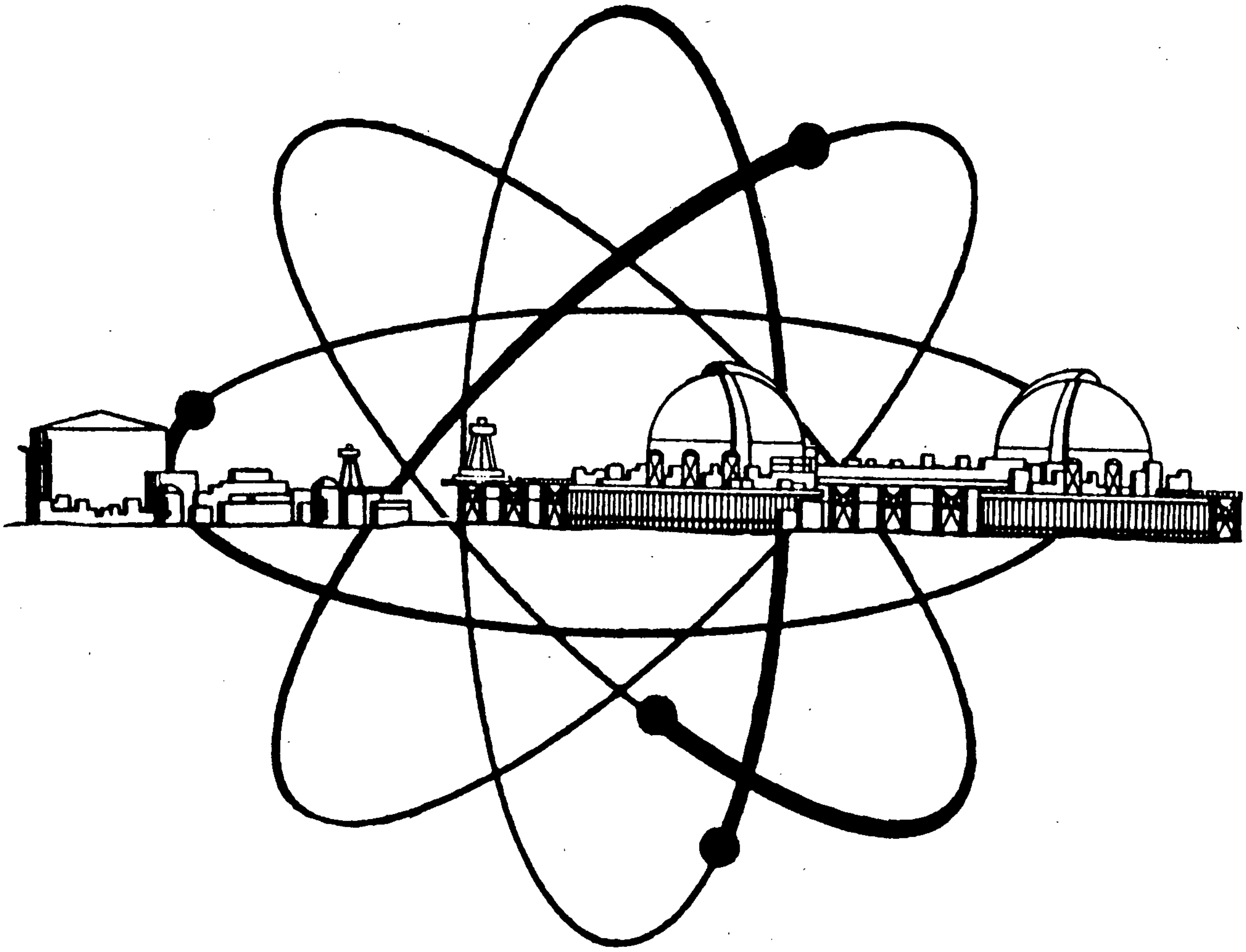
ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR 1994 SAN ONOFRE NUCLEAR GENERATING STATION UNITS 1, 2, & 3



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RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT FOR 1994

SAN ONOFRE NUCLEAR GENERATING STATION UNITS 1, 2 AND 3

SOUTHERN CALIFORNIA EDISON COMPANY
SAN DIEGO GAS AND ELECTRIC COMPANY

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I. 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 operated until February 1982 when it was shut down for seismic modifications. The Unit was brought back into service during November 1984. Unit 1 was removed from service permanently 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.

To monitor the operations of SONGS Units 1, 2 and 3, and to fulfill the requirements of the SONGS Offsite Dose Calculation Manuals (ODCMs) for Units 1, 2 and 3, an annual operational Radiological Environmental Monitoring Program (REMP) was conducted at SONGS during 1994. This program was designed 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 included the following: soil, shoreline sediment (beach sand), air, 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.

A. The Program

In its operational phase, the 1994 REMP was conducted in accordance with Section 5.0 of the SONGS Unit 1, and Section 5.0 of the SONGS Units 2 and 3 Offsite Dose Calculation Manuals. Administrative control of the program was conducted in accordance with sections 6.9.1.6 and 6.9.1.7 for Unit 1 and sections 6.8.4.f and 6.9.1.6 of Units 2 and 3 Technical Specifications.

All REMP activities were conducted in accordance with the Environmental Monitoring Program Procedures (See Reference Section). These procedures are a replacement to the EMPP manual and provide the necessary administrative and management controls for the environmental monitoring program as specified in Regulatory Guide 4.8.

B. Objectives

The objectives of the operational REMP are:

1. To fulfill the obligation for radiological surveillance required by Technical Specifications and ODCM. The REMP will provide the following:

    - Monitoring the radiation and radionuclides in the environs of the plant by making representative measurements of radioactivity in the highest potential exposure pathways.

    - Verification of the accuracy of the effluent monitoring program and modeling of the environmental exposure pathways. 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. (Appendix D).

- Inclusion of the program in the ODCM, conformance with the guidance of the Appendix I, 10CFR Part 50, and inclusion of the following:

  - Monitoring, sampling, analyzing, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM (see appendices B and I of the report).

  - A land use census 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.

  - Participation in an interlaboratory comparison program to ensure that independent checks on the precision and accuracy of the measurements of the radioactive materials in the environmental sample matrices are performed as part of quality assurance requirements for environmental monitoring. Appendix C of the report lists such results.

2. To determine whether there is 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.

C. 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.

D. 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.

E. Exposure Pathway

Figure 1 illustrates various exposure pathways resulting in radiation dose to the surrounding population from operation of a nuclear facility. In almost all cases 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 drinking water, fish consumption and direct exposure from the ocean water by swimming and the shoreline activities. Consumption of fish, crops, or drinking water from the area receiving liquid effluents and breathing contaminated air from the gaseous effluents releases are the most probable sources of internal exposure.

The annual doses calculated from gaseous effluent, tritium, radioiodines, and particulates of the gaseous effluent within a five-mile distance from the plant are summarized in Appendix D, Tables D-1 and D-2. This Appendix also summarizes the maximum annual doses calculated from TLDs (gamma) and other environmental pathways.

F. Regulatory Limits, Guidance and Requirements

* 10CFR50

  The revised (as of Jan. 1, 1994), 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 the limits specified below. These limits are applicable to the sum of both liquid and gaseous effluents.i 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.

* Doses calculated for drinking water ingestion are based on reporting levels established by 40CFR141 concentration levels.

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)

G. Quality Assurance Program

To assure quality of sample analyses, a portion of the REMP was devoted to quality control. The main aspects of this part of the program included process quality control, instrument quality control, comprehensive data reviews, and EPA interlaboratory cross-check analyses.

All Radiological Environmental Monitoring Activities for San Onofre are assessed by Quality Assurance requirements as defined in Regulatory Guide 4.15. The Quality Assurance (QA) Program for REMP is described in the Topical Quality Assurance Manual and consists of a series of planned and systematic actions that provide adequate confidence in the REMP activities and check the validity of the monitoring program through routine audits and compliance with written procedures and policies. The QA Program which provides assurance in the results of the REMP are partially performed by the Nuclear Oversight Division and are as follows:

* Performing regular audits of the REMP such as sample collection procedures and methods.

* Assure that the contracted laboratories participate in the US EPA Inter-Laboratory cross-check program.

* Assure that the contracted environmental analysis laboratory split samples for separate analysis such as in-house spiking.

* Providing split samples to an independent laboratory, e.g., Department of Health Services (DHS) and comparing the radioanalytical results for agreement.

In the DHS program, the identical samples are analyzed by an independent laboratory (DHS) and their results are compared against San Onofre contracted laboratory. This comparison provides a valuable QA tool to verify the quality of the analytical laboratories procedures and the radioanalytical data.

H. Sample Analysis

Environmental samples were collected at different locations (listed in Appendix A) in the vicinity of SONGS, and then shipped to a contracted radiological laboratory. A total of 1908 analyses were performed in 1994 (Table I-2). Each sample was analyzed using both standard radioanalytical and radiochemical procedures. The results of the analyses are summarized in Appendix B by sample type and analysis.

TABLE I-1

A COMPARISON OF USNRC REPORTING LEVELS (RL) FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES AND 10CFR20 VALUES

Analysis	NRC RL Water (pCi/l)	Revised 10CFR20 Values (pCi/l)	NRC RL Airborne Particulate or Gases (pCi/m^3)	Revised 10CFR20 Values (pCi/m^3)	NRC RL Marine Animals (pCi/Kg, wet)	NRC RL Local Crops (pCi/Kg, wet)
H-3 (Ocean)	-	1×10^6	-	2×10^5	-	-
H-3 (Drinking)	2×10^4	2×10^4	-	-	-	-
Mn-54	1×10^3	3×10^4	-	1×10^3	3×10^4	-
Fe-59	4×10^2	1×10^4	-	5×10^2	1×10^4	-
Co-58	1×10^3	2×10^4	-	2×10^3	3×10^4	-
Co-60	1×10^3	3×10^3	-	2×10^2	1×10^4	-
Zn-65	3×10^2	5×10^3	-	4×10^2	2×10^4	-
Zr(Nb)-95	4×10^2	2×10^4	-	-	-	-
I-131	2	1×10^3	0.9	2×10^2	-	-
Cs-134	30	9×10^2	10	2×10^2	1×10^3	1×10^2
Cs-137	50	1×10^3	20	2×10^2	2×10^3	1×10^3
Ba-La-140	2×10^2	8×10^3	-	2×10^3	-	2×10^3

(a) For drinking water samples. This is 40 CFR Part 141 value. For ocean water, 3E+6 pCi/l is the limit recommended by 10CFR20, Appendix B, Table 2, Column 2.

I. Data Management System Using SAS

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.

SAS is a computer language and operating system for data analysis. The environmental monitoring program data sets (files), data entry screens, and program components are designed for data input, storage, and retrieval, as well as statistical analysis and generation of reports. There is one EMP SAS data set for each sample (24 total) or composite collected.

The SAS program, which has recently been converted to a Personal Computer (PC) version, allows the REMP to be easily administered by statistically analyzing the data, graphing, and tabulating them in the format of Regulatory Guide 4.8.

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: environmental dose calculations and correlation of effluent releases with environmental concentrations (Appendix D), historical trending of radionuclide concentrations in sampled environmental media over a period of several years (Appendix E), comparison of operational to preoperational environmental data (Appendix F), summary of deviations from sampling requirements and corrective actions taken (Appendix G), and finally the results of Land Use Census reports for 1994 as well as changes in the Land Uses from the previous year (Appendix H). Summaries and comparisons of indicator to control locations are presented in Section II of the text of this report. Other data comparisons are presented in the Appendices following the text of the report.

II. RESULTS AND DISCUSSIONS OF 1994 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 (TLDs) were placed at each of 44 indicator and control locations (excluding three laboratory controls and one transit dose TLD). They were then collected, and analyzed at prescribed intervals. 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 control TLD's if necessary. The TLD's were replaced with re-zeroed dosimeters every quarter. The locations are selected as inner and outer rings for all three Units (Tables II-1 to II-4), as required by Unit 1 and Units 2/3 Offsite Dose Calculation Manual0s (ODCMs).

TABLE I-2

REMP SAMPLE ANALYSIS SUMMARY FOR 1994

MEDIUM	ANALYSIS TYPE	SAMPLING FREQUENCY	# OF LOCATIONS	TOTAL # OF ANALYSES IN 1994
Direct Radiation	Dosimetry	Quarterly	52*	208
Airborne Particulates	Gross β	Weekly	12	624
Charcoal Cartridge	I-131	Weekly	10	520
Airborne Particulates	Ge(Li) Scan	Quarterly	10	40
Airborne Particulates	Gross α	Quarterly	10	40
Airborne Particulates	Sr-90	Quarterly	10	40
Ocean Water	Ge(Li) Scan	Monthly	4	48
Ocean Water	H-3	Quarterly	4	16
Drinking Water, Unfiltered Drinking Water, Unfiltered	Ge(Li) Scan H-3	Monthly Monthly	3 3	36 36
Drinking Water (Solids)	Gross α Gross β	Monthly Monthly	3 3	36 36
Drinking Water, Filtrate Drinking Water, Filtrate	Gross α Gross β	Monthly Monthly	3 3	36 36
Drinking Water, Solids Drinking Water, Solids	Gross α Gross β	Quarterly Quarterly	3 3	12 12
Drinking Water, Filtrate Drinking Water, Filtrate	Ge(Li) Scan H-3	Quarterly Quarterly	3 3	12 12
Drinking Water Filtrate Drinking Water Filtrate	Gross α Gross β	Quarterly Quarterly	3 3	12 12
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	2	8
Crops Crops	Gross α Sr-90	Semi-Annually Semi-Annually	2 2	8 8
Kelp	Ge(Li)Scan	Semi-Annually	4	8
Soil Soil	Ge(Li)Scan Sr-90	Annually Annually	5 5	5 5

* The 52 locations include 4 control and transit TLDs and four for the SSID.

A total of 48 TLDs were analyzed quarterly (two packets for each location or 96 analyses quarterly). All analyses were performed on TLDs (except two missing TLDs, #35 and #38 in the first quarter, and #31 in the fourth quarter of 1994). In addition, TLD numbers 17, 18, and 60 are used only for lab control and #99 for transit dose (dose contribution from the lab and during transportation). The environmental dosimetry program is also conducted in accordance with ANSI-N545 standards.

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 12.5 to 24.5 mrem, with an average dose of 17.7 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 (24.5 mrem), with an average quarterly dose of 21.7 mrem (uncorrected for background). Subtracting a background dose of 74 mrem/year, the net annual dose for this location was 0.43 mrem based on an occupancy factor of 300 hours per year for beach users. This location therefore had the highest annual reading.

The second highest annual TLD reading was at San Onofre State Beach (location #56, at 0.1 miles SW) ranging from 18.4 mrem to 23.4 mrem with a quarterly average of 20.5 mrem (uncorrected for background). 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 (Figures 2A-4B). The current "control" is the numerical average of the readings at locations #31 and #50. The positive correlation observed between the control and the indicator locations indicate other factors such as environmental and seasonal variations are responsible and that plant effects are negligible.

Figures 2A to 3B compare environmental radiation levels of indicator and control locations for the operational year 1994 and the previous years. These figures show the comparison between the controls and inner ring as well as the outer ring location.

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 II-1

INNER RING LOCATIONS REQUIRED BY SONGS UNIT 1 ODCM

Direction (Sector)	Distance in 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	Former 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 II-2

INNER RING LOCATIONS REQUIRED BY SONGS UNITS 2/3 ODCM

Direction (Sector)	Distance in 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	Former 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 II-3

OUTER RING LOCATIONS REQUIRED BY SONGS UNIT 1 ODCM

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

TABLE II-4

OUTER RING LOCATIONS REQUIRED BY SONGS UNITS 2/3 ODCM

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

B. Airborne Particulate Analysis

Sample locations are selected in accordance with the requirements of the Unit 1 and Units 2/3 Offsite Dose Calculation Manuals (See Tables II-5 and II-6).

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 II-7).

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. This makes the identification of beta-emitting radionuclides very difficult. Therefore, 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 II-7) and from a control location situated in the city of Huntington Beach. Figures 5A and 5B show the variation in gross beta activity level in 1994 in different locations. After collection, the samples were analyzed for gross beta activity with a lower limit of detection of 0.001 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. Air samplers #5 and #7 are not required by ODCMs, Section 5.0 and therefore not listed in the REMP results. These samplers are located within the Exclusion Area Boundary (EAB).

Gross beta activity was detected in each weekly airborne particulate sample. The concentration of gross beta activity in the samples collected from the indicator locations ranged from 0.009 to 0.052 pCi/m^3, averaging 0.022 pCi/m^3 of air. The concentrations of gross beta activity in the samples from Huntington Beach control location ranged from 0.011 to 0.073 pCi/m^3, averaging 0.022 pCi/m^3 of air. See Figures 5A & 5B for 1994 weekly airborne particulates gross beta activity in the air samples collected from locations required by Section 5.0 of Unit 1 and Units 2/3 Offsite Dose Calculation Manuals (ODCMs).

When the quarterly-composite samples were analyzed for strontium-90 and gross alpha radioactivity, no strontium-90 or gross alpha was detected in any of the composite samples.

No gamma-emitting radionuclides were detected in the quarterly-composite samples except naturally-occurring K-40 which was detected in one sample (location #12) in the second quarter of 1994.

Per requirement of Unit 1 and Units 2/3 ODCMs, 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 1994 was 0.052 pCi/m^3 and the control location average was 0.022 pCi/m^3. No action was taken since the indicator value of 0.052 pCi/m^3 did not exceed 0.22 pCi/m^3 which is ten times the annual average gross beta activity of the control (0.022 pCi/m^3).

C. Radioiodine in Air

In 1994, weekly air samples for radioiodine were collected by adsorption on charcoal cartridges from seven ODCM-required locations in the vicinity of SONGS and from Huntington Beach (which served as a control location). During 1994, a total of 416 air cartridges (eight locations times 52 weeks per year) were analyzed to detect their iodine-131 radioactivity concentration. Of these 416 air cartridges, 52 were control samples (364 indicators).

Iodine I-131 was not detected in any of the 364 indicator samples analyzed during 1994. The lower limit of detection (LLD) of I-131 in the samples was 0.033 pCi/m^3.

The concentrations of iodine-131 in the 52 samples collected from the control location were all less than the lower limit of detection. See Table 3 of Appendix B for a listing of radioiodine activity in the weekly air samples for 1994.

In conclusion, during 1994, no iodine-131 activity was detected beyond the SONGS Exclusion Area Boundary (EAB) and its impact on the environment is negligible.

D. Ocean Water

In 1994, 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 19 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 1994; potassium-40, and thorium-228 were the naturally-occurring gamma-emitting radionuclides detected in the monthly gamma spectral analyses of samples from some of the indicator and control locations. Potassium-40 was detected in each sample. The concentrations of potassium-40 in the 36 samples from the indicator locations ranged from 234 to 370 pCi/l, averaging 307 pCi/l. The concentrations of potassium-40 in the samples from the control location ranged from 246 to 316 pCi/l, averaging 288 pCi/l. Naturally-occurring radium-226 was not detected in the samples but thorium-228 was detected in one control sample from the the Newport Beach Control at a concentration of 6.48 pCi/l.

TABLE II-5

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 In 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

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 II-6

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 In 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

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

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

TABLE II-7

LOCATIONS OF AIR SAMPLERS FOR UNITS 1, 2, AND 3 BY SECTOR ANALYSIS

Location #	Location Name	SONGS UNITS 2/3 Sector	SONGS UNITS 2/3 Angle from True North	SONGS UNITS 2/3 Distance (Miles)	SONGS UNIT 1 Sector	SONGS UNIT 1 Angle from True North	SONGS UNIT 1 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 East) (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.

Tritium was not detected in the quarterly-composite samples obtained from any of the sampling locations.

Virtually all other detected radioactivity in each of the ocean water samples can be attributed to naturally-occurring potassium-40. The variation of potassium-40 in ocean water is considered characteristic of this environmental medium. These data indicate that SONGS operations had a negligible impact on this environmental medium.

E. Drinking Water

In 1994, drinking water samples were collected on a monthly basis from two indicator locations and from a control location situated in Huntington Beach. Upon collection, the samples were analyzed for tritium as well as for 16 naturally-occurring and SONGS-related gamma emitting radionuclides. Afterwards, the samples were filtered so that the suspended solids and filtrate could be analyzed separately for gross alpha and gross beta activity. Samples from each location were also composited quarterly, and filtered in the same manner. In each instance, the suspended solids were analyzed for gross beta concentrations, and the filtrates were analyzed for gross beta activity and for tritium.

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

Part A. Monthly Drinking Water Results

Unfiltered Samples

No radionuclides were detected in monthly drinking water samples.

Drinking Water Solids and Filtrates:

Gross alpha activity was not detected in the drinking water solids and filtrates. Gross beta activity was not detected in the solids but it was detected in all 22 filtrate indicator and 12 control samples. The range of gross beta was 5.0 to 13.0 in the 22 indicators and 4.0 to 18.0 in the 12 control samples. It should be noted that the well water in the San Clemente Golf Course (location #2) was not operational in the months of November and December so no samples were available for those times.

Part B. Quarterly Drinking Water Composite Results

Drinking Water Solids

Gross alpha and beta radioactivities were not detected in any of the quarterly-composite samples from the Tri-Cities Municipal Water District Reservoir, the San Clemente Golf Course, or the control location.

Drinking Water Filtrate

Gross alpha activity was not detected in any of the composite samples collected from Tri-Cities Municipal Water District Reservoir, from San Clemente Golf Course, and Huntington Beach control location (the lower limit of detection was 0.63 pCi/l).

Gross beta activity was detected in each quarterly-composite sample. Gross beta activity in the composite samples from Tri-Cities Municipal

Water District Reservoir and the San Clemente Golf Course Well ranged from 7.0 to 34.0 pCi/l, averaging 13.0 pCi/l. Gross beta activity in the samples collected from Huntington Beach ranged from 6.0 to 13.0 pCi/l, averaging 8.8 pCi/l. Tritium was not detected in any of the quarterly composite samples and its concentration was below the lower limit of detection (102 pCi/l).

Conclusions

No plant-related gamma-emitting radionuclides were found in the monthly drinking water or the quarterly-composite samples. Gross beta activities were, however, detected in a number of samples collected throughout 1994. A comparison of the results with the control location (Figures 19A and 19B) indicates that the presence of gross alpha (if any) and gross beta in the indicator and control locations is due to natural sources of radioactivity. There is no indication that gross alpha or gross beta due to plant related radionuclides is accumulating in either drinking water filtrate or drinking water solids (LLD = 102 pCi/l).

F. Shoreline Sediment (Beach Sand)

Beach sand was collected semiannually in 1994 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 1994, three naturally-occurring radionuclides were detected in shoreline sediment samples. They include 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. The only plant-related radionuclides detected were Ce-141 in one sample at a concentration of 0.03 pCi/g, wet at the San Onofre State Beach, 0.6 miles Southeast of Units 2 and 3, and Cs-137 in three samples at a concentration of 0.008 to 0.060 pCi/gram, wet. The presence of Cs-137 may also be attributed to fallout deposition due to nuclear weapons testings.

Because most SONGS-related radionuclides were not detected in the shoreline sediment samples, the impact of SONGS operations on shoreline sediment is considered to be negligible.

G. Ocean Bottom Sediments

To determine the radioactivity in ocean bottom sediments in the vicinity of the Station in 1994, representative samples were collected semiannually near each of the Station discharge outfalls (which served as indicator locations), and from Laguna Beach, which served as a control location.

After collection, the samples were analyzed by gamma-spectral analysis for 19 naturally-occurring and station-related radionuclides. The results of these analyses are summarized in Appendix B of the report in terms of "as received" wet sample weights.

In 1994, three naturally-occurring radionuclides (K-40, Ra-226, and Th-228) were detected in the ocean bottom sediment samples. The variation of the concentrations of these radionuclides in the ocean bottom sediment samples is considered to be characteristic of this environmental medium (Figures 16&17). Cesium-137 was the only plant-related radionuclide detected in five indicator samples and in one control sample of Laguna

Beach. Its concentration ranged from 0.010 to 0.040 pCi/g, wet weight in the indicators and 0.04 pCi/gram, wet in the control sample.

Although Cs-137 was detected in a few ocean bottom sediment samples, the impact of SONGS operations on ocean bottom sediments is considered to be negligible. The presence of this radionuclide may also be due to fallout.

H. Non-Migratory Marine Species (Flesh)

During 1994, non-migratory marine species were collected near SONGS Unit 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.

The naturally-occurring radionuclides K-40, Ra-226, and Th-228 were detected in most of the samples.

Cesium-137, a plant-related radionuclide was detected in one sample of black perch at 0.005 pCi/g (Units 2/3 outfall), and four sheephead samples at an average of 0.006 pCi/gram, wet. Cerium-141 was also detected in one sample of black perch at 0.002 pCi/g at Unit 1 outfall. Cesium-134 was also detected in one control sample of sheephead and Cs-137 in two samples of sheephead caught at the control location of Laguna Beach.
To determine whether or not these radionuclides are accumulating in the marine animals, concentrations of each of these radionuclides in sheephead (a fish), crustacea, and mollusks were plotted versus time from 1987 to 1994 (Figures 8-10) (Also see 1993 Annual Report). Trending of these data indicates that the concentrations of each of these radionuclides are greater than or equal to concentrations measured at the control location, but are not accumulating in the marine animals. The presence of station-related radionuclides in the control location samples may be attributed to the reverse current (North and South) and nuclear fallout. The highest concentration of Cs-137 (0.010 pCi/g) detected in the marine species of Unit 1 outfall in 1994 was less than one percent (0.5%) of the reporting level established by Nuclear Regulatory Commission (2 pCi/g, wet).

The sum of the concentrations of marine species averaged over each quarter and divided by the corresponding reporting levels resulted in a fraction much less than one (0.0212).

Based on these data, it was concluded that (1) 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.

I. Local Crops

Representative fleshy crops were collected semiannually in 1994 from farms in San Clemente (which served as the indicator location), and from a garden situated at SSE of Oceanside (which served as the control location). Leafy vegetable samples were not available. After collection, the edible portion of the crop samples was analyzed quantitatively for 11 gamma-emitting radionuclides, as well as for radiostrontium by beta counting. The results of the analyses are summarized based on "as received" wet sample weights, as follows:

Cucumber, yellow squash, tomato, strawberries, brussel sprout, string beans, and zucchini were collected from the San Clemente and Oceanside sampling locations. Upon analysis, naturally-occurring K-40 was detected in the indicator samples with concentrations from 2.50 to 3.23 pCi/g, wet weight.

Potassium-40 was also detected in the samples from the control location. The concentrations of K-40 in the control samples ranged from 1.46 to 1.79 pCi/g, wet weight.

During 1994, Sr-90 was also detected in indicator and control samples. Its concentration was 0.0002 to 0.0006 pCi/g in the indicators and 0.0006 to 0.030 pCi/gram, wet, in the control samples. The even distribution of this radionuclide between indicator and control locations leads one to conclude that Sr-90 in this medium is mostly the result of factors such as nuclear weapons testing fallout rather than SONGS operations.

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.

J. 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 K-40 and Cs-137 were present in detectable quantities in one or more of the samples. The findings are summarized in terms of dry sample weights.

Surface Soil Sample Results

Two radionuclides were detected in surface soil collected from the indicator and control locations. Potassium-40 was detected in each sample. The concentrations of K-40 in the samples from the indicator locations ranged from 7.0 to 19.0 pCi/g, averaging 14.0 pCi/g. The concentration of K-40 in one sample from the control location was 19.1 pCi/g, dry weight.

Cesium-137 was detected in samples collected from two indicator locations. The concentration of Cs-137 in the indicator samples ranged from 0.30 to 0.39 pCi/g, dry weight averaging 0.34 pCi/g. Cerium-144 was detected in one indicator sample collected during 1994, at 0.30 pCi/gram, dry.

The concentration of Sr-90 in the samples, was below the lower limit of detection of 0.007 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 supports the fact that the major source of this radionuclide is due to fallout deposition.

To assess the importance of detecting strontium-90 in the surface soil samples, data collected from the indicator locations over a period of several years were compared to similar data collected from Huntington Beach. Concentrations of Sr-90 and Cs-137 in soil have also been plotted versus time in Figures 16A&16B of the Appendix I. Variation in concentration of certain radionuclides is described in Appendix E, historical trending. These data indicate that the concentrations of each of these radionuclides seen at both indicator and control locations are similar. Because of this, the activity can be attributed to atmospheric nuclear weapons tests and not SONGS operations.

