

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

JANUARY 1, 1975 THROUGH DECEMBER 31, 1975

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 January 1, 1975 through December 31, 1975, and is submitted in accordance with Section IX.1.3.a.¹ 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 hour decay period" is 0.18 $\mu\text{Ci/sec}$.
- d. Liquid Effluents: 10CFR20

2. Maximum Permissible Concentrations

Provide the MPCs used in determining allowable release rates or concentrations.

- a. Fission and activation gases: Not applicable.
- b. Iodines: 3×10^{-10} $\mu\text{Ci/cc}$

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¹ A revised Section IX of the Humboldt Technical Specifications was issued by the NRC on January 6, 1976. Section IX.1.3.a. of this revision requires semi-annual reporting of effluents and waste disposal in a different reporting format than that under which Humboldt has been reporting. Since Humboldt was not required to submit a semi-annual report in 1975, information is supplied for the entire year 1975 rather than for the last two quarters of the year.

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- c. Particulates, half-lives >8 days: 3×10^{-10} $\mu\text{Ci/cc}$
- d. Liquid effluents: 10CFR20, Table 11, 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:

Samples (of air ejector off-gas) are taken at least monthly for Sodium Iodide gamma spectrum analysis and, based on six measurable nuclides (Xe138, Kr87, Kr88, Kr89m, Xe135 and Xe133), the remaining nuclides in the mixture are estimated. This analysis is used to calibrate the gross counting results of routine samples which are then used to calibrate the stack continuous monitors. Daily average release rates determined from the stack monitors are used to derive total quantity of the mixtures released, and individual nuclides are proportioned according to the mixture found from the monthly analysis.

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).

c. Particulates:

Filter papers are removed from the stack sampling system weekly and gross beta counted after 48 hour decay. After 7 days they are recounted to determine BaLa140 (Sodium Iodide detector).

Four filters for each quarter are decay counted to determine other particulates long-lived), alpha emitters, and analyzed for Sr89 and Sr90. Quarterly curie quantities are estimated from this information, proportional to BaLa140.

d. Liquid Effluents:

Waste receiver tank and waste hold tank batch samples are gamma spectrum analyzed (Sodium Iodide detector) and gross Beta and gross Gamma counted. If the nuclides identified do not account for the gross gamma count, the mixture is proportionately adjusted. If the gross beta count indicates more activity than the adjusted mixture, the excess activity is recorded as "Additional But Otherwise Unspecified".

Laundry waste tanks are individually analyzed only by gross beta and gross gamma. A monthly composite is analyzed as above.

A quarterly composite of all batches is analyzed for Tritium, Sr89 and Sr90.

5. Batch Releases

a. Liquid:

- 1) Number of batch releases: 285 (A total of 45,010 gallons of laundry waste and 400,645 gallons of treated waste tank discharge)
- 2) Total time period for batch releases: 475 hours
- 3) Maximum time period for a batch release: 24 hours
- 4) Average time period for batch releases: 100 minutes
- 5) Minimum time period for a batch release: 5 minutes
- 6) Average stream flow during periods of release of effluent into a flowing stream: 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 126.6 cubic meters of solid radwaste totaling 43.09 Ci was shipped. Table 3 summarizes the radioactive waste material shipments.

E. ENVIRONMENTAL MONITORING

Quarterly reports, "Environmental Radiation Study in the Vicinity of Humboldt Bay Power Plant (HBPP), Eureka, California," contain the basic data from the Humboldt Bay Power Plant environmental monitoring program. The most recent Reports Nos. 54, 55, 56, 57, and 58 are attached and include data from the second half of 1974 and the first three quarters of 1975. Data from Report 59 (which is in draft form and will be issued later) has also been used to complete the dose estimates in the following tables. These reports describe the sampling locations, total number of samples for each media sampled, as well as the associated measured levels of radioactivity. The types of media sampled are marine flora, marine fish, invertebrates, bottom sediment, milk, domestic water, air particulate, and external radiation measurements with ion chambers.

Potential public exposure in the environs of the plant was calculated from dosimetry data and those sampling media that could result in exposure pathways to man. These sampling media include the aquatic species (gaper clams, Pacific oysters, red-tail perch), milk, domestic water, and air particulate.

It was shown that, with the exception of the direct exposure measurements from ion chambers, the levels of radioactive materials in environmental media indicate that public exposures were less than 1 percent of those that could have resulted from continuous exposure to the concentrations listed in Appendix B, Table II, Part 20. The ion chamber measurements for station recording the highest reading when extrapolated to yearly rates for each half year since the last report were 190.8, 136.1, and 121.2 millirem per year for the second half of 1974, first half of 1975, and the second half of 1975, respectively. These extrapolated doses represented 101.5, 60.1, and 36.1 millirem per year above background. Each of which is well below the technical specification limit of 500 millirem per year above natural background.

1. Potential Exposure from Aquatic Media

The aquatic dose model used was taken from ICRP Publication 2, Report of Committee II, "Permissible Doses for Internal Radiation." The samples of gaper clams and red-tail perch, which can be taken by sports fishermen, were collected in the vicinity of the plant discharge. Pacific oysters, which are taken commercially from Humboldt Bay, were collected from the North Bay at Station 65. It was assumed that an individual would consume 20 grams per day of each species. If particular isotopes were identified by the gamma scans of the samples, then these isotopes were used in the exposure evaluations. In cases where there was an unidentified residual activity in the gross beta-gamma measurements or if there were no isotopes identified, the measured gross beta-gamma activity was distributed according to the radionuclides in the plant liquid releases as reported in Table II of the "Report on the Operation of Humboldt Bay Power Plant, July 1, 1974, through December 31, 1974," and Table 2B of this report.

Table 1 summarized the potential exposures from the ingestion of the three aquatic species, gaper clams, Pacific oysters, and red-tail perch. These data showed that the ingestion of the above species would result in exposures to all organs of much less than 1 percent of the 10 CFR 20 limits.

2. Potential Exposure from Milk

The plant contribution to the radioactivity in milk and potential exposures were determined by two different methods. Since no specific radionuclides other than ^{40}K were identified in the milk samples, the first estimate of exposure assumed that the difference between the gross beta-gamma radioactivity measurement and the ^{40}K activity, as determined by atomic absorption spectroscopy, was of plant origin. Large errors are introduced in this method of analysis because essentially all of the measured radioactivity is ^{40}K . This model, like the aquatic model, assumes that the unidentified activity is distributed according to the isotopic distribution of measured plant airborne particulate releases. Using this assumption, the principal isotope in milk was ^{89}Sr from the chain ^{85}Kr 3.10m, ^{89}Rb 15.2m, ^{89}Sr 50.8d, ^{89}Y stable.

The second model used the measured airborne release data from the plant and the annual average X/Q data to predict airborne concentrations. In this calculation, the NRC model in Regulatory Guide 1.42, Appendix C, for transfer of radioiodine through the air-plant-milk chain was used to estimate the concentration of all isotopes as well as the iodines in milk. Again, the principal isotope of concern was ^{89}Sr from the above mentioned decay chain. The effective environmental decay constants of 4 days* for ^{89}Sr and 12 days for the iodines were used.

Table 2 compares net radioactivity and potential exposures resulting Model 1 and Model 2 calculations. The measured beta activity in several of the samples was not statistically above the measured K-40 activity; therefore, Model 1 shows the minimum detectable concentration and the exposures that would have resulted from this concentration of Sr-89 in these milk samples. Model 2 using plant release data predicts that the exposures derived from milk consumption could have been in this same range which in all cases would have been less than 1 percent of those that would have resulted from continuous exposure to the air and water concentrations listed in Appendix B, Table II, Part 20.

3. Potential Exposure from Domestic Water

The potential exposure resulting from domestic water was also considered. The data from water samples collected from wells supplying the plant, which are shown in Table 3 of the attached reports, show a mean of gross beta-gamma activity of 1.2 pCi/L . The above values may be compared with data collected in 1971 and 1972. These data** from well-water and treated water in Eureka show yearly gross beta-gamma activity averages of 6.0 and 6.3 pCi/L , respectively. It should be noted that because of the low beta-gamma activities, the water samples are not routinely

*Krieger, Herman L., "Effective Half-Times of ^{85}Sr and ^{134}Cs for a Contaminated Pasture," Health Physics, Volume 17, pp. 811-824.

**"Radiation Data and Reports," U.S. Environmental Protection Agency, Volume 14, Number 11, November 1973.

gamma-scanned. Thus, when comparing the gross beta-gamma activity measurements in domestic water, it can be seen that the levels of radioactivity are well within local background radiation levels.

4. Potential Exposure from Air Particulate

The fourth potential exposure pathway to man was via inhalation of airborne particulates. Data from Table 6 of the Environmental Radiation Study Reports were averaged for each quarter and exposures calculated assuming that the unidentified isotopes were distributed according to the measured particulate releases from the plant during the corresponding period. The principal contributor to the exposure was assumed to be 89-Sr. The data shown in Table 3 results in exposures well below 1 percent of the 10 CFR 20 exposure limits. It should be noted that although all the particulate activity was assumed to be 89-Sr, the measured air particulate activities during this half of 1974 and all of 1975 were all within the range of activities as measured by the network of air particulate stations in the State of California.⁴ Thus, the exposure resulting from the above assumption and shown in Table 3 is well below 1 percent of the 10 CFR 20 exposure limits.

5. Potential Exposure for External Radiation

As seen in Figure 1, there are currently 30 dosimetry stations in the vicinity of the plant. Ionization chambers, which are typically read on a biweekly basis, are presently being utilized for dosimetry. Table 4 in the attached environmental radiation study reports, presents the biweekly dosimetry measurements from all stations with Stations 2 and 5 representing 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 test (a two-way classification, and a 95 percent confidence limit least significant difference test) were made during biweekly dosimeter readings for each station. Using the above test, it was determined that 3, 4, and 3 stations were statistically significant above background for the second half of 1974, the first half 1975, and the second half 1975, respectively. These stations along with their extrapolated yearly exposures are shown on Table 4. As can be seen by comparing this table to Figure 1, the stations above background are located near the plant and at low elevations. The exposures associated with the gaseous effluent from the plant appear to be greatly dependent not only upon meteorological conditions and distance from the plant, but also on the topography.

⁴Private Communication, State of California Health Department, Radiologic Health Section, 1974.

TABLE I
ESTIMATED EXPOSURES FROM MEASURED RADIOACTIVITY IN AQUATIC SPECIES

Station Depth	Sample Description	Quarter Collected	Exposure (mrem/quarter)			
			Whole Body	Bone	Internal	Thyroid
55	74357 Red-tailed Surf Perch	3rd-1974	<0.001	<0.001	<0.013	<0.002 (2)
55	74455 Red-tailed Surf Perch	4th-1974	<0.001	<0.004	<0.001	<0.001 (1)
55	75194 Red-tailed Surf Perch	1st-1975	0.008	0.025	0.010	0.006
55	75316 Red-tailed Surf Perch	2nd-1975	0.023	0.107	0.030	0
55	75423 Red-tailed Surf Perch	3rd-1975	0.078	0.169	0.129	0
65	74289 Pacific Oyster	3rd-1974	0.099	0.432	0.133	0.344
65	74462 Pacific Oyster	4th-1974	0.104	0.496	0.125	0.085
65	75070 Pacific Oyster	1st-1975	0.116	0.344	0.146	0.078
65	75323 Pacific Oyster	2nd-1975	0.072	0.330	0.093	0
65	75430 Pacific Oyster	3rd-1975	0.019	0.042	0.032	0
65	75664 Pacific Oyster	4th-1975	<0.001	<0.002	<0.001	0 (1)
59	74290 Caper Clam	3rd-1974	0.001	0.015	6.254	<0.002 (3)
59	74463 Caper Clam	4th-1974	0.078	0.375	0.094	0.064

TABLE 1
ESTIMATED EXPOSURES FROM MEASURED RADIOACTIVITY IN AQUATIC SPECIES

Station Number	Sample Description	Quarter Collected	Exposure (mrem/quarter)			
			Whole Body	Bone	Internal	Thyroid
59	75071 Gaper Clam	1st-1975	0.075	0.224	0.095	0.051
59	75324 Gaper Clam	2nd-1975	0.101	0.464	0.131	0
59	75431 Gaper Clam	3rd-1975	0.063	0.135	0.103	0
59	75465 Gaper Clam	4th-1975	<0.001	<0.003	<0.001	0 (1)

¹ Radioactivity in this sample was not above the measured 40-K activity.

² Zirconium-95 identified.

³ Cerium-144 identified.

TABLE 2

POTENTIAL EXPOSURES IN MILK

MODEL 1 - ESTIMATED BY USE OF MEASURED ACTIVITY

Station No.	Sample Description	Quarter Collected	Net Sample Activity $\mu\text{Ci/l}$	Exposure ($\mu\text{rem/quarter}$)			
				Whole Body	Bone	Internal	Thyroid
6	74294 Milk	3/74	150.7	0.71	1.28	0.16	(1)
16	74295 Milk	3/74	119.2	0.56	1.01	0.13	(1)
6	74441 Milk	4/74	119.3	0.56	1.02	0.13	(1)
16	74442 Milk	4/74	<64.1	<0.30	<0.55	<0.07	(1)
6	75158 Milk	1/75	<71.6	<0.34	<0.61	<0.08	(1)
16	75159 Milk	1/75	<62.0	<0.29	<0.53	<0.07	(1) (2)
6	75328 Milk	2/75	<50.9	<0.24	<0.43	<0.05	(1)
16	75329 Milk	2/75	<55.8	<0.26	<0.46	<0.06	(1)
6	75466 Milk	3/75	213.52	1.01	1.82	0.23	(1)
16	75467 Milk	3/75	88.83	0.42	0.76	0.09	(1)
6	75675 Milk	4/75	<60.4	<0.29	<0.51	<0.06	(1) (2)
16	75676 Milk	4/75	<59.1	<0.28	<0.50	<0.06	(1) (2)

- (1) Exposure to thyroid was several orders of magnitude below the exposure to the other organs.
 (2) Radioactivity in this sample was not above the measured K-40 activity.

