PACIFIC GAS AND ELECTRIC COMPANY

DOCKET NO. 50-133

REPORT ON RADIOACTIVE EFFLUENT RELEASES AND WASTE DISPOSAL

FOR HUMBOLDT BAY POWER PLANT UNIT NO. 3, COVERING THE PERIOD

JULY 1, 1980 THROUGH DECEMBER 31, 1980

This report summarizes the quantity of each of the principal radionuclides released to unrestricted areas in liquids and gaseous effluents and summarizes radioactive waste disposal from July 1, 1980 to December 31, 1980 and is submitted in accordance with Section IX.I.3.a. of the Technical Specifications.

A. SUPPLEMENTAL INFORMATION

1. Regulatory Limits

a. Fission and activation gases: The current license limits are 50,000 µCi per second for an annual average release rate and 500,000 µCi per second for an instantaneous release.

b. Iodines: Refer to c., "Particulates."

c. Particulates: The limit "for halogens and particulate material based on the isotopes present on the sampling filters after 48 hours decay period: is 0.18 µCi/sec.

d. Liquid Effluents: 10CFR20.

2. Maximum Permissible Concentrations

Provide the MPC's used in determining allowable release rates or concentrations.

a. Fission and activation gases: Not applicable.

b. Iodines: 3×10^{-10} µCi/cc

c. Particulates, half-lives >8 days: 3×10^{-10} µCi/cc

d. Liquid effluents: 10CFR20, Table II, Appendix B.

3. Average Energy

Not applicable.

4. Measurements and Approximations of Total Radioactivity

The methods used to measure or approximate the total radioactivity in effluents and the methods used to determine radionuclide composition are as follows:

a. Fission and activation gases:

Due to the long decay time since operation (shutdown July 2, 1976), no detectable releases of fission and activation gases can be expected. An arbitrary 1 microcurie of each nuclide found during operation has been reported.

b. Iodines:

Charcoal cartridges are removed from the stack sampling system weekly and, after 48 hour decay, are gamma spectrum counted for I-131 and I-133 (with a Sodium Iodide detector).

Due to the long decay time since operation, no detectable releases of Iodines have been found. An arbitrary 1 microcurie of each nuclide found during operation has been reported.

c. Particulates:

Filter papers are removed from the stack sampling system weekly and gross beta counted. An arbitrary 1 microcurie has been reported for Ba-La140 and Sr89 due to the long decay time since operation.

Selected filters for each quarter are decay counted to determine other particulates (long-lived), alpha emitters, and analyzed for Sr90.

d. Liquid Effluents:

Waste receiver tank and waste hold tank batch samples were gamma spectrum analyzed and gross Beta and gross Gamma counted. The nuclides identified account for the gross gamma and the gross beta count.

Laundry waste tanks are individually analyzed only by gross beta and gross gamma counting, and based on the mixture determined above.

A quarterly composite of all batches is analyzed for Tritium and Sr90.

5. Batch Releases

a. Liquid:

1) Number of batch releases: 27 (A total of 4,411 gallons of laundry waste and 48,050 gallons of treated waste tank discharge)

2) Total time period for batch releases: 37 hours, 24 minutes

3) Maximum time period for a batch release: 5 hours, 20 minutes

4) Average time period for batch releases: 1 hour, 23 minutes

5) Minimum time period for a batch release: 10 minutes

6) Average stream flow during periods of release of effluent into a flowing stream: Not Applicable; Discharge is into Humboldt Bay.

b. Gaseous: None

6. Abnormal Releases

a. Liquid:

1) Number of releases: None

2) Total activity released: None

b. Gaseous:

1) Number of releases: None

2) Total activity released: None

B. GASEOUS EFFLUENTS

The monitoring systems associated with the emergency condenser and liquid radwaste system vents to atmosphere indicate that no detectable releases of radioactive gases occurred during the report period. Therefore, only gaseous radioactive waste releases made via the 250 foot stack are reported.

Table 1A summarizes the total quantities of radioactive effluents released by quarter. Table 1B summarizes the total quantities for each of the nuclides determined to be released.

C. LIQUID EFFLUENTS

The activity in each batch of liquid radioactive waste was either in solution at the time of discharge or the batch was filtered prior to discharge. Analysis of weekly composite samples from the plant effluent canal and monitoring by the liquid waste discharge monitor confirmed that no unaccounted release of radioactive waste occurred during the report period.

Table 2A summarizes the total quantities of radioactive effluents released by quarter. Table 2B summarizes the total quantity for each of the nuclides determined to be released.

D. SOLID WASTE

During the report period, a total of 82.01 cubic meters of evaporator bottoms (solidified with Urea Formaldehyde), totaling 69.5 Curies, was shipped. Table D1 summarizes these radioactive waste shipments.

E. ENVIRONMENTAL MONITORING

The environmental monitoring program was continued unchanged during this period. Quarterly reports, "Environmental Radiation Study in the Vicinity of Humboldt Bay Power Plant (HBPP), Eureka, California," contain the basic radiologic data collected from the Humboldt Bay Power Plant environs. The most recent reports issued, Nos. 77 and 78, are attached and contain data from the second quarter 1980 and third quarter 1980. Although data collected during the fourth quarter have not been issued in report form, the dosimeter data from this period was included in the analysis detailed below. The quarterly reports describe the sampling locations, total number of samples of each media sampled, and the measured radioactivity concentration in the samples. The types of media sampled are marine flora, fish, and invertebrates; bottom sediment; milk; air particulate; and external radiation exposure measured by ion chambers.

Plant releases continued to be much lower than when the plant last operated. The calculated potential public exposures due to the plant releases were very low at that time. Therefore, potential exposure calculations were determined only from the dosimetry data.

There are currently 30 dosimetry stations (Figure 1E) in the vicinity of the plant. Ionization chambers, read on a biweekly basis, are used for dosimetry. Stations 2 and 5 are considered to be background in that they are assumed to be completely removed from the influence of the plant.

In order to test for statistically significant difference between stations, two statistical tests (a two-way classification, and a 95% confidence limit least significant difference test) were made using biweekly dosimeter readings for each station. The exposure extrapolated to one year for the background stations, Stations 2 and 5, was 78.6 milliroentgens per year (mR/yr). Two stations were found to be statistically higher than this background value. These stations and their extrapolated yearly exposures are as follows: Station 16, 100.3 and Station 27, 90.6. The extrapolated exposure measured at the stations ranged from a high of 100.3 mR/yr at Station 16 to a low of 71.0 mR/yr at Station 6.

F. METEOROLOGICAL DATA

Wind speed and direction and temperature differential are presently recorded on strip charts, but the meteorological data logging system was removed from service in 1967. Therefore, the information specified by Regulatory Guide 1.21, Appendix B, Section F, is not readily available for this report period.

Table F1 summarizes the cumulative joint frequency distribution of wind speed, wind direction, and atmospheric stability for the period April, 1962 through June, 1967 when the meteorological data logging system was in service.

TABLE B1

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1980

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Third Quarter	Fourth Quarter	Est. Total Error %
A. Fission & activation gases				
1. Total release	Ci	LT 1.1E-5	LT 1.1E-5	2.00E1
2. Average release rate for period	µCi/sec	LT 1.40E-6	LT 1.40E-6	
3. Percent of Technical Specification limit	%	LT 2.80E-9	LT2.80E-9	
B. Iodines				
1. Total iodine-131	Ci	LT 1.00E-6	LT 1.00E-6	1.50E1
2. Average release rate for period (I-131)	µCi/sec	LT 1.27E-7	LT 1.27E-7	
3. Percent of Technical Specification limit	%	LT7.06E-5	LT7.06E-5	
C. Particulates				
1. Particulates with half-lives >8 days	Ci	9.62E-5	2.27E-4	1.50E1
2. Average release rate for period	µCi/sec	1.21E-5	2.89E-5	
3. Percent of Technical Specification limit	%	6.72E-3	1.60E-2	
4. Gross alpha radioactivity	Ci	LT 5.33E-7	LT 1.39E-7	
D. Tritium				
1. Total release	Ci	LT 1.00E-2	LT 1.00E-2	5.00E1
2. Average release rate for period	µCi/sec	LT 1.27E-3	LT 1.27E-3	

TABLE B2

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1980

GASEOUS EFFLUENTS - ELEVATED RELEASE

Continuous Mode

Nuclides Released	Unit	Third Quarter	Fourth Quarter
1. Fission gases			
krypton-83M	Ci	LT1.00E-6**	LT1.00E-6**
krypton-89	Ci	LT1.00E-6**	LT1.00E-6**
krypton-85M	Ci	LT1.00E-6**	LT1.00E-6**
krypton-87	Ci	LT1.00E-6**	LT1.00E-6**
krypton-88	Ci	LT1.00E-6**	LT1.00E-6**
xenon-133	Ci	LT1.00E-6**	LT1.00E-6**
xenon-135	Ci	LT1.00E-6**	LT1.00E-6**
xenon-135m	Ci	LT1.00E-6**	LT1.00E-6**
xenon-138	Ci	LT1.00E-6**	LT1.00E-6**
xenon-137	Ci	LT1.00E-6**	LT1.00E-6**
xenon-133m	Ci	LT1.00E-6**	LT1.00E-6**
Total for period	Ci	LT 1.10E-5	LT 1.10E-5
2. Iodines			
iodine-131	Ci	LT1.00E-6**	LT1.00E-6**
iodine-133	Ci	LT1.00E-6**	LT1.00E-6**
iodine-135	Ci	LT1.00E-6**	LT1.00E-6**
Total for period	Ci	LT3.00E-6	LT3.00E-6
3. Particulates			
strontium-89	Ci	LT1.00E-6**	LT1.00E-6**
strontium-90	Ci	6.93E-7	3.92E-7
cesium-134	Ci	LT4.00E-6*	LT2.00E-6*
cesium-137	Ci	3.37E-5	1.58E-5
barium-lanthanum-140	Ci	LT1.00E-6**	LT1.00E-6**
cobalt-60	Ci	4.58E-5	1.67E-4
manganese-54	Ci	LT5.00E-6*	LT2.00E-5*
cerium-144	Ci	LT5.00E-6*	LT2.00E-5*

* The minimum sensitivity of the plant spectrometer system for a particular nuclide depends upon the mixture of nuclides present in each batch, therefore, some nuclides not detected could be present at level comparable to those detected. Those nuclides expected to be present, but not detected, are reported "Less Than" (LT) typical quarter Curie maximum quantities.

** No release was detected due to the decay time since the Unit was shutdown on July 2, 1976. Quantities reported are an arbitrary 1 micro-curie.