K. Kelp Sampling

Kelp was collected during May and October 1994 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 19 different naturally-occurring and Station-related radionuclides. Plant-related gamma-emitting radionuclides detected in the samples included Cs-137, and I-131, as well as the naturally-occurring K-40, Ra-226, and Th-228. The results of these analyses are summarized below in terms of wet sample weights.

Naturally-occurring potassium-40, Ra-226 and Th-228 were detected in a few samples. The concentrations of K-40 in the samples from the indicator locations ranged from 6.7 to 11.0 pCi/g, averaging 9.4 pCi/gram, wet. The concentrations of K-40 in the samples from the control location ranged from 8.0 to 13.0 pCi/g, averaging 10.5 pCi/g. Thorium-228 was detected in two samples averaging 0.007 pCi/g. Radium-226 was also detected in one indicator at a concentration of 0.06 pCi/gram and one control at 0.004 pCi/gram, wet weights.

Iodine-131 was detected in three indicator and two control location samples. The concentration range of iodine-131 in the samples collected from the indicator locations was 0.02 to 0.05 pCi/g. At the control station, the concentration range was 0.03 to 0.08 pCi/g. In other locations, it was below the lower limit of detection (LLD = 0.020 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. Figures 17&18 show the variation in concentration of cesium-137 and iodine-131 in kelp samples from 1985 to 1994. 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.

III. CONCLUSIONS

Levels of radioactivity in environmental media depend on many components, including the following: 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 1994 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.

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 1994 against the levels observed in pre-operational years.

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

In comparing these findings to the conservatively-defined limits of the facility operating licenses, it is concluded that the radiological environmental impact of San Onofre Units 1, 2 and 3 operations through 1994 has been negligible, and the resulting dose to man is negligible.

IV. 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 1, 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-XXXIX-1, 1.1, 2, 2.1)

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. 1, February 1979.

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

11. 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.

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

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

14. 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.

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

16. 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*
Direct Radiation			
1	City of San Clemente (Former SDG&E Offices)	5.6	NW
2	Camp San Mateo (MCB, Camp Pendleton)	3.5	N
3	Camp San Onofre (MCB, Camp Pendleton)	2.6	NE
4	Camp Horno (MCB, Camp Pendleton)	4.5	E
5	DELETED		
6	Old Route 101 (East-Southeast)	3.0	ESE
7	DELETED		
8	Noncommissioned Officers Beach Club	1.5	NW
9	DELETED		
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
20	DELETED		
21	DELETED		
22	Former U.S. Coast Guard Station - San Mateo Point	2.7	WNW
23	San Clemente General Hospital	8.2	NW
24	DELETED		
25	DELETED		
26	DELETED		
27	DELETED		

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation (Continued)			
28	DELETED		
29	DELETED		
30	DELETED		
31	Aurora Park - Mission Viejo (CONTROL)	18.7	NNW
32	DELETED		
33	Camp Talega (MCB, Camp Pendleton)	5.7	N
34	San Onofre School (MCB, Camp Pendleton)	1.9	NW
35	Range 312 (MCB, Camp Pendleton)	4.7	NNE
36	Range 208C (MCB, Camp Pendleton)	4.2	NE
37	DELETED		
38	San Onofre State Beach Park	3.3	SE
39	DELETED		
40	SCE Training Center - Mesa (Adjacent to PIC #3)	0.7	NNW
41	Old Route 101 - East	0.4**	E
42	DELETED		
43	DELETED		
44	Fallbrook Fire Station	18.0	E
45	DELETED		
46	San Onofre State Beach Park	1.0	SE
47	Camp Las Flores (MCB, Camp Pendleton)	8.6	SE
48	DELETED		
49	Camp Chappo (MCB, Camp Pendleton)	12.8	ESE
50	Oceanside Fire Station (CONTROL)	15.5	SE
51	DELETED		
52	DELETED		
53	San Diego County Operations Center	45	SE

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Direct Radiation (Continued)			
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, Camp Pendleton)	4.3	ENE
99	Transit TLD	---	---
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
6	**DELETED**		
7	AWS Roof (Added)	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 Corps Base (Camp Pendleton East)	0.7	E

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
Soil Samples			
1	Camp San Onofre	2.5	NE
2	Old Route 101 - East Southeast	3.0	ESE
3	Basilone Road/I-5 Freeway Offramp	2.0	NW
4	Huntington Beach Generating Station (CONTROL)	37.0	NW
5	Former Visitor's Center (East Site Boundary)	0.2**	NNW
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 Southeast)	0.6	SE
2	San Onofre Surfing Beach	0.9	NW
3	San Onofre State Beach (3.1 miles Southeast)	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
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

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS

TYPE OF SAMPLE AND SAMPLING LOCATION***		DISTANCE* (miles)	DIRECTION*
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 and 3 midpoint. Direction is determined from degrees true north.

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

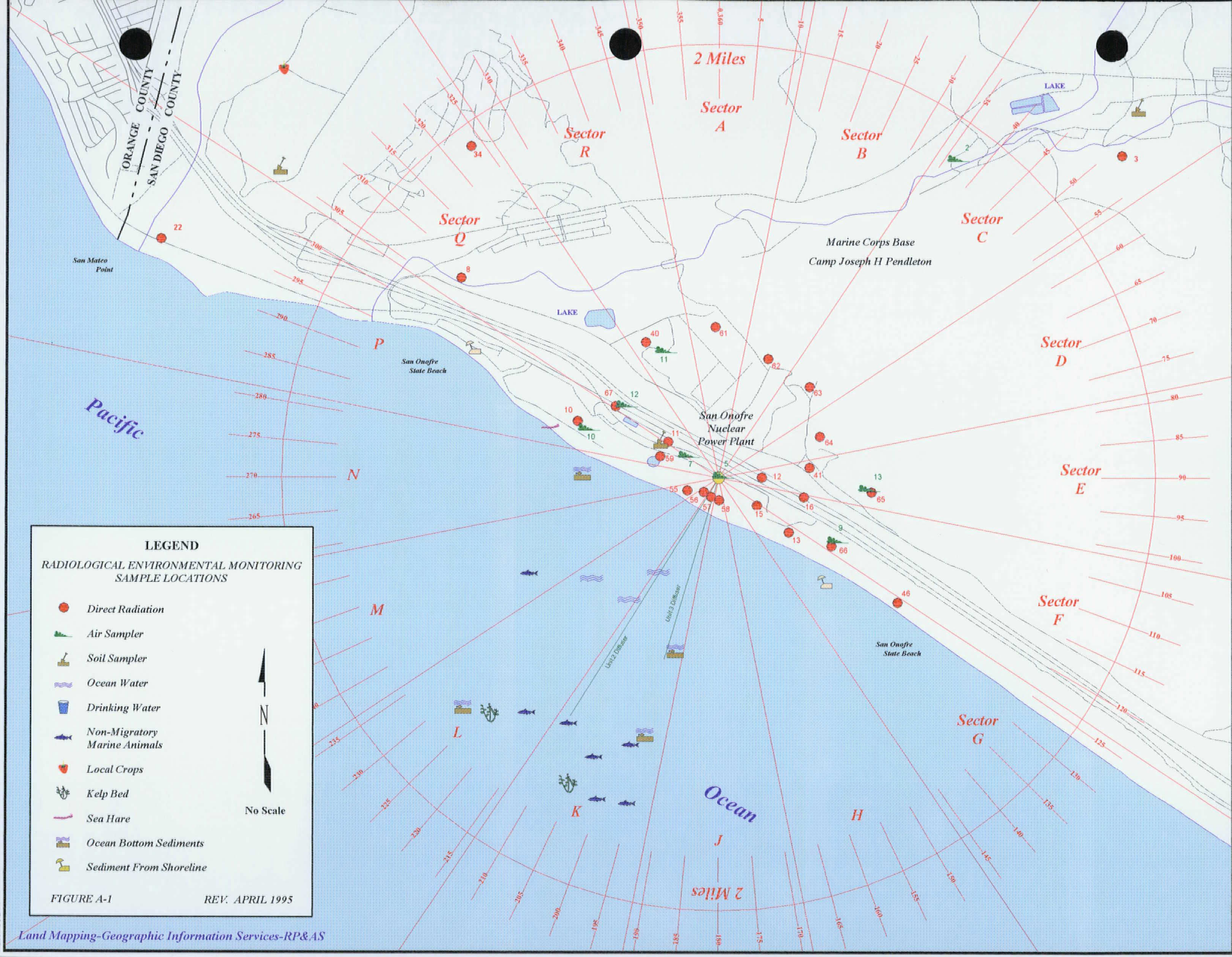
*** MCB - Marine Corps Base

PIC Pressurized Ion Chamber

TABLE A-2

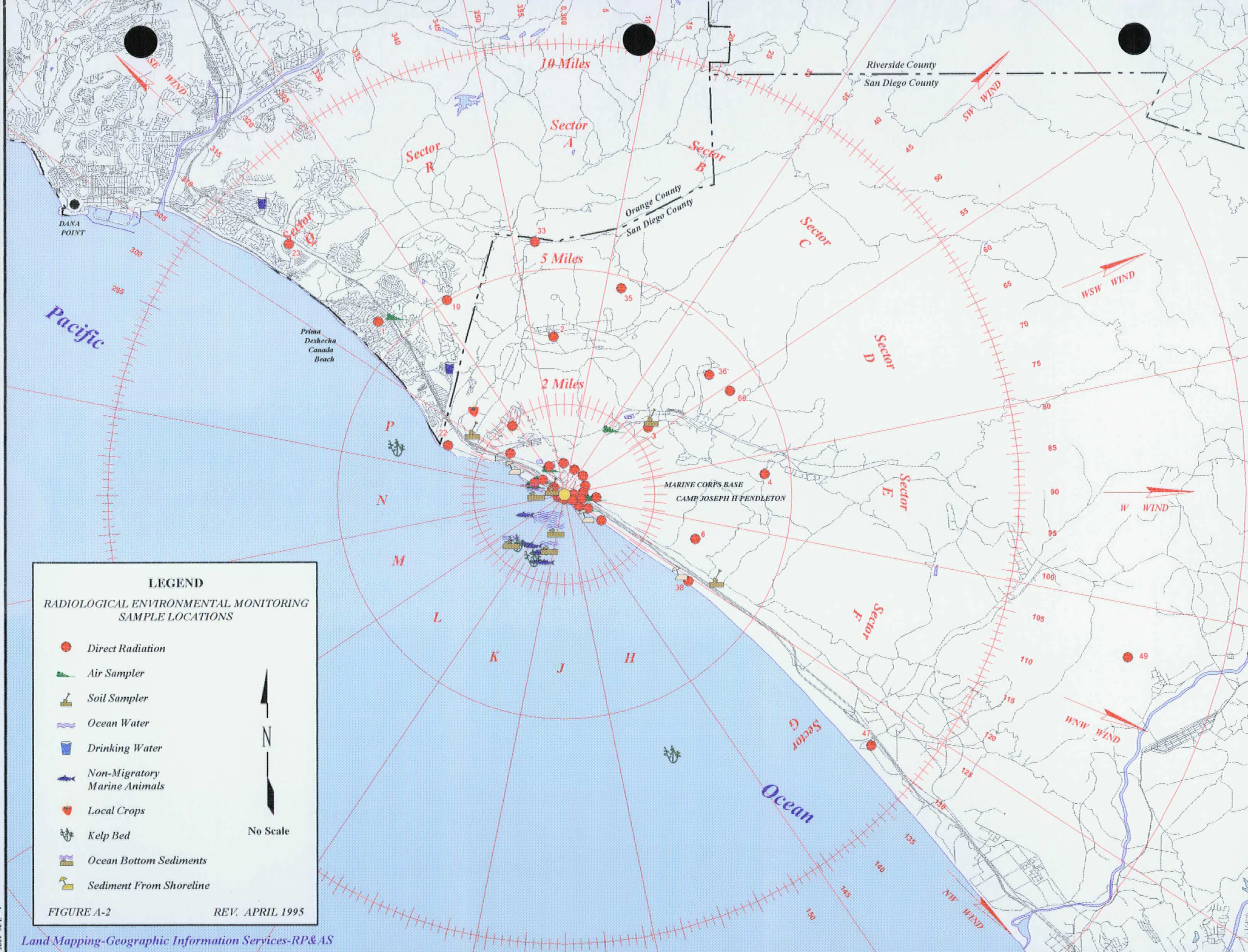
SECTOR AND DIRECTION DESIGNATION FOR RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATION MAP

DEGREES TRUE NORTH FROM SONGS 2 AND 3 MID-POINT			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	281.15	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



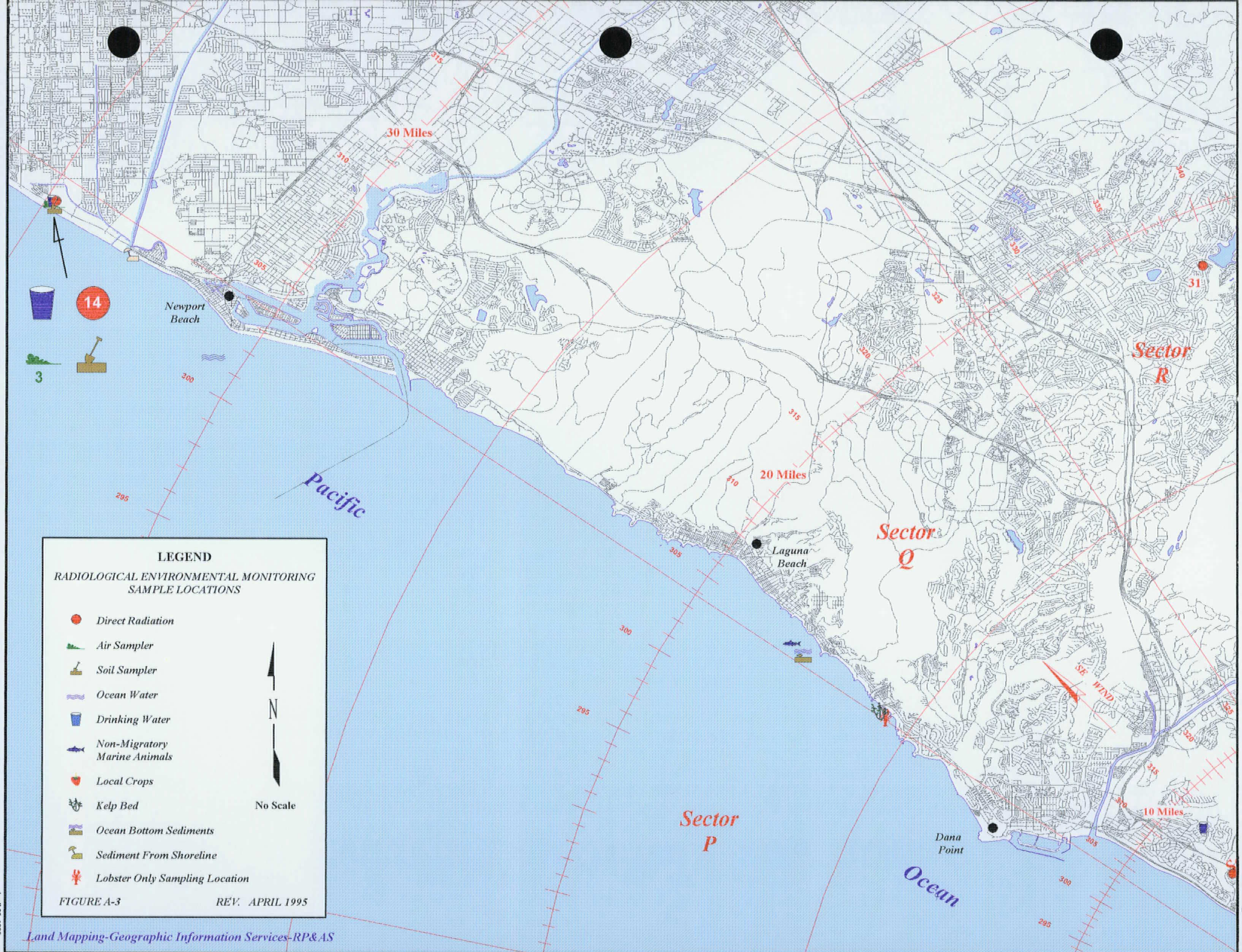
LEGEND
RADIOLOGICAL ENVIRONMENTAL MONITORING SAMPLE LOCATIONS
Direct Radiation
Air Sampler
Soil Sampler
Ocean Water
Drinking Water
Non-Migratory Marine Animals
Local Crops
Kelp Bed
Sea Hare
Ocean Bottom Sediments
Sediment From Shoreline
REV. APRIL 1995
N
No Scale
San Onofre Nuclear Power Plant
Marine Corps Base Camp Joseph H Pendleton
ORANGE COUNTY
SAN DIEGO COUNTY
San Mateo Point
San Onofre State Beach
San Onofre State Beach
LAKE
LAKE
Pacific
Ocean
2 Miles
2 Miles
Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector R
Sector Q
P
N
M
L
K
J
H
Unit 2 Diffuser
Unit 3 Diffuser
Land Mapping-Geographic Information Services-RP&AS

FIGURE A-1

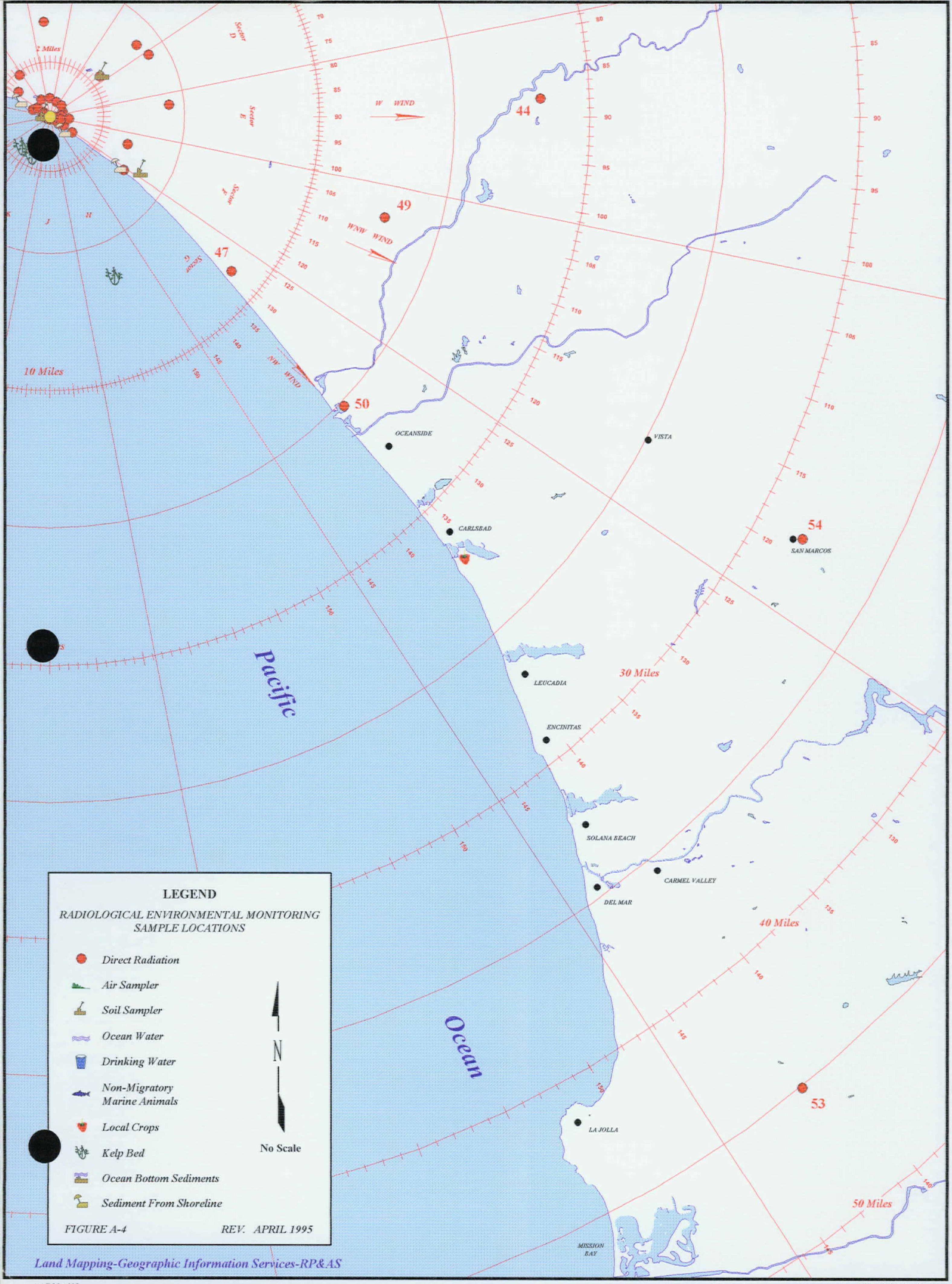


Riverside County
San Diego County
Orange County
San Diego County
10 Miles
5 Miles
2 Miles
Sector A
Sector B
Sector C
Sector D
Sector E
Sector F
Sector G
Sector R
Sector Q
P
N
M
L
K
J
H
SE WIND
SW WIND
WSW WIND
W WIND
WNW WIND
NW WIND
MARINE CORPS BASE
CAMP JOSEPH H PENDLETON
DANA POINT
Prima Deshecha Canada Beach
Pacific
Ocean
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
REV. APRIL 1995
Land Mapping-Geographic Information Services-RP&AS

FIGURE A-2



30 Miles
20 Miles
10 Miles
Newport Beach
Laguna Beach
Dana Point
Pacific
Ocean
Sector P
Sector Q
Sector R
SE WIND
14
3
31
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
N
No Scale
FIGURE A-3
REV. APRIL 1995
Land Mapping-Geographic Information Services-RP&AS


2 Miles
10 Miles
30 Miles
40 Miles
50 Miles
Sector D
Sector E
Sector F
Sector G
J
H
K
W WIND
WNW WIND
NW WIND
44
49
47
50
54
53
OCEANSIDE
VISTA
CARLSBAD
SAN MARCOS
LEUCADIA
ENCINITAS
SOLANA BEACH
CARMEL VALLEY
DEL MAR
LA JOLLA
MISSION BAY
Pacific
Ocean
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 OF 1994 RADIOLOGICAL ENVIRONMENTAL DATA

SAN ONOFRE NUCLEAR GENERATING STATION

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutin Reported Measureme
Table 1A Quarterly Gamma Exposure (millirem)								
	Gamma Exposure	189	5.0000	17.691(166/168) (12.500-24.500)	San Onofre State Beach (Unit 1) 0.2 mi. WSW	21.725(4/ 4) (19.000-24.500)	18.614(7/ 8) (16.100-21.500)	

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 Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutin Reported Measureme
Table 3 Weekly Radioiodine I-131 Activity (pCi/cu.m)							
	I-131 416	0.0430	<LLD (0/364)	ALL <LLD	-----	<LLD (0/ 52)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 4A Quarterly - Composite Airborne Particulates Gamma Spectral Analysis (pCi/cu.m)								
	K-40	32	0.0061	0.0210(1/ 28) (0.021- 0.021)	Former SONGS Evaporation Pond 0.6 mi. NW	0.0210(1/ 4) (0.021- 0.021)	<LLD (0/ 4)	
	Ru-103	32	0.0007	<LLD (0/ 28)	ALL <LLD	-----	<LLD (0/ 4)	
	Zr(Nb)-95	32	0.0011	<LLD (0/ 28)	ALL <LLD	-----	<LLD (0/ 4)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean Range	Control Locations Mean Range	Number o Nonrouti Reported Measurem
Table 5 Monthly Ocean Water Gamma Spectral Analysis (pCi/l)							
	Ag-110m 48	3.0860	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Ba(La)-140 48	28.610	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Ce-141 48	5.6990	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Ce-144 48	15.460	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Co-57 48	1.7400	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Co-58 48	4.8680	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Co-60 48	5.3430	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Cs-134 48	4.5810	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Cs-137 48	3.6870	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 5 Monthly Ocean Water Gamma Spectral Analysis (pCi/l)								
	Zn-65	48	7.6210	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	
	Zr(Nb)-95	48	7.2990	<LLD (0/ 36)	ALL <LLD	-----	<LLD (0/ 12)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 9A Monthly Drinking Water Analysis (pCi/l)								
	Ag-110m	1	3.1280	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Ba(La)-140	1	37.351	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Be-7	1	38.903	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Ce-141	1	6.3400	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Ce-144	1	15.649	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Co-58	1	5.1110	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Co-60	1	5.3530	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Cs-134	1	4.6020	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Cs-137	1	3.6880	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	Fe-59	1	9.4770	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0
	H-3	1	102.00	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	0

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 9B Monthly Drinking Water Solids Gross Alpha and Gross Beta Activities (pCi/l)								
	Gross Alpha	34	0.2110	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	
	Gross Beta	34	0.7380	<LLD (0/ 22)	ALL <LLD	-----	<LLD (0/ 12)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 9D Quarterly-Composite Drinking Water Solids Gross Alpha and Gross Beta Activities (pCi/l)								
	Gross Alpha	12	0.2110	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	
	Gross Beta	12	0.7380	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 9E Quarterly-Composite Drinking Water Filtrate Analysis (pCi/l)							
	Gross Alpha 12	0.6320	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0
	Gross Beta 12	0.6990	13.000(8/ 8) (7.000-34.000)	Tri-Cities Muni. Water Dist. 8.7 mi. NW	18.750(4/ 4) (12.000-34.000)	8.750(4/ 4) (6.000-13.000)	0
	H-3 12	102.00	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0
	I-131 12	0.5100	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0
	K-40 12	42.201	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0
	Mn-54 12	3.7040	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0
	Ru-103 12	4.7210	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0
	Zn-65 12	7.7300	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 4)	0

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 10 Semi-Annual Shoreline Sediment Gamma Spectral Analysis (pCi/g)							
	I-131 8	0.0690	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
	K-40 8	0.0740	12.900(5/ 6) (11.000-16.000)	Laguna Beach (North End) 30 mi. NW	18.000(2/ 2) (17.000-19.000)	18.000(2/ 2) (17.000-19.000)	
	Mn-54 8	0.0070	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
	Mo(Tc)-99m 8	5.5350	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
	Ra-226 8	0.0130	0.4140(5/ 6) (0.200- 0.760)	San Onofre State Beach 0.6 mi. SE	0.4800(2/ 2) (0.200- 0.760)	0.2550(2/ 2) (0.190- 0.320)	
	Ru-103 8	0.0080	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
	Ru-106 8	0.0550	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
	Th-228 8	0.0090	0.5280(5/ 6) (0.220- 1.000)	San Onofre State Beach 0.6 mi. SE	0.6100(2/ 2) (0.220- 1.000)	0.5700(2/ 2) (0.430- 0.710)	
	Zn-65 8	0.0140	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
	Zr(Nb)-95 8	0.0104	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	

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, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutin Reported Measureme
Table 11 Semi-Annual Ocean Bottom Sediment Gamma Spectral Analysis (pCi/g)								
	I-131	10	0.0170	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	
	K-40	10	0.0660	11.500(8/ 8) (10.000-15.000)	Unit 3 Outfall 1.2 mi. SSW	13.000(2/ 2) (11.000-15.000)	10.000(2/ 2) (4.000-16.000)	
	Mn-54	10	0.0060	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	
	Mo(Tc)-99m	10	4.9010	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	
	Ra-226	10	0.0120	0.3562(8/ 8) (0.190- 0.630)	Unit 1 Outfall 0.6 mi. W	0.5850(2/ 2) (0.540- 0.630)	0.2000(2/ 2) (0.200- 0.200)	
	Ru-103	10	0.0070	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	
	Ru-106	10	0.0480	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	
	Th-228	10	0.0080	0.4600(8/ 8) (0.210- 1.000)	Unit 1 Outfall 0.6 mi. W	0.8650(2/ 2) (0.730- 1.000)	0.3200(2/ 2) (0.310- 0.330)	
	Zn-65	10	0.0120	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	
	Zr(Nb)-95	10	0.0120	<LLD (0/ 8)	ALL <LLD	-----	<LLD (0/ 2)	

