1995 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

Docket Nos. 50-206, 50-361, 50-362

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

APRIL 1996

SOUTHERN CALIFORNIA EDISON

An *EDISON INTERNATIONAL* Company

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Approved by: MJ Johnson 4/16/96

APRIL 1996

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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 since then.

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 & 2/3 Offsite Dose Calculation Manual (ODCM), Administrative control of the program was conducted in accordance with sections 6.9.1.3 and 6.9.2 of the Unit 1 Permanently Defueled Technical Specifications (PDTS) and sections 6.8.4.f and 6.9.1.6 of Unit 2 and Unit 3 Technical Specifications.

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 REMP Report.

A land use census was performed in 1995 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 H 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 man, experience gained during the preoperational phase, 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 and may be expected to manifest effects of 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 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 report 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.

* NUREG-1301

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

* 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

Establishment 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 1995 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 DHS. 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 1995 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 1995 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 1995 has been negligible, and the resulting dose to man is negligible. The trend continues to be towards de minimis levels of radioactivity attributable to the operation of SONGS in the local environment.

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 1994.

4. ODCM (Offsite Dose Calculation Manual) for SONGS Units 1, 2 and 3, Section 5.0, 1994.

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

6. USNRC Draft Regulatory Guide 4.8, Table 1, "Standard Format and Principal Content of Environmental Technical Specifications," December 1975.

7. USNRC Regulatory Guide 4.13, "Performance, Testing and Procedural Specifications for Thermoluminescent Dosimetry - Environmental Applications," 1977.

8. USNRC Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs," Rev. l, February 1979.

9. SONGS Units 1, 2 and 3, Technical Specifications Section 6.9, Administrative Controls.

10. USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR 50, Appendix I," Rev. 1, October 1977.

11. AIF/NESP-004, Environmental Impact Monitoring of Nuclear Power Plants, February 1975.

12. USNRC NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants.

13. USNRC NUREG-1301, Offsite Dose Calculations Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors Generic Letter 89-01, Supplement No. 1, April 1991.

14. NUREG-0543, Methods for Demonstrating LWR Compliance with the EPA Uranium Fuel Cycle Standard (40 CFR Part 190).

15. Annual Radioactive Effluent Release Reports for Unit 1 and Units 2 and 3, 1994.

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)	5.6	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	1.5	NW
10	Bluff (Adjacent to PIC #1)	0.7	WNW
11	Former Visitor's Center	0.3 **	NW
12	South of Switchyard	0.2 **	E
13	Southeast Site Boundary (Bluff)	0.4 **	SE
14	Huntington Beach Generating Station	37	NW
15	Southeast Site Boundary (Office Building)	0.2 **	SE
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	8.2	NW

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

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

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

MCB Marine Corp Base Camp Pendleton

PIC Pressurized Ion Chamber

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

	TYPE OF SAMPLE AND SAMPLING LOCATION	DISTANCE * (miles)	DIRECTION * (sector)
Direct Radiation (Continued)			
31	Aurora Park - Mission Viejo (CONTROL)	18.7	NNW
33	Camp Talega - MCB	5.7	N
34	San Onofre School - MCB	1.9	NW
35	Range 312 - MCB	4.7	NNE
36	Range 208C - MCB	4.2	NE
38	San Onofre State Beach Park	3.3	SE
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	NNW
41	Old Route 101 - East	0.4 **	E
44	Fallbrook Fire Station	18.0	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

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)	15.5	SE
53	San Diego County Operations Center	45	SE
54	Escondido Fire Station	32	ESE
55	San Onofre State Beach (Unit 1, West Southwest)	0.2 **	WSW
56	San Onofre State Beach (Unit 1, Southwest)	0.1 **	SW
57	San Onofre State Beach (Unit 2)	0.1 **	SSW
58	San Onofre State Beach (Unit 3)	0.1 **	S
59	SONGS Meteorological Tower	0.3 **	WNW
60	Transit Control Storage Area	---	---
61	Mesa - East Boundary (Adjacent to PIC #4)	0.7	N
62	MCB - Camp Pendleton (Adjacent to PIC #5)	0.6	NNE
63	MCB - Camp Pendleton (Adjacent to PIC #6)	0.6	NE
64	MCB - Camp Pendleton (Adjacent to PIC #7)	0.5	ENE
65	MCB - Camp Pendleton (Adjacent to PIC #8)	0.7	E
66	San Onofre State Beach (Adjacent to PIC #9)	0.6	ESE
67	Former SONGS Evaporation Pond (Adjacent to PIC #2)	0.6	NW
68	Range 210C - MCB	4.3	ENE
73	South Yard	0.2	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)

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

MCB Marine Corp Base Camp Pendleton

PIC Pressurized Ion Chamber

SSID Shop Services & Instrumentation Division, Westminister California (not part of SONGS)

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)	5.5	NW
2	Camp San Onofre (Camp Pendleton)	1.8	NE
3	Huntington Beach Generating Station (CONTROL)	37.0	NW
5	Units 2 and 3 Switchyard	0.13 **	NNE
7	AWS Roof	0.18 **	NW
9	State Beach Park	0.6	ESE
10	Bluff	0.7	WNW
11	Mesa EOF	0.7	NNW
12	Former SONGS Evaporation Pond	0.6	NW
13	Marine Corp Base (Camp Pendleton East)	0.7	E
Soil Samples			
1	Camp San Onofre	2.5	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)	37.0	NW
5	Former Visitor's Center (East Site Boundary)	0.2 **	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

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	8.7	NW
2	San Clemente Golf Course Well	3.5	NNW
3	Huntington Beach (CONTROL)	37.0	NW
Shoreline Sediment (Beach Sand)			
1	San Onofre State Beach (0.6 mile)	0.6	SE
2	San Onofre Surfing Beach	0.9	NW
3	San Onofre State Beach (3.1 miles)	3.1	SE
4	Newport Beach North End (CONTROL)	30.0	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.

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

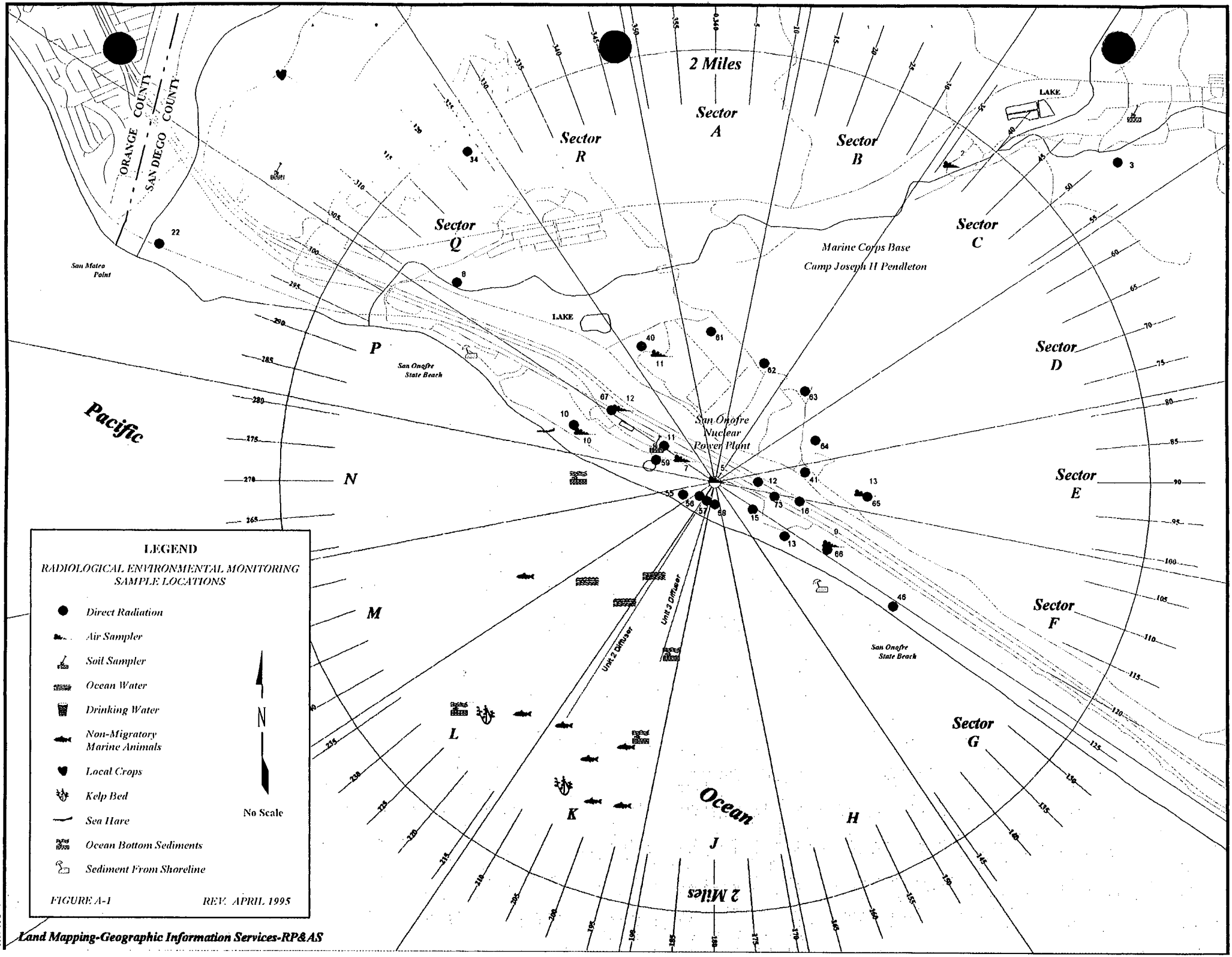
* Distance (miles) and Direction (sector) are measured relative to Units 2 & 3 midpoint. Direction is determined from degrees true north.

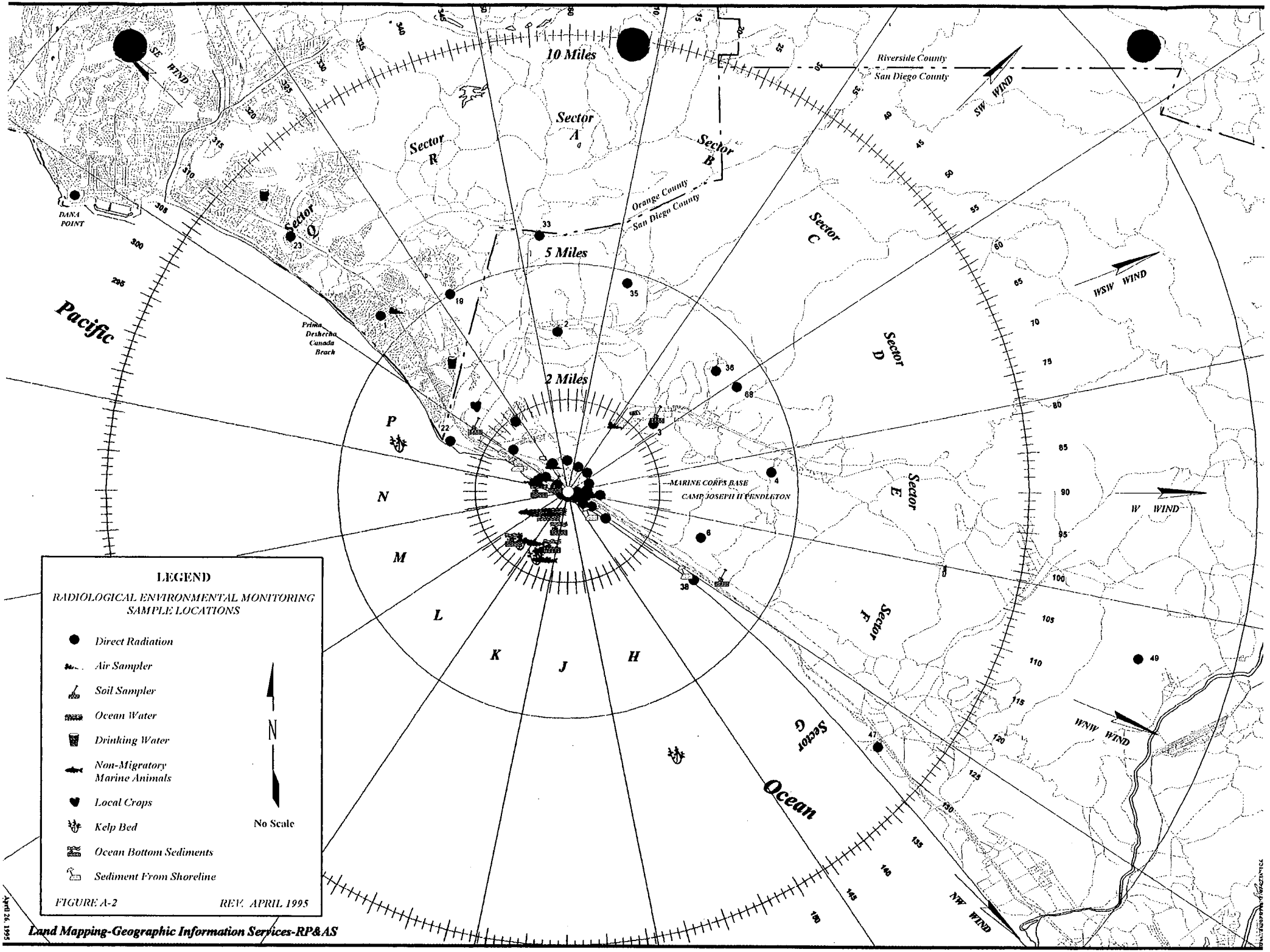
TABLE A-2

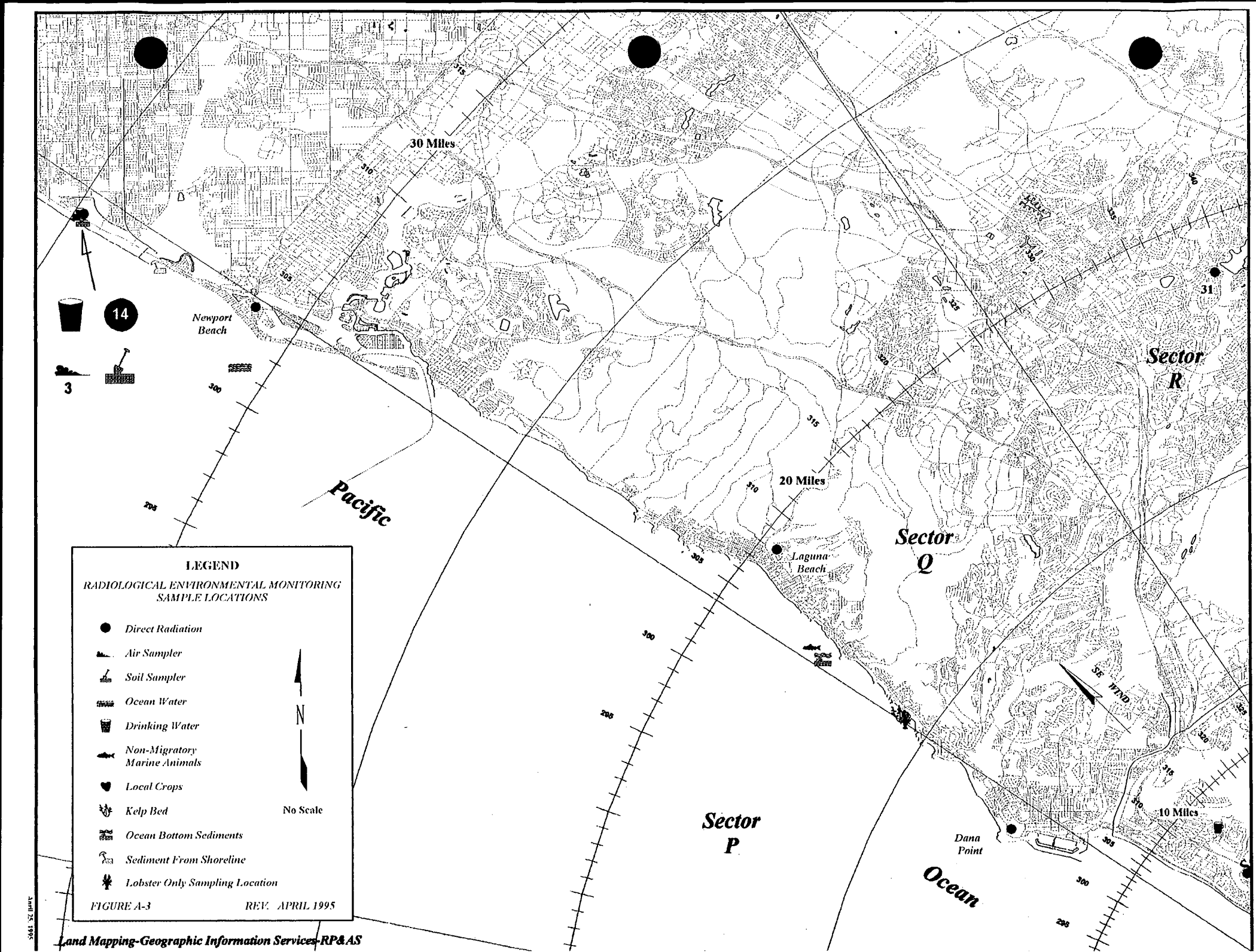
SECTOR AND DIRECTION DESIGNATION FOR RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATION MAP