MODEL 2 - ESTIMATED BY USE OF PLANT RELEASE DATA

Station No.	Distance from Plant (Km)	K/Q (sec/m^3)	Sample Activity $\mu\text{Ci/l}$	Exposure ($\mu\text{rem/quarter}$)			
				Whole Body	Bone	Internal	Thyroid
16	2.8	6.13×10^{-8}	12.4	0.24	0.42	0.05	1.40 (a)
6	10.7	2.00×10^{-8}	4.0	0.07	0.14	0.02	0.41 (a)
16	2.8	6.13×10^{-8}	26.1	0.49	0.89	0.20	0.50 (b)
6	10.7	2.00×10^{-8}	8.5	0.16	0.29	0.04	0.15 (b)
16	2.8	6.13×10^{-8}	47.3	0.90	1.61	0.11	0.20 (c)
6	10.7	2.00×10^{-8}	15.5	0.29	0.53	0.07	0.06 (c)

- (a) Computed from plant data July-December 1974.
 (b) Computed from plant data January-June 1975.
 (c) Computed from plant data July-December 1975.

TABLE 3

ESTIMATED EXPOSURES FROM MEASURED ACTIVITY IN AIR PARTICULATE

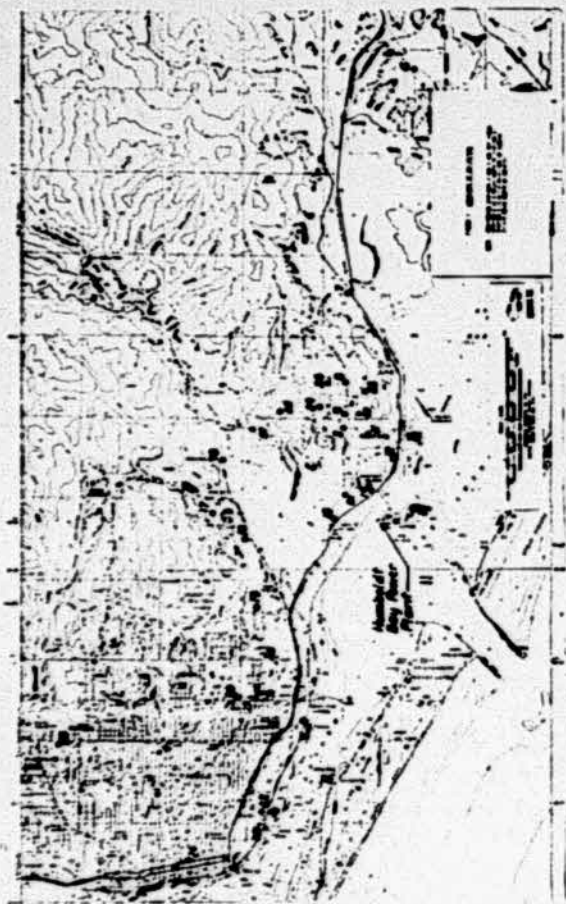
Station No.	Weekly Air Particulate Activity $\mu\text{Ci}/\text{m}^3$	Quarter Collected	Radiation Exposure per Quarter			(1)
			Whole Body	Bone	Internal	Total Exposure (mrem/qr)
3	0.068 ± 0.017	3/74	0.006	0.197	0.011	0.207
3	0.065 ± 0.018	4/74	0.005	0.189	0.011	0.205
45	0.056 ± 0.020	3/74	0.005	0.162	0.009	0.176
45	0.069 ± 0.021	4/74	0.006	0.200	0.012	0.207
3	0.078 ± 0.029	1/75	0.006	0.226	0.013	0.234
3	0.060 ± 0.025	2/75	0.005	0.174	0.010	0.189
45	0.084 ± 0.026	1/75	0.007	0.244	0.014	0.265
45	0.058 ± 0.028	2/75	0.005	0.168	0.010	0.182
3	0.061 ± 0.030	3/75	0.005	0.177	0.010	0.192
3	0.019 ± 0.004	4/75	0.002	0.055	0.003	0.060
45	0.027 ± 0.011	3/75	0.002	0.078	0.004	0.085
45	0.018 ± 0.005	4/75	0.002	0.052	0.003	0.057

(1) Radiation doses are assumed to be principally due to Sr-89.

TABLE 4

Estimated External Radiation Exposure
From Ion Chamber Readings

<u>Station</u>	<u>Extrapolated Yearly Exposure (mRem/Yr.)</u>	<u>Exposure Above Background (mRem/Yr.)</u>	<u>Period of Exposure</u>
14	190.8	101.5	July-December 1974
11	159.6	70.5	"
12	137.6	48.3	"
11	136.1	60.1	January-June 1975
14	107.8	31.7	"
12	102.7	26.7	"
25	102.3	26.3	"
14	121.2	36.1	July-December 1975
1	112.0	26.9	"
12	105.0	20.7	"



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 1973.

Table 4A 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 3

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1975

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of Waste	Unit	1975	Est.Total Error, %
a. Solidified evaporator bottoms	m ³ C1	3.73E1 2.89E0	1.00E1
b. Dry compressible waste, contaminated equip, etc.	m ³ C1	8.93E1 4.02E1	2.50E1

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

a. Cesium-134	2	2.00E1
Cesium-137	2	2.00E1
Unidentified Mixed Fission Products	2	1.50E1
Cobalt-60	2	1.50E1
Manganese-54	2	1.00E1
b. Cesium-134	2	1.00E1
Cesium-137	2	1.50E1
Unidentified Mixed Fission Products	2	1.50E1
Cobalt-60	2	1.00E1
Manganese-54	2	1.00E1

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
6	Truck (sole use)	Richland, Washington
1	Truck (sole use)	Beatty, Nevada

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
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None

TABLE 1A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1975

GASEOUS EFFLUENTS - SUMMARY OF ALL RELEASES

	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Est. Total Error ±
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A. Fission & activation gases

1. Total release	Ci	9.94E4	8.13E4	4.00E4	7.57E4	2.0E1
2. Average release rate for period	μCi/sec	1.28E4	1.03E4	5.03E3	9.52E3	
3. Percent of Technical specification limit	%	2.56E1	2.06E1	1.01E1	1.90E1	

B. Iodines

1. Total iodine-131	Ci	7.71E-2	7.08E-2	2.55E-2	3.35E-2	1.5E1
2. Average release rate for period (I-131)	μCi/sec	9.92E-3	9.00E-3	3.21E-3	4.21E-3	
3. Percent of technical specification limit	%	5.51E0	5.00E0	1.78E0	2.34E0	

C. Particulates

1. Particulates with half- lives >8 days	Ci	4.58E-2	2.48E-2	7.46E-1	2.24E-2	1.5E1
2. Average release rate for period	μCi/sec	5.89E-3	3.15E-3	9.38E-2	2.82E-3	
3. Percent of technical specification limit	%	3.27E0	1.75E0	5.29E1	1.57E0	
4. Gross alpha radioactivity	Ci	2.64E-8	1.89E-8	2.73E-7	5.67E-8	

D. Tritium

1. Total release	Ci	5.68E-1	7.08E-1	7.07E-1	5.09E-1	5.0E1
2. Average release rate for period	μCi/sec	7.30E-2	9.00E-2	8.90E-2	6.40E-2	

TABLE 16

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1975

GASEOUS EFFLUENTS - ELEVATED RELEASE

Continuous Mode

Nuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
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1. Fission gases

krypton-84	Ci	2.19E1	2.15E1	1.37E1	6.86E1
krypton-85m	Ci	3.23E3	3.47E3	3.15E3	1.82E1
krypton-87	Ci	1.89E4	1.20E4	5.59E3	9.27E3
krypton-86	Ci	1.65E4	1.19E4	5.10E3	8.50E3
argon-133	Ci	2.20E3	1.64E3	3.98E2	6.20E2
argon-135	Ci	1.24E3	1.54E3	7.77E2	9.0E2
argon-135m	Ci	1.20E4	9.18E3	3.61E3	1.19E4
argon-136	Ci	1.0E4	2.32E4	1.49E4	1.21E4
argon-137	Ci	2.36E2	1.93E2	1.23E2	5.38E2
argon-43m	Ci	1.18E2	1.13E2	2.34E1	3.79E1
argon-43m	Ci	2.93E1	2.34E1	1.04E1	1.78E1
Total for period	Ci	9.94E4	8.11E4	4.00E4	7.57E4

2. Iodines

iodine-131	Ci	7.71E-2	7.08E-2	2.55E-2	1.35E-2
iodine-133	Ci	2.51E-1	1.86E-1	2.12E-1	2.11E-1
iodine-135	Ci	1.11.00E-1*	1.11.00E-1*	1.11.07E-1*	1.11.00E-1*
Total for period	Ci	3.30E-1	2.57E-1	2.18E-1	2.46E-1

3. Particulates

strontium-89	Ci	1.05E-3	2.26E-3	1.81E-3	1.09E-3
strontium-90	Ci	2.43E-5	1.89E-5	5.89E-6	3.60E-5
cesium-134	Ci	6.49E-3	3.58E-3	1.15.00E-3*	1.15.00E-3*
cesium-137	Ci	1.26E-2	7.18E-3	9.71E-3	3.85E-3
barium-lanthanum-140	Ci	2.19E-2	9.75E-3	2.55E-3	1.5E-2
cobalt-60	Ci	1.77E-3	3.78E-3	6.76E-3	1.15.00E-3*
total particulates	Ci	1.11.00E-3*	1.15.00E-3*	5.20E-3	1.15.00E-3*

- * The minimum sensitivity of the plant's Sodium Iodide 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.

TABLE 2A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1975
LIQUID EFFLUENTS - SIMULATION OF ALL RELEASES

	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Est. Total Errors
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A. FISSION AND ACTIVATION PRODUCTS

1. Total release(not including tritium,gases,alpha)	CI	2.60E0	2.90E-1	4.51E-1	1.23E-1	1.50E1
2. Average diluted concentration during period	μCi/ml	5.81E-8	8.06E-9	1.04E-8	3.00E-9	
3. Percent of applicable limit	%	5.81E-1	8.06E0	1.04E1	3.00E0	

B. Tritium

1. Total release	CI	5.65E0	3.87E0	3.89E0	6.61E0	5.00E0
2. Average diluted concentration during period	μCi/ml	1.27E-7	1.08E-7	9.00E-8	1.60E-7	
3. Percent of applicable limit	%	4.23E-3	3.60E-3	3.00E-3	5.33E-2	

C. Dissolved and entrained gases

1. Total release	CI	1T2.00E-3	1T2.00E-3	1T2.60E-3	1T2.00E-3	5.00E1
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D. Gross alpha radioactivity

1. Total release	CI	3.52E-5	1.95E-5	3.07E-5	1.75E-5	7.5E1
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E. Volume of waste released (prior to dilution)	liter	4.56E5	4.45E5	3.98E5	4.00E5	5.00E0
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F. Volume of dilution water used during period	liter	4.46E10	3.60E10	4.32E10	4.16E10	5.00E0
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- * The minimum sensitivity of the plant's Sodium Iodide 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.

TABLE 2B

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1975

LIQUID EFFLUENTS

Nuclides Released	Unit	Batch mode			
		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
strontium-89	CI	1.22E-1	1.09E-2	8.84E-4	4.48E-4
strontium-90	CI	4.15E-3	1.20E-3	5.62E-4	5.84E-4
cesium-134	CI	7.15E-1	8.05E-2	1.30E-1	3.16E-2
cesium-137	CI	1.57E-0	1.55E-1	2.78E-1	7.66E-2
iodine-131	CI	1.41E-2	1.100E-3*	1.100E-3*	1.100E-3*
cobalt-58	CI	9.00E-5	1.500E-3*	9.00E-5	6.00E-5
cobalt-60	CI	8.14E-2	1.72E-2	1.10E-2	4.11E-3
zinc-65	CI	2.61E-2	6.75E-3	8.70E-4	1.30E-3
manganese-54	CI	4.05E-2	3.24E-3	1.12E-3	5.50E-4
chromium-51	CI	1.300E-3*	1.300E-3*	1.300E-3*	1.300E-3*
zirconium-niobium-95	CI	1.100E-3*	1.100E-3*	1.100E-3*	1.100E-3*
molybdenum-99	CI	1.79E-1	1.100E-3*	1.100E-3*	1.100E-3*
technetium-99m	CI	1.96E-1	1.100E-3*	1.100E-3*	1.100E-3*
barium-lanthanum-140	CI	1.100E-3*	1.100E-3*	2.00E-5	1.100E-3*
cerium-141 (as equivalent 144)	CI	1.92E-2	1.51E-2	2.27E-2	5.76E-3
neptunium-239	CI	4.62E-3	1.100E-3	1.100E-3	1.100E-3
Total for period (above)	CI	2.60E0	2.90E-1	4.51E-1	1.25E-1
xenon-131	CI	1.100E1*	1.100E1*	1.100E1*	1.100E1*
xenon-135	CI	-	-	-	-

- * The minimum sensitivity of the plant's Sodium Iodide 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.

