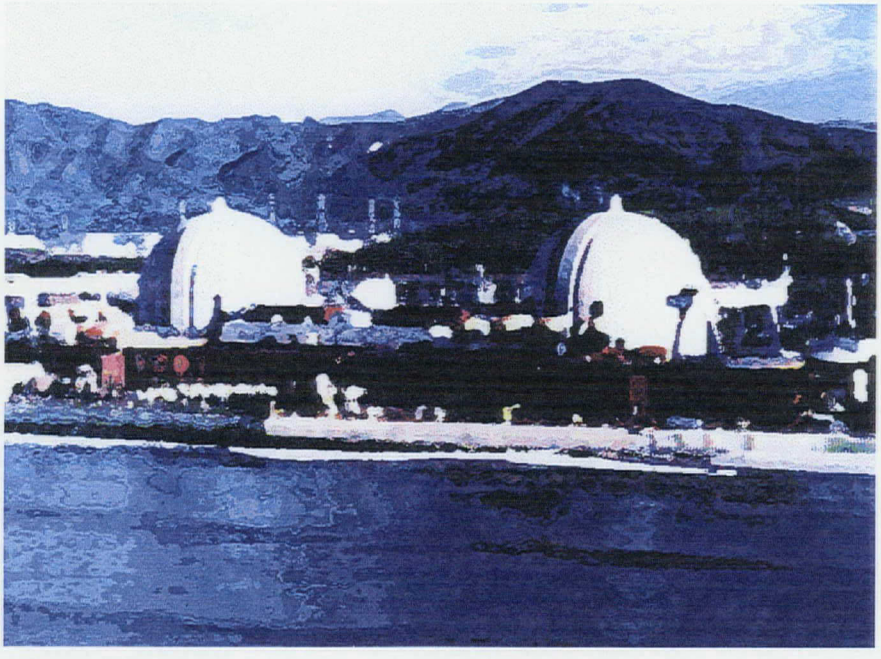
1996

Radiological Environmental

Operating Report



UNITS 1,2, & 3

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 1997

SOUTHERN CALIFORNIA EDISON
An *EDISON INTERNATIONAL* Company

1996 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

Prepared by: N. A. Hansen 4/17/97

Approved by: M. J. Johnson 4/18/97

Approved by: H. W. Newton 4/23/97

Approved by: E. S. Medling 4/22/97

Approved by: J. R. Clark 4/18/97

APRIL 1997

TABLE OF CONTENTS

INTRODUCTION

San Onofre Nuclear Generating Station (SONGS) consists of three pressurized water nuclear reactors housed in separate containment buildings. Unit 1 attained initial criticality June 1967 and was permanently shut down 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 Radiological Environmental Monitoring (REM) Program 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 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 were analyzed for both naturally-occurring and SONGS-related radionuclides.

The REM Program is conducted in accordance with Section 5.0 of the SONGS Unit 1 and 2/3 Offsite Dose Calculation Manuals (ODCM). Administrative control of the program was conducted in accordance with the Unit 1 Facility Operating (Possession Only) License, Appendix A, sections D4 and D6; and in accordance with the Units 2/3 Facility Operating License, Appendix A, Technical Specification, sections 6.8.4(f), 6.9.1.6, and 6.8.1(h).

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 1994 Annual Radiological Environmental Operating Report (AREOR).

A land use census was performed in 1996 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.

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 and iodine-131, and activation products such as cobalt-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 contribute to human radiation exposure as an external 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 activation (capture of thermal neutrons) of deuterium in the water 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 1994 Annual Radiological Environmental Operating Report. Refer to the 1994 AREOR for detailed information on this analysis.

REGULATORY LIMITS, GUIDANCE, AND REQUIREMENTS

* 10CFR50

The Code of Federal Regulations Title 10, Part 50, Appendix I (10CFR50, Appendix I) provides limits on the releases of radioactivity to the environment and the resulting dose to the public.

* 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

Revised (as of Jan. 1, 1994) 10CFR20, Appendix B, Tables 1 and 2, Effluent Concentrations in Air and Water above Natural Background.

Guidance:

* Standard Technical Specifications, NUREG-0472

Standard Radiological Effluents Technical Specifications for PWRs Based on Regulatory Guide 4.8, Table 2, Rev. 3, 1989

* 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

* Revised 10CFR50, Appendices I and A

Etablishment of an Appropriate Surveillance and Monitoring Program, Sections IV.B.2 and IV.B.3 (Appendix I) Criterion 64: Monitoring Radioactivity Releases (Appendix A)

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 Statistical Analysis System (SAS) software package was used to perform the statistical analysis and tabulation of the data.

The radiological environmental data are reviewed for accuracy and comparison against NRC reporting levels, and then entered into the SAS database. One of the sub-menus creates a maximum value table which enables the user to single-out measurements exceeding the administrative levels (10% of the NRC reporting levels) established by Southern California Edison (SCE). Data exceeding these maximum values are flagged.

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 1996 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 by Quality Assurance requirements as defined in Regulatory Guide 4.15. The Contracted Environmental Analysis (CEA) Laboratory participated in the EPA interlaboratory comparison program as part of quality assurance requirements for environmental monitoring. A split sampling program was conducted in cooperation with the State of California Department of Health Services. Refer to Appendix C.

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 testing; seasonal variability of fallout; soil conditions; local terrain and variability in the natural environment.

Radiological environmental data collected throughout 1996 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 1994 AREO Report).

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 1996 against the levels observed in pre-operational years.

5. Historical trending of radionuclides in various media during operational years (detailed examination contained in 1994 AREO Report).

In comparing these findings to the conservatively-defined limits of the facility operating licenses, it is concluded that the radiological environmental impact of San Onofre Units 1, 2 and 3 operations through 1996 has been negligible, and the resulting dose to man is negligible.

REFERENCES

1. 10CFR20, 10CFR50 (both revised as of January 1, 1994).

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, September 1996.

4. ODCM (Offsite Dose Calculation Manual) for SONGS Units 1, 2 and 3, Section 5.0, 1996.

5. SONGS Radiological Monitoring (RM) Procedures: SO123-RM-1 (SO123-IX-10)

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	.17 **	E
13	Southeast Site Boundary (Bluff)	0.4 **	ESE #
14	Huntington Beach Generating Station	31.1 #	NW
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

\# These locations reflect changes from the 1995 Annual Report due to more accurate mapping. During the 1996 Land Use Census, a Global Positioning System receiver was used to verify REMP sample locations. The data from the GPS survey was incorporated into the REMP map database.

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	.34 ** #	E
44	Fallbrook Fire Station	17.7 #	E
46	San Onofre State Beach Park	1.0	SE
47	Camp Las Flores - MCB	8.6	SE
49	Camp Chappo - MCB	12.8	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 (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

\# These locations reflect changes from the 1995 Annual Report due to more accurate mapping. During the 1996 Land Use Census, a Global Positioning System receiver was used to verify REMP sample locations. The data from the GPS survey was incorporated into the REMP map database.

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION	DISTANCE * (miles)	DIRECTION * (sector)
Direct Radiation (Continued) ***			
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)	0.23 ** #	W #
56	San Onofre State Beach (Unit 1, Southwest)	0.16 ** #	W #
57	San Onofre State Beach (Unit 2)	0.10 **	WSW #
58	San Onofre State Beach (Unit 3)	0.10 **	S
59	SONGS Meteorological Tower	0.30 **	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)	0.5 #	NW
68	Range 210C - MCB	4.3	ENE
73	South Yard	0.37 #	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 (0.4 mile in all sectors) 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

\# These locations reflect changes from the 1995 Annual Report due to more accurate mapping. During the 1996 Land Use Census, a Global Positioning System receiver was used to verify REMP sample locations. The data from the GPS survey was incorporated into the REMP map database.

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
2	Camp San Onofre (Camp Pendleton)	2.4 #	NE
3	Huntington Beach Generating Station (CONTROL)	31.1 #	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	0.5 #	NW
13	Marine Corp Base (Camp Pendleton East)	0.7	E
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
4	Huntington Beach Generating Station (CONTROL)	31.1 #	NW
5	Former Visitor's Center (East Site Boundary)	0.38 ** #	NNW

* 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

= These locations reflect changes from the 1995 Annual Report due to more accurate mapping. During the 1996 Land Use Census, a Global Positioning System receiver was used to verify REMP sample locations. The data from the GPS survey was incorporated into the REMP map database.

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	0.5	SSW
B	Outfall - Unit 2	0.7	SW
C	Outfall - Unit 3	0.7	SW
D	Newport Beach (CONTROL)	30.0	NW
Drinking Water			
1	Tri-Cities Municipal Water District Reservoir	8.6 #	NW
2	San Clemente Golf Course Well	3.3 #	NW #
3	Huntington Beach (CONTROL)	31.1 #	NW
Shoreline Sediment (Beach Sand)			
1	San Onofre State Beach (0.6 mile)	0.6	SE
2	San Onofre Surfing Beach	0.8 #	WNW #
3	San Onofre State Beach (3.1 miles)	3.5 #	SE
4	Newport Beach North End (CONTROL)	29.2 #	NW
Local Crops			
1	San Mateo Canyon (San Clemente Ranch)	2.6	NW
2	Southeast of Oceanside (CONTROL)	22.0	SE
3	Cotton Point Estates (Casa Pacifica)	2.8	WNW

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

\# These locations reflect changes from the 1995 Annual Report due to more accurate mapping. During the 1996 Land Use Census, a Global Positioning System receiver was used to verify REMP sample locations. The data from the GPS survey was incorporated into the REMP map database.

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

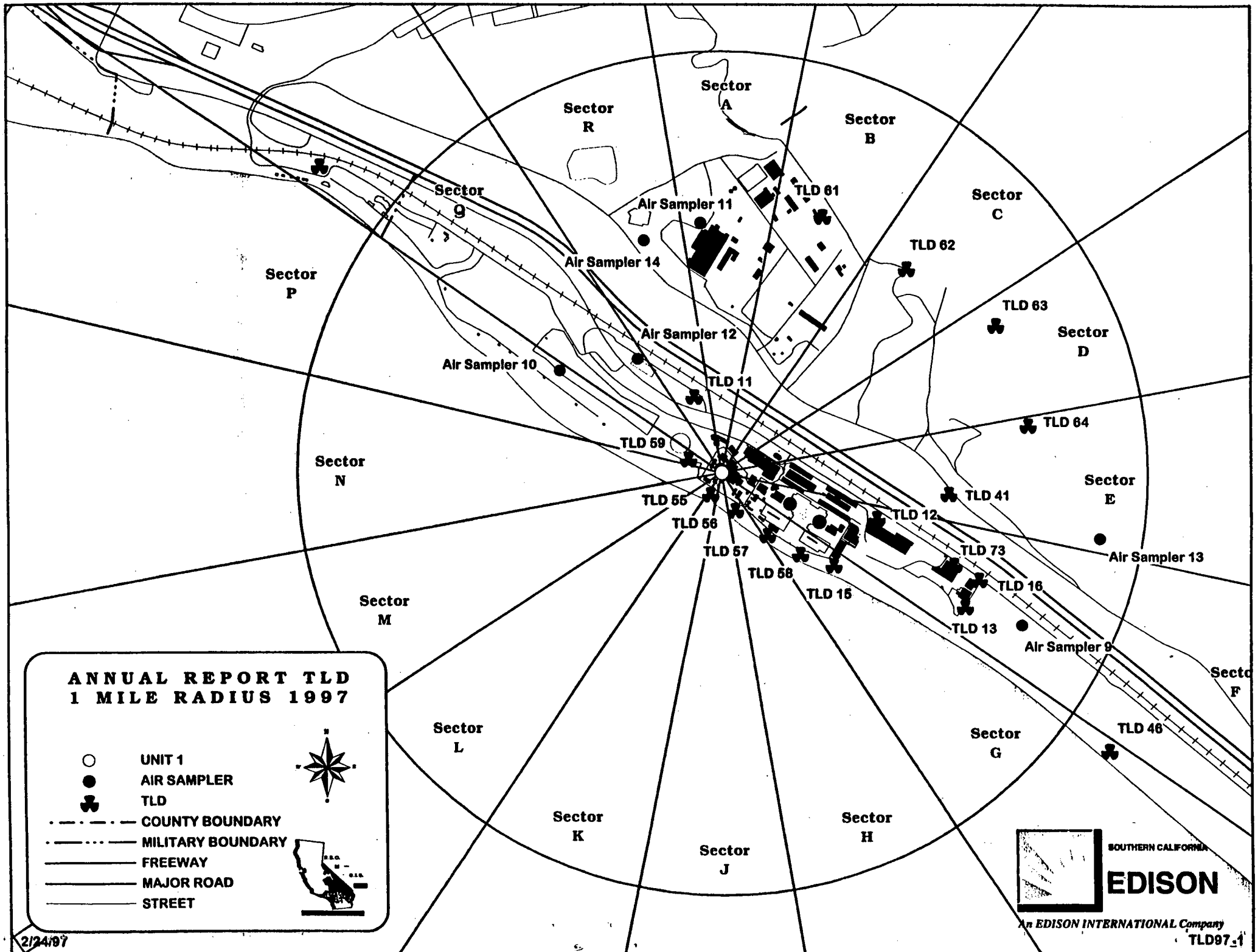
	TYPE OF SAMPLE AND SAMPLING LOCATION	DISTANCE * (miles)	DIRECTION * (sector)
Non-Migratory Marine Animals			
A	Unit 1 Outfall	0.9	WSW
B	Units 2 and 3 Outfall	1.5	SSW
C	Laguna Beach (CONTROL)	18.2	NW
Kelp			
A	San Onofre Kelp Bed	1.5	SSW
B	San Mateo Kelp Bed	3.8	WNW
C	Barn Kelp Bed	6.3	SSE
D	Laguna Beach (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

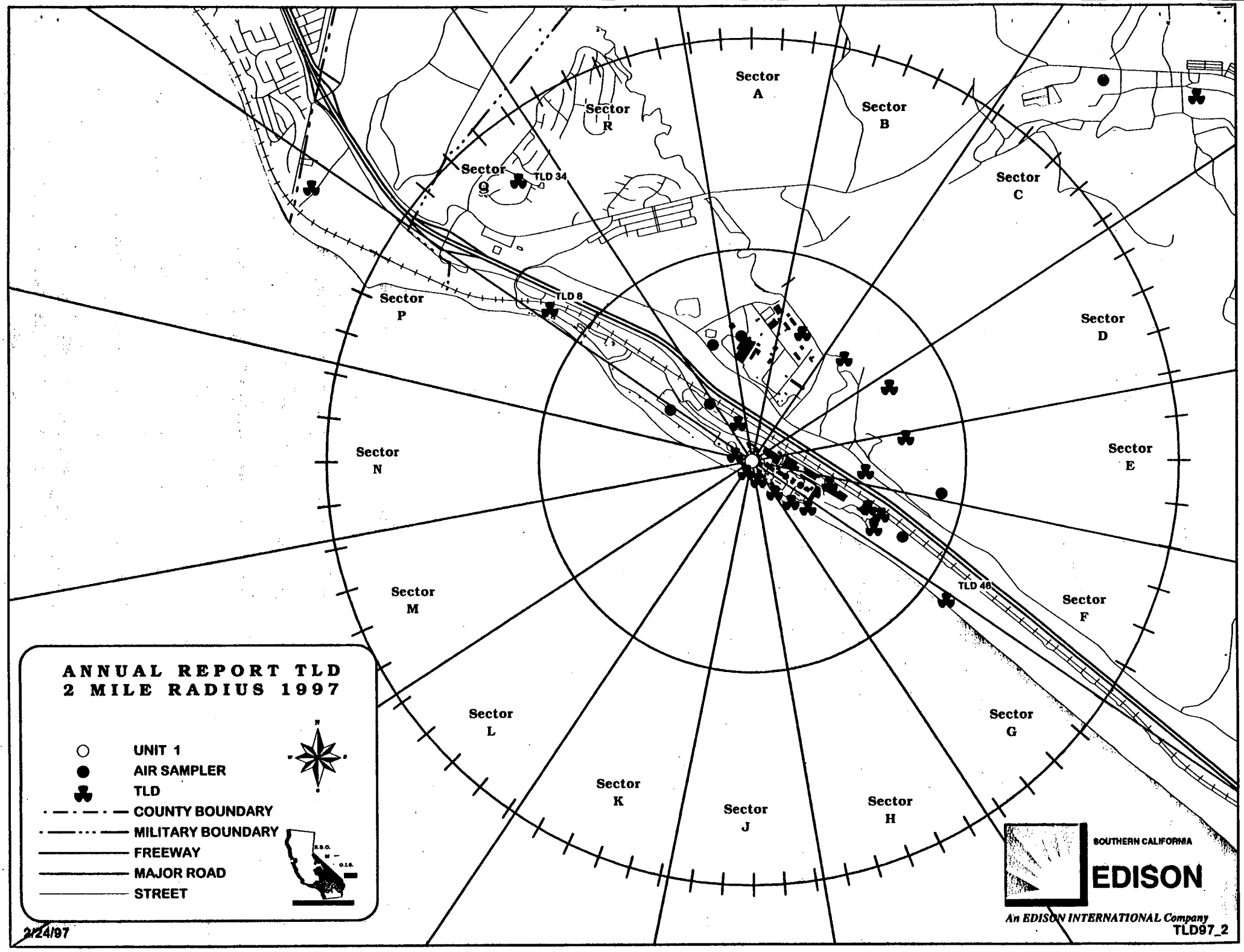
* Distance (miles) and Direction (sector) are measured relative to Units 2 & 3 midpoint. Direction is determined from degrees true north.