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, 1994 to December 31, 1994

Table 12A
Quarterly Non-Migratory
Marine Animals Analysis (pCi/g) (flesh type)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
bay mussel	I-131	2	0.0150	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
bay mussel	K-40	2	0.0400	2.0500(2/ 2) (2.000- 2.100)	Units 2/3 Outfall 1.5 mi. SSW	2.0500(2/ 2) (2.000- 2.100)	<LLD (0/ 0)	
bay mussel	Mn-54	2	0.0030	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
bay mussel	Mo(Tc)-99m	2	2.6620	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
bay mussel	Ra-226	2	0.0650	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
bay mussel	Ru-103	2	0.0040	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
bay mussel	Ru-106	2	0.0280	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 12A Quarterly Non-Migratory Marine Animals Analysis (pCi/g) (flesh type)								
black perch	Cs-134	6	0.0040	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	
black perch	Cs-137	6	0.0030	0.0050(1/ 4) (0.005- 0.005)	Units 2/3 Outfall 1.5 mi. SSW	0.0050(1/ 2) (0.005- 0.005)	<LLD (0/ 2)	
black perch	Fe-59	6	0.0090	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	
black perch	I-131	6	0.0150	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	
black perch	K-40	6	0.0400	3.4575(4/ 4) (3.360- 3.540)	Laguna Beach 18.2 mi. NW	3.5800(2/ 2) (3.260- 3.900)	3.5800(2/ 2) (3.260- 3.900)	
black perch	Mn-54	6	0.0030	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	
black perch	Mo(Tc)-99m	6	2.6620	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
SAN ONOFRE NUCLEAR GENERATING STATION

Docket Nos. 50-206, 50-361, 50-362
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Reporting period: January 1, 1994 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 12A Quarterly Non-Migratory Marine Animals Analysis (pCi/g) (flesh type)								
keyhole limpet	Ce-144	2	0.0140	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Co-57	2	0.0020	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Co-58	2	0.0050	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Co-60	2	0.0050	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Cs-134	2	0.0040	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Cs-137	2	0.0030	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Fe-59	2	0.0090	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1994 to December 31, 1994

Table 12A
Quarterly Non-Migratory
Marine Animals Analysis (pCi/g) (flesh type)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses 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
keyhole limpet	Zn-65	2	0.0070	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
keyhole limpet	Zr(Nb)-95	2	0.0070	<LLD (0/ 0)	ALL <LLD	-----	<LLD (0/ 2)	
sea hare	Ag-110m	2	0.0030	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Ce-141	2	0.0050	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Ce-144	2	0.0140	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Co-57	2	0.0020	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Co-58	2	0.0050	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Co-60	2	0.0050	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Cs-134	2	0.0040	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	

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Table 12A
Quarterly Non-Migratory
Marine Animals Analysis (pCi/g) (flesh type)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
sea hare	Ru-103	2	0.0040	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Ru-106	2	0.0280	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Th-228	2	0.0040	0.1200(2/ 2) (0.020- 0.220)	Unit 1 Outfall 0.9 mi. WSW	0.1200(2/ 2) (0.020- 0.220)	<LLD (0/ 0)	
sea hare	Zn-65	2	0.0070	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sea hare	Zr(Nb)-95	2	0.0070	<LLD (0/ 2)	ALL <LLD	-----	<LLD (0/ 0)	
sheephead	Ag-110m	6	0.0030	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	
sheephead	Ce-141	6	0.0050	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	
sheephead	Ce-144	6	0.0140	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 12A Quarterly Non-Migratory Marine Animals Analysis (pCi/g) (flesh type)							
sheephead	K-40 6	0.0400	3.5675(4/ 4) (3.000- 4.100)	Units 2/3 Outfall 1.5 mi. SSW	3.8800(2/ 2) (3.660- 4.100)	3.4800(2/ 2) (3.460- 3.500)	0
sheephead	Mn-54 6	0.0030	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
sheephead	Mo(Tc)-99m 6	2.6620	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
sheephead	Ra-226 6	0.0650	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
sheephead	Ru-103 6	0.0040	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
sheephead	Ru-106 6	0.0280	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
sheephead	Th-228 6	0.0040	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
sheephead	Zn-65 6	0.0070	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 12A Quarterly Non-Migratory Marine Animals Analysis (pCi/g) (flesh type)								
spiny lobster	Fe-59	6	0.0090	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
spiny lobster	I-131	6	0.0150	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
spiny lobster	K-40	6	0.0400	4.1900(4/ 4) (4.030- 4.500)	Unit 1 Outfall 0.9 mi. WSW	4.2650(2/ 2) (4.030- 4.500)	4.0600(2/ 2) (3.920- 4.200)	0
spiny lobster	Mn-54	6	0.0030	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
spiny lobster	Mo(Tc)-99m	6	2.6620	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
spiny lobster	Ra-226	6	0.0650	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0
spiny lobster	Ru-103	6	0.0040	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 2)	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
SAN ONOFRE NUCLEAR GENERATING STATION

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San Diego County, California

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Table 13A
Semi-Annual Local Crops
Gamma Spectral Analysis (pCi/g)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean: Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
All Species*	Ag-110m	8**	0.0010	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	0
All Species	Be-7	8	0.0110	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	0
All Species	Ce-141	8	0.0020	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	0
All Species	Co-58	8	0.0010	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	0
All Species	Co-60	8	0.0020	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 4)	0
All Species	Cs-134	8	0.0010	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 4)	0
All Species	Cs-137	8	0.0010	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 4)	0
All Species	I-131	8	0.0090	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 4)	0
All Species	K-40	8	0.0120	1.6750(4/ 4) (1.460- 1.790)	SE of Oceanside 22.0 mi. SE	2.8600(4/ 4) (2.500- 3.230)	2.8600 (4/ 4) (2.500- 3.230)	0
All Species	Ru-103	8	0.0010	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 4)	0
All Species	Zr(Nb)-95	8	0.0010	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 4)	0

* Indicator: cucumber, strawberries, and tomatoes Control: brussel sprout, string beans, yellow squash, and zucchini

** Eight is the total number of analysis for all species, not individual species.

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonroutine Reported Measurements
Table 14 Annual Soil Analysis - Depth: 3" (pCi/g)								
	Ag-110m	5	0.0050	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	Be-7	5	0.0610	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	Ce-141	5	0.0100	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	Ce-144	5	0.0250	0.3000(1/ 4) (0.300- 0.300)	E. Site Boundary 0.2 mi. NNW	0.3000(1/ 1) (0.300- 0.300)	<LLD (0/ 1)	
	Co-58	5	0.0080	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	Co-60	5	0.0080	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	Cs-134	5	0.0070	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	Cs-137	5	0.0060	0.3430(2/ 4) (0.296- 0.390)	Camp San Onofre Camp Pen. 2.5 mi. NE	0.3900(1/ 1) (0.390- 0.390)	<LLD (0/ 1)	
	I-131	5	0.0170	<LLD (0/ 4)	ALL <LLD	-----	<LLD (0/ 1)	
	K-40	5	0.0670	13.975(4/ 4) (7.100-19.000)	Huntington Beach Generating Station 37 mi. NW	19.100(1/ 1) (19.100-19.100)	19.100(1/ 1) (19.100-19.100)	

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Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Annual Mean Name, Distance and Direction	Location with Highest Annual Mean Mean Range	Control Locations Mean Range	Number of Nonrout Reported Measurem
Table 15 Semi-Annual Kelp Analysis (pCi/g)							
macrocystis p.	Ag-110m 8	0.0060	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Ce-141 8	0.0100	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Ce-144 8	0.0250	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Co-57 8	0.0030	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Co-58 8	0.0090	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Co-60 8	0.0100	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Cs-134 8	0.0080	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	
macrocystis p.	Cs-137 8	0.0060	0.0040(1/ 6) (0.004- 0.004)	Barn Kelp Bed 6.3 mi. SSE	0.0040(1/ 2) (0.004- 0.004)	0.0030(1/ 2) (0.003- 0.003)	
macrocystis p.	Fe-59 8	0.0180	<LLD (0/ 6)	ALL <LLD	-----	<LLD (0/ 2)	

APPENDIX C

SUMMARY OF 1994 INTERLABORATORY COMPARISON AND QUALITY CONTROL PROGRAMS

Table C-1
Results of 1994 Interlaboratory Cross-Check Program

Between Environmental Protection Agency (EPA) and Our Contractor
Environmental Analysis Laboratory (CEAL)

1994 Date	Sample Type	Analysis Type	Mean CEAL + s.d.	Known EPA + s.d.	Control Limit	R +SR
JUN	Water (pCi/l)	Co-60	42.33 ± 3.21	50.0 ± 5.0	41.3 - 58.7	0.709
JUN	Water (pCi/l)	Zn-65	131.00 ± 3.61	134.0 ± 13.0	111.4 - 156.6	0.318
JUN	Water (pCi/l)	Ru-106	187.33 ± 14.01	252.0 ± 25.0	208.6 - 295.4*	0.638
JUN	Water (pCi/l)	Cs-134	36.67 ± 0.58	40.0 ± 5.0	31.3 - 48.7	0.118
JUN	Water (pCi/l)	Cs-137	51.00 ± 1.73	49.0 ± 5.0	40.3 - 57.7	0.354
JUN	Water (pCi/l)	Ba-133	84.33 ± 3.21	98.0 ± 10.0	80.7- 115.3	0.354
NOV	Water (pCi/l)	Co-60	41.33 ± 2.52	59.0 ± 5.0	50.3 - 67.7*	0.0591
NOV	Water (pCi/l)	Zn-65	117.67 ± 9.71	100.0 ± 10.0	82.7 - 117.3*	1.233
NOV	Water (pCi/l)	Ru-106	D	D	D	D
NOV	Water (pCi/l)	Cs-134	31.33 ± 4.51	24.0 ± 5.0	15.3 - 32.7	1.120
NOV	Water (pCi/l)	Cs-137	48.00 ± 2.65	49.0 ± 5.0	40.3 - 57.7	0.591
NOV	Water (pCi/l)	Ba-133	68.67 ± 3.79	73.0 ± 7.0	60.9 - 85.0	0.591
FEB	Water (pCi/l)	I-131	133.3 ± 3.21	119.0 ± 12.0	98.2 - 139.8	0.295
OCT	Water (pCi/l)	I-131	84.0 ± 1.00	79.0 ± 8.0	65.1 - 92.9	0.148
JAN	Water (pCi/l)	Gross α	14.0 ± 1.73	15.0 ± 5.0	6.3 - 23.7	0.354

Table C-1
Results of 1994 Interlaboratory Cross-Check Program

Between Environmental Protection Agency (EPA) and Our Contractor
Environmental Analysis Laboratory (CEAL)

1994 Date	Sample Type	Analysis Type	Mean CEAL + s.d.	Known EPA + s.d.	Control Limit	R +SR
AUG	Water (pCi/l)	Pu-239	D	D	D	D
JAN	Water (pCi/l)	Sr-90	ND	25.0 ± 5.0	16.3 - 33.7	ND
JUL	Water (pCi/l)	Sr-90	19.67 ± 1.15	20.0 ± 5.0	11.3 - 28.7	0.236
SEP	Water (pCi/l)	Sr-90	D	D	D	D
FEB	Water (pCi/l)	U-238	9.67 ± 0.15	10.1 ± 3.0	4.9 - 15.3	0.059
JUN	Water (pCi/l)	U-238	52.43 ± 0.99	52.6 ± 5.3	43.4 - 61.8	0.201
SEP	Water (pCi/l)	U-238	36.27 ± 1.43	35.0 ± 3.0	29.8 - 40.2	0.551
APR	Water (pCi/l)	Gross α	97.0 ± 3.46	86.0 ± 22.0	47.8 - 124.2	0.161
APR	Water (pCi/l)	Ra-226	15.8 ± 1.15	20.0 ± 3.0	14.8 - 25.2	0.453
APR	Water (pCi/l)	Ra-228	20.5 ± 0.30	20.1 ± 5.0	11.4 - 28.8	0.071
APR	Water (pCi/l)	U-(nat)	26.17 ± 0.95	25.0 ± 3.0	19.8 - 30.2	0.374
APR	Water (pCi/l)	Gross ß	ND	117.0 ± 18.0	85.8 - 148.2	ND
APR	Water (pCi/l)	Sr-89	19.0 ± 1.0	20.0 ± 5.0	113.0 - 28.7	0.236
APR	Water (pCi/l)	Sr-90	14.0 ± 0.0	14.0 ± 5.0	5.3 - 22.7	0.000
APR	Water (pCi/l)	Co-60	19.0 ± 1.00	20.0 ± 5.0	11.3 - 28.7	0.236

Table C-1
Results of 1994 Interlaboratory Cross-Check Program

Between Environmental Protection Agency (EPA) and Our Contractor
Environmental Analysis Laboratory (CEAL)

1994 Date	Sample Type	Analysis Type	Mean CEAL + s.d.	Known EPA + s.d.	Control Limit	R +SR
MAR	Air Filter (pCi/filter)	Gross α	D	D	D	D
AUG	Air Filter (pCi/filter)	Gross α	34.00 ± 4.36	35.0 ± 9.0	19.44 - 50.6	0.525
MAR	Air Filter (pCi/filter)	Gross ß	D	D	D	D
AUG	Air Filter (pCi/filter)	Gross ß	53.00 ± 3.46	5.6 ± 10.0	38.7 - 73.3	0.354
MAR	Air Filter (pCi/filter)	Sr-90	D	D	D	D
AUG	Air Filter (pCi/filter)	Sr-90	19.67 ± 1.53	20.0 ± 5.0	11.3 - 28.7	0.354
MAR	Air Filter (pCi/filter)	Cs-137	D	D	D	D
AUG	Air Filter (pCi/filter)	Cs-137	16.67 ± 0.58	15.0 ± 5.0	6.3 - 23.7	0.118

Results of 1994 Interlaboratory Cross-Check Program

Between Environmental Protection Agency (EPA) and our Contractor
Environmental Analysis Laboratory (CEAL)

The results of the interlaboratory cross-check program showed that 7.1% of the samples fell outside of the control limits range, which is within the (15-20%) the acceptance criterion. The errors were randomly distributed among all of the different samples and different analyses. The values indicated by asterisks were outside of the control limits established by the EPA and corrective actions were taken to eliminate the problems. No food samples were provided by EPA in 1994.

It should be noted that milk is not a pathway at SONGS and, therefore, the laboratory is not committed to performing milk analysis.

Corrective actions were taken for the analyses outside the EPA control limits to prevent recurrence.

***** **Data falling outside of the control limits.**
ND **EPA provided the samples but no data was provided by the contracted laboratory.**
D **Deleted from the EPA cross-check program.**

APPENDIX D

ENVIRONMENTAL DOSE CALCULATIONS AND CORRELATION
OF EFFLUENT RELEASES WITH ENVIRONMENTAL CONCENTRATIONS
FOR 1994

DOSE CALCULATIONS:

Results of ingestion dose calculations have been listed in Table D-1. Data show that the ingestion dose due to consumption of marine species is a very small fraction of the maximum permissible dose, and in most cases the dose is too low (i.e., zero) to be considered significant. The dose values in the table have been calculated by using the USNRC Regulatory Guide 1.109 parameters. The fish consumption rates of 6.9, 16, and 21 kg/year for child, teen, and adult have been taken from Table E-5 of the Guide. Ingestion dose factors for radionuclides of interest in mrem per picocurie ingested were obtained from Tables E-11 through E-13 of the Regulatory Guide 1.109. For kelp an estimated value of 20 kg/year was used in the calculations.

Table D-2 summarizes the dose calculated based on maximum environmental concentration detected in the samples. This table also compares the environmental doses to the regulatory limits.

Liquid Effluent:

Table D-3 compares measured environmental concentrations with the projected concentrations based on 1994 effluent releases. To calculate the concentrations of radionuclides in different media, Regulatory Guide 1.109 methodology was used. For fish, Equation A-3 of the Guide was used assuming no dilution factor (mixing ratio of 1.0) For shoreline sediments, Equation A-4 of the Guide was used to calculate the projected concentration corresponding to 1994 liquid effluents releases. For kelp, concentrations of radionuclides were calculated using parameters used for marine species.

Gaseous Effluents:

Radionuclides concentrations were estimated using deposition factors used at the sampling locations distances for local crops, surface density of vegetation using NRC values for dry vegetation density as listed in the NRC Radiological Assessment text book, Table 5.2 and 1994 curies released at San Onofre. A comparison was made of the TLD doses measured at the vicinity of San Onofre, to calculated ones, using R_i (dose parameters) for the gaseous effluents for those locations where environmental TLDs existed. The dose calculated from R_i is basically the ground dose due to deposition of plant-related radionuclides while the environmental TLD doses are a combination of natural radioactivity in the soil, contribution of cosmic rays and radionuclides of the gaseous effluent released by the plant. Therefore, a comparison of such doses is not valid due to these other contributing factors. Most of the ground doses are zero while the background is subtracted and correction for cosmic contribution is made indicating that the plant effects are negligible. That same comparison can be made for gross beta measured in air versus the actual predicted concentration based on 1994 releases and X/Q (dispersion factor) but the results are not valid due to naturally-occurring radionuclide contributions to the gross beta radioactivity.

TABLE D-2

SUMMARY OF ANNUAL ENVIRONMENTAL DOSES AND COMPARISON WITH REGULATORY LIMITS FOR 1994

MEDIA	MAX CONC DETECTED	NRC RL	% OF NRC	CAL DOSE (mrem/year)	DOSE LIMIT	% DOSE LIMIT	COMMENTS
TLD (Direct Radiation)	--	--	--	0.43 (direct exposure)	25 mrem 40CFR190	1.72	This is normalized for an occupancy factor of 300 hours at the San Onofre State Beach (0.2 miles WSW).
AIR PARTICULATES	All gaseous effluent radionuclides	--	--	2.06E-02 (Inhalation)	15 mrem 10CFR50, Appendix I	0.14	San Onofre Mobile Home Park is the critical receptor (1.3 miles NW).
OCEAN WATER	H-3 = <LLD	3E+6 pCi/l	0.0045	--	---	---	Tritium Conc. <LLD.
DRINKING WATER	H-3 = <LLD	2E+4 pCi/l	0.0	--	3 mrem whole body 10 mrem critical organ	0.0 0.0	This is tritium ingestion dose with child being the limiting age group. (No pathway at SONGS)
SHORELINE SEDIMENT	Cs-137 = 0.04 pCi/g	--	--	<0.001 (shoreline exposure)	15 mrem 10CFR50, Appendix I	0.001	This is exposure dose from Cs-137 with teen being the --- age group.
LOCAL CROPS	Sr-90 = 0.0006 pCi/g	--	--	1.70 (ingestion)	15 mrem 10CFR50, Appendix I critical organ	11	This is the dose from Sr-90 ingestion based on a given crop consumption rate per year for the teen age group.
SOIL (GROUND PLANE)	All gaseous effluent radionuclides	--	--	4.24E-04 (ground exposure)	15 mrem 10CFR50, Appendix I	0.003	This is ground dose from all radionuclides in the gaseous effluents for the critical receptor (San Onofre Mobile Homes Park (1.3 miles, NW).
KELP	Cs-137 = 0.004 pCi/g	--	--	0.02 (ingestion)	15 mrem 10CFR50, Appendix I	0.13	This is the dose from Cs-137 ingestion of kelp to an the adult's critical organ.

APPENDIX E

HISTORICAL TRENDING OF DATA
(1985-1994)

To assess the changes or trends in the radioactivity level in the environment over the past ten years, the data from January 1985 to December 1994 were evaluated (Table E-1). Historical data prior to 1985 can be retrieved from the 1993 REMP report.

A. DIRECT RADIATION

To determine any changes in the environmental radiation levels, several years of data were plotted and indicator locations were compared against the control stations. As it is shown in Figures 2A-4B, the environmental radiation levels have been reduced due to curtailment of nuclear weapons testing. No trend of any unusual radioactivity was detected in the environment of SONGS.

B. AIRBORNE PARTICULATES

Weekly air samples were collected from a number of indicator locations, and from a control location situated in Huntington Beach. The samples were subsequently analyzed for gross beta activity.

To determine whether or not there are any trends toward increasing gross beta activities with time, calculated average quarterly gross beta activities from each indicator location were compared to equivalent data from the Former Huntington Beach control location (Figures 13A, 13B & 14). Over the past several years, the average quarterly gross beta activities measured in San Clemente have been consistently below the levels measured in samples from Huntington Beach. Average quarterly gross beta activities measured at the other indicator locations, however, have fluctuated unpredictably, and have often been below the levels measured in samples from Huntington Beach.

A review of the data indicates that there are no trends toward increasing levels of gross beta activity in the air near SONGS, and that the operations of SONGS have had a negligible detectable impact on this environmental medium.

A review of the quarterly composite gamma spectral analysis results showed that Co-60, Cs-134, Cs-137, and Ru-103 were detected in a few samples as indicated in Table E-1. Naturally-occurring K-40 was also detected in three samples.

Gross alpha radioactivity was detected in 116 quarterly-composite indicator and 15 control samples but Sr-90 concentration was below the lower limit of detection of 0.003 pCi/m^3.

There is no indication that any station-related radionuclides are accumulating in the environment since they have been below detection limits most of the time in the recent years.

G. OCEAN BOTTOM SEDIMENTS

To determine whether or not radionuclides are accumulating in ocean bottom sediments near SONGS, representative samples are collected near each of the SONGS discharge outfalls (which serve as indicator locations), and from the Laguna Beach (which serves as the control location). After collection, the samples are analyzed for a total of 19 naturally-occurring and station-related radionuclides. Radionuclides detected in ocean bottom sediments over the past ten years near SONGS are presented in Table E-1 in terms of "as received" wet sample weights and are plotted against the control (Figures 6 & 7).

Plant-related radionuclides detected during the period 1985 to 1994 in ocean bottom sediments near SONGS outfalls include: Mn-54, Co-60, Mo(Tc)-99m, I-131, Cs-137, and Ce-141. The concentrations of the plant-specific radionuclides in most of the samples were below the lower limits of detection during the period of investigation. Naturally-occurring K-40, Ra-226 and Th-228 were also detected in all the eighty samples analyzed for the period.

Cobalt-60 was detected in several indicator samples near Units 1 and 2/3 outfalls during the periods of 1985 to 1994. The maximum concentration of cobalt-60 in the samples was 0.09 pCi/g at San Onofre Unit 1 East (location A). One sample collected at the control location had a detectable level of Co-60 at a concentration of 0.09 pCi/g, wet.

Cesium-137 was detected in several indicator samples collected between 1985 and 1994. The maximum Cs-137 concentration was 0.083 pCi/g in a Unit 1 outfall sample. Cesium-137 level was below the LLD of 0.006 pCi/g, in the rest of the samples. Cesium-137 was also detected in three of the twenty control samples with a maximum concentration of 0.04 pCi/g.

Station-related radionuclides were detected in some samples near SONGS at concentrations above those detected at the control location situated in Laguna Beach (Figures 6, 7A and 7B). However, the concentrations of each of these radionuclides in ocean bottom sediments have been diminishing steadily over the past several years. The reduction in detectable activity is attributable, at least in part, to Edison's commitment to reduce radioactive liquid effluent releases from SONGS.

Canyon (San Clemente Ranch), which serves as the indicator location, and a location situated SSE of Oceanside. Upon collection, the samples were analyzed for 12 naturally-occurring, and station-related gamma-emitting radionuclides, and for Sr-90.

Strontium-90 was detected in several crop samples collected from the indicator and control locations over the period of time and its concentration in the indicator samples ranged from below the lower limit of detection of 0.0005 to 0.002 pCi/g wet. Strontium-90 was detected in several samples collected from the control location (SSE of Oceanside). The maximum concentration of strontium-90 in the kale samples collected from SSE of Oceanside was 0.011 pCi/g, wet weight. Interestingly, Sr-90 has been detected more frequently in the crop samples of the control than in indicator samples.

J. SOIL

Surface Soil samples, although not a requirement of the ODCM, are collected at a 3-inch depth annually from Basilone Road, the East Site Boundary, Camp San Onofre, Old Highway 101 (which served as indicator locations), and from Huntington Beach (which served as the control location).

Over the past ten years, minute amounts of naturally-occurring and station-related radionuclides have been detected in soil samples collected near San Onofre and in the Huntington Beach control. There were detectable differences in the amounts of naturally-occurring K-40 seen in samples collected from each of the locations. The difference in the levels, however, is considered indicative of this particular environment. Strontium-90 and Cs-137 were also detected in samples from both the indicator and control locations at different frequencies, in a narrow concentration range. Although detectable, there is no indication that either Sr-90 or Cs-137 is accumulating in the soil near San Onofre (Figure 16A & 16B). Because Sr-90 and Cs-137 are detected in control locations, and Co-60 is not detected at any location, we concluded that the Sr-90 and Cs-137 are likely due to fallout from weapons testing.