TABLE 4A

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 74m Level						Total ¹
	0-3	4-7	8-12	13-18	19-24	>24	
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	0.02
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	0.00
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	0.00
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	0.01	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 4A

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						Total
	0-3	4-7	8-12	13-18	19-24	>24	
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	3.32	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	0.53
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	0.04	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	0.15	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 4A

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						Total
	0-3	4-7	8-12	13-18	19-24	>24	
0.00	1.04	1.06	2.00	1.84	0.82	0.10	6.66
10.00	0.17	0.80	1.55	0.90	0.36	0.10	1.78
20.00	0.30	0.83	1.26	0.47	0.13	0.00	2.99
30.00	0.17	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	0.37	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	0.45	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	0.35	0.13	5.22

TABLE 4A

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						Total
	0-3	4-7	8-12	13-18	19-24	>24	
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	0.12	0.11	0.10	0.04	0.00	0.00	0.37
40.00	0.07	0.13	0.10	0.03	0.01	0.00	0.34
50.00	0.09	0.13	0.06	0.00	0.00	0.00	0.27
60.00	0.14	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	0.10	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	0.43
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

Report Issued

Report 7804.2-73

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 47
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING DECEMBER 31, 1972
(Fall)

R. F. C.
R. F. C. LATER

Report Prepared By:

V. Cereca
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DPSorps

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SUMMARY

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

INTRODUCTION

This is the 47th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period October through December 1972. 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 Public 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

Thirty-four gross beta analyses and 16 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned. 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 and confirmatory analyses of 3 samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

<u>Sample No.</u>	<u>Teledyne Isotopes</u>	<u>DER</u>
	<u>Gross Beta activity (pCi/g dry)</u>	
72520	12.9 \pm 0.5	10.5 \pm 0.7
72526	6.8 \pm 0.4	8.1 \pm 0.6
72527	6.1 \pm 0.4	6.2 \pm 0.5

Dosimeter readings during this quarter were generally above background levels (measured at Stations 2 and 5) and consistent with stack releases from HBPP Unit 3 for the period. During the preceeding 52-week period, the maximum integrated dose was measured at Station 14. The measured contribution from Unit 3 to the total dose at Station 14 was approximately 66 mR above background, which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 shows the dosimeter and film pack doses by the month at Station 14 and the air-particulate activity at Station 3 from January 1968 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - uc per Second *</u>
October	950
November	12,000
December	8,700

* Following the completion of annual maintenance on October 23, 1972, the unit was operated between 180 and 210 MWt.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 6, 1966.
- ⁴ Department of Public Health letter to P G and E, 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

Table 1	Samples Collected
Table 2	Radioactivities in Marine Samples
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Table 5	Film Pack Measurements
Table 6	Air Particulate, Station No. 3, Gross Beta Activities
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Figure 2	Station Locations of Dosimeters and Film Packs
Figure 3	Monthly Accumulation of Environmental Activities

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 HSPF personnel on a bi-weekly basis. The lower of the two readings is normally reported since the dosimeters normally read high on failure. The Radiation Detection Company (RDC), Mountain View, 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 FLODA	YEAFF- GRAVES	CLAMS & OYSTERS	OTHER INVERT.	BOTTOM SEDIM.	TERRES- TRIAL	AIR PARTIC.	DIS- METERS	FILM PACKS
1 HUMBOLDT POWER PLANT						2		7	3
2 1742 WOOD, FORTUNA									3
3 HUMBOLDT HILL							16	7	3
4 WOOD & N. CURERA								7	3
5 ARCATIA						1		7	3
6 TABLE ALUSFELDETA								7	3
7 WILLIAM BRIDGE								7	3
8 HUMBOLDT HILL								7	3
9 HUMBOLDT HILL								7	3
10 FIELDS LANDING								7	3
11 HUMBOLDT HILL								7	3
12 HUMBOLDT HILL								7	3
13 RUMBLE POINT								7	3
14 SOUTH BAY SCHOOL								7	3
15 SPRUCE POINT								7	3
16 ELK R. RD. (HONEYCUTT)						1		7	3
17 RIDGEMOUNT								7	3
18 ELK RIVER SCHOOL								7	3
19 PINE HILL								7	3
20 CURERA JR. H.S.								7	3
21 PG&E WELL 2								7	3
22 WHIMPLE ST. STA.								7	3
23 HARRIS ST. SUBSTA.								7	3
24 PG&E OFFICE, CURERA								7	3
25 HUMBOLDT HILL								4	2
26 HUMBOLDT HILL								7	3
27 HEATA ROAD								7	3
28 HEATA ROAD								7	3
29 HUMBOLDT HILL								7	3
30 HUMBOLDT HILL								7	3
35 Humboldt Sub. Sta.								5	3
35 PG&E OUTFALL	2								
36 1000 FT. N. OUTFALL	1								
37 1000 FT. S. OUTFALL	1								
39 HYDROTON CHANNEL		1							
39 COAST OYSTER CN.		1							

TABLE 2

REPORT 3004.2-93

RADIOACTIVITY IN MARINE SAMPLING

SIS SAMPLE SIS SAMPLE	DESCRIPTION	DATE		GROSS DETECTED SPECIFIC ACTIVITY DATA	GROSS CTD	POTASSIUM CONTENT SIS CTD	KNO ACTIVITY IN POTASSIUM SPECIFIC ACTIVITY DATA	GROSS DATA ACTIVITY SPECIFIC ACTIVITY DATA	
		DATE	DATE						
55	SP510 BERMONT	12/17/72	1/28/73	5.30 ± 0.70		0.4	0.3	5.30 ± 0.7	
55	SP510 RED ALGAE SP510000 SP.1	12/17/72	1/28/73	10.5 ± 0.85		12.7	10.8	5.20 ± 0.3	
55	SP510 RED ALGAE SP510000 SP510000	12/17/72	1/28/73	17.5 ± 1.55	25-120	56.7 ± 3.1	18.0	11.3	5.30 ± 0.7
56	SP512 BERMONT	12/17/72	1/28/73	7.00 ± 0.70		0.9	0.4	5.30 ± 0.7	
56	SP512 RED ALGAE SP510000 SP.1	12/17/72	1/28/73	12.8 ± 1.02	25-120	3.37 ± 0.30	11.8	9.7	5.20 ± 0.3
57	SP514 BERMONT	12/17/72	1/28/73	6.10 ± 0.50	25-120	20 ± 20	0.6	0.3	5.30 ± 0.7
57	SP514 RED ALGAE SP510000 SP.1	12/17/72	1/28/73	10.3 ± 0.80		11.7	9.5	5.10 ± 0.2	
58	SP516 PACIFIC OYSTER SP510000 SP510000	12/17/72	1/28/73	0.07 ± 0.02		5.4	0.1	1.50 ± 0.1	
59	SP517 GARDENIA SP510000 SP510000	12/17/72	1/28/73	0.10 ± 0.05		0.3	0.3	1.30 ± 0.1	
59	SP518 RED GRASS SP510000 SP510000	12/17/72	1/28/73	5.60 ± 0.80		5.2	0.3	1.00 ± 0.2	
6	SP520 SOIL	12/17/72	1/28/73	10.0 ± 0.80	25-120	40 ± 10	0.4	0.3	0.30 ± 0.2
6	SP520 SOIL	12/17/72	1/28/73	0.00 ± 0.01	25-120	40 ± 10	0.4	0.3	0.30 ± 0.2

NOTE: "SELECTED TO COLLECTION DATE," ONLY THESE RADIOISOTOPES, OTHER THAN KNO, IDENTIFIED BY MASS SPECTROMETRY ANALYSIS AND REPORTED.

AND ACTIVITY IN SPECIFIC NATURAL POTASSIUM

FILM PACK MEASUREMENTS

PERIOD START END	9/26/72 10/24/72	10/24/72 12/ 5/72	12/ 5/72 1/16/73
---------------------	---------------------	----------------------	---------------------

ELAPSED TIME DAYS	28	42	42
----------------------	----	----	----

STATION	TOTAL MP(1)	TOTAL MP(1)	TOTAL MP(1)
---------	-------------	-------------	-------------

1	0	7	10
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	7	0
12	0	3	0
13	0	3	0
14	0	3	0
15	0	3	0
16	0	3	0
17	0	0	0
18	0	3	0
19	0	0	0
20	0	0	0
21	0	3	0
22	0	0	0
23	0	3	0
24	0	0	0
25	0	12	0
26	0	3	0
27	0	3	0
28	0	0	0
29	12	3	12
30	0	0	0

1. ABOVE BACKGROUND OF B. BRIND

2. FILM PACK MISSING

AIR PARTICULATE
STATION NO. 3 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (ml x 3)	COLLECTION DATE	COUNTING DATE	PCI/1000
72422	286	10/ 3/72	10/16/72	0.031+-0.002
72421	286	10/10/72	10/17/72	0.038+-0.003
72435	286	10/17/72	10/27/72	0.017+-0.002
72445	286	10/24/72	3/ 1/73	0.022+-0.003
72477	286	10/31/72	3/19/73	0.014+-0.003
72478	286	11/ 7/72	11/15/72	0.014+-0.003
72484	286	11/14/72	11/21/72	0.028+-0.001
72498	286	11/21/72	11/29/72	0.012+-0.001
72496	286	11/28/72	12/ 9/72	0.028+-0.001
72510	286	12/ 5/72	12/22/72	0.017+-0.001
72514	286	12/12/72	12/26/72	0.033+-0.002
72510	286	12/14/72	1/ 3/73	0.015+-0.001
72543	227	12/27/72	1/ 4/73	0.012+-0.001
72544	245	1/ 2/73	1/10/73	0.014+-0.001

AIR PARTICULATE
STATION NO. 45 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (mls)	COLLECTION DATE	COUNTING DATE	PCI/No*
72509	857	12/ 5/72	12/22/72	0.071*-0.001
72513	430	12/12/72	12/26/72	0.030*-0.001
72538	418	12/19/72	1/ 3/73	0.018*-0.001
72544	443	12/27/72	1/ 4/73	0.012*-0.001
72550	363	1/ 2/73	1/13/73	0.013*-0.002

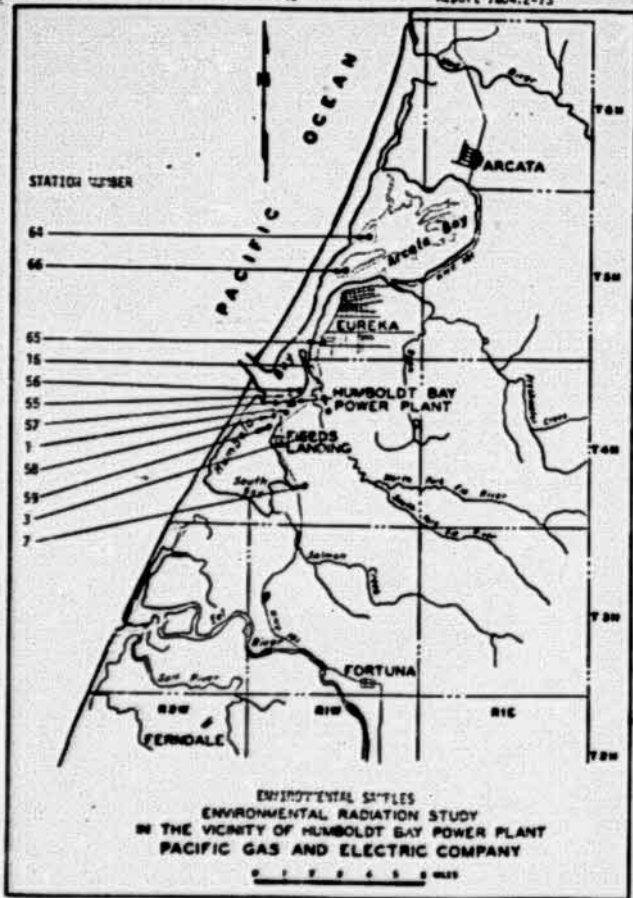


Figure 1

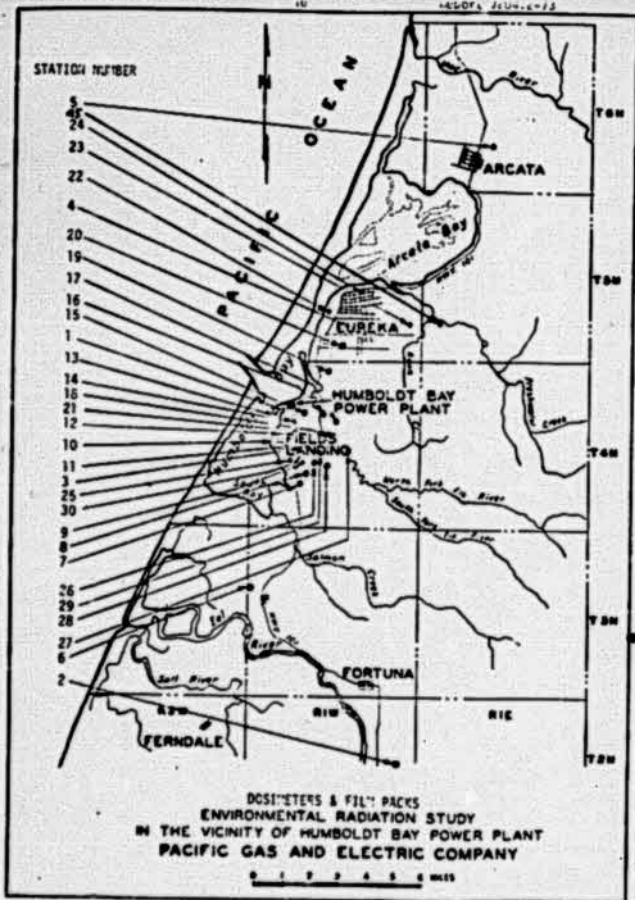


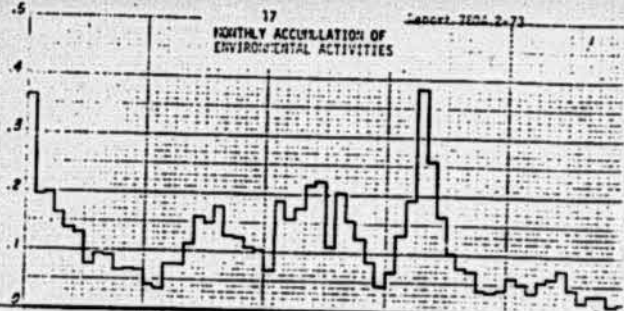
Figure 2

MONTHLY ACCUMULATION OF ENVIRONMENTAL ACTIVITIES

Chart 7704 2-73

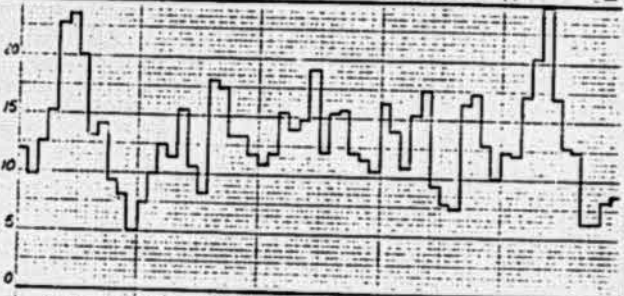
STATION 3

Monthly Average Air Radioactive, $\mu\text{Ci}/\text{m}^3$

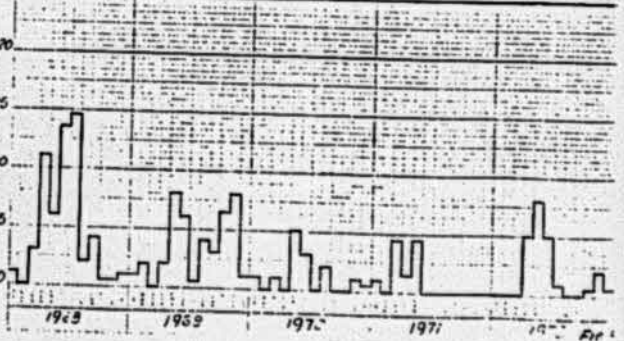


DOSIMETRY, STATION 14

Ion Chambers, mr



Film Packs, mr, above background of 2 mr/yr

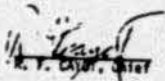


Report Issued: AUG 11 1974

Report 7856.1-74

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 51
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING DECEMBER 31, 1973
(Fall)



R. T. CASATI, Jt. Dir.

Report Prepared By:

W. H. Culver
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D. P. Serpa

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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 except for the 65-Zn activity found in one of the red algae samples. All liquid radwaste releases from the plant were well within the limits of the existing regulations. The maximum integrated dose measured was well below the permissible contribution of 500 mrem/year in unrestricted areas.