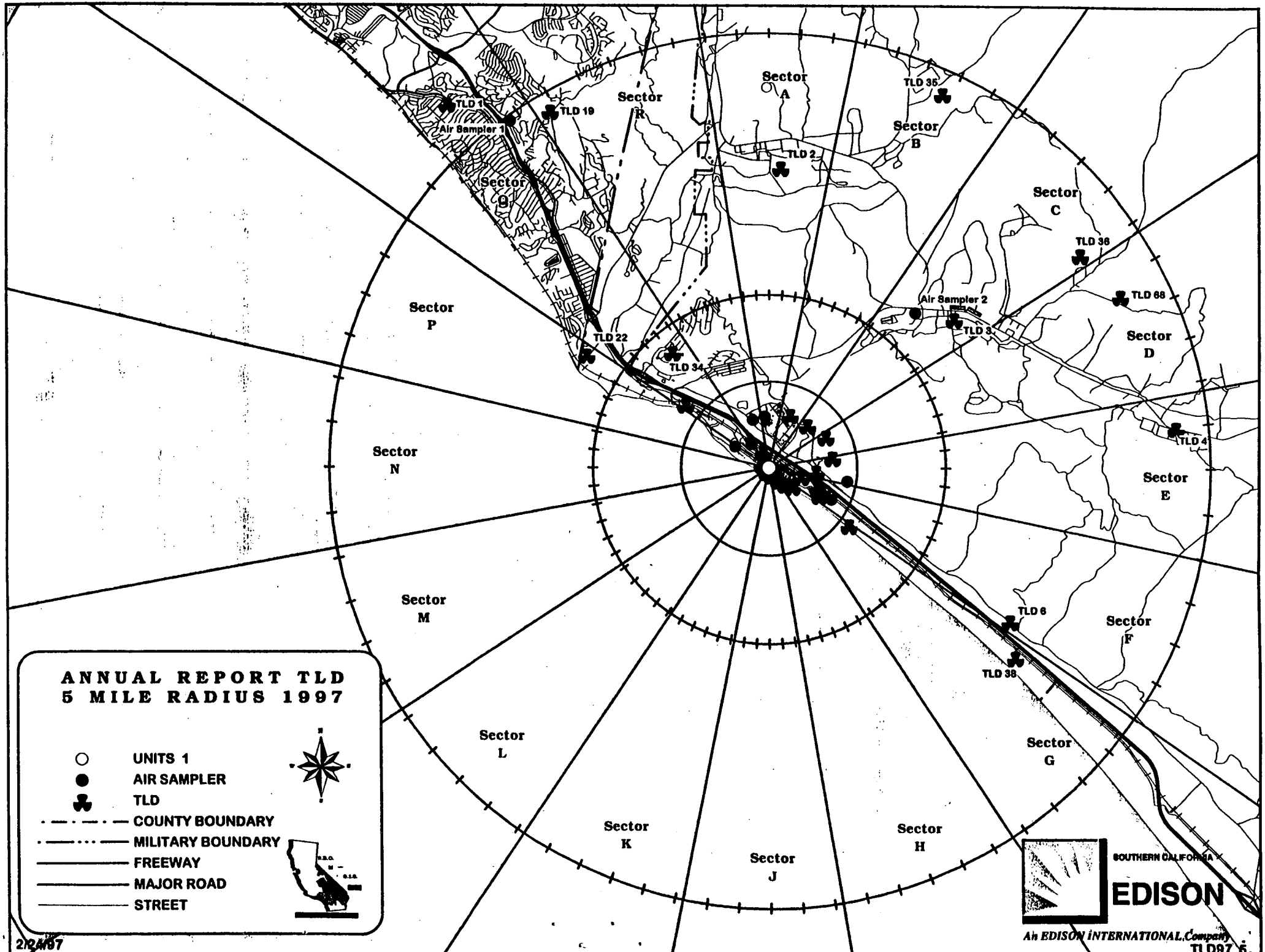
TABLE A-2

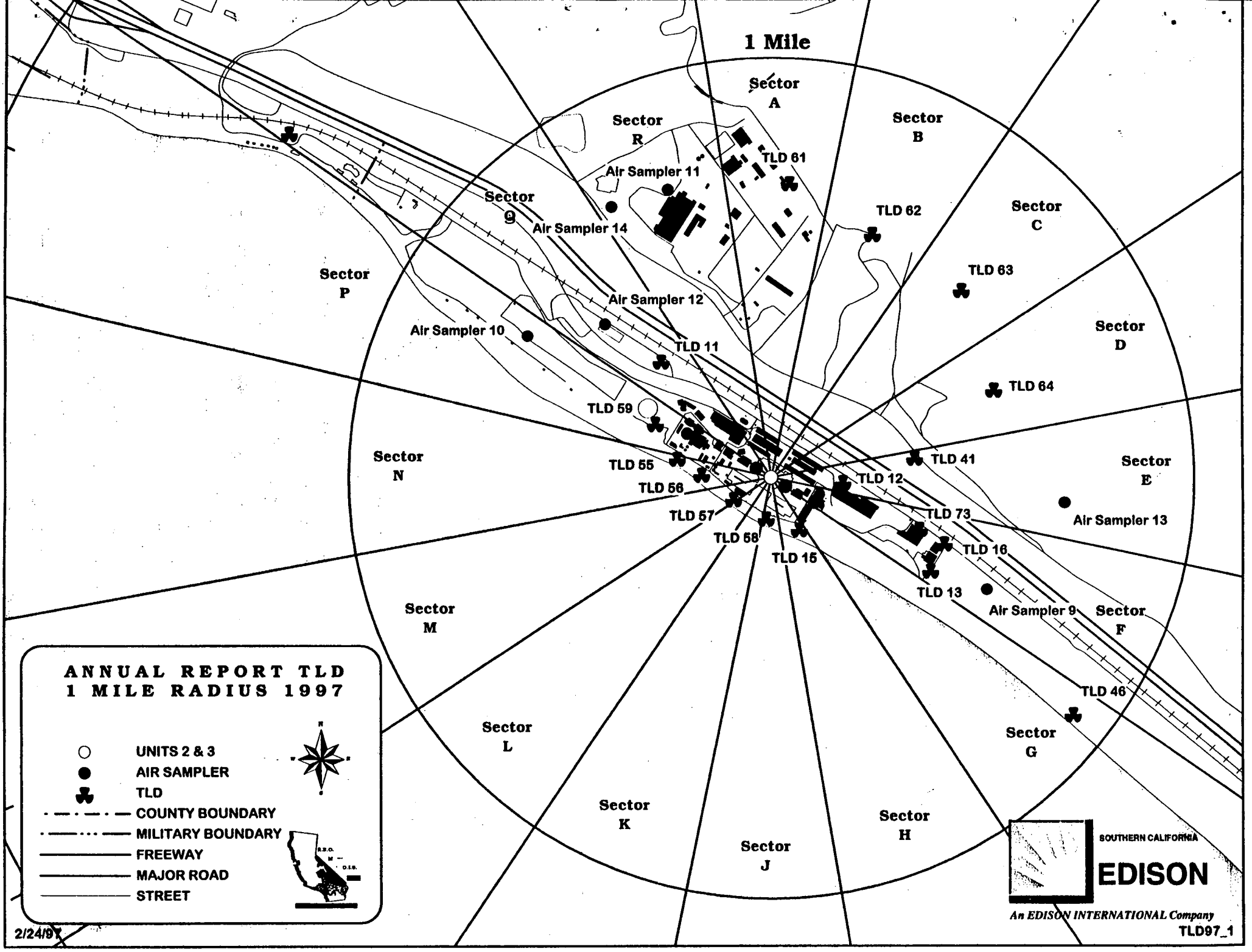
SECTOR AND DIRECTION DESIGNATION FOR RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATION MAP

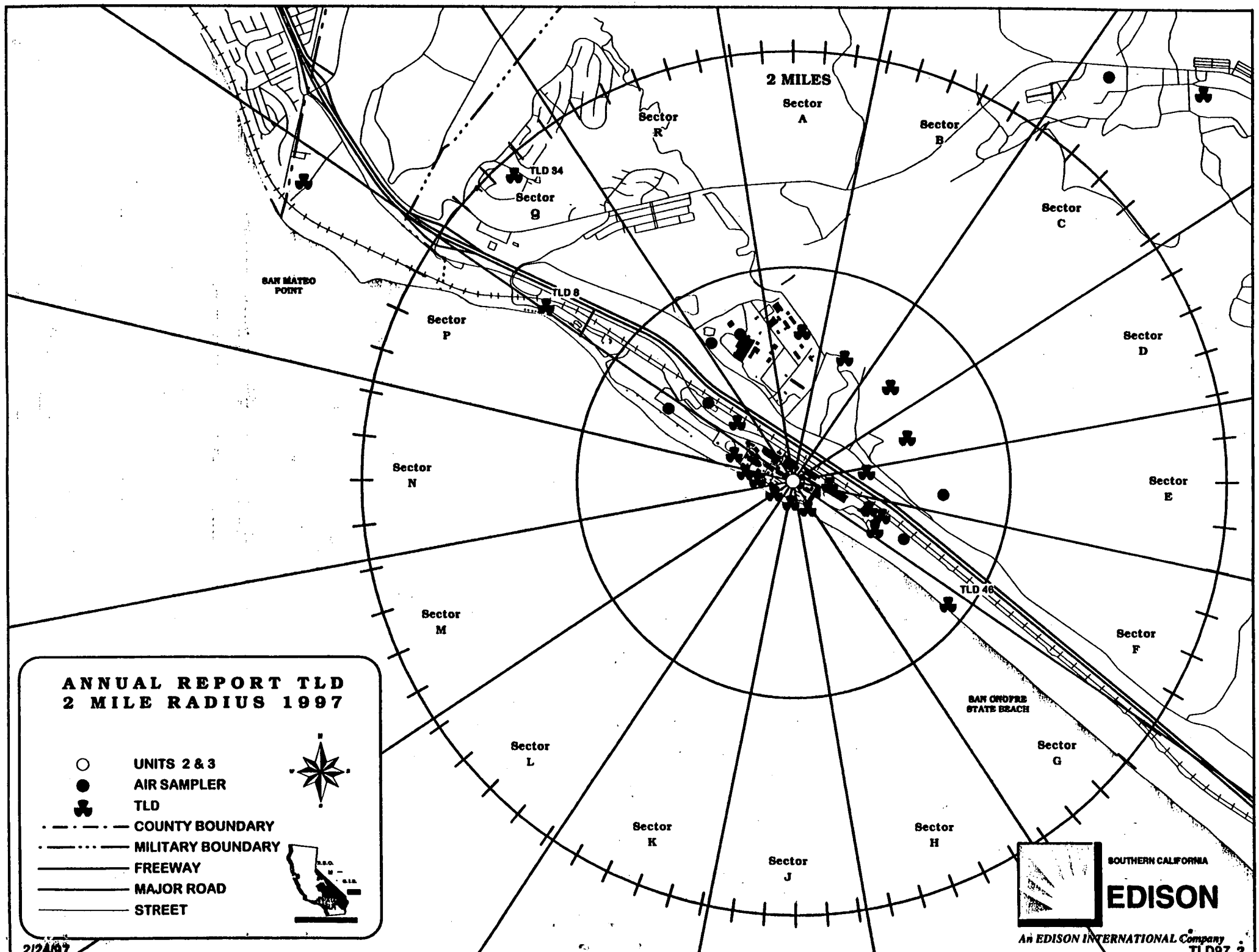
DEGREES TRUE NORTH FROM SONGS 2 AND 3 MIDPOINT			NOMENCLATURE	
Sector Limit	Center Line	Sector Limit	22.5° Sector	Direction
348.75	0 & 360	11.25	A	N
11.25	22.5	33.75	B	NNE
33.75	45.0	56.25	C	NE
56.25	67.5	78.75	D	ENE
78.75	90.0	101.25	E	E
101.25	112.0	123.75	F	ESE
123.75	135.0	146.25	G	SE
146.25	157.0	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

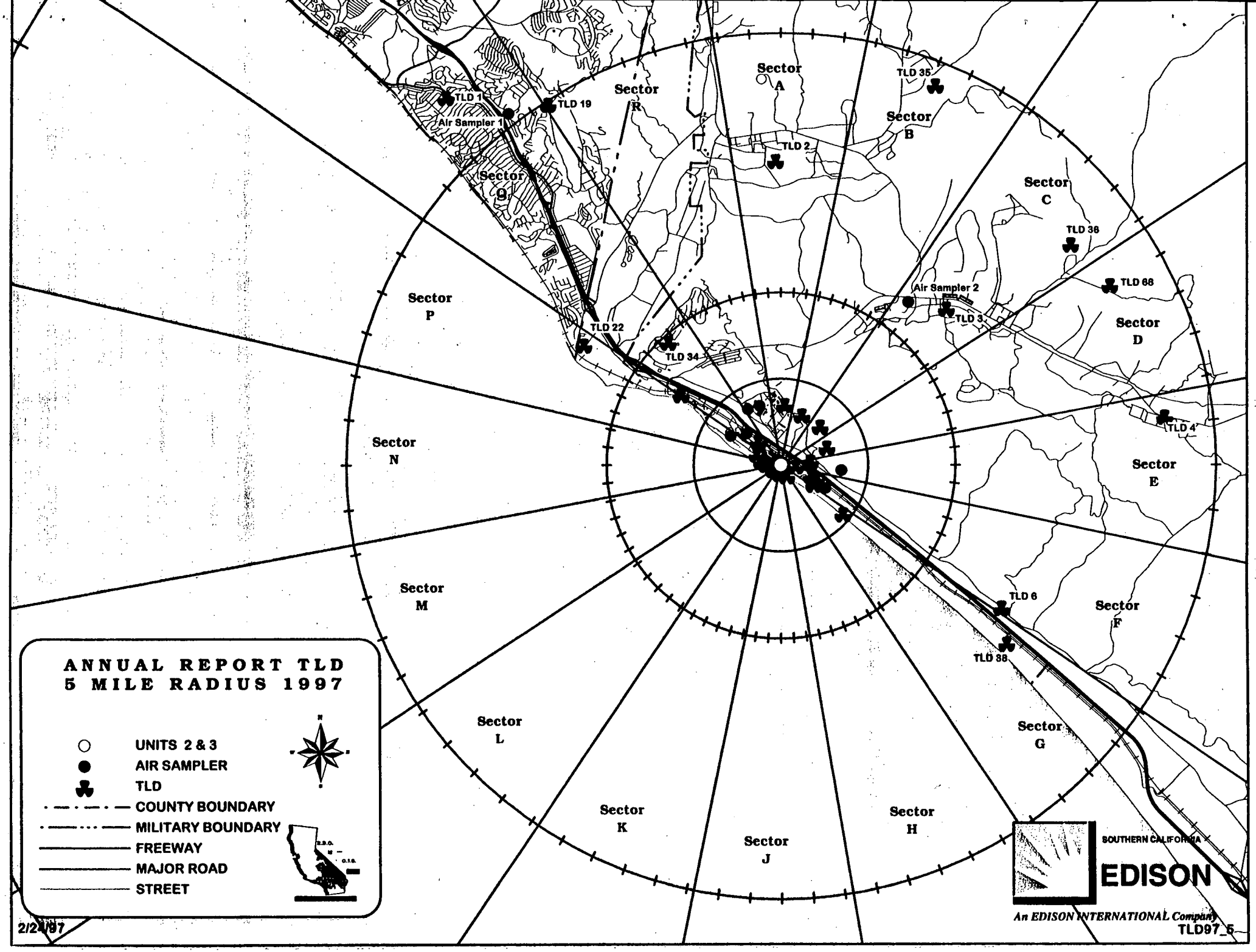

Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector R
Sector 9
Air Sampler 11
Air Sampler 14
Air Sampler 12
Air Sampler 10
Air Sampler 13
Air Sampler 9
TLD 61
TLD 62
TLD 63
TLD 64
TLD 11
TLD 59
TLD 55
TLD 56
TLD 57
TLD 58
TLD 15
TLD 12
TLD 41
TLD 73
TLD 16
TLD 13
TLD 46
ANNUAL REPORT TLD
1 MILE RADIUS 1997
UNIT 1
AIR SAMPLER
TLD
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
2/24/97
TLD97-1

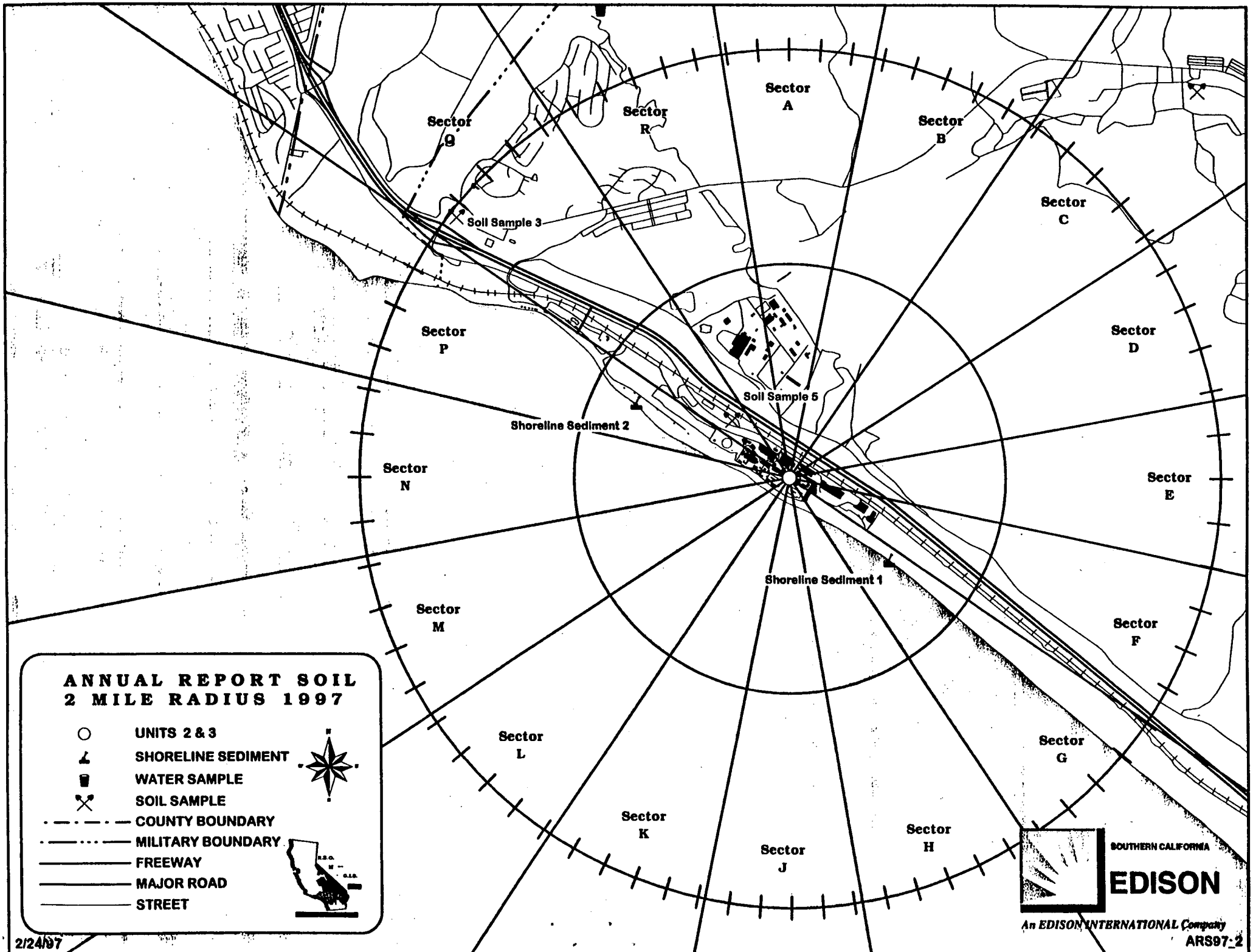

Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector R
Sector Q
TLD 34
TLD 8
TLD 46
ANNUAL REPORT TLD
2 MILE RADIUS 1997
UNIT 1
AIR SAMPLER
TLD
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
2/24/97
TLD97_2


ANNUAL REPORT TLD
5 MILE RADIUS 1997
UNITS 1
AIR SAMPLER
TLD
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector Q
Sector R
TLD 1
TLD 19
Air Sampler 1
TLD 35
TLD 2
TLD 36
TLD 68
Air Sampler 2
TLD 3
TLD 22
TLD 34
TLD 4
TLD 6
TLD 38
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
2/24/97
TLD97-5


1 Mile
Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector R
Sector 9
TLD 61
TLD 62
TLD 63
TLD 64
TLD 41
TLD 12
TLD 73
TLD 16
TLD 13
TLD 15
TLD 68
TLD 57
TLD 56
TLD 55
TLD 59
TLD 11
TLD 46
Air Sampler 11
Air Sampler 14
Air Sampler 12
Air Sampler 10
Air Sampler 13
Air Sampler 9
ANNUAL REPORT TLD
1 MILE RADIUS 1997
UNITS 2 & 3
AIR SAMPLER
TLD
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
2/24/97
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
TLD97_1


2 MILES
Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector R
Sector 9
TLD 34
TLD 8
TLD 46
SAN MATEO POINT
SAN ONOFRE STATE BEACH
ANNUAL REPORT TLD
2 MILE RADIUS 1997
UNITS 2 & 3
AIR SAMPLER
TLD
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
2/24/97
TLD97-2


Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector R
Sector Q
TLD 1
TLD 19
Air Sampler 1
TLD 2
TLD 35
TLD 36
TLD 68
Air Sampler 2
TLD 3
TLD 4
TLD 22
TLD 34
TLD 6
TLD 38
ANNUAL REPORT TLD
5 MILE RADIUS 1997
UNITS 2 & 3
AIR SAMPLER
TLD
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
N
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
2/24/97
TLD97_5


Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector H
Sector J
Sector K
Sector L
Sector M
Sector N
Sector P
Sector R
Sector 9
Soil Sample 3
Soil Sample 5
Shoreline Sediment 2
Shoreline Sediment 1
ANNUAL REPORT SOIL
2 MILE RADIUS 1997
UNITS 2 & 3
SHORELINE SEDIMENT
WATER SAMPLE
SOIL SAMPLE
COUNTY BOUNDARY
MILITARY BOUNDARY
FREEWAY
MAJOR ROAD
STREET
N
SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company
2/24/97
ARS97-2

APPENDIX B

SUMMARY, RESULTS, AND DISCUSSIONS

OF 1996 ENVIRONMENTAL DATA

SUMMARY

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 1996 to December 1996 were evaluated. The 1994 Annual Radiological Environmental Operating Report (AREOR) and historical data were also reviewed. An updated evaluation of trends is included herein. Refer to the 1994 AREOR for detailed historical data. In 1996 the radioactivity detected in Radiological Environmental Monitoring Program (REMP) samples was almost exclusively from naturally occurring isotopes. Table B-1 summarizes the REMP samples obtained in 1996. A statistical summary of the 1996 REMP data is contained in Table B-2.