K. KELP

Harvestable kelp is collected semi-annually from the San Onofre Kelp Bed, the San Mateo Kelp Bed, the Barn Kelp Bed (occasionally), and from a kelp bed (control) situated in Laguna Beach. Because of its atrophied condition, kelp is not collected from the Barn Kelp Bed near SONGS regularly. Once collected, the kelp is analyzed for 19 naturally-occurring and station-related gamma-emitting

TABLE E-1

STATISTICAL SUMMARY OF RADIOLOGICAL ENVIRONMENTAL MONITORING

DATA FOR 1985-1994

Reporting period: January 1, 1985 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Mean Range	Control Locations Mean Range	Number o Nonrouti Reportec Measurem
A. DIRECT RADIATION (mrem):							
Gamma Exposure	2,720	5.0000	18.440(2E3/3E3) (12.100-39.500)	San Onofre State Beach (Unit 1) 0.2 mi. WSW	22.400(40/ 40) (19.000-26.700)	18.471(78/ 80) (14.300-22.600)	
B. AIRBORNE PARTICULATES (pCi/m3):							
Weekly Gross Beta	5,230	0.0011	0.0217(4E3/5E3) (0.001- 0.890)	Units 2/3 Switchyard 0.13 mi. NNE	0.0290(401/523) (0.006- 0.890)	0.0210(520/523) (0.004- 0.720)	
Quarterly-Composite Gross Alpha	315	0.0003	0.0049(116/281) (0.002- 0.012)	Units 2/3 Switchyard 0.13 mi. NNE	0.0057(11/ 26) (0.002- 0.010)	0.0046(15/ 34) (0.002- 0.011)	
Quarterly-Composite Strontium-90	314	0.0030	<LLD (0/280)	ALL <LLD	-----	<LLD (0/ 34)	
QUARTERLY-COMPOSITE GAMMA SPECTRAL ANALYSIS:							
Ag-110m	371	0.0004	<LLD (0/331)	ALL<LLD	-----	<LLD (0/ 40)	
Ce-141	371	0.0008	<LLD (0/331)	ALL<LLD	-----	<LLD (0/ 40)	
Ce-144	371	0.0019	<LLD (0/331)	ALL<LLD	-----	<LLD (0/ 40)	
Co-58	371	0.0007	<LLD (0/331)	ALL<LLD	-----	<LLD (0/ 40)	

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean: Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonrout[ine] Reporte[d] Measure[ments]
D. OCEAN WATER							
MONTHLY GAMMA SPECTRAL ANALYSIS (pCi/l):							
Ag-110m	478	10.000	<LLD (0/358)	ALL <LLD	-----	<LLD (0/120)	
Ba(La)-140	478	10.000	<LLD (0/358)	ALL <LLD	-----	<LLD (0/120)	
Ce-141	478	15.000	<LLD (0/358)	ALL <LLD	-----	<LLD (0/120)	
Ce-144	478	20.000	<LLD (0/358)	ALL <LLD	-----	<LLD (0/120)	
Co-57	478	6.0000	<LLD (0/358)	ALL <LLD	-----	<LLD (0/120)	
Co-58	478	6.0000	<LLD (0/358)	ALL<LLD	-----	<LLD (0/120)	
Co-60	478	6.0000	<LLD (0/358)	ALL<LLD	-----	<LLD (0/120)	
Cs-134	478	6.0000	<LLD (0/358)	ALL<LLD	-----	<LLD (0/120)	
Cs-137	478	6.0000	<LLD (0/358)	ALL<LLD	-----	<LLD (0/120)	
Fe-59	478	20.000	<LLD (0/358)	ALL<LLD	-----	<LLD (0/120)	

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMAY
SAN ONOFRE NUCLEAR GENERATING STATION

Reporting period: January 1, 1985 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Mean Range	Number of Control Locations Mean Range	Nonrout Reporte Measure
E. MONTHLY DRINKING WATER (pCi/l):								
	Ag-110m	359	3.1280	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Be-7	359	38.903	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Ce-141	359	6.3400	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Ce-144	359	15.649	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Co-58	359	5.1110	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Co-60	359	5.3530	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Cs-134	359	4.6020	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Cs-137	359	3.6880	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Fe-59	359	9.4770	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	H-3	359	102.00	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	I-131	359	0.4910	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	K-40	359	42.201	69.500 (2/239) (59.00- 80.00)	Municipal Tri-Cities 8.7 mi. NW	69.500 (2/120) (59.00- 80.00)	59.000(1/120) (59.000-59.000)	
	Mn-54	359	3.7040	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Ru-103	359	4.7210	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
	Zn-65	359	7.7300	<LLD (0/239)	ALL <LLD	-----	<LLD (0/120)	
QUARTERLY-COMPOSITE DRINKING WATER SOLIDS								
	Gross Alpha	120	0.2110	0.7500(10/ 80) (0.200- 1.400)	Municipal Tri-Cities 8.7 mi. NW	0.7500(10/ 40) (0.200- 1.400)	0.2000(2/ 40) (0.200- 0.200)	
	Gross Beta	120	0.7380	2.1516(19/ 80) (0.200- 10.100)	Municipal Tri-Cities 8.7 mi. NW	2.9446(13/ 40) (0.180-10.100)	0.4526(19/ 40) (0.200- 1.400)	

Reporting period: January 1, 1985 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number Nonroutine Reported Measurements
F. SHORELINE SEDIMENTS (Continued):							
	I-131 80	0.0690	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	
	K-40 80	0.0740	12.471(59/ 60) (7.700-18.900)	Laguna Beach (North End) 30 mi. NW	15.690(20/ 20) (12.400-19.000)	15.690(20/ 20) (12.400-19.000)	
	Mn-54 80	0.0070	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	
	Mo(Tc)-99m 80	5.5350	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	
	Ra-226 80	0.0130	0.3041(59/ 60) (0.120- 0.900)	Laguna Beach (North End) 30 mi. NW	0.4985(20/ 20) (0.180- 1.470)	0.4985(20/ 20) (0.180- 1.470)	
	Ru-103 80	0.0080	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	
	Ru-106 80	0.0550	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	
	Th-228 80	0.0090	0.3783(59/ 60) (0.120- 1.300)	Laguna Beach (North End) 30 mi. NW	1.2510(20/ 20) (0.120- 4.600)	1.2510(20/ 20) (0.120- 4.600)	
	Zn-65 80	0.0140	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	
	Zr(Nb)-95 80	0.0140	<LLD (0/ 60)	ALL <LLD	-----	<LLD (0/ 20)	

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number of Nonrout Reporte Measure
G. OCEAN BOTTOM SEDIMENTS (Continued):								
	I-131	100	0.0170	0.0100(1/ 80) (0.010- 0.010)	Unit 2 Outfall 1.6 mi. SW	0.0100(1/ 20) (0.010- 0.010)	<LLD (0/ 20)	
	K-40	100	0.0660	10.795(80/ 80) (4.800-18.100)	Unit 2 Outfall 1.6 mi. SW	11.290(20/ 20) (4.800-15.200)	10.775(20/ 20) (3.500-16.000)	
	Mn-54	100	0.0060	0.0097(3/ 80) (0.005- 0.014)	Unit 1 Outfall 0.8 mi. SSW	0.0120(2/ 20) (0.010- 0.014)	<LLD (0/ 20)	
	Mo(Tc)-99m	100	4.9010	0.0100(1/ 80) (0.010- 0.010)	Unit 1 Outfall 0.8 mi. SSW	0.0100(1/ 20) (0.010- 0.010)	<LLD (0/ 20)	
	Ra-226	100	0.0120	0.4304(80/ 80) (0.090- 1.220)	Unit 1 Outfall 0.8 mi. SSW	0.5340(20/ 20) (0.220- 1.220)	0.3120(20/ 20) (0.090- 1.320)	
	Ru-103	100	0.0070	<LLD (0/ 80)	ALL <LLD	-----	<LLD (0/ 20)	
	Ru-106	100	0.0480	<LLD (0/ 80)	ALL <LLD	-----	<LLD (0/ 20)	
	Th-228	100	0.0080	0.5615(80/ 80) (0.080- 1.690)	Unit 1 Outfall 0.6 mi. W	0.7080(20/ 20) (0.130- 1.160)	0.4670(20/ 20) (0.100- 1.450)	
	Zn-65	100	0.0120	<LLD (0/ 80)	ALL <LLD	-----	<LLD (0/ 20)	
	Zr(Nb)-95	100	0.0120	<LLD (0/ 80)	ALL <LLD	-----	<LLD (0/ 20)	

Reporting period: January 1, 1985 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses 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 o Nonrouti Reported Measurem
H. MARINE SPECIES (Continued):								
All Species	K-40	430	0.0400	2.3490(285/285) (0.6700-4.5000)	Units 2/3 Outfall 1.5 mi. SSW		2.3000(145/145) (0.6400-4.5000)	
All Species	Mn-54	430	0.0030	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Mo(Tc)-99m	430	2.6620	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Ra-226	430	0.0650	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Ru-103	430	0.0040	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Ru-106	430	0.0280	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Sr-90	430	0.0200	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Th-228	430	0.0040	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Zn-65	430	0.0070	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	
All Species	Zr(Nb)-95	430	0.0070	<LLD (0/285)	ALL <LLD	-----	<LLD (0/145)	

Species: Bay Mussel, Black Perch, Keyhole Limpet, Sea hare, Sheephead, Spiny Lobster

Docket Nos. 50-206, 50-361, 50-362
San Diego County, California

Reporting period: January 1, 1985 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number Nonroutine Reported Measurements
I. LOCAL CROPS (Continued)								
Strontium-90 Activity (pCi/g)								
strawberries	Sr-90	2	0.0005	0.0009(2/ 2) (0.001- 0.001)	San Mateo Canyon 2.6 mi. NW	0.0009(2/ 2) (0.001- 0.001)	<LLD (0/ 0)	
string beans	Sr-90	2	0.0005	<LLD (0/ 0)	SE of Oceanside	0.0300(1/ 2)	0.0300(1/ 2)	
tomato	Sr-90	25	0.0005	0.0003(5/ 10) (0.000- 0.001)	San Mateo Canyon 2.6 mi. NW	0.0003(5/ 10) (0.000- 0.001)	0.0002(3/ 15) (0.000- 0.000)	
yellow squash	Sr-90	1	0.0005	<LLD (0/ 0)	SE of Oceanside 22 mi. SE	0.0006(1/ 1) (0.001- 0.001)	0.0006(1/ 1) (0.001- 0.001)	
zucchini	Sr-90	4	0.0005	<LLD (0/ 0)	SE of Oceanside 22 mi. SE	0.0010(4/ 4) (0.001- 0.001)	0.0010(4/ 4) (0.001- 0.001)	

Reporting period: January 1, 1985 to December 31, 1994

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed		Lower Limit of Detection (LLD)	All Indicator Locations Mean Range	Location with Highest Statistical Mean Name, Distance and Direction	Mean Range	Control Locations Mean Range	Number Nonrou Report Measur
K. KELP GAMMA SPECTRAL ANALYSIS (pCi/g)								
macrocystis p.	Ag-110m	81	0.0060	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	
macrocystis p.	Ce-141	81	0.0100	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	
macrocystis p.	Ce-144	81	0.0250	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	
macrocystis p.	Co-57	81	0.0030	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	
macrocystis p.	Co-58	81	0.0090	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	
macrocystis p.	Co-60	81	0.0100	0.0028(4/ 59) (0.002- 0.004)	San Onofre Kelp Bed 1.5 mi. SSW	0.0039(2/ 22) (0.004- 0.004)	<LLD (0/ 22)	
macrocystis p.	Cs-134	81	0.0080	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	
macrocystis p.	Cs-137	81	0.0060	0.0039(15/ 59) (0.002- 0.006)	Laguna Beach 15.6 mi. NW	0.0046(7/ 22) (0.003- 0.009)	0.0046(7/ 22) (0.003- 0.009)	
macrocystis p.	Fe-59	81	0.0180	<LLD (0/ 59)	ALL <LLD	-----	<LLD (0/ 22)	

APPENDIX F

COMPARISON OF 1994 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 in operation until February 27, 1982. There were 8 refueling outages in this time period. Unit 1 was taken off line from February 27, 1982 to November 27, 1984 to complete NRC backfit modifications related to TMI fire protection and seismic modifications. Unit 1 was in full power operation (90%) since November 27, 1984 with a cycle VIII refueling outage from November 29, 1985 to July 26, 1986, a mid-cycle IX maintenance outage from May 9, 1987 to July 2, 1987, a second mid-cycle IX maintenance outage from February 14, 1988 to August 5, 1988, and cycle IX refueling outage from November 28, 1988 to May 25, 1989. The cycle X refueling outage was initiated on June 30, 1990 and ended March 23, 1991. Unit 1 was permanently shut down on November 30, 1992.

Unit 2 attained initial criticality on July 26, 1982. The six refueling outages were: October 20, 1984 to April 17, 1985, for cycle II; March 15, 1986 to June 12, 1986, for cycle III; August 29, 1987 to December 12, 1987, for cycle IV; September 2, 1989 to December 8, 1989, for cycle V; August 17, 1991 to November 20, 1991 for Cycle VI; June 5, 1993 to August 8, 1993 for Cycle VII. There was no refueling outage for Unit 2 in 1994.

Unit 3 attained initial criticality on August 29, 1983. The six refueling outages were: September 14, 1985 to January 11, 1986, for cycle II; January 3, 1987 to March 12, 1987 for cycle III; April 30, 1988 to August 20, 1988, for cycle IV; April 14, 1990 to July 23, 1990 for cycle V, January 24, 1992 to March 30, 1992 for Cycle VI; October 10, 1993 to December 30, 1993 for Cycle VII. There was no refueling outage for Unit 3 in 1994.

A variety of environmental samples were analyzed and the radioanalytical results (January 1, 1979 to July 31, 1982) were compared with the 1994 operational data obtained for SONGS Units 1, 2 and 3.

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

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

The range of quarterly direct radiation doses was larger at both indicator and control locations during the preoperational period than during the 1994 operational period for SONGS Units 2 and 3.

The larger range of quarterly radiation levels 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 1994 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. Unit 1 achieved initial criticality in 1967 and was in operation until November 1992 when it was shut down permanently. Units 2 and 3 achieved initial criticality in July 1982 and August 1983, respectively.

During the preoperational period of 1964-1967 (Figure 16), 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 1994, the gross beta activity at the indicator locations ranged from 0.002 to 0.045 pCi/m^3, and averaging 0.016 pCi/m^3. The control location gross beta activity ranged from 0.004 to 0.051 pCi/m^3 with an average of 0.017 pCi/m^3 (Figure 18). The decrease in activity levels between 1965 and 1994 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:

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.

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 and 0.56 pCi/m^3 for the indicator location of units 2/3 Switchyard. 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. 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 13B and 14 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 released to the environment, since the operational levels are not significantly different from the preoperational activity levels. A comparison between the control location (Huntington Beach) and the indicator locations did not reveal any significant difference in activity levels. During the preoperational period, gross beta activities measured at the indicator locations ranged from 0.004 to 0.560 pCi/m^3, averaging 0.045 pCi/m^3. The gross beta activities measured at the control location, on the other hand, ranged from 0.005 to 0.290 pCi/m^3, averaging 0.045 pCi/m^3. The average activity in all the indicator locations during operational period of January to December 1994 was found to be 0.016 pCi/m^3, whereas in the Huntington Beach control location it was also found to be 0.017 pCi/m^3. Therefore, it can be concluded that the rise in gross beta activity is not the result of plant operation and is the result of other environmental phenomena. 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. In this case, an average baseline of 0.025 pCi/m^3 was used by extrapolation which has remained fairly constant after 1987 and curtailment of Chernobyl contribution to gross beta activity in the air.

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 0.040 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 0.043 pCi/m^3.

E. **Drinking Water**

SONGS Unit 1:

Solids:

Monthly drinking water solid and filtrate gross alpha and beta activities for the two periods have been compared. The operational levels are much lower than the preoperational levels. The contribution of fallout to gross beta activity during the preoperational period prevents useful and accurate comparison with the preoperational data plotted in Figures 15A and 15B. However, gamma spectral analysis was performed on drinking water, and it did not show the presence of any plant-specific radionuclides in detectable levels.

During the preoperational period, the gross alpha activity of the solids was below the lower limit of detection of 0.21 pCi/l. Gross beta activity ranged from 0.37 to 3.00 pCi/l averaging 1.08 pCi/l for the indicator. The control location activity was below the lower limit of detection of 0.74 pCi/l. In 1994 operational period, the monthly gross alpha and beta activities of solids were below the lower limit of detection in all locations (Table F-1A).

Filtrate:

During the preoperational period, gross alpha was below the lower limit of detection (3.0 pCi/l) and gross beta ranged from 5.2 to 90.0 pCi/l, averaging 28.5 pCi/l. One of the 10 control location samples activities was 32.00 pCi/l. The high activity is attributable to the nuclear weapons testing during the years indicated in the report. The gross alpha activity during the 1994 operational period was below the lower limit of detection for all 12 control samples. The gross beta activity during the 1994 operational period ranged from 5.0 to 13.0 pCi/l, averaging 9.1 pCi/l at the indicator locations. The control location gross beta activity ranged from 4.0 to 18.0, averaging 10.4 pCi/l. The decrease in gross beta activity level in 1994 relative to the preoperational period is due to the curtailment of activity from nuclear weapons testing. The gross beta activity was detected in all indicator and control samples.

SONGS Units 2 and 3:

Solids:

Gross alpha activity during the preoperational period ranged from 0.2 to 0.4 pCi/l during January 1979 to July 1982. The gross beta activity ranged from 0.3 to 2.7 pCi/l in all indicator locations from January 1979 to July 1982. The activity range in Huntington Beach control was 0.6 to 2.2 pCi/l during the same time period. Gross alpha and beta activities were below the lower limits of detection for the operational period. The highest gross beta activity observed during the preoperational time was in September 1980 (2.7 pCi/l) in Tri-Cities Municipal Reservoir and in January 1980 in San Clemente (2.2 pCi/l). The average gross beta activity during the preoperational phase was 1.13 pCi/l for all the indicator locations, where in Huntington Beach control it was 1.05 pCi/l.

TABLE F-1A

DRINKING WATER (pCi/l)
PREOPERATIONAL AND OPERATIONAL DATA*
SONGS UNIT 1

Medium	Period	Analysis Type	Indicator Range	Indicator Average	Control Range	Control Average
Drinking water solids	Pre-op	G. Alpha	<LLD	<LLD	<LLD	<LLD
Drinking water solids	Op	G. Alpha	<LLD	<LLD	<LLD	<LLD
Drinking water solids	Pre-op	G. Beta	0.37-3.00	1.08	<LLD	<LLD
Drinking water solids	Op	G. Beta	<LLD	<LLD	<LLD	<LLD
Drinking water filtrate	Pre-op	G. Alpha	<LLD	<LLD	<LLD	<LLD
Drinking water filtrate	Op	G. Alpha	<LLD	<LLD	<LLD	<LLD
Drinking water filtrate	Pre-op	G. Beta	5.2-90.0	28.5	<LLD-32.0	<LLD
Drinking water filtrate	Op	G. Beta	5.0-13.0	9.1	4.0-18.0	10.4

TABLE F-1B

DRINKING WATER (pCi/l)
PREOPERATIONAL AND OPERATIONAL DATA**
SONGS UNITS 2 AND 3

Medium	Period	Analysis Type	Indicator Range	Indicator Average	Control Range	Control Average
Drinking water solids	Pre-op	G. Alpha	0.20-0.40	0.33	0.30-0.60	0.45
Drinking water solids	Op	G. Alpha	<LLD	<LLD	<LLD	<LLD
Drinking water solids	Pre-op	G. Beta	0.30-2.7	1.13	0.6-2.2	1.05
Drinking water solids	Op	G. Beta	<LLD	<LLD	<LLD	<LLD
Drinking water filtrate	Pre-op	G. Alpha	2.0-5.0	3.71	2.0-6.0	3.0
Drinking water filtrate	Op	G. Alpha	<LLD	<LLD	<LLD	<LLD
Drinking water filtrate	Pre-op	G. Beta	6.0-20.0	12.1	3.7-21.0	7.84
Drinking water filtrate	Op	G. Beta	5.0-13.0	9.1	4.0-18.0	10.4

*** Preoperational period - January 1964 to June 1967**
Operational period - January to December 1994
**** Preoperational period - January 1979 to July 1982**
Operational period - January to December 1994

F. 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 1994 operational data. The only SONGS-related radionuclide detected in shoreline sediment in either time frame was Cs-137 with a range of 0.012 to 0.022 pCi/g, averaging 0.019 in 5 sediment samples (Table F-2A). One control sample Cs-137 activity was 0.032 pCi/g in July 1979. However, three naturally-occurring (non plant-related) radionuclides were detected in shoreline sediments. They include: K-40, Ra-226, and Th-228. Cesium-137 was detected in three indicator and one control samples collected in 1994. Its concentration ranged from 0.008 to 0.060 pCi/g in the indicators and 0.02 pCi/g in one control sample which is insignificant and comparable to the preoperational period. 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 significant concentrations during the preoperational and 1994 operational periods for SONGS Units 2 and 3, the impact of SONGS on this environmental medium is considered to be negligible.

G. 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 F-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.

TABLE F-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

TABLE F-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
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-58	Preop	0.013-1.160	0.199	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Co-60	Preop	0.014-8.100	0.788	<LLD	<LLD
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Mo(Tc)-99m	Preop	<LLD	<LLD	<LLD	<LLD
Mo(Tc)-99m	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	Preop	<LLD-0.020	<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-137	Preop	0.014-0.090	0.039	<LLD-0.043	<LLD
Cs-137	Op	0.010-0.040	0.030	<LLD	<LLD
Ce-144	Preop	0.060-0.260	0.160	<LLD	<LLD
Ce-144	Op	<LLD	<LLD	<LLD	<LLD

*Preop = January 1979 to July 1982
Operational = January to December 1994

TABLE F-3

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

Sheephead Flesh

Radionuclide	Period	Indicator Range	Indicator Average	Control Range	Control Average
Mn-54	Preop	<LLD	<LLD	<LLD	<LLD
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-57	Preop	<LLD	<LLD	<LLD	<LLD
Co-57	Op	<LLD	<LLD	<LLD	<LLD
Co-58	Preop	0.016-0.030	0.023	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Fe-59	Preop	<LLD	<LLD	<LLD	<LLD
Fe-59	Op	<LLD	<LLD	<LLD	<LLD
Co-60	Preop	0.005-0.044	0.017	<LLD	<LLD
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	Preop	<LLD-0.004	<LLD	<LLD	<LLD
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
Cs-134	Preop	<LLD	<LLD	<LLD	<LLD
Cs-134	Op	<LLD	<LLD	<LLD-0.010	<LLD
Cs-137	Preop	0.004-0.018	0.007	0.005-0.012	0.007
Cs-137	Op	0.005-0.010	0.006	<LLD	<LLD
Ru-103	Preop	----	----	----	----
Ru-103	Op	<LLD	<LLD	<LLD	<LLD

Black Perch Flesh

Radionuclide	Period	Indicator Range	Indicator Average	Control Range	Control Average
Mn-54	Preop	<LLD	<LLD	<LLD	<LLD
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-57	Preop	<LLD	<LLD	<LLD	<LLD
Co-57	Op	<LLD	<LLD	<LLD	<LLD
Co-58	Preop	0.009-0.011	0.010	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Fe-59	Preop	<LLD	<LLD	<LLD	<LLD
Fe-59	Op	<LLD	<LLD	<LLD	<LLD
Co-60	Preop	0.004-0.045	0.017	<LLD	<LLD
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	Preop	0.002-0.009	0.006	<LLD	<LLD
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
Cs-134	Preop	<LLD	<LLD	<LLD	<LLD
Cs-134	Op	<LLD	<LLD	<LLD	<LLD
Cs-137	Preop	0.003-0.015	0.008	0.004-0.014	0.009
Cs-137	Op	<LLD-0.005	<LLD	<LLD	<LLD
Ru-103	Preop	<LLD	<LLD	<LLD	<LLD
Ru-103	Op	<LLD	<LLD	<LLD	<LLD

*Preoperational - January 1979 to July 1982
Operational = January to December 1994
LLD = Lower Limits of Detection are listed in Appendix B.

TABLE F-3 (continued)

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

Sea Hare Flesh

Radionuclide	Period	Indicator Range	Indicator Average	Control Range	Control Average
Mn-54	Preop	<LLD	<LLD	<LLD	<LLD
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-57	Preop	0.006-0.017	0.009	<LLD	<LLD
Co-57	Op	<LLD	<LLD	<LLD	<LLD
Co-58	Preop	0.006-12.4	1.233	<LLD	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Fe-59	Preop	<LLD	<LLD	<LLD	<LLD
Fe-59	Op	<LLD	<LLD	<LLD	<LLD
Co-60	Preop	0.016-2.000	0.448	0.003-0.027	0.013
Co-60	Op	<LLD-0.007	<LLD	<LLD	<LLD
Zn-65	Preop	<LLD-0.10	<LLD	<LLD	<LLD
Zn-65	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	Preop	0.018-0.50	0.138	0.020-0.039	0.030
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
Cs-134	Preop	<LLD	<LLD	<LLD	<LLD
Cs-134	Op	<LLD	<LLD	<LLD	<LLD
Cs-137	Preop	<LLD-0.004	<LLD	<LLD-0.005	<LLD
Cs-137	Op	<LLD	<LLD	<LLD	<LLD
Ru-103	Preop	<LLD	<LLD	<LLD	<LLD
Ru-103	Op	<LLD	<LLD	<LLD	<LLD
CE-144	Preop	<LLD	<LLD	<LLD	<LLD
CE-144	Op	<LLD-0.010	<LLD	<LLD	<LLD

Keyhole Limpet (Flesh)

Radionuclide	Period	Indicator Range	Indicator Average	Control Range	Control Average
Mn-54	Preop	<LLD	<LLD	<LLD	<LLD
Mn-54	Op	<LLD	<LLD	<LLD	<LLD
Co-57	Preop	<LLD	<LLD	<LLD	<LLD
Co-57	Op	<LLD	<LLD	<LLD	<LLD
Co-58	Preop	0.007-0.101	0.054	<LLD-0.190	<LLD
Co-58	Op	<LLD	<LLD	<LLD	<LLD
Fe-59	Preop	<LLD	<LLD	<LLD	<LLD
Fe-59	Op	<LLD	<LLD	<LLD	<LLD
Co-60	Preop	0.021-0.040	0.033	<LLD-0.022	0.022
Co-60	Op	<LLD	<LLD	<LLD	<LLD
Ag-110m	Preop	0.033-0.101	0.054	0.005-0.042	0.022
Ag-110m	Op	<LLD	<LLD	<LLD	<LLD
Cs-134	Preop	<LLD	<LLD	<LLD	<LLD
Cs-134	Op	<LLD	<LLD	<LLD	<LLD
Cs-137	Preop	<LLD	<LLD	<LLD-0.005	<LLD
Cs-137	Op	<LLD	<LLD	<LLD	<LLD
Ru-103	Preop	<LLD	<LLD	<LLD	<LLD
Ru-103	Op	<LLD	<LLD	<LLD	<LLD

TABLE F-4A

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

SONGS UNIT 1

Radionuclide	Type**	Period	Indicator Range	Indicator Average	Control Range	Control Average
H-3 Aqueous	All	Preop	<LLD	<LLD	<LLD	<LLD
H-3 Bound	All	Preop	<LLD	<LLD	<LLD	<LLD
Sr-90	All	Preop	0.008-0.030	0.022	<LLD	<LLD
H-3 Aqueous	Deleted					
H-3 Bound	Deleted					
Sr-90	All	Op	<LLD-0.0013	<LLD	<LLD-0.001	<LLD

* Preoperational = January 1964 to June 1967
Operational = January to December 1994

TABLE F-4B

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

SONGS UNITS 2/3

Radionuclide	Type**	Period	Indicator Range	Indicator Average	Control Range	Control Average
H-3 Aqueous	All	Preop	<LLD	<LLD	<LLD	<LLD
H-3 Bound	All	Preop	<LLD	<LLD	<LLD	<LLD
H-3 Aqueous	All	op	<LLD	<LLD	<LLD	<LLD
H-3 Bound	All	op	<LLD	<LLD	<LLD	<LLD
Sr-90	All	Preop	<LLD	<LLD	0.050-0.027	0.056
Sr-90	All	Op	<LLD-0.001	<LLD	0.010-0.030	
0.008						

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

** Cabbage, celery, lettuce, strawberries, and tomato samples were collected during preoperational period. Strawberries, cucumber, tomato, yellow squash, string beans, and zucchini samples were collected during 1994 operational period.

TABLE F-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	<LLD	<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	<LLD	0.296-0.390	0.343	<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-0.30	<LLD	<LLD	<LLD

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

APPENDIX G

DEVIATIONS FROM ODCM SAMPLING REQUIREMENTS

IN 1994

DEVIATIONS FROM SAMPLING REQUIREMENTS

As required by the Unit 1, and Units 2/3 Offsite Dose Calculation Manuals (ODCMs), Section 5.0, deviations from sampling requirements for all radiological environmental sampling locations are listed below:

Part I. TERRESTRIAL SAMPLING

a. **Weekly Air Sampling:**

Air Sampler #1 (City of San Clemente):
No deviations were observed.

Air Sampler #2 (Camp San Onofre):
Lost 1.5 hours of collection due to a suspected local power failure the week ending May 24, 1994. It also lost 0.5 hours of collection time due to a probable power interruption the week ending November 29, 1994.

Air Sampler #3 (Huntington Beach Generating Station):
Lost 109.2 hours of collection time due to loss of power the week ending March 1, 1994. This sampler also lost 85.6 hours for the week ending June 7, 1994. The root cause appeared to be personnel error because the circuit breaker which is located in a lighting panel was inadvertently secured by operators.

Air Sampler #5 (Units 2/3 Switchyard):
No deviations were observed.

Air Sampler #6 (SONGS Met Tower):
Deleted from the REMP.

Air Sampler #7 (AWS Roof):
No deviations were observed.

Air Sampler #9 (State Beach Park):
Lost 105.4 hours of collection time due to electrical power failure of an electrical supply conduit week ending February 8, 1994.

Air Sampler # 10 (Bluff):
Lost 0.8 hours of collection time due to a planned power outage for the week ending November 18, 1994.

Air Sampler #11 (Mesa E.O.F.):
No deviations were observed.

Air Sampler #12 (Former SONGS Evaporation Pond):
No deviations were observed.

Air Sampler #13 (Camp Pendleton, East):
Lost 109 hours of collection time due to a vacuum pump motor failure the week ending September 13, 1994.

b. **Direct Radiation:**

During the first quarter of 1994, TLD #35 and TLD #38 were found missing due to an apparent vandalism and no data was therefore available. As a

Weekly Changeout: Approximately 1 minute x 52 = 52 minutes
Quarterly (P.M.): Approximately 5 minutes x 4 = 20 minutes
Annual Cal.Check: Approximately 10 minutes x 1 = 10 minutes

2. Corrective actions taken. Performance standard criterion of 95%, averaged on an annual basis is applied for the environmental data collection. Applying a 95% performance standard to the collection of air samplers would permit the failure to collect each regulatory-required air sampler two weeks per year. Any air sampler failing to collect the volume required to meet the sensitivity requirement of 0.07 pCi/m^3 twice per year (7000 cubic feet) will receive bi-weekly inspections. Applying the above criteria, the following corrective actions were taken:

   The down time of the air samplers #2, #3, #9, #10, and #13 were caused by power outages which were beyond control. These down times do not require any corrective actions based on the 95% annual performance criterion used. Air samplers #5 and #7 are not required by ODCM Section 5.0, and not considered offsite environmental air samplers because they are located within the Exclusion Area Boundary (EAB) distances of all three units.

3. Environmental TLDs are not collected from ocean-bound sectors due to extreme impracticality of doing so. In addition, information obtained from measuring exposures in the ocean-bound sectors is not of significant value because these sectors are not inhabited by members of the public.

APPENDIX H

LAND USE CENSUS FOR 1994

INTRODUCTION

Purpose Of The Land Use Census

The 1994 Land Use Census (LUC) was conducted using in-house resources. This census is to identify land uses within the five-mile radius of the San Onofre Nuclear Generation Station (SONGS) as required by ODCM Section 5.2.