INTRODUCTION

This is the 51st quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period October through December 1973. 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 17 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 Public 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-four gross beta analyses and 17 gamma scans were performed for this report; air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (nCi/g dry)	
	Teledyne Isotopes	DER
73526	11.5 \pm 0.8	15.0 \pm 0.3
73533	5.9 \pm 0.9	7.7 \pm 0.5
73534	5.5 \pm 0.9	8.1 \pm 0.9
73536	6.8 \pm 0.9	8.5 \pm 1.0
73567	6.7 \pm 0.7	8.6 \pm 0.7

The Zn-65 activity in one of the red algae samples was again higher than those found during the 1971-72 period. This is probably due to Zn-65 releases from further demineralizer regenerations and the relatively long biological half-life of Zn-65. All liquid radwaste releases from the plant were well within the limits of the existing regulations.

Dosimeter readings during this quarter were generally above background levels (measured at Stations 2 and 5) and consistent with stack releases from HBPP Unit 3 for the period. The measured contribution from Unit 3 to

the total dose at Station 14 was approximately 47 mr above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 shows the dosimeter and film pack doses by the month at Station 14 and the air-particulate activity at Station 3 from January 1969 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate</u> <u>For Month - uc per Second**</u>
October 1973	9,100
November 1973	11,500
December 1973	12,400

*Based on 50 weeks of measurements.

**The unit was operated between 160 and 214 Mwt during this quarter.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. PG and E 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 45 (Figure 2). The constant flow samplers have flow rates in the range of 1.0 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. Gross beta activity is counted 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), Mountain View, 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

[illegible]

TABLE 3

RADIOACTIVITY IN DOMESTIC SAMPLES

REPORT 79-01-00

WFO SAMPLE	DESCRIPTION	COLLECTION DATE	DATA DATE	DOMESTIC ACTIVITY (DPM/G)	DOMESTIC ACTIVITY (DPM/G)	DOMESTIC ACTIVITY (DPM/G)	DOMESTIC ACTIVITY (DPM/G)	DOMESTIC ACTIVITY (DPM/G)
1	23355 S-1A	11/11/73	12/7/73	10.300	1.00	0.4	0.4	0.400-0.400
2	23356 S-1A	11/16/73	11/7/73	0.500	0.07	0.5	0.5	0.400-0.70
3	23357 S-1A	11/20/73	1/7/74	0.400	0.30	0.2	0.2	1.000-0.10 (0.1)
4	23358 S-1A	11/20/73	12/14/73	0.400	0.50	10.0	0.2	0.400-0.400 (0.1)
5	23359 S-1A	11/20/73	12/12/73	0.400	0.07	0.2	0.2	1.000-0.400 (0.1)

1. DOMESTIC ACTIVITY IN COLLECTION DATE

2. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

3. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

4. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

5. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

6. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

7. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

8. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

9. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

10. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

11. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

12. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

13. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

14. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

15. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

16. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

17. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

18. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

19. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

20. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

21. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

22. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

23. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

24. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

25. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

26. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

27. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

28. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

29. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

30. DOMESTIC ACTIVITY IN DATE OF ANALYSIS

FILM PACK MEASUREMENTS

PERIOD START	6/25/73	11/ 6/73	12/ 6/73
END	11/ 6/73	12/ 4/73	1/ 3/74

ELAPSED TIME

DAYS

42

28

20

STATION

TOTAL ME(I)

TOTAL ME(I)

TOTAL ME(I)

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	121	0
29	121	0	0
30	0	0	0

1. FIVE BACKGROUND CF F ME/MD
2. FILM PACK MISSING

TABLE 6

REPORT 7850-1-74

 AIR PARTICULATE
 STATION NO. 2 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (mcc)	COLLECTION DATE	COUNTING DATE	PCI/1000
73450	200	10/22/73	10/25/73	0.025±0.002
73450	200	10/25/73	10/27/73	0.019±0.002
73461	320	10/17/73	10/24/73	0.024±0.002
73474	200	10/23/73	10/30/73	0.020±0.002
73474	200	10/30/73	11/2/73	0.023±0.002
73484	200	11/6/73	2/12/74	0.009±0.001
73521	200	11/13/73	11/20/73	0.012±0.001
73523	200	11/20/73	11/20/73	0.017±0.002
73549	200	11/27/73	11/30/73	0.011±0.001
73560	200	12/4/73	12/7/73	0.012±0.001
73591	200	12/11/73	12/17/73	0.024±0.002
73601	200	12/18/73	12/27/73	0.017±0.002
73623	320	12/20/73	2/13/74	0.022±0.001
73625	320	1/2/74	1/9/74	0.037±0.004

TABLE 7

REPEAT 7H26. 1-74

AIR PARTICULATE
STATION 22.45 GPS2 ECT ACTIVITIES

SAMPLE NUMBER	VOLUME (ML)	COLLECTION DATE	COUNTING DATE	PC1/R443
72451	425	10/ 2/73	10/ 5/73	0.024 ±0.002
72459	417	10/ 5/73	10/17/73	0.019 ±0.002
72464	450	10/17/73	10/24/73	0.014 ±0.002
72475	376	10/22/73	10/26/73	0.017 ±0.001
72480	451	10/30/73	11/ 5/73	0.031 ±0.002
72490	426	11/ 8/73	2/13/74	0.008 ±0.001
72522	421	11/13/73	11/26/73	0.014 ±0.001
72544	424	11/4/73	11/27/73	0.015 ±0.001
72550	425	11/27/73	12/ 3/73	0.005 ±0.001
72567	426	12/ 4/73	12/ 7/73	0.010 ±0.001
72592	430	12/11/73	12/17/73	0.026 ±0.001
72621	456	12/18/73	12/27/73	0.017 ±0.001
72626	471	12/26/73	2/13/74	0.022 ±0.002
72637	426	1/ 2/74	1/ 9/74	0.003 ±0.003

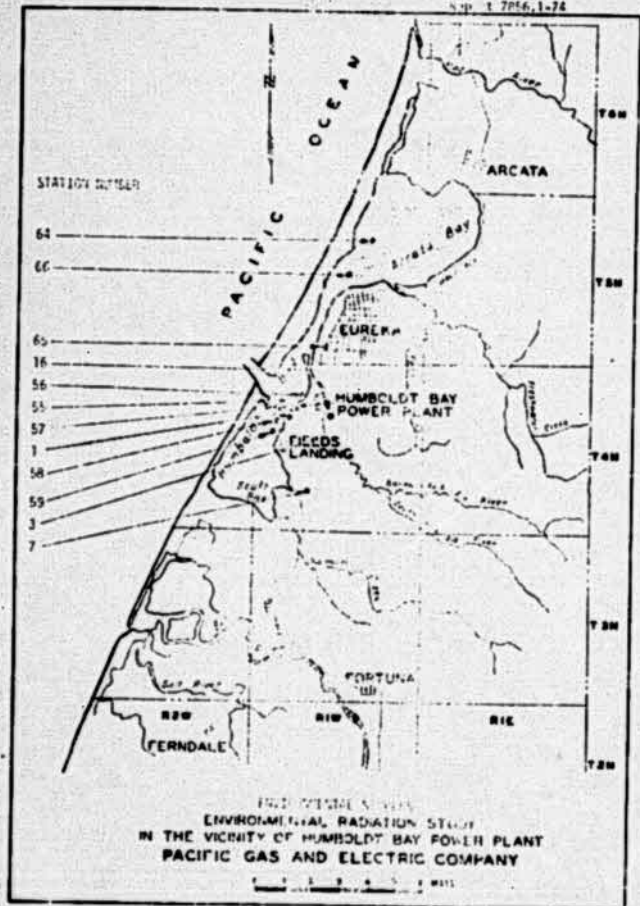
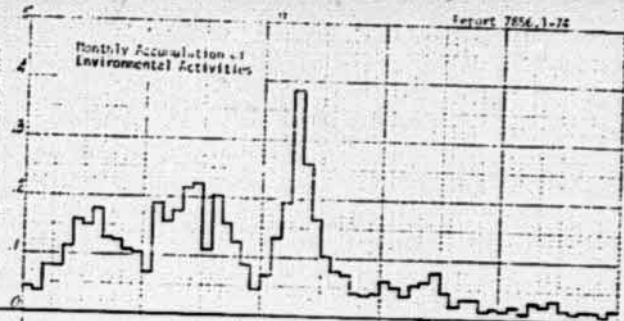


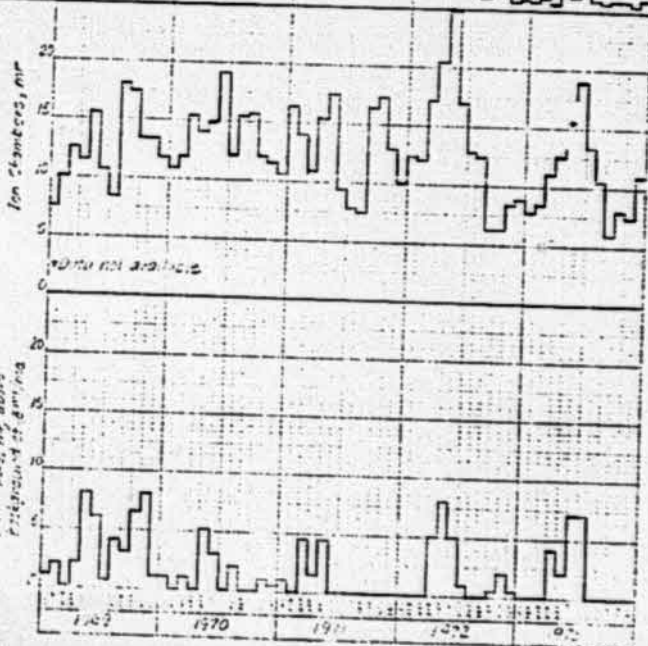
FIGURE 1

Station 3

Monthly Average for April 1939, 1940

Monthly Accumulation of
Environmental Activities

Dosimetry, Station 14

Fluor Facts, my above
percentage of gamma

Report Issued: MAY 2 1975

Report 7936-75

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 55
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING DECEMBER 31, 1974
(Fall)

R. F. CAYOT, Chief

Report Prepared By:

C. G. Hensel
R. J. Lorenz

sm/t

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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 55th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period October through December 1974. 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 17 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 Public 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-three gross beta analyses and 18 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 ICPP personnel. Film packs were read and confirmatory analysis of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)		
	LEU Environmental	Tellegen Isotopes	UM
74454	11.7 \pm 1.2	7.8 \pm 1.6	19.1 \pm 0.6
74455	12.1 \pm 1.4	10.4 \pm 1.3	11.7 \pm 1.1
74456	5.8 \pm 0.6	4.9 \pm 1.5	5.7 \pm 0.3
74460	12.7 \pm 1.2	9.5 \pm 1.8	12.1 \pm 0.7
74464	10.3 \pm 1.0	7.7 \pm 1.6	10.4 \pm 0.7

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The measured contribution from Unit 3 to the total dose at Station 14 was approximately 98 mrem above background, which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1970 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate</u> <u>for 1 month = μ Ci per Second*</u>
October 1974	15,500
November 1974	1,100
December 1974	700

*The unit was operated between 0 and 160 MWt during this quarter.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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 1-3.
6. Code of Federal Regulations, Title 10, Para. 20.105.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

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

Marine and terrestrial samples are processed quarterly at DEK. 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

Radiostidine analyses are performed on milk samples using the procedure described in Nuclear Regulatory Commission (NRC) Regulatory Guide 4.3. The detection limit attained by this method is typically 1 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 airborne particulate samplers are located at Stations 3 and 4 (Figure 1). The constant flow samplers have flow rates in the range of 1.0 to 1.5 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. Gross beta activity is counted 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 IGPP 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), Mountain View, 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

REPORT FORM - 75

SAMPLES COLLECTED

STATION	WATER FLORA	WATER FAUNA	CLAY & OTHER DEPOSITS	BOTTOM INVEST.	VEGETATION THIN	AIR	OPTIC- MICROSC.	WILSON PACKS
1. MOUNTAIN SPRING PLANT								
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TABLE 1