Of the 563 isotopically analyzed REMP samples, two (2) results were slightly above detection limit for SONGS related isotopes but, the trend continues to be towards de minimis levels of anthropogenic radioactivity in the environs of SONGS. We conclude that SONGS had a neglible radiological impact to the environment during 1996.

RESULTS AND DISCUSSIONS OF 1996 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 ($CaSO_4$:Dy) thermoluminescent dosimeters (TLD's) were placed at each of 45 indicator and control locations. They were then collected and analyzed at prescribed intervals in accordance with ANSI-N545 standards. The two control locations were in Mission Viejo (Aurora Park at 18.6 miles, NW) and in Oceanside (Fire Station at 15.6 miles, SE). Several other locations may also serve as backup control TLDs if necessary. The TLDs were replaced with re-zeroed dosimeters every quarter. The indicator locations are selected as inner and outer rings for all three Units (Tables B1, B2, B3, and B4), 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.

A total of 6 laboratory control TLDs were analyzed quarterly. TLD numbers 17, 18, and 60 are used for background dose normalization. TLD's #A and #B are used to compensate for transit dose. A fader TLD 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. Quarterly doses measured by the calcium sulfate TLDs from the indicator locations ranged from 10.4 to 27.6 mrem, with an average dose of 15.5 mrem. The location at the San Onofre State Beach (location #55, at 0.2 miles WSW of Unit 1) had the highest TLD reading in the first quarter (22.7 mrem), with an average quarterly dose of 19.6 mrem (uncorrected for background). Subtracting a background dose of 74 mrem/year, the net annual dose for this location was 0.20 mrem based on an occupancy factor of 300 hours per year for beach users. This location is within the Units 1,2, &3 site boundary and was not required by the ODCM.

The quarterly doses measured by the calcium sulfate dosimeters for the control locations #31 and #50, ranged from 16.1 to 21.5 mrem with an average dose of 18.6 mrem.

In most locations, a correlation can be seen between the control and indicator locations. The current "control" is the numerical average of the readings at locations #31 and #50. The close correlation observed between the control and the indicator locations show that other factors such as environmental and seasonal variations are responsible and that power plant effects are negligible.

Figures 2A & 2B compare environmental radiation levels of indicator and control locations for the operational year 1996 and for previous years. These figures show the comparison between the controls and inner ring locations. Because virtually all the measured doses at locations near SONGS were considered comparable to the direct radiation dose measured at the two control locations, it was concluded that SONGS operations had a negligible impact on direct radiation exposure.

B. Airborne Particulate, Iodine, and Composite Isotopic Analyses

Sample locations are selected according to with the requirements of the Unit 1 and Units 2/3 Offsite Dose Calculation Manuals.

The locations with the highest annual average D/Q (deposition factor in $1/m^2$) and the highest occupancy factor were evaluated for Units 2 and 3 and the angles and distance were translated using a spreadsheet to obtain the equivalent distance and angle (Sector) for Unit 1.

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 the presence of specific radionuclides. Gross beta measurement then acts as a tool to identify whether or not action may be taken for further analysis.

Air particulate samples were collected on a weekly basis from seven indicator locations and from a control location situated in the city of Huntington Beach. After collection, the samples were analyzed for gross beta activity.

Gross beta activity in all indicator and control samples were above the lower limit of detection. The concentration of gross beta activity in the samples collected from the indicator locations ranged from 0.008 to 0.048 pCi/m^3, averaging 0.022 pCi/m^3 of air. The concentrations of gross beta activity in the samples from Huntington Beach control location ranged from 0.010 to 0.052 pCi/m^3, averaging 0.022 pCi/m^3 of air. The gross beta activity average for all indicator locations equal the average for the control location (0.022 pCi/m^3). The control and indicator locations gross beta data show a close correlation. Figures 3E and 3F show the variation in gross beta activity level in 1996 in different locations.

Per requirement 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 #3). The results showed that indicator locations maximum gross beta activity in air in 1996 was 0.048 pCi/m^3 and the control location average was 0.022 pCi/m^3. No action was taken since the indicator value of 0.048 pCi/m^3 did not exceed ten times the annual average gross beta activity of the control (0.22 pCi/m^3).

All samples analyzed for I-131 were less than the lower limit if detection. Samples were also composited quarterly and analyzed for 28 naturally-occurring and station-related radionuclides by gamma spectral analysis. The quarterly composite analyses yielded only naturally occurring Be-7 and NO plant related isotopes. It can therefore be concluded that the operation of SONGS had a negligable impact on this sample medium.

C. *Ocean Water*

In 1996, ocean water samples were collected on a monthly basis in the vicinity of each of the station discharge outfalls (which served as the indicator locations), and from Newport Beach (which served as the control location). Upon collection, each sample was analyzed for naturally-occurring and station-related gamma-emitting radionuclides. Ocean water samples were composited quarterly and analyzed for tritium according to ODCM requirements.

Throughout 1996 only naturally occurring potassium-40 was detected in the monthly gamma spectral analyses of samples. Tritium was not detected in any of the quarterly-composite samples. The data indicate that SONGS operations had no impact on this environmental medium.

D. *Drinking Water*

In 1996, drinking water samples were collected on a monthly basis from two indicator locations and from a control location situated in Huntington Beach. Indicator sample #2 (San Clemente Golf Course well) was unavailable for sampling during a portion of 1996. The City of San Clemente secures this well for aquifer regeneration during the winter months. Upon collection the samples were analyzed for tritium, gross beta, and 28 naturally-occurring and SONGS-related gamma emitting radionuclides.

It should be noted that there is no drinking water pathway for liquid effluent at SONGS. The gross beta analysis data indicates a close correlation between indicator and control locations. Based on these results, it can be concluded that the operation of SONGS had no impact on this sample medium.

Neither tritium nor any other radionuclides were detected in the 1996 monthly drinking water samples.

E. *Shoreline Sediment (Beach Sand)*

Beach sand was collected semiannually in 1996 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. In 1996 two naturally-occurring radionuclides were detected in shoreline sediment samples (K-40 and Th-228). The variation of the concentrations of these radionuclides in the shoreline sediment samples is considered to be characteristic of this environmental medium. Based on these results, it can be concluded that the operation of SONGS had no impact on this sample medium.

F. *Ocean Bottom Sediments*

To monitor the radioactivity in ocean bottom sediments in the vicinity of SONGS representative samples were collected semiannually near each of the Station discharge outfalls and from Newport Beach which served as a control location. After collection, the samples were analyzed by gamma-spectral analysis for 28 naturally-occurring and station-related radionuclides. In 1996 the only radionuclides detected in this sample medium were naturally occurring K-40 and Th-228. The data indicate no measurable effect from the operation of SONGS on this sample medium.

G. *Non-Migratory Marine Species (Flesh)*

During 1996, non-migratory marine species were collected near SONGS Unit 1, 2, and 3 outfalls. Species of adult fish, crustacea and mollusks, were collected on a semi annual basis at the SONGS Unit l outfall, at the SONGS Units 2 and 3 outfall and from Laguna Beach. Upon collection, the flesh portion of each

sample type was analyzed for three naturally-occurring radionuclides and for 28 gamma-emitting station-related 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.

In 1996 naturally-occurring K-40 was detected in 21 of the 24 samples. The only plant related isotope detected in 1996 was Co-60 in one sea hare indicator sample. The sea hare sample taken from offshore San Onofre Surfing Beach on October 15, 1996 yielded 0.227 pCi/g Co-60 (reporting level 10 pCi/g).

Based on these data, it was concluded that (l) SONGS operations had a negligible impact on this environmental medium, and (2) the potential dose to members of the public from consumption of marine species near SONGS is negligible.

H. Local Crops

Representative fleshy crops were collected semiannually in 1996 from farms in San Clemente (which served as the indicator location), and from a garden situated near Oceanside (which served as the control location). The leafy vegetables indicator location sample was collected from Casa Pacifica (the Old Nixon Estate). The control leafy vegetable samples were collected near Oceanside. After collection, the edible portion of the crop samples was analyzed quantitatively for 28 gamma-emitting radionuclides.

The only detectable radionuclide was naturally occurring K-40.

Based on these data, it was concluded that (1) SONGS operations had a negligible impact on this environmental medium, and (2) 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, soil samples were collected from the East Site Boundary (Former Visitor's center), Old Route 101, Basilone Road, and Camp San Onofre (which served as indicator locations in the vicinity of SONGS), and from Huntington Beach which served as a control location. Surface soil was collected from all indicator and control locations at the depth of 3 inches from all locations. The soil sampling is conducted in accordance with HASL-300 procedures and is not required by ODCMs.

After collection, each soil sample was analyzed for naturally-occurring and SONGS-related gamma-emitting radionuclides via gamma spectral analysis. The analyses indicated that naturally occurring K-40 was present in detectable quantities each of the samples.

Cs-137 and Sr-90 were detected in soil profile analyses conducted in previous years. Cesium-137 and Sr-90 concentrations are mostly due to the nuclear weapons testing fallout depositing on soil and retention of these radionuclides due to their long half lives. Cesium-137 is normally retained at the top few inches of soil. Cesium-137 in soil with high clay content usually binds to the silicate structure more than rocky type soil. This can be seen in location No. 1 (Camp San Onofre) and location No. 2 (Old Route 101), which have higher clay contents and higher concentrations of Cs-137. The presence of Cs-137 in the control location in previous years supports the supposition 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 1994 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. Since SONGS related radionuclides were not detected in this medium during 1996, we conclude that SONGS had a neglible impact on this sample medium.

J. Kelp Sampling

Kelp was collected during April and October 1996 from the San Onofre, San Mateo, and Barn Kelp Beds, as well as a control sample from the kelp bed in Laguna Beach. Upon collection, the samples were analyzed by gamma-spectral analysis for 28 different naturally-occurring and Station-related radionuclides. The only radionuclides detected in 1996 were K-40 and I-131.

Potassium-40 (K-40) is naturally occurring and not related to the operation of SONGS.

In October 1996 Iodine-131 was detected in the CONTROL location sample. The control location I-131 concentration was 0.046 pCi/g. The detection of iodine-131 at the control location was likely due to sewage discharge of medically administered I-131. The northern control location is too far away and in the predominantly upstream direction for the I-131 activity to be attributable to SONGS. I-131 was NOT detected in at any indicator location during 1996.

To determine if these radionuclides are accumulating in kelp with time, data were examined from 1985 through 1994. This analysis was performed in conjunction with the 1994 AREOR. The data indicate that the concentrations of K-40 at both indicator and control locations have remained relatively constant, as anticipated. The frequency of detection and concentrations of I-131 and Cs-137 in kelp have decreased in the past few years relative to the years of 1983 through 1988. Doses via the ingestion pathway to members of public have been calculated because San Onofre kelp near SONGS is occasionally harvested. Dose impact from plant-related radionuclides were insignificant. In the case of I-131, its 8-day half life relative to the transit time (the time after harvesting to the time of shelving and consuming the food product containing kelp, usually 6-8 weeks) allows the decay of I-131 to a much lower level of activity. Doses calculated have shown no significant impact on the maximally exposed individual. Refer to the 1994 AREOR for more information.

Because the only anthropogenic radionuclide detected in 1996 kelp samples was at the control location, it is concluded that SONGS had no impact on this environmental medium in 1996.

TABLE B-1

REMP SAMPLE ANALYSIS SUMMARY FOR 1996

Medium	Analysis Type	Sampling Frequenty	# of Locations	Total # of Analysis in 1996
Direct Radiation	Dosimetry	Quarterly	45	180
Airborne Particulates	Gross β	Weekly	8	420
Charcoal Cartridge	I-131	Weekly	8	422
Airborne Particulates	Ge (Li) Scan	Quarterly	8	32
Ocean Water	Ge (Li) Scan	Monthly	4	48
Ocean Water	H-3	Quarterly	4	16
Drinking Water, Unfiltered	Ge (Li) Scan H-3 Gross β	Monthly	3 3 3	32 32 30
Shoreline Sediment	Ge (Li) Scan	Semi-Annually	4	8
Ocean Bottom Sediment	Ge (Li) Scan	Semi-Annually	5	10
Marine Species, Flesh	Ge (Li) Scan	Semi-Annually	3	24
Crops	Ge (Li) Scan	Semi-Annually	3	8
Kelp	Ge (Li) Scan	Semi-Annually	4	8
Soil	Ge (Li) Scan	Annually	5	5

TABLE B-2

STATISTICAL SUMMARY OF RADIOLOGICAL ENVIRONMENTAL MONITORING DATA FOR 1996

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
SAN ONOFRE NUCLEAR GENERATING STATION

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		
TABLE 1A Quarterly Gamma Exposure (millirem)							
Gamma Exposure	180	5.0000	15.516 (172/ 172) (10.200-22.700)	San Onofre State Beach (Unit 1) 0.2 Mi. WSW	19.625 (4/ 4) (18.000-22.700)	16.850 (8/ 8) (16.000-18.300)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		
TABLE 2 Weekly Airborne Particulates Gross Beta Activity (pCi/cu.m)							
	Gross Beta 420	0.0030	0.0218 (367/ 367) (0.008-0.048)	Former SONGS Evap Pond 0.6 Mi. NNW	0.0236 (52/ 52) (0.011-0.047)	0.0220 (53/ 53) (0.010-0.052)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		

TABLE 3
Weekly Radioiodine I-131 Activity
(pCi/cu.m)

	I-131	422	0.0530	<LLD	(0/ 369)	-----	<LLD	(0/ 53)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		
TABLE 4A Quarterly Composite Airborne Particulates Gamma Spectral Analysis (pCi/cu.m)							
Ag-110m	32	0.0021	<LLD (0/ 28)		-----	<LLD (0/ 4)	0
Be-7	32	0.0250	0.1044 (28/ 28) (0.077-0.149)	Mesa EOF 0.7 Mi NNW	0.1125 (4/ 4) (0.087-0.132)	0.1015 (4/ 4) (0.077-0.119)	0
Ce-141	32	0.0030	<LLD (0/ 28)		-----	<LLD (0/ 4)	0
Ce-144	32	0.0035	<LLD (0/ 28)		-----	<LLD (0/ 4)	0
Co-58	32	0.0025	<LLD (0/ 28)		-----	<LLD (0/ 4)	0
Co-60	32	0.0017	<LLD (0/ 28)		-----	<LLD (0/ 4)	0
Cs-134	32	0.0024	<LLD (0/ 28)		-----	<LLD (0/ 4)	0
Cs-137	32	0.0013	<LLD (0/ 28)		-----	<LLD (0/ 4)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean		Control Locations Mean Range		Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean Range			
TABLE 4A (Cont) Quarterly Composite Airborne Particulates Gamma Spectral Analysis (pCi/cu.m)									
K-40	32	0.0210	<LLD	(0/ 28)		-----	<LLD	(0/ 4)	0
Ru-103	32	0.0026	<LLD	(0/ 28)		-----	<LLD	(0/ 4)	0
Zr(Nb)-95	32	0.0036	<LLD	(0/ 28)		-----	<LLD	(0/ 4)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean		Control Locations Mean Range		Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean Range			
TABLE 5 Monthly Ocean Water Gamma Spectral Analysis (pCi/l)									
Ag-110m	48	11.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Ba(La)-140	48	13.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Ce-141	48	14.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Ce-144	48	53.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Co-57	48	6.7000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Co-58	48	9.3000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Co-60	48	10.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Cs-134	48	15.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
Cs-137	48	9.0000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 5 (Cont.) Monthly Ocean Water Gamma Spectral Analysis (pCi/l)								
	Fe-59	48	27.000	<LLD (0/ 36)		-----	<LLD (0/ 12)	0
	I-131	48	18.000	<LLD (0/ 36)		-----	<LLD (0/ 12)	0
	K-40	48	100.00	327.67 (36/ 36) (260.00-402.00)	Station Discharge Outfall - Unit 1 0.5 Mi SSW	343.58 (12/ 12) (283.00-402.00)	320.17 (12/ 12) (247.00-354.00)	0
	Mn-54	48	7.8000	<LLD (0/ 36)		-----	<LLD (0/ 12)	0
	Mo(Tc)-99m	48	900.00	<LLD (0/ 36)		-----	<LLD (0/ 12)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 5 (Cont.) Monthly Ocean Water Gamma Spectral Analysis (pCi/l)										
	Ru-103	48	8.5000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
	Ru-106	48	75.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
	Th-228	48	30.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
	Zn-65	48	29.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	0
	Zr(Nb)-95	48	15.000	<LLD	(0/ 36)		-----	<LLD	(0/ 12)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		
TABLE 7 Quarterly Composite Ocean Water Tritium Activity (pCi/l)							
	Tritium 16	835.00	<LLD (0/ 12)		-----	<LLD (0/ 4)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean		Control Locations Mean Range		Number of Nonroutine Reported Measurements
						Name, Distance and Direction	Mean Range			
TABLE 9A Monthly Drinking Water Analysis (pCi/l)										
	Ag-110m	32	8.3000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Ba(La)-140	32	15.000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Be-7	32	56.000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Ce-141	32	11.000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Ce-144	32	41.000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Co-58	32	7.0000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Co-60	32	7.4000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Cs-134	32	11.000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0
	Cs-137	32	6.6000	<LLD	(0/ 20)		-----	<LLD	(0/ 12)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 9A (Cont.) Monthly Drinking Water Analysis (pCi/l)								
	Fe-59	32	20.000	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	Gross Beta	30	3.6000	7.0279 (19/ 19) (3.800-10.300)	Tri-Cities Mun Water Dist Res 8.7 Mi NW	7.8818 (11/ 11) (3.800-10.300)	5.0000 (11/ 11) (3.800- 6.100)	0
	H-3	32	820.00	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	I-131	32	15.000	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	K-40	32	92.000	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	Mn-54	32	5.5000	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	Ru-103	32	6.9000	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	Zn-65	32	25.000	<LLD (0/ 20)		-----	<LLD (0/ 12)	0
	Zr(Nb)-95	32	11.000	<LLD (0/ 20)		-----	<LLD (0/ 12)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean		Control Locations Mean Range		Number of Nonroutine Reported Measurements
						Name, Distance and Direction	Mean Range			
TABLE 10 Semi-Annual Shoreline Sediment Gamma Spectral Analysis (pCi/g)										
	Ag-110m	8	0.0590	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Ce-141	8	0.0750	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Ce-144	8	0.2700	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Co-57	8	0.0900	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Co-58	8	0.1500	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Co-60	8	0.0510	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Cs-134	8	0.0820	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 10 (Cont.) Semi-Annual Shoreline Sediment Gamma Spectral Analysis (pCi/g)										
	Cs-137	8	0.0410	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Fe-59	8	0.1600	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	I-131	8	0.1100	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	K-40	8	0.5500	12.800 (10.200-14.100)	(6/ 6)	Newport Beach (North End) 30 Mi NW	19.900 (18.800-21.000)	19.900 (18.800-21.000)	(2/ 2)	0
	Mn-54	8	0.0450	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Mo(Tc)-99m	8	12.000	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Ru-103	8	0.1100	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 10 (Cont.) Semi-Annual Shoreline Sediment Gamma Spectral Analysis (pCi/g)								
	Ru-106	8	0.3500	<LLD (0/ 6)		-----	<LLD (0/ 2)	0
	Th-228	8	0.1400	0.3650 (6/ 6) (0.170-0.600)	Newport Beach (North End) 30 Mi NW	0.7650 (2/ 2) (0.390-1.140)	0.7650 (2/ 2) (0.390-1.140)	0
	Zn-65	8	0.2000	<LLD (0/ 6)		-----	<LLD (0/ 2)	0
	Zr(Nb)-95	8	0.0890	<LLD (0/ 6)		-----	<LLD (0/ 2)	0