TABLE C1

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1980

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Third Quarter	Fourth Quarter	Est. Total Error %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	4.02E-2	3.50E-2	1.50E1
2. Average diluted concentration during period	µCi/ml	1.59E-9	1.39E-9	
3. Percent of applicable limit	%	7.26E-3	7.24E-3	
B. Tritium				
1. Total release	Ci	5.67E-2	3.70E-2	4.00E0
2. Average diluted concentration during period	µCi/ml	2.24E-9	1.46E-9	
3. Percent of applicable limit	%	7.47E-5	4.97E-5	
C. Dissolved and entrained gases				
1. Total release	Ci	LT2.00E-6	LT2.00E-6	5.00E1
D. Gross alpha radioactivity				
1. Total release	Ci	LT2.34E-5	LT2.34E-5	7.50E1
E. Volume of waste released (prior to dilution)	liter	4.32E4	1.55E5	5.00E0
F. Volume of dilution water used during period	liter	2.53E10	2.53E10	5.00E0

TABLE C2

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1980

LIQUID EFFLUENTS

Batch mode

Nuclides Released	Unit	Third Quarter	Fourth Quarter
strontium-89	Ci	LT1.00E-6**	LT1.00E-6**
strontium-90	Ci	5.40E-7	2.57E-6
cesium-134		2.33E-3	1.98E-3
cesium-137		2.44E-2	2.76E-2
iodine-131		LT1.00E-6**	LT1.00E-6**
cobalt-58	Ci	LT1.00E-6**	LT1.00E-6**
cobalt-60	Ci	1.06E-2	4.04E-3
zinc-65	Ci	LT1.00E-3*	LT4.00E-5*
manganese-54	Ci	9.67E-4	3.50E-5
chromium-51	Ci	LT1.00E-6**	LT1.00E-6**
zirconium-niobium-95	Ci	LT1.00E-6**	LT1.00E-6**
molybdenum-99	Ci	LT1.00E-6**	LT1.00E-6**
technetium-99m	Ci	LT1.00E-6**	LT1.00E-6**
barium-lanthanum-140	Ci	LT1.00E-6**	LT1.00E-6**
cerium-144	Ci	8.93E-4	1.34E-3
neptunium-239	Ci	LT1.00E-6**	LT1.00E-6**
Total for period (above)	Ci	4.02E-2	3.50E-2
xenon-133	Ci	LT1.00E-6**	LT1.00E-6**
xenon-135	Ci	LT1.00E-6**	LT1.00E-6**

* The minimum sensitivity of the plant's spectrometer system for a particular nuclide depends upon the mixture of nuclides present in each batch, therefore, some nuclides not detected could be present at levels comparable to those detected. Those nuclides expected to be present, but not detected, are reported "Less Than" (LT) typical quarter Curie maximum quantities.

** No release was detected due to the decay time since the unit was shutdown on July 2, 1976. Quantities reported are an arbitrary 1 micro-curie.

TABLE D1

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT

SECOND HALF OF 1980

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. Solid Waste Shipped Offsite for Burial or Disposal (not irradiated fuel)

1. Type of Waste	Unit	Quantity	Est. Total Error %
a. Solidified evaporator bottoms and solidified demineralizer resins	m^3	8.20E1	1.0 E1
	Ci	6.95E1	2.5 E1
b. Dry compressible waste, contaminated equip., etc.	m^3	None	-
	Ci	-	-

2. Estimate of major nuclide composition (by type of waste)

a.	Cesium-134	%	6.61E0
	Cesium-137	%	8.83E1
	Unidentified Mixed Fission Products	%	3.94E0
	Cobalt-60	%	1.07E0
	Manganese-54	%	5.61E-2
b.	Cesium-134	%	-
	Cesium-137	%	-
	Unidentified Mixed Fission Products	%	-
	Cobalt-60	%	-
	Manganese-54	%	-

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
9	Truck (Sole Use)	Richland, Washington

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation
None	-

TABLE F1

PERCENT OF PERIOD AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: April, 1962 through June 1967

STABILITY CLASS: C

ELEVATION: 250 feet

Wind Direction(°)	Wind Speed (mph) at 76m Level						
	0-3	4-7	8-12	13-18	19-24	>24	Total[1]
0.	0.02	0.06	0.05	0.03	0.02	0.01	0.20
10.00	0.02	0.03	0.04	0.03	0.01	0.00	0.13
20.00	0.03	0.03	0.01	0.01	0.00	0.00	0.08
30.00	0.02	0.02	0.00	0.00	0.00	0.00	0.04
40.00	0.00	0.01	0.00	0.01	0.00	0.00	0.02
50.00	0.01	0.01	0.00	0.00	0.00	0.00	0.02
60.00	0.01	0.01	0.00	0.00	0.00	0.00	0.03
70.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01
90.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
120.00	0.01	0.01	0.01	0.00	0.00	0.00	0.03
130.00	0.01	0.01	0.00	0.01	0.00	0.00	0.03
140.00	0.00	0.01	0.01	0.00	0.01	0.00	0.02
150.00	0.00	0.01	0.01	0.02	0.01	0.00	0.06
160.00	0.00	0.01	0.01	0.01	0.01	0.00	0.04
170.00	0.00	0.00	0.02	0.02	0.01	0.01	0.07
180.00	0.00	0.01	0.02	0.02	0.00	0.00	0.05
190.00	0.01	0.01	0.01	0.01	0.01	0.00	0.04
200.00	0.00	0.02	0.02	0.02	0.00	0.01	0.09
210.00	0.02	0.03	0.06	0.02	0.01	0.00	0.13
220.00	0.01	0.02	0.08	0.04	0.03	0.02	0.19
230.00	0.01	0.06	0.12	0.14	0.05	0.02	0.39
240.00	0.01	0.09	0.22	0.15	0.02	0.03	0.51
250.00	0.02	0.18	0.26	0.10	0.02	0.00	0.58
260.00	0.02	0.13	0.24	0.04	0.01	0.00	0.44
270.00	0.02	0.16	0.22	0.02	0.01	0.00	0.42
280.00	0.02	0.13	0.11	0.01	0.00	0.00	0.27
290.00	0.02	0.10	0.10	0.01	0.01	0.00	0.24
300.00	0.01	0.09	0.06	0.00	0.00	0.00	0.15
310.00	0.01	0.04	0.06	0.01	0.00	0.00	0.12
320.00	0.01	0.03	0.05	0.01	0.01	0.01	0.12
330.00	0.01	0.03	0.03	0.01	0.02	0.01	0.11
340.00	0.01	0.04	0.04	0.03	0.02	0.01	0.15
350.00	0.01	0.02	0.06	0.07	0.05	0.01	0.22

[1] Rows may not sum to exact total due to rounding off.

TABLE F1 (cont)

PERCENT OF PERIOD AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: April 1962 through June 1967

STABILITY CLASS: D

ELEVATION: 250 feet

Wind Direction	Wind Speed (mph) at 76m Level 0-3	4-7	8-12	13-18	19-24	>24	Tota
0.00	0.11	0.34	0.78	0.85	0.49	0.48	3.05
10.00	0.04	0.27	0.52	0.46	0.38	0.27	1.95
20.00	0.05	0.21	0.32	0.19	0.16	0.11	1.04
30.00	0.06	0.20	0.16	0.08	0.03	0.04	0.58
40.00	0.05	0.11	0.05	0.02	0.00	0.01	0.23
50.00	0.03	0.05	0.08	0.00	0.01	0.00	0.16
60.00	0.04	0.08	0.04	0.00	0.00	0.00	0.15
70.00	0.04	0.02	0.01	0.01	0.00	0.00	0.08
80.00	0.02	0.04	0.00	0.01	0.00	0.00	0.07
90.00	0.01	0.04	0.03	0.00	0.00	0.00	0.09
100.00	0.02	0.01	0.02	0.00	0.00	0.00	0.05
110.00	0.00	0.03	0.01	0.01	0.01	0.00	0.06
120.00	0.02	0.03	0.03	0.02	0.01	0.00	0.11
130.00	0.01	0.03	0.02	0.02	0.01	0.00	0.10
140.00	0.02	0.03	0.02	0.04	0.01	0.01	0.13
150.00	0.03	0.03	0.03	0.09	0.03	0.02	0.23
160.00	0.01	0.04	0.05	0.10	0.04	0.01	0.26
170.00	0.02	0.05	0.12	0.16	0.04	0.01	0.40
180.00	0.04	0.08	0.12	0.13	0.03	0.01	0.40
190.00	0.02	0.07	0.09	0.06	0.03	0.02	0.28
200.00	0.05	0.10	0.17	0.11	0.02	0.01	0.46
210.00	0.05	0.12	0.20	0.08	0.04	0.01	0.51
220.00	0.05	0.14	0.14	0.12	0.05	0.02	0.51
230.00	0.03	0.14	0.17	0.11	0.06	0.02	0.53
240.00	0.08	0.22	0.21	0.06	0.03	0.01	0.61
250.00	0.08	0.17	0.13	0.04	0.01	0.00	0.43
260.00	0.08	0.22	0.13	0.02	0.01	0.00	0.47
270.00	0.12	0.21	0.11	0.03	0.01	0.00	0.49
280.00	0.05	0.20	0.11	0.04	0.00	0.00	0.40
290.00	0.04	0.22	0.11	0.02	0.00	0.00	0.39
300.00	0.10	0.21	0.20	0.02	0.01	0.00	0.53
310.00	0.08	0.28	0.19	0.03	0.02	0.01	0.60
320.00	0.07	0.25	0.33	0.09	0.04	0.01	0.80
330.00	0.06	0.21	0.35	0.16	0.09	0.03	0.90
340.00	0.07	0.24	0.50	0.47	0.17	0.08	1.53
350.00	0.07	0.30	0.82	0.86	0.49	0.33	2.87

TABLE F1 (cont)

PERCENT OF PERIOD AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: April 1962 through June 1967

STABILITY CLASS: E

ELEVATION: 250 feet

Wind Direction	Wind Speed (mph) at 76m Level						
	0-3	4-7	8-12	13-18	19-24	>24	Total
0.00	1.04	1.06	2.00	1.84	0.82	0.10	6.86
10.00	0.17	0.80	1.55	0.90	0.36	0.10	3.78
20.00	0.30	0.83	1.26	0.47	0.13	0.00	2.99
30.00	0.37	0.73	0.64	0.19	0.01	0.00	1.94
40.00	0.21	0.60	0.47	0.02	0.00	0.00	1.31
50.00	0.18	0.56	0.28	0.02	0.00	0.00	1.05
60.00	0.21	0.54	0.19	0.00	0.00	0.00	0.93
70.00	0.19	0.44	0.07	0.00	0.00	0.00	0.81
80.00	0.20	0.41	0.07	0.00	0.00	0.00	0.68
90.00	0.27	0.47	0.17	0.01	0.00	0.00	0.82
100.00	0.17	0.24	0.06	0.01	0.00	0.00	0.49
110.00	0.20	0.31	0.10	0.00	0.00	0.00	0.60
120.00	0.18	0.31	0.19	0.01	0.02	0.00	0.70
130.00	0.14	0.25	0.09	0.08	0.03	0.03	0.72
140.00	0.09	0.22	0.21	0.23	0.22	0.25	1.21
150.00	0.09	0.24	0.22	0.45	0.52	0.46	2.08
160.00	0.05	0.22	0.25	0.62	0.44	0.21	1.79
170.00	0.04	0.26	0.43	0.73	0.23	0.09	1.89
180.00	0.26	0.32	0.45	0.43	0.20	0.02	1.77
190.00	0.15	0.26	0.37	0.35	0.15	0.02	1.20
200.00	0.22	0.48	0.47	0.26	0.18	0.06	1.77
210.00	0.20	0.44	0.58	0.18	0.05	0.04	1.60
220.00	0.20	0.40	0.55	0.15	0.14	0.03	1.37
230.00	0.23	0.43	0.40	0.14	0.13	0.05	1.39
240.00	0.24	0.39	0.23	0.15	0.13	0.01	1.24
250.00	0.21	0.32	0.16	0.03	0.01	0.01	0.84
260.00	0.24	0.31	0.17	0.03	0.00	0.00	0.85
270.00	0.35	0.35	0.13	0.12	0.01	0.00	0.97
280.00	0.19	0.30	0.15	0.01	0.01	0.01	0.67
290.00	0.19	0.33	0.17	0.01	0.01	0.01	0.81
300.00	0.21	0.37	0.16	0.01	0.00	0.01	0.88
310.00	0.20	0.47	0.29	0.02	0.00	0.00	0.98
320.00	0.20	0.59	0.65	0.12	0.01	0.05	1.72
330.00	0.22	0.87	0.98	0.35	0.02	0.02	2.45
340.00	0.20	0.88	1.55	0.74	0.01	0.00	3.48
350.00	0.19	1.02	2.02	1.41	0.55	0.13	5.22