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Year	Population	Area	Population Density	Area	Population Density	Area	Population Density
1950	1,000,000	100,000	10.0	100,000	10.0	100,000	10.0
1955	1,100,000	110,000	11.0	110,000	11.0	110,000	11.0
1960	1,200,000	120,000	12.0	120,000	12.0	120,000	12.0
1965	1,300,000	130,000	13.0	130,000	13.0	130,000	13.0
1970	1,400,000	140,000	14.0	140,000	14.0	140,000	14.0
1975	1,500,000	150,000	15.0	150,000	15.0	150,000	15.0
1980	1,600,000	160,000	16.0	160,000	16.0	160,000	16.0
1985	1,700,000	170,000	17.0	170,000	17.0	170,000	17.0
1990	1,800,000	180,000	18.0	180,000	18.0	180,000	18.0
1995	1,900,000	190,000	19.0	190,000	19.0	190,000	19.0
2000	2,000,000	200,000	20.0	200,000	20.0	200,000	20.0
2005	2,100,000	210,000	21.0	210,000	21.0	210,000	21.0
2010	2,200,000	220,000	22.0	220,000	22.0	220,000	22.0
2015	2,300,000	230,000	23.0	230,000	23.0	230,000	23.0
2020	2,400,000	240,000	24.0	240,000	24.0	240,000	24.0
2025	2,500,000	250,000	25.0	250,000	25.0	250,000	25.0
2030	2,600,000	260,000	26.0	260,000	26.0	260,000	26.0
2035	2,700,000	270,000	27.0	270,000	27.0	270,000	27.0
2040	2,800,000	280,000	28.0	280,000	28.0	280,000	28.0
2045	2,900,000	290,000	29.0	290,000	29.0	290,000	29.0
2050	3,000,000	300,000	30.0	300,000	30.0	300,000	30.0

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STATIONERY DIV., U.S. GOVERNMENT PRINTING OFFICE

[illegible]

ALCOAT 1010 - 75

TABLE 7

ALL DATA AVAILABLE
STATION NO. 1010, COAST GUARD, 1010110

STATION	WY. NO.	DATE	TIME	WIND	WAVE	SWELL	PERIOD
1010110	1010110	10/1/75	10/1/75	10/1/75	10/1/75	10/1/75	10/1/75
1010110	1010110	10/2/75	10/2/75	10/2/75	10/2/75	10/2/75	10/2/75
1010110	1010110	10/3/75	10/3/75	10/3/75	10/3/75	10/3/75	10/3/75
1010110	1010110	10/4/75	10/4/75	10/4/75	10/4/75	10/4/75	10/4/75
1010110	1010110	10/5/75	10/5/75	10/5/75	10/5/75	10/5/75	10/5/75
1010110	1010110	10/6/75	10/6/75	10/6/75	10/6/75	10/6/75	10/6/75
1010110	1010110	10/7/75	10/7/75	10/7/75	10/7/75	10/7/75	10/7/75
1010110	1010110	10/8/75	10/8/75	10/8/75	10/8/75	10/8/75	10/8/75
1010110	1010110	10/9/75	10/9/75	10/9/75	10/9/75	10/9/75	10/9/75
1010110	1010110	10/10/75	10/10/75	10/10/75	10/10/75	10/10/75	10/10/75
1010110	1010110	10/11/75	10/11/75	10/11/75	10/11/75	10/11/75	10/11/75
1010110	1010110	10/12/75	10/12/75	10/12/75	10/12/75	10/12/75	10/12/75
1010110	1010110	10/13/75	10/13/75	10/13/75	10/13/75	10/13/75	10/13/75
1010110	1010110	10/14/75	10/14/75	10/14/75	10/14/75	10/14/75	10/14/75
1010110	1010110	10/15/75	10/15/75	10/15/75	10/15/75	10/15/75	10/15/75
1010110	1010110	10/16/75	10/16/75	10/16/75	10/16/75	10/16/75	10/16/75
1010110	1010110	10/17/75	10/17/75	10/17/75	10/17/75	10/17/75	10/17/75
1010110	1010110	10/18/75	10/18/75	10/18/75	10/18/75	10/18/75	10/18/75
1010110	1010110	10/19/75	10/19/75	10/19/75	10/19/75	10/19/75	10/19/75
1010110	1010110	10/20/75	10/20/75	10/20/75	10/20/75	10/20/75	10/20/75
1010110	1010110	10/21/75	10/21/75	10/21/75	10/21/75	10/21/75	10/21/75
1010110	1010110	10/22/75	10/22/75	10/22/75	10/22/75	10/22/75	10/22/75
1010110	1010110	10/23/75	10/23/75	10/23/75	10/23/75	10/23/75	10/23/75
1010110	1010110	10/24/75	10/24/75	10/24/75	10/24/75	10/24/75	10/24/75
1010110	1010110	10/25/75	10/25/75	10/25/75	10/25/75	10/25/75	10/25/75
1010110	1010110	10/26/75	10/26/75	10/26/75	10/26/75	10/26/75	10/26/75
1010110	1010110	10/27/75	10/27/75	10/27/75	10/27/75	10/27/75	10/27/75
1010110	1010110	10/28/75	10/28/75	10/28/75	10/28/75	10/28/75	10/28/75
1010110	1010110	10/29/75	10/29/75	10/29/75	10/29/75	10/29/75	10/29/75
1010110	1010110	10/30/75	10/30/75	10/30/75	10/30/75	10/30/75	10/30/75
1010110	1010110	10/31/75	10/31/75	10/31/75	10/31/75	10/31/75	10/31/75

1. DATA NOT AVAILABLE FROM 12/17/75 TO 12/24/75

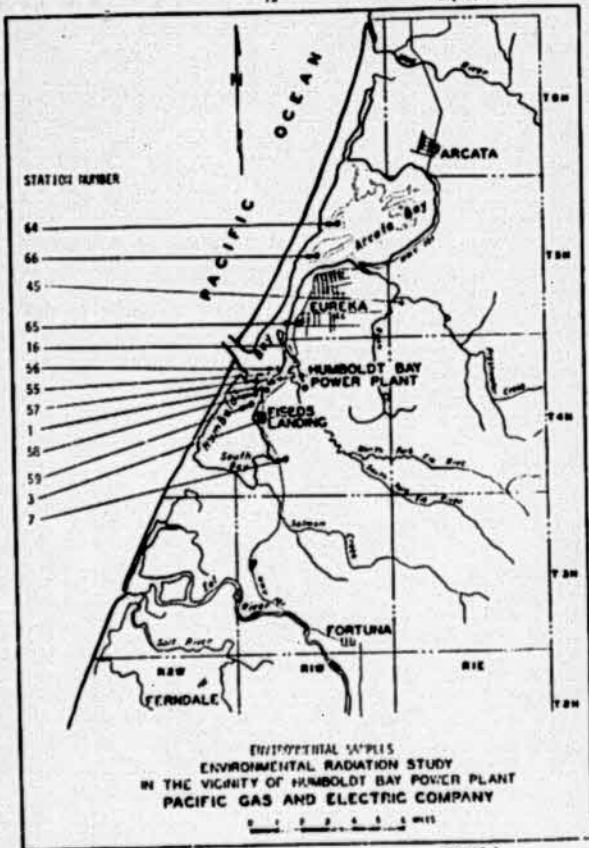


FIGURE 1

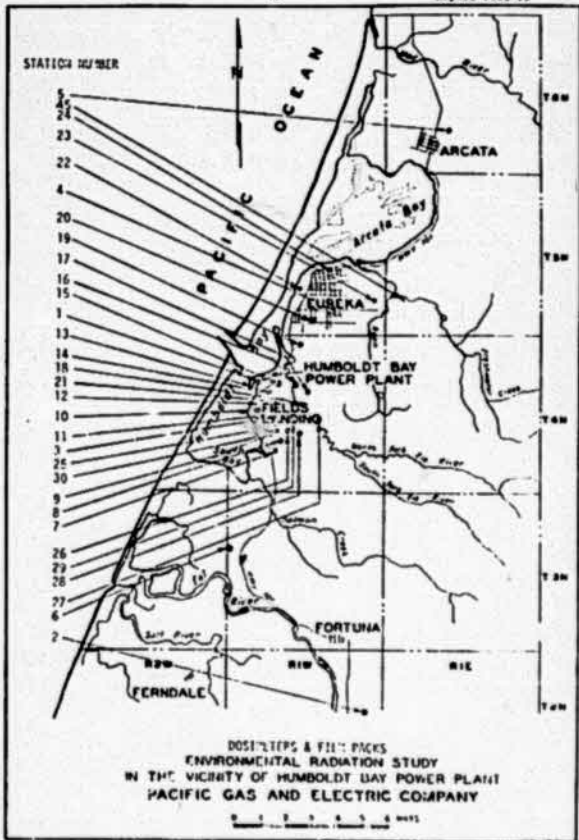
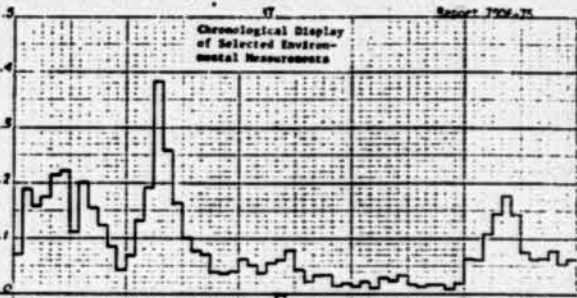


FIGURE 2

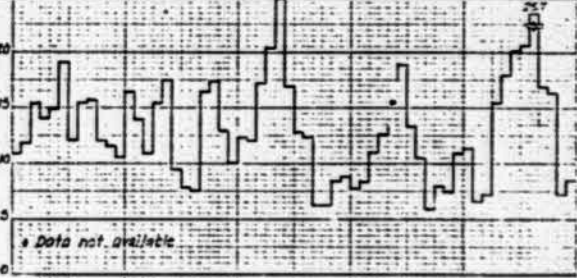
Station 3

Monthly Average of Particulate, $\mu\text{Ci}/\text{m}^3$



Dosimetry, Station 14

Ion Chambers, mR



Film Packs, mR above background at 2 m/hrs

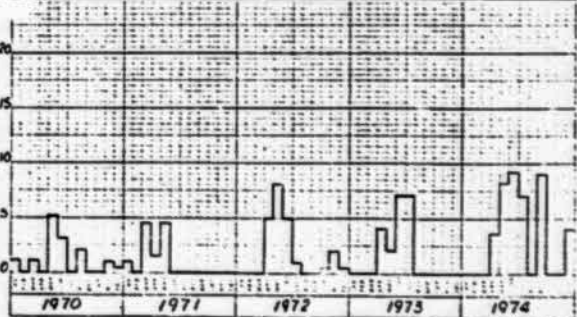


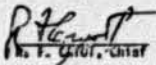
Figure 3

Report Issued: MAR 22 1976

Report 7906.4-76

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 59
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING DECEMBER 31, 1975
(FALL)



R. F. Gerst, Chief

Report Prepared By:

C. G. Hensel
R. M. Lorenz

sm/t

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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 59th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period October through December 1975. 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 16 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-two gross beta analyses and 15 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned. 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 and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ As shown below, the confirmatory analyses by an outside contractor are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)	
	FE Environmental	DER
75657	12.2 \pm 1.0	11.2 \pm 0.6
75663	11.0 \pm 1.2	9.1 \pm 0.7
75665	8.3 \pm 1.0	8.3 \pm 0.5
75667	8.6 \pm 0.8	7.9 \pm 0.6
75676	7.8 \pm 0.8	7.4 \pm 0.5

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The annual contribution from Unit 3 to the total dose at Station 14 was approximately 35 mrem above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

*Extrapolated to one year from actual measurements.

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1971 through this quarter. Reports 37 and 55 contain graphs of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate</u> <u>For Month - μCi per Second*</u>
October 1975	6,360
November 1975	7,150
December 1975	9,167**

*The unit was operating at an average of 203 hlt during this quarter.

**Determined from averages of periodic grab samples.

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 P G and E, Attn: F. F. Hautz, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. P G and E 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 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 by using the procedure abstracted in Nuclear Regulatory Commission (NRC) Regulatory Guide 4.3. 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 rates in the range of 1.0 to 1.5 cfm; 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 IBPP 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), Mountain View, 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.

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TABLE 1

STATION	TESTE- SPECIES	CLAMPS & OTHERS	SAMPLES COLLECTED OTHER INVEST. CREDIT	TESTES- SPECIES	DATE PARTIC.	COLL- PETERS	FILM
1. WATKINS FORK PLANT							
2. 1200, FORTUNA							
3. WATKINS MILL							
4. WATKINS MILL							
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98. WATKINS MILL							
99. WATKINS MILL							
100. WATKINS MILL							

TABLE 2
RADIOANALYSIS OF IRRADIATED SAMPLES

REPORT 7704.4-76

STA SAMPLE	DESCRIPTION	BETA		GROSS ACTIVITY		POTASSIUM CONTENT % (BY WGT)	140 ACTIVITY IN POTASSIUM SAMPLE (1)	GROSS BETA ACTIVITY IN POTASSIUM SAMPLE (2)
		COLLECTION DATE	COUNTING DATE	(FCI-8 DRY SAMPLE) BETA	(FCI-8 DRY SAMPLE) GAMMA (1)			
49	2405 SEDIMENT	11/11/75	12/17/75	5.62±0.942	(CS137) 0.642±0.106 (CS134) 0.921±0.105	9.51	3.79	5.62±0.942
55	2406 RED MUD	11/11/75	12/23/75	15.1±1.22	(CS137) 0.77±0.142 (CS134) 0.125±0.019	14.7	17.5	9.75±1.25
55	2407 RED MUD	(13) 11/11/75	12/16/75	11.2±0.64		17.1	16.9	3.02±0.17
56	2408 RED MUD	11/2/75	12/16/75	8.47±0.70	(CS137) 0.679±0.097 (CS134) 0.679±0.096	7.04	5.04	6.94±0.35
56	2409 RED MUD	11/2/75	12/23/75	19.8±1.21		12.0	13.1	9.55±0.75
56	2410 RED MUD	11/2/75	1/5/76	9.07±0.04		12.8	10.6	3.10±0.16
57	2411 RED MUD	11/4/75	12/17/75	6.15±0.649	(CS137) 0.633±0.106	9.70	9.47	5.70±0.97
57	2412 RED MUD	11/4/75	12/24/75	11.2±0.76		13.4	11.7	3.76±0.43
57	2413 RED MUD	11/4/75	12/24/75	9.11±0.68		12.6	10.5	2.72±0.20
57	2414 RED MUD	11/4/75	12/24/75	0.11±0.031		11.6	9.59	1.79±0.00
58	2415 RED MUD	11/24/75	12/16/75	0.11±0.031		16.3	9.32	1.74±0.12
59	2416 RED MUD	11/2/75	12/16/75	0.21±0.031				