SAN ONOFRE NUCLEAR GENERATING STATION

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 11 Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis (pCi/g)									
	Ag-110m	10	0.1300	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Ce-141	10	0.5800	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Ce-144	10	0.5500	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Co-57	10	0.0670	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Co-58	10	0.1500	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Co-60	10	0.0780	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Cs-134	10	0.1300	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Cs-137	10	0.0640	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0
	Fe-59	10	0.6700	<LLD	(0/ 8)	-----	<LLD	(0/ 2)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 11 (Cont.) Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis (pCi/g)								
	I-131	10	0.3600	<LLD (0/ 8)		-----	<LLD (0/ 2)	0
	K-40	10	0.7400	14.975 (8/ 8) (12.900-21.900)	Laguna Beach 18.2 Mi NW	20.550 (2/ 2) (20.000-21.100)	20.550 (2/ 2) (20.000-21.100)	0
	Mn-54	10	0.0800	<LLD (0/ 8)		-----	<LLD (0/ 2)	0
	Mo(Tc)-99m	10	4.9010	<LLD (0/ 8)		-----	<LLD (0/ 2)	0
	Ru-103	10	0.2900	<LLD (0/ 8)		-----	<LLD (0/ 2)	0
	Ru-106	10	0.6400	<LLD (0/ 8)		-----	<LLD (0/ 2)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 11 (Cont.) Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis (pCi/g)							
	Th-228 10	0.2600	0.7200 (4/ 8) (0.500-1.210)	Unit 1 Outfall 0.6 Mi W	1.2100 (1/ 2) (1.210-1.210)	0.5200 (1/ 2) (0.520-0.520)	0
	Zn-65 10	0.4400	<LLD (0/ 8)		-----	<LLD (0/ 2)	0
	Zr(Nb)-95 10	0.2900	<LLD (0/ 8)		-----	<LLD (0/ 2)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
SAN ONOFRE NUCLEAR GENERATING STATION

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 12A Semi-Annual Non-Migratory Marine Animals Analysis (pCi/g) (Flesh Type)										
(All Species)	Ag-110m	24	0.0980	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Ce-141	24	0.1600	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Ce-144	24	0.3200	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Co-57	24	0.0410	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Co-58	24	0.0660	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Co-60	24	0.0830	0.2270 (0.227- 0.227)	(1/ 16)	Unit 1 Outfall 0.9 Mi WSW	0.2270 (0.227- 0.227)	<LLD	(0/ 8)	0
(All Species)	Cs-134	24	0.1100	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Cs-137	24	0.0780	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0
(All Species)	Fe-59	24	0.2300	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 12A (Cont.) Semi-Annual Non-Migratory Marine Animals Analysis (pCi/g) (Flesh Type)								
(All Species)	I-131	24	0.2300	<LLD (0/ 16)		-----	<LLD (0/ 8)	0
(All Species)	K-40	24	1.2000	3.3467 (15/ 16) (2.080-4.580)	Laguna Beach 18.2 Mi NW	3.5167 (6/ 8) (3.160-4.120)	3.5167 (6/ 8) (3.160-4.120)	0
(All Species)	Mn-54	24	0.0770	<LLD (0/ 16)		-----	<LLD (0/ 8)	0
(All Species)	Mo(Tc)-99m	24	48.000	<LLD (0/ 16)		-----	<LLD (0/ 8)	0
(All Species)	Ru-103	24	0.1100	<LLD (0/ 16)		-----	<LLD (0/ 8)	0
(All Species)	Ru-106	24	0.7900	<LLD (0/ 16)		-----	<LLD (0/ 8)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean		Control Locations Mean Range		Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean Range			
TABLE 12A (Cont.) Semi-Annual Non-Migratory Marine Animals Analysis (pCi/g) (Flesh Type)									
(All Species)	Th-228	24	0.2500	<LLD	(0/ 16)	-----	<LLD	(0/ 8)	0
(All Species)	Zn-65	24	0.1900	<LLD	(0/ 16)	-----	<LLD	(0/ 8)	0
(All Species)	Zr(Nb)-95	24	0.1400	<LLD	(0/ 16)	-----	<LLD	(0/ 8)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 13A Semi-Annual Local Crops Gamma Spectral Analysis (pCi/g)										
(All Species)	Ag-110m	8	0.0320	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Be-7	8	0.2100	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Ce-141	8	0.0280	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Ce-144	8	0.1000	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Co-58	8	0.0250	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Co-60	8	0.0270	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Cs-134	8	0.0450	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0
(All Species)	Cs-137	8	0.0270	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 13A (Cont.) Semi-Annual Local Crops Gamma Spectral Analysis (pCi/g)								
(All Species)	I-131	8	0.0420	<LLD (0/ 4)		-----	<LLD (0/ 4)	0
(All Species)	K-40	8	0.4400	1.5325 (4/ 4) (1.080- 1.810)	Old Nixon Estate 2.8 Mi WNW	1.8100 (1/ 1) (1.810- 1.810)	1.6875 (4/ 4) (1.380- 2.130)	0
(All Species)	Ru-103	8	0.0240	<LLD (0/ 4)		-----	<LLD (0/ 4)	0
(All Species)	Zr(Nb)-95	8	0.0440	<LLD (0/ 4)		-----	<LLD (0/ 4)	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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		
TABLE 14 Annual Soil Analysis Depth: 3" (pCi/g)							
	Ag-110m 5	0.0950	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Be-7 5	0.5600	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Ce-141 5	0.1100	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Ce-144 5	0.3400	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Co-58 5	0.0670	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Co-60 5	0.0750	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Cs-134 5	0.1300	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Cs-137 5	0.0810	<LLD (0/ 4)		-----	<LLD (0/ 1)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

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
TABLE 14 (Cont.) Annual Soil Analysis Depth: 3" (pCi/g)							
	I-131 5	0.2700	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	K-40 5	0.7500	13.850 (4/ 4) (2.900-21.200)	Huntington Beach Generating Station 29.1 Mi NW	22.700 (1/ 1) (22.700-22.700)	22.700 (1/ 1) (22.700-22.700)	0
	Ru-103 5	0.0740	<LLD (0/ 4)		-----	<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: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 15 Semi-Annual Kelp Analysis (pCi/g)										
macrocystis p.	Ag-110m	8	0.0320	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Ce-141	8	0.0270	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Ce-144	8	0.0940	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Co-57	8	0.0130	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Co-58	8	0.0210	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Co-60	8	0.0290	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Cs-134	8	0.0210	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Cs-137	8	0.0240	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 15 (Cont.) Semi-Annual Kelp Analysis (pCi/g)										
macrocystis p.	Fe-59	8	0.0970	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	I-131	8	0.0500	<LLD	(0/ 6)	Laguna Beach 15.6 Mi NW	0.046 (1/ 2) (0.046 - 0.046)	<LLD	(1/ 2)	0
macrocystis p.	K-40	8	0.2700	10.893 (8.800-13.500)	(6/ 6)	Laguna Beach 15.6 Mi NW	12.370 (2/ 2) (11.020-13.720)	12.370 (11.020-13.720)	(2/ 2)	0
macrocystis p.	Mn-54	8	0.0210	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Mo(Tc)-99m	4	4.4000	<LLD	(0/ 3)		-----	<LLD	(0/ 1)	0
macrocystis p.	Ru-103	8	0.0250	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Ru-106	8	0.1700	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0

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

REPORTING PERIOD: January 1, 1996 to December 31, 1996

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 15 (Cont.) Semi-Annual Kelp Analysis (pCi/g)										
macrocystis p.	Th-228	8	0.0990	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Zn-65	8	0.0760	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Zr(Nb)-95	8	0.0360	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0

APPENDIX C

SUMMARY OF 1996 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.

EPA INTERLABORATORY CROSS-CHECK PROGRAM:

US EPA National Exposure Research Laboratory
Environmental Laboratory Performance Evaluation
1996

The results of the 1996 interlaboratory cross-check program between the Environmental Protection Agency (EPA) and our CEAL have been summarized in Table C-1. The mean results of cross-check analyses have been evaluated against the EPA control limits. Values outside the control limits were evaluated and resolved. Likewise, the "normalized ranges" as calculated by EPA have been investigated against the control limit. Trend analyses of the results were performed on the values that are within the control limits to determine if they exhibit a trend toward these limits. No adverse trends were observed in the CEAL's QA Report.

The CEAL was Yankee Atomic Environmental Laboratory for 1996. The cross-check results for Yankee Atomic are listed in Table C-1.

SPLIT SAMPLING PROGRAM WITH DHS:

The California Department of Health Services (DHS) supervises the performance of split and duplicate sampling of selected media in cooperation with 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 1995 DHS Environmental Surveillance Report** for most sample media types 'there were no major discrepancies between the data provided by the SRL and those submitted by the licensees'. The DHS obtained split samples from the following SONGS environmental media during the most recent completed study period (1995): air particulate gross beta, airborne I-131, air particulate composite gamma scan, ocean water, marine species, and kelp.

Airborne Particulate Gross Beta and Composite Gamma

The DHS gross beta in air results showed a very close correlation with SONGS for both control and indicator locations. The average of the air particulates gross beta activity for SONGS and the DHS indicate that the control location gross beta is comparable to the indicator location gross beta. The DHS maintains an indicator air sampler adjacent to SONGS air sampler #10.

1995 Annual average SONGS indicator sampler #10	0.024 pCi/m^3
1995 Annual average DHS air sampler adjacent to SONGS #10	0.023 pCi/m^3
1995 Annual average SONGS control	0.023 pCi/m^3
1995 Annual average DHS control	0.023 pCi/m^3

** California Nuclear Power Plant Environmental Surveillance Report, 1995 prepared by the California Department of Health Services, Radiological Health Branch Pursuant to Contract NRC-32-83-684.

Direct Radiation

"The measured quarterly doses at various locations are consistent among the licensees', the NRC's , and the State's TLD systems." "It was determined that no TLD locations received a dose in excess of its natural background reading." **

Airborne Gamma Spectral Analyses of Particulates

"No radioisotopes attributable to the licensees' operations were detected." **

Waterborne (Ocean Water)

DHS conclusion - no major discrepancies between SONGS and DHS split samples. **

Sediment / Soil

DHS conclusion - no major discrepancies between SONGS and DHS split samples. **

CALIBRATION OF AIR SAMPLER VOLUME METERS

The Shop Services and Instrumentation Division of Edison International performs an annual NIST traceable calibration procedure on all REM air sampler gas meters. The acceptance criterion is +/- 5% of the known volume. In 1996 only one gas meter failed to meet this criterion. The gas meter attached to control air sampler #3 (Huntington Beach Generating Station) was biased high (6%) in total volume at the flow rate of interest. This may have resulted in a slight low bias in the gross beta activity results for the control air sampler.

The annual average of the SONGS control station gross beta activity for 1996 was 0.022 pCi/m^3. The 1996 annual average gross beta activity of the 7 SONGS indicator locations was 0.022 pCi/m^3. No impact to the REMP program or conclusions resulted.

** California Nuclear Power Plant Environmental Surveillance Report, 1995 prepared by the California Department of Health Services, Radiological Health Branch Pursuant to Contract NRC-32-83-684.

TABLE C-1

EPA Cross Check Program Summary (including only those analyses performed by the CEAL for SONGS)

Date	Sample Type	Analyte	Mean CEAL ± s.d.	Known EPA ± expected bias	Control Limit	R +SR
Jan. 23	Water(pCi/l)	Sr-89	79.3 ± 1.53	73.0 ± 5.0	64.3 - 81.7	0.354
Jan. 23	Water(pCi/l)	Sr-90	4.67 ± 0.58	5.0 ± 5.0	0 - 13.7	0.118
Jan. 26	Water (pCi/l)	Gross Alpha	(1)	---	---	---
Jan. 26	Water (pCi/l)	Gross Beta	(1)	---	---	---
Feb. 2	Water (pCi/l)	I-131	(2)	---	---	---
Mar. 8	Water (pCi/l)	H-3	23430.0 ±633.78	22002 ± 2200	18185.1-25818.9	0.338
Apr. 16	Water (pCi/l)	Gross Beta	(3)	---	---	---
Apr. 16	Water (pCi/l)	Gross Alpha	(3)	---	---	---
Apr. 16	Water (pCi/l)	Co-60	31.33 ± 0.58	31.0 ± 5.0	22.3 - 39.7	0.118
Apr. 16	Water (pCi/l)	Cs-134	42.67 ± 1.15	46.0 ± 5.0	37.3 - 54.7	0.236
Apr. 16	Water (pCi/l)	Cs-137	49.00 ± 1.73	50.0 ± 5.0	41.3 - 58.7	0.354
Apr. 16	Water (pCi/l)	Nat. U	55.47 ± 1.36	58.4 ± 5.8	48.3 - 68.5	0.265
Apr. 16	Water (pCi/l)	Ra-226	3.6 ± 0.20	3.0 ± 0.5	2.1 - 3.9	0.473
Apr. 16	Water (pCi/l)	Ra-228	5.13 ± 1.08	5.0 ± 1.3	2.7 - 7.3	0.909
Apr. 16	Water (pCi/l)	Sr-89	46.00 ± 1.00	43.0 ± 5.0	34.3 - 51.7	0.236
Apr. 16	Water (pCi/l)	Sr-90	14.67 ± 0.58	16.0 ± 5.0	7.3 - 24.7	0.118
June 7	Water (pCi/l)	Ba-133	734.67 ± 7.57	745.0 ± 75.0	614.9 - 875.1	0.110

Date	Sample Type	Analyte	Mean CEAL ± s.d.	Known EPA ± expected bias	Control Limit	R +SR
June 7	Water (pCi/l)	Co-60	96.00 ± 1.73	99.0 ± 5.0	90.3 - 107.7	0.354
June 7	Water (pCi/l)	Cs-134	76.33 ± 2.08	79.0 ± 5.0	70.3 - 87.7	0.473
June 7	Water (pCi/l)	Cs-137	198.0 ± 3.61	197.0 ± 10.0	179.7 - 214.3	0.413
June 7	Water (pCi/l)	Zn-65	303.33 ± 6.35	300.0 ± 30.0	248.0 - 352.0	0.217
June 21	Water (pCi/l)	Nat. U	19.00 ± 0.70	20.2 ± 3.0	15.0 - 25.4	0.276
June 21	Water (pCi/l)	Ra-226	5.40 ± 0.26	4.9 ± 0.7	3.7 - 6.1	0.422
June 21	Water (pCi/l)	Ra-228	8.07 ± 0.97	9.0 ± 2.3	5.0 - 13.0	0.488
July 12	Water (pCi/l)	Sr-89	24.33 ± 1.53	25.0 ± 5.0	16.3 - 33.7	0.354
July 12	Water (pCi/l)	Sr-90	12.00 ± 1.00	12.0 ± 5.0	3.3 - 20.7	0.236
July 19	Water (pCi/l)	Gross Alpha	10.80 ± 0.75	24.4 ± 6.1	13.8 - 35.0	0.145
July 19	Water (pCi/l)	Gross Beta	40.53 ± 0.91	44.8 ± 5.0	36.1 - 53.5	0.213
Aug 9	Water (pCi/l)	H-3	10226.67 ± 353.03	10879 ± 1088	8991.4 - 12766.6	0.380
Sep 27	Water (pCi/l)	Nat. U	9.68 ± 0.12	10.1 ± 3.0	4.9 - 15.3	0.039
Sep 27	Water (pCi/l)	Ra-226	13.20 ± 0.20	14.0 ± 2.1	10.4 - 17.6	0.113
Sep 27	Water (pCi/l)	Ra-228	6.23 ± 0.31	4.7 ± 1.2	2.6 - 6.8	0.295
Oct 4	Water (pCi/l)	I-131LL	28.67 ± 2.08	27.0 ± 6.0	16.6 - 37.4	0.394
Oct 15	Water (pCi/l)	Gross Beta	(3)			
Oct 15	Water (pCi/l)	Gross Alpha	(3)			
Oct 15	Water (pCi/l)	Co-60	14.00 ± 0.00	15.0 ± 5.0	6.3 - 23.7	0.000
Oct 15	Water (pCi/l)	Cs-134	19.33 ± 1.15	20.0 ± 5.0	11.3 - 28.7	0.236

Date	Sample Type	Analyte	Mean CEAL ± s.d.	Known EPA ± expected bias	Control Limit	R +SR
Oct 15	Water (pCi/l)	Cs-137	30.00 ± 1.00	30.0 ± 5.0	21.3 - 38.7	0.236
Oct 15	Water (pCi/l)	Nat. U	38.73 ± 0.55	40.9 ± 4.1	33.8 - 48.0	0.158
Oct 15	Water (pCi/l)	Ra-226	9.07 ± 0.35	9.9 ± 1.5	7.3 - 12.5	0.276
Oct 15	Water (pCi/l)	Ra-228	6.67 ± 0.74	5.1 ± 1.3	2.8 - 7.4	0.636
Oct 15	Water (pCi/l)	Sr-89	11.67 ± 1.15	10.0 ± 5.0	1.3 - 18.7	0.236
Oct 15	Water (pCi/l)	Sr-90	23.00 ± 0.00	25.0 ± 5.0	16.3 - 33.7	0.000
Oct 25	Water (pCi/l)	Gross Alpha	10.47 ± 0.35	10.3 ± 5.0	1.6 - 19.0	0.083
Oct 25	Water (pCi/l)	Gross Beta	34.57 ± 2.16	34.6 ± 5.0	25.9 - 43.3	0.508
Nov 8	Water (pCi/l)	Ba-133	60.67 ± 2.52	64.0 ± 6.0	53.6 - 74.4	0.492
Nov 8	Water (pCi/l)	Co-60	43.67 ± 0.58	44.0 ± 5.0	35.3 - 52.7	0.118
Nov 8	Water (pCi/l)	Cs-134	11.00 ± 0.00	11.0 ± 5.0	2.3 - 19.7	0.000
Nov 8	Water (pCi/l)	Cs-137	20.00 ± 1.00	19.0 ± 5.0	10.3 - 27.7	0.236
Nov 8	Water (pCi/l)	Zn-65	34.67 ± 1.53	35.0 ± 5.0	26.3 - 43.7	0.354
Dec 6	Water (pCi/l)	Nat. U	4.70 ± 0.10	5.0 ± 3.0	0 - 10.2	0.039
Dec 6	Water (pCi/l)	Ra-226	18.63 ± 3.13	20.1 ± 3.0	14.9 - 25.3	1.383
Dec 6	Water (pCi/l)	Ra-228	10.50 ± 0.60	10.2 ± 2.6	5.7 - 14.7	0.273

(1) This PE Sample was not provided to the contracted laboratory.
(2) This PE sample was not provided to the contracted laboratory in time for inclusion to the study.
(3) The contracted laboratory does not perform gross alpha or beta on mixed matrices because they calibrate at one energy level.