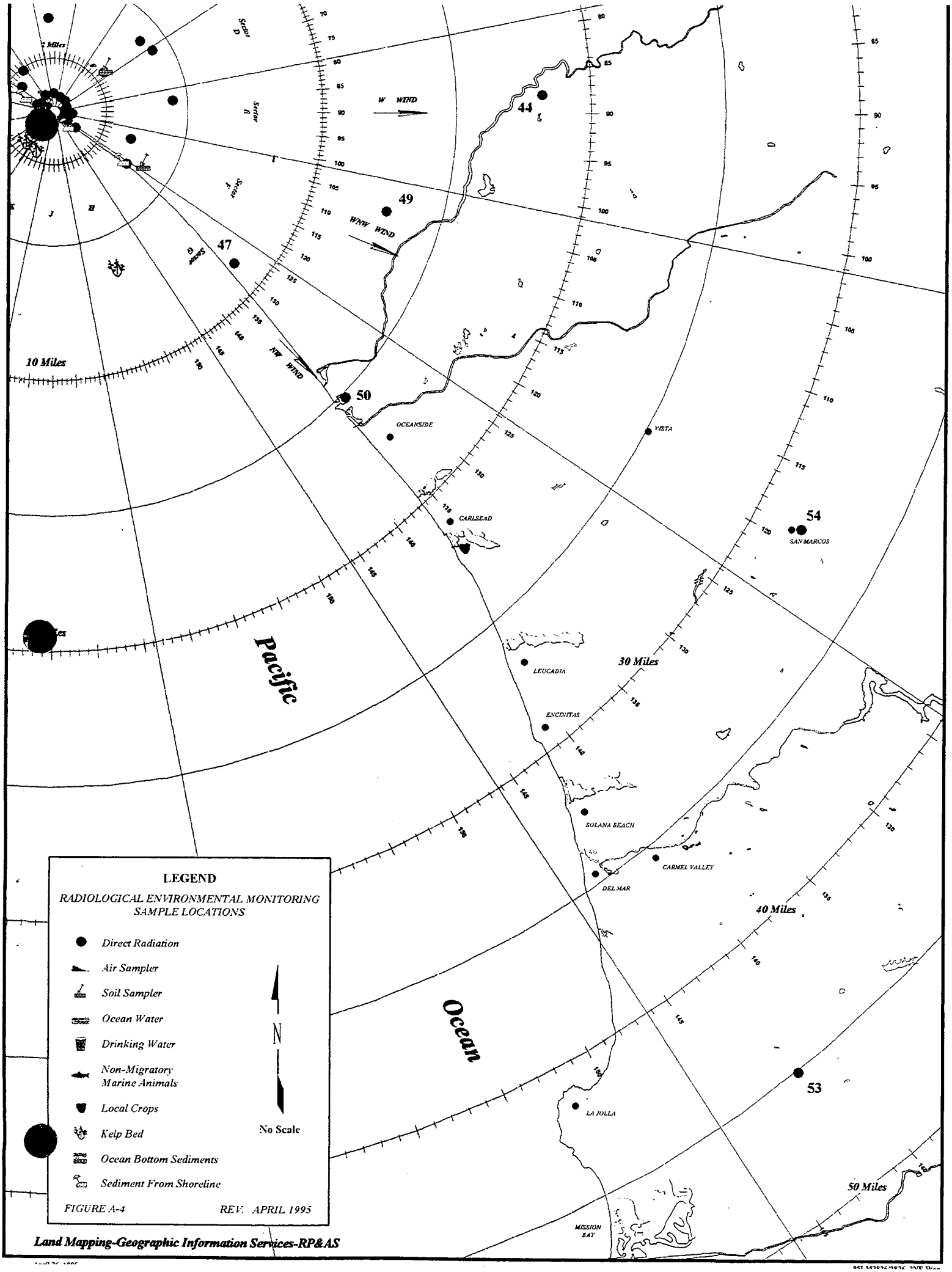
DEGREES TRUE NORTH
FROM SONGS 2 AND 3 MIDPOINT — NOMENCLATURE

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


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 Q
Sector R
ORANGE COUNTY
SAN DIEGO COUNTY
Pacific
Ocean
San Mateo Point
San Onofre State Beach
San Onofre Nuclear Power Plant
Marine Corps Base Camp Joseph H Pendleton
LAKE
Unit 2 Diffuser
Unit 3 Diffuser
LEGEND
RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS
Direct Radiation
Air Sampler
Soil Sampler
Ocean Water
Drinking Water
Non-Migratory Marine Animals
Local Crops
Kelp Bed
Sea Hare
Ocean Bottom Sediments
Sediment From Shoreline
N
No Scale
FIGURE A-1
REV. APRIL 1995
Land Mapping-Geographic Information Services-RP&AS
April 26, 1995
95LM2826/LM2826NE.Wor


10 Miles
5 Miles
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 Q
Sector R
Riverside County
San Diego County
Orange County
San Diego County
SE WIND
SW WIND
WSW WIND
W WIND
WNW WIND
NW WIND
DANA POINT
Pacific
Ocean
Prima Deshecha Canada Beach
MARINE CORPS BASE
CAMP JOSEPH H PENDLETON
LEGEND
RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS
Direct Radiation
Air Sampler
Soil Sampler
Ocean Water
Drinking Water
Non-Migratory Marine Animals
Local Crops
Kelp Bed
Ocean Bottom Sediments
Sediment From Shoreline
N
No Scale
FIGURE A-2
REV. APRIL 1995
April 26, 1995
Land Mapping-Geographic Information Services-RP&AS


30 Miles
20 Miles
10 Miles
Newport Beach
Laguna Beach
Dana Point
Pacific
Ocean
Sector P
Sector Q
Sector R
14
3
31
56 WIND
N
No Scale
LEGEND
RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS
Direct Radiation
Air Sampler
Soil Sampler
Ocean Water
Drinking Water
Non-Migratory Marine Animals
Local Crops
Kelp Bed
Ocean Bottom Sediments
Sediment From Shoreline
Lobster Only Sampling Location
FIGURE A-3
REV. APRIL 1995
Land Mapping-Geographic Information Services-RP&AS
April 25, 1995
95LM2826/2826_2NE.Wor


W WIND
WNW WIND
NW WIND
44
49
47
50
54
53
10 Miles
30 Miles
40 Miles
50 Miles
OCEANSIDE
VISTA
CARLSBAD
SAN MARCOS
LEUCADIA
ENCINITAS
SOLANA BEACH
CARMEL VALLEY
DEL MAR
LA JOLLA
MISSION BAY
Pacific
Ocean
Sector D
Sector E
Sector F
Sector G
LEGEND
RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS
Direct Radiation
Air Sampler
Soil Sampler
Ocean Water
Drinking Water
Non-Migratory Marine Animals
Local Crops
Kelp Bed
Ocean Bottom Sediments
Sediment From Shoreline
N
No Scale
FIGURE A-4
REV. APRIL 1995
Land Mapping-Geographic Information Services-RP&AS

APPENDIX B

SUMMARY, RESULTS, AND DISCUSSIONS

OF 1995 ENVIRONMENTAL DATA

SUMMARY

To assess the changes or trends in the radioactivity level in the environment over the past year, the data from January 1995 to December 1995 were evaluated. The 1994 Annual Radiological Environmental Operating (AREO) report and historical data were also reviewed. An updated evaluation of trends is included herein. Refer to the 1994 AREO report for detailed historical data. In 1995 the radioactivity detected in Radiological Environmental Monitoring Program (REMP) samples was almost exclusively from naturally occurring isotopes. Table B-8 summarizes the REMP samples obtained in 1995. A statistical summary of the 1995 REMP data is contained in Table B-9. Of the 587 isotopically analyzed REMP samples three (3) results were slightly above detection limit for isotopes attributable to the operation of SONGS (I-131 detected in two Kelp and Cs-137 detected in one soil sample). The likely source of the detected radioactivity does not appear to be SONGS related. The trend continues to be towards de minimis levels of anthropogenic radioactivity in the environment near SONGS.

RESULTS AND DISCUSSIONS OF 1995 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 (excluding six laboratory control TLD's). 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 18.7 miles, NW) and in Oceanside (Fire Station at 15.5 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 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).

A total of 51 TLDs were analyzed quarterly (except one missing TLD, # 22, in the second quarter of 1995). In addition, TLD numbers 17, 18, and 60 are used only for lab control and #A & #B for transit dose (dose contribution from the lab and during transportation). A fader TLD used to compensate for the time and temperature dependent "fade" associated with these type of dosimeters.

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 17.3 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 fourth quarter (27.6 mrem), with an average quarterly dose of 26.2 mrem (uncorrected for background). Subtracting a background dose of 74 mrem/year, the net annual dose for this location was 1.05 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, on the other hand, 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 plant effects are negligible.

Figures 2A & 2B compare environmental radiation levels of indicator and control locations for the operational year 1995 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 this environmental medium.

TABLE B-1

INNER RING LOCATIONS REQUIRED BY SONGS UNIT 1 ODCM

Direction (Sector)	Distance (Miles)	Angle From True North	TLD	Location Description**
WNW (P)	0.39	297.6	10	Bluff (Adjacent to PIC #1)
NW (Q)	1.22	310.1	8	Non-Commissioned Officers Beach Club
NNW (R)	0.30	326.8*	67	Formes SONGS Evaporation Pond (Adjacent to PIC #2)
N (A)	0.54	0.07	40	SCE Training Center (Adjacent to PIC #3)
NNE (B)	0.63	26.6	61	MCB Camp Pendleton (Adjacent to PIC #4)
NE (C)	0.66	43.4	62	MCB Camp Pendleton (Adjacent to PIC #5)
ENE (D)	0.72	67.8	63	MCB Camp Pendleton (Adjacent to PIC #6)
E (E)	0.76	86.1	64	MCB Camp Pendleton (Adjacent to PIC #7)
ESE (F)	0.86	120.2	66	MCB Camp Pendleton (Adjacent to PIC #9)
SE (G)	1.28	121.3	46	San Onofre State Beach Park

* **At the border of Sectors Q and R**
** **PIC - Pressurized in chamber**

TABLE B-2

INNER RING LOCATIONS REQUIRED BY SONGS UNITS 2/3 ODCM

Direction (Sector)	Distance (Miles)	Angle From True North	TLD	Location Description
WNW (P)	0.665	298	10	Bluff (Adjacent to PIC #1)
NW (Q)	0.553	313	67	Formes SONGS Evaporation Pond (Adjacent to PIC #2)
NNW (R)	0.715	340	40	SCE Training Center (Adjacent to PIC #3)
N (A)	0.696	3	61	MCB Camp Pendleton (Adjacent to PIC #4)
NNE (B)	0.653	19	62	MCB Camp Pendleton (Adjacent to PIC #5)
NE (C)	0.584	46	63	MCB Camp Pendleton (Adjacent to PIC #6)
ENE (D)	0.541	70	64	MCB Camp Pendleton (Adjacent to PIC #7)
E (E)	0.696	98	65	MCB Camp Pendleton (Adjacent to PIC #8)
ESE (F)	0.584	121	66	MCB Camp Pendleton (Adjacent to PIC #9)
SE (G)	1.0	122	46	San Onofre State Beach Park

TABLE B-3

OUTER RING LOCATIONS REQUIRED BY SONGS UNIT 1 ODCM

Direction (Sector)	Distance (Miles)	Angle From True North	TLD	Location Description
WNW (P)	2.42	300.2	22	Former U. S. Coast Guard Stations San Mateo Point
NW (Q)	5.33	311.6	1	City of San Clemente
NNW (R)	4.76	331.8	19	San Clemente Highlands
N (A)	3.38	355.4	2	Camp San Mateo
NNE (B)	4.66	21.4	35	Range 312 (MCB)
NE (C)	4.32	55.4	36	Range 208C (MCB)
ENE (D)	4.48	70.3	68	Range 210C (MCB)
E (E)	4.73	84.0	4	Camp Horno
ESE (F)	3.28	118.1	6	Old Route 101
SE (G)	3.58	126.3	38	San Onofre State Beach Park

TABLE B-4

OUTER RING LOCATIONS REQUIRED BY SONGS UNITS 2/3 ODCM

Direction (Sector)	Distance (Miles)	Angle From True North	TLD	Location Description
WNW (P)	2.7	300	22	Former U. S. Coast Guard Stations San Mateo Point
NW (Q)	5.6	319	1	City of San Clemente
NNW (R)	5.0	330	19	San Clemente Highlands
N (A)	5.7	353	33	Camp San Mateo
NNE (B)	4.7	18	35	Range 312 (MCB)
NE (C)	4.2	52	36	Range 208C (MCB)
ENE (D)	4.3	68	68	Range 210C (MCB)
E (E)	4.5	82	4	Camp Horno
ESE (F)	3.0	118	6	Old Route 101
SE (G)	3.3	127	38	San Onofre State Beach Park

B. Airborne Particulate, Iodine, and Composite Isotopic Analyses

Sample locations are selected in accordance with the requirements of the Unit 1 and Units 2/3 Offsite Dose Calculation Manuals (See Tables B-6 and B-7).

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 (Table B-5).

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 (seven required by ODCMs appear in Table B-5) and from a control location situated in the city of Huntington Beach. Figures 3E and 3F show the variation in gross beta activity level in 1995 in different locations. After collection, the samples were analyzed for gross beta activity with a lower limit of detection of 0.003 pCi/m^3 of air.

Samples were also composited quarterly and analyzed for 11 naturally-occurring and station-related radionuclides by gamma spectral analysis, radio-strontium by beta counting, and gross alpha radioactivity by alpha counting. Gross beta activity in 364 indicator samples and 52 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 0.005 to 0.059 pCi/m^3, averaging 0.023 pCi/m^3 of air. The concentrations of gross beta activity in the samples from Huntington Beach control location ranged from 0.007 to 0.059 pCi/m^3, averaging 0.023 pCi/m^3 of air.