1. ACTIVITY AT TIME OF SAMPLING. ACTIVITIES INCLUDING RADIOISOTOPES ARE NOT REPORTED.

2. FOR 140 ACTIVITY OF 870 FCAL INTRINSIC POTASSIUM.

3. THIS SAMPLE WAS ANALYZED AT DES THEN SENT TO THE STATE DEPARTMENT OF HEALTH FOR COMPARISON ANALYSIS.

TABLE 2
PHOTOMANALYSIS OF TERRESTRIAL SAMPLES

SIA SAMPLE	DESCRIPTION	COLLECTION DATE	BETA COUNTING DATE	GROSS ACTIVITY (dpm/g dry sample)		POTASSIUM CONTENT (mg/g dry sample)	SIA ACTIVITY IN POTASSIUM SAMPLE (dpm/g dry sample)	GROSS BETA ACTIVITY IN POTASSIUM SAMPLE (dpm/g dry sample)
				BETA	NET			
1	77516 SOIL	11/17/73	12/17/73	16.54	0.45 (5127)	0.0164	0.016	0.22
2	77557 SOIL	11/17/73	12/17/73	2.50	0.25 (5127)	0.0134	0.013	0.25
3	77567 MUF	12/17/73	12/17/73	9.75	0.75 (5127)	0.0203	0.020	0.25
4	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
5	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
6	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
7	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
8	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
9	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
10	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
11	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
12	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
13	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
14	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
15	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
16	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
17	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
18	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
19	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
20	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
21	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
22	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
23	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
24	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
25	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
26	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
27	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
28	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
29	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
30	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
31	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
32	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
33	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
34	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
35	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
36	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
37	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
38	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
39	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
40	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
41	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
42	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
43	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
44	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
45	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
46	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
47	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
48	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
49	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
50	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
51	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
52	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
53	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
54	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
55	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
56	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
57	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
58	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
59	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
60	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
61	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
62	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
63	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
64	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
65	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
66	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
67	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
68	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
69	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
70	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
71	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
72	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
73	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
74	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
75	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
76	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
77	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
78	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
79	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
80	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
81	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
82	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
83	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
84	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
85	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
86	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
87	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
88	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
89	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
90	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
91	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
92	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
93	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
94	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
95	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
96	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
97	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
98	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
99	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22
100	77567 MUF	12/17/73	12/17/73	46.20	0.49			0.22

1. ACTIVITY AT TIME OF SAMPLING. NORMALLY GROSSING PHOTOISOTOPES ARE NOT REPORTED.

2. FOR THE ACTIVITY OF 520 PC1-60 IN THE POTASSIUM.

3. SAMPLE ACTIVITY. ACTIVITY IN THE SAMPLE.

4. SAMPLE IS EQUIVALENT FOR BETA ANALYSIS AND DISTILLED FOR M-3 ANALYSIS.

5. ACTIVITY IN ACTIVITY.

6. ACTIVITY IN ACTIVITY.

7. ACTIVITY IN ACTIVITY. THEREFORE, SAMPLES WERE ANALYZED BY BOTH FOR AND STATE DEPARTMENT OF HEALTH.

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TABLE 6

SAMPLE NUMBER	VOLUME (liters)	STATION NO. 3 GROSS BETR COLLECTION DATE	AIR PARTICULATE ACTIVITY COUNTING DATE	PCI/1000
7906.4-1	20.0	10/7/75	10/14/75	0.023+-0.002
7906.4-2	20.0	10/14/75	10/17/75	0.015+-0.001
7906.4-3	20.0	10/21/75	10/21/75	0.021+-0.001
7906.4-4	20.0	10/28/75	11/1/75	0.015+-0.002
7906.4-5	20.0	11/4/75	11/7/75	0.023+-0.001
7906.4-6	20.0	11/11/75	11/15/75	0.015+-0.001
7906.4-7	20.0	11/18/75	11/24/75	0.023+-0.001
7906.4-8	20.0	11/25/75	12/4/75	0.023+-0.002
7906.4-9	20.0	12/2/75	12/2/75	0.013+-0.001
7906.4-10	20.0	12/9/75	12/15/75	0.013+-0.002
7906.4-11	20.0	12/16/75	12/30/75	0.016+-0.001
7906.4-12	20.0	12/23/75	1/8/76	0.025+-0.002
7906.4-13	20.0	12/30/75	1/13/76	0.017+-0.001

REPORT 7906.4-76

TABLE 7

SAMPLE NUMBER	STATION VOLUME (liters)	AIR PARTICULATE		ACTIVITY COUNTING DATE	PCI/R#3
		NO. 45 COLLECTION DATE	EE1A DATE		
1521	421	10/7/75	10/14/75	10/14/75	0.024+-0.001
1522	417	10/14/75	10/14/75	10/17/75	0.017+-0.001
1523	442	10/21/75	10/31/75	10/31/75	0.020+-0.001
1524	406	10/28/75	11/1/75	11/1/75	0.022+-0.001
1525	428	11/4/75	11/7/75	11/7/75	0.020+-0.001
1526	426	11/11/75	11/13/75	11/13/75	0.013+-0.001
1527	431	11/18/75	11/24/75	11/24/75	0.015+-0.001
1528	424	11/25/75	12/4/75	12/4/75	0.014+-0.001
1529	471	12/2/75	12/13/75	12/13/75	0.022+-0.001
1530	426	12/3/75	1/2/76	1/2/76	0.011+-0.001
1531	430	12/14/75	1/2/76	1/2/76	0.015+-0.001
1532	431	12/23/75	1/12/76	1/12/76	0.020+-0.002
1533	428	12/30/75	1/14/76	1/14/76	0.017+-0.002

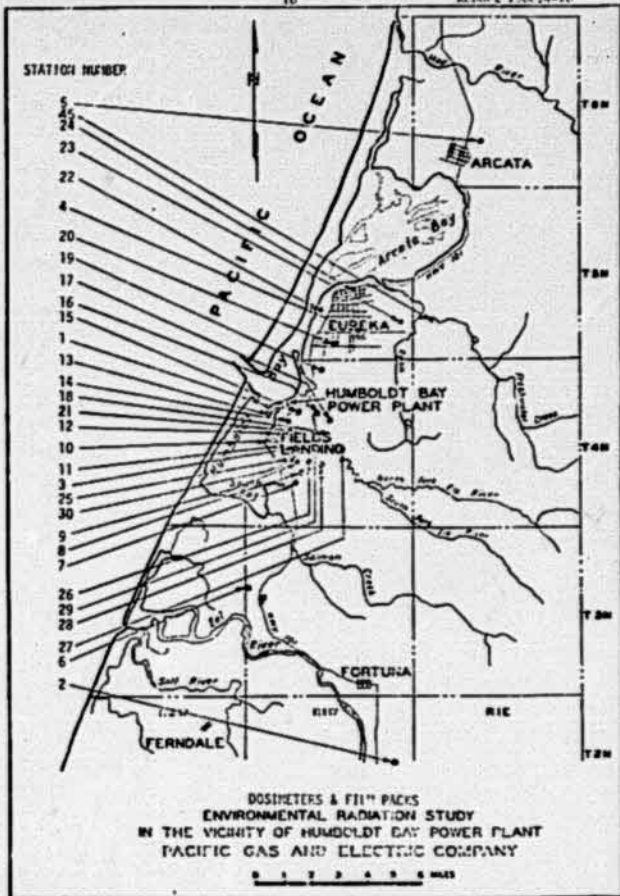


TABLE 3

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1976

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of Waste	Unit	6 month total	Est. Total Error, %
a. Solidified evaporator bottoms	m ³ Ct	8.50E-1 1.37E-1	1.00E1
b. Dry compressible waste, contaminated equip, etc.	m ³ Ct	4.48E1 2.82E0	2.50E1

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

a. Cesium-134	1	2.00E1
Cesium-137	2	4.00E1
Unidentified Mixed Fission Products	1	1.50E1
Cobalt-60	1	1.50E1
Manganese-54	2	1.00E1
b. Cesium-134	1	1.00E1
Cesium-137	1	1.50E1
Unidentified Mixed Fission Products	1	1.50E1
Cobalt-60	1	3.00E1
Manganese-54	1	3.00E1

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
1	Truck (sole use)	Richland, Washington
1	Truck (sole use)	Beatty, Nevada

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
None		

PACIFIC GAS AND ELECTRIC COMPANY

DOCKET NO. 50-113

REPORT ON RADIOACTIVE EFFLUENT RELEASES AND WASTE DISPOSAL
FOR NUNBOLDT BAY POWER PLANT (UNIT NO. 3, COVERING THE PERIOD
JANUARY 1, 1976 THROUGH JUNE 30, 1976

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 January 1, 1976 through June 30, 1976, and is submitted in accordance with Section IX.1.3.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 hour decay period" is 0.18 $\mu\text{Ci/sec}$.
- d. Liquid Effluents: 10CFR20

2. Maximum Permissible Concentrations

Provide the MPCs used in determining allowable release rates or concentrations.

- a. Fission and activation gases: Not applicable.
- b. Iodines: 3×10^{-10} $\mu\text{Ci/cc}$

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Control # 8949
Date Rec'd. 2/4/76
Regulatory Docket File

- c. Particulates, half-lives > 8 days: 3×10^{-10} $\mu\text{Ci}/\text{cc}$
- 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:

Samples (of air ejector off-gas) are taken at least monthly for Sodium Iodide gamma spectrum analysis and, based on six measurable nuclides (Xe138 , Kr87 , Kr88 , Kr92m , Xe135 and Xe137), the remaining nuclides in the mixture are estimated. This analysis is used to calibrate the gross counting results of routine samples which are then used to calibrate the stack continuous monitors. Daily average release rates determined from the stack monitors are used to derive total quantity of the mixtures released, and individual nuclides are proportioned according to the mixture found from the monthly analysis.

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).

c. Particulates:

Filter papers are removed from the stack sampling system weekly and gross beta counted after 48 hour decay. After 7 days they are recounted to determine BaLa140 (Sodium Iodide detector).

Four filters for each quarter are decay counted to determine other particulates (long-lived), alpha emitters, and then analysed for Sr89 and Sr90. Quarterly curie quantities are estimated from this information, proportional to BaLa140.

d. Liquid Effluents:

Waste receiver tank and waste hold tank batch samples are gamma spectrum analysed (Sodium Iodide detector) and gross Beta and gross Gamma counted. If the nuclides identified do not account for the gross gamma count, the mixture is proportionately adjusted. If the gross beta count indicates more activity than the adjusted mixture, the excess activity is recorded as "Additional But Otherwise Unspecified".

Laundry waste tanks are individually analyzed only by gross beta and gross gamma. A monthly composite is analyzed as above.

A quarterly composite of all batches is analyzed for Tritium, Sr89 and Sr90.

5. Batch Releases

a. Liquid:

- 1) Number of batch releases: 219 (A total of 40,067 gallons of laundry waste and 185,432 gallons of treated waste tank discharge)
- 2) Total time period for batch releases: 125 hours
- 3) Maximum time period for a batch release: 5 hours
- 4) Average time period for batch releases: 35 minutes
- 5) Minimum time period for a batch release: 5 minutes
- 6) Average stream flow during periods of release of effluent into a flowing stream: 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 radonate 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 45.6 cubic meters of solid radonate totaling 2.96 Ci was shipped. Table 3 summarizes the radioactive waste material shipments.

E. ENVIRONMENTAL MONITORING

Quarterly reports, "Environmental Radiation Study in the Vicinity of Humboldt Bay Power Plant (HBPP), Eureka, California," contain the basic data from the Humboldt Bay Power Plant environmental monitoring program. The most recent Reports Nos. 59 and 60 are attached and include data from the last quarter of 1975 and the first quarter of 1976. Data from Report 61 (which is in draft form and will be issued later) has also been used to complete the dose estimates in the following tables. These reports describe the sampling locations, total number of samples for each media sampled, as well as the associated measured levels of radioactivity. The types of media sampled are marine flora, marine fish, invertebrates, bottom sediment, milk, domestic water, air particulate, and external radiation measurements with ion chambers.

Potential public exposure in the environs of the plant was calculated from dosimetry data and those sampling media that could result in exposure pathways to man. These sampling media include the aquatic species (gaper clams, Pacific oysters, red-tail perch), milk, domestic water, and air particulate.

It was shown that, with the exception of the direct exposure measurements from ion chambers, the levels of radioactive materials in environmental media indicate that public exposures were less than 1 percent of those that could have resulted from continuous exposure to the concentrations listed in Appendix B, Table II, Part 20. The ion chamber measurements for station recording the highest reading when extrapolated to yearly rates was 142.6 millirem per year for first half of 1976. This extrapolated dose represents 62.9 millirem per year above background, which is well below the technical specification limit of 500 millirem per year above natural background.

1. Potential Exposure from Aquatic Media

The aquatic dose model used was taken from ICRP Publication 2, Report of Committee II, "Permissible Doses for Internal Radiation." The samples of gaper clams and red-tail perch, which can be taken by sports fishermen, were collected in the vicinity of the plant discharge. Pacific oysters, which are taken commercially from Humboldt Bay, were collected from the North Bay at Station 65. It was assumed that an individual would consume 20 grams per day of each species. If particular isotopes were identified by the gamma scans of the samples, then these isotopes were used in the exposure evaluations. In cases where there was an unidentified residual activity in the gross beta-gamma measurements or if there were no isotopes identified, the measured gross beta-gamma activity was distributed according to the radionuclides in the plant liquid releases as reported in Table 2B of this report.

Table 1 summarized the potential exposures from the ingestion of the three aquatic species, gaper clams, Pacific oysters, and red-tail perch. These data showed that the ingestion of the above species would result in exposures to all organs of much less than 1 percent of the 10 CFR20 limits.

2. Potential Exposure from Milk

The plant contribution to the radioactivity in milk and potential exposures were determined by two different methods. Since no specific radionuclides other than 40-K were identified in the milk samples, the first estimate of exposure assumed that the difference between the gross beta-gamma radioactivity measurement and the 40-K activity, as determined by atomic absorption spectroscopy, was of plant origin. Large errors are introduced in this method of analysis because essentially all of the measured radioactivity is 40-K. This model, like the aquatic model, assumes that the unidentified activity is distributed according to the isotopic distribution of measured plant airborne particulate releases. Using this assumption, the principal isotope in milk was 89-Sr from the chain 89-Kr 3.1d, 89-Rb 15.2w, 89-Sr 50.8d, 89-Y stable.