TABLE F1

PERCENT OF PERIOD AT EACH WIND SPEED AND DIRECTION

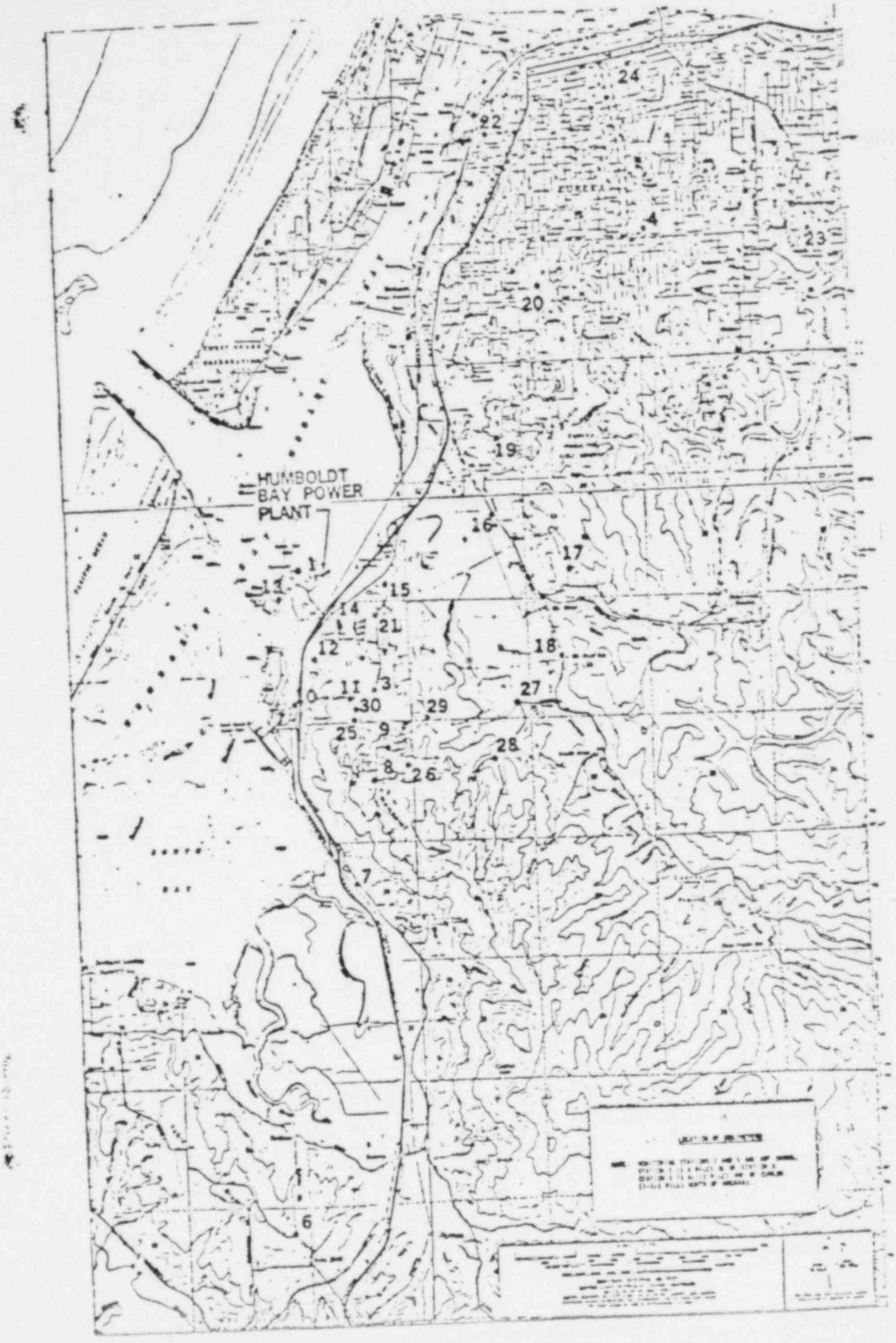
PERIOD OF RECORD: April 1962 through June 1967

STABILITY CLASS: F

ELEVATION: 250 feet

Wind Direction	Wind Speed (mph) at 76m Level						
	0-3	4-7	8-12	13-18	19-24	>24	Total
0.00	0.42	0.08	0.03	0.00	0.00	0.00	0.53
10.00	0.05	0.06	0.05	0.01	0.00	0.00	0.18
20.00	0.05	0.09	0.08	0.03	0.00	0.00	0.24
30.00	0.1[illegible]	0.11	0.10	0.04	0.00	0.00	0.37
40.00	0.0[illegible]	0.13	0.10	0.03	0.01	0.00	0.34
50.00	0.0[illegible]	0.13	0.06	0.00	0.00	0.00	0.27
60.00	0.1[illegible]	0.19	0.07	0.01	0.00	0.00	0.40
70.00	0.11	0.22	0.08	0.00	0.00	0.00	0.40
80.00	0.1[illegible]	0.22	0.07	0.00	0.00	0.00	0.39
90.00	0.14	0.25	0.07	0.00	0.00	0.00	0.46
100.00	0.11	0.29	0.09	0.01	0.01	0.00	0.51
110.00	0.13	0.31	0.13	0.02	0.00	0.00	0.59
120.00	0.15	0.33	0.18	0.03	0.00	0.00	0.69
130.00	0.10	0.23	0.14	0.02	0.00	0.00	0.50
140.00	0.10	0.22	0.11	0.09	0.02	0.00	0.54
150.00	0.12	0.19	0.10	0.07	0.03	0.02	0.52
160.00	0.08	0.15	0.16	0.08	0.01	0.00	0.47
170.00	0.07	0.15	0.14	0.07	0.00	0.00	0.43
180.00	0.16	0.26	0.13	0.02	0.00	0.00	0.56
190.00	0.12	0.18	0.13	0.02	0.00	0.01	0.46
200.00	0.13	0.25	0.18	0.02	0.00	0.00	0.58
210.00	0.18	0.32	0.20	0.02	0.00	0.01	0.73
220.00	0.14	0.28	0.09	0.02	0.00	0.00	0.54
230.00	0.18	0.24	0.07	0.01	0.01	0.00	0.50
240.00	0.19	0.19	0.05	0.02	0.00	0.00	0.45
250.00	0.15	0.16	0.01	0.00	0.00	0.00	0.32
260.00	0.17	0.10	0.01	0.00	0.00	0.00	0.29
270.00	0.18	0.09	0.01	0.00	0.00	0.00	0.28
280.00	0.10	0.04	0.01	0.00	0.00	0.00	0.15
290.00	0.11	0.05	0.01	0.00	0.00	0.00	0.16
300.00	0.13	0.07	0.00	0.00	0.00	0.00	0.19
310.00	0.07	0.05	0.01	0.00	0.00	0.00	0.13
320.00	0.09	0.05	0.03	0.00	0.00	0.00	0.17
330.00	0.09	0.09	0.01	0.00	0.00	0.00	0.19
340.00	0.06	0.10	0.03	0.01	0.00	0.00	0.20
350.00	0.07	0.09	0.05	0.01	0.00	0.00	0.21

FIGURE 1E


HUMBOLDT
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Report Issued: NOV - 4 1980

Report 420-80.165

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 77
ENVIRONMENTAL RADIATION STUDY IN THE VICINITY OF HUMBOLDT BAY POWER PLANT EUREKA, CALIFORNIA
QUARTER ENDING JUNE 30, 1980
(SPRING)

R. F. CAYOT, Chief

Report Prepared By:

D. L. Brownrigg
P. A. Szalinski

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SUMMARY

Measurements of radioactivity in marine and terrestrial samples and in air particulates from the environment near the Humboldt Bay Power Plant during this quarter generally remained within the range of preoperational background measurements. The maximum integrated dose measured was well below the permissible contribution of 500 mrem/year in unrestricted areas.

INTRODUCTION

This is the 77th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period April through June 1980. This report contains information on the samples collected, methods and results of radiochemical analyses, a discussion of the results, and also information about the "Releases of Gaseous Radioactive Waste" supplied by the Department of Steam Generation. Information on the release of liquid radioactive waste from HBPP is reported elsewhere.[1*]

SAMPLE COLLECTIONS AND ANALYSES

Air particulate filters, dosimeters, film packs, and 15 marine and terrestrial samples were collected for this report in accordance with the requirements of the North Coast Regional Water Quality Control Board[2,3] and the Department of Health.[4] A table of the samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix.

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*See reference page.

Forty gross beta analyses, two iodine-131 analyses, and 15 gamma scans were performed for this report. The results are tabulated in the Appendix. All samples except the dosimeters and film packs were analyzed at the Department of Engineering Research (DER). Dosimeters were read by HBPP personnel. Film packs were read by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, radioactivity concentration levels comparable to preoperational activity levels of similar samples.[5]

During the preceding 52-week period, the maximum integrated radiation exposure was measured at Station 27. The total annual exposure at Station 27 was approximately 20.9 mR above background measured at Stations 2 and 5.

Figure 3 is a chronological display of dosimeter and film pack radiation exposures per month at Station 14 and the air particulate activity at Station 3 from January 1976 through this quarter. Reports 37, 55, and 75 contain graphs from previous years.

RELEASES OF GASEOUS RADIOACTIVE WASTE

The routine releases of gaseous radioactive wastes have been monitored by the air ejector off-gas and stack-gas monitoring systems. The calibration of these monitors for noble and activated gases has been checked by periodic analyses of "grab" samples on a multichannel gamma scintillation spectrometer. The refueling, maintenance, and station modification outage which started in July 1976, continued through this quarter; therefore, airborne releases were insignificant.