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 indicated that indicator locations maximum gross beta activity in air in 1995 was 0.059 pCi/m^3 and the control location average was 0.023 pCi/m^3. No action was taken since the indicator value of 0.059 pCi/m^3 did not exceed ten times the annual average gross beta activity of the control (0.23 pCi/m^3).

All ODCM samples analyzed for I-131 were < LLD. The gross beta activity average for all indicator locations equal the average for the control location (0.023 pCi/m^3). The control and indicator locations gross beta data show a close correlation. The quarterly composite analyses yielded only naturally occurring Be-7 and NQ plant related isotopes. It can therefore be concluded that the operation of SONGS had a negligable impact on this sample medium.

TABLE B-5
LOCATIONS OF AIR SAMPLERS FOR UNITS 1, 2, AND 3 BY SECTOR ANALYSIS

		SONGS UNITS 2/3			SONGS UNIT 1		
Location #	**Location Name**	**Sector**	**Angle from True North**	**Distance (Miles)**	**Sector**	**Angle from True North**	**Distance (Miles)**
1	City of San Clemente	Q	319	5.5	Q	320.1	5.24
2	Camp San Onofre	C	39	1.8	C	47.4	1.87
3	Huntington Beach Control	Q	308	37.0	Q	308.1	36.72
9	State Beach Park (Adjacent to PIC #9)	F	121	0.584	F	120.2	0.863
10	Bluff (Adjacent to PIC #1)	P	298	0.665	P	297.6	0.386
11	Mesa EOF (Adjacent to PIC #3)	R	340	0.715	A	0.074	0.538
12	Former SONGS Evaporation Pond (Adjacent to PIC #2)	Q	313	0.553	Q/R*	326.8*	0.291
13	MCB (Camp Pendleton) (Adjacent to PIC #8)	E	98	0.696	F	103.9	0.962

*** Border line of sectors Q and R.**

Note: Air sample locations 1, 2, 3, 9, 10, 11, 12, and 13 are all required by ODCM. Locations 5 and 7 are not required by ODCM because they are located within the EAB.

C. Ocean Water

In 1995, 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. Every other month, samples were also analyzed for gross beta activity. Finally, ocean water samples were composited quarterly and analyzed for tritium.

Throughout 1995 only naturally occurring potassium-40 was detected in the monthly gamma spectral analyses of samples. Tritium was not detected in the quarterly-composite samples. The data indicate that SONGS operations had a negligible impact on this environmental medium.

D. Drinking Water

In 1995, 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 a portion of 1995. The City of San Clemente secures this well for aquifer regeneration during the winter months. Upon collection the samples were analyzed for tritium and 16 naturally-occurring and SONGS-related gamma emitting radionuclides.

It should be noted that there is no drinking water pathway for liquid effluent at SONGS.

Neither tritium nor any other radionuclides were detected in the 1995 monthly drinking water samples. Based on the data it can be concluded that the operation of SONGS had a negligible impact on this sample medium.

E. Shoreline Sediment (Beach Sand)

Beach sand was collected semiannually in 1995 from three indicator locations, and from a control location situated in Newport Beach. After collection, the samples were analyzed for 19 different plant-related and naturally-occurring radionuclides. In 1995 three naturally-occurring radionuclides were detected in shoreline sediment samples (K-40, Ra-226, 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. Because no plant related radionuclides were detected in 1995 the impact of SONGS operations on shoreline sediment is considered to be negligible.

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 17 naturally-occurring and station-related radionuclides. In 1995 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 1995, 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 1 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, for 16 gamma-emitting station-related radionuclides, and for aqueous and bound tritium. The results were subsequently reported to Edison in terms of both wet and dry sample weights. Because results based on a wet sample weight are most useful for calculating doses, the results of sample analyses are summarized below in terms of "as received" wet weights.

In 1995 only naturally-occurring K-40 was detected. No plant-related radionuclides were detected in any of the Marine Species samples collected in 1995.

Based on these data, it was concluded that (l) SONGS operations has 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 1995 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 12 gamma-emitting radionuclides, as well as for radiostrontium by beta counting.

The detectable radionuclides included naturally occurring Be-7 and K-40. No other radionuclides were detected in the samples collected from San Clemente and Oceanside, indicating that SONGS operations had a negligible impact on this environmental medium.

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, and for radiostrontium by beta counting. The analyses indicated that naturally occurring K-40 was present in detectable quantities each of the samples. Cesium-137 was detected at 0.234 pCi/g in one of the indicator locations (Camp San Onofre). The sample location is not in the sector with the highest deposition factor and no Cs-137 was detected in a composite Air Particulate sample. The concentration of Sr-90 in the samples, was below the lower limit of detection of 0.16 pCi/g, dry.

Potassium-40, 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 fact 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 AREO Report 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.

J. Kelp Sampling

Kelp was collected during April and October 1995 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 18 different naturally-occurring and Station-related radionuclides. The only radionuclides detected in 1995 were K-40 and I-131.

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

In October 1995 Iodine-131 was detected in one indicator location and at the control location. The I-131 indicator location concentration was 0.061 pCi/g. The control location I-131 concentration was 0.073 pCi/g. In all the other locations, it was below the lower limit of detection (LLD = 0.050 pCi/g, wet). The detection of iodine-131 at the control location indicates that medical administration of the radionuclide can be a source of kelp contamination. Iodine-131 at the indicator station could be due to medical administration and/or plant related releases.

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 AREO Report. The data indicate that the concentrations of K-40 at both indicator and control locations have remained commensurate, 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 maximum individual. Refer to the 1994 AREO Report for more information.

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 posteriori detection limit of 0.05 pCi/g. The northern control location is too far away and in the wrong direction for the I-131 activity to have come from SONGS since the predominant currents flow in a southerly direction. Although a SONGS discharge cannot be ruled out as the source for the I-131 in the indicator location; the most likely source of I-131 in both samples appears to be a medically related discharge via up stream sewage treatment plants.

TABLE B-6

DEPOSITION FACTOR, D/Q IN M^{-2} IN LANDWARD SECTORS AS A FUNCTION OF DISTANCE FROM EXCLUSION AREA BOUNDARY (EAB)

(SONGS UNIT 1)

Sector (Direction)	D/Q in m^{-2} (At EAB)	Distance in Miles	D/Q in m^{-2} (At Nearest Use)	Distance (Miles)
P (WNW)	2.7 E-08	0.20	2.7 E-08	0.2
Q (NW)	7.2 E-08	0.20	1.7 E-08	0.5
R (NNW)	5.2 E-08	0.21	3.8 E-09	1.1
A (N)	3.8 E-08	0.24	4.3 E-10	3.5
B (NNE)	3.1 E-08	0.29	1.2 E-09	2.1
C (NE)	2.4 E-08	0.36	1.1 E-09	2.3
D (ENE)	1.9 E-08	0.44	7.3 E-10	2.9
E (E)	2.3 E-08	0.55	5.8 E-10	4.2
F (ESE)	1.0 E-08	0.64	5.0 E-09	1.0
G (SE)	6.5 E-09	0.59	2.9 E-09	1.0

Note: **Sectors Q, R, A, B, and P have the highest D/Q at the Exclusion Area Boundary (EAB) of Unit 1.**

Sectors P, Q, F, R, and G, have the highest D/Q at the nearest use location from the Unit 1 release point.

TABLE B-7

DEPOSITION FACTOR, D/Q IN M^{-2} IN LANDWARD SECTORS AS A FUNCTION OF DISTANCE FROM EXCLUSION AREA BOUNDARY (EAB)

(SONGS UNITS 2/3)

Sector (Direction)	D/Q in m^{-2} (At EAB)	Distance in Miles	D/Q in m^{-2} (At Nearest Use)	Distance (Miles)
P (WNW)	8.8 E-09	0.37	8.2 E-09	0.4
Q (NW)	2.8 E-08	0.37	1.2 E-08	0.6
R (NNW)	2.2 E-08	0.37	3.2 E-09	1.2
A (N)	1.9 E-08	0.37	4.1 E-10	3.6
B (NNE)	2.0 E-08	0.37	1.2 E-09	2.1
C (NE)	2.3 E-08	0.37	1.2 E-09	2.2
D (ENE)	2.4 E-08	0.37	6.4 E-10	2.8
E (E)	4.3 E-08	0.37	6.4 E-10	4.0
F (ESE)	2.8 E-08	0.37	7.5 E-09	0.8
G (SE)	1.3 E-08	0.37	3.9 E-09	0.8

Note: **Sectors E, Q, F, D, and C have the highest D/Q at theExclusion Area Boundary (EAB) of Units 2/3.**

Sectors Q, P, F, G, and R have the highest D/Q at the nearestuse locations from Units 2/3 release point.

TABLE B-8

REMP SAMPLE ANALYSIS SUMMARY FOR 1995

Medium	Analysis Type	Sampling Frequenty	# of Locations	Total # of Analysis in 1995
Direct Radiation	Dosimetry	Quarterly	51	203
Airborne Particulates	Gross β	Weekly	8	416
Charcoal Cartridge	I-131	Weekly	8	416
Airborne Particulates	Ge (Li) Scan	Quarterly	8	32
Airborne Particulates	Gross α	Quarterly	8	32
Airborne Particulates	Sr-90	Quarterly	8	32
Ocean Water	Ge (Li) Scan	Monthly	4	48
Ocean Water	H-3	Quarterly	4	16
Drinking Water, Unfiltered Drinking Water	Ge (Li) Scan H-3	Monthly	3	28
Drinking Water, Solids	Gross α & β	Monthly	3	6
Drinking Water, Filtrate	Gross α & β	Monthly	3	6
Drinking Water, Solids	Gross α & β	Quarterly	3	10
Drinking Water, Filtrate	Gross α & β Ge (Li) Scan	Quarterly	3	10
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
Crops	Gross α, Sr-90	Semi-Annually	3	8
Kelp	Ge (Li) Scan	Semi-Annually	4	8
Soil	Ge (Li) Scan, Sr-90	Annually	5	5

* **The 52 locations includes control and transit TLDs.**

TABLE B-9

STATISTICAL SUMMARY OF RADIOLOGICAL ENVIRONMENTAL MONITORING DATA FOR 1995

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, 1995 to December 31, 1995

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 179	5.0000	17.281 (171/ 171) (10.400-27.600)	San Onofre State Beach (Unit 1) 0.2 Mi. WSW	26.200 (4/ 4) (25.100-27.600)	18.688 (8/ 8) (15.500-21.200)	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, 1995 to December 31, 1995

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 416	0.0030	0.0231 (364/ 364) (0.005-0.059)	Mesa EOF 0.7 Mi. NNW	0.0245 (52/ 52) (0.007-0.059)	0.0233 (52/ 52) (0.007-0.052)	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, 1995 to December 31, 1995

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	416	0.0530	<LLD (0/ 364)	-----	<LLD (0/ 52)	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, 1995 to December 31, 1995

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	0.0872 (25/ 28) (0.048-0.112)	Bluff 0.7 Mi WNW	0.0933 (3/ 4) (0.085-0.100)	0.0930 (4/ 4) (0.077-0.125)	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, 1995 to December 31, 1995

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

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				Name, Distance and Direction	Mean Range			
TABLE 4C Quarterly Composite Airborne Particulates Gross Alpha & Strontium Activities (pCi/cu.m)								
Gross Alpha	32	0.0190	<LLD	(0/ 28)	-----	<LLD	(0/ 4)	0
Sr-89	24	0.0170	<LLD	(0/ 21)	-----	<LLD	(0/ 3)	0
Sr-90	32	0.0088	<LLD	(0/ 28)	-----	<LLD	(0/ 4)	0

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					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

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					Name, Distance and Direction	Mean Range		
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	327.03 (36/ 36) (253.00-390.00)	Outfall - Unit 3 0.7 Mi SW	330.67 (12/ 12) (272.00-390.00)	323.67 (12/ 12) (240.00-418.00)	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
	Ra-226	12	7.4890	<LLD (0/ 9)		-----	<LLD (0/ 3)	0

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						Name, Distance and Direction	Mean Range			
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

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					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

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					Name, Distance and Direction	Mean Range			
TABLE 9A Monthly Drinking Water Analysis (pCi/l)									
Ag-110m	28	8.3000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Ba(La)-140	28	15.000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Be-7	28	56.000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Ce-141	28	11.000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Ce-144	28	41.000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Co-58	28	7.0000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Co-60	28	7.4000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Cs-134	28	11.000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0
Cs-137	28	6.6000	<LLD	(0/ 16)	-----		<LLD	(0/ 12)	0

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					Name, Distance and Direction	Mean Range			
TABLE 9A (Cont.) Monthly Drinking Water Analysis (pCi/l)									
	Fe-59	28	20.000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	H-3	28	820.00	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	I-131	28	15.000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	K-40	28	92.000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	Mn-54	28	5.5000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	Ru-103	28	6.9000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	Zn-65	28	25.000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0
	Zr(Nb)-95	28	11.000	<LLD (0/ 16)		-----	<LLD	(0/ 12)	0

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TABLE 9B Monthly Drinking Water Solids Gross Alpha and Gross Beta Activities (pCi/l)							
	Gross Alpha 6	0.2110	1.4300 (2/ 3) (0.260-2.600)	Huntington Beach 37 Mi NW	4.8000 (1/ 3) (4.800-4.800)	4.8000 (1/ 3) (4.800-4.800)	0
	Gross Beta 6	0.7380	<LLD (0/ 3)		-----	<LLD (0/ 3)	0

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				Name, Distance and Direction	Mean Range		
TABLE 9C Monthly Drinking Water Filtrate Gross Alpha and Gross Beta Activities (pCi/l)							
	Gross Alpha 6	0.4430	0.5300 (2/ 3) (0.460-0.600)	Huntington Beach 37 Mi NW	0.8000 (1/ 3) (0.800-0.800)	0.8000 (1/ 3) (0.800-0.800)	0
	Gross Beta 6	1.4750	13.000 (3/ 3) (12.000-15.000)	Tri-Cities Municipal Water District Reservoir 8.7 Mi NW	13.000 (3/ 3) (12.000-15.000)	6.5000 (3/ 3) (5.500-8.000)	0

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				Name, Distance and Direction	Mean Range		
TABLE 9D Quarterly Composite Drinking Water Solids Gross Alpha and Gross Beta Activities (pCi/l)							
	Gross Alpha 10	3.9000	<LLD (0/ 6)		-----	<LLD (0/ 4)	0
	Gross Beta 10	2.2000	<LLD (0/ 6)		-----	<LLD (0/ 4)	0

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					Name, Distance and Direction	Mean Range			
TABLE 9E Quarterly Composite Drinking Water Filtrate Analysis (pCi/l)									
	Ag-110m	10	4.2000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Ba(La)-140	10	15.000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Be-7	10	29.000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Ce-141	10	5.0000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Ce-144	10	17.000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Co-58	10	2.8000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Co-60	10	3.6000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Cs-134	10	6.6000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Cs-137	10	3.5000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0

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TABLE 9E (Cont.) Quarterly Composite Drinking Water Filtrate Analysis (pCi/l)							
	Fe-59 10	10.000	<LLD (0/ 6)		-----	<LLD (0/ 4)	0
	Gross Alpha 10	7.1000	<LLD (0/ 6)		-----	<LLD (0/ 4)	0
	Gross Beta 10	1.8000	8.9000 (6/ 6) (5.300-16.000)	Tri-Cities Municipal Water District Reservoir 8.7 Mi NW	10.425 (4/ 4) (6.300-16.000)	5.9125 (4/ 4) (4.800-8.000)	0
	H-3 10	820.00	<LLD (0/ 6)		-----	<LLD (0/ 4)	0
	I-131 8	36.000	<LLD (0/ 5)		-----	<LLD (0/ 3)	0