APPENDIX D

COMPARISON OF 1996 OPERATIONAL DATA WITH PREOPERATIONAL DATA

COMPARISON OF OPERATIONAL DATA WITH PREOPERATIONAL DATA

For comparison of operational data with the preoperational data, all the measurements from January 1979 to July 1982 are used for preoperational phase of SONGS Unit 2 and Unit 3. These preoperational data are the actual operational data obtained from the radiological environmental monitoring program for SONGS Unit 1. Unit 1 became critical on June 14, 1967 and was permanently shut down on November 30, 1992. Unit 2 attained initial criticality on July 26, 1982. Unit 3 attained initial criticality on August 29, 1983.

A variety of environmental samples were analyzed and the radio analytical results (January 1, 1979 to July 31, 1982) were compared with the 1996 operational data obtained for SONGS Units 1, 2 and 3.

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

A. External Radiation
B. Air Particulates
C. Radioiodine
D. Ocean Water
E. Shoreline Sediments
F. Ocean Bottom Sediments
G. Marine Species
H. Local Crops
I. Soil
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 1996 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:

The operational data for Unit 1 are used as baseline (preoperational data) for Units 2 and 3 (from 1979 to 1982). Figures 2A & 2B compare the environmental radiation levels of indicator and control locations. As can be seen, the control location external radiation level is lower than the indicator locations. Also, a decreasing trend was observed from 1975 to 1996, partly due to the curtailment of the atmospheric nuclear weapons testing. The variation in radiation level between the controls and indicators is comparable. Simultaneous variation in radiation levels between the control and indicators in the same direction also show that environmental and seasonal effects are contributing to these variations rather than plant operation.

Direct radiation measurements were made quarterly at 43 indicator locations and two control locations in 1996. Dosimeters were collected at a number of inner as well as at outer ring locations as specified by the ODCMs. In order to evaluate the variation in external radiation exposure, a plot was made of direct radiation exposure in mrem, obtained from thermoluminescent dosimeters, versus time for a given number of indicator locations, as well as the two control locations. The figures compare some of the locations and also show the time variation of radiation level during both preoperational (January 1979 - July 1982) and operational periods of January 1996 to December 1996.

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.

In the 1996 operational year for Units 2 and 3, all indicator stations ranged from 10.2 to 22.7 millirem with an average of 15.5 millirem while the control locations ranged from 16.0 to 18.3 millirem with an average of 16.9 millirem.

Comparison of indicator station's data with those of the control stations shows that there has not been any significant external radiation impact of SONGS on the environment.

Factors such as meteorology, geographic location, and statistical and seasonal fluctuations may describe the variability in the data seen during the preoperational period for each location. The decrease in radiation levels in the area surrounding SONGS during the preoperational period for the two units may be attributable to a curtailment of the atmospheric nuclear weapons testing, and the continued decay fission products from previous nuclear weapons tests. It should be noted that, during the 1996 operational year, the control location mean was greater than the indicator location mean.

The range of quarterly direct radiation doses was larger at both indicator and control locations during the preoperational period than during the 1996 operational period for SONGS Units 2 and 3. The larger range observed during the preoperational time span may be attributable to atmospheric nuclear weapons tests that occurred in March of 1978 and on October 15, 1980, as well as the eruption of the Mount St. Helens volcano in May 1980. The noticeable decline in direct radiation levels since 1979 is likely due to a curtailment of the atmospheric nuclear weapons testing. The larger range of annual direct radiation levels seen in 1986 and 1987 may be attributable to the Chernobyl Nuclear Power Plant accident that occurred April 26, 1986, in addition to the continued fallout from weapons testing. Other factors, such as meteorology, geographic locations and statistical and seasonal fluctuations may also contribute to the variation in the direct radiation levels.

We conclude that SONGS has not had a measurable impact during 1996 on this environmental medium.

B. Air Particulates

SONGS Unit 1:

Before SONGS Unit 1 attained initial criticality, samples of air particulates were collected frequently from indicator and control locations surrounding SONGS, and subsequently analyzed for gross beta activity. During the preoperational period of 1964-1967, detectable gross beta activities 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 1996, the gross beta activity at the indicator locations ranged from 0.008 to 0.048 pCi/m^3, and averaging 0.022 pCi/m^3. The control location gross beta activity ranged from 0.010 to 0.052 pCi/m^3 with an average of

0.022 pCi/m^3. The decrease in activity levels between 1965 and 1996 might be ascribed to the curtailment of atmospheric fallout from nuclear weapons testing.

Valid comparisons of preoperational data to operational data are difficult to make in this instance because the actual background levels are masked by activity from fallout caused by weapons testing.

SONGS Units 2 and 3:

In order to provide the preoperational data for SONGS 2 and 3, a number of studies were conducted from 1979 to 1983. These preoperational data for SONGS Units 2 and 3 are operational data of SONGS Unit 1 operation. 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 activities in air. This period extends from the fourth quarter of 1980 through the fourth quarter of 1981. These higher activities may be attributable to the atmospheric nuclear weapons tests that occurred in March 1978 and October 15, 1980, as well as the eruption of the Mount St. Helens volcano in May 1980. Because these higher levels mask the normal environmental gross beta levels near SONGS, the data collected during this time frame is not considered valid for comparison with the preoperational data. One of the studies involved measurement of gross beta activity in air particulates. Air samples from different locations near the plant were collected on a weekly basis and analyzed. Figures 3C and 3D present the monthly variation in the gross beta activity of air particulates in San Clemente, Camp San Onofre, and Huntington Beach (Control) locations. Figures 3C and 3D also compare the gross beta activity levels of these stations during the preoperational (January 1979 to July 1982) and operational periods (July 1982 to December 1996). As seen in the graph, during most of the time span, the environmental levels of gross beta remained the same for the indicator and the control locations. The minor variations observed are of statistical or seasonal nature depending on the geographical location of each station.

The presence of the first major group of peaks observed during February to July 1978 of the preoperational period may be attributed to Chinese atmospheric nuclear weapons testing of March 14, 1978 and the residual fallout activity from the previous atmospheric testing of September 17, 1977. The May 1980 eruption of Mount Saint Helens and the subsequent volcanic activities also contributed to the elevation of the natural background levels in the environment. During this time period, the Huntington Beach control station was affected as well as the other locations. Since all the locations were affected equally, it may be concluded that the rise in gross beta activity was not plant related. The decrease in gross beta activity level after January 1979 might be ascribed to the curtailment of nuclear weapons testing in the atmosphere. The rise in gross beta activity observed after October 1980 is thought to be the fallout contribution from the Chinese atmospheric nuclear weapons testing of October 15, 1980. The presence of the large group of peaks, observed in the region of October 1980 to August 1981, is attributed to the October 15, 1980 atmospheric nuclear weapons testing and also to the volcanic eruption of Mount Saint Helens located in the state of Washington.

The 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 observed at the Huntington Beach Control station was 0.29 pCi/m^3 on May 11, 1981. The dispersion of the radioactive plume and its travel throughout the country affected the environmental levels at the locations being studied. All the locations, more or less, were affected simultaneously by these environmental factors. All the other minor peaks observed have little significance and their presence is attributed to the statistical deviation of the data points and also seasonal variation and fluctuations in all the locations. Figures 3A and 3B also show the presence of a sharp peak in the month of June which is due to the Chernobyl accident of April 1986. These data suggest that there is no plant-related activity detectable in this sample medium because the control and indicator locations show simultaneous variations of similar magnitude. The variations are closely timed to known atmospheric releases not related to the operation of SONGS (Chinese Nuclear Weapons testing and

Mt. St. Helens). Therefore, it can be concluded that the fluctuations in gross beta activity is not the result of plant operation and is the result of other environmental phenomena.

The average activity in all the indicator locations during operational period of January to December 1996 was found to be 0.022 pCi/m^3. During 1996 the Huntington Beach control location average was also found to be 0.022 pCi/m^3. It should be mentioned that the presence of activity due to atmospheric nuclear weapons testing and other environmental phenomena, such as volcanic activities, make the comparison difficult since the background level is affected. The close correlation between the monthly average indicator locations and the monthly average control location gross beta activities over an extended period of time support the conclusion that the operation of SONGS had no meaningful impact on this sample medium.

C. Radioiodine

SONGS Unit 1:

Radioiodine measurements were not made during the preoperational period of 1964 to 1967, and the operational levels for SONGS Unit 1 have been mostly below the lower limit of detection of 0.053 pCi/m^3.

SONGS Units 2 and 3:

A comparison of radioiodine measurements is not necessary since most of the preoperational and all the 1996 operational data for I-131 level are below the lower limit of detection of 0.053 pCi/m^3.

D. Ocean Water

SONGS Unit 1:

No ocean water samples were collected and analyzed during the preoperational period of SONGS Unit 1, so no comparison can be made with the operational data.

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 serve as indicator locations) and from Newport Beach (which serves as a control location). Upon collection, samples are analyzed for naturally-occurring and station-related gamma-emitting radionuclides. Every other month, the samples are also analyzed for gross beta activity. Finally, samples are composited quarterly and are analyzed for tritium.

During the preoperational period, naturally-occurring potassium-40 was detected in each of the samples collected from both indicator and control locations. Other gamma-emitting radionuclides were detected in only one ocean water sample. In May 1980, Co-58, Co-60, Cs-l34, and Cs-137 were detected in an ocean water sample collected from the SONGS Unit l outfall. Concentrations of the radionuclides in this sample were 11, 6, 380, and 430 pCi/l, in that order.

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. The tritium concentration in all 1996 ocean water samples was below the lower limit of detection.

Throughout 1996 operational period only naturally-occurring gamma-emitting radionuclides were detected in the monthly ocean water gamma spectral analyses. From these data it was concluded that the operation of SONGS has had a negligible impact on this sample medium.

E. Shoreline Sediments (Sand)

SONGS Unit 1:

Samples of shoreline sediments were not collected and analyzed during the preoperational period for SONGS Unit 1. Therefore, no comparison with operational data is possible.

SONGS Units 2 and 3:

Beach sand is collected semiannually from three indicator locations and from a control location situated in Newport Beach. After collection, the samples are analyzed for 19 naturally-occurring and plant-related radionuclides.

To assess the impact of SONGS operations on this environmental medium, preoperational data were compared to 1996 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 Cs-137 activity was 0.032 pCi/g in July 1979. Because it is also detected in the control samples, the contribution from the nuclear weapons testings of the past should be considered. Only naturally occurring radionuclides were detected in the samples collected during 1996 operational period.

Because no station-related radionuclides were detected in shoreline sediment in 1996 the impact of SONGS on this environmental 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 gamma-emitting radionuclides, including Co-58, Co-60, Ag-110m and Cs-137. The results of the analyses are listed in Table D-2B. It is clear in surveying the data that the concentration of each of the radionuclides has decreased with time, or as in the case of Ag-110m, has consistently been below the lower limit of detection of that radionuclide.

During the preoperational period, three naturally-occurring radionuclides were found in each sample collected from the indicator locations. They include K-40, Ra-226, and Th-228. Station-related radionuclides were also detected in samples collected during this time frame. Manganese-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 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 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. Cesium-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 was found in two samples. The concentration of Ce-144 in the samples was 0.06 and 0.26 pCi/g respectively.

The concentration of station-related radionuclides in all ocean bottom sediment samples analyzed in 1996 was below the LLD.

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. The comparison of sediment activity with the preoperational values is difficult due to the small number of samples analyzed. Although Co-58, Co-60, Ag-110m, 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. Therefore, we conclude that SONGS Units 2 and 3 operation has not had any impact upon this environment.

TABLE D-2A

SHORELINE 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	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	<LLD	<LLD	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.012-0.022	0.019	<LLD-0.032	<LLD
Ce-144	PreOp	<LLD	<LLD	<LLD	<LLD
**	Operational	<LLD	<LLD	<LLD	<LLD

TABLE D-2B

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
Mo(Tc)-99m	PreOp	<LLD	<LLD	<LLD	<LLD
Ag-110m	PreOp	<LLD-0.020	<LLD	<LLD	<LLD
I-131	PreOp	<LLD	<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
**	Operational	<LLD	<LLD	<LLD	<LLD

* **Preop = January 1979 to July 1982; Operational - January to December 1996**

** **During January to December 1996 all station related Radionuclides from all sample locations were < LLD**

G. Marine Species (Flesh)

SONGS Unit 1:

Marine species were not collected and analyzed during the preoperational period for SONGS Unit 1. Therefore, 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 three naturally-occurring radionuclides, for 16 gamma-emitting, station-related radionuclides. The results are subsequently reported as pCi/gram wet weight.

Selected results for different marine species for both the preoperational and 1996 operational periods for Units 2 and 3 are presented in Table D-3. 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 activity not included in Table D-3 were below the lower limits of detection for both the preoperational and operational time periods.

In comparing preoperational and operational data for each marine species and radionuclide, it is evident that the concentrations of station-related radionuclides detected in each species during 1996 are commensurate to or less than the concentrations detected in the same marine species during the preoperational period. During the 1996 operational period, the only station related radionuclide detected was Co-60 in Sea Hare.

From these data, it can be concluded that the operation of SONGS Units 1, 2, and 3 in 1996 has had no significant impact on this environmental medium.

TABLE D-2

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 1996 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
**	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
**	Operational	<LLD	<LLD	<LLD	<LLD

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
**	Operational	<LLD	<LLD	<LLD	<LLD

* Preop = January 1979 to July 1982; Operational - January to December 1996
** During January to December 1996 all station related Radionuclides from all sample locations were < LLD
LLD Lower limits of detection are listed in Appendix B.

TABLE D-2 (continued)

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

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
**	Operational	<LLD	<LLD	<LLD	<LLD

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
Co-60	Operational	<LLD-0.227	0.119	<LLD	<LLD
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

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
**	Operational	<LLD	<LLD	<LLD	<LLD

* Preop = January 1979 to July 1982; Operational - January to December 1996
** During January to December 1996 all station related Radionuclides from all sample locations were < LLD
LLD Lower limits of detection 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 1996 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, Strontium-90 was detected in the control samples of kale, parsley, and squash. Potassium-40 was detected in cucumber, kale, and tomato samples from the indicator and control locations. Cerium-144 and Zr(Nb)-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 1996 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. The decrease may be attributed to the termination of atmospheric nuclear weapons testing. It does not appear that the operation of SONGS has had a measurable impact on this medium.

I. Soil

SONGS Unit 1:

No soil data were available for Unit 1 preoperational phase so 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 15 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.

J. Kelp

SONGS Unit 1:

Samples of kelp were not collected and analyzed during the preoperational period for SONGS Unit l. Therefore, 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 station-related radionuclides.

To assess the impact of SONGS operations on kelp, preoperational data were compared to 1996 operational data (Table D-6). Radionuclides detected during the preoperational period for SONGS Units 2 and 3 include Mn-54, Co-60, Zr(NB)-95, I-131, and Cs-137. During the 1996 operational period, I-131 was detected in the control location. I-131 was NOT detected in any indicator location during 1996. No other station related isotopes were detected in kelp samples during the 1996 operational period. Figures 4A & 4B show the variations in kelp I-131 during operational & preoperational periods.

Although I-131 activity has been randomly detected in kelp since 1977, there is no evidence that the concentration of I-131 in kelp is increasing near SONGS. It is quite possible that I-131 in kelp is due to sewer release of medical administrations, since it is detected in controls as well as indicator locations.

TABLE D-3

SOIL PREOPERATIONAL AND OPERATIONAL DATA* (pCi/g, dry weight)

SONGS UNITS 2/3

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Sr-90	PreOp	0.02-0.08	0.044	<LLD-0.03	<LLD
Cs-137	PreOp	0.02-0.20	0.096	<LLD-0.06	<LLD
**	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	<LLD	<LLD	<LLD-0.046	<LLD
Cs-137	PreOp	0.004-0.009	0.006	<LLD	<LLD

* **Preoperational = January 1979 to July 1982; Operational = January to December 1996**

** **During January to December 1996, all station related radionuclides from all samples locations were <LLD.**

APPENDIX E

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

IN 1996

DEVIATIONS FROM SAMPLING REQUIREMENTS

Deviations from the REMP sampling requirements are identified below in accordance with section 5.0 of the ODCM. The performance standard for environmental data collection of 95% was met for all sample types.

Part I TERRESTRIAL SAMPLING

A. WEEKLY AIR SAMPLING

Downtime for each air sampler in 1996 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 #1 (City of San Clemente):

During the collection period ending December 10, 1996 a portion of the sample flow bypassed the filter media. This caused the gross beta activity for the collection period to be anomalously low and unusable. The root cause was off center installation of the media. The anomalously low gross beta data for this collection period was not included in the data base.

Air Sampler #2 (Camp San Onofre):

During the collection period ending March 12, 1996 the sample vacuum pump motor assembly malfunctioned, causing 49.2 hours of down time during that collection period. The root cause was a motor failure. During the collection period ending July 23, 1996 a power surge caused the motor assembly fuse to blow. This resulted in 97.9 hours of down time. The fuse was replaced with a 15 amp slow blow fuse and the assembly was returned to service. The sample volumes were >7000 cu. ft. and the a priori LLD was met.

Air Sampler # 3:

No deviations were observed.

Air Sampler # 9:

The vacuum pump failed to operate during a portion of the collection period ending October 29, 1996. The motor continued to operate but there was no flow through the sample media for part of the collection period. The down time was estimated to be 20 hours based on the total volume collected.