REFERENCES

1. Quarterly report to Regional Water Quality Control Board on Liquid Waste Discharge from Humboldt Bay Power Plant.

2. Letter from North Coastal Regional Water Quality Control Board to PGandE, Attn: F. F. Mautz, concerning modifications to waste discharge and environmental radiation monitoring requirements, dated May 7, 1965.

3. Letter from North Coastal Regional Water Quality Control Board to PGandE, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.

4. Department of Public Health letter to PGandE, Attn: Mr. P. Matthew, concerning modifications to environmental radiation monitoring requirements, dated June 17, 1966.

5. Environmental Radiation in the Vicinity of Humboldt Bay Power Plant, Reports 1-8.

6. Code of Federal Regulations, Title 10, Para. 20.105.

APPENDIX

METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. PGandE Humboldt Division personnel collect the remainder of the samples.

Marine and terrestrial samples are processed quarterly at DER. Samples are freeze-dried prior to determining gross beta activity. The gross beta analysis is performed on low background, thin window, gas flow proportional counters; the limit of detectability is about 0.5 pCi/gm of a standard containing K-40. Activities are reported both per gram of the dry and per gram of the original sample.

The freeze-dried samples and domestic water are gamma scanned, using a Ge(Li) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 5 pCi/l of water solution containing a single radionuclide.

Radioiodine analyses are performed on milk samples within eight days of collection. Following addition of stable iodine to the raw milk to determine chemical recovery, iodine is separated from the milk by using anion ion exchange resin. Iodine is stripped from the resin and after purification is precipitated as cuprous iodide for measurements by beta-gamma coincidence counting. The detection limit attained by this method is typically 0.2 pCi/liter for I-131.

The potassium content of most of the freeze-dried samples is measured by flame photometry in order to estimate the K-40 contribution to the gross activities. The range of concentrations used is one to ten ppm; the

standard deviation in the concentration units (Gaussian) is about 12 percent at the 5 ppm level. Using the factor of 830 pCi/g K, the activity of K-40 in a sample is calculated.

The tritium (H-3) activity in domestic water is determined by analyzing a distilled aliquot of the sample with a liquid scintillation spectrometer. The limit of detection for this analysis is typically 0.2 pCi/ml of water.

The airborne particulate samplers are located at Stations 3 and 45 (Figure 1). The constant flow samplers have flow rate in the range of 30 to 40 lpm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. The filters are counted to determine gross beta activity at least 72 hours after collection to allow for naturally occurring short-lived radionuclides to decay.

Gamma dosimetry is performed with two ion chambers (Victoreen, Model 239) and a film pack located at each of the 30 stations shown in Figure 2. The ion chambers are read in the field by HBPP personnel on a biweekly basis. The lower of the two readings is normally reported since the dosimeters normally read high on failure. The Radiation Detection Company (RDC), Sunnyvale, California, supplies and reads the film packs. RDC reports film pack doses relative to "background" at the RDC laboratory, which consistently is 8 mR/month.

The $\pm$ term in the following tables is the two-sigma error; i.e., the 95 percent confidence level.

TABLE 1

SAMPLES COLLECTED

Station	Marine Flora	Verte-brates	Clams & Oysters	Other Invert.	Bottom Sedim.	Terres-trial	Air Partic.	Dosi-meters	Film Packs
1 K. Salmon Picnic Area						2		6	3
2 1742 Wood, Fortuna								6	3
3 Humboldt Hill (HH) Rd							12	6	3
4 Wood & K, Eureka								6	3
5 Redwood Ave, Arcata						1		6	3
6 Table Bluff & Clough								6	3
7 Col. of the Redwds								6	3
8 Hmblt Hl Rd								6	3
9 Harbor View								6	3
10 E St., Field Lndg								6	3
11 Whittier Ct								6	3
12 Bell Hill Rd, HH								6	3
13 Crab St, Buhne Pt								6	3
14 South Bay School								6	3
15 Eich Rd								6	3
16 Bennett Dairy						1		6	3
17 Bassford Rd, Ridgewd								6	3
18 6418 Elk River Rd								6	3
19 Noe St								6	3
20 3537 Union St								6	3
21 PG&E Well 2, HH Rd								6	3
22 Sta B - 14th St								6	3
23 Harris St. Substa.								6	3
24 PG&E Office, Eureka								6	3
25 Irving Dr								6	3
26 Worthington Dr								6	3
27 Berta Road, 6700								6	3
28 Berta Road, 7200								6	3
29 Vista Rd								6	3
30 Burns Dr							13		
45 Humboldt Substation						1			
48 Holgerson Dairy					1				
55 PG&E Outfall	2				1				
56 1000 ft. N Outfall	2				1				
57 1000 ft. S Outfall	2								
59 Hookton Channel			1						
65 Coast Oyster Co.									

TABLE 2

RADIOANALYSIS OF MARINE SAMPLES

Sample	Description	Collection Date	Beta Counting Date	Gross Activity (pCi/g Dry Sample) Beta	Gross Activity (pCi/g Dry Sample) Gamma[1/]	Potassium Content (mg K/g Dry Sample)	K40 Activity in Potassium (pCi/g Dry Sample)[2/]	Gross Beta Activity (pCi/g Orig. Sample)
55 80320	Sediment[3/]	5/18/80	6/ 6/80	7.29±0.55	134Cs=0.013±0.005 137Cs=0.015±0.004	4.9	4.1	6.05±0.46
56 80318	Red Algae (Gigartina agardhii)	5/18/80	8/ 4/80	12.1±0.87	-	10.0	8.3	2.35±0.17
58 80319	Red Algae[3/] (Iridaea sp.)	5/18/80	6/11/80	8.57±0.65	-	7.1	5.9	1.10±0.08
60	[4/] Fish	-	-	-	-	-	-	-
61 80321	Sediment	5/18/80	6/ 6/80	7.04±0.54	137Cs=0.014±0.008	4.9	4.1	5.93±0.45
62 80323	Red Algae (Gigartina agardhii)	5/18/80	8/ 4/80	14.2±0.99	-	14.4	11.9	2.73±0.19
64 80322	Red Algae (Iridaea sp.)	5/18/80	6/11/80	9.39±0.70	-	8.1	6.7	0.97±0.07
65 80325	Sediment	5/18/80	6/ 6/80	7.39±0.56	137Cs=0.013±0.008	5.0	4.2	7.14±0.54
67 80324	Red Algae (Gigartina agardhii)	5/18/80	8/ 4/80	16.8±1.16	-	17.1	14.2	3.02±0.21
68 80326	Red Algae (Iridaea sp.)	5/18/80	7/31/80	8.57±0.66	-	9.0	7.5	0.87±0.07
70	[4/] Pacific Oyster (Crassostrea gigas)	-	-	-	-	-	-	-
71 80327	Gaper Clam[3/] (Tresus capex)	5/17/80	6/11/80	11.2±0.81	137Cs=0.052±0.009	4.3	3.6	1.83±0.13

[1/] ...tivity at time of sampling. Naturally occurring radioisotopes are not reported.
[2/] ... K40 activity of 830 pCi/gm natural potassium.
[3/] ...ples analyzed at DFR then sent to State Department of Health.
[4/] ...ple not collected.

TABLE 3

RADIOANALYSIS OF TERRESTRIAL SAMPLES

Sta	Sample	Description	Collection Date	Beta Counting Date	Gross Activity (pCi/g Dry Sample) Beta	Gross Activity (pCi/g Dry Sample) Gamma[1]	Potassium Content (mg K/g Dry Sample)	K40 Activity in Potassium (pCi/g Dry Sample)[2]	Gross Beta Activity (pCi/g Orig. Sample)
7	80191	Domestic Water[3]	4/ 8/80	5/ 9/80	16.3±1.75	-	-	-	1.42±0.15[5]
1	80316	Soil	5/18/80	6/ 6/80	8.78±0.65	137Cs=0.136±0.014	6.4	5.3	8.62±0.63
5	80317	Soil	5/19/80	6/ 6/80	5.30±0.61	137Cs=0.154±0.013	2.9	2.4	4.01±0.46
16	80190	Milk[6] [4]	4/ 8/80	5/19/80	8.39±0.67	-	8.4	7.0	1120±80[5]
				4/13/80		<0.2			
43	80199	Milk[6] [4]	4/ 7/80	5/19/80	7.33±0.60	-	6.4	6.4	1067±88[5]
				4/14/80		<0.2			

[1] Activity at time of sampling. Naturally occurring radioisotopes are not reported.
[2] For K40 activity of 820 pCi/gm natural potassium.
[3] Sample is evaporated for beta analysis and distilled for H-3 analysis. H-3 activity less than 0.33 pCi/ml.
[4] Iodine-131 activity, pCi/l., at time of sampling.
[5] pCi/l.
[6] Sampled jointly with the State Department of Health.

TABLE 4

DOSIMETER MEASUREMENTS

Period Start:	4/ 1/80	4/16/80	4/29/80	5/13/80	5/28/80	6/10/80	6/26/79	
Period End:	4/16/80	4/29/80	5/13/80	5/28/80	6/10/80	6/24/80	6/24/80	
Elapsed Time, Days:	15	13	14	15	13	14	364	2/
Station	Total mR	Total mR	Total mR	Total mR	Total mR	Total mR	Total mR	
1	3.3	3.0	3.4	3.1	3.2	2.7	78.5	(48)
2	3.0	3.1	2.9	2.7	3.1	2.5	81.0	
3	2.6	3.3	3.0	3.2	2.3	2.5	73.2	
4	2.5	2.9	1.2	2.6	2.5	2.3	68.7	
5	2.5	2.8	2.7	3.0	2.6	2.7	67.5	(46)
6	3.3	2.8	2.7	3.4	2.4	3.0	91.0	
7	3.0	2.4	2.9	2.3	2.6	2.4	71.9	
8	3.2	2.5	3.0	2.8	2.5	2.9	83.6	
9	3.3	2.5	2.9	2.9	2.8	2.6	74.8	(50)
10	2.6	3.6	2.7	1.3	3.2	2.7	78.5	(50)
11	3.2	2.8	3.8	2.4	2.6	2.9	81.2	
12	3.4	3.0	2.5	1.9	2.7	2.5	74.5	
13	2.9	2.8	2.4	2.9	3.2	2.6	75.2	(48)
14	4.7	3.3	4.7	2.2	3.1	2.2	86.1	
15	3.4	3.1	3.0	2.6	2.8	2.3	84.0	(50)
16	3.2	2.6	3.4	2.9	2.5	3.5	86.6	
17	2.7	3.0	2.6	2.8	2.8	2.5	78.2	
18	2.5	2.8	3.8	2.7	2.8	2.6	80.5	
19	3.0	2.9	2.9	2.3	2.0	2.8	75.9	(50)
20	3.6	3.3	2.3	2.9	2.8	2.6	73.0	(44)
21	3.1	2.5	3.4	3.0	2.1	2.7	90.4	
22	2.9	2.6	2.7	1/	2.4	2.9	80.9	(50)
23	4.0	2.8	3.1	3.0	2.4	2.6	89.2	(48)
24	2.6	2.0	3.4	2.7	2.7	2.6	72.7	
25	2.9	3.0	2.7	3.0	2.6	2.5	74.3	
26	2.8	2.9	2.9	2.8	2.7	2.8	68.4	(48)
27	4.1	3.1	3.0	3.4	2.9	2.7	95.7	(50)
28	3.1	2.9	2.5	2.3	2.4	2.2	73.1	
29	3.1	2.5	2.7	2.9	2.7	2.8	76.2	
30	3.0	2.9	2.9	2.8	2.7	2.5	74.1	

1/Both dosimeters read 0 and/or full scale. 2/Weeks of data, if less than 52.