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					Name, Distance and Direction	Mean Range			
TABLE 9E (Cont.) Quarterly Composite Drinking Water Filtrate Analysis (pCi/l)									
	K-40	10	52.000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Mn-54	10	2.6000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Ru-103	10	5.0000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Zn-65	10	13.000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0
	Zr(Nb)-95	10	5.6000	<LLD	(0/ 6)	-----	<LLD	(0/ 4)	0

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					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	0.0340	<LLD (0/ 6)		-----	<LLD	(0/ 2)	0
	Co-58	8	0.0470	<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
	Cs-137	8	0.0410	<LLD (0/ 6)		-----	<LLD	(0/ 2)	0

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TABLE 10 (Cont.) Semi-Annual Shoreline Sediment Gamma Spectral Analysis (pCi/g)								
	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	11.180 (6/ 6) (8.140-14.700)	Newport Beach (North End) 30 Mi NW	20.350 (2/ 2) (19.900-20.800)	20.350 (2/ 2) (19.900-20.800)	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
	Ra-226	4	0.0130	0.2600 (3/ 3) (0.240-0.280)	San Onofre State Beach 0.6 Mi SE	0.2800 (1/ 1) (0.280-0.280)	0.2100 (1/ 1) (0.210-0.210)	0

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TABLE 10 (Cont.) Semi-Annual Shoreline Sediment Gamma Spectral Analysis (pCi/g)										
	Ru-103	8	0.0510	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Ru-106	8	0.3500	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
	Th-228	8	0.1400	1.3300 (0.185-5.210)	(6/ 6)	San Onofre State Beach 0.6 Mi SE	2.9135 (2/ 2) (0.617-5.210)	0.4095 (0.389-0.430)	(2/ 2)	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

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						Name, Distance and Direction	Mean Range			
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

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				Name, Distance and Direction	Mean Range		
TABLE 11 (Cont.) Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis (pCi/g)							
I-131	5	0.3600	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
K-40	10	0.7400	14.400 (8/ 8) (12.300-16.000)	Laguna Beach 18.2 Mi NW	17.400 (2/ 2) (17.200-17.600)	17.400 (2/ 2) (17.200-17.600)	0
Mn-54	10	0.0800	<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

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				Name, Distance and Direction	Mean Range		
TABLE 11 (Cont.) Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis (pCi/g)							
Th-228	10	0.2600	0.6317 (6/ 8) (0.370-0.860)	Unit 1 Outfall 0.6 Mi W	0.8150 (2/ 2) (0.770-0.860)	0.4150 (2/ 2) (0.320-0.510)	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

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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	<LLD	(0/ 16)		-----	<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	0.3000	<LLD	(0/ 16)		-----	<LLD	(0/ 8)	0

SAN ONOFRE NUCLEAR GENERATING STATION

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

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
TABLE 12A (Cont.) Semi-Annual Non-Migratory Marine Animals Analysis (pCi/g) (Flesh Type)								
(All Species)	I-131	18	0.2300	<LLD (0/ 14)		-----	<LLD (0/ 4)	0
(All Species)	K-40	24	1.2000	3.0793 (15/ 16) (1.960-4.190)	Laguna Beach 18.2 Mi NW	3.4417 (6/ 8) (2.300-4.240)	3.4417 (6/ 8) (2.300-4.240)	0
(All Species)	Mn-54	24	0.0770	<LLD (0/ 16)		-----	<LLD (0/ 8)	0
(All Species)	Mo(Tc)-99m	18	48.000	<LLD (0/ 14)		-----	<LLD (0/ 4)	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

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

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean Range		
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	17.000 (2/ 4) (16.000-18.000)	San Mateo Canyon 2.6 Mi NW	17.000 (2/ 4) (16.000-18.000)	2.7000 (2/ 4) (2.000-3.400)	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

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean Range		
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	16.148 (4/ 4) (1.570-40.000)	San Mateo Canyon 2.6 Mi NW	16.148 (4/ 4) (1.570-40.000)	13.970 (4/ 4) (2.040-32.000)	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

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
TABLE 13B Semi-Annual Local Crops Tritium and Strontium Activities (pCi/g)										
(All Species)	Sr-89	4	0.2800	<LLD	(0/ 2)		-----	<LLD	(0/ 2)	0
(All Species)	Sr-90	8	0.0840	<LLD	(0/ 4)		-----	<LLD	(0/ 4)	0

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
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	0.2340 (0.234-0.234)	(1/ 4)	Camp San Onofre Camp Pendleton 2.5 Mi NE	0.2340 (0.234-0.234)	<LLD	(0/ 1)	0

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
				Name, Distance and Direction	Mean Range		
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	12.208 (4/ 4) (6.030-16.900)	Huntington Beach Generating Station 37 Mi NW	18.600 (1/ 1) (18.600-18.600)	18.600 (1/ 1) (18.600-18.600)	0
	Ru-103 5	0.0740	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Sr-89 5	2.7000	<LLD (0/ 4)		-----	<LLD (0/ 1)	0
	Sr-90 5	0.1600	<LLD (0/ 4)		-----	<LLD (0/ 1)	0

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range		Location with Highest Annual Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range		Number of Nonroutine Reported Measurements
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	0.0180	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0
macrocystis p.	Fe-59	8	0.0970	<LLD	(0/ 6)		-----	<LLD	(0/ 2)	0

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analysis Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean		Control Locations Mean Range	Number of Nonroutine Reported Measurements
					Name, Distance and Direction	Mean Range		
TABLE 15 (Cont.) Semi-Annual Kelp Analysis (pCi/g)								
macrocystis p.	I-131	8	0.0500	0.0610 (1/ 6) (0.061-0.061)	Laguna Beach 15.6 Mi NW	0.0730 (1/ 2) (0.073-0.073)	0.0730 (1/ 2) (0.073-0.073)	0
macrocystic p.	K-40	8	0.2700	9.5683 (6/ 6) (7.710-12.230)	San Mateo Kelp Bed 3.8 Mi WNW	9.9700 (2/ 2) (7.710-12.230)	9.7550 (2/ 2) (9.240-10.270)	0
macrocystic p.	Mn-54	8	0.0210	<LLD (0/ 6)		-----	<LLD (0/ 2)	0
macrocystic p.	Mo(Tc)-99m	4	4.4000	<LLD (0/ 3)		-----	<LLD (0/ 1)	0
macrocystic p.	Ru-103	8	0.0250	<LLD (0/ 6)		-----	<LLD (0/ 2)	0
macrocystic p.	Ru-106	8	0.1700	<LLD (0/ 6)		-----	<LLD (0/ 2)	0

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

APPENDIX C

SUMMARY OF 1995 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
1995

The results of the 1995 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. 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 TMA Norcal for the first quarter 1995 and Yankee Atomic Environmental Laboratory for the remainder of 1995. Cross check results for TMA are listed in the 1994 Annual Radiological Environmental Operating Report for SONGS. 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. According to the 1994 DHS Environmental Surveillance Report** for most sample media types 'there were no major discrepancies between the data provided by the SLR and those submitted by the licensees'. The DHS gross beta in air results are higher than the results reported by the licensees (Humboldt Bay, Diablo Canyon, Rancho Seco, and SONGS) for both control and indicator locations. The DHS has reported that the high bias may be attributable to different filter media.

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.

SONGS annual average indicator 0.023 pCi/m^3; SONGS annual average control 0.023 pCi/m^3.

DHS annual average indicator 0.026 pCi/m^3; DHS annual average control 0.028 pCi/m^3.

** California Nuclear Power Plant Environmental Surveillance Report, 1994 prepared by the California Department of Health Services, Radiological Health Branch Pursuant to Contract NRC-32-83-684.

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 1995 only one gas meter failed to meet this criterion. The gas meter attached to Air Sampler # 1 failed low in volume during the calibration performed on 9/29/95. This calibration failure resulted in a slight (approximate 6%) low bias in the reported volumes. The actual gross beta activity per unit volume as reported in Appendix B for Air Sampler # 1 is therefore about 6% lower than reported. No meaningful impact to the REMP program or conclusions resulted.

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. 13	Water(pCi/l)	Sr-89	22.0 ± 0	20.0 ± 5.0	11.3 - 28.7	0
Jan. 13	Water(pCi/l)	Sr-90	18.33 ± 1.53	15.0 ± 5.0	6.3 - 23.7	0.354
Jan. 27	Water (pCi/l)	Gross Alpha	5.0 ± 1.0	5.0 ± 5.0	0 - 13.7	0.236
Jan. 27	Water (pCi/l)	Gross Beta	5.67 ± 0.58	5.0 ± 5.0	0 - 13.7	0.118
Feb. 3	Water (pCi/l)	I-131	100.33 ± 1.15	100.0 ± 10.0	82.7 - 117.3	0.118
Mar. 10	Water (pCi/l)	Tritium	7005.67 ± 238.71	7435.0 ± 744.0	6144.2 - 8725.8	0.366
Apr. 18	Water (pCi/l)	Sr-89	25.00 ± 1.73	20.00 ± 5.0	11.3 - 28.7	0.354
Apr. 18	Water (pCi/l)	Sr-90	16.00 ± 1.00	15.0 ± 5.0	6.3 - 23.7	0.236
Apr. 18	Water (pCi/l)	Co-60	28.33 ± 0.58	29.0 ± 5.0	20.3 - 37.7	0.118
Apr. 18	Water (pCi/l)	Cs-134	18.0 ± 0	20.0 ± 5.0	11.3 - 28.7	0
Apr. 18	Water (pCi/l)	Cs-137	12.33 ± 1.53	11.0 ± 5.0	2.3 - 19.7	0.354
Apr. 18	Water (pCi/l)	Gross Alpha	ND	ND	ND	ND
Apr. 18	Water (pCi/l)	Gross Beta	ND	ND	ND	ND
June 9	Water (pCi/l)	Co-60	38.67 ± 1.53	40.0 ± 5.0	31.3 - 48.7	0.354
June 9	Water (pCi/l)	Zn-65	77.67 ± 2.08	76.0 ± 8.0	62.1 - 89.9	0.295
June 9	Water (pCi/l)	Cs-134	46.67 ± 2.52	50.0 ± 5.0	41.3 - 58.7	0.591

Date	Sample Type	Analyte	Mean CEAL ± s.d.	Known EPA ± expected bias	Control Limit	R +SR
June 9	Water (pCi/l)	Cs-137	34.67 ± 0.58	35.0 ± 5.0	26.3 - 43.7	0.118
July 14	Water (pCi/l)	Sr-89	18.0 ± 0	20.0 ± 5.0	11.3 - 28.7	0
July 14	Water (pCi/l)	Sr-90	9.33 ± 0.58	8.0 ± 5.0	0 - 16.7	0.118
July 21	Water (pCi/l)	Gross Alpha	**13.90 ± 0.62 (a)**	27.5 ± 6.9	15.5 - 39.5	0.103
July 21	Water (pCi/l)	Gross Beta	20.67 ± 0.23	19.4 ± 5.0	10.7 - 28.1	0.047
Aug. 4	Water (pCi/l)	Tritium	5154.33 ± 173.7	4872.0 ± 487.0	4027.1 - 5716.9	0.383
Aug. 25	Air Filte (pCi/F)	Alpha	25.27 ± 1.19	25.0 ± 6.3	14.1 - 35.9	0.216
Aug. 25	Air Filte (pCi/F)	Beta	83.10 ± 1.25	86.6 ± 10.0	69.3 - 103.9	0.148
Aug. 25	Air Filte (pCi/F)	Sr-90	28.33 ± 1.15	30.0 ± 5.0	21.3 - 38.7	0.236
Aug. 25	Air Filte (pCi/F)	Cs-137	24.67 ± 0.58	25.0 ± 5.0	16.3 - 33.7	0.118
Oct. 6	Water (pCi/l)	I-131	150.67 ± 3.21	148.0 ± 15.0	122.0 - 174.0	0.236
Oct. 27	Water (pCi/l)	Gross Alpha	**21.07 ± 3.48 (a)**	51.2 ± 12.8	29.0 - 73.4	0.305
Oct. 27	Water (pCi/l)	Gross Beta	27.90 ± 0.78	24.8 ± 5.0	16.1 - 33.5	0.165
Nov.3	Water (pCi/l)	Co-60	59.00 ± 1.73	60.0 ± 5.0	51.3 - 68.7	0.354
Nov.3	Water (pCi/l)	Zn-65	127.00 ± 1.00	125.0 ± 13.0	102.4 - 147.6	0.091
Nov.3	Water (pCi/l)	Cs-134	36.33 ± 0.58	40.0 ± 5.0	31.3 - 48.7	0.118
Nov.3	Water (pCi/l)	Cs-137	50.67 ± 1.15	49.0 ± 5.0	40.3 - 57.7	0.236

(a) Data falls outside EPA Control Limits. EPA has identified a method bias. No corrective action required.
ND EPA provided the samples but no data was provided by the contracted laboratory.

APPENDIX D

COMPARISON OF 1995 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. 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 1995 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	G.	Marine Species
B.	Air Particulates	H.	Local Crops
C.	Radioiodine	I.	Soil
D.	Ocean Water	J.	Kelp
E.	Shoreline Sediments	K.	Drinking Water
F.	Ocean Bottom Sediments		

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. Comparisons of preoperational data to 1995 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 1995, 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 indicator locations and two control locations in 1995. 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 1995 to December 1995. In the 1995 operational year for Units 2 and 3, all indicator stations ranged from 10.4 to 27.6 millirem with an average of 17.3 millirem while the control locations ranged from 15.5 to 21.2 millirem with an average of 18.7 millirem.

The reduction of environmental factors, such as nuclear weapons testing, has also reduced the natural radiation levels of the environment. 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 of existing neutron activation and fission products from previous nuclear weapons tests. It should be noted that the control location mean was greater than the indicator location mean. Effects due to station operation, if any, are masked by this background radiation.

The range of quarterly direct radiation doses was larger at both indicator and control locations during the preoperational period than during the 1995 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 describe the variation in the direct radiation levels.

Because of the above factors, we conclude that SONGS has not had a measurable impact during 1995 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 0.307 pCi/m^3. The control location of Oceanside had an average gross beta activity of 0.34 ranging from 0.05 to 2.77 pCi/m^3. During 1995, the gross beta activity at the indicator locations ranged from 0.005 to 0.059 pCi/m^3, and averaging 0.023 pCi/m^3. The control location gross beta activity ranged from 0.007 to 0.059 pCi/m^3 with an average of 0.023 pCi/m^3. The decrease in activity levels between 1965 and 1995 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 1995). 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. Volcanic activities and other environmental phenomena can be the cause for this increase in gross beta level. 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 1995 was found to be 0.023 pCi/m^3. During 1995 the Huntington Beach control location average was also found to be 0.023 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 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 the only gamma-emitting radionuclide 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 activities measured in ocean water

were 1900 and 400 pCi/l, respectively. Tritium concentration in all 1995 ocean water samples was below the lower limit of detection of 102 pCi/l.

Throughout 1995 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 1995 operational data. Only naturally occurring radionuclides were detected in the samples collected during 1995 operational period. The only SONGS-related radionuclide detected in shoreline sediment in preoperational time frame was Cs-137 with a range of 0.012 to 0.022 pCi/g, averaging 0.019 in 5 sediment samples (Table D-2A). 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.

Because no station-related radionuclides were detected in shoreline sediment in 1995 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.

In the 1995 operational period only naturally-occurring K-40, Ra-226, and Th-228 were detected in shoreline sediment samples. The concentrations of station-related radionuclides detected in most ocean bottom sediment samples were below the LLD for all shoreline samples in 1995.