Air Sampler # 10 (Bluff):

A power surge caused a blown fuse during the collection period ending March 19, 1996. This resulted in 163.7 hours of down time during this collection period. The volume (480 cu. ft.) was not sufficient to perform an analysis capable of meeting the ODCM requirements.

During the collection period ending December 10, 1996 the filter paper was installed off center causing most of the sample flow to bypass the filter media. The anomalously low gross beta results were not included in the data base.

Air Sampler #11 (EOF):

Torn filter media resulted in slightly low gross beta results for the collection period ending February 6, 1996.

During the collection period ending October 22, 1996 the motor assembly ceased to operate resulting in 8.2 hours of down time for that period.

Air Sampler #12 (Former SONGS Evaporation Pond):

A power surge caused a blown fuse during the collection period ending March 19, 1996. This resulted in 163.7 hours of down time during this collection period. The volume (530 cu. ft.) was not sufficient to perform an analysis capable of meeting the ODCM requirement.

During the collection period ending August 27, 1996 the vacuum pump motor failed. This caused a low volume (3780 cu. ft.) The gross beta activity was comparable to the other stations and was above the a priori LLD for that period.

Summary of Air Sampler Corrective Actions

Power supply interruption continues to be the dominant Air Sampler failure mechanism. A primary cause of Air Sampler down time in 1996 was related to under sized fuses in the Air Sample motor assemblies. The fuses were replaced with the size and type fuses recommended by the manufacturer of the motor assemblies.

Several deviations were due to off center particulate filter media causing the sample to by-pass the media. REMP personnel were retrained on the correct method of verifying proper filter paper installation in order to prevent a recurrance of off center particulate filter media installation.

B. DIRECT RADIATION

It has been determined that location of TLD # 46 has been inconsistent with the ODCM per GPS receiver data. The location of TLD # 46 was moved from 1.0 miles ESE to a location 0.9 miles SE on March 25, 1997. Distance & direction are relative to the midpoint of Units 2/3.

C. LOCAL CROPS

In the spring, leafy vegetables were not available at the ODCM specified control location, 22 miles in Sector G. The control leafy was obtained 21 miles in sector E. In the Fall, leafy vegetables were not available at the Nixon Estate.

D. SHORELINE SEDIMENTS

No deviations were observed.

E. DRINKING WATER

Samples were intermitently unavailable from location #2 (San Clemente Golf Course). The well is periodically secured for aquifer regeneration.

F. SOIL

No deviations were observed.

PART II MARINE SAMPLING

A. MARINE SPECIES

In June 1996 the marine sampling procedure was enhanced to include Global Positioning System (GPS) receiver data from each sample taken. This enables more accurate mapping of the actual sample locations. The ODCM specifies sample locations in close proximity to the discharge of each Unit. The GPS data indicate that the marine species samples were collected in accordance with the intent of the ODCM. Corrections due to more accurate mapping will be incorporated in the next appropriate ODCM revisions.

B. OCEAN WATER SAMPLING

The ODCM specifies that the samples are collected from the outfall of each respective Unit. The vendor was instructed to collect the sample from the actual discharge of Unit 1 pending correction of the ODCM. The ODCM specifies that the Unit 2 and the Unit 3 Ocean water samples are to be collected from the same location (0.7 miles SW). Since the intent is to collect a discharge sample, the vendor was instructed to collect the samples from the diffuser terminus of each unit. The ODCM will be corrected to reflect more accurate mapping.

C. OCEAN BOTTOM SEDIMENTS

Samples were collected from the closest location with a sandy bottom.

D. KELP

Samples obtained from the closest available location.

APPENDIX F

LAND USE CENSUS

INTRODUCTION

Southern California Edison conducted the annual 1996 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-2.

HIGHLIGHTS OF CHANGES FROM THE 1995 CENSUS

Changes in the land uses, occupancy (employment hours), or distance are described in Table F-1. The computer based (AutoCAD) local area map was merged with the Thomas Brothers data set to more accurately position SONGS relative to the study area. Additionally, a Global Positioning System (GPS) receiver was employed to fix selected locations. These enhancements caused a number of minor changes in the 1996 LUC. The critical receptors did NOT change.

THE STUDY AREA

The study area includes half of the city of San Clemente (population estimated at 46750 on January 1, 1995), 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

(1) establish land use census procedure
(2) obtain and map existing information and aerial photography
(3) verify data by windshield surveys, interviews and correspondence
(4) prepare data tables using Southern California Edison (SCE) Form 26-184 and land use map for review
(5) prepare a draft report
(6) resolve comments and issue final report.

The Land Use Census Procedure outlines in detail the processes followed in preparing the Documentation Notebook (prepared under separate cover from this report).

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 are cows, goats and sheep whose milk is used in dairy products for human consumption.

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

Leafy vegetables include, but are not limited to, lettuce, cabbage, collar greens, and spinach.

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

TABLE F-1
Summary of Changes from 1995
Land Uses

1. San Onofre Mobile Homes. More accurate mapping as described above has moved the distance from 1.3 to 1.4 miles in Sector Q and from 1.2 to 1.3 miles in Sector R.

2. Sheep. The northern lease on Camp Pendleton was not renewed in 1995. The closest commercial meat animals are 5 miles from SONGS in Sectors E & F.

3. Hunting. The 1996 LUC includes revised base hunting take and range information. The Marine Corps Base Camp Pendleton Environmental Security Office provided hunting take date for the 1996 season.

4. Outage residence. There were no outage residences in parking lot 4 during the study period (June 1 to October 1, 1996).

5. More accurate mapping has caused relocation of a number of LUC locations. A Global Positioning System (GPS) receiver was used to establish the location of several census use areas.

6. San Onofre State Beach Campground (Sector G). The resident groundsman is no longer there. The estimated occupancy is 720 hours per year.

7. Several drinking wells were identified in the adjacent aquifers. These wells will be included in the REMP sample schedule pending approval of the sample plan by the Marine Corps Base.

TABLE F-2

1996 SONGS Units 2/3 **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 & Milk Animals (Specify Meat/Milk Producing)	
	Location (Miles)	Description	Location (Miles)	Description	Maximum Reported Person Exposure (hrs/yr)	Location (Miles)	Description
West Northwest (P)	2.8	Cotton Point Estates	* 0.5	Surf Beach	667	--	None **
Northwest (Q)	* 1.2	Maintenance Yard at 51 Area Beach	0.6	State Park Office Trailer	400	--	None **
North Northwest (R)	* 1.3	San Onofre Mobile Homes	2.6	San Clemente Ranch Packing	3,500 **	1.8 **	Hunting (Dove)
North (A)	3.6	Camp San Mateo	3.6	Camp San Mateo Motor Pool	2,000	1.8 **	Hunting (Dove)
North Northeast (B)	--		2.1	Sanitary Landfill	2,000	1.6 **	Hunting (Dove)
Northeast (C)	* 2.5	Camp San Onofre Fire Station	2.2	Camp San Onofre Sewage Treatmt Plant	2,000	1.0 **	Hunting (Deer)
East Northeast (D)	* 3.0	Camp San Onofre	3.7	Camp Horno Sewage Treatment Plant	2,000	0.8 **	Hunting (Deer)
East (E)	* 4.1	Camp Horno	4.0	Camp Horno Motor Pool	2,000	0.8 **	Hunting (Deer)
East Southeast (F)	--		0.8	San Onofre State Beach Entrance (Guard Shack)	1,500	1.5 **	Hunting (Deer)
Southeast (G)	--		* 0.9	San Onofre Beach (Campground)	720 **	--	None **

NOTES:

a. All distances are in miles from SONGS 2/3 site reference point (midpoint of SONGS Units 2/3 containment building).

b All sectors include 22 1/2° with "A" sector centered on True North.

c. A "residence" is a location occupied by an individual 2,000 hours or more in a year.

d. Sectors H, J, K, L, M, and N, are oceanward sectors and therefore land uses are not applicable.

*** Denotes changes from 1995 LUC based on updated mapping.**

**** Indicates change in land use from 1995 LUC.**

TABLE F-2 (Continued)

1996 SONGS Units 2/3
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	Location (Miles)	Description
West Northwest (P)	2.8	Casa Pacifica Gardens	2.8	Cotton Point Estates Gardens
Northwest (Q)	--	--	2.2	San Clemente Ranch
North Northwest (R)	--	--	2.3	San Clemente Ranch
North (A)	--	--	--	--
North Northeast (B)	--	--	--	--
Northwest (C)	--	--	--	--
East Northeast (D)	--	--	--	--
East (E)	--	--	--	--
East Southeast (F)	--	--	--	--
Southwest (G)	--	--	--	--

NOTES:
a. All distances are in miles from SONGS Units 2/3 site reference point (midpoint of SONGS Units 2/3 containment building).
b. All sectors include 22 1/2° with "A" sector centered on True North.
c. A "residence" is a location occupied by an individual 2,000 hours or more in a year.

TABLE F-3

1996 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 & Milk Animals (Specify Meat/Milk Producing)	
	Location (Miles)	Description	Location (Miles)	Description	Maximum Reported Person Exposure (hrs/yr)	Location (Miles)	Description
West Northwest (P)	2.6 *	Cotton Point Estates	0.4 *	Surf Beach	667	--	None
Northwest (Q)	0.9	Maintenance Yard at 51 Area Beach	0.5	State Park Office Trailer	400	--	None **
North Northwest (R)	1.2 *	San Onofre Mobile Homes	2.4	San Clemente Ranch Packing	3,218	1.6 **	Hunting (Dove)
North (A)	3.5	Camp San Mateo	3.5	Camp San Mateo Motor Pool	2,000	1.7 **	Hunting (Dove)
North Northeast (B)	--		2.1	Sanitary Landfill	2,000	1.6 **	Hunting (Dove)
Northeast (C)	2.4	Camp San Onofre Fire Station	2.3	Camp San Onofre Sewage Treatmt Plant	2,000	1.1 **	Hunting (Deer)
East Northeast (D)	3.0 *	Camp San Onofre	3.8 *	Camp Horno Sewage Treatment Plant	2,000	1.0 **	Hunting (Deer)
East (E)	4.2	Camp Horno	4.2	Camp Horno Motor Pool	2,000	1.0 **	Hunting (Deer)
East Southeast (F)	--		1.0	San Onofre State Beach Entrance (Guard Shack)	1,500	1.7 **	Hunting (Deer)
Southeast (G)	--		1.1 *	San Onofre Beach (Campground)	720 **	--	None **

NOTES:

a. All distances are in miles from SONGS Unit 1 site reference point (midpoint of SONGS Unit 1 containment building).

b All sectors include 22 1/2° with "A" sector centered on True North.

c. A "residence" is a location occupied by an individual 2,000 hours or more in a year.

d. Sectors H, J, K, L, M, and N are oceanward sectors and therefore land uses are not applicable.

*** Denotes changes from 1995 LUC based on updated mapping.**

**** Donates change based on updated hunting take data and information from the State Park.**

TABLE F-3 (Continued)

1996 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	Location (Miles)	Description
West Northwest (P)	2.6	Casa Pacifica Gardens	2.6	Cotton Point Estates
Northwest (Q)	--	--	2.0 *	San Clemente Ranch
North Northwest (R)	--	--	2.2 *	San Clemente Ranch
North (A)	--	--	--	--
North Northeast (B)	--	--	--	--
Northwest (C)	--	--	--	--
East Northeast (D)	--	--	--	--
East (E)	--	--	--	--
East Southeast (F)	--	--	--	--
Southwest (G)	--	--	--	--

NOTES: a. **All distances are in miles from SONGS Unit 1 site reference point (midpoint of SONGS Unit 1 containment building).**

b. **All sectors include 22 1/2° with "A" sector centered on True North.**

c. **A "residence" is a location occupied by an individual 2,000 hours or more in a year.**

* **Denotes changes from 1995 LUC based on updated mapping.**

APPENDIX G

FIGURES FOR 1996

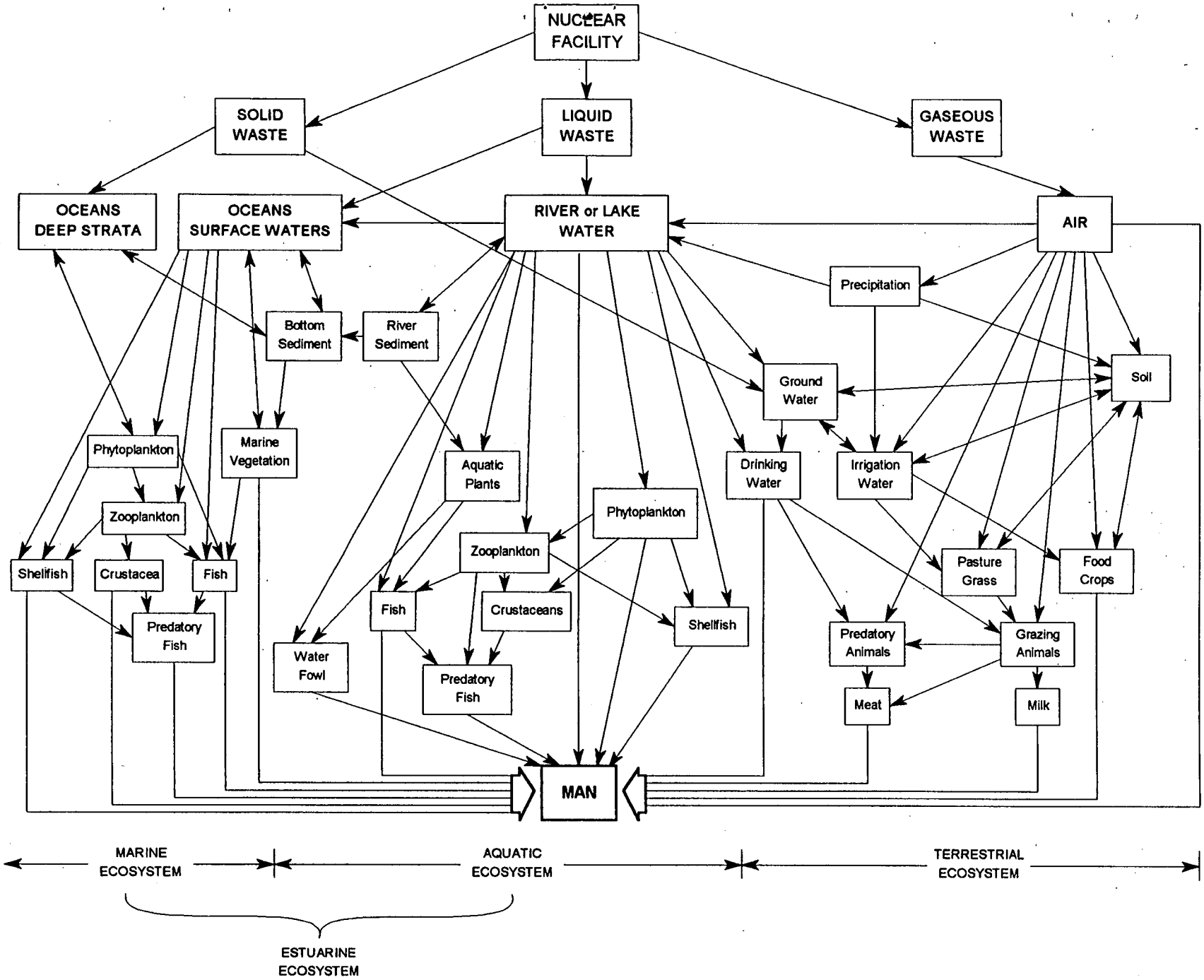


Figure 1. Potential Radiation Exposure Pathways Leading to Man

Direct Radiation Monitoring
Inner Ring Locations Vs. Controls - Quarterly Gamma Exposure (MREM)

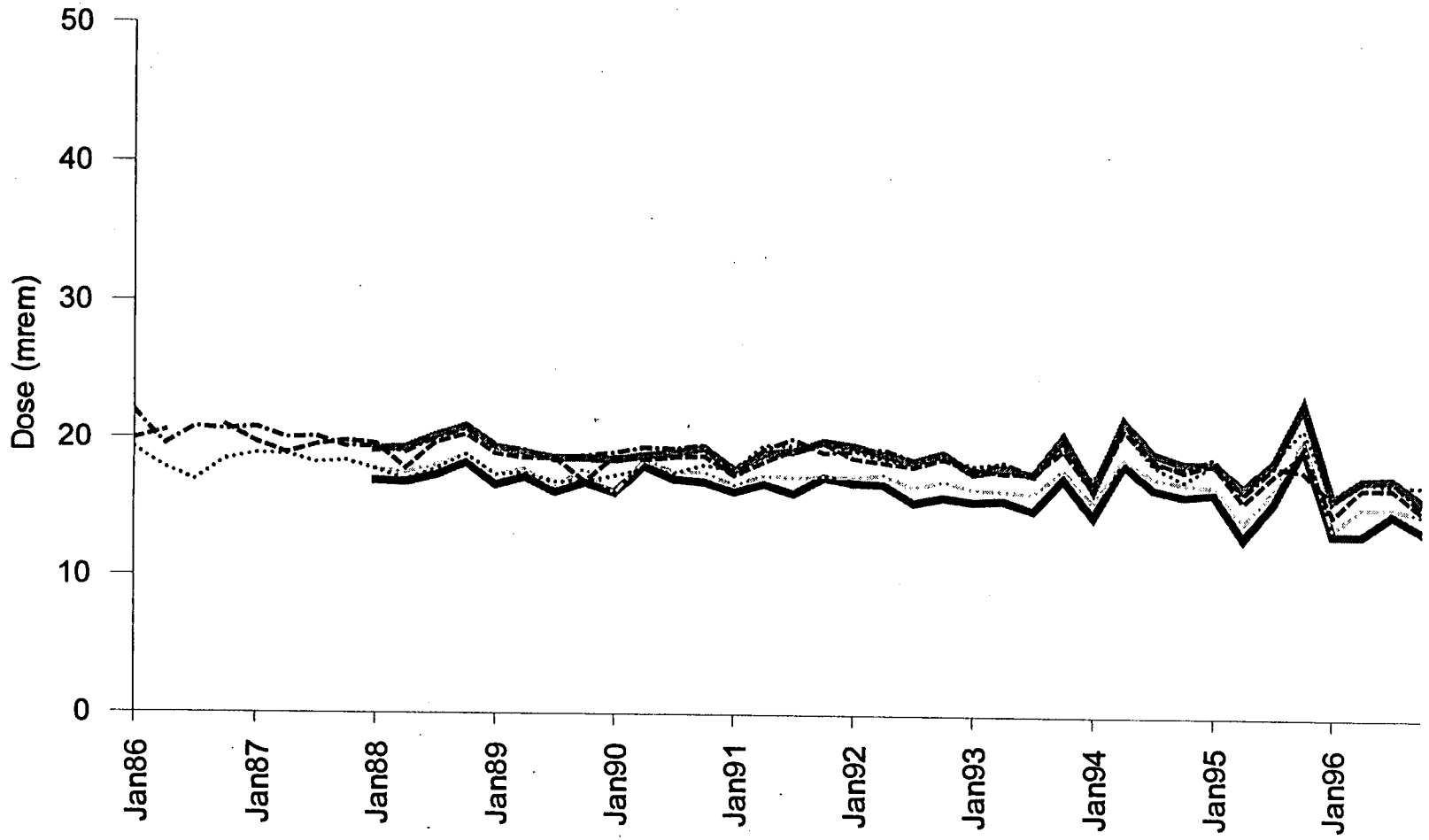


Figure 2A

Direct Radiation Monitoring
Inner Ring Locations Vs. Controls - Quarterly Gamma Exposure (MREM)