TABLE 5
FILM PACK MEASUREMENTS

Period Start:	3/18/80	4/29/80	5/28/80
Period End:	4/29/80	5/28/80	6/24/80
Elapsed Time, Days:	42	29	27
Station	Total mR 1/	Total mR 1/	Total mR 1/
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	0	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0

1/ Above background of 8 mR/mo.

TABLE 6

AIR PARTICULATE
STATION NO. 3 GROSS BETA ACTIVITY

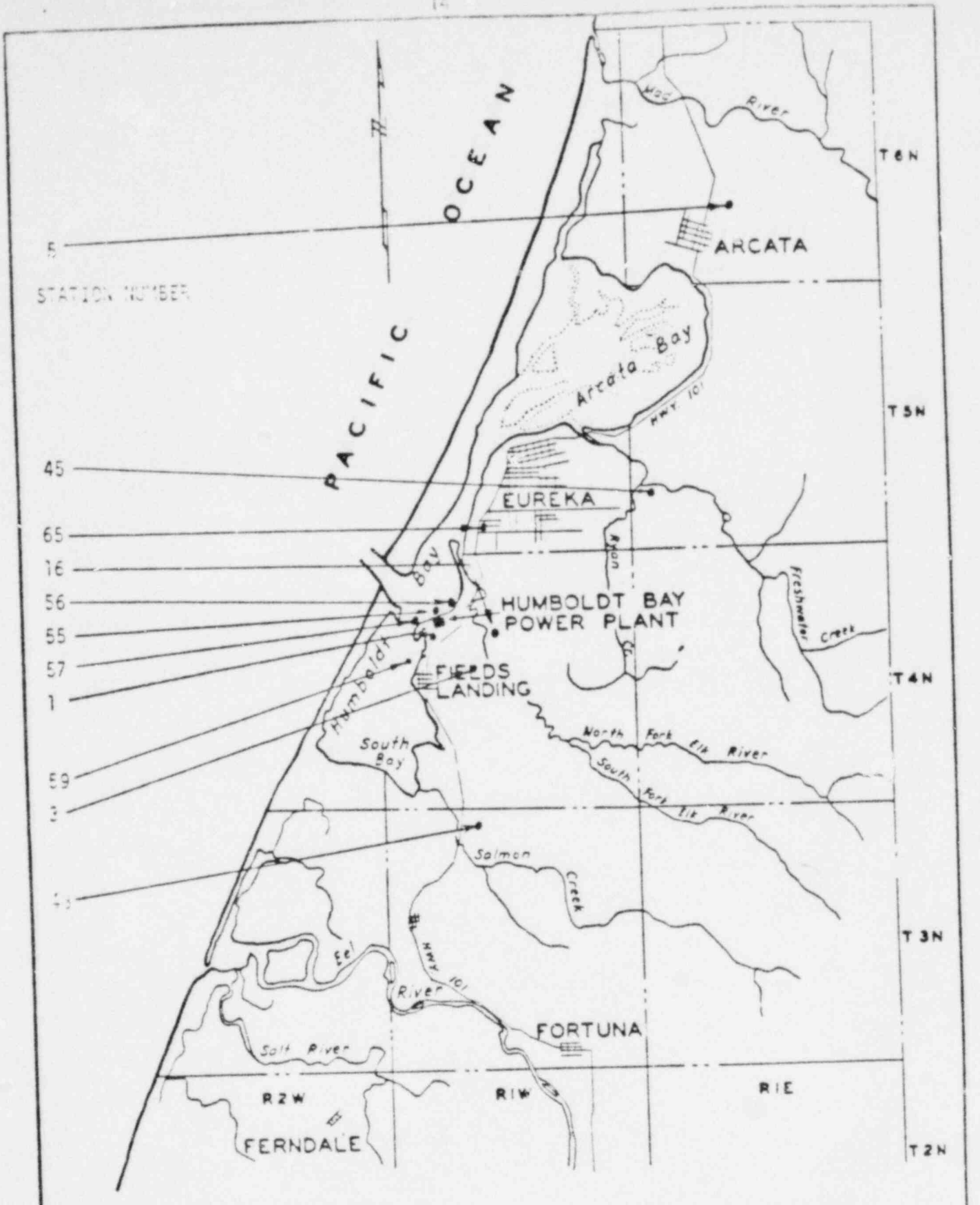
Sample Number	Volume (m**3)	Collection Date	Counting Date	pCi/m**3
80179	285	4/ 8/80	4/14/80	0.026±0.003
80217	326	4/16/80	4/22/80	0.029±0.003
80230	247	4/22/80	4/25/80	0.028±0.003
80246	282	4/29/80	5/14/80	0.032±0.003
80250	285	5/ 6/80	5/14/80	0.029±0.002
80276	294	5/13/80	5/19/80	0.015±0.002
-*	-	5/20/80	-	-
80312	320	5/28/80	6/ 9/80	0.019±0.002
80332	245	6/ 3/80	6/ 9/80	0.019±0.002
80351	293	6/10/80	6/18/80	0.014±0.001
80354	276	6/17/80	6/25/80	0.014±0.001
80385	286	6/24/80	6/30/80	0.018±0.002
80393	292	7/ 1/80	7/ 4/80	0.016±0.002

*Sampler not turned on - no sample collected.

TABLE 7

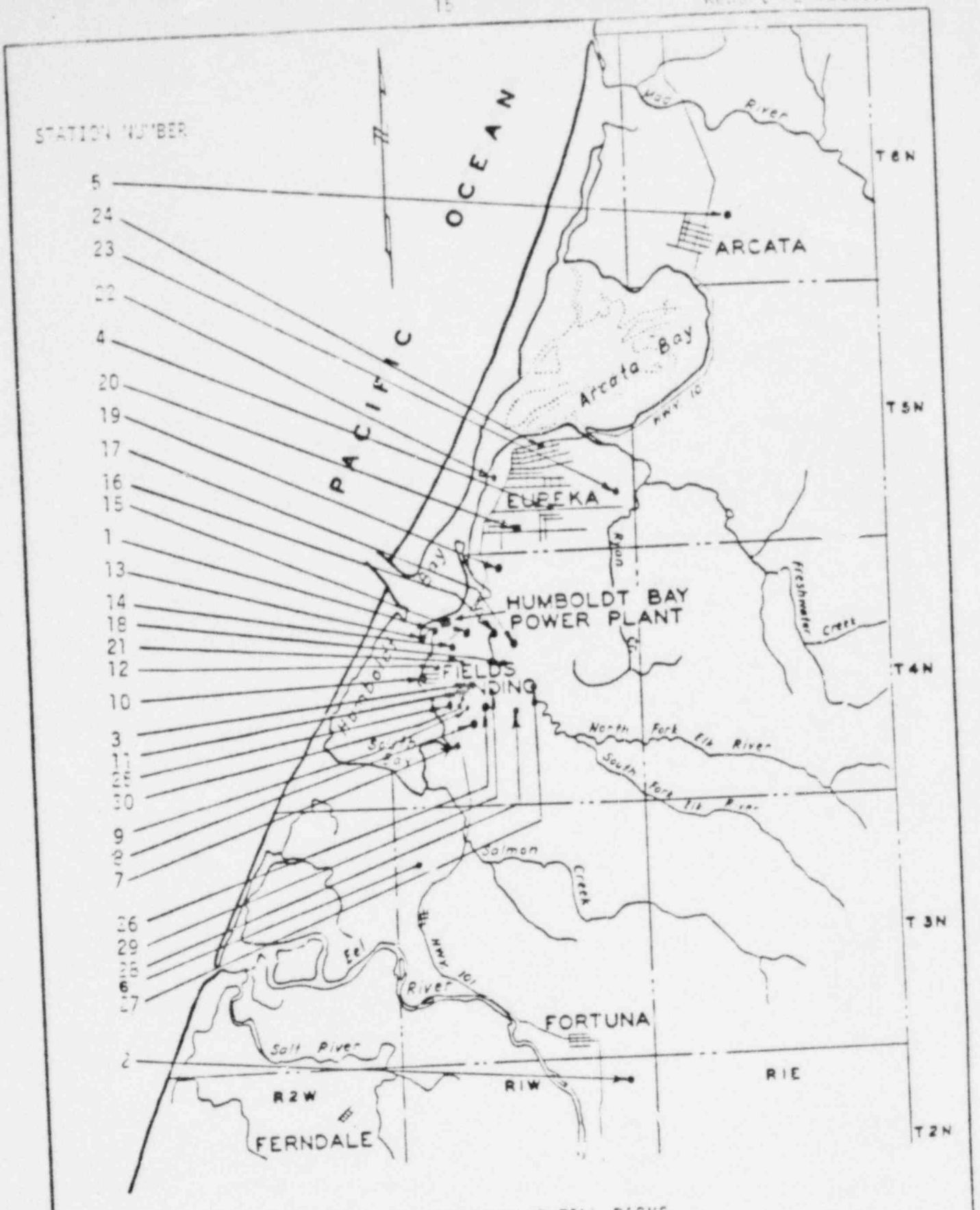
AIR PARTICULATE
STATION NO. 45 GROSS BETA ACTIVITY

Sample Number	Volume (m**3)	Collection Date	Counting Date	pCi/m**3
80198	423	4/ 8/80	4/15/80	0.028±0.002
80218	439	4/15/80	4/22/80	0.032±0.003
80231	377	4/22/80	4/25/80	0.029±0.002
80247	423	4/29/80	5/14/80	0.031±0.002
80251	424	5/ 6/80	5/14/80	0.026±0.002
80277	431	5/13/80	5/19/80	0.016±0.001
80301	473	5/20/80	5/29/80	0.024±0.002
80313	485	5/28/80	6/ 9/80	0.019±0.001
80333	241	6/ 3/80	6/ 9/80	0.029±0.002
80352	434	6/10/80	6/18/80	0.015±0.001
80355	423	6/17/80	6/25/80	0.015±0.001
80386	425	6/24/80	6/30/80	0.020±0.002
80394	429	7/ 1/80	7/ 4/80	0.017±0.001