The second model used the measured airborne release data from the plant and the annual average I/Q data to predict airborne concentrations. In this calculation, the MRC model in Regulatory Guide 1.42, Appendix C, for transfer of radioiodine through the air-grass-milk chain was used to estimate the concentration of all isotopes as well as the iodines in milk. Again, the principal isotope of concern was 89-Sr from the above mentioned decay chain. The effective environmental decay constants of 4 days* for 89-Sr and 11 days for the iodines were used.

Table 2 compares net radioactivity and potential exposures resulting Model 1 and Model 2 calculations. Model 2 using plant release data predicts that the exposures derived from milk consumption could have been in this same range which in all cases would have been less than 1 percent of those that would have resulted from continuous exposure to the air and water concentrations listed in Appendix B, Table 11, Part 20.

3. Potential Exposure from Domestic Water

The potential exposure resulting from domestic water was also considered. The data from water samples collected from wells supplying the plant, which are shown in Table 3 of the attached reports, show a mean of gross beta-gamma activity of 1.6 pCi/l. The above values may be compared with data collected in 1971 and 1972. These data** from well-water and treated water in Eureka show yearly gross beta-gamma activity averages of 6.0 and 6.3 pCi/l, respectively. It should be noted that because of the low beta-gamma activities, the water samples are not routinely gamma-scanned. Thus, when comparing the gross beta-gamma activity measurements in domestic water, it can be seen that the levels of radioactivity are well within local background radiation levels.

*Krieger, Herman L., "Effective Half-Times of 85-Sr and 134-Cs for a Contaminated Pasture," Health Physics, Volume 17, pp. 811-824.

**"Radiation Data and Reports," U.S. Environmental Protection Agency, Volume 14, Number 11, November 1973.

4. Potential Exposure from Air Particulate

The fourth potential exposure pathway to man was via inhalation of airborne particulates. Data from Table 6 of the Environmental Radiation Study Reports were averaged for each quarter and exposures calculated assuming that the unidentified isotopes were distributed according to the measured particulate releases from the plant during the corresponding period. The principal contributor to the exposure was assumed to be 89-Sr. The data shown in Table 3 results in exposures well below 1 percent of the 10 CFR 20 exposure limits. It should be noted that although all the particulate activity was assumed to be 89-Sr, the measured air particulate activities during this half of 1976 were all within the range of activities as measured by the network of air particulate stations in the State of California.* Thus, the exposure resulting from the above assumption and shown in Table 3 is well below 1 percent of the 10 CFR 20 exposure limits.

5. Potential Exposure for External Radiation

As seen in Figure 1, there are currently 30 dosimetry stations in the vicinity of the plant. Ionization chambers, which are typically read on a biweekly basis, are presently being utilized for dosimetry. Table 4 in the attached environmental radiation study reports, presents the biweekly dosimetry measurements from all stations with Stations 2 and 5 representing 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 test (a two-way classification, and a 95 percent confidence limit least significant difference test) were made during biweekly dosimeter readings for each station. Using the above test, it was determined that 3 stations were statistically significant above background for the first half of 1976. These stations along with their extrapolated yearly exposures are shown on Table 4. As can be seen by comparing this table to Figure 1, the stations above background are located near the plant and at low elevations. The exposures associated with the gaseous effluent from the plant appear to be greatly dependent not only upon meteorological conditions and distance from the plant, but also on the topography.

*Private Communication, State of California Health Department, Radiologic Health Section, 1976.

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.

Refer to Table 4A in the report for 1975, which 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 1

ESTIMATED EXPOSURES FROM MEASURED RADIOACTIVITY IN AQUATIC SPECIES

Station Number	Sample Description	Quarter Collected	Whole Body	Exposure (mRem/quarter)		Thyroid
				Bone	Internal	
55	76050 Red-tailed Surf Perch	1st- 1976	0.007	0.040	0.010	0.012
65	76048 Pacific Oyster	1st- 1976	0.081	0.507	0.122	0.144
59	76049 Gaper Clam	1st- 1976	0.263	1.635	0.393	0.465
65	76280 Pacific Oyster	2nd- 1976	0.090	0.579	0.143	0.076
59	76281 Gaper Clam	2nd- 1976	0.163	1.052	0.026	0.138

TABLE 2
POTENTIAL EXPOSURES IN MILK
MODEL 1 - ESTIMATED BY USE OF MEASURED ACTIVITY

Station No.	Sample Description	Quarter Collected	Net Sample Activity pCi/s	Exposure (mRem/quarter)*		
				Whole Body	Bone	Internal
6	76084 Milk	1/76	206.5	3.91	7.04	0.88
16	76085 Milk	1/76	138.8	2.62	4.73	0.59
6	76208 Milk	2/76	263.9	4.99	9.00	1.12
16	76254 Milk	2/76	279.2	5.28	9.52	1.19

* Exposure to thyroid was several orders of magnitude below the exposure to the other organs.

MODEL 2 - ESTIMATED BY USE OF PLANT RELEASE DATA*

Station No.	Distance from Plant (Km)	1/Q ³ (sec/m ³)	Sample Activity pCi/l	Exposure (mRem/quarter)			
				Whole Body	Bone	Internal	Thyroid
6	10.7	2.00×10^{-8}	6.1	0.11	0.21	0.03	.05
16	2.8	6.13×10^{-8}	18.7	0.35	0.64	0.08	.18

* Computed from Plant Data January - June 1976

TABLE 3

ESTIMATED EXPOSURES FROM MEASURED ACTIVITY IN AIR PARTICULATE

Station No.	Average of Weekly Air Particulate Activity $\mu\text{Ci}/\text{m}^3$	Quarter Collected	Radiation Exposure ($\text{mRem}/\text{Quarter}$) (1)		
			Whole Body	Bone	Internal
3	0.026	1/76	0.002	0.074	0.004
3	0.016	2/76	0.001	0.045	0.003
45	0.021	1/76	0.002	0.060	0.003
45	0.015	2/76	0.001	0.045	0.003

(1) Radiation doses are assumed to be principally due to Sr-89.

TABLE 4

ESTIMATED EXTERNAL RADIATION EXPOSURE
FROM ION CHAMBER READINGS

Station	Extrapolated Yearly Exposure ($\text{mRm}/\text{Yr.}$)	Exposure Above Background ($\text{mRm}/\text{Yr.}$)	Period of Exposure
13	142.6	62.9	Jan-June 1976
11	117.7	38.0	"
14	117.0	37.3	"

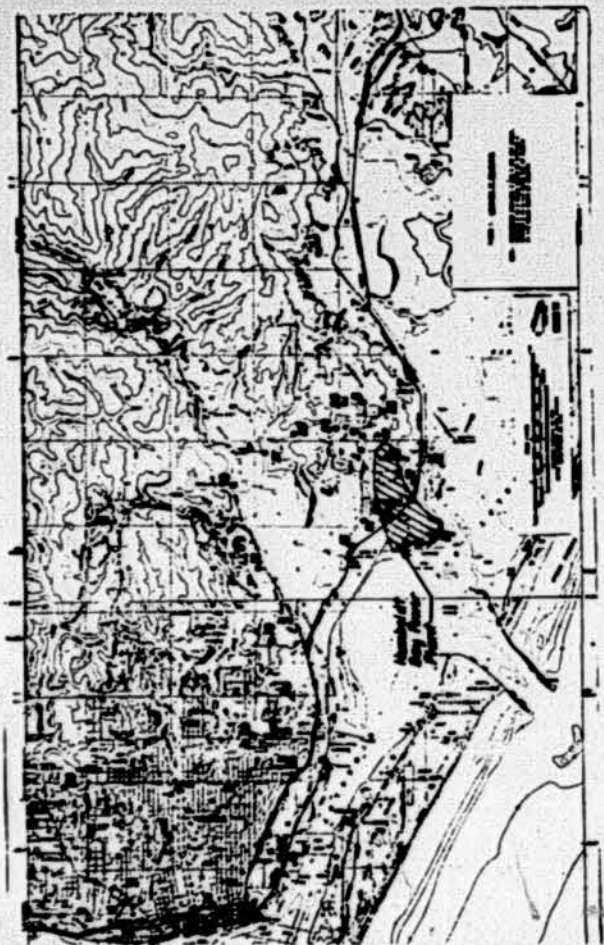


TABLE 1A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1976
GASEOUS EFFLUENTS - SUMMARY OF ALL RELEASES

	Unit	First Quarter	Second Quarter	Est. Total Error %
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A. Fission & activation gases

1. Total release	CI	5.85E4	3.38E4	2.01E1
2. Average release rate for period	$\mu\text{Ci/sec}$	7.43E3	4.25E3	
3. Percent of Technical specification limit	%	1.49E1	8.50E0	

B. Iodine

1. Total iodine-131	CI	3.21E-2	2.15E-2	1.5E1
2. Average release rate for period (I-131)	$\mu\text{Ci/sec}$	4.08E-3	2.73E-3	
3. Percent of technical specification limit	%	2.27E0	1.52E0	

C. Particulates

1. Particulates with half- lives > 8 days	CI	1.43E-2	1.15E-2	1.5E1
2. Average release rate for period	$\mu\text{Ci/sec}$	1.82E-3	1.46E-3	
3. Percent of technical specification limit	%	1.01E0	8.11E-1	
4. Gross alpha radioactivity	CI	2.54E-7	7.15E-8	

D. Tritium

1. Total release	CI	6.03E-1	5.72E-1	5.0E1
2. Average release rate for period	$\mu\text{Ci/sec}$	7.67E-2	7.28E-2	

TABLE 16

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1976

GASEOUS EFFLUENTS - ELEVATED RELEASE

Continuous Mode

Nuclides Released	Unit	First Quarter	Second Quarter
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1. Fission gases

krypton-89	CI	2.78E1	4.82E0
krypton-85m	CI	1.76E3	1.29E3
krypton-87	CI	7.23E3	4.95E3
krypton-88	CI	7.51E3	5.43E3
neon-133	CI	1.22E3	9.20E2
neon-135	CI	8.53E3	6.36E3
neon-135m	CI	8.30E3	3.84E3
neon-138	CI	2.21E4	9.85E3
neon-137	CI	2.40E2	3.75E1
neon-139m	CI	3.25E1	4.65E1
krypton-83m	CI	1.48E3	1.04E3
Total for period	CI	5.84E4	3.38E4

2. Iodines

iodine-131	CI	3.21E-2	2.15E-2
iodine-133	CI	1.86E-1	1.18E-1
iodine-135	CI	1.71.00E-1*	1.71.00E-1*
Total for period	CI	2.18E-1	1.40E-1

3. Particulates

strontium-89	CI	4.62E-3	2.18E-3
strontium-90	CI	1.92E-5	1.35E-5
cesium-134	CI	3.40E-4	1.75.00E-5*
cesium-137	CI	7.40E-4	7.94E-5
barium-lanthanum-140	CI	8.52E-3	8.79E-3
cobalt-60	CI	6.40E-5	2.32E-4
manganese-54	CI	1.71.00E-4*	1.97E-4
cerium-144	CI	8.75E-5	1.71.00E-4*

* The minimum sensitivity of the plant's Sodium Iodide 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.

TABLE 2A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1976

LIQUID EFFLUENTS - SUMMARY OF ALL RELEASES

	Unit	First Quarter	Second Quarter	Total Error ¹
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A. THORIUM-232 ACTIVATION PRODUCTS

1. Total release (not including tritium, gases, alpha)	ci	4.03E-1	2.58E-1	1.50E1
2. Average diluted concentration during period	μCi/ml	1.03E-8	5.92E-9	
3. Percent of applicable limit	%	1.03E1	5.92E0	

B. Tritium

1. Total release	ci	5.23E0	6.32E0	5.00E0
2. Average diluted concentration during period	μCi/ml	1.34E-7	1.45E-7	
3. Percent of applicable limit	%	6.47E-3	4.83E-3	

C. Dissolved and entrained gases

1. Total release	ci	1.15E-3	LT1.00E-05	5.00E1
------------------	----	---------	------------	--------

D. Gross alpha radioactivity

1. Total release	ci	LT2.00E-05	LT3.00E-5	7.5E1
------------------	----	------------	-----------	-------

E. Volume of waste released (prior to dilution)	liter	3.63E5	4.94E5	5.00E0
F. Volume of dilution water used during period	liter	3.91E10	4.36E10	5.00E0

¹ The minimum sensitivity of the plant's Sodium Iodide 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.

TABLE 2B

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1976

LIQUID EFFLUENTS

Nuclides Released	Unit	Batch Mode	
		First Quarter	Second Quarter
strontium-89	Cl	5.80E-3	4.53E-2
strontium-90	Cl	1.35E-3	1.00E-3
cesium-134	Cl	8.49E-2	2.96E-2
cesium-137	Cl	2.00E-1	7.88E-2
iodine-131	Cl	4.90E-3	1.00E-3
cobalt-58	Cl	1.73.00E-3 ^a	1.59E-3
cobalt-60	Cl	3.95E-2	3.97E-2
zinc-65	Cl	1.82E-2	1.18E-2
manganese-54	Cl	2.81E-2	4.27E-2
chromium-51	Cl	3.65E-4	1.73.00E-3 ^a
zirconium-niobium-95	Cl	1.71.00E-3 ^a	1.71.00E-3 ^a
molybdenum-99	Cl	1.71.00E-3 ^a	1.71.00E-3 ^a
technetium-99m	Cl	1.71.00E-3 ^a	1.71.00E-3 ^a
barium-lanthanum-140	Cl	1.71.00E-3 ^a	1.71.00E-3 ^a
cerium-141 (as equivalent [as])	Cl	1.90E-2	6.48E-1
neptunium-239	Cl	1.71.00E-3 ^a	1.71.00E-3 ^a
Total for period (above)	Cl	4.03E-1	2.58E-1
cesium-134	Cl	1.15E-3	1.1.00E-3 ^a
cesium-137	Cl	-	-

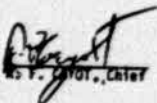
- * The minimum sensitivity of the plant's Sodium iodide spectrometer system for a particular nuclide depends upon the mixture of nuclides present in each batch, therefore, some nuclides not detected could be present at levels comparable to those detected. Those nuclides expected to be present, but not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

Report Issued: JAN 24 1974

Report 7804.4-73

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 49
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING JUNE 30, 1973
(Spring)



W. H. Culver, Chief

Report Prepared By:

W. H. Culver
C. Hensel
D. P. Serpa

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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 except for the 65-Zn activity found in the red algae samples. All liquid radwaste releases from the plant were well within the limits of the existing regulations. The maximum integrated dose measured was well below the permissible contribution of 500 mr/year in unrestricted areas.

