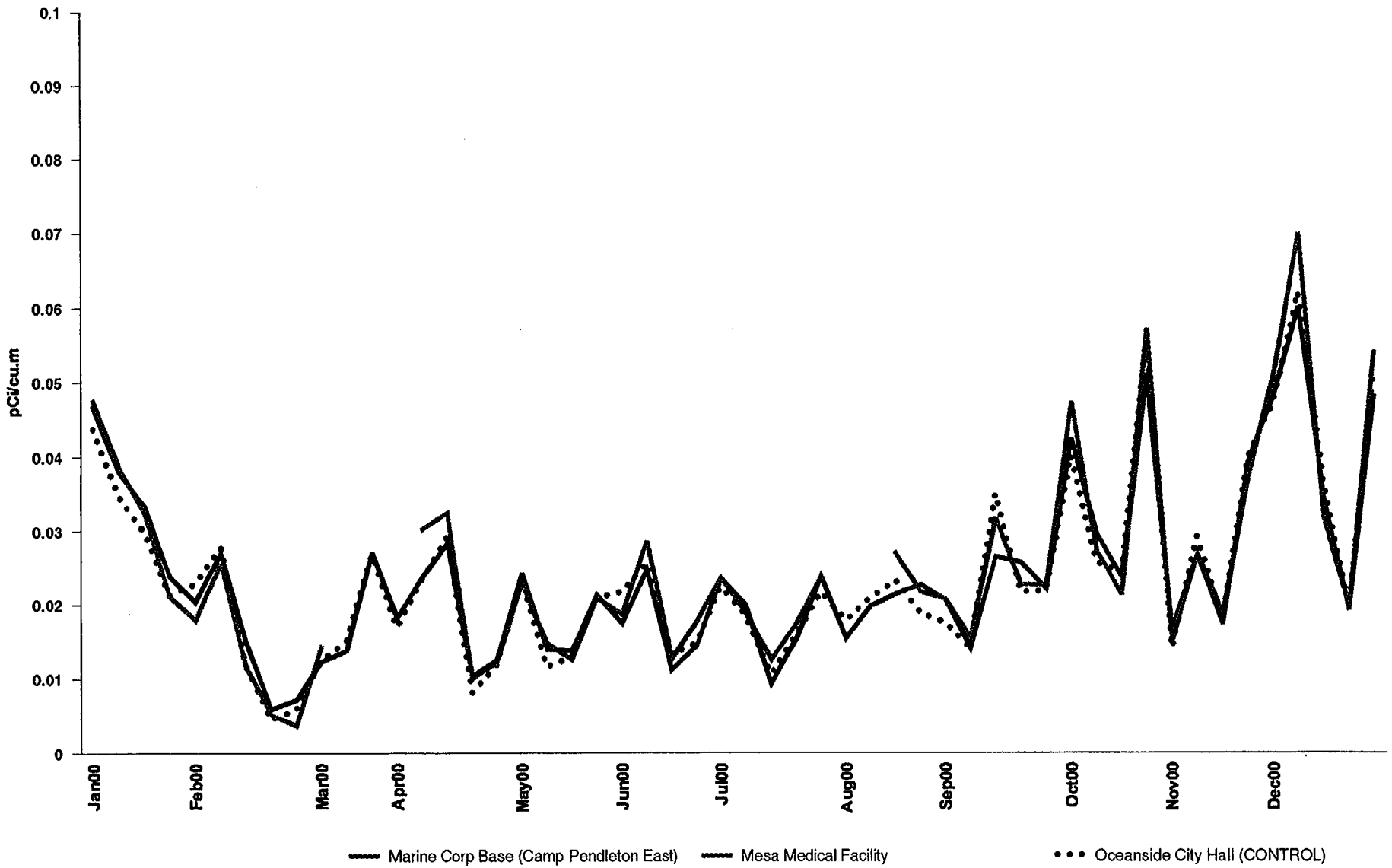

Figure 3C

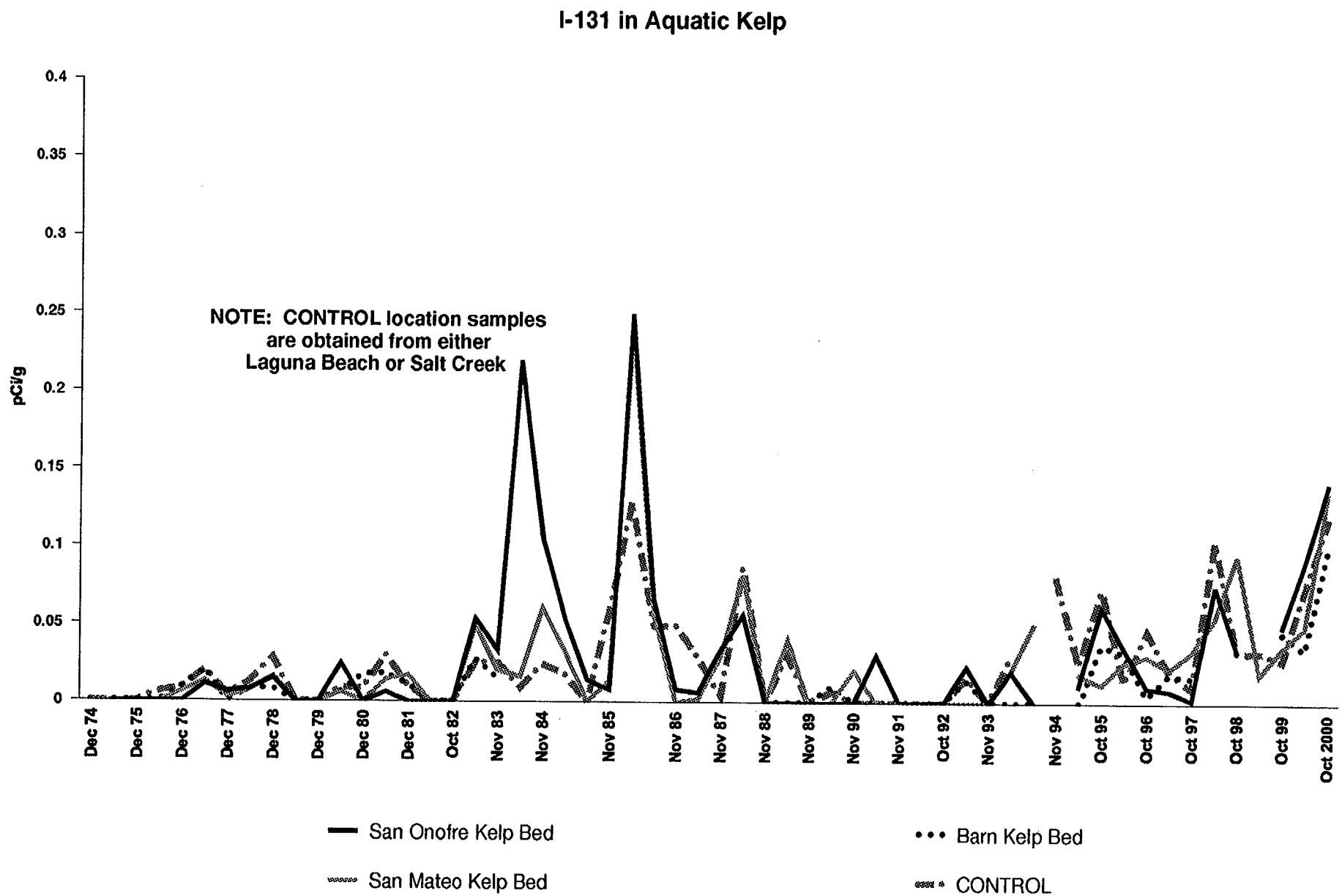
I-131 in Aquatic Kelp
pCi/g
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
NOTE: CONTROL location samples are obtained from either Laguna Beach or Salt Creek
Dec 74
Dec 75
Dec 76
Dec 77
Dec 78
Dec 79
Dec 80
Dec 81
Oct 82
Nov 83
Nov 84
Nov 85
Nov 86
Nov 87
Nov 88
Nov 89
Nov 90
Nov 91
Oct 92
Nov 93
Nov 94
Oct 95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

Figure 4

APPENDIX H

ERRATA TO THE 1999 AREOR

The following errors were detected in the 1999 AREOR:

Page 32	The correct unit of measure for direct radiation gamma exposure is mR. The unit of measure reported on page 32 was millirem.
Page 82	The average indicator location gross beta was 0.024 pCi/m^3 during 1999. The value reported on page 82 was 0.034 pCi/m^3.
Page 104	The LUC identification number for the San Mateo Point housing is R-P2. The identification number reported in the 1999 AREOR was R-P1.

APPENDIX I

REMP TLDs CO-LOCATED WITH NRC TLDs During 2000

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

The DHS also maintains a TLD program in the environs of SONGS. The DHS direct radiation monitoring program uses Radiation Detection Corporation (RDC) TLDs.