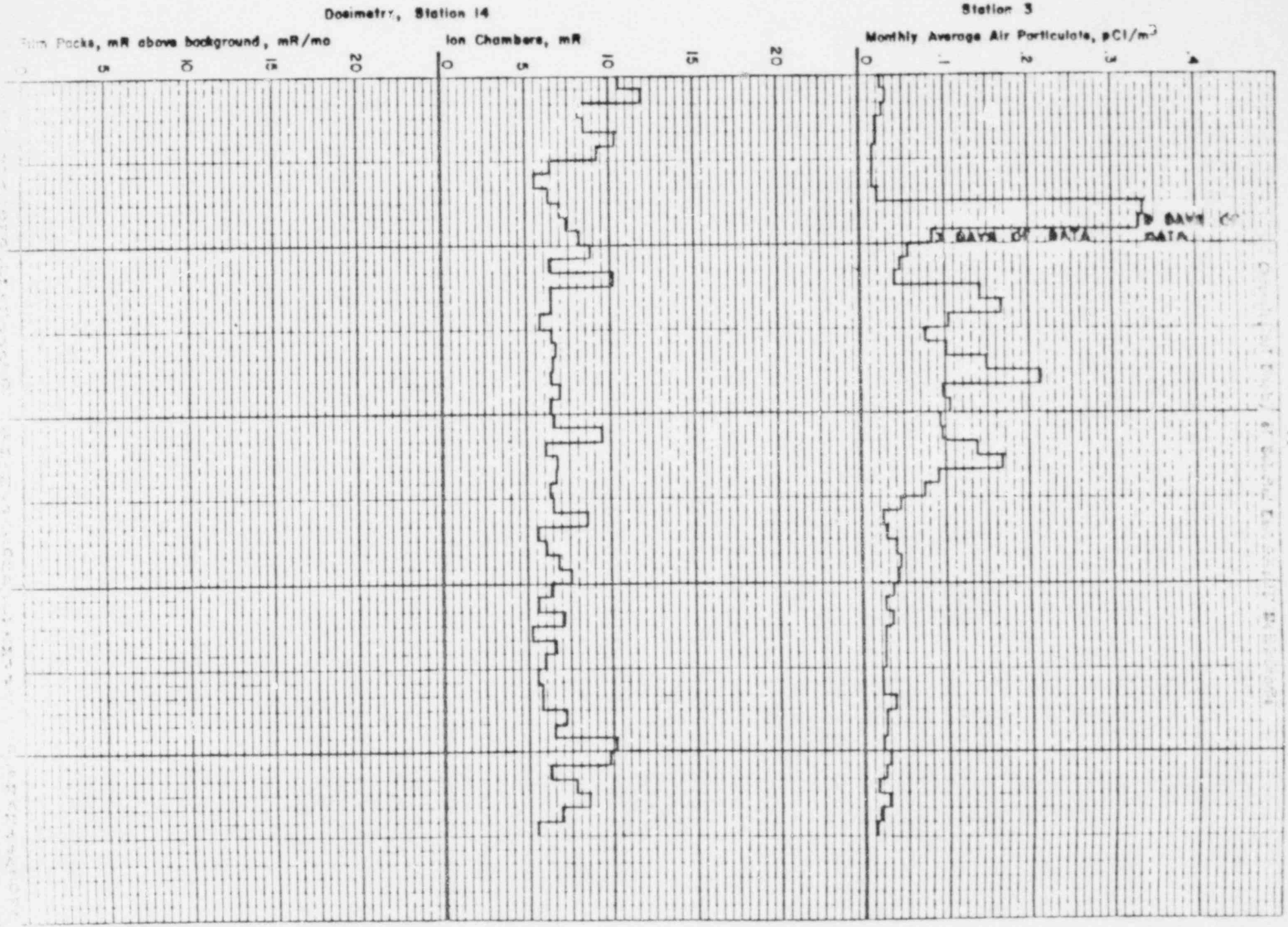
ENVIRONMENTAL SAMPLES
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF HUMBOLDT BAY POWER PLANT
PACIFIC GAS AND ELECTRIC COMPANY

0 1 2 3 4 5 6 MILES



DOSIMETERS & FILM PACKS
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF HUMBOLDT BAY POWER PLANT
PACIFIC GAS AND ELECTRIC COMPANY

0 1 2 3 4 5 6 MILES


Dosimetry, Station 14
Film Packs, mR above background, mR/mo
0
5
10
15
20
Ion Chambers, mR
0
5
10
15
20
Station 3
Monthly Average Air Particulate, pCi/m³
0
1
2
3
4
DAYS OF DATA
DAYS OF DATA

Report Issued: FEB 11 1981

Report 420-80.206

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 78
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING SEPTEMBER 30, 1980
(SUMMER)

R. F. CAGOT, Chief

Report Prepared By:

D. L. Brownrigg
P. A. Szalinski

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SUMMARY

Measurements of radioactivity in marine and terrestrial samples and in air particulates from the environment near the Humboldt Bay Power Plant during this quarter generally remained within the ranges of preoperational background measurements. The maximum integrated dose measured was well below the permissible contribution of 500 mrem/year in unrestricted areas.

INTRODUCTION

This is the 78th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period July through September 1980. This report contains information on the samples collected, methods and results of radiochemical analyses, a discussion of the results, and also information about the "Releases of Gaseous Radioactive Waste" supplied by the Department of Steam Generation. Information on the release of liquid radioactive waste from HBPP is reported elsewhere.[1*]

SAMPLE COLLECTIONS AND ANALYSES

Air particulate filters, dosimeters, film packs, and 15 marine and terrestrial samples were collected for this report in accordance with the requirements of the North Coast Regional Water Quality Control Board[2,3] and the Department of Health.[4] A table of the samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix.

*See reference page.

Forty-one gross beta analyses, two iodine-131 analyses, and 15 gamma scans were performed for this report. The results are tabulated in the Appendix. All samples except the dosimeters and film packs were analyzed at the Department of Engineering Research (DER). Dosimeters were read by HBPP personnel. Film packs were read by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, radioactivity concentration levels comparable to preoperational activity levels of similar samples.[5]

During the preceding 52-week period, the maximum integrated radiation exposure was measured at Station 27. The total annual exposure at Station 27 was approximately 19.1 mR above background measured at Stations 2 and 5.

Figure 3 is a chronological display of dosimeter and film pack radiation exposures per month at Station 14 and the air particulate activity at Station 3 from January 1976 through this quarter. Reports 37, 55, and 75 contain graphs from previous years.

RELEASES OF GASEOUS RADIOACTIVE WASTE

The routine releases of gaseous radioactive wastes have been monitored by the air ejector off-gas and stack-gas monitoring systems. The calibration of these monitors for noble and activated gases has been checked by periodic analyses of "grab" samples on a multichannel gamma scintillation spectrometer. The refueling, maintenance, and station modification outage which started in July 1976, continued through this quarter; therefore, airborne releases were insignificant.

REFERENCES

1. Quarterly report to Regional Water Quality Control Board on Liquid Waste Discharge from Humboldt Bay Power Plant.

2. Letter from North Coastal Regional Water Quality Control Board to PGandE, Attn: F. F. Mautz, concerning modifications to waste discharge and environmental radiation monitoring requirements, dated May 7, 1965.

3. Letter from North Coastal Regional Water Quality Control Board to PGandE, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.

4. Department of Public Health letter to PGandE, Attn: Mr. P. Matthew, concerning modifications to environmental radiation monitoring requirements, dated June 17, 1966.

5. Environmental Radiation in the Vicinity of Humboldt Bay Power Plant, Reports 1-8.

6. Code of Federal Regulations, Title 10, Para. 20.105.

APPENDIX

METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. PGandE Humboldt Division personnel collect the remainder of the samples.

Marine and terrestrial samples are processed quarterly at DER. Samples are freeze-dried prior to determining gross beta activity. The gross beta analysis is performed on low background, thin window, gas flow proportional counters; the limit of detectability is about 0.5 pCi/gm of a standard containing K-40. Activities are reported both per gram of the dry and per gram of the original sample.

The freeze-dried samples and domestic water are gamma scanned, using a Ge(Li) detector or an Intrinsic Germanium detector and a multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 5 pCi/l of water solution containing a single radionuclide.

Radioiodine analyses are performed on milk samples within eight days of collection. Following addition of stable iodine to the raw milk to determine chemical recovery, iodine is separated from the milk by using anion ion exchange resin. Iodine is stripped from the resin and after purification is precipitated as palladous iodide for measurements by beta-gamma coincidence counting. The detection limit attained by this method is typically 0.2 pCi/liter for I-131.

The potassium content of most of the freeze-dried samples is measured by flame photometry in order to estimate the K-40 contribution to the gross activities. The range of concentrations used is one to ten ppm; the

standard deviation in the concentration units (Gaussian) is about 12 percent at the 5 ppm level. Using the factor of 830 pCi/g K, the activity of K-40 in a sample is calculated.

The tritium (H-3) activity in domestic water is determined by analyzing a distilled aliquot of the sample with a liquid scintillation spectrometer. The limit of detection for this analysis is typically 0.2 pCi/ml of water.

The airborne particulate samplers are located at Stations 3 and 45 (Figure 1). The constant flow samplers have flow rate in the range of 30 to 40 lpm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. The filters are counted to determine gross beta activity at least 72 hours after collection to allow for naturally occurring short-lived radionuclides to decay.

Gamma dosimetry is performed with two ion chambers (Victoreen, Model 239) and a film pack located at each of the 30 stations shown in Figure 2. The ion chambers are read in the field by HBPP personnel on a biweekly basis. The lower of the two readings is normally reported since the dosimeters normally read high on failure. The Radiation Detection Company (RDC), Sunnyvale, California, supplies and reads the film packs. RDC reports film pack doses relative to "background" at the RDC laboratory, which consistently is 8 mR/month.

The $\pm$ term in the following tables is the two-sigma error; i.e., the 95 percent confidence level.