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 during the operational years. 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.

The fact that the concentrations of the radionuclides decreased with time is probably due to the curtailment of atmospheric nuclear weapons tests, and the continued decay of fission and activation products from previous atmospheric nuclear weapons tests.

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
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.012-0.022	0.019	<LLD-0.032	<LLD
Cs-137	Op	0.008-0.060	0.043	<LLD-0.020	<LLD
Ce-144	PreOp	<LLD	<LLD	<LLD	<LLD
Ce-144	Op	<LLD	<LLD	<LLD	<LLD
Operational**		All <LLD		All <LLD	

* **Preop = January 1979 to July 1982; Operational - January to December 1995**

** **During January to December 1995 all station related Radionuclides from all sample locations were < 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**		All <LLD		All <LLD	

* **Preop = January 1979 to July 1982; Operational - January to December 1995**

** **During January to December 1995 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, and for aqueous and bound tritium. The results are subsequently reported to us in terms of both dry and wet sample weights.

Selected results for different marine species for both the preoperational and 1995 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 1995 are commensurate to or less than the concentrations detected in the same marine species during the preoperational period. No SONGS related radionuclides were detected in any of the non-migratory marine species samples taken in 1995.

From these data, it can be concluded that the operation of SONGS Units 1, 2, and 3 in 1995 has had no significant impact on this environmental medium.

TABLE D-3

MARINE SPECIES CONCENTRATIONS (pCi/g, wet weight) PREOPERATIONAL AND 1995 OPERATIONAL DATA (SONGS UNITS 2/3)

Sheephead Flesh

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD	<LLD	<LLD	<LLD
Co-57	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	0.016-0.030	0.023	<LLD	<LLD
Fe-59	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	0.005-0.044	0.017	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.004-0.018	0.007	0.005-0.012	0.007
Ru-103	PreOp	--	--	--	--
Operational**		All <LLD		All <LLD	

Black Perch Flesh

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD	<LLD	<LLD	<LLD
Co-57	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	0.009-0.011	0.010	<LLD	<LLD
Fe-59	PreOp	<LLD	<LLD	<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-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.003-0.015	0.008	0.004-0.014	0.009
Ru-103	PreOp	<LLD	<LLD	<LLD	<LLD
Operational**		All <LLD		All <LLD	

* **Preop = January 1979 to July 1982; Operational - January to December 1995**

** **During January to December 1995 all station related Radionuclides from all sample locations were < LLD**

LLD **Lower limits of detection are listed in Appendix B.**

TABLE D-3 (continued)

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

Bay Mussel Flesh

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	0.009-0.025	0.017	<LLD	<LLD
Co-57	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	0.008-0.080	0.028	--	--
Fe-59	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	0.005-0.40	0.077	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.003-0.006	0.004	<LLD	<LLD
Ru-103	PreOp	<LLD-0.045	<LLD	<LLD	<LLD
Ce-141	PreOp	<LLD	<LLD	<LLD	<LLD
Operational**		All <LLD		All <LLD	

Spiny Lobster Flesh

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD	<LLD	<LLD	<LLD
Co-57	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	0.007-0.270	0.086	<LLD	<LLD
Fe-59	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	0.014-0.210	0.060	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.005-0.011	0.008	0.040-0.015	0.008
Ru-103	PreOp	<LLD	<LLD	<LLD	<LLD
Operational**		All <LLD		All <LLD	

TABLE D-3 (continued)

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

Sea Hare Flesh

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD	<LLD	<LLD	<LLD
Co-57	PreOp	0.006-0.017	0.009	<LLD	<LLD
Co-58	PreOp	0.006-12.4	1.233	<LLD	<LLD
Fe-59	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	0.016-2.000	0.448	0.003-0.027	0.013
Zn-65	PreOp	<LLD-0.10	<LLD	<LLD	<LLD
Ag-110m	PreOp	0.018-0.50	0.138	0.020-0.039	0.030
Cs-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	<LLD-0.004	<LLD	<LLD-0.005	<LLD
Ru-103	PreOp	<LLD	<LLD	<LLD	<LLD
Ce-144	PreOp	<LLD	<LLD	<LLD	<LLD
Operational**		All <LLD		All <LLD	

* Preop = January 1979 to July 1982; Operational - January to December 1995

** During January to December 1995 all station related Radionuclides from all sample locations were < LLD

LLD Lower limits of detection are listed in Appendix B.

TABLE D-3 (continued)

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

Keyhole Limpet (Flesh)

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Mn-54	PreOp	<LLD	<LLD	<LLD	<LLD
Co-57	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	0.007-0.101	0.054	<LLD-0.190	<LLD
Fe-59	PreOp	<LLD	<LLD	<LLD	<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-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	<LLD	<LLD	<LLD-0.005	<LLD
Ru-103	PreOp	<LLD	<LLD	<LLD	<LLD
	Operational**	All <LLD		All <LLD	

* **Preop = January 1979 to July 1982; Operational - January to December 1995**
** **During January to December 1995 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 results are summarized in Table D-4A.

During the 1995 operational period Strontium-90 was not detected in any of the indicator or control locations (Table D-4A).

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 1995 operational period only naturally occurring radionuclides were detected in the Crop samples (Table D-4B). 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.

TABLE D-4A

LOCAL CROPS PREOPERATIONAL AND OPERATIONAL DATA (pCi/g, wet weight)

SONGS UNIT 1

			INDICATOR		CONTROL	
Radionuclide	**Period**	**Type****	**Range**	**Average**	**Range**	**Average**
Sr-90	PreOp	All	0.008-0.030	0.022	<LLD	<LLD
Sr-90	Op	All	<LLD	<LLD	<LLD	<LLD

TABLE D-4B

LOCAL CROPS PREOPERATIONAL AND OPERATIONAL DATA (pCi/g, wet weight)

SONGS UNITS 2/3

			INDICATOR		CONTROL	
Radionuclide	**Period**	**Type****	**Range**	**Average**	**Range**	**Average**
Sr-90	PreOp	All	<LLD	<LLD	0.050-0.027	0.056
Sr-90	Op	All	<LLD	<LLD	<LLD	<LLD

* **Preoperational = January 1979 to July 1982; Operational -January to December 1994**

** **Strawberries, cabbage, tomato, celery, and lettuce samples were collected during preoperational period. Strawberries, cabbage, tomato, and collar green samples were collected during 1995 operational period.**

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 in soil (Table D-5); and in most measurements, all the levels were below the lower limit of detection of the radionuclides of interest. 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 Sr-90 or Cs-137 in soil.

J. Kelp

SONGS Unit 1:

Samples of kelp 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:

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 1995 operational data (Table D-6). Radionuclides detected during the preoperational period for SONGS Units 2 and 3 include naturally-occurring K-40, Mn-54, Co-60, Zr(NB)-95, I-131, and Cs-137. Of these, only K-40 and I-131 were present in detectable amounts in the kelp samples collected in 1995. Figures 4A and 4B compare I-131 variation in kelp since 1977. These figures also compare the concentrations of I-131 detected in kelp in the 1995 operational period to preoperational period for SONGS Units 2 and 3.

Though the I-131 and Cs-137 released from the liquid effluent have had a detectable effect on kelp beds in the last few years, the dose impact to the member of public resulting from these radionuclides in kelp is insignificant. Although the concentrations of I-131 have increased in a random manner, there is no evidence that I-131 is steadily increasing in concentration in kelp near SONGS.

TABLE D-5

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

SONGS UNITS 2/3

		INDICATOR		CONTROL	
Radionuclide	**Period**	**Range**	**Average**	**Range**	**Average**
Co-58	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	<LLD	<LLD	<LLD	<LLD
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Sr-90	PreOp	0.02-0.08	0.044	<LLD-0.03	<LLD
Sr-90	Op	<LLD	<LLD	<LLD	<LLD
Zr(Nb)-95	PreOp	<LLD	<LLD	<LLD	<LLD
Zr(Nb)-95	Op	<LLD	<LLD	<LLD	<LLD
Ru-103	PreOp	<LLD	<LLD	<LLD	<LLD
Ru-103	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
I-131	PreOp	<LLD	<LLD	<LLD	<LLD
I-131	Op	<LLD	<LLD	<LLD	<LLD
Cs-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-134	Op	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.02-0.20	0.096	<LLD-0.06	<LLD
Cs-137	Op	<LLD-0.234	0.119	<LLD	<LLD
Ce-141	PreOp	<LLD	<LLD	<LLD	<LLD
Ce-141	Op	<LLD	<LLD	<LLD	<LLD
Ce-144	PreOp	<LLD	<LLD	<LLD	<LLD
Ce-144	Op	<LLD	<LLD	<LLD	<LLD

* **Preoperational = January 1979 to July 1982; Operational - January to December 1995**

TABLE D-6

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
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-58	PreOp	<LLD	<LLD	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Co-60	PreOp	0.006-0.009	0.008	<LLD	<LLD
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Zr(Nb)-95	PreOp	0.014-0.090	0.046	0.018-0.053	0.036
Zr(Nb)-95	Op	<LLD	<LLD	<LLD	<LLD
Ru-103	PreOp	<LLD	<LLD	<LLD	<LLD
Ru-103	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	PreOp	<LLD	<LLD	<LLD	<LLD
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
I-131	PreOp	0.006-0.024	0.013	0.008-0.030	0.014
I-131	Op	<LLD-0.061	0.052	<LLD-0.073	0.062
Cs-134	PreOp	<LLD	<LLD	<LLD	<LLD
Cs-134	Op	<LLD	<LLD	<LLD	<LLD
Cs-137	PreOp	0.004-0.009	0.006	<LLD	<LLD
Cs-137	Op	<LLD	<LLD	<LLD	<LLD

*** Preoperational = January 1979 to July 1982; Operational = January to December 1995**

APPENDIX E

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

IN 1995

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

To accommodate the July 4 company holiday an eight day sampling period was performed on the collection period ending July 5, 1995; which was followed by a six day sample period ending July 11, 1995.

Downtime for each air sampler in 1995 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 July 25, 1995 this sampler experienced 105.5 hours of down time and had a sample volume of 6970 cu. ft. The root cause was a tripped circuit breaker. The power supply is not directly under SCE control. The City of San Clemente Maintenance Department indicated that they will make every reasonable effort to assure that the air sampler has continuous power.

During the collection period ending October 24, 1995 a slight tear in the active area of the particulate filter media was noted. A metal filing on the retaining support screen was the root cause of the tear. The screen was repaired to prevent a reoccurrence.

Air Sampler #2 (Camp San Onofre):

During the collection period ending Sept. 5, 1995 the filter media was torn. The root cause was that the REM sample collector installed the retaining screen upside down causing the glass fiber filter media to be unsupported during the collection. This caused the filter paper to tear when the sample pump was turned on.

During the collection period ending December 5, 1995 the sampler was out of service for 26 hours and collected 15680 cu. ft. The outage was caused by an undersized fuse on the sample motor power supply circuit. The fuse was replaced with an appropriately sized fuse.

Air Sampler # 10 (Bluff):

An electrical outage caused 1.9 hours of down time during the collection period ending January 3, 1996.

A failed sample pump motor caused 140.4 hours of down time during the collection period ending. January 10, 1995. The collection volume of 2800 cu. ft. The a priori LLD was 0.04 pCi/m^3 for I-131 and 0.001 pCi/m^3 for gross beta as calculated by the Contracted Environmental Analysis Laboratory. Both LLD values were less than the maximum LLD listed in the ODCM.

A power failure caused 24.5 hours of down time during the collection period ending May 30, 1995. The volume was 15130 cu.ft.

Air Sampler #11 (EOF):

No deviations were observed.

Air Sampler #12 (Former SONGS Evaporation Pond):

No deviations were observed.

Air Sampler #13 (Camp Pendleton, East):

During the collection periods ending March 28, April 4, and April 25, the filter media was partially eaten by wasps causing part of the air flow to bypass the filter media. An inlet strainer was installed on April 25 to prevent insects from entering the inlet tube.

During the collection period ending June 20, 1995 the sampler was out of service for 4.6 hours due to a power outage. The sampler availability was much greater than 95% for the year; therefore no corrective action was required.

Summary of Air Sampler Corrective Actions and Program Upgrades:

New sample filter heads were purchased and placed in service February 27, 1996. This action was taken to reduce the likelihood of damaging the filter media during collection and/or sample head assembly. The filter media support screen and iodine cartridge container in the new heads are one piece, eliminating the need for filter screen support assembly. The new heads are designed for service with glass fiber filter paper. The old heads were primarily designed for cellulose filter media.

Inlet strainers (heavy mesh) were installed on the inlet tube of selected air samplers. This action was taken to prevent flying insect damage to the filter media.

Power supply interruption continues to be the dominant Air Sampler failure mechanism. The power supply for each Air Sampler was traced and the corresponding circuit breaker was labeled. A notice requesting uninterrupted power was posted in each breaker box. The controlling organization was notified for those power supplies not under SCE control.

B. DIRECT RADIATION

During the second Quarter 1995 sample # 22, San Mateo Coast Guard Station, was missing. The root cause was believed to be random vandalism.

Environmental TLDs are not collected from ocean-bound sectors outside the site boundary because these sectors are not inhabited by members of the general public.

C. *LOCAL CROPS*

Spring samples were obtained from the Nixon Estate (Leafy) and San Clemente Ranch (fleshy). Spring control samples (leafy & fleshy) were obtained from vegetable stand in Sector F, Eastern Oceanside.

Fall samples were taken from the same indicator locations. The fleshy control samples was taken from Rancho Vera (Sector F 18 miles ESE). The leafy control was taken from Sector G 16 miles SE.

The ODCM specifies that the control samples will be taken from 22.0 miles SE of SONGS in sector G. Area development and changing land use prevented control samples from being obtained in the area specified by the ODCM. This deviation had no meaningful impact on the data. The ODCM will be modified during the next revision to identify available crop sample control locations.

D. *SHORELINE SEDIMENTS*

No deviations were observed.

E. *DRINKING WATER*

No deviations were observed.

F. *SOIL*

No deviations were observed.

PART II MARINE SAMPLING

A. *MARINE SPECIES*

No deviations were observed.

B. *OCEAN WATER SAMPLING*

No deviations were observed.

C. *OCEAN BOTTOM SEDIMENTS*

No deviations were observed.

D. *KELP*

No deviations were observed.

APPENDIX F

LAND USE CENSUS

INTRODUCTION

Southern California Edison conducted the annual 1995 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 and producing 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 1994 CENSUS

Changes in the land uses, occupancy (employment hours), or distance are described in Table F-1. The closest garden growing leafy vegetables was the Old Nixon Estate in sector P, 2.8 miles from Units 2/3 midpoint. Two gardens (with residence) in sector Q no longer exist. The closest Garden producing fleshy vegetables continues to be the San Clemente Ranch in sectors Q and R, 2.2 to 2.3 miles from Units 2/3 midpoint.

During January to October 1995, outage workers for Units 2 and 3 were residing in Recreational Vehicles (RVs) located outside the Exclusion Area Boundary (EAB) in Parking Lot 4A. The RVs were located in the NW direction (sector Q) at 0.7 miles from SONGS Units 2/3 midpoint, and 0.5 miles from SONGS Unit 1.