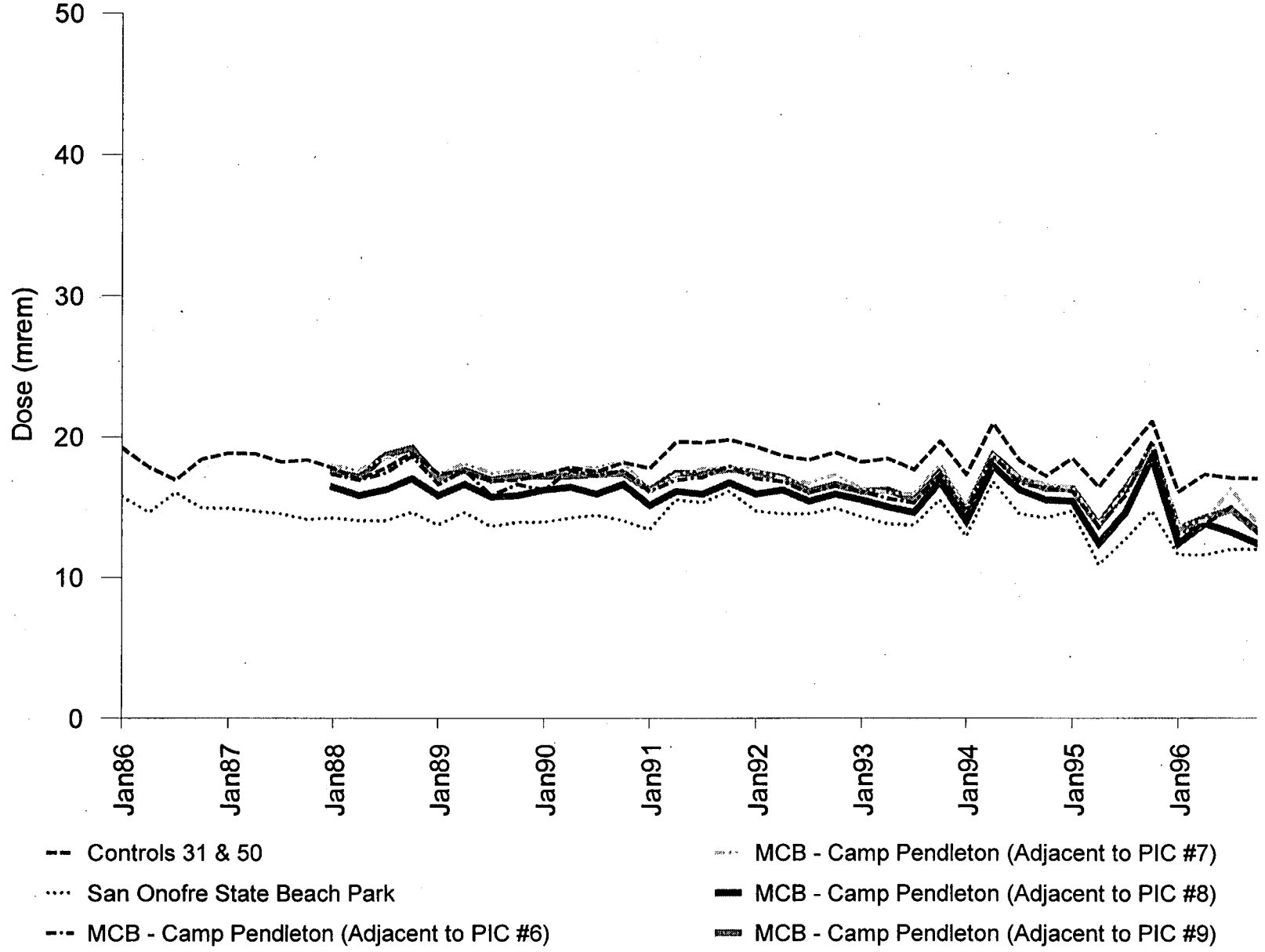


Figure 2B

Monthly Average Airborne Particulates Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3

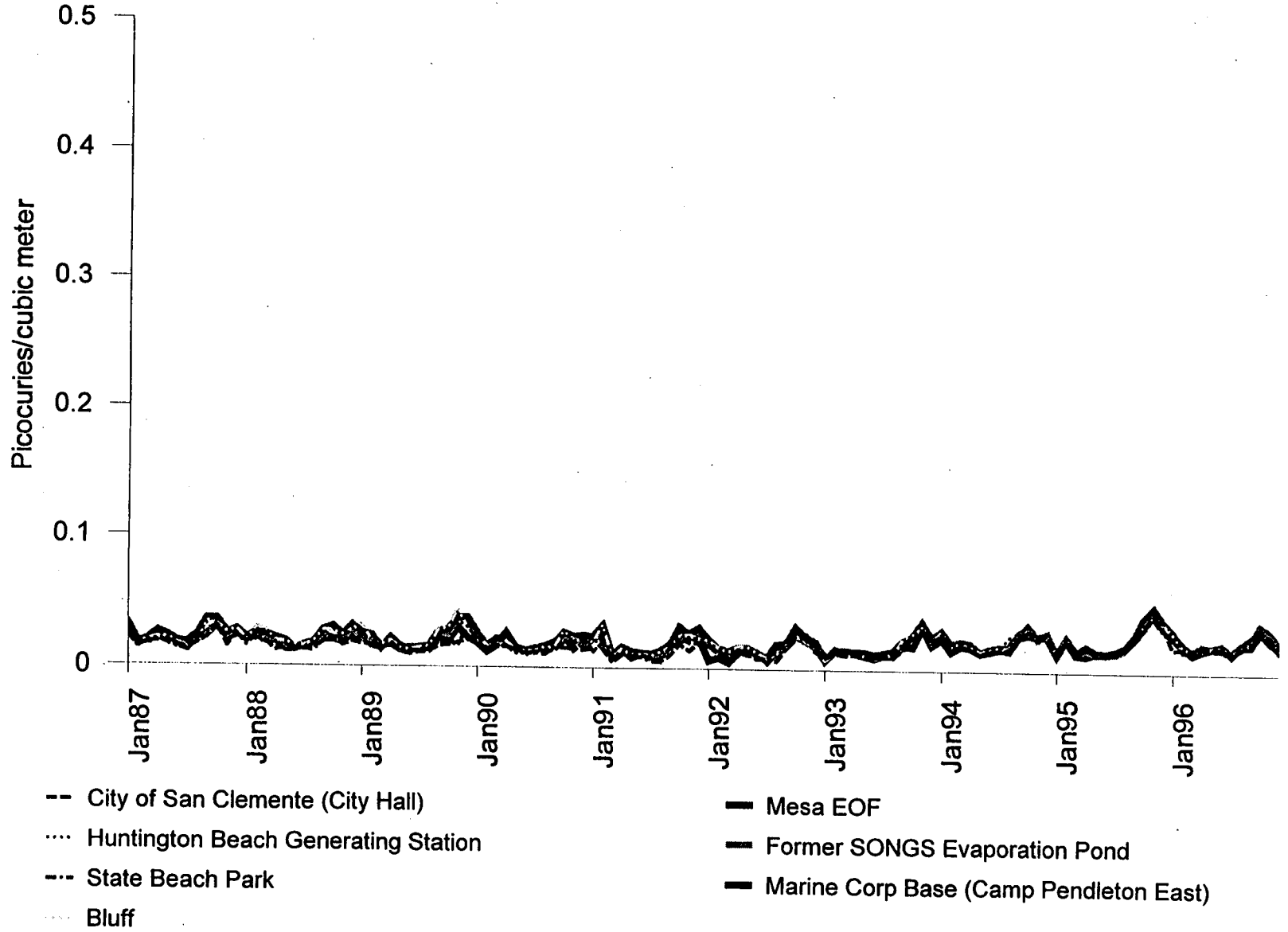


Figure 3A

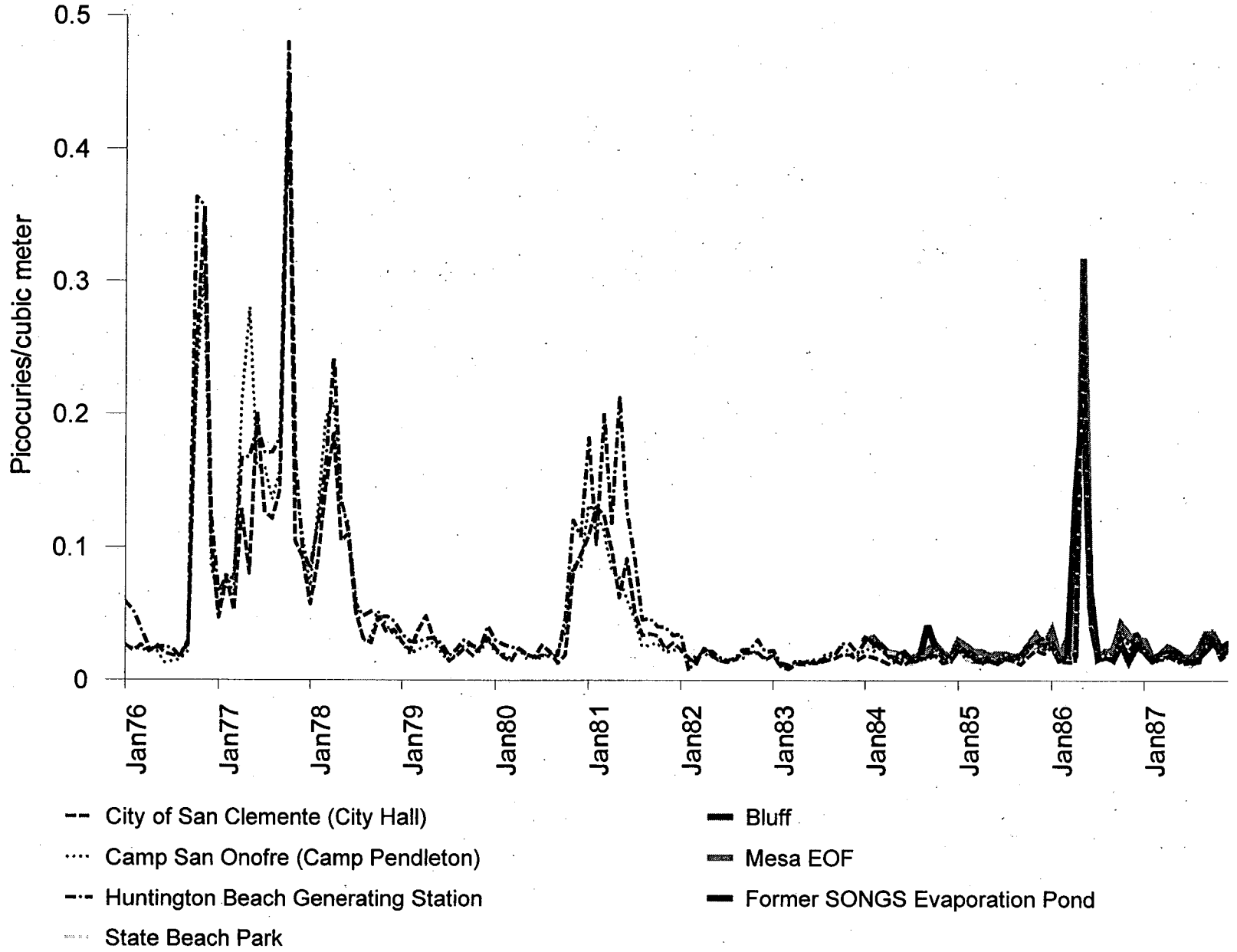

Monthly Average Airborne Particulates Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
Picocuries/cubic meter
0.5
0.4
0.3
0.2
0.1
0
Jan76
Jan77
Jan78
Jan79
Jan80
Jan81
Jan82
Jan83
Jan84
Jan85
Jan86
Jan87
City of San Clemente (City Hall)
Camp San Onofre (Camp Pendleton)
Huntington Beach Generating Station
State Beach Park
Bluff
Mesa EOF
Former SONGS Evaporation Pond

Figure 3B

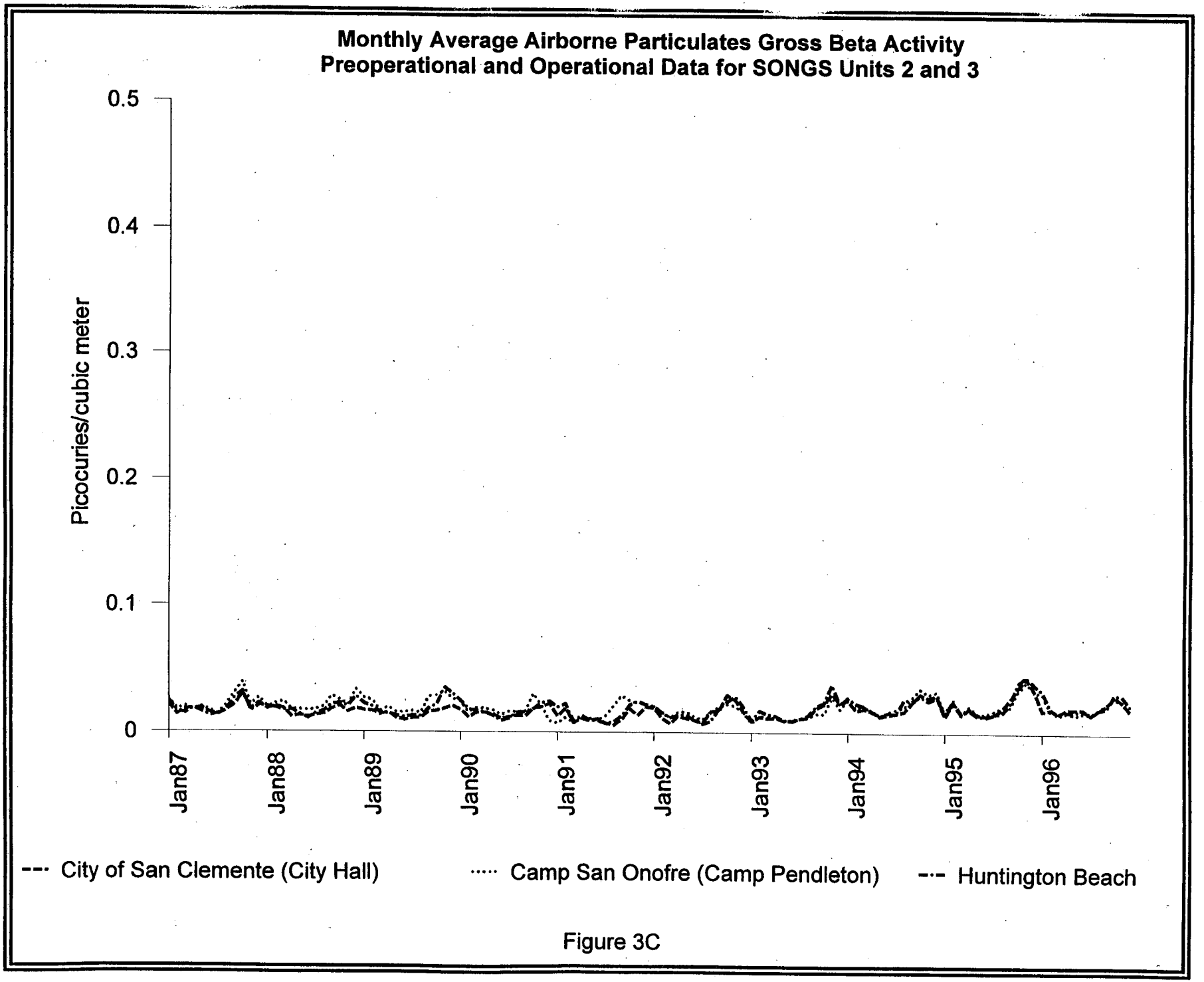

Monthly Average Airborne Particulates Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
Picocuries/cubic meter
0.5
0.4
0.3
0.2
0.1
0
Jan87
Jan88
Jan89
Jan90
Jan91
Jan92
Jan93
Jan94
Jan95
Jan96
City of San Clemente (City Hall)
Camp San Onofre (Camp Pendleton)
Huntington Beach

Figure 3C

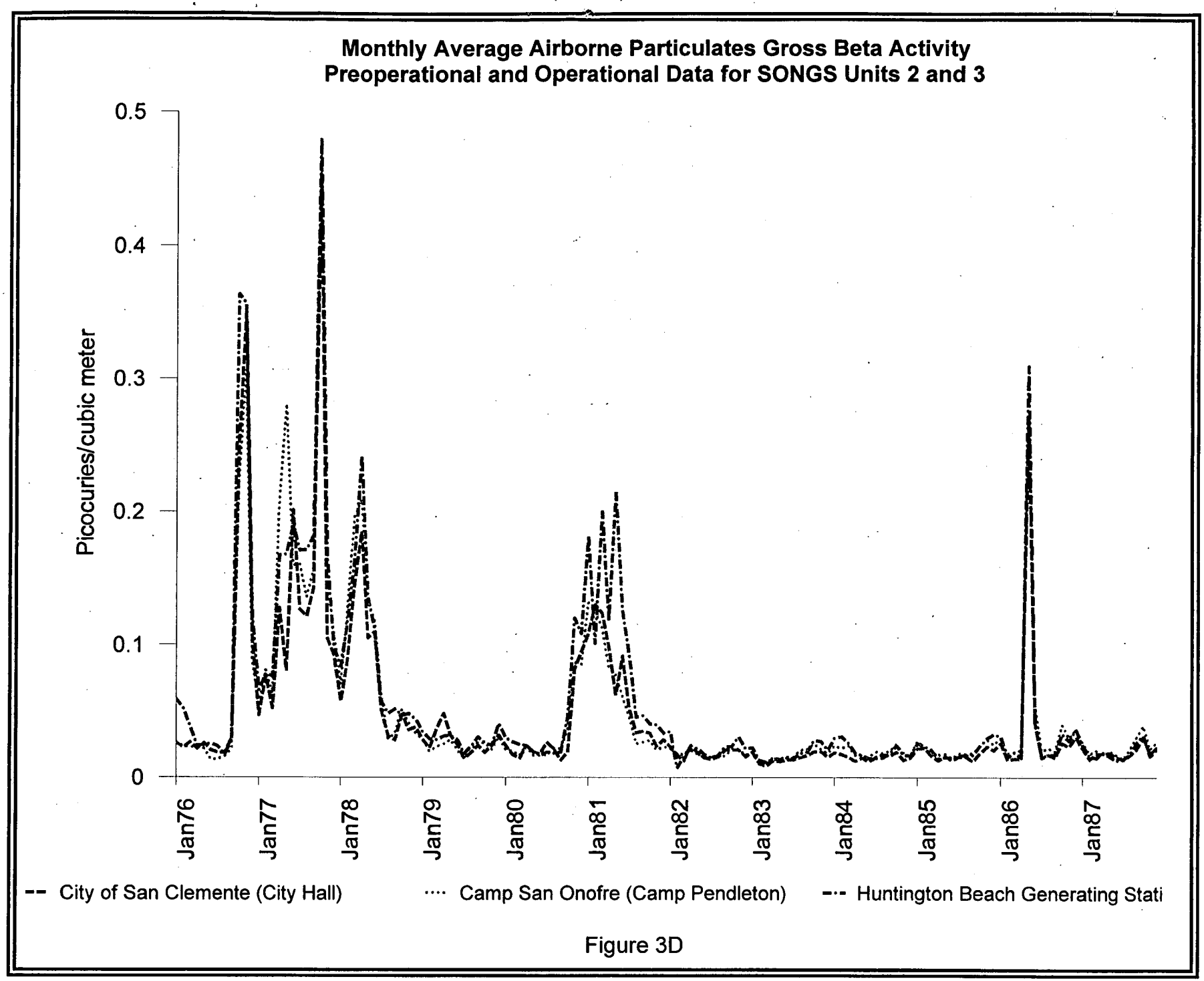

Monthly Average Airborne Particulates Gross Beta Activity
Preoperational and Operational Data for SONGS Units 2 and 3
Picocuries/cubic meter
0.5
0.4
0.3
0.2
0.1
0
Jan76
Jan77
Jan78
Jan79
Jan80
Jan81
Jan82
Jan83
Jan84
Jan85
Jan86
Jan87
City of San Clemente (City Hall)
Camp San Onofre (Camp Pendleton)
Huntington Beach Generating Stati