The below listed quarterly TLD data is from the SCE TLD program. NRC & RDC data are not listed. The NRC location numbers refer to the locations in the previous program, terminated before 2000.

		2000 Data from SCE TLDs			
Location Number	Location Name	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
SCE -1 , NRC -7, RDC -55	San Clemente	16.33	17.77	18.72	16.41
SCE -2, NRC -23, RDC -61	Camp San Mateo	16.78	19.78	19.32	18.37
SCE -3, NRC -19, RDC -62	Camp San Onofre	15.29	17.27	17.37	16.58
SCE -6, RDC -63	Old Route 101 (East-Southeast)	10.24	11.79	11.73	10.87
SCE 10, NRC -12, RDC -59	San Onofre Surfing Beach	15.53	16.40	16.58	16.75
SCE 16, RDC 60 *	ESE Site boundary	15.63	16.56	18.22	17.50
SCE 22, NRC 11, RDC 57	Coast Guard Station	15.26	18.39	18.38	17.42
SCE -34, NRC -14, RDC 58	San Onofre Elementary School	14.45	17.15	17.01	16.35
SCE 41, NRC 25, RDC 64**	Old Route 101 (Unit 3)	13.69	16.31	15.44	15.39
SCE 50, NRC 32, RDC 66	Oceanside Fire Station	15.85	16.80	15.90	16.27

* SCE 16 is approximately 15 meters from RDC 60. RDC 60 is across Basilone Rd.

** SCE 41 is approximately 120 meters from RDC 64. Results included per DHS request.