The overall objective of this census is to identify important radiological pathways to man. This is accomplished by locating and documenting the nearest residences, milk animals, meat animals, gardens of at least 500 square feet producing fleshy or leafy vegetables (Tables H-2 and H-4) and other specified uses such as campgrounds, employment, etc. in each of the 16 meteorological sectors within a five-mile radius of SONGS (Tables H-3 and H-5).

Definition of Uses

Residence is defined as any structure (single family house, apartment, mobile home, barracks or similar type unit), which is occupied by an individual(s) or resident(s) for three months (2,000 hours) or longer in a given year.

Other Specified Use is defined as a location occupied by members of the general population as other than their primary residence. The use is divided into two categories: employment and non-employment related.

Employment use is defined as a location occupied by members of the general population engaged in normal work activities regardless of the length of time spent at the location, or 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, timeshare condominiums, motels, hotels, school, and beaches.

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

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

Fresh, leafy vegetables include examples such as lettuce, cabbage, and spinach. Other vegetables, known as "fleshy" vegetables, were also included in the census. Fleshy vegetables include tomatoes, cucumbers, cauliflower, and sweet corn.

HIGHLIGHTS OF CHANGES FROM THE 1993 CENSUS

The overall objective of this census is to identify radiological pathways to humans. Its methodology is to locate and document 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 16 meteorological sectors (10 landward

TABLE H-1

Summary of Changes from 1993
Land Uses

Description	Sector	Changes from 1993	Distance and Direction
Outage Resident for Units 2/3	(Q)	Trailers removed in 1994 upon completion of the outages	0.7 miles in NW
Highway Patrol Weigh Station (Northbound)	(F)	Annual occupancy increased from 1880 to 2080 hours	1.9 miles in ESE
Highway Patrol Weigh Station (Southbound)	(G)	Annual occupancy increased from 1880 to 2080 hours	2.0 miles in SE
Cotton Point Estates Garden	(P)	Identified a new garden at Cotton Point Estates residential structure	2.8 miles in WNW
Christianitos Road Marine Guard Shack	(R)	Annual occupancy increased from 2100 to 4200 hours	4.0 miles in NNW

TABLE H-2 (Continued)

1994 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	Cotton Point Estates 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 1993 survey**

SCE Form 26-184

TABLE H-3 (Continued)

1994 SONGS Units 2/3
Key to Uses Referenced on
Land Use Map and Text

#	Sector	Use	1994 Distance From SONGS (Miles)	Maximum Reported Person Exposure (Hours/Year)	1993 Distance (Miles)
18	Q	51 Area Beach Lifeguard Tower	1.5	2,000	1.5
19	R	Camp San Mateo Sewage Treatment Plant	3.7	2,000	3.7
20	R	Sea Ridge Estates	4.6	resident year-round	4.6
21	R	Cristianitos Road Marine Guard Shack	4.0	4,200*	4.0
22	A	SCE Land Uses	0.4*	--	0.3
23	A	Gas Station	4.1	2,000	4.1
24	A	Cristianitos Fire Station	4.9	3,600	4.9
25	A	Camp San Mateo Motor Pool	3.6	2,000	3.6
26	B	Northern Impact Control Tower	3.8	410	3.8
27	B	Ammunition Dump	4.6	--	4.6
28	C	Camp San Onofre	2.6	resident (year-round)	2.6
29	E	Camp Horno Truck Co	4.7	vacant	4.7
30	F	Ranger Station	0.9	83	0.9
31A	F	Border Patrol Checkpoint (Northbound of San Diego Fwy)	1.8*	2,500	1.9
31B	F	Highway Patrol Weigh Station (Northbound of San Diego Fwy)	1.8*	2080*	1.9
32	G	Highway Patrol Weigh Station (Southbound of San Diego Fwy)	2.0	2080*	2.0
33	Q	51 Area Beach Campground and Cottages - Southern End	1.1	1,080	1.1
34	Q	San Onofre Mobile Homes	1.3	resident (year-round)	1.3

* Denotes changes from 1993 survey
-- Not applicable

TABLE H-4 (Continued)

1994 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	Cotton Point Estates*	2.6	Cotton Point Estates*
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 1993 survey.**

SCE Form 26-184

TABLE H-5 (Continued)

1994 SONGS Unit 1
Key to Uses Referenced on Land Use Map and Text

#	Sector	Use	1994 Distance From SONGS (Miles)	Maximum Reported Person Exposure (Hours/Year)	1993 Distance (Miles)
18	Q	51 Area Beach Lifeguard Tower	1.3	2,000	1.3
19	A	Camp San Mateo Sewage Treatment Plant	3.5	2,000	3.5
20	R	Sea Ridge Estates	4.4	resident year-round	4.4
21	A	Cristianitos Road Marine Guard Shack	3.9	4,200*	3.9
22	B	SCE Land Uses	0.3	--	0.3
23	A	Gas Station	4.0	2,000	4.0
24	A	Cristianitos Fire Station	4.8	3,600	4.8
25	A	Camp San Mateo Motor Pool	3.5	2,000	3.5
26	B	Northern Impact Control Tower	3.8	410	3.8
27	B	Ammunition Dump	4.6	--	4.6
28	C	Camp San Onofre	2.7	resident (year-round)	2.7
29	E	Camp Horno Truck Co	4.9	vacant	4.9
30	F	Ranger Station	1.1	83	1.1
31A	F	Border Patrol Checkpoint (Northbound of San Diego Fwy)	2.0*	2,500	2.1
31B	F	Highway Patrol Weigh Station (Northbound of San Diego Fwy)	2.0*	2080*	2.1
32	G	Highway Patrol Weigh Station (Southbound of San Diego Fwy)	2.2	2080*	2.2
33	Q	Enlisted Beach Campground and Cottages - Southern End	0.9	1,080	0.9
34	Q	San Onofre Mobile Homes	1.2	resident (year-round)	1.2

* Denotes change from 1993 survey
-- Not applicable
Table 8 (SONGS Unit 1) numbering is consistent with numbering on Table 4 (SONGS Units 2/3) but because of sector shift, distances change and will not be the same as Units 2/3 distances.

APPENDIX I

FIGURES FOR 1994

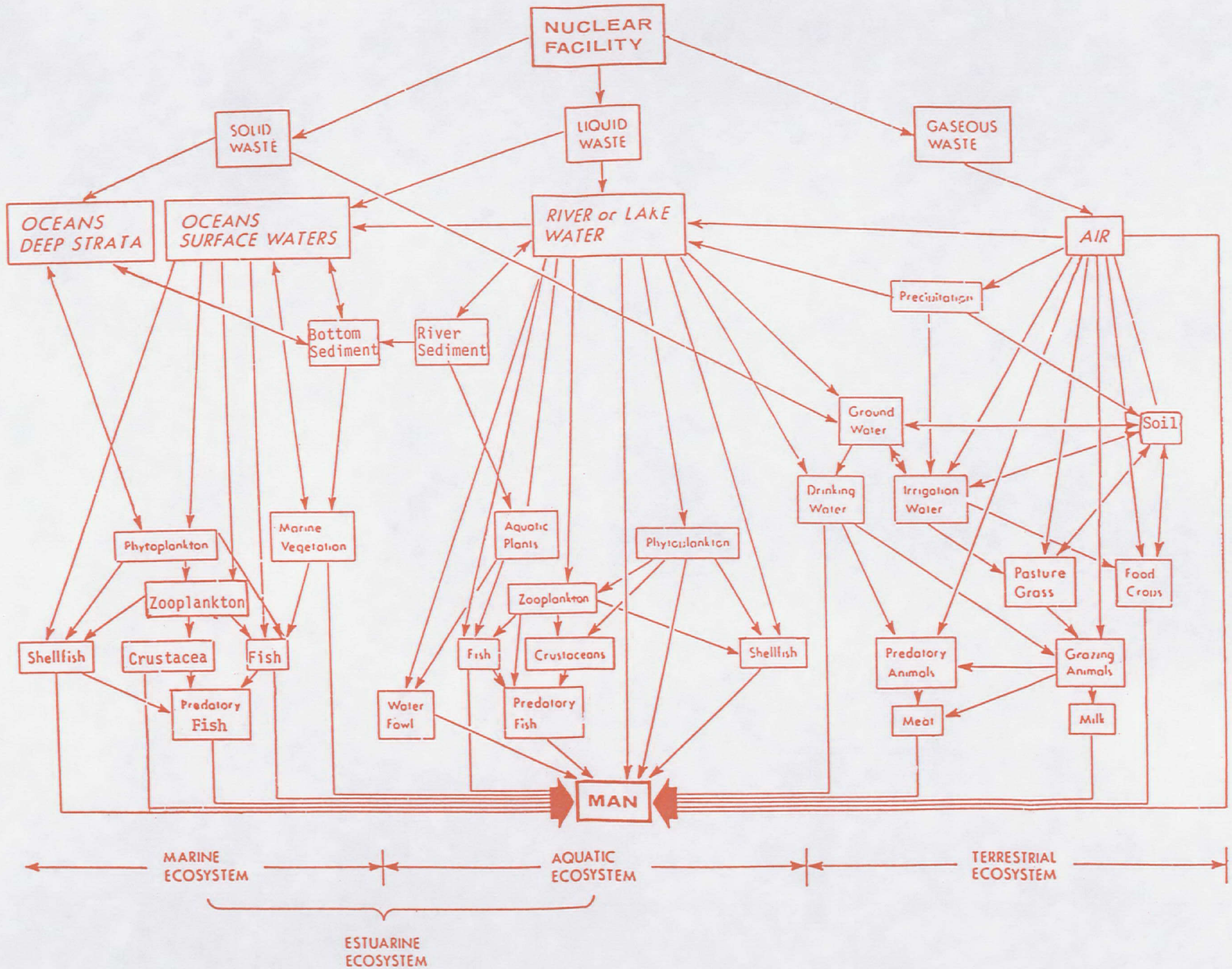


Figure 1. Potential Radiation Exposure Pathways Leading to Man

Direct Radiation Monitoring

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

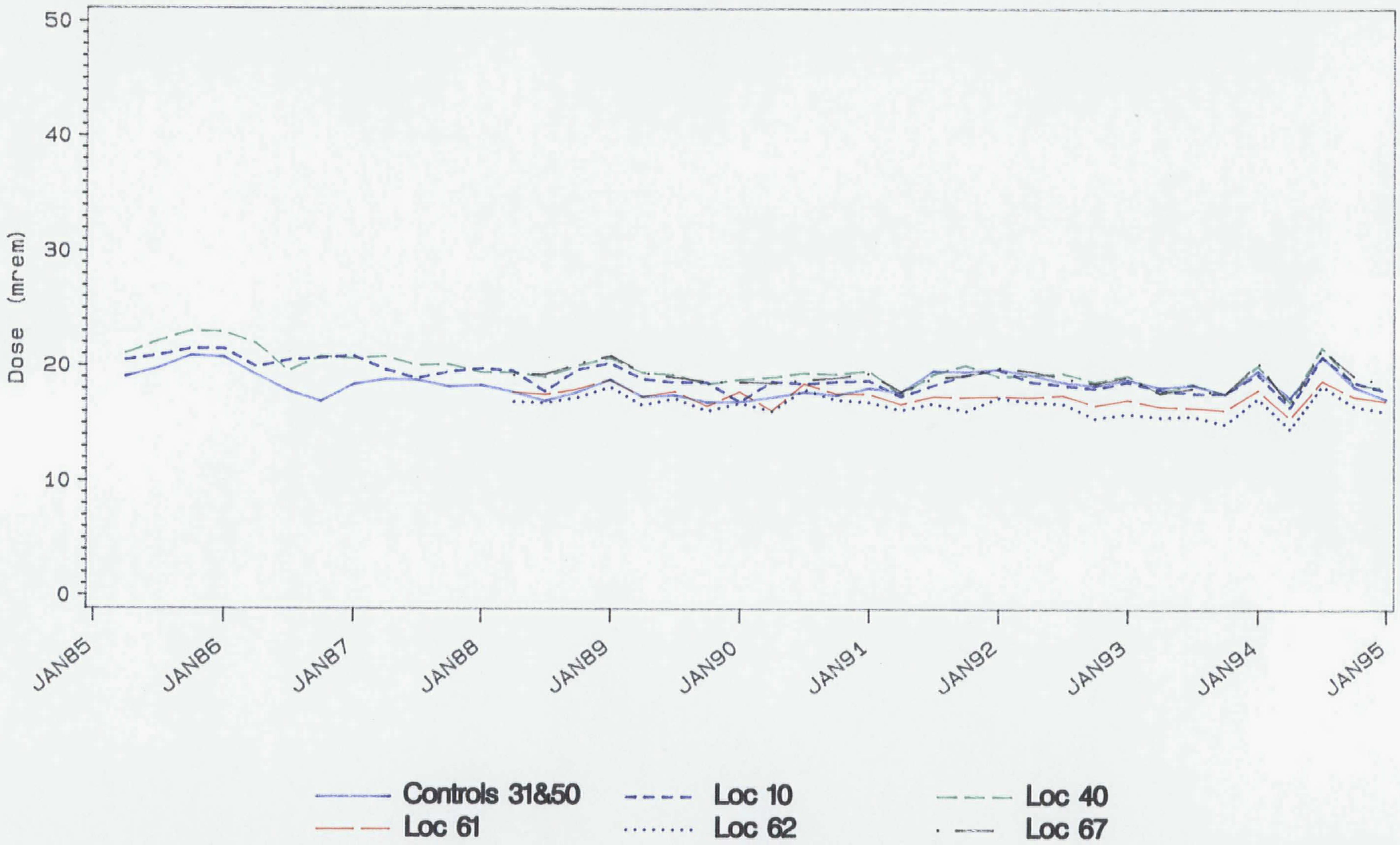


FIGURE 2A

Direct Radiation Monitoring

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

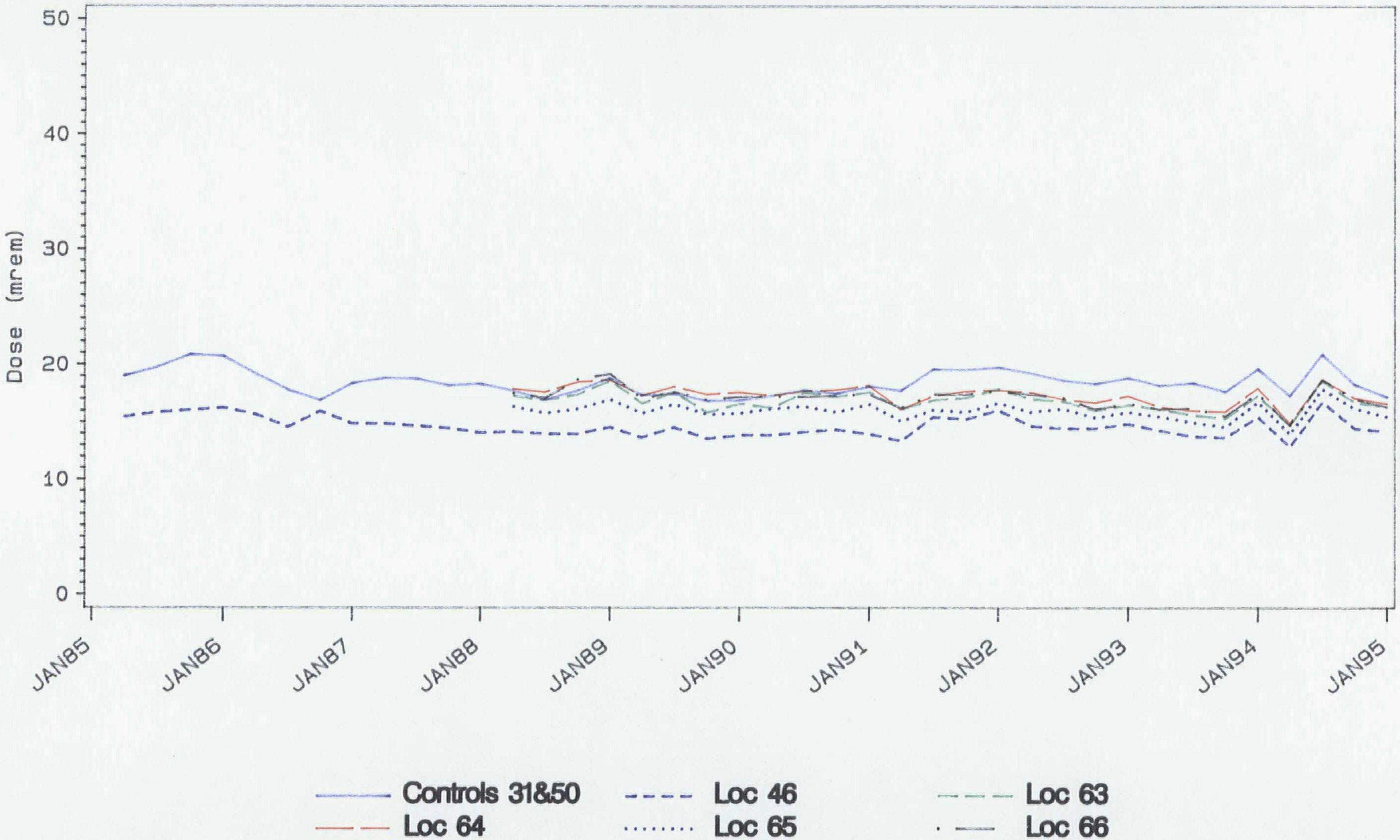


FIGURE 2B

Direct Radiation Monitoring

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

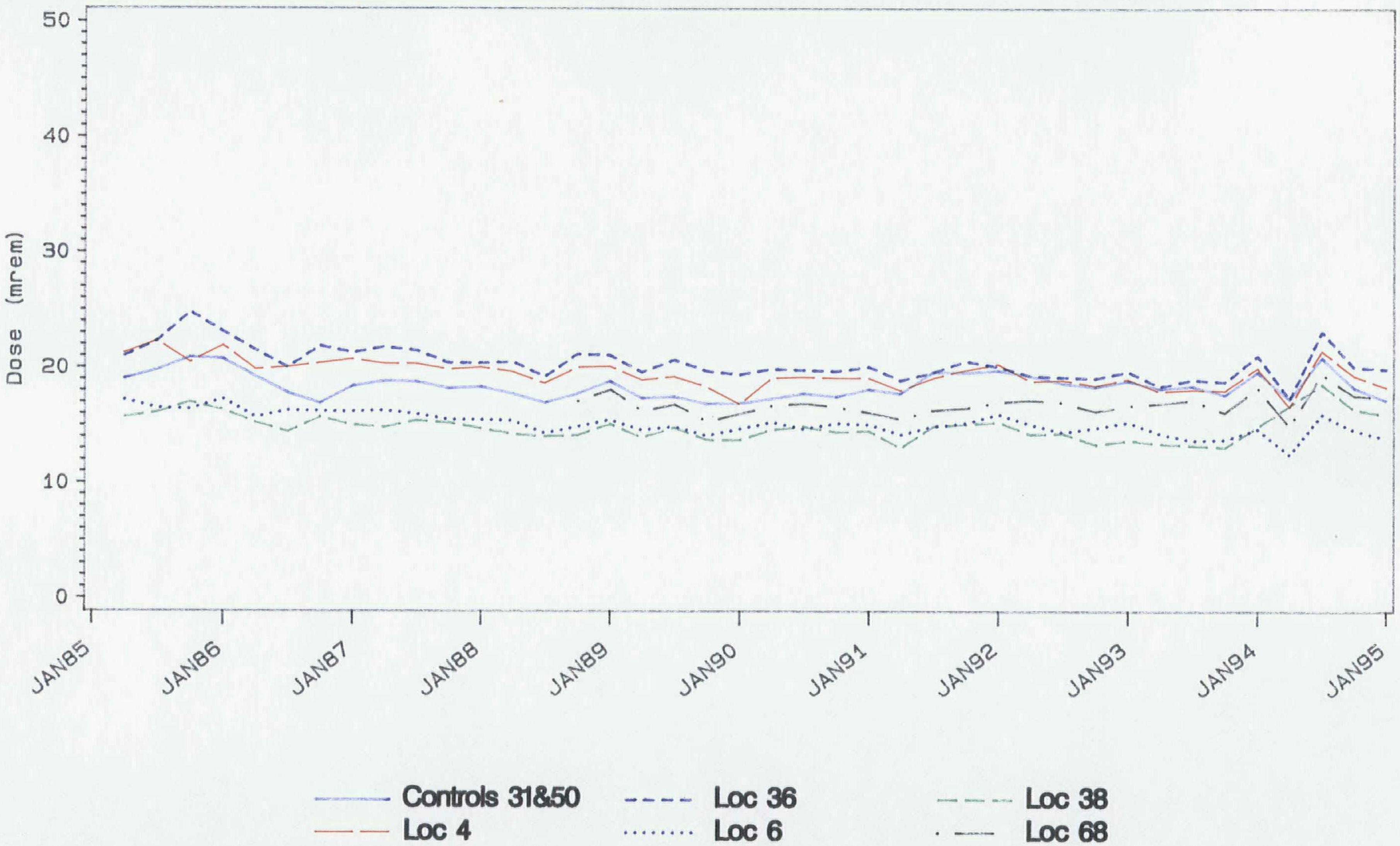


FIGURE 3A

Direct Radiation Monitoring

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

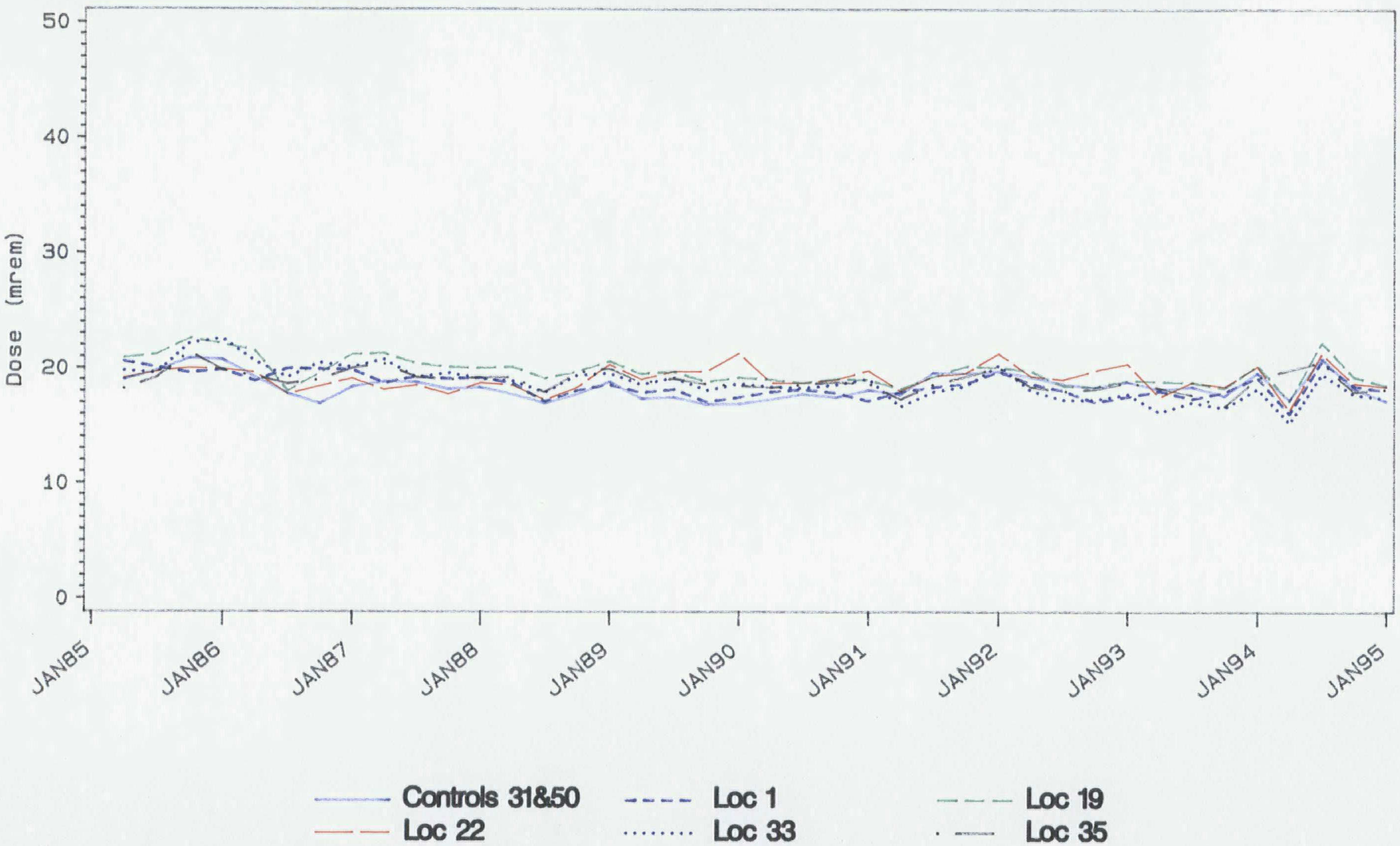


FIGURE 3B

Direct Radiation Monitoring

Control Locations for Sectors P, Q, R, A, B (Quarterly Gamma Exposure)

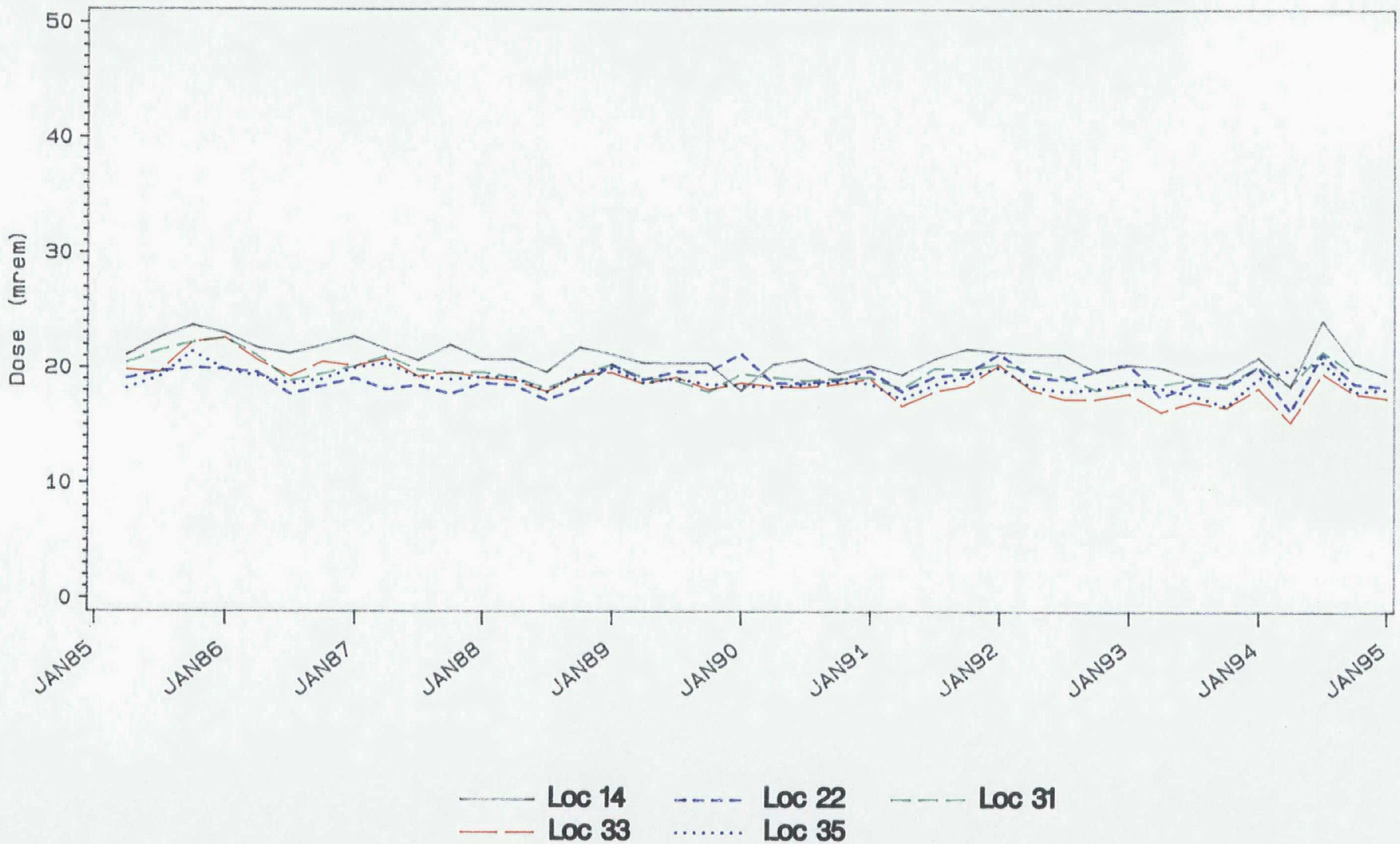


FIGURE 4A

Direct Radiation Monitoring

Control Locations for Sectors C, D, E, F, G (Quarterly Gamma Exposure)