TABLE 1

SAMPLES COLLECTED

Station	Marine Flora	Verte-brates	Clams & Oysters	Other Invert.	Bottom Sedim.	Terres-trial	Air Partic.	Dosi-meters	Film Packs
1 K. Salmon Picnic Area						2		7	3
2 1742 Wood, Fortuna								7	3
3 Humboldt Hill (HH) Rd							13	7	3
4 Wood & K, Eureka								7	3
5 Redwood Ave, Arcata						1		7	3
6 Table Bluff & Clough								7	3
7 Col. of the Redwds								7	3
8 Hmblt Hl Rd								7	3
9 Harbor View								7	3
10 B St., Field Lndg								7	3
11 Whittier Ct								7	3
12 Bell Hill Rd, HH								7	3
13 Crab St, Byrne Pt								7	3
14 South Bay School								7	3
15 Eich Rd								7	3
16 Bennett Dairy								7	3
17 Bassford Rd, Ridgewd								7	3
18 6418 Elk River Rd								7	3
19 Noe St								7	3
20 3537 Union St								7	3
21 PG&E Well 2, HH Rd								7	3
22 Sta B - 14th St								7	3
23 Harris St. Substa.								7	3
24 PG&E Office, Eureka								7	3
25 Irving Dr								7	3
26 Worthington Dr								7	3
27 Berta Road, 6700								7	3
28 Berta Road, 7200								7	3
29 Vista Rd								7	3
30 Burns Dr							13		
45 Humboldt Substation						1			
48 Holgerson Dairy					1				
55 PG&E Outfall	1				1				
56 1000 ft. N Outfall	2				1				
57 1000 ft. S Outfall	2								
59 Hookton Channel			1						
55 Coast Oyster Co.			1						

TABLE 2

RADIOANALYSIS OF MARINE SAMPLES

Sta	Sample	Description	Collection Date	Beta Counting Date	Gross Activity (pCi/g Dry Sample) Beta	Gamma[1/]	Potassium Content (mg K/ Dry Sample)	K40 Activity in Potassium (pCi/g Dry Sample)[2/]	Gross Beta Activity (pCi/g Orig. Sample)
55	80467	Sediment[3/]	7/28/80	10/ 3/80	6.03±0.51	137Cs=0.017±.0.004	5.76	4.78	4.99±0.42
55		Red Algae[4/] (Gigartina agardhii)							
55	80468	Red Algae[3/] (Iridaea sp.)	7/28/80	9/ 2/80	9.96±0.73	-	11.7	9.68	1.25±0.09
55		Fish[4/]							
56	80470	Sediment	7/28/80	10/ 8/80	4.85±0.57	95Zr=0.023±0.012	4.74	3.93	4.24±0.50
56	80472	Red Algae (Gigartina agardhii)	7/28/80	11/ 2/80	8.36±0.67	-	10.9	9.03	1.42±0.11
56	80471	Red Algae (Iridaea sp.)	7/28/80	11/ 2/80	8.42±0.68	-	11.3	9.37	0.73±0.06
57	80473	Sediment	7/28/80	10/ 3/80	6.00±0.50	137Cs=0.011±0.003	5.32	4.42	5.12±0.43
57	80475	Red Algae (Gigartina agardhii)	7/28/80	10/17/80	8.95±0.68	-	11.5	9.51	1.31±0.10
57	80474	Red Algae (Iridaea sp.)	7/28/80	10/17/80	8.28±0.67	-	12.1	10.0	1.30±0.11
65	80477	Pacific Oyster[3/] (Crassostrea gigas)	7/31/80	9/ 2/80	5.67±0.46	-	6.39	5.30	1.02±0.09
59	80476	Gaper Clam[3/] (Tresus capex)	7/28/80	9/ 2/80	8.20±0.62	95Zr=0.137±0.062	9.74	8.08	1.99±0.15

1/Activity at time of sampling. Naturally occurring radioisotopes are not reported.
2/For K40 activity of 830 pCi/gm natural potassium.
3/Samples analyzed at DER then sent to State Department of Health.
4/Sample not available at this time.

TABLE 3

RADIOANALYSIS OF TERRESTRIAL SAMPLES

Sta	Sample	Description	Collection Date	Beta Counting Date	Gross Activity (pCi/g Dry Sample) Beta	Gross Activity (pCi/g Dry Sample) Gamma[1/]	Potassium Content (mg K/g Dry Sample)	K40 Activity in Potassium (pCi/g Dry Sample)[2/]	Gross Beta Activity (pCi/g Orig. Sample)
1	80430	Domestic Water[3/]	7/16/80	8/23/80	10.7±1.3	-	-	-	1.76±0.21[5/]
1	80465	Soil	7/28/80	10/17/80	7.46±0.61	137Cs=0.065±0.010	6.20	5.15	7.37±0.60
5	80466	Soil	7/28/80	10/ 3/80	6.86±0.55	137Cs=0.229±0.008 54Mn=0.008±0.008	7.13	5.92	4.89±0.39
16	80452	Milk[6/ 4/]	7/28/80	10/17/80 8/ 1/80	8.13±0.66	140Ba=0.282±0.250 131I=<0.20	12.9	10.7	935±76[5/]
48	80453	Milk[6/ 4/]	7/28/80	10/17/80 8/ 4/80	6.26±0.55	131I=<0.20	8.44	7.00	944±83[5/]

1/ Activity at time of sampling. Naturally occurring radioisotopes are not reported.

2/ For K40 activity of 830 pCi/gm natural potassium.

3/ Sample is evaporated for beta analysis and distilled for H-3 analysis. H-3 activity less than 0.20 pCi/ml.

4/ Iodine-131 activity, pCi/l., at time of sampling.

5/ pCi/l.

6/ Sampled jointly with the State Department of Health.

TABLE 4

DOSIMETER MEASUREMENTS

Period Start:	6/24/80	7/ 8/80	7/23/80	8/ 5/80	8/19/80	9/ 2/80	9/16/80	10/ 2/79	
Period End:	7/ 8/80	7/23/80	8/ 5/80	8/19/80	9/ 2/80	9/16/80	9/30/80	9/30/80	
Elapsed Time, Days:	14	15	13	14	14	14	14	364	2/
Station	Total mR	Total mR	Total mR	Total mR	Total mR	Total mR	Total mR	Total mR	
1	3.1	3.5	2.9	3.3	3.6	3.3	3.4	80.7	(48)
2	2.9	2.9	3.6	3.3	2.8	3.2	4.0	83.0	
3	3.0	2.9	2.8	2.5	2.6	3.3	3.5	73.6	
4	2.4	2.4	2.4	2.8	2.8		3.4	67.7	
5	2.8	2.9	2.5	2.7	2.8		3.3	66.7	(46)
6	2.1	3.2	3.0	2.6	2.7	.6	3.1	89.8	
7	2.8	3.3	2.9	2.8	2.2	2.8	2.2	71.6	
8	3.6	2.3	3.4	2.9	2.5	3.4	3.4	86.1	
9	3.0	3.0	3.0	3.0	2.8	2.8	3.0	77.5	(50)
10	2.8	2.5	2.6	2.7	2.6	1.0	2.8	77.6	(50)
11	2.7	2.5	3.2	2.5	1.(	2.8	2.8	81.2	
12	2.5	2.7	2.8	2.4	?	5.4	2.6	79.8	
13	2.5	3.4	2.3	3.0	.7	2.8	2.9	77.1	(48)
14	2.1	2.6	3.3	3.1	2.4	3.2	5.2	89.8	
15	2.9	2.7	2.6	3.1	2.9	2.8	3.4	84.6	(50)
16	3/	7.3	3.7	3.7	3.8	3.6	3.(	87.6	(50)
17	2.3	2.4	2.4	2.8	2.7	3.3	2.8	76.6	
18	3.1	3.2	3.2	2.7	3.2	3.2	3.5	80.0	
19	2.4	3.1	3.3	2.9	2.2	3.0	3.5	75.8	(50)
20	2.8	2.6	3.0	3.1	2.7	3.1	3.3	77.2	(48)
21	2.5	2.7	2.6	2.3	2.8	3.1	3.0	90.9	
22	3.0	2.9	3.4	2.7	2.5	2.8	2.6	80.1	(50)
23	3.3	3.0	2.5	2.8	3.4	3.5	2.4	79.8	(48)
24	2.6	2.7	2.8	2.4	2.7	2.8	1.9	71.9	
25	3.1	2.6	2.6	3.1	2.5	2.8	2.7	75.6	
26	2.9	3.4	2.3	2.5	3.1	2.7	3.0	70.8	(48)
27	2.6	4.1	3.2	3.3	3.1	3.5	4.7	94.5	(50)
28	2.7	2.4	3.1	2.9	3.0	2.6	3.2	72.9	
29	2.9	3.2	3.0	3.1	2.8	3.0	3.4	77.4	
30	2.4	2.9	2.8	2.6	2.2	2.8	3.5	73.9	

1/Both dosimeters read 0 and/or full scale. 2/Weeks of data, if less than 52. 3/Equipment failure.

TABLE 5

FILM PACK MEASUREMENTS

	6/24/80	7/23/80	8/19/80
Period Start:	7/23/80	8/19/80	9/30/80
Period End:	29	27	42
Elapsed Time, Days:			
Station	Total mR[1/]	Total mR[1/]	Total mR[1/]
1	4	0	0
2	0	0	0
3	4	0	0
4	0	0	0
5	0	0	0
6	4	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	4	0	0
16	4	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	4	0	0
21	4	0	0
22	0	0	0
23	0	0	0
24	4	0	0
25	4	0	0
26	4	0	0
27	0	0	0
28	4	0	0
29	4	0	0
30			

1/ Above background of 8 mR/mo.