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 1994
Land Uses

Description	Sector	Changes From 1994	Distance & Direction Units 2/3 (Unit 1)
Outage Residents for Units 2/3, Residing in Parking Lot 4A	(Q)	Recreational Vehicles Parked during the Units 2/3 outages in Parking Lot 4A, Outside the EAB. Occupancy from January to October 1995.	0.7 Miles in NW (0.5)
Cotton Point Estates Gardens (Casa Pacifica)	(P)	The new garden at Cotton Point Estates (Casa Pacifica), producing leafy vegetables	2.8 Miles in WNW (2.6)
San Onofre Beach Campground	(G)	A ground man is now watching the grounds all year round	0.8 Miles in SE (1.0)
Garden (with residence)	(Q)	The garden at 3 W. Avenida San Antonio is converted to residential structure (Table 4, #14)	4.4 Miles in NW (4.2)
Garden (with residence)	(Q)	The garden at 147 W. Avenida Junipero is now vacant and no longer cultivated (Table 4, #16)	4.1 Miles in NW (3.9)

TABLE F-2

1995 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	0.4	Surf Beach	667	--	
Northwest (Q)	1.1	Maintenance Yard at 51 Area Beach	0.6	State Park Office Trailer	400	1.6	Meat Animals (Sheep)
North Northwest (R)	1.2	San Onofre Mobile Homes	2.6	San Clemente Ranch Packing	3,218	0.9	Meat Animals (Sheep)
North (A)	3.6	Camp San Mateo	3.6	Camp San Mateo Motor Pool	2,000	0.2	Meat Animals (Sheep)
North Northeast (B)	--		2.1	Sanitary Landfill	2,000	0.2	Meat Animals (Sheep)
Northeast (C)	2.3	Camp San Onofre Fire Station	2.2	Camp San Onofre Sewage Treatmt Plant	2,000	0.2	Meat Animals (Sheep)
East Northeast (D)	2.8	Camp San Onofre	3.7	Camp Horno Sewage Treatment Plant	2,000	0.2	Meat Animals (Sheep)
East (E)	4.0	Camp Horno	4.0	Camp Horno Motor Pool	2,000	0.3	Meat Animals (Sheep)
East Southeast (F)	--		0.8	San Onofre State Beach Entrance (Guard Shack)	1,500	0.5	Meat Animals (Sheep)
Southeast (G)	--		0.8	San Onofre Beach (Campground)	Resident* Yr Round	2.7	Meat Animals (Sheep)

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 1994 survey.**

TABLE F-2 (Continued)

1995 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.**
***** **Denotes changes from 1994 survey**

TABLE F-3

1995 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)	2.8	Cotton Point Estates	0.2	Surf Beach	667	--	
Northwest (Q)	0.9	Maintenance Yard at 51 Area Beach	0.5	State Park Office Trailer	400	--	Meat Animals (Sheep)
North Northwest (R)	1.1	San Onofre Mobile Homes	2.4	San Clemente Ranch Packing	3,218	0.9	Meat Animals (Sheep)
North (A)	3.5	Camp San Mateo	3.5	Camp San Mateo Motor Pool	2,000	0.7	Meat Animals (Sheep)
North Northeast (B)	--		2.1	Sanitary Landfill	2,000	0.7	Meat Animals (Sheep)
Northeast (C)	2.4	Camp San Onofre Fire Station	2.3	Camp San Onofre Sewage Treatmt Plant	2,000	0.3	Meat Animals (Sheep)
East Northeast (D)	2.9	Camp San Onofre	3.9	Camp Horno Sewage Treatment Plant	2,000	0.3	Meat Animals (Sheep)
East (E)	4.2	Camp Horno	4.2	Camp Horno Motor Pool	2,000	0.4	Meat Animals (Sheep)
East Southeast (F)	--		1.0	San Onofre State Beach Entrance (Guard Shack)	1,500	0.7	Meat Animals (Sheep)
Southeast (G)	--		1.0	San Onofre Beach (Campground)	Resident* Yr Round	3.1	Meat Animals (Sheep)

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 1994 survey.**

TABLE [redacted] (Continued)

1995 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 Esates*
Northwest (Q)	--	--	1.9	San Clemente Ranch
North Northwest (R)	--	--	2.0	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 1994 survey.**

APPENDIX G

FIGURES FOR 1995

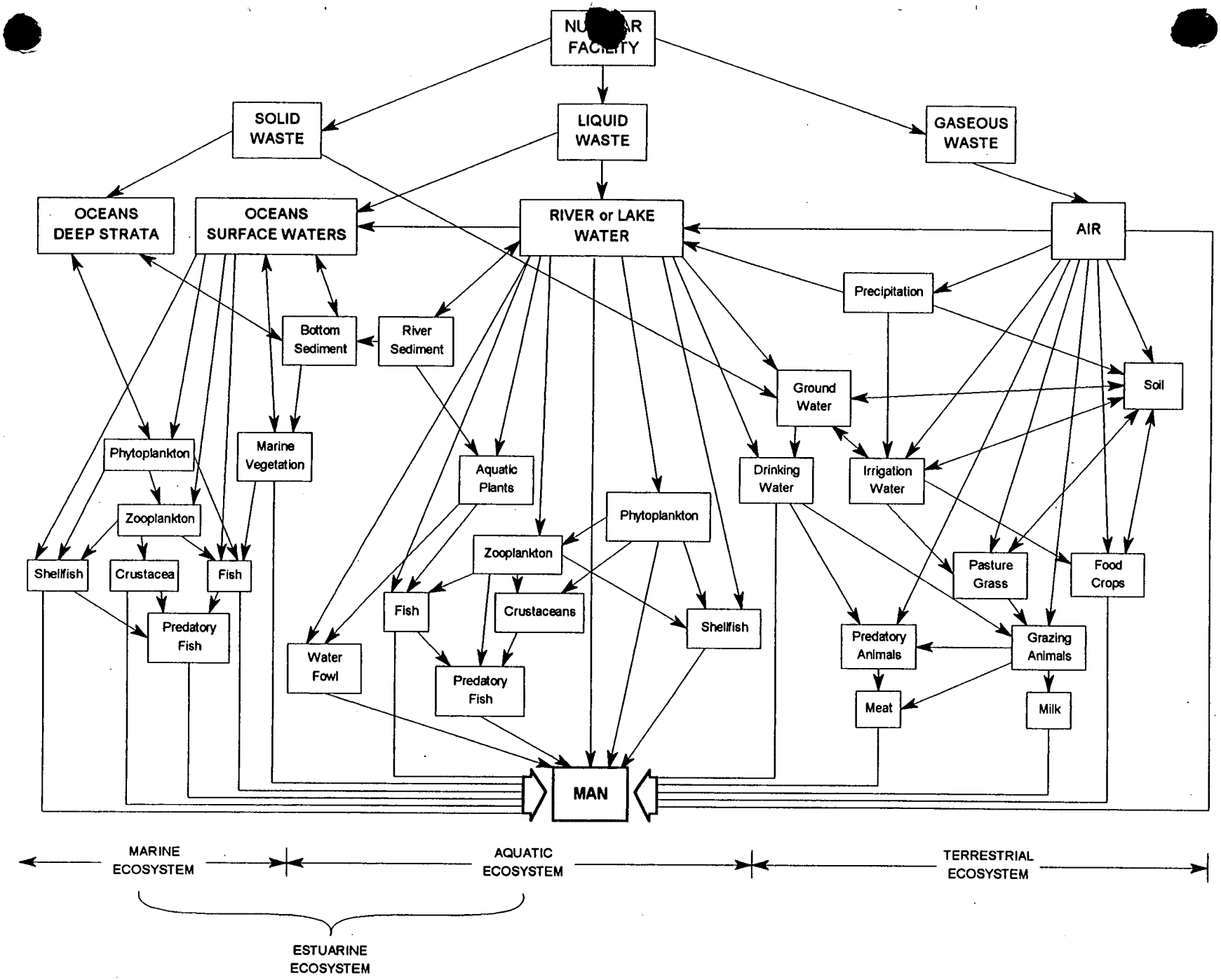


Figure 1. Potential Radiation Exposure Pathways Leading to Man

Direct Radiation Monitoring

Inner Ring Locations Vs. Controls – Quarterly Gamma Exposure (MREM)

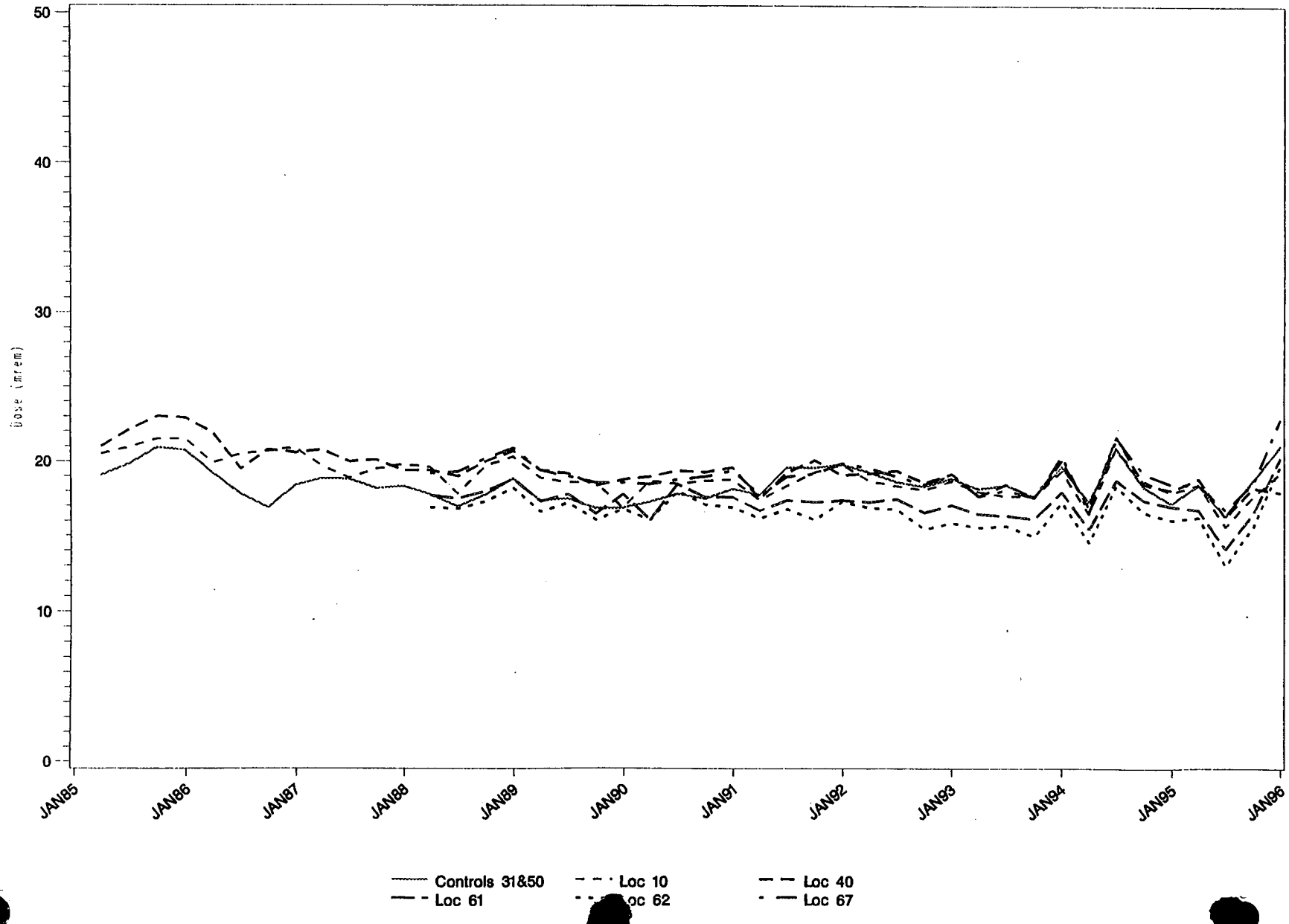


Figure 2A

Direct Radiation Monitoring

Inner Ring Locations Vs. Controls – Quarterly Gamma Exposure (MREM)