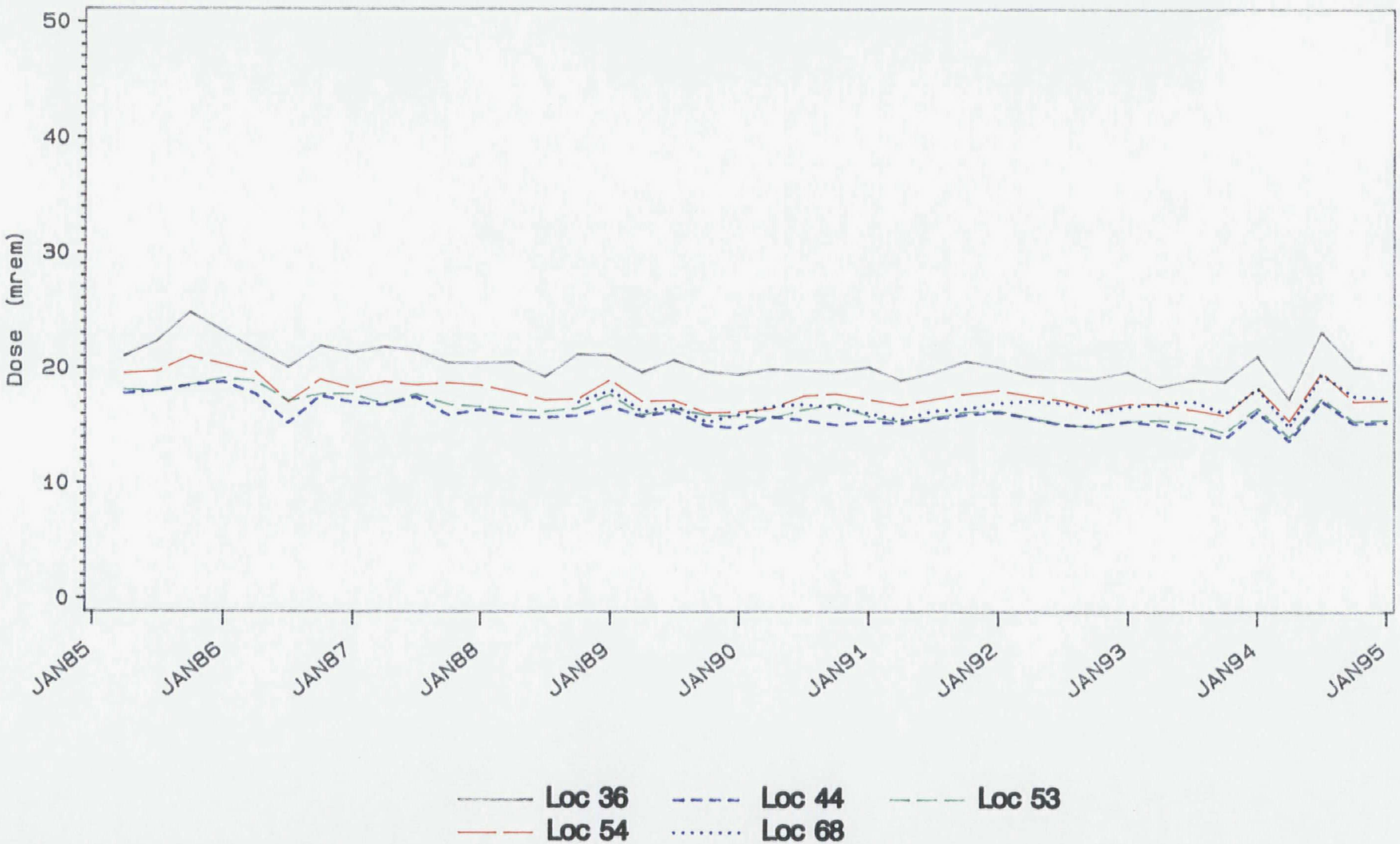


FIGURE 4B

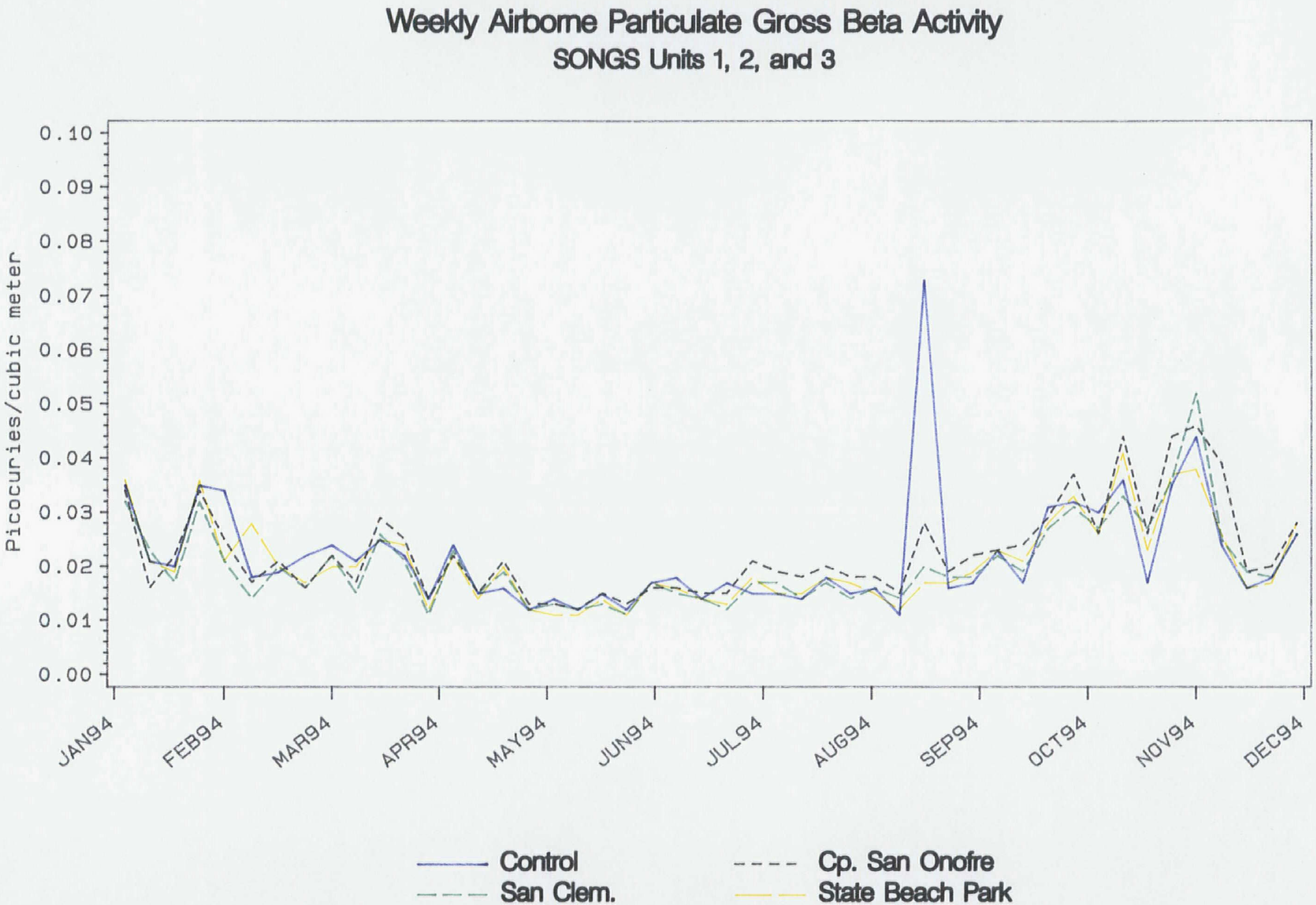

Weekly Airborne Particulate Gross Beta Activity
SONGS Units 1, 2, and 3
Picocuries/cubic meter
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
JAN94
FEB94
MAR94
APR94
MAY94
JUN94
JUL94
AUG94
SEP94
OCT94
NOV94
DEC94
Control
Cp. San Onofre
San Clem.
State Beach Park

FIGURE 5A

Weekly Airborne Particulate Gross Beta Activity

SONGS Units 1, 2, and 3

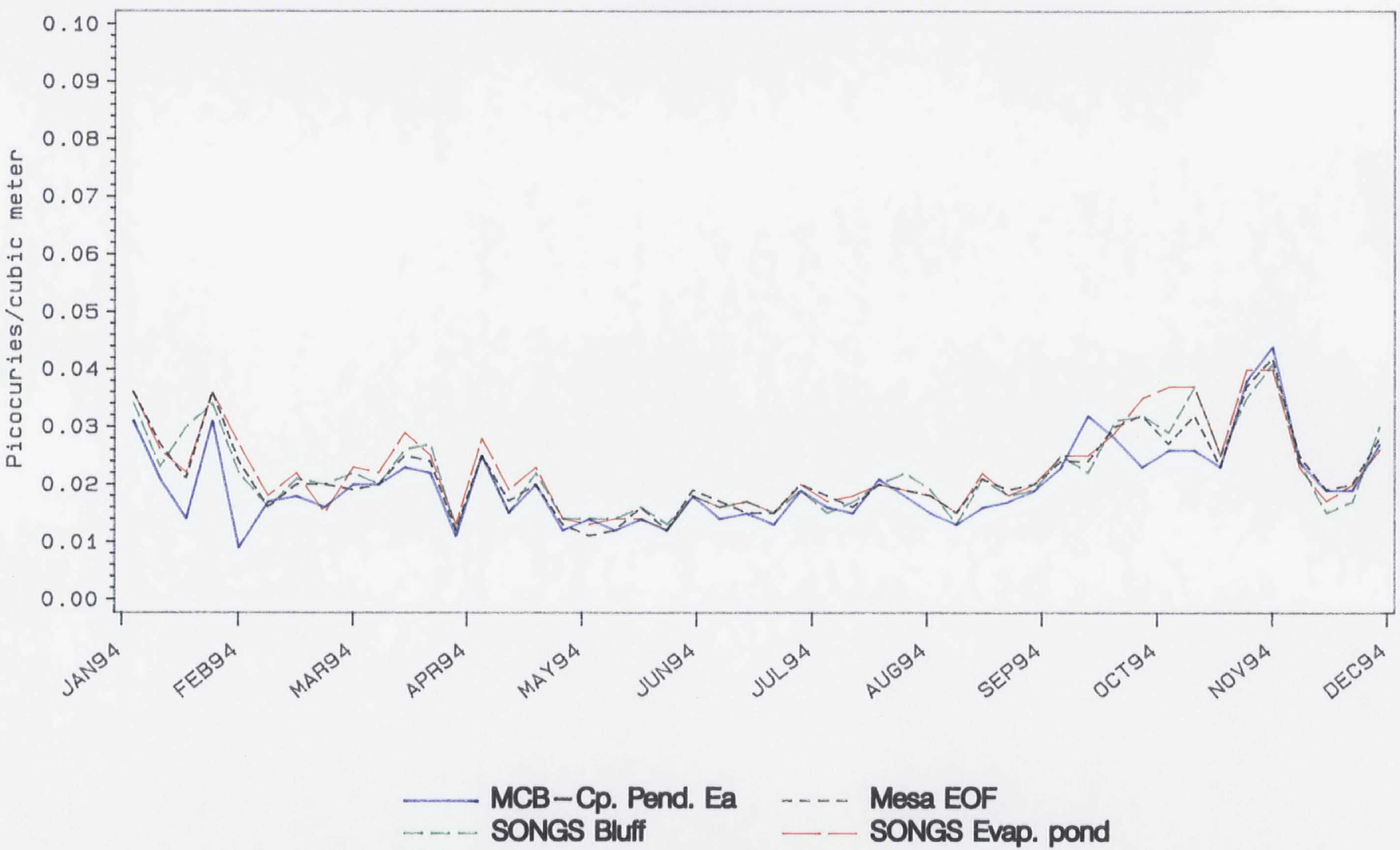


FIGURE 5B

Cobalt – 60 in Ocean Bottom Sediments (Operational)

Units 1, 2, and 3 vs. Control

ELEMENT=Co-60

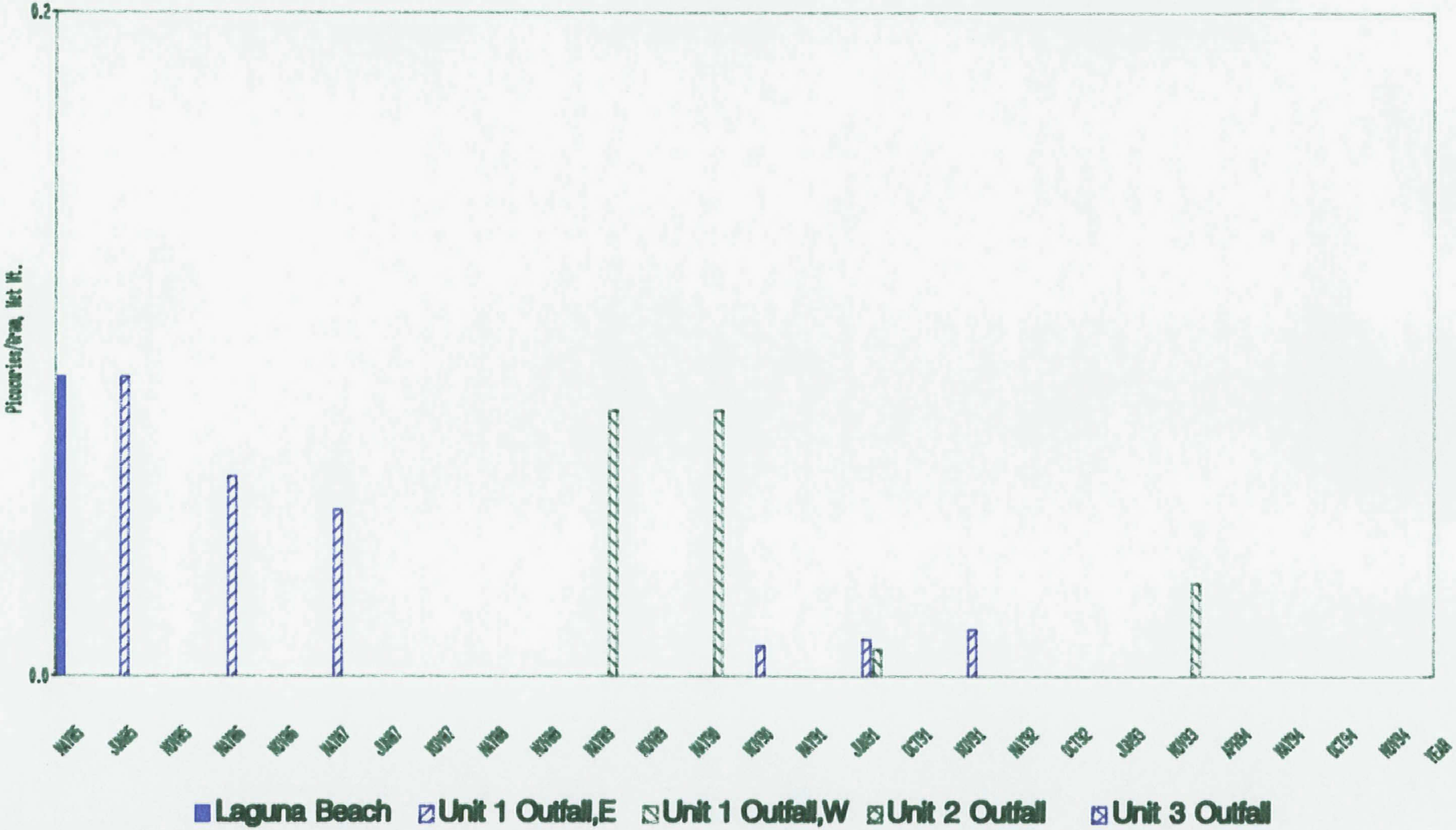


FIGURE 6

Cesium-137 in Ocean Bottom Sediments (Operational)

Units 1, 2, and 3 vs. Control

ELEMENT=Cs-137

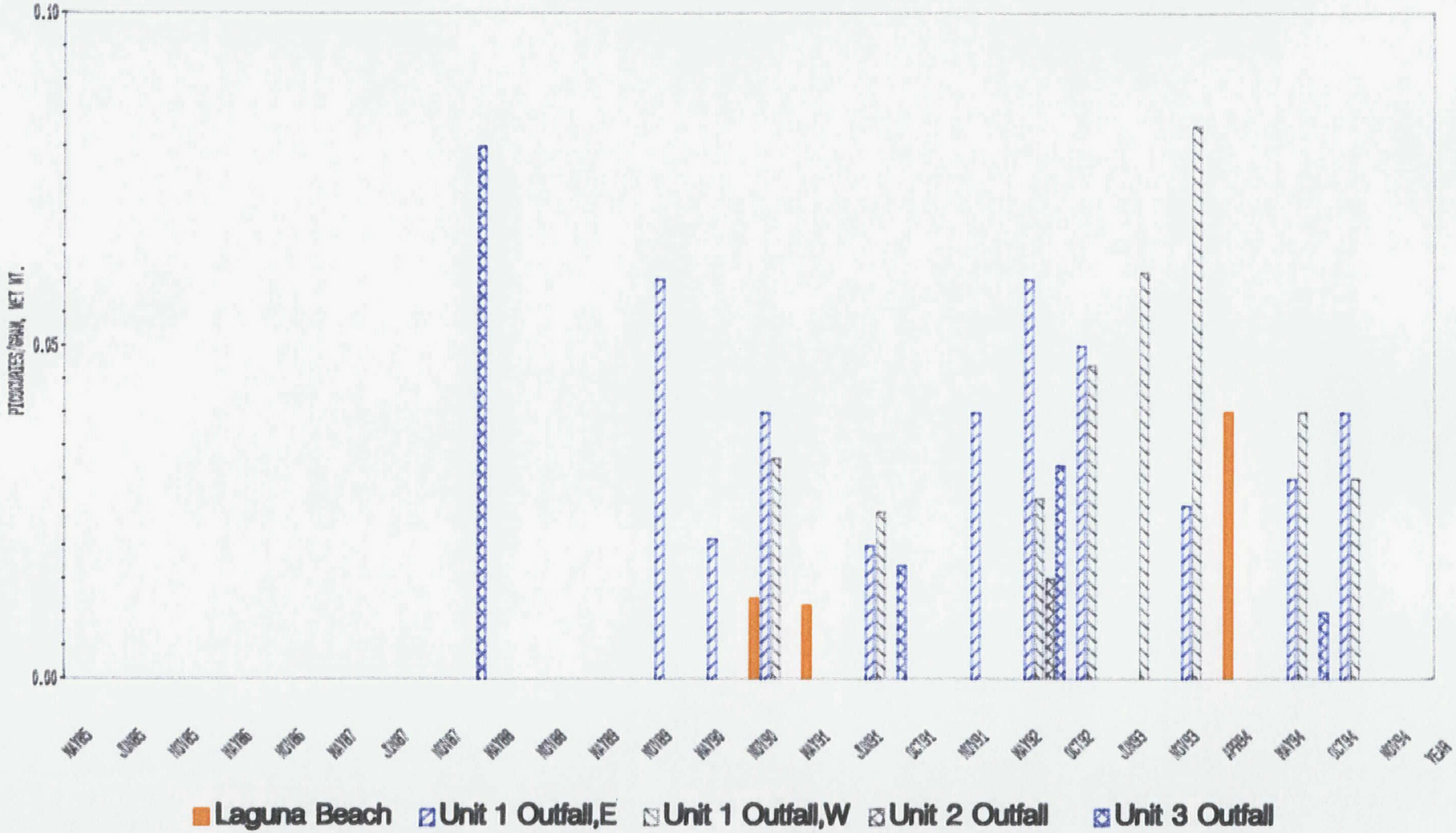


FIGURE 7

Cesium–137 in the Flesh of Sheephead (Operational)

SONGS Units 1, and 2/3 Outfalls vs. Control

ELEMENT=Cs-137 Sample Type# #=sheephead

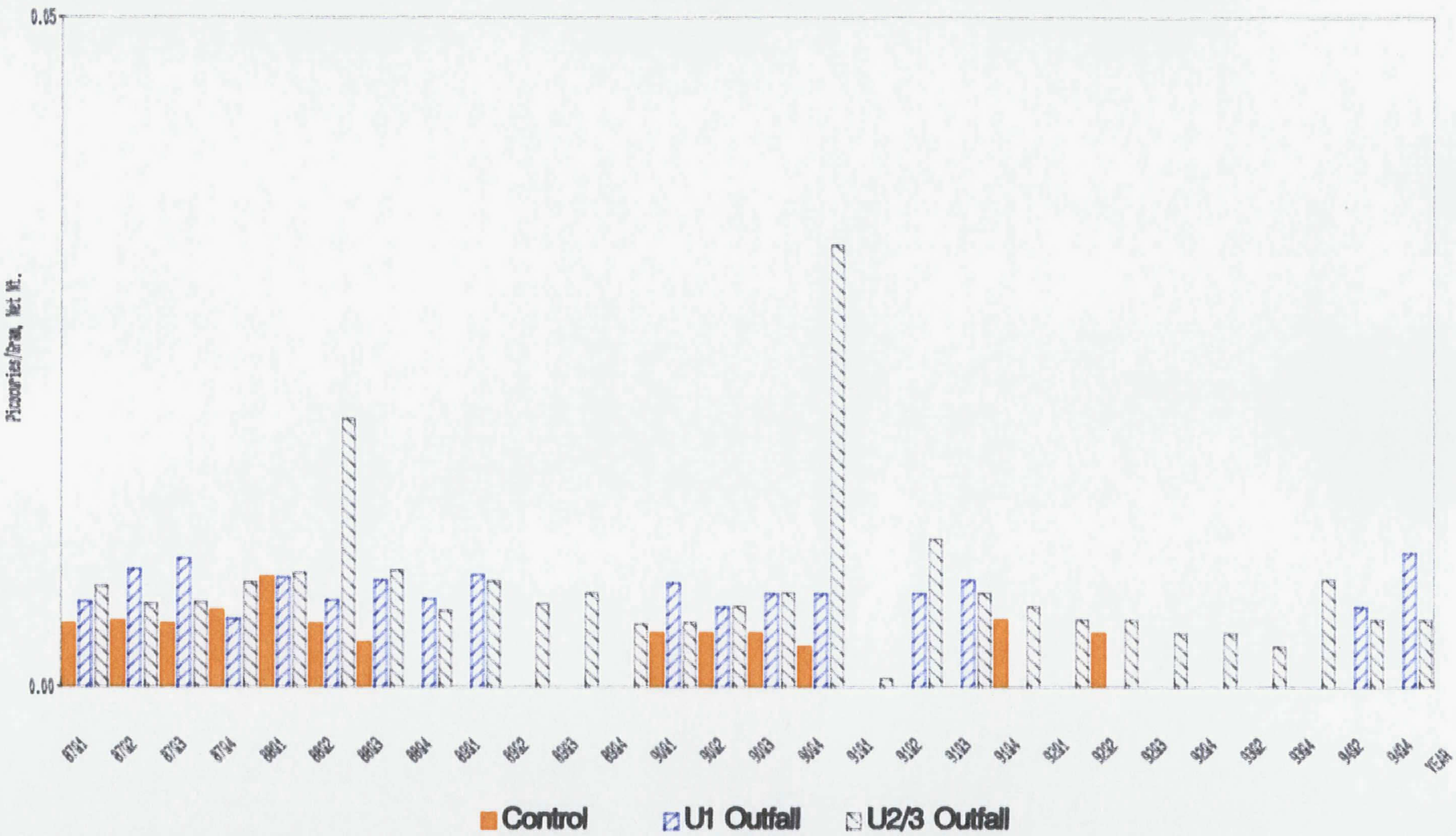


FIGURE 8

Cesium – 137 in the Flesh of Black Perch (Operational)

SONGS Units 1, and 2/3 Outfalls vs. Control

ELEMENT=Cs-137 Sample Type* * *=black perch

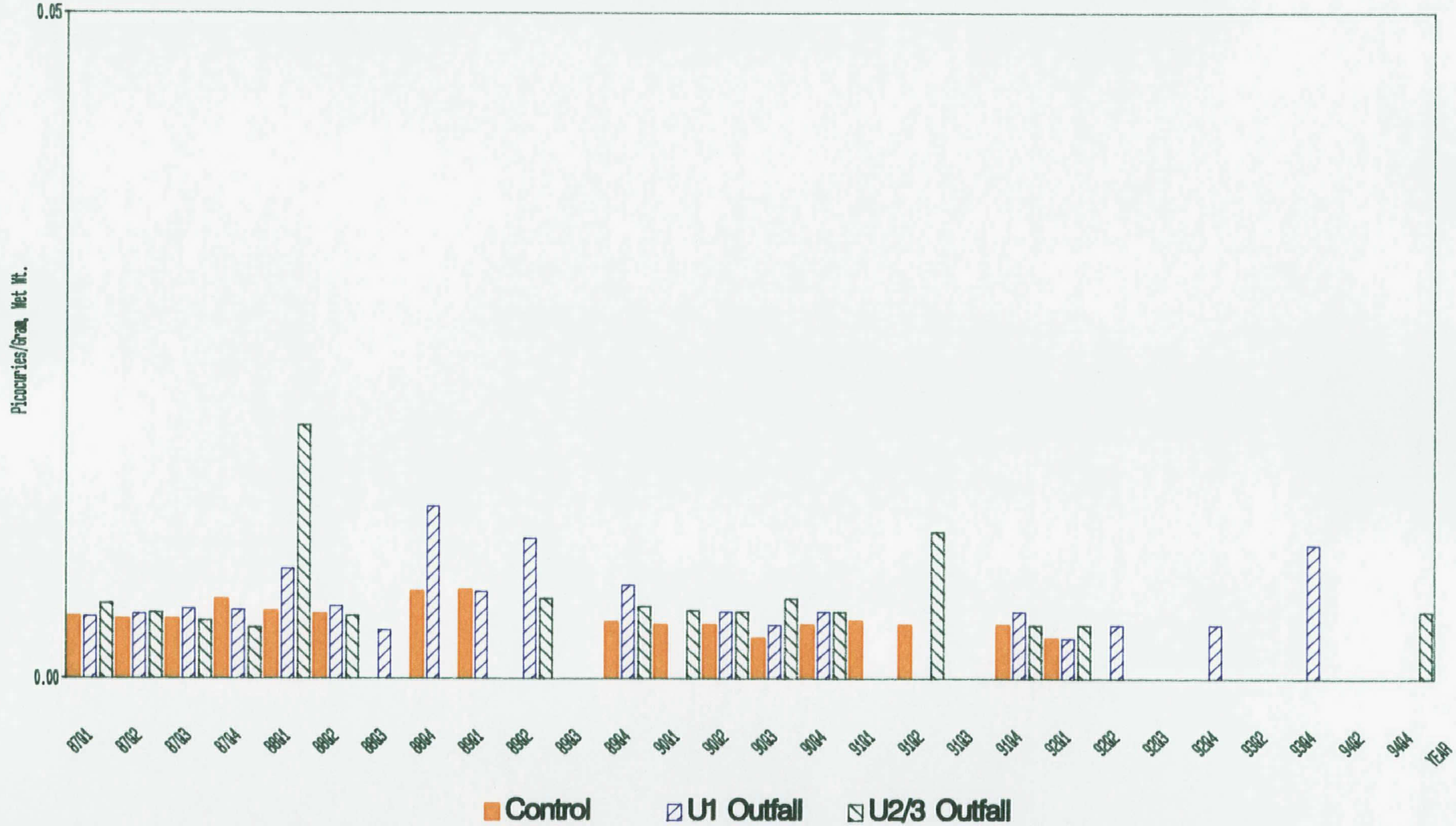
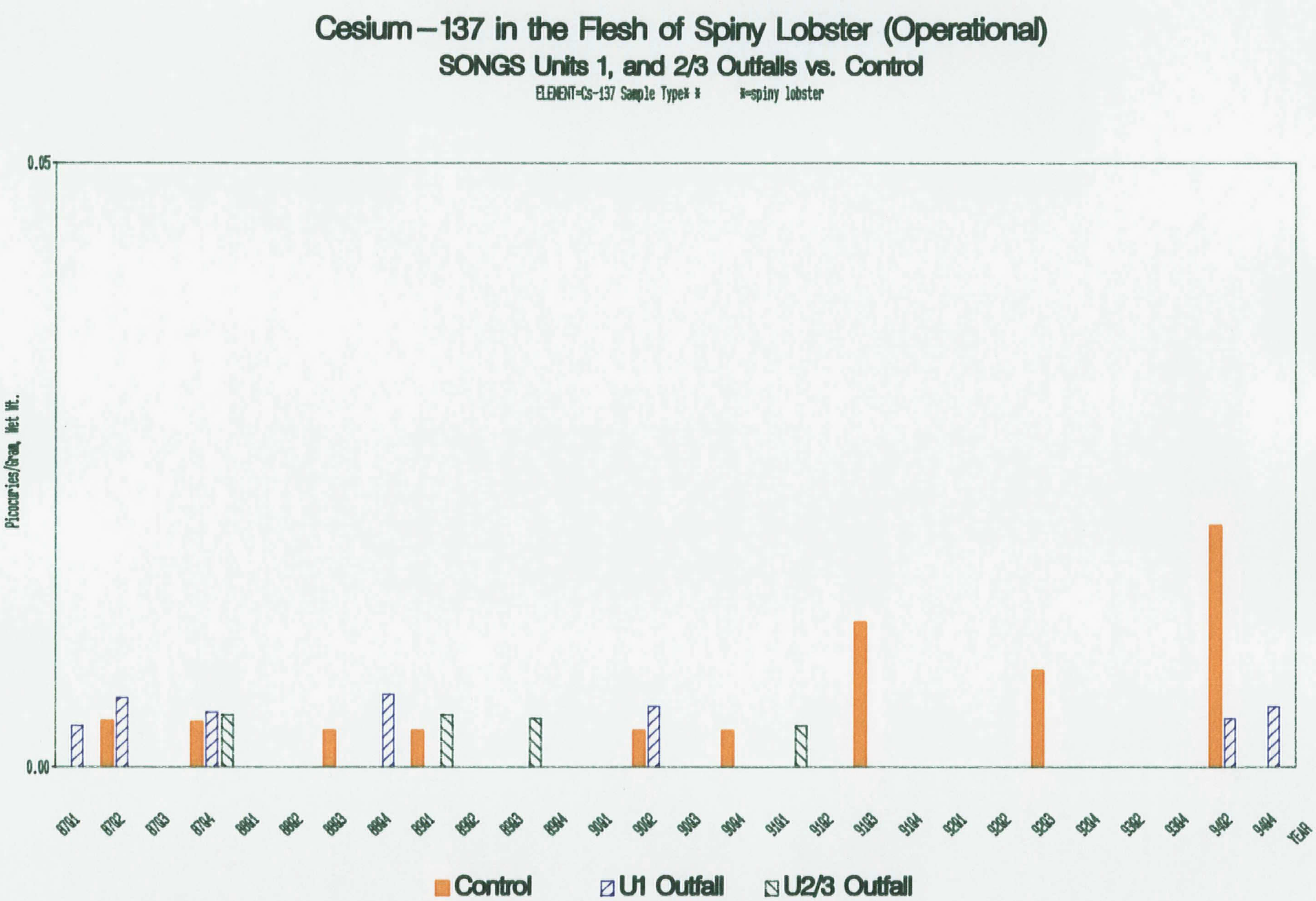