TABLE 6

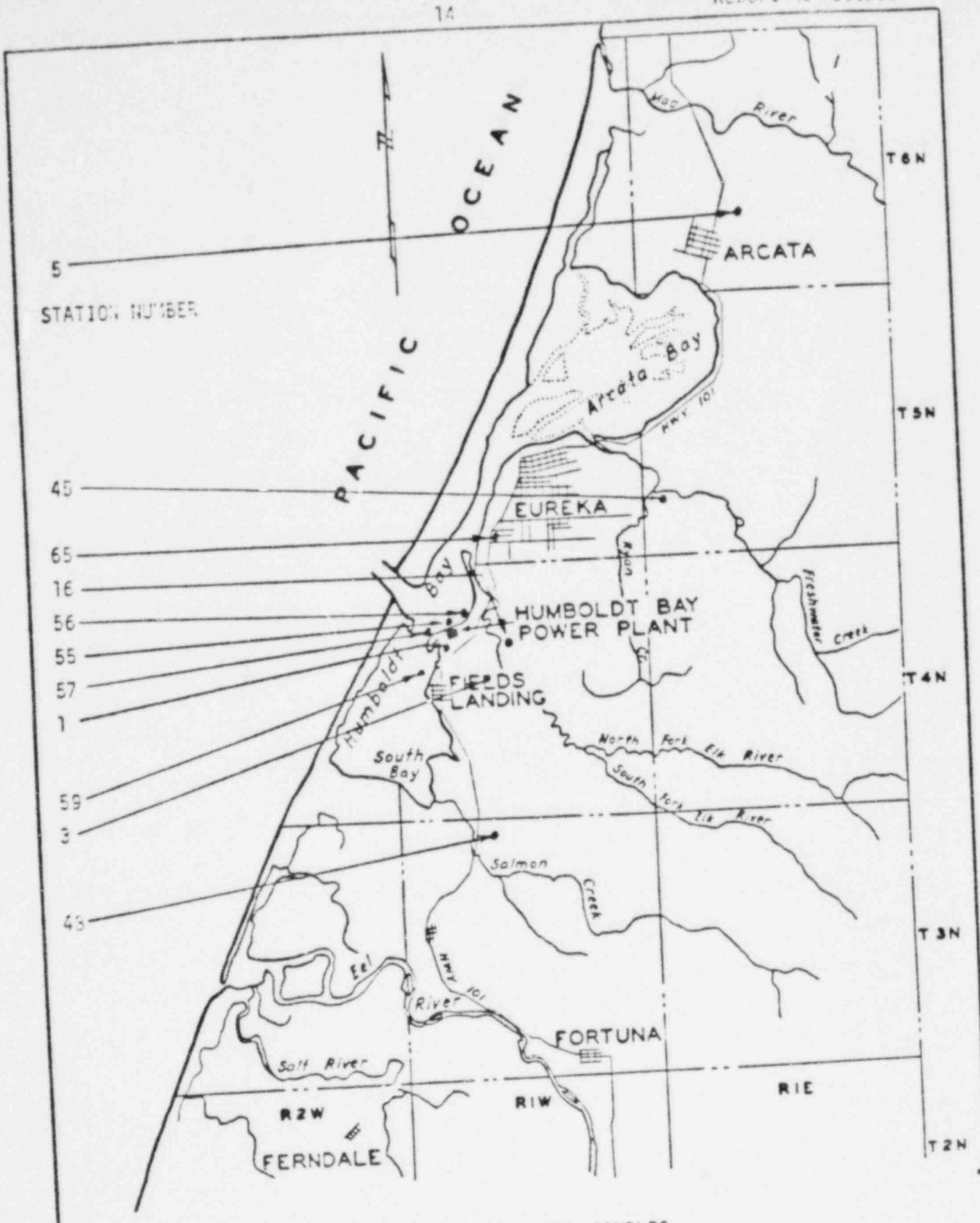
AIR PARTICULATE
STATION NO. 3 GROSS BETA ACTIVITY

Sample Number	Volume (m**3)	Collection Date	Counting Date	pCi/m**3
80412	288	7/ 8/80	7/18/80	0.016±0.002
80425	282	7/15/80	7/24/80	0.013±0.002
80445	286	7/22/80	8/ 4/80	0.014±0.001
80454	281	7/29/80	8/ 7/80	0.012±0.002
80490	293	8/ 5/80	8/14/80	0.015±0.001
80505	275	8/12/80	8/19/80	0.017±0.002
80540	286	8/19/80	8/23/80	0.014±0.001
80558	288	8/26/80	9/ 4/80	0.018±0.002
80577	289	9/ 2/80	9/ 8/80	0.022±0.002
80593	279	9/ 9/80	9/12/80	0.014±0.001
80617	290	9/16/80	9/26/80	0.026±0.002
80629	281	9/23/80	9/29/80	0.032±0.003
80643	296	9/30/80	10/ 7/80	0.033±0.003

TABLE 7

AIR PARTICULATE
STATION NO. 45 GROSS BETA ACTIVITY

Sample Number	Volume (m**3)	Collection Date	Counting Date	pCi/m**3
80413	426	7/ 8/80	7/18/80	0.016±0.001
80426	429	7/15/80	7/24/80	0.016±0.001
80446	481	7/23/80	8/ 4/80	0.011±0.001
80455	367	7/29/80	8/ 7/80	0.017±0.001
80491	433	8/ 5/80	8/18/80	0.014±0.001
80506	418	8/12/80	8/19/80	0.017±0.001
80541	432	8/19/80	8/23/80	0.015±0.001
80559	429	8/26/80	9/ 4/80	0.020±0.002
80578	439	9/ 2/80	9/ 8/80	0.022±0.002
80594	412	9/ 9/80	9/16/80	0.022±0.002
80618	442	9/16/80	9/26/80	0.023±0.002
80630	383	9/23/80	9/29/80	0.036±0.003
80644	433	9/30/80	10/ 7/80	0.031±0.002



ENVIRONMENTAL SAMPLES
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF HUMBOLDT BAY POWER PLANT
PACIFIC GAS AND ELECTRIC COMPANY

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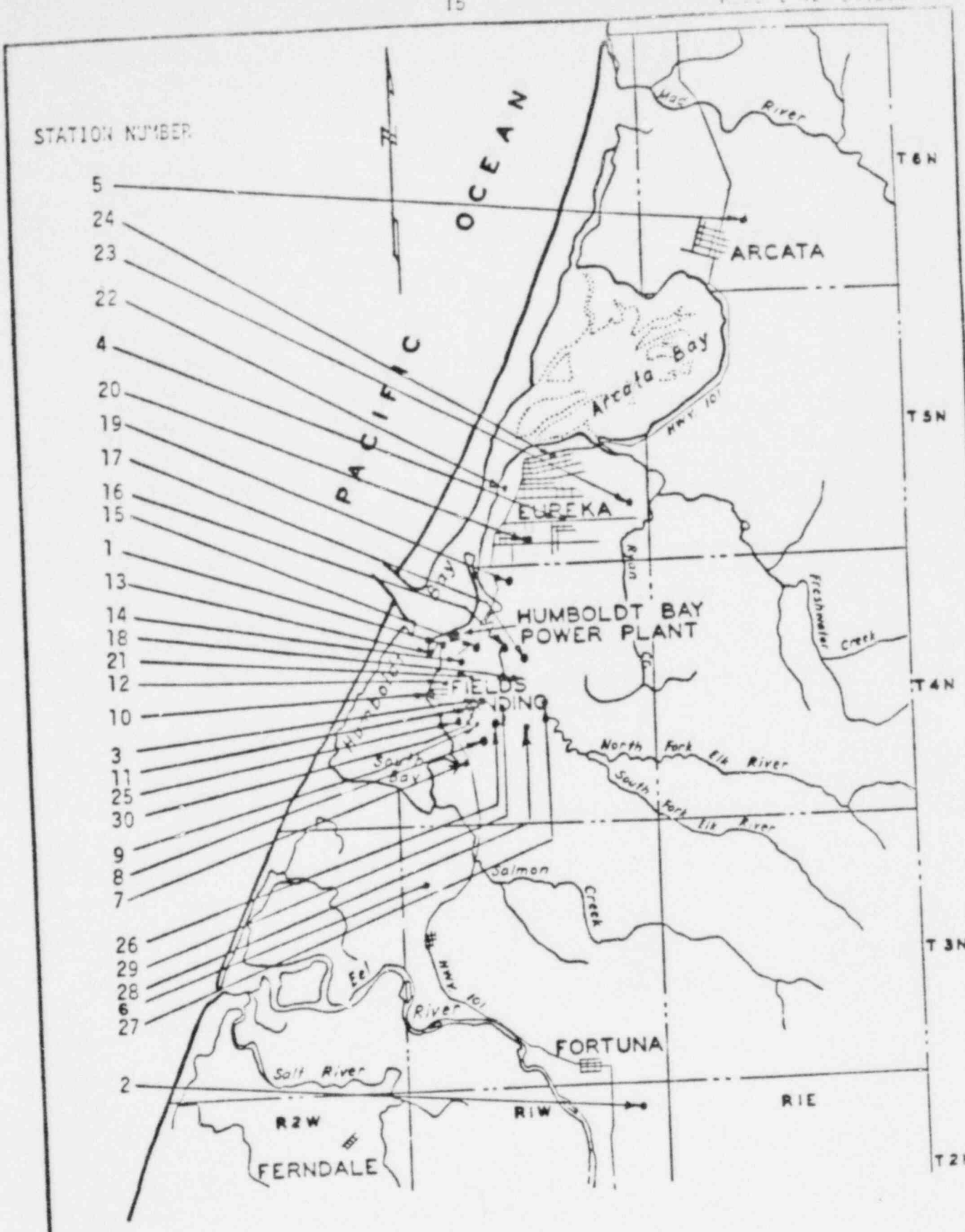
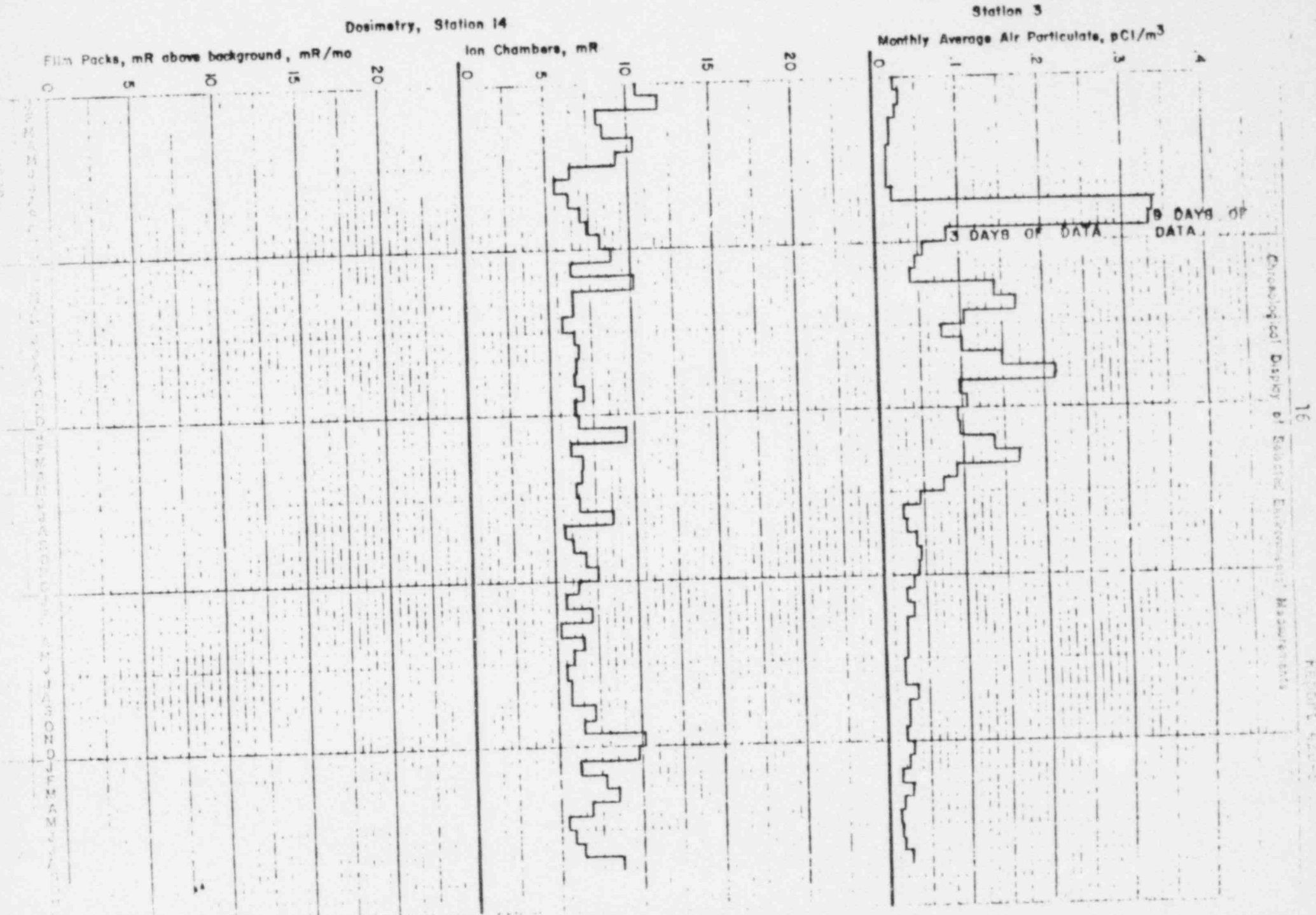


DOSIMETERS & FILM PACKS
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF HUMBOLDT BAY POWER PLANT
PACIFIC GAS AND ELECTRIC COMPANY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Film Packs, mR above background, mR/mo
0
5
10
15
20
Ion Chambers, mR
0
5
10
15
20
Station 3
Monthly Average Air Particulate, pCi/m3
0
1
2
3
4
3 DAYS OF DATA
8 DAYS OF DATA