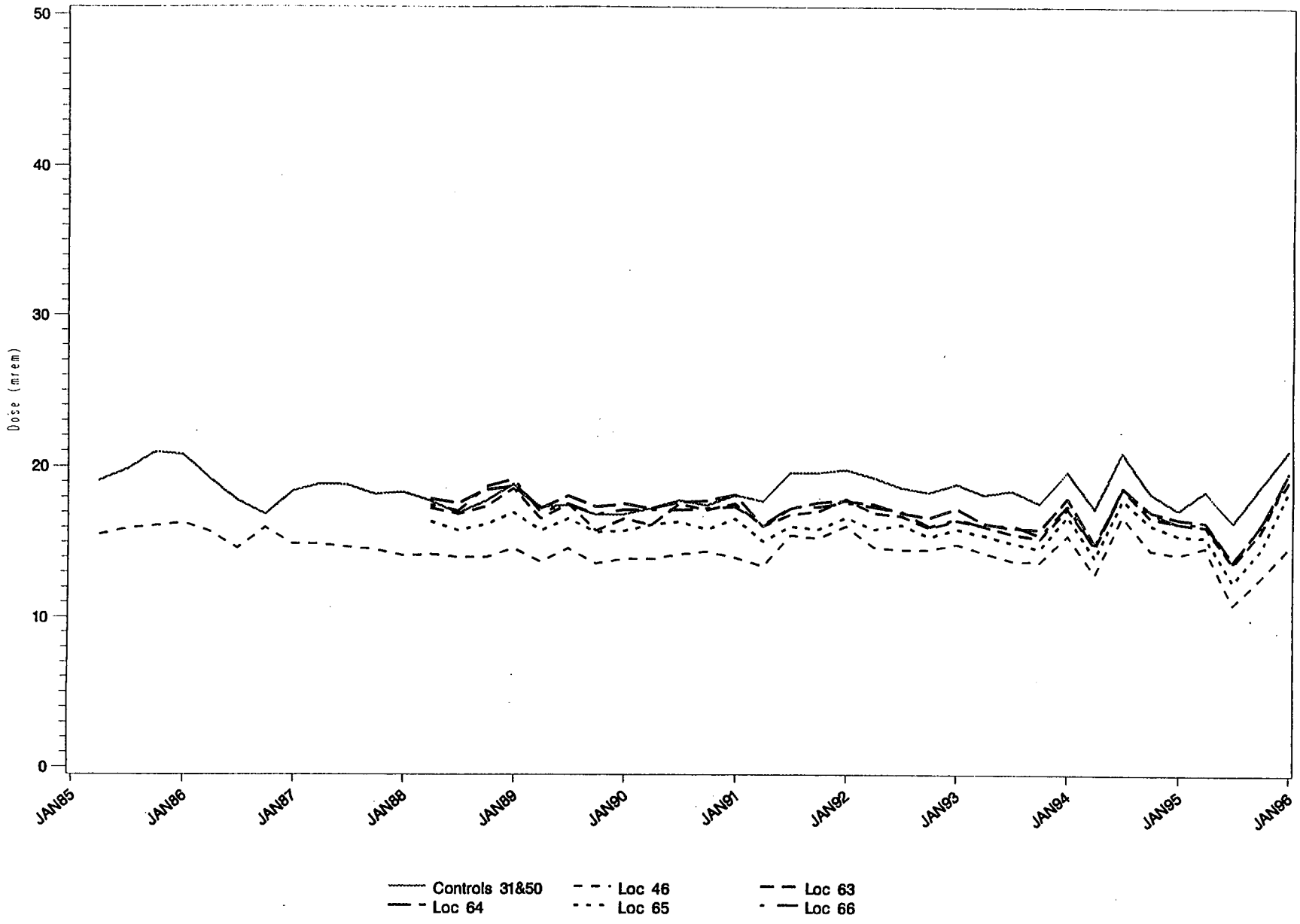


Figure 2B

Monthly Average Airborne Particulates Gross Beta Activity

Preoperational and Operational Data for SONGS Units 2 and 3

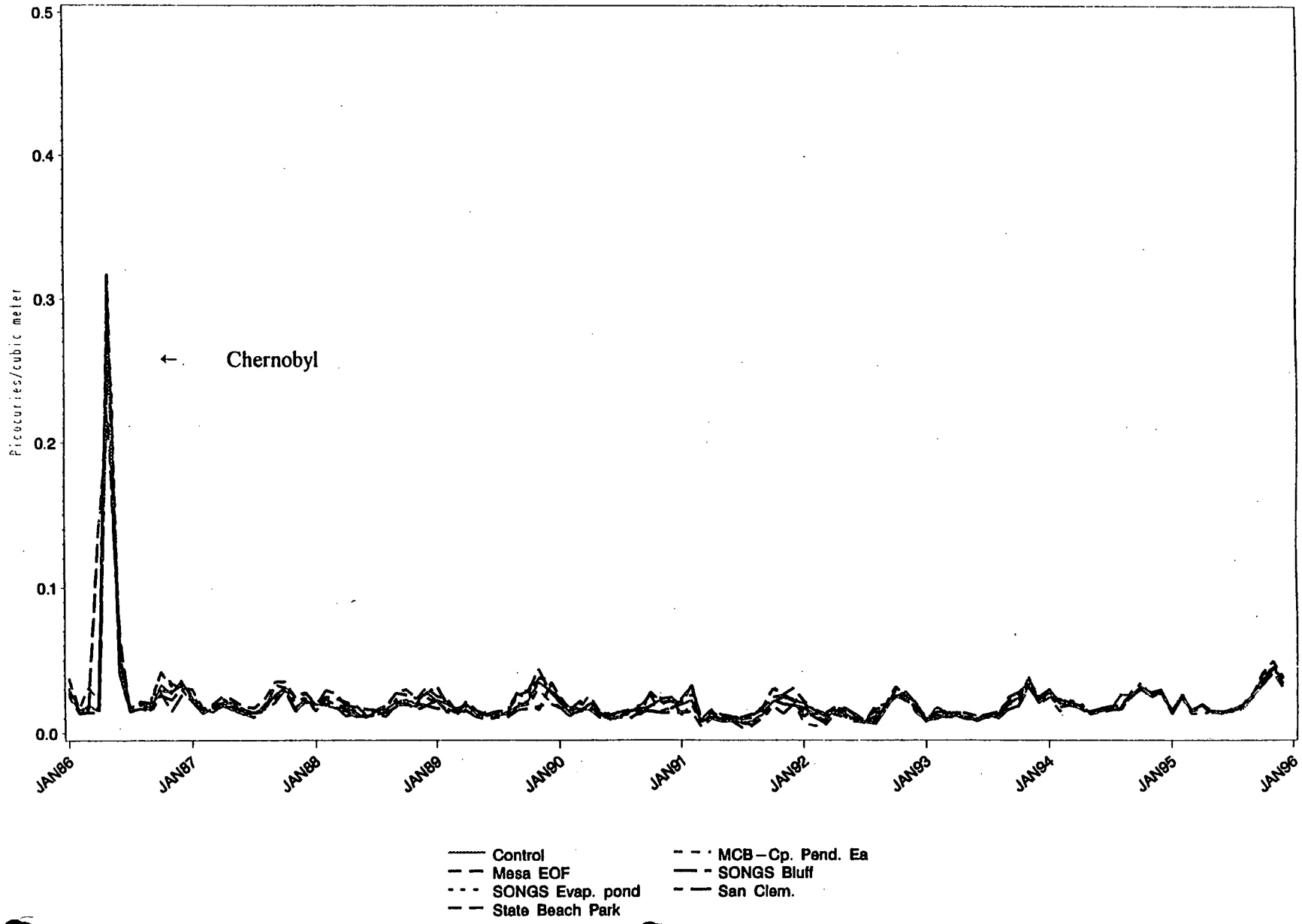


Figure 3A

Monthly Average Airborne Particulates Gross Beta Activity

Preoperational and Operational Data for SONGS Units 2 and 3

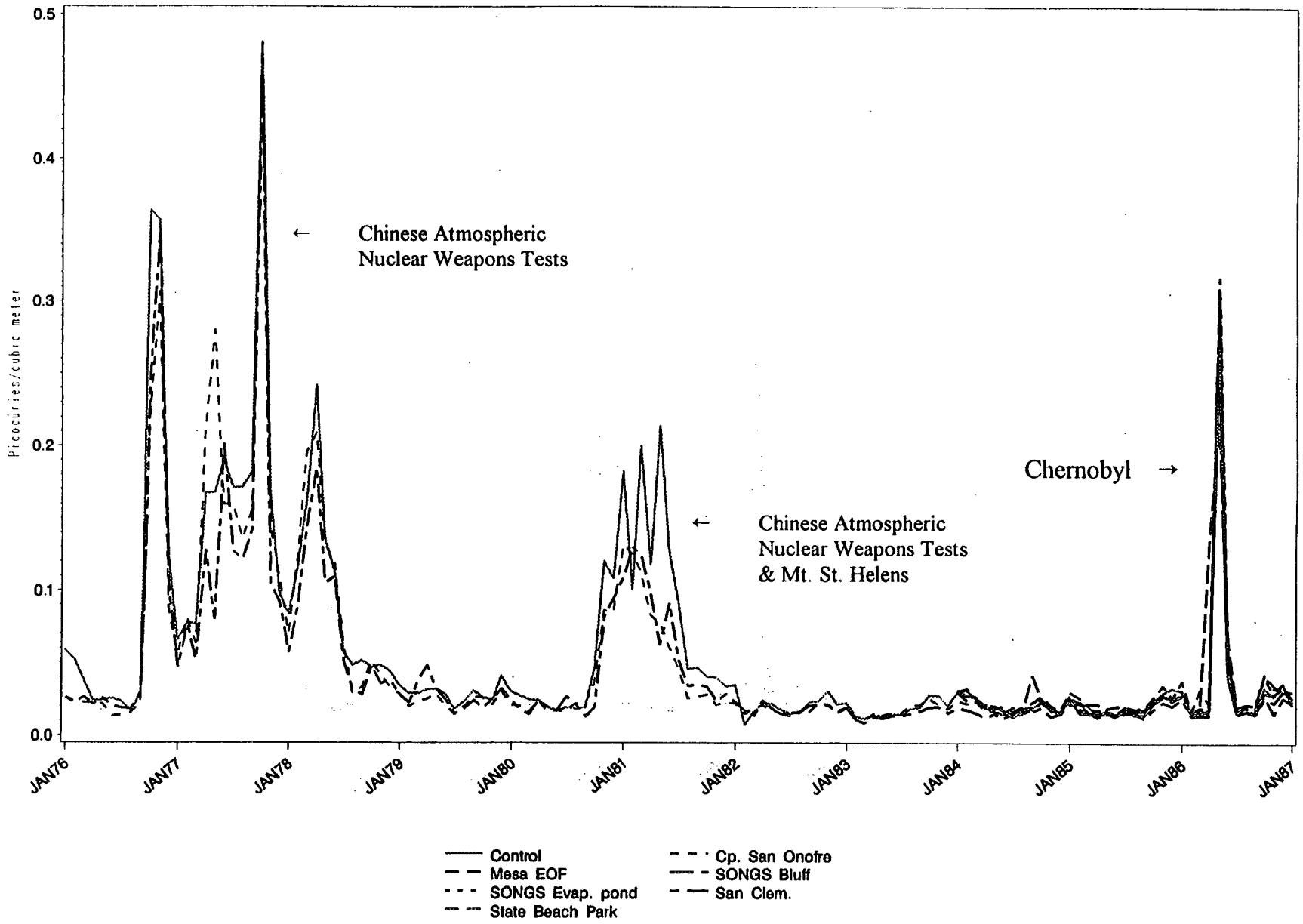


Figure 3B

Monthly Average Airborne Particulates Gross Beta Activity

Preoperational and Operational Data for SONGS Units 2 and 3

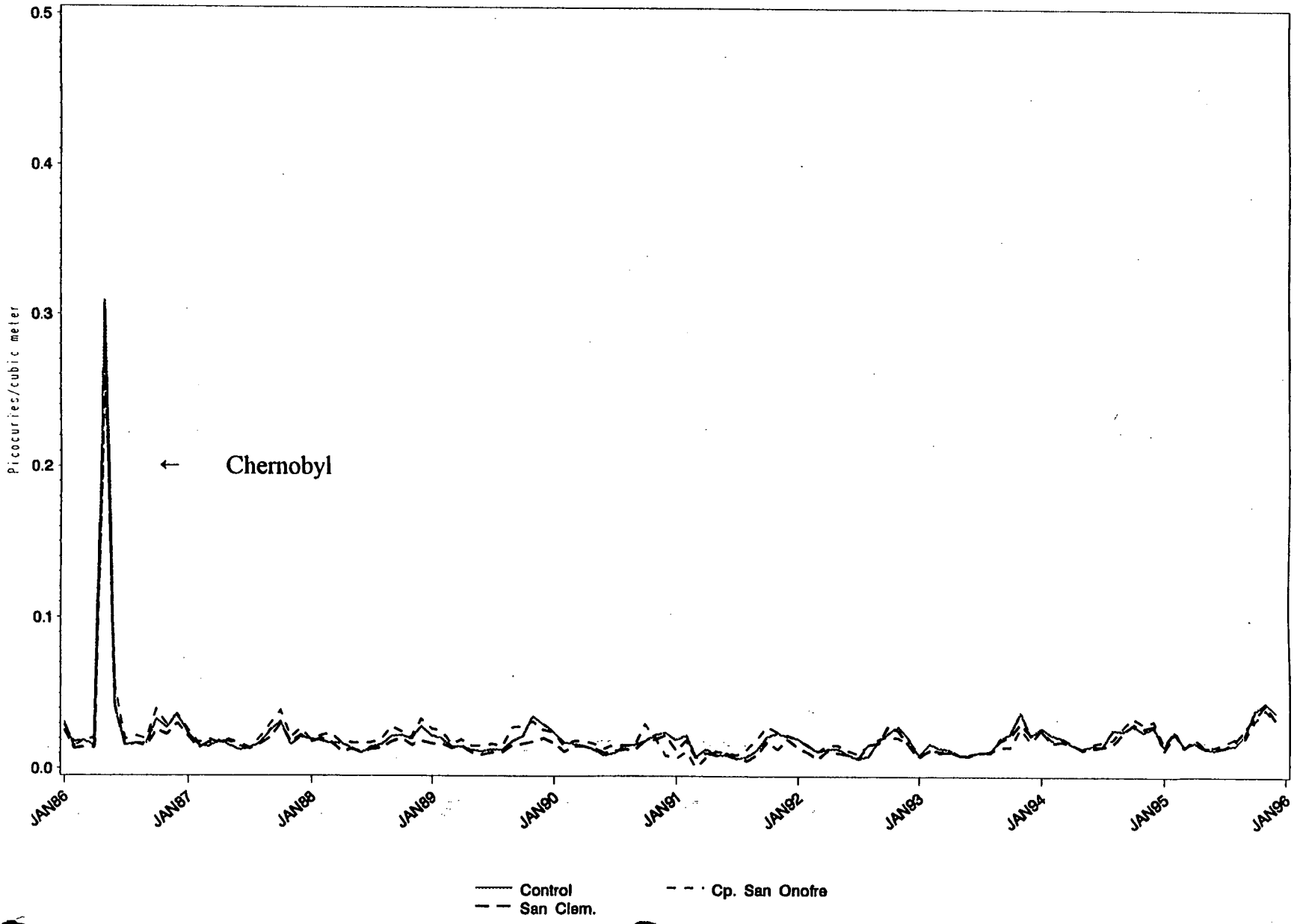


Figure 3C

Monthly Average Airborne Particulates Gross Beta Activity