FIGURE 9



Cesium-137 in the Flesh of Spiny Lobster (Operational)
SONGS Units 1, and 2/3 Outfalls vs. Control
ELEMENT=Cs-137 Sample Type* * *=spiny lobster
Picocuries/Gram, Wet Wt.
0.05
0.00
8701
8702
8703
8704
8801
8802
8803
8804
8901
8902
8903
8904
9001
9002
9003
9004
9101
9102
9103
9104
9201
9202
9203
9204
9302
9304
9402
9404
YEAR
Control
U1 Outfall
U2/3 Outfall

FIGURE 10

Cesium – 137 in the Flesh of Sheephead (Operational)

SONGS Units 1, and 2/3 Outfalls vs. Control

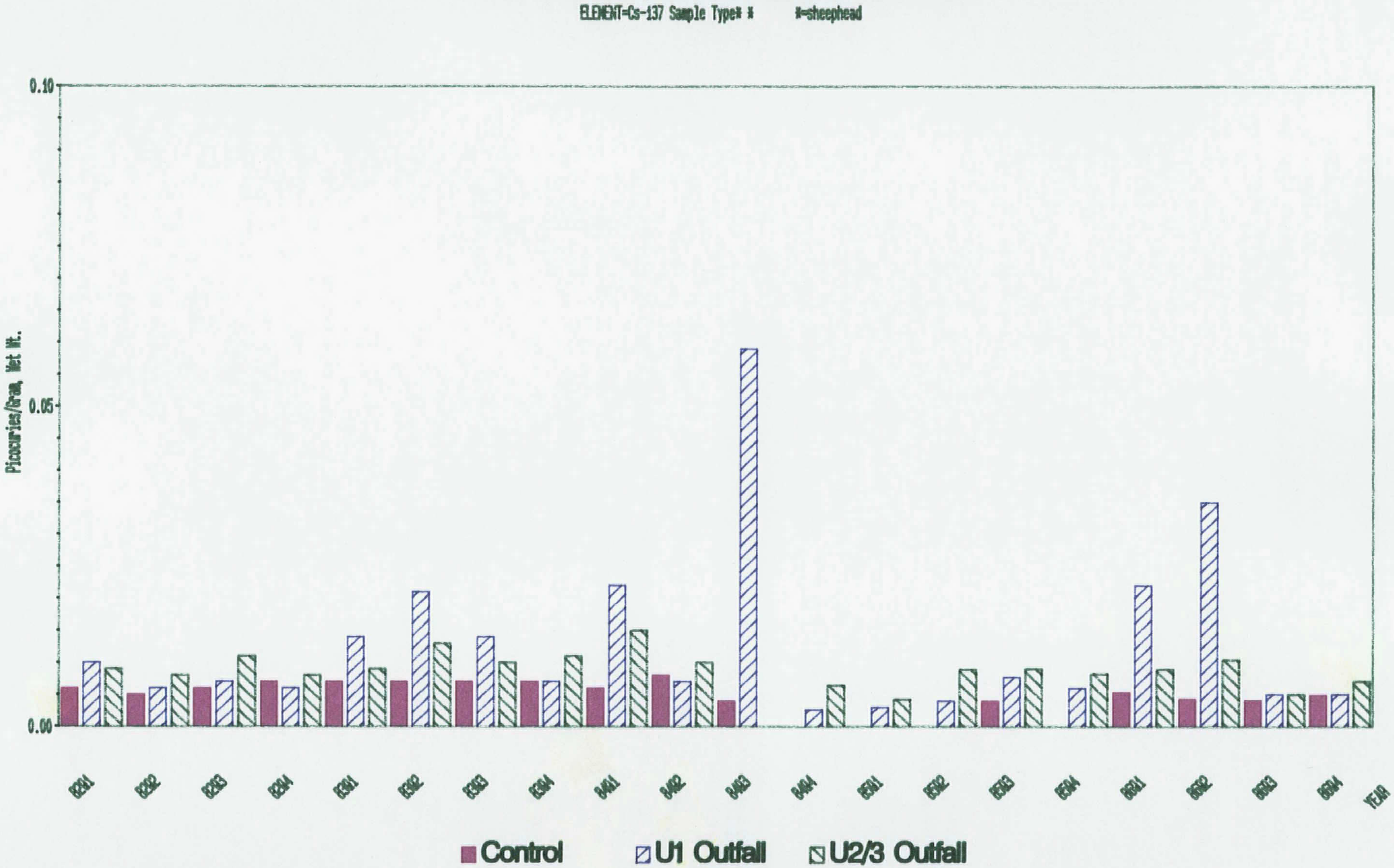


FIGURE 11A

Cesium—137 in the Flesh of Sheephead (Preoperational)

SONGS Units 1, and 2/3 Outfalls vs. Control

ELEMENT=Cs-137 Sample Type# # #=sheephead

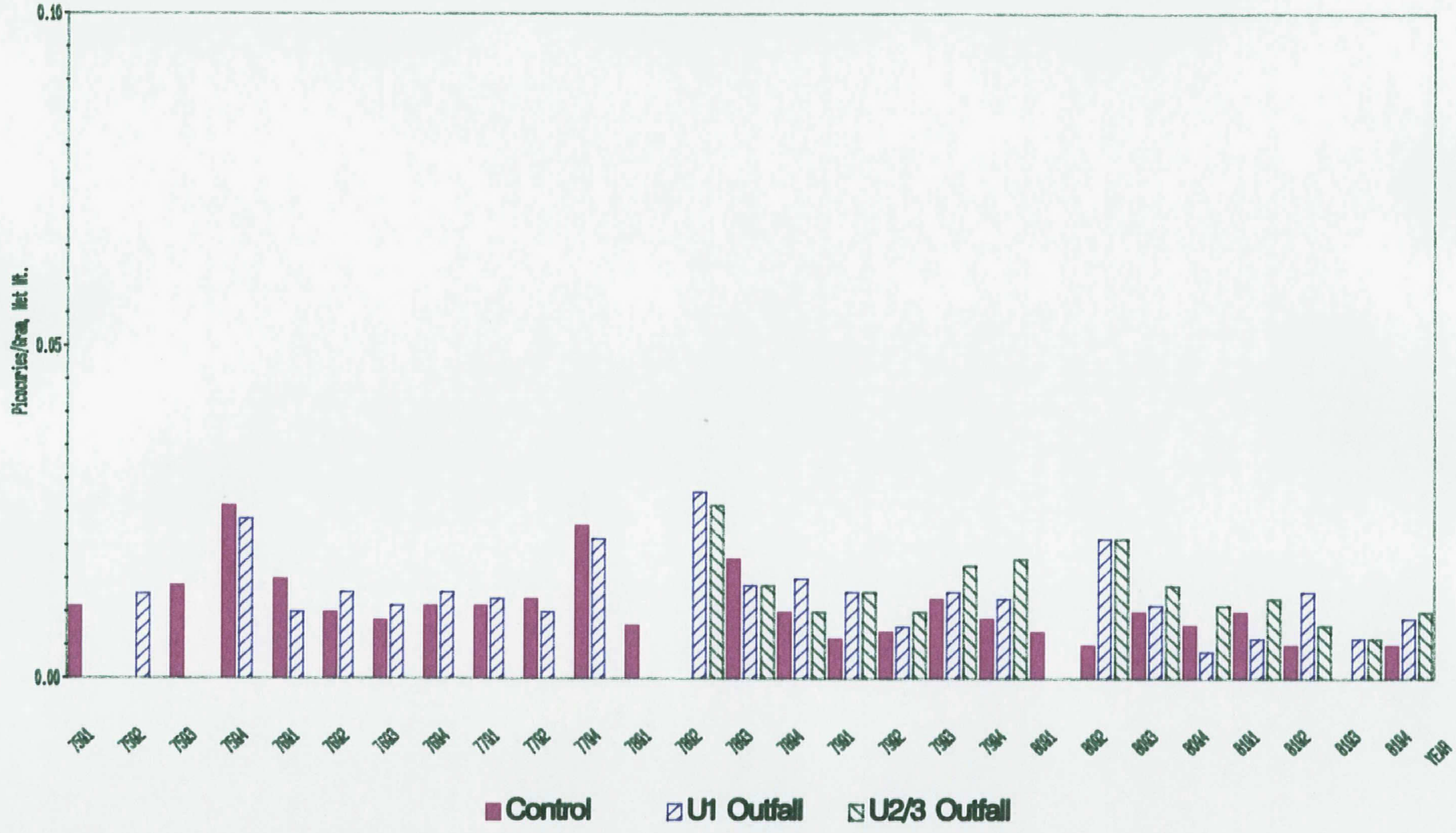


FIGURE 11B

Direct Radiation Monitoring (Preoperational Data)

Quarterly Gamma Exposure for TLDs Co-Located with Air Samplers

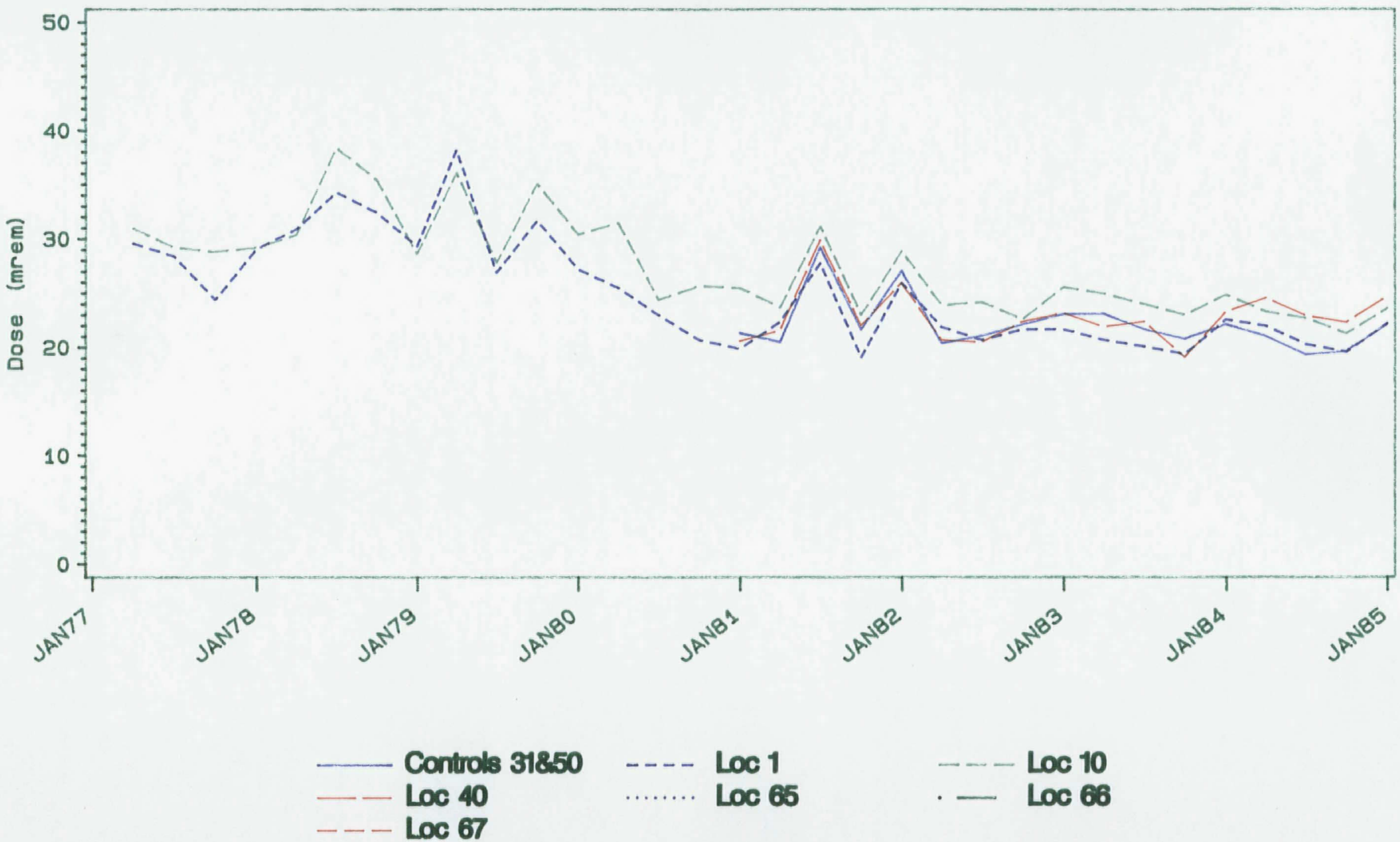


FIGURE 12A

Direct Radiation Monitoring (Operational Data)

Quarterly Gamma Exposure for TLDs Co-Located with Air Samplers

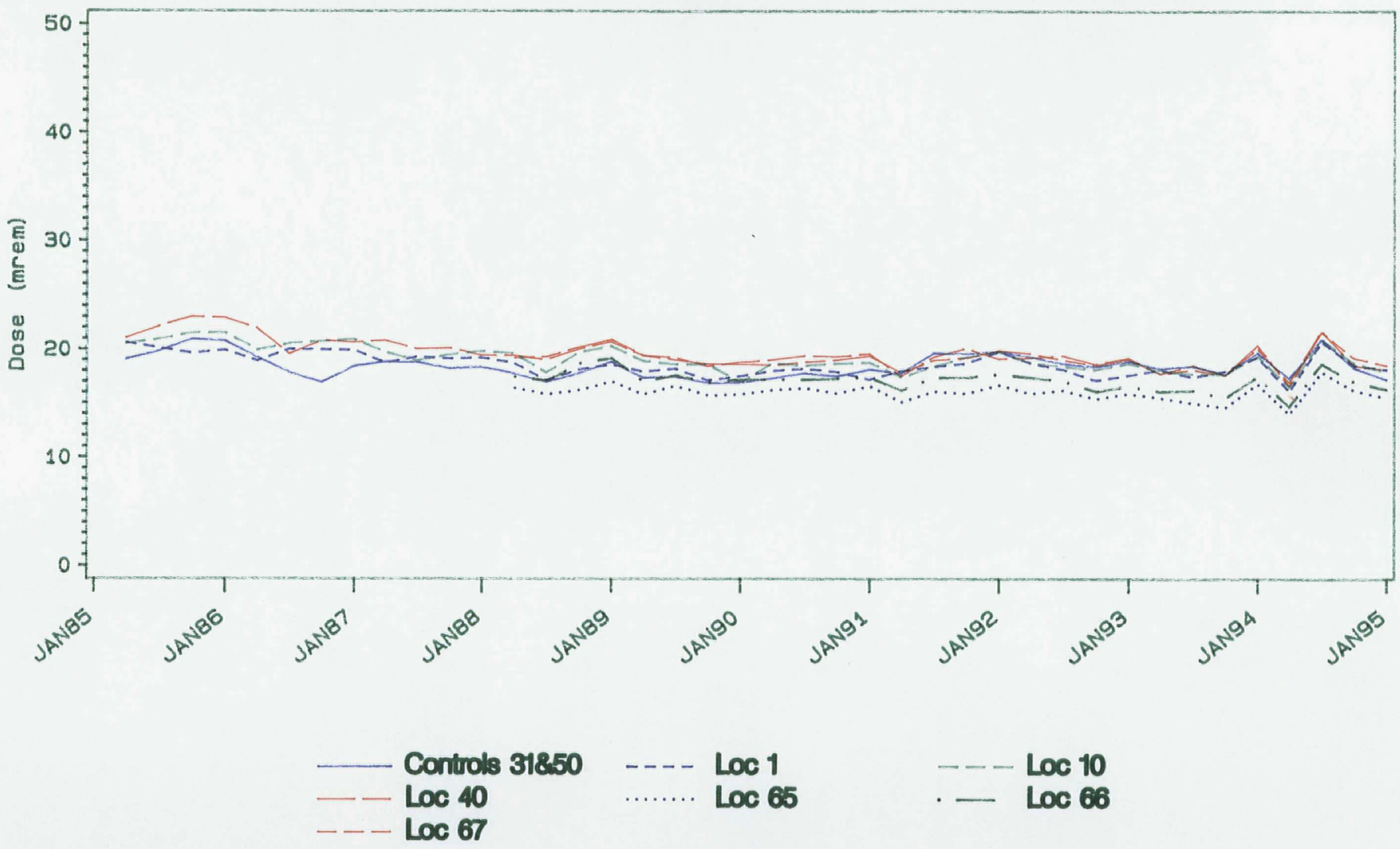


FIGURE 12B

Monthly Average Airborne Particulates Gross Beta Activity

Preoperational and Operational Data for SONGS Units 2 and 3

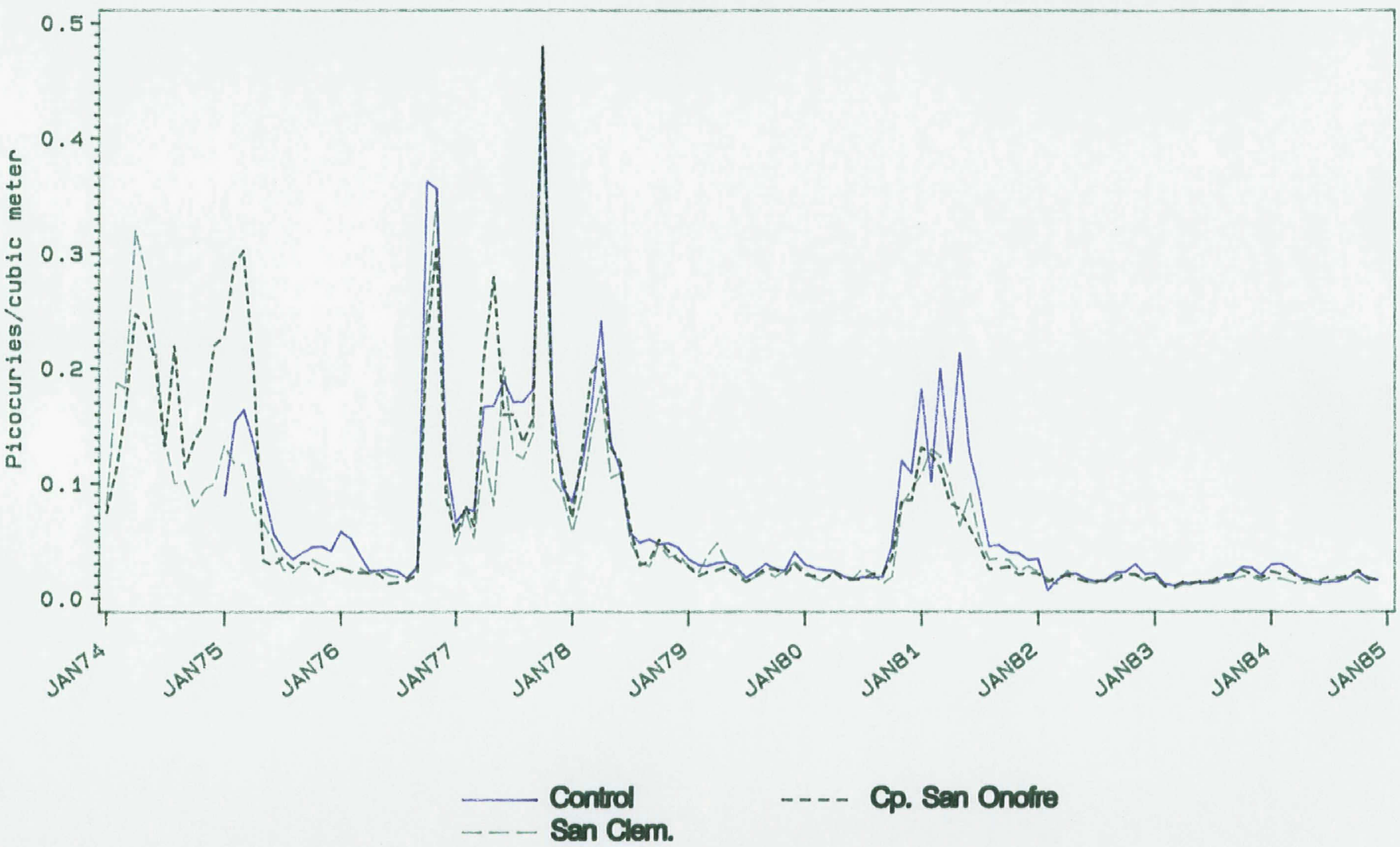


FIGURE 13A

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

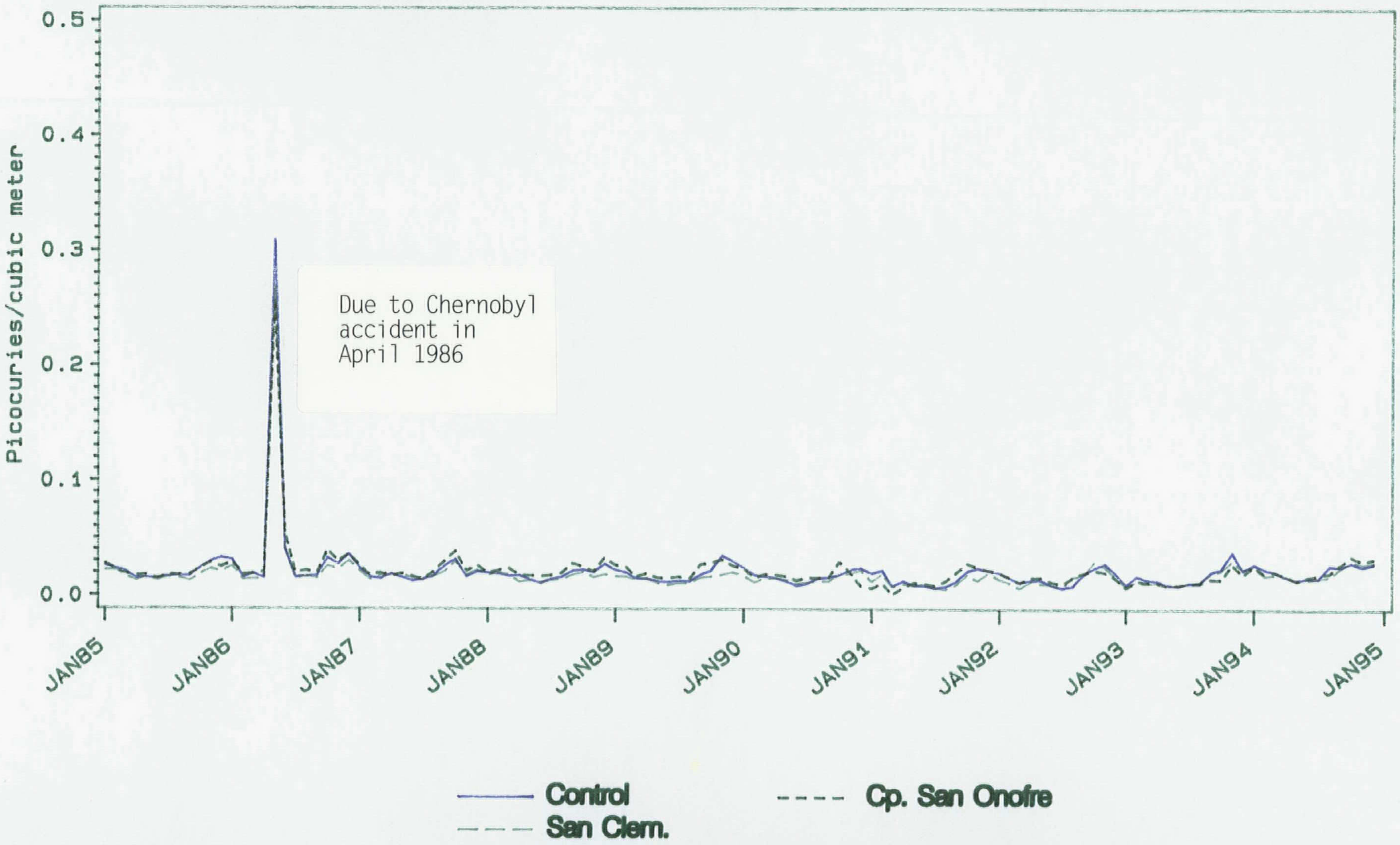


FIGURE 13B

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

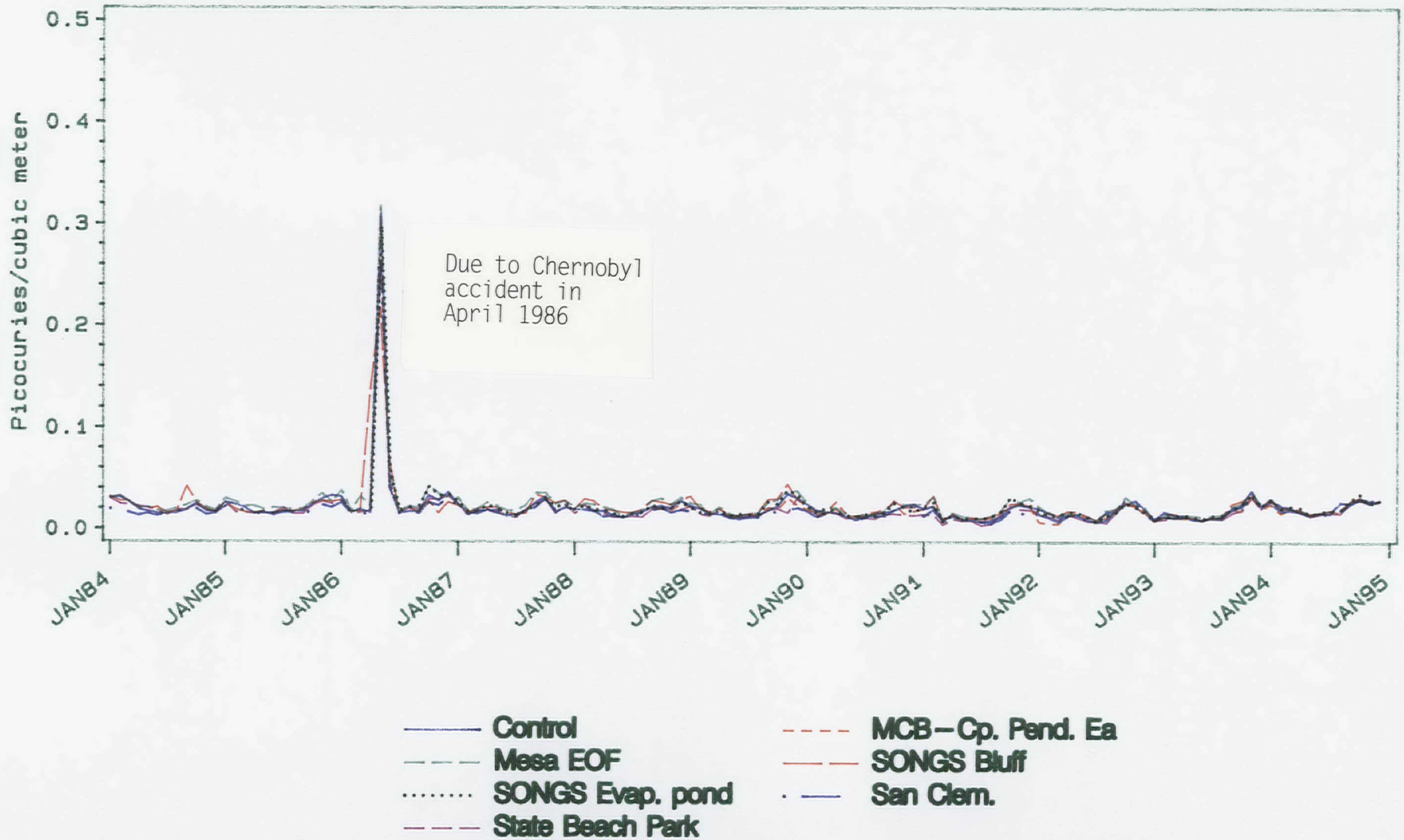


FIGURE 14

Monthly Drinking Water Filtrate Gross Beta Activity
Preoperational and Operational Data – SONGS Units 1, 2 and 3