Figure 3D

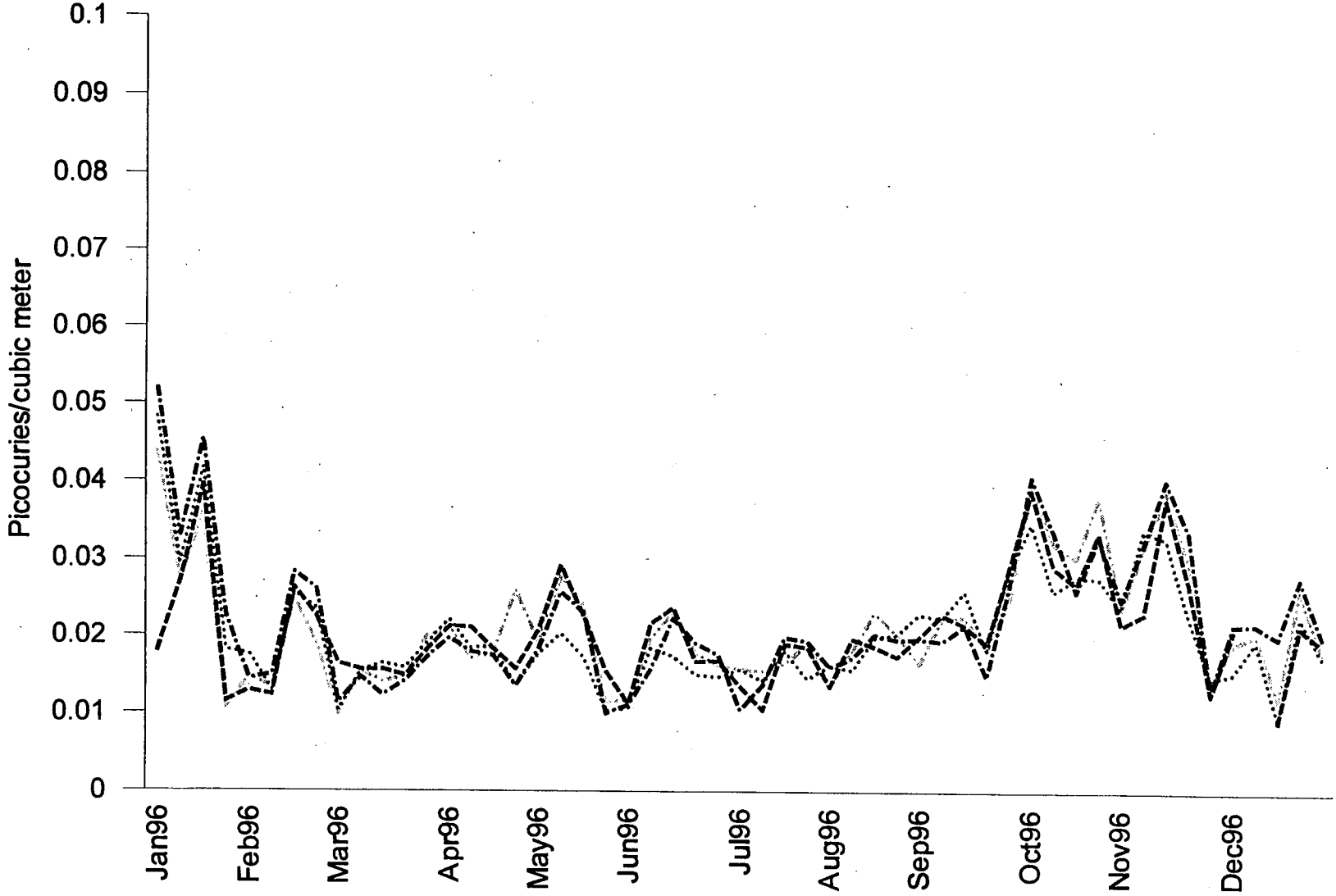

Weekly Airborne Particulate Gross Beta Activity
SONGS Units 1, 2 and 3
Picocuries/cubic meter
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Jan96
Feb96
Mar96
Apr96
May96
Jun96
Jul96
Aug96
Sep96
Oct96
Nov96
Dec96
City of San Clemente (City Hall)
Huntington Beach Generating Station
Camp San Onofre (Camp Pendleton)
State Beach Park

Figure 3E

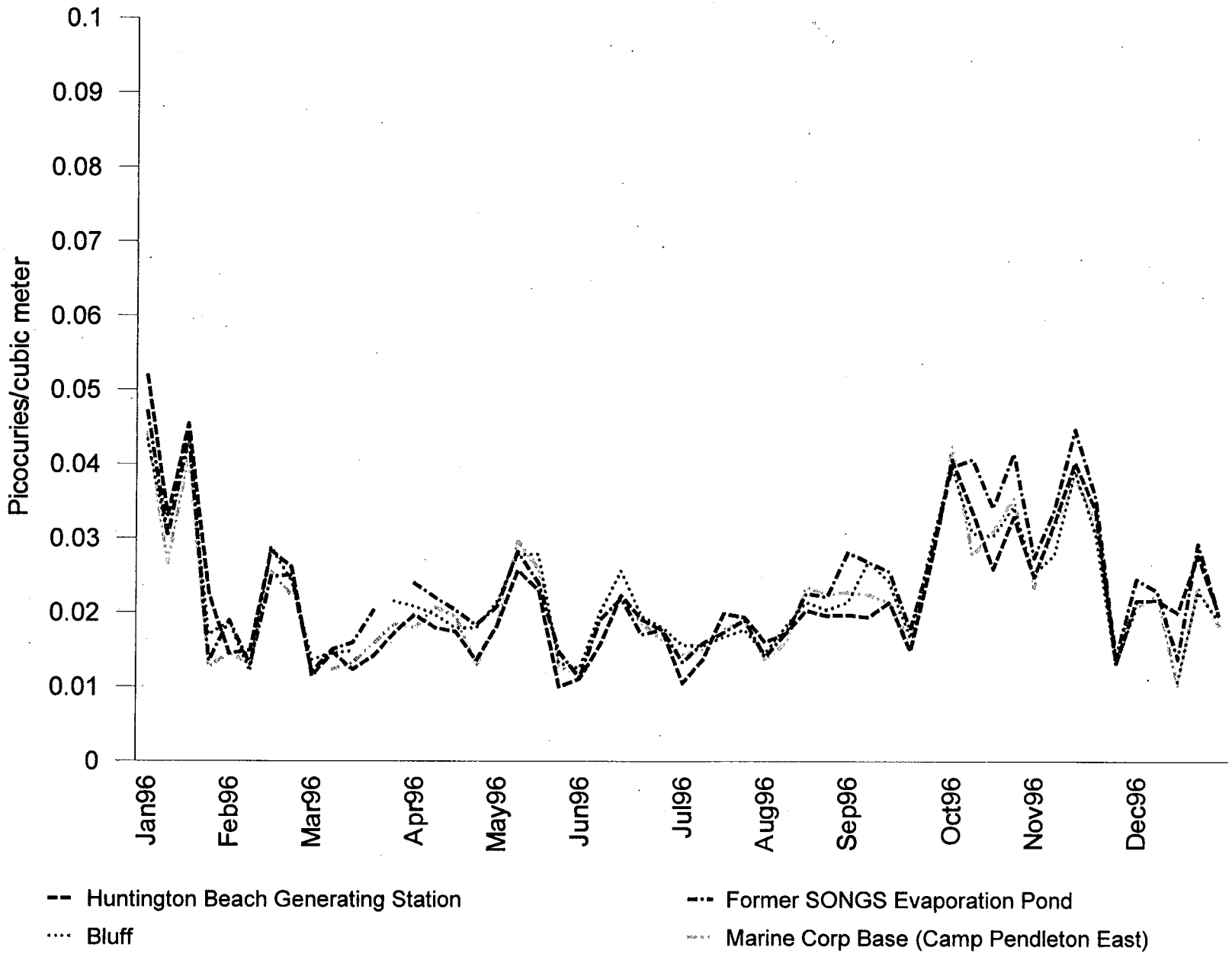

Weekly Airborne Particulate Gross Beta Activity
SONGS Units 1, 2 and 3
Picocuries/cubic meter
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Jan96
Feb96
Mar96
Apr96
May96
Jun96
Jul96
Aug96
Sep96
Oct96
Nov96
Dec96
Huntington Beach Generating Station
Former SONGS Evaporation Pond
Bluff
Marine Corp Base (Camp Pendleton East)

Figure 3F

Preoperational and Operational Data For SONGS Units 2 and 3
Radionuclide Activity in Kelp
Element = I-131

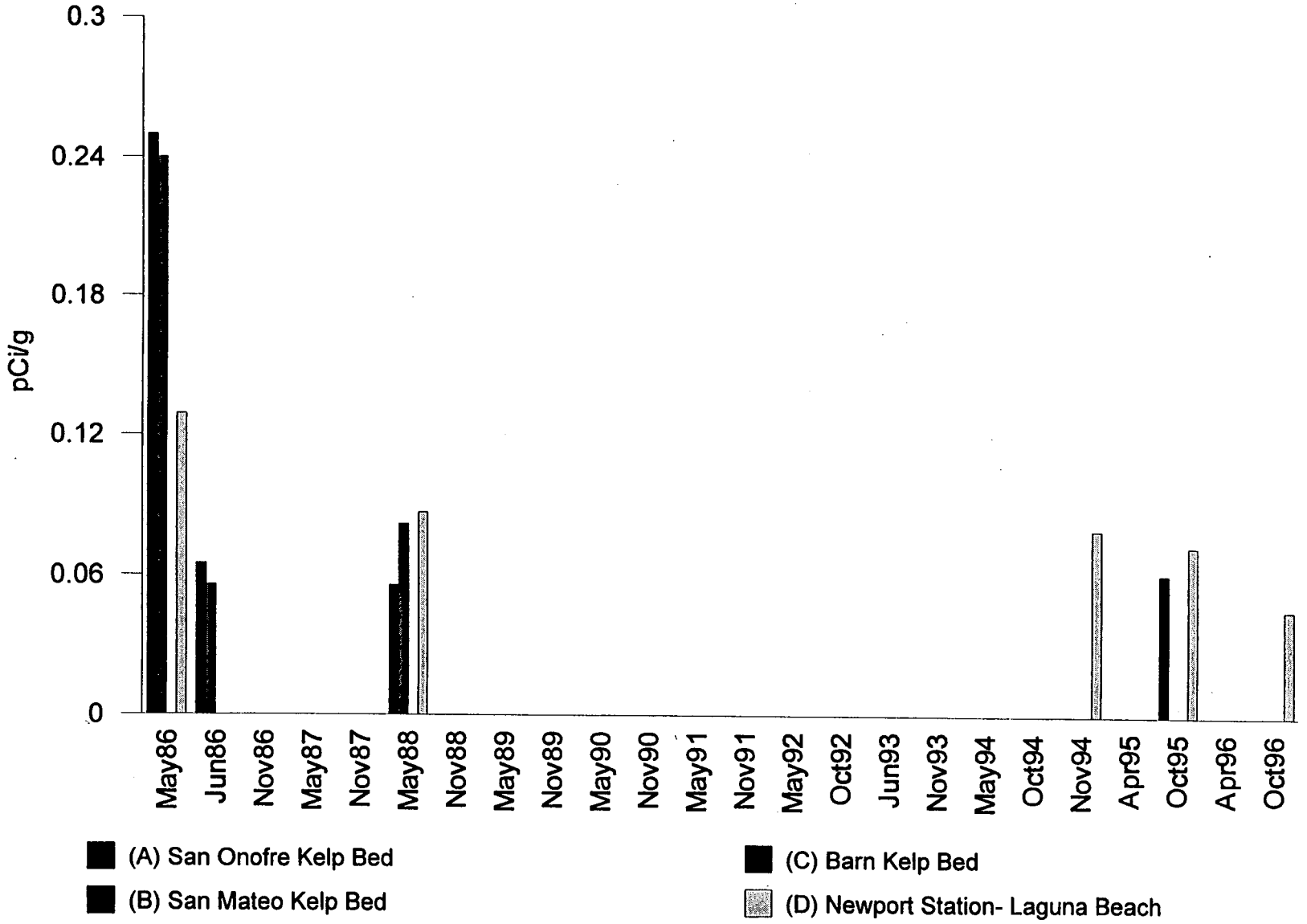


Figure 4A

Preoperational and Operational Data For SONGS Units 2 and 3
Radionuclide Activity in Kelp
Element = I-131

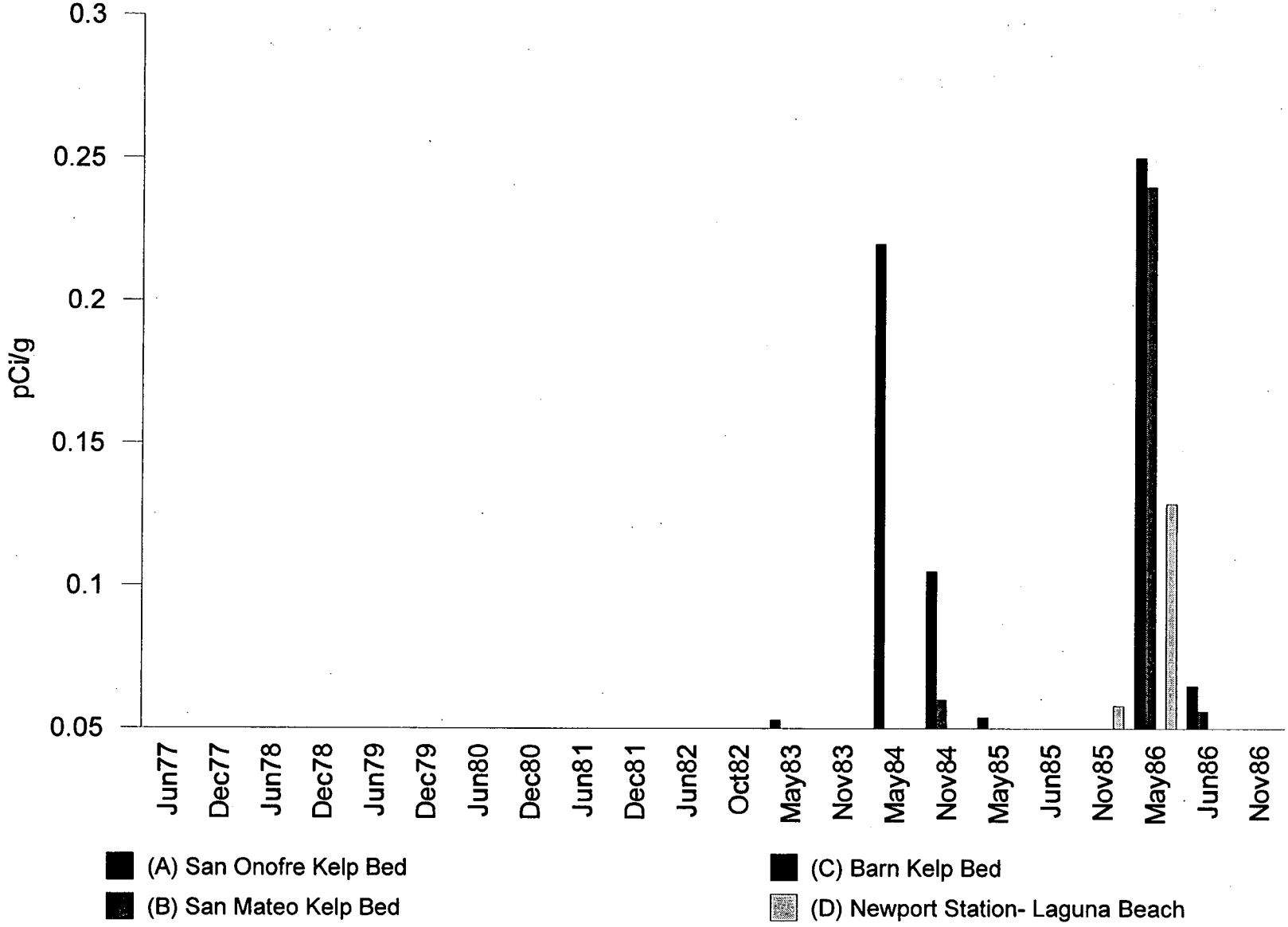


Figure 4B

APPENDIX H

ERRATA TO THE 1995 AREOR

The following errors were detected in the 1995 AREOR:

Page 29 — The 1995 I-131 concentration at the control location (0.073 pCi/g) and the indicator location (0.061 pCi/g) were slightly above the a priori LLD (0.05 pCi/g). In the 1995 AREOR, the LLD was identified as an a posteriori value.

Page 58 — The a priori LLD for Fe-59 in Non-migratory Marine Animals was 0.26 pCi/g. The value reported was 0.30 pCi/g.

Page 81 — Cs-137 was <LLD for all shoreline sediment samples during the 1995 operational period.

APPENDIX I

REMP TLDs CO-LOCATED WITH NRC TLDs

Requirements in the standard Technical Specifications adopted under the Technical Specifications Improvement Program include reporting results of those thermoluminescent dosimeters that are co-located with NRC dosimeters. This appendix adds these data.

The co-located dosimeters and results of the dosimeters (millirem) for 1996 are indicated below.

Location #	Location Name	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
1	San Clemente	15.2	17.4	17.2	16.4
2	Camp San Mateo	16.5	18.1	18.9	18.3
3	Camp San Onofre	14.8	16.2	15.8	15.5
6	Old Route 101 (East-Southeast)	10.2	11.1	11.0	11.3
10	San Onofre Surfing Beach	14.8	16.8	16.8	15.1
22	Coast Guard Station	15.4	16.3	18.6	16.1
34	San Onofre Elementary School	14.9	16.4	16.9	16.7
41	Old Route 101 (Unit 3)	14.5	15.0	15.6	14.1
50	Oceanside Fire Station	16.0	16.3	16.9	16.0