Preoperational and Operational Data for SONGS Units 2 and 3

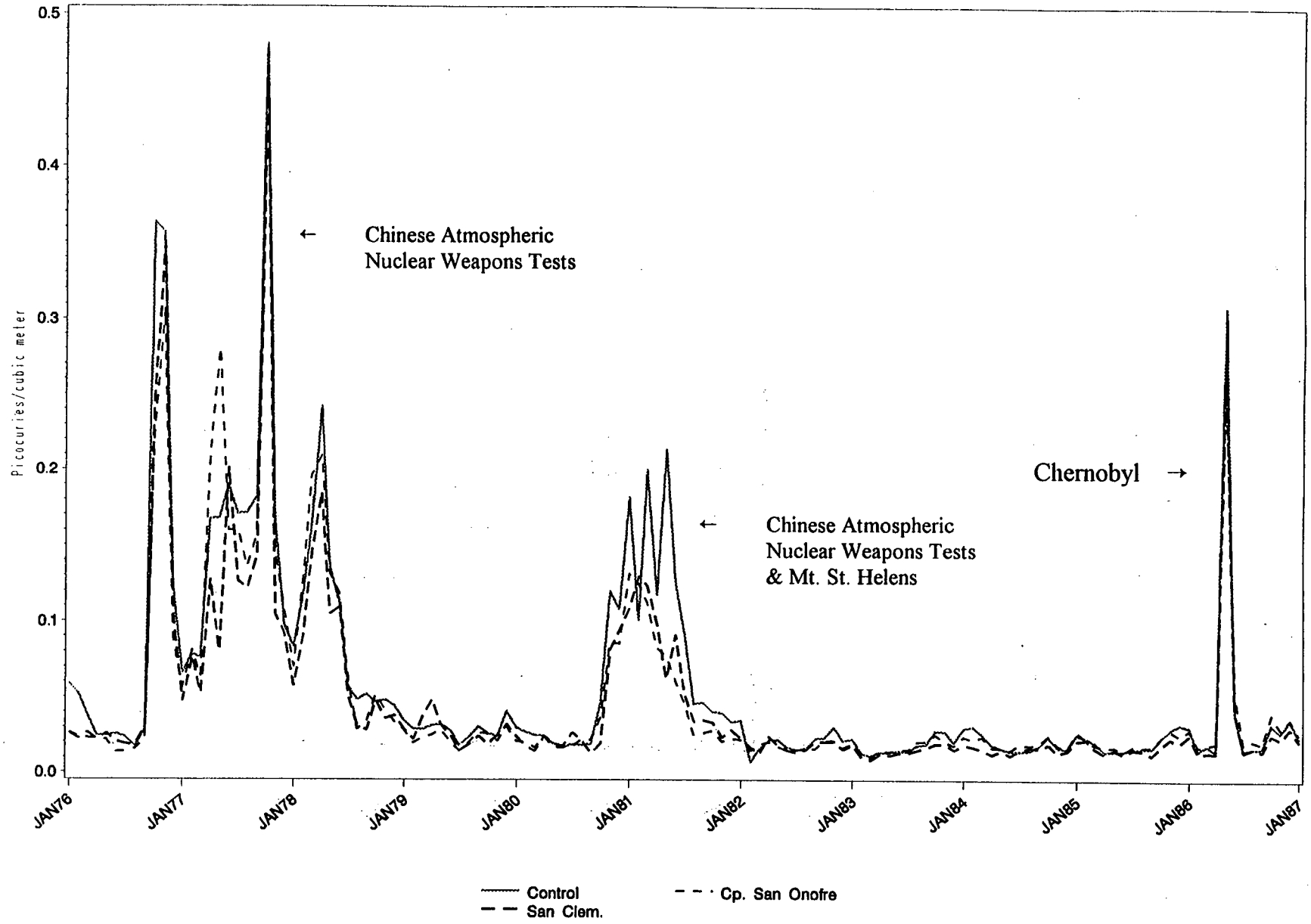


Figure 3D

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

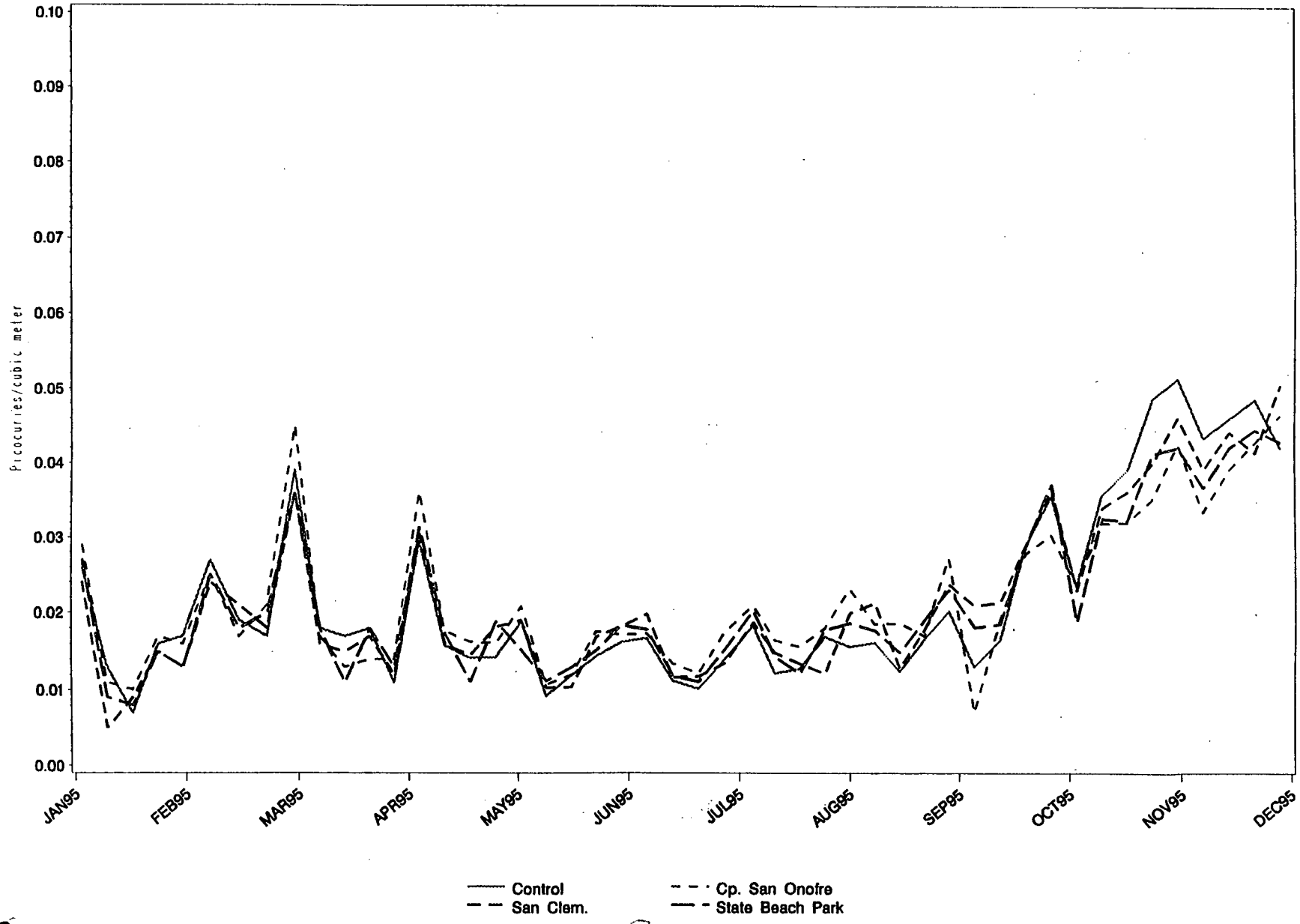


Figure 3E

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

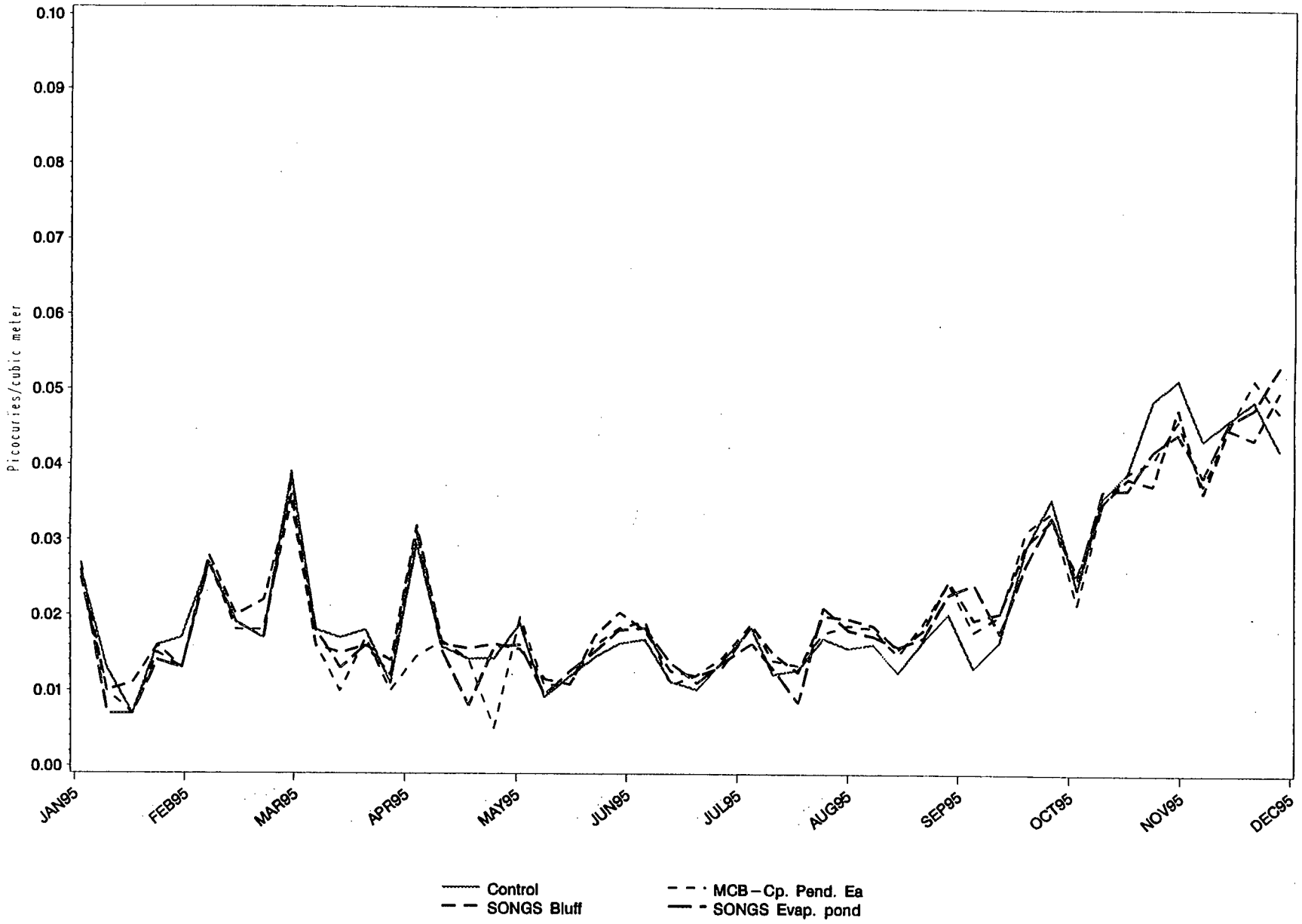
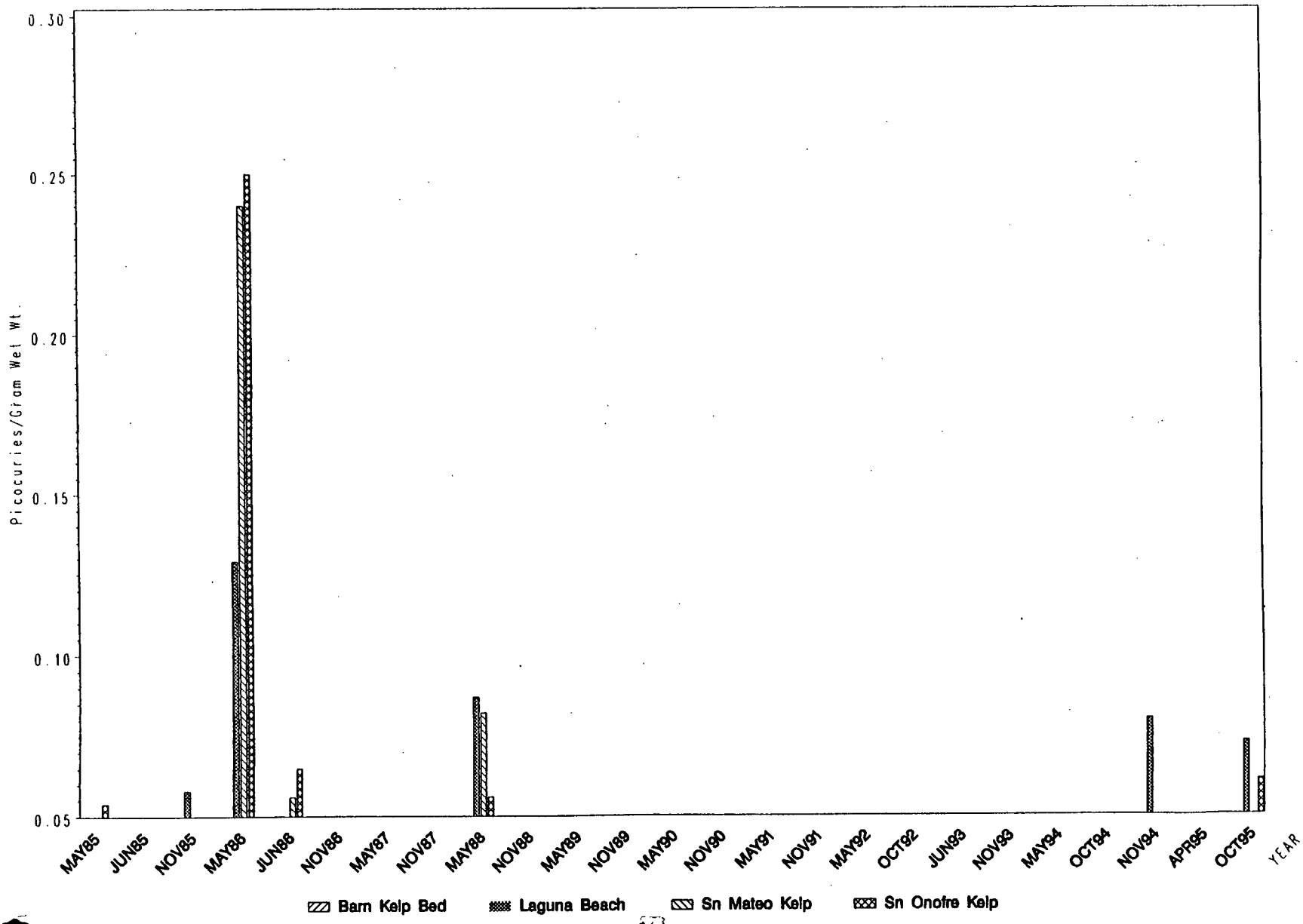


Figure 3F

Preoperational and Operational Data For SONGS Units 2 and 3

Radionuclide Activity in Kelp

ELEMENT=I-131



ure 4A

Preoperational and Operational Data For SONGS Units 2 and 3

Radionuclide Activity In Kelp

ELEMENT=I-131

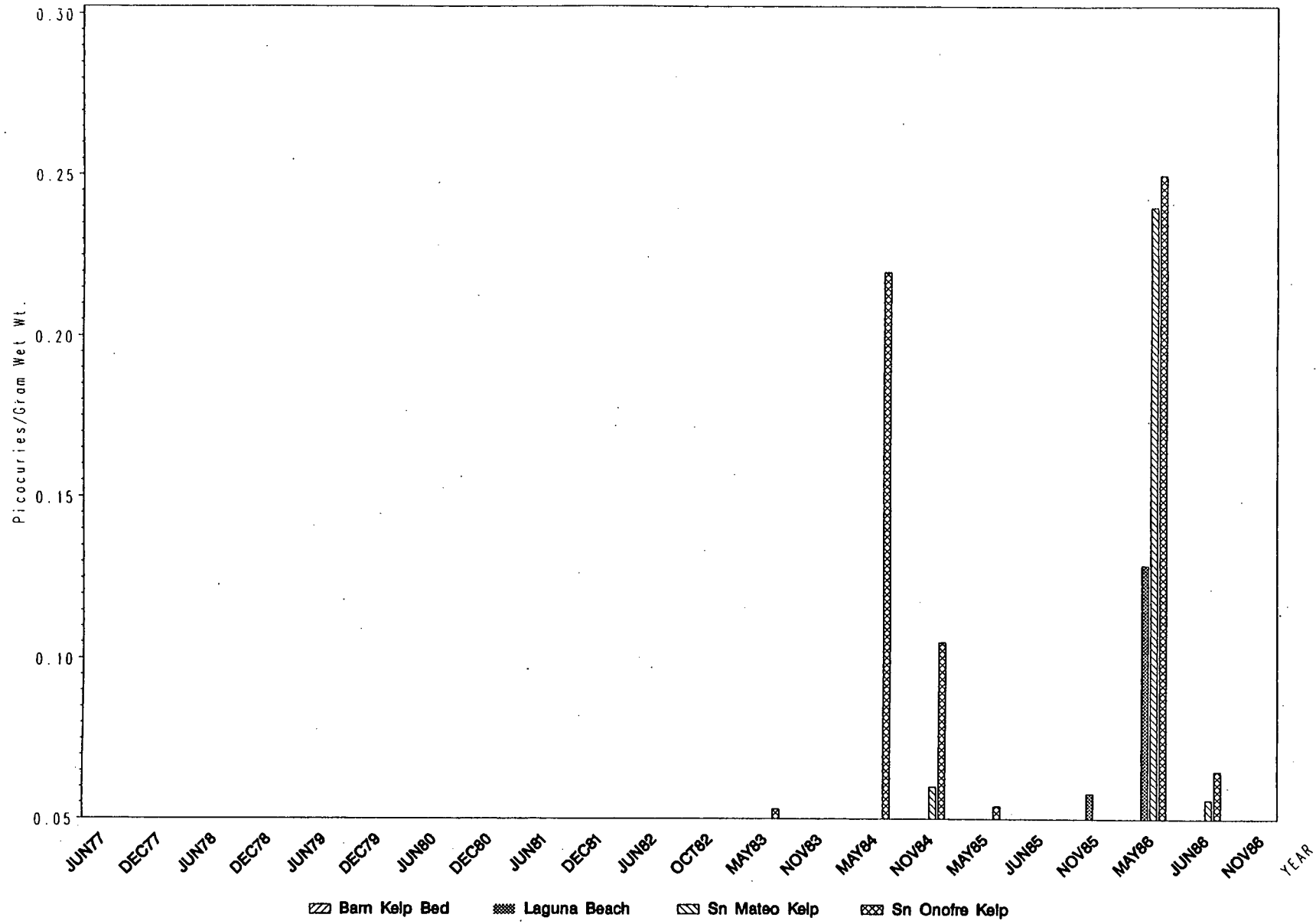


Figure 4B