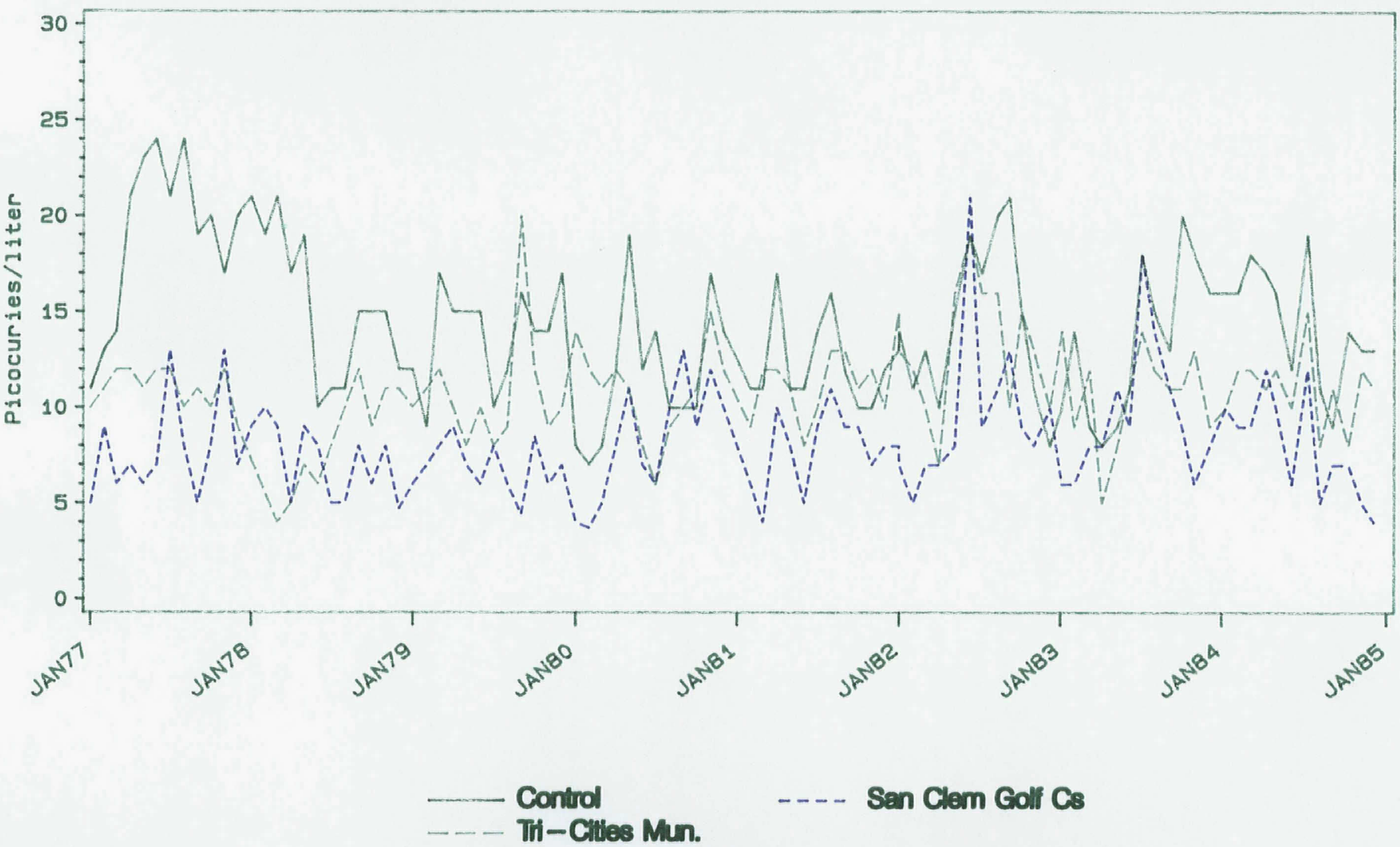


FIGURE 15A

Monthly Drinking Water Filtrate Gross Beta Activity
Preoperational and Operational Data – SONGS Units 1, 2 and 3

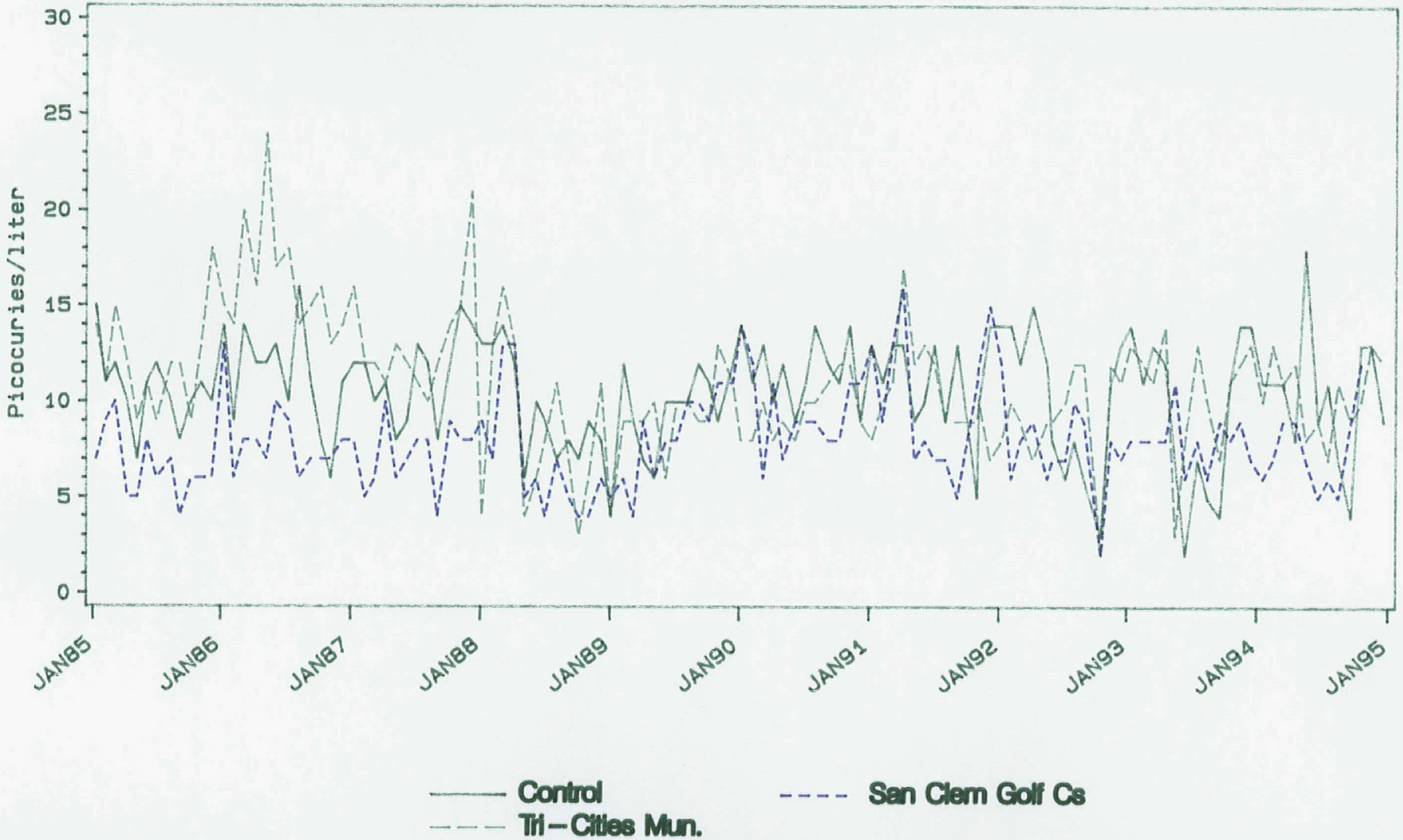


FIGURE 15B

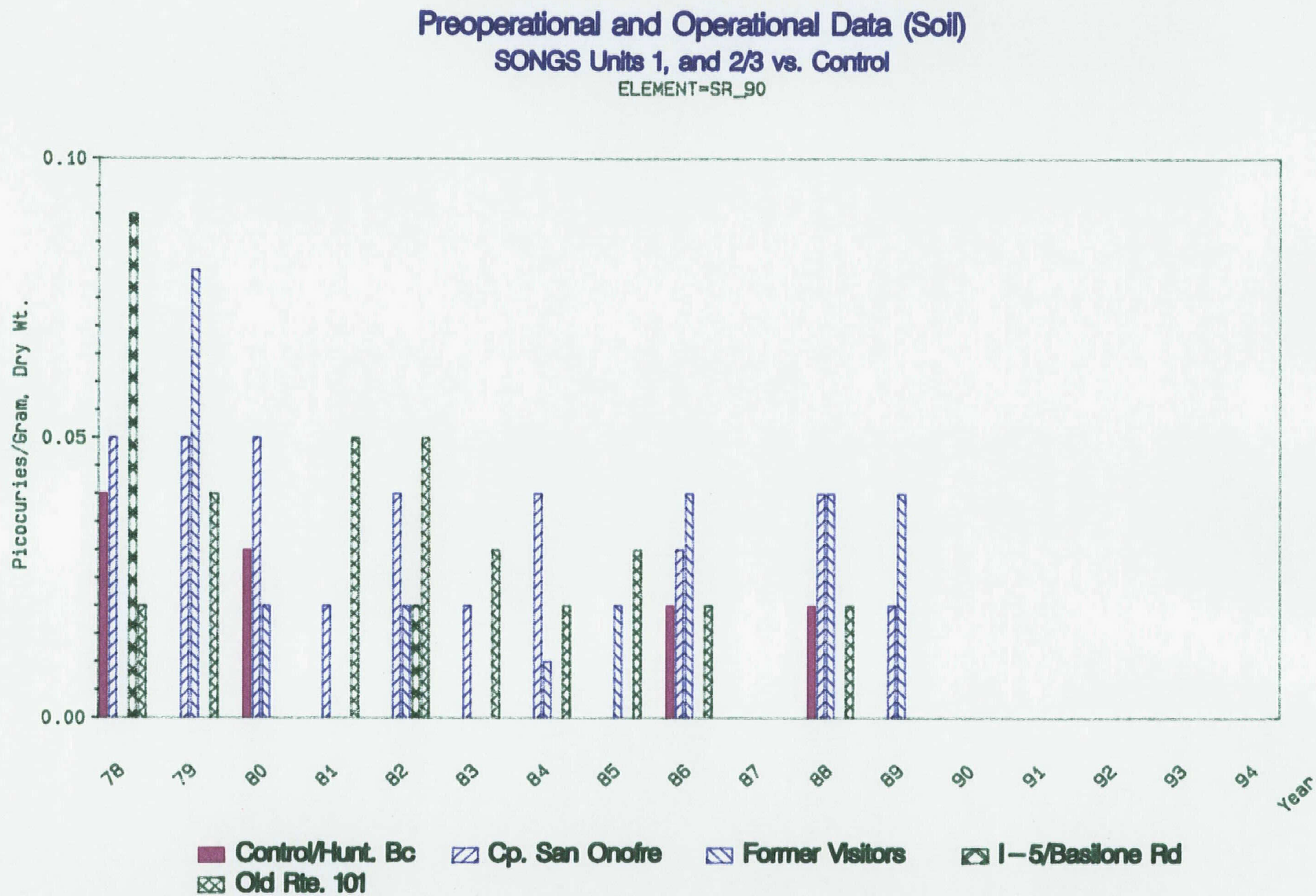

Preoperational and Operational Data (Soil)
SONGS Units 1, and 2/3 vs. Control
ELEMENT=SR_90
Picocuries/Gram, Dry Wt.
0.10
0.05
0.00
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
Year
Control/Hunt. Bc
Cp. San Onofre
Former Visitors
I-5/Basilone Rd
Old Rte. 101

FIGURE 16A

Preoperational and Operational Data (Soil)
SONGS Units 1, and 2/3 vs. Control
ELEMENT=CS_137

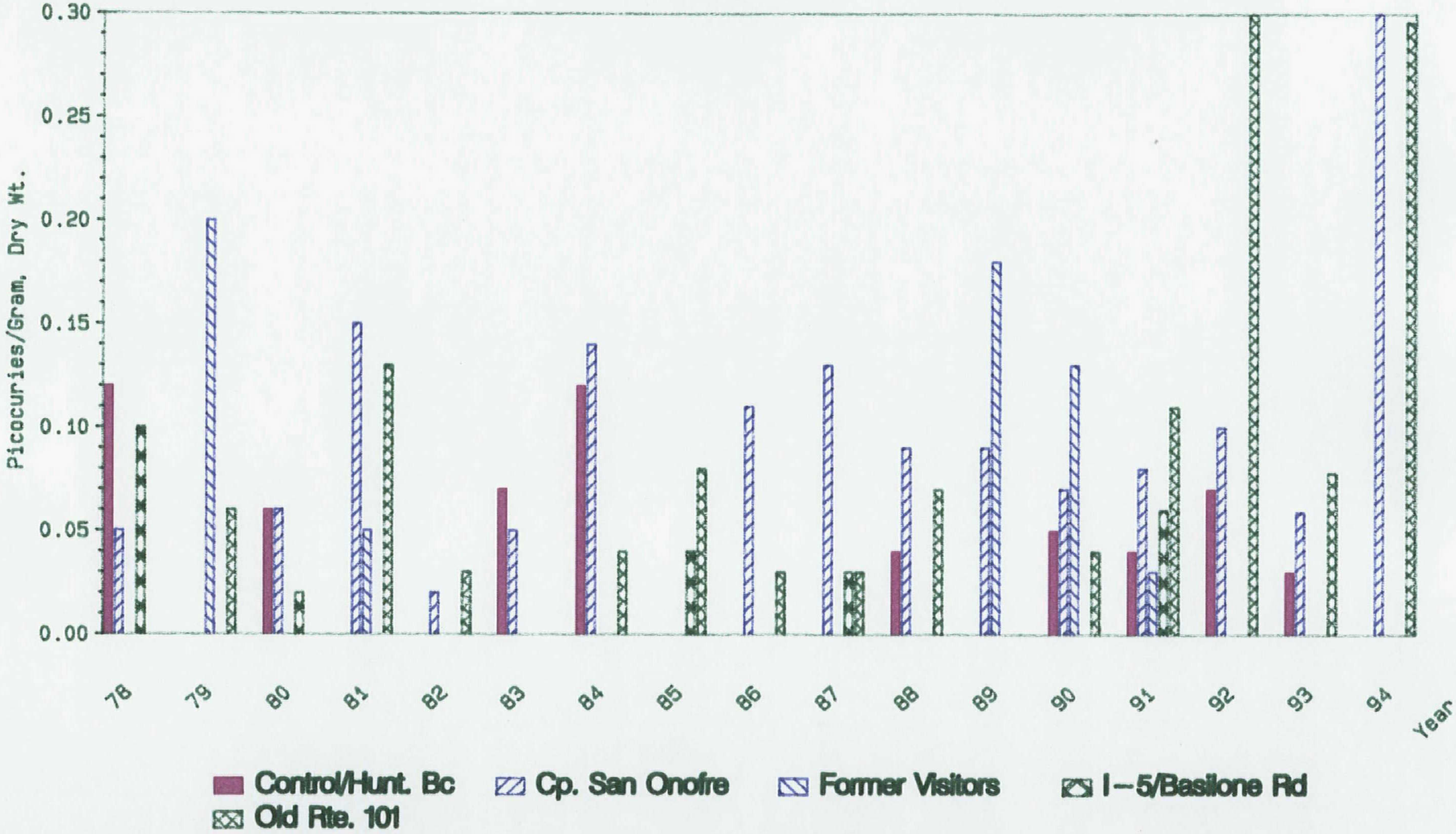


FIGURE 16B

Operational Data For SONGS Units 2 and 3

Iodine−131 Activity in Kelp

ELEMENT=I-131

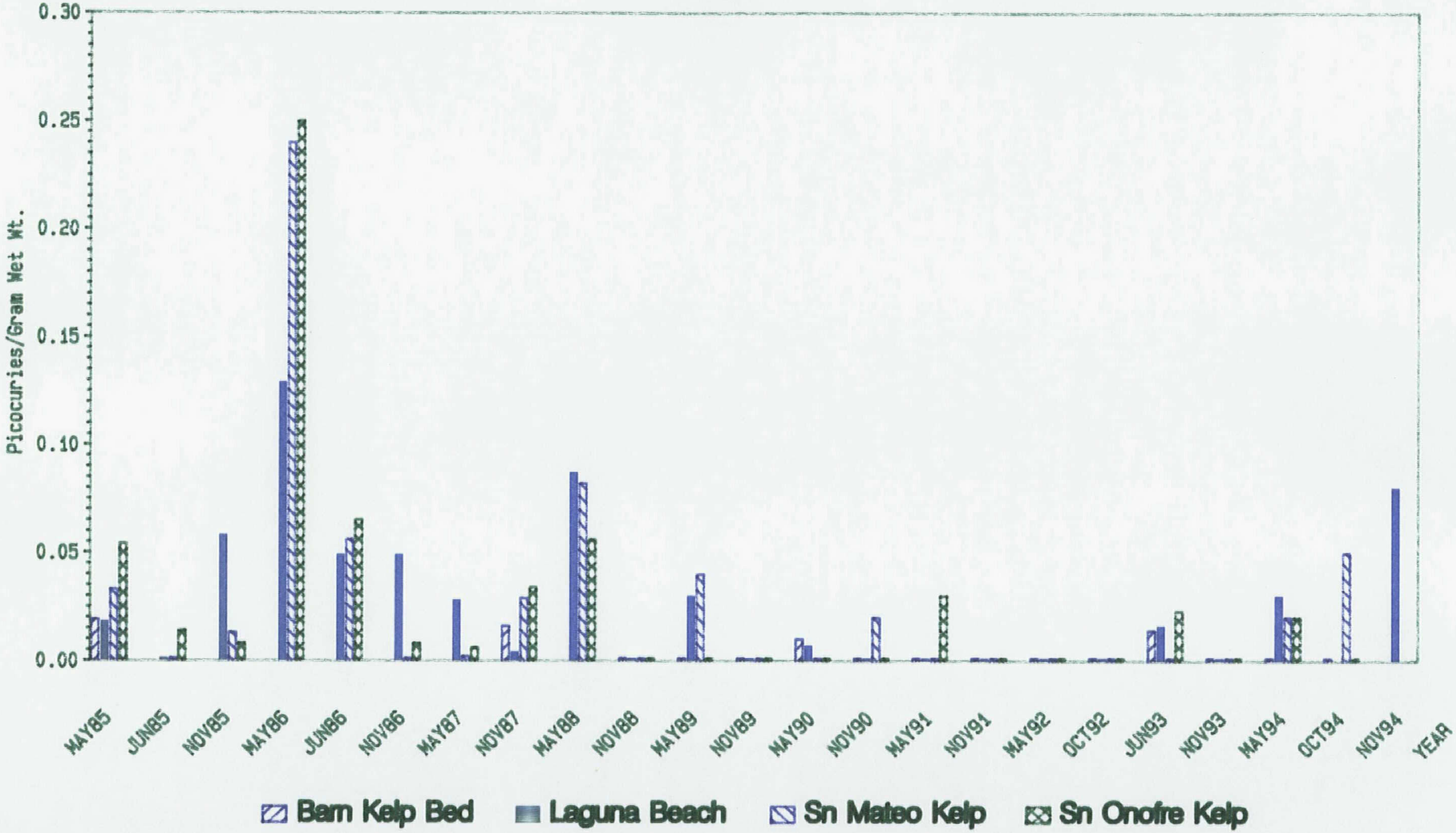
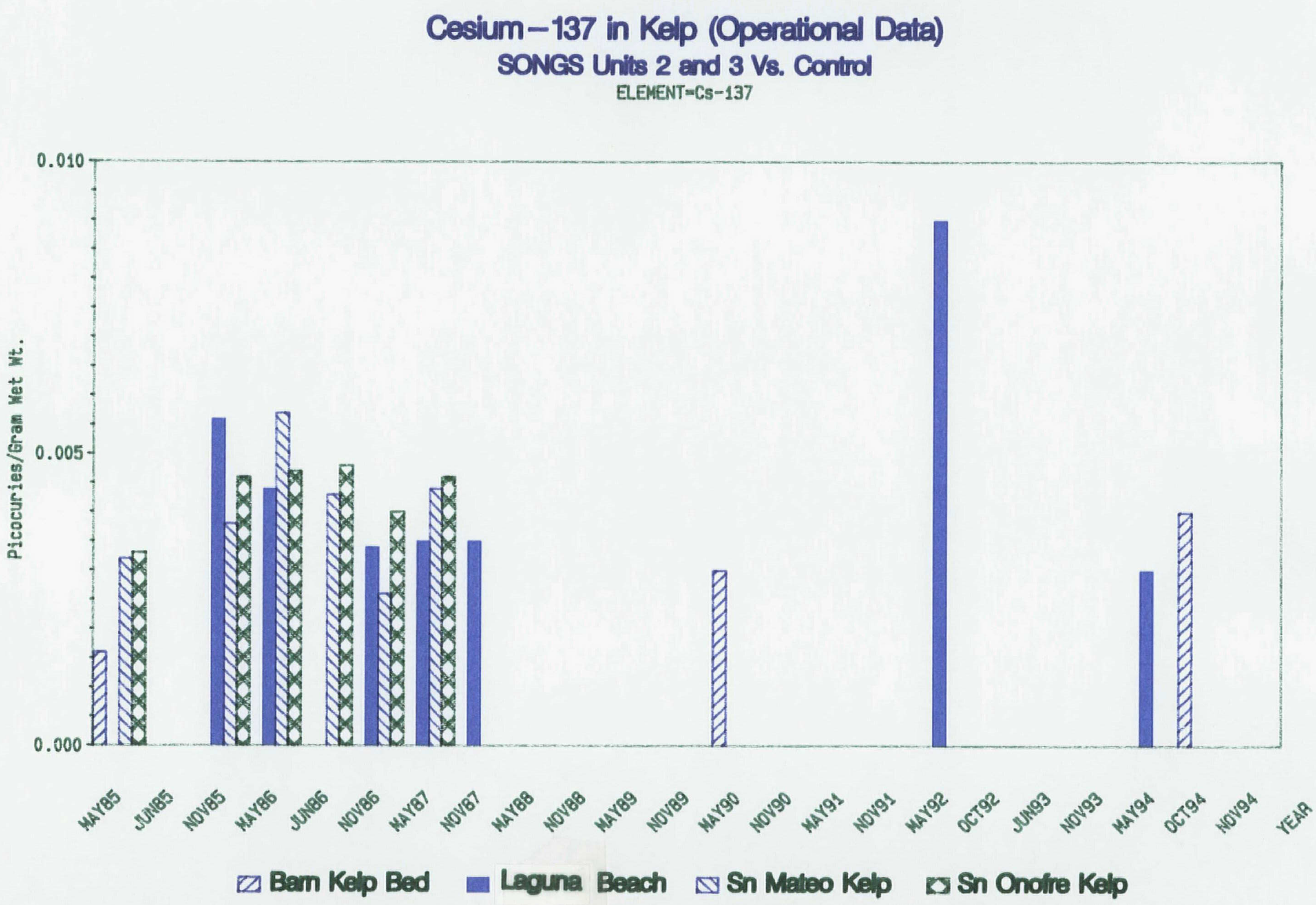


FIGURE 17



Cesium-137 in Kelp (Operational Data)
SONGS Units 2 and 3 Vs. Control
ELEMENT=Cs-137
Picocuries/Gram Wet Wt.
0.010
0.005
0.000
MAY85
JUN85
NOV85
MAY86
JUN86
NOV86
MAY87
NOV87
MAY88
NOV88
MAY89
NOV89
MAY90
NOV90
MAY91
NOV91
MAY92
OCT92
JUN93
NOV93
MAY94
OCT94
NOV94
YEAR
Barn Kelp Bed
Laguna Beach
Sn Mateo Kelp
Sn Onofre Kelp

FIGURE 18

ERRATA FOR 1993 RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

PAGE NUMBER (location)	INCORRECT	CORRECT
Page i (Table of Contents)	Section II. D......	D. Ocean Water....18
Page ii (List of Tables, Table E-1)	1975-1933	1975-1993
Page ii (List of Tables, Table E-2)	1974-1933	1974-1993
Page iv (Table 4A)	Quarterly-composite	Quarterly-Composite
Page 7 (Table I-1)	ZN-65	Zn-65
Page 7 (Table I-1)	Zr-Na-95	Zr-Nb-95
Page 11 (Table II-1)	Table title not centered	Center the title
Page 29 (Table A-1)	Blank after TLD #68	Add #99 Transit Control
Page 40 (Table 4A)	I-131 line	Delete I-131 line
Page 48 (Table 9A)	I-131 line	Delete I-131 line
Page 101 (Table C-1), MAR & AUG	Ca-137	Cs-137
Page 106 (Table D-2) Shoreline Sediment	NRC and % of NRC Columns (blank)	Insert "--" in both blank columns
Page 227, Figure 22A	Newport Becah (Legend)	Change to Laguna Beach
Page 228, Figure 22B	Newport Beach (Legend)	Change to Laguna Beach