INTRODUCTION

This is the 49th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period April through June 1973. 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 Public Health.⁴ A table of the samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix. During this quarter, the air particulate sampler at Station 45 was out of service for repairs.

*See reference page.

Twenty-nine gross beta analyses and 16 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 and confirmatory analyses of three samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

<u>Sample No.</u>	<u>Gross Beta Activity (pCi/g dry)</u>	
	<u>Teledyne Isotopes</u>	<u>DER</u>
73269	11.1 \pm 0.7	12.8 \pm 1.5
73275	6.9 \pm 0.6	8.0 \pm 0.9
73277	6.5 \pm 0.6	8.2 \pm 0.8

The Zn-65 activities in the red algae samples were again higher than those found during the 1971-72 period. This is probably due to Zn-65 releases from further demineralizer regenerations and the relatively long biological half-life of Zn-65. All liquid radwaste releases from the plant were well within the limits of the existing regulations.

Dosimeter readings during this quarter were generally above background levels (measured at Stations 2 and 5) and consistent with stack releases from HBPP Unit 3 for the period. The measured contribution from Unit 3 to

the total dose at Station 14 was approximately 38 mr above background,^a which is well below the permissible dose contribution in unrestricted areas of 50 mrem/year.^b

Figure 3 shows the dosimeter and film pack doses by the month at Station 14 and the air-particulate activity at Station 3 from January 1969 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	Average Release Rate For Month - $\mu\text{C per Second}^{**}$
April	13,200
May	14,600
June	13,500

^aBased on 50 weeks of measurements.

^{**}During this quarter, the unit was operated between 180 and 210 MWt.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. P G and E 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 45 (Figure 2). The constant flow samplers have flow rates in the range of 1.0 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. Gross beta activity is counted 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 KBPP 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), Mountain View, 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.

SUPPLY COLLECTION

DATE

TIME

WIND

WIND

WIND

WIND

1. MOUNTAIN (WIND PLANT)

2. THE MOUNTAIN PLANT

3. MOUNTAIN PLANT

4. MOUNTAIN PLANT

5. MOUNTAIN PLANT

6. MOUNTAIN PLANT

7. MOUNTAIN PLANT

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37. MOUNTAIN PLANT

38. MOUNTAIN PLANT

39. MOUNTAIN PLANT

40. MOUNTAIN PLANT

41. MOUNTAIN PLANT

42. MOUNTAIN PLANT

43. MOUNTAIN PLANT

44. MOUNTAIN PLANT

45. MOUNTAIN PLANT

TABLE 3
RADIOACTIVITIES IN TERRESTRIAL SAMPLES

SITE SAMPLE	COLLECTION DATE	META DATE	GROSS ACTIVITY PC/14G DRY SAMPLES META	GROSS ACTIVITY PC/14G DRY SAMPLES CANAL (1)	POTASSIUM CONTENT MG. P/0 DRY SAMPLES	GROSS ACTIVITY PC/14G DRY SAMPLES (2)	GROSS NET ACTIVITY PC/14G DRY SAMPLES
1. 73270 JMWELTIC WATER	1/31	5/29/73	7/12/73	0.92 ± 0.04			
2. 73270 WTR	(3)	5/29/73	7/12/73	7.67 ± 0.94	0.2	6.9	159 ± 1.01
3. 73270 WTR	(3)	5/29/73	7/12/73	5.71 ± 1.04	9.2	7.2	114 ± 1.02
4. 73270 SOIL	6/2/73	7/13/73	9.87 ± 1.09		0.5	0.4	8.73 ± .86
5. 73270 SOIL	6/2/73	7/13/73	0.09 ± 0.39		0.5	0.4	7.14 ± .87

1. CORRECTED TO COLLECTION DATE. ONLY THREE RADIOISOTOPES, OTHER THAN K40, IDENTIFIED BY PULSE HEIGHT ANALYSIS ARE REPORTED.
 2. PM AND ACTIVITY OF 230PC/14G METAL POTASSIUM.
 3. RECOUNTED SAMPLE.

4. THE WTR SAMPLES WERE SAMPLES OBTAINED ON THE FOLLOWING DATES: MET 5/21/73, WTR 6/22/73

SAMPLING MEASUREMENTS

REPORT START END	DATE/TIME DATE/TIME	DATE/TIME DATE/TIME	DATE/TIME DATE/TIME	DATE/TIME DATE/TIME	DATE/TIME DATE/TIME	DATE/TIME DATE/TIME	DATE/TIME DATE/TIME
STATION	TOTAL, mm	TOTAL, mm	TOTAL, mm	TOTAL, mm	TOTAL, mm	TOTAL, mm	TOTAL, mm
1	5.5	2.7	5.5	5.5	5.5	5.5	5.5
2	2.0	2.0	2.0	2.0	2.0	2.0	2.0
3	2.0	2.0	2.0	2.0	2.0	2.0	2.0
4	2.0	2.0	2.0	2.0	2.0	2.0	2.0
5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
6	2.0	2.0	2.0	2.0	2.0	2.0	2.0
7	2.0	2.0	2.0	2.0	2.0	2.0	2.0
8	2.0	2.0	2.0	2.0	2.0	2.0	2.0
9	2.0	2.0	2.0	2.0	2.0	2.0	2.0
10	2.0	2.0	2.0	2.0	2.0	2.0	2.0
11	2.0	2.0	2.0	2.0	2.0	2.0	2.0
12	2.0	2.0	2.0	2.0	2.0	2.0	2.0
13	2.0	2.0	2.0	2.0	2.0	2.0	2.0
14	2.0	2.0	2.0	2.0	2.0	2.0	2.0
15	2.0	2.0	2.0	2.0	2.0	2.0	2.0
16	2.0	2.0	2.0	2.0	2.0	2.0	2.0
17	2.0	2.0	2.0	2.0	2.0	2.0	2.0
18	2.0	2.0	2.0	2.0	2.0	2.0	2.0
19	2.0	2.0	2.0	2.0	2.0	2.0	2.0
20	2.0	2.0	2.0	2.0	2.0	2.0	2.0
21	2.0	2.0	2.0	2.0	2.0	2.0	2.0
22	2.0	2.0	2.0	2.0	2.0	2.0	2.0
23	2.0	2.0	2.0	2.0	2.0	2.0	2.0
24	2.0	2.0	2.0	2.0	2.0	2.0	2.0
25	2.0	2.0	2.0	2.0	2.0	2.0	2.0
26	2.0	2.0	2.0	2.0	2.0	2.0	2.0
27	2.0	2.0	2.0	2.0	2.0	2.0	2.0
28	2.0	2.0	2.0	2.0	2.0	2.0	2.0
29	2.0	2.0	2.0	2.0	2.0	2.0	2.0
30	2.0	2.0	2.0	2.0	2.0	2.0	2.0
31	2.0	2.0	2.0	2.0	2.0	2.0	2.0
32	2.0	2.0	2.0	2.0	2.0	2.0	2.0
33	2.0	2.0	2.0	2.0	2.0	2.0	2.0
34	2.0	2.0	2.0	2.0	2.0	2.0	2.0
35	2.0	2.0	2.0	2.0	2.0	2.0	2.0
36	2.0	2.0	2.0	2.0	2.0	2.0	2.0
37	2.0	2.0	2.0	2.0	2.0	2.0	2.0
38	2.0	2.0	2.0	2.0	2.0	2.0	2.0
39	2.0	2.0	2.0	2.0	2.0	2.0	2.0
40	2.0	2.0	2.0	2.0	2.0	2.0	2.0
41	2.0	2.0	2.0	2.0	2.0	2.0	2.0
42	2.0	2.0	2.0	2.0	2.0	2.0	2.0
43	2.0	2.0	2.0	2.0	2.0	2.0	2.0
44	2.0	2.0	2.0	2.0	2.0	2.0	2.0
45	2.0	2.0	2.0	2.0	2.0	2.0	2.0
46	2.0	2.0	2.0	2.0	2.0	2.0	2.0
47	2.0	2.0	2.0	2.0	2.0	2.0	2.0
48	2.0	2.0	2.0	2.0	2.0	2.0	2.0
49	2.0	2.0	2.0	2.0	2.0	2.0	2.0
50	2.0	2.0	2.0	2.0	2.0	2.0	2.0
51	2.0	2.0	2.0	2.0	2.0	2.0	2.0
52	2.0	2.0	2.0	2.0	2.0	2.0	2.0
53	2.0	2.0	2.0	2.0	2.0	2.0	2.0
54	2.0	2.0	2.0	2.0	2.0	2.0	2.0
55	2.0	2.0	2.0	2.0	2.0	2.0	2.0
56	2.0	2.0	2.0	2.0	2.0	2.0	2.0
57	2.0	2.0	2.0	2.0	2.0	2.0	2.0
58	2.0	2.0	2.0	2.0	2.0	2.0	2.0
59	2.0	2.0	2.0	2.0	2.0	2.0	2.0
60	2.0	2.0	2.0	2.0	2.0	2.0	2.0
61	2.0	2.0	2.0	2.0	2.0	2.0	2.0
62	2.0	2.0	2.0	2.0	2.0	2.0	2.0
63	2.0	2.0	2.0	2.0	2.0	2.0	2.0
64	2.0	2.0	2.0	2.0	2.0	2.0	2.0
65	2.0	2.0	2.0	2.0	2.0	2.0	2.0
66	2.0	2.0	2.0	2.0	2.0	2.0	2.0
67	2.0	2.0	2.0	2.0	2.0	2.0	2.0
68	2.0	2.0	2.0	2.0	2.0	2.0	2.0
69	2.0	2.0	2.0	2.0	2.0	2.0	2.0
70	2.0	2.0	2.0	2.0	2.0	2.0	2.0
71	2.0	2.0	2.0	2.0	2.0	2.0	2.0
72	2.0	2.0	2.0	2.0	2.0	2.0	2.0
73	2.0	2.0	2.0	2.0	2.0	2.0	2.0
74	2.0	2.0	2.0	2.0	2.0	2.0	2.0
75	2.0	2.0	2.0	2.0	2.0	2.0	2.0
76	2.0	2.0	2.0	2.0	2.0	2.0	2.0
77	2.0	2.0	2.0	2.0	2.0	2.0	2.0
78	2.0	2.0	2.0	2.0	2.0	2.0	2.0
79	2.0	2.0	2.0	2.0	2.0	2.0	2.0
80	2.0	2.0	2.0	2.0	2.0	2.0	2.0
81	2.0	2.0	2.0	2.0	2.0	2.0	2.0
82	2.0	2.0	2.0	2.0	2.0	2.0	2.0
83	2.0	2.0	2.0	2.0	2.0	2.0	2.0
84	2.0	2.0	2.0	2.0	2.0	2.0	2.0
85	2.0	2.0	2.0	2.0	2.0	2.0	2.0
86	2.0	2.0	2.0	2.0	2.0	2.0	2.0
87	2.0	2.0	2.0	2.0	2.0	2.0	2.0
88	2.0	2.0	2.0	2.0	2.0	2.0	2.0
89	2.0	2.0	2.0	2.0	2.0	2.0	2.0
90	2.0	2.0	2.0	2.0	2.0	2.0	2.0
91	2.0	2.0	2.0	2.0	2.0	2.0	2.0
92	2.0	2.0	2.0	2.0	2.0	2.0	2.0
93	2.0	2.0	2.0	2.0	2.0	2.0	2.0
94	2.0	2.0	2.0	2.0	2.0	2.0	2.0
95	2.0	2.0	2.0	2.0	2.0	2.0	2.0
96	2.0	2.0	2.0	2.0	2.0	2.0	2.0
97	2.0	2.0	2.0	2.0	2.0	2.0	2.0
98	2.0	2.0	2.0	2.0	2.0	2.0	2.0
99	2.0	2.0	2.0	2.0	2.0	2.0	2.0
100	2.0	2.0	2.0	2.0	2.0	2.0	2.0

1. NO. OF READING TESTS AND IN AN-AM FULL SCALE.
 2. NO. OF READING TESTS AND IN AN-AM FULL SCALE.
 3. NO. OF READING TESTS AND IN AN-AM FULL SCALE.

FILM PACK MEASUREMENTS

EXPOSURE START END	3/27/73 4/24/73	4/24/73 5/22/73	5/22/73 7/ 3/73
ELAPSED TIME DAYS	28	28	42
STATION	TOTAL NR(1)	TOTAL NR(1)	TOTAL NR(1)
1	4	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	4	0	0
15	0	0	10
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. APPROX. BACKGROUND OF 0 NR/MO

TABLE 6

REPORT 7804A-73

 AIR PARTICULATE
 STATION NO. 3 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (cc x 3)	COLLECTION DATE	COUNTING DATE	PC1/M+3
73176	286	4/3/73	4/18/73	0.010 +0.001
73181	286	4/10/73	4/19/73	0.048+0.006
73188	286	4/17/73	4/26/73	0.030+0.003
73202	286	4/24/73	5/ 2/73	0.012+0.002
73207	286	5/ 1/73	5/ 9/73	0.317+0.002
73219	286	5/ 8/73	5/17/73	0.021+0.002
73225	286	5/15/73	5/30/73	0.032+0.001
73251	286	5/22/73	6/ 3/73	0.022+0.002
73253	286	5/29/73	6/ 5/73	0.076+0.003
73261	286	6/ 5/73	6/15/73	0.027+0.002
73266	286	6/12/73	6/19/73	0.031+0.003
73286	286	6/19/73	6/26/73	0.084+0.006
73290	286	6/26/73	7/ 9/73	0.015+0.001
73296	286	7/ 3/73	7/11/73	0.011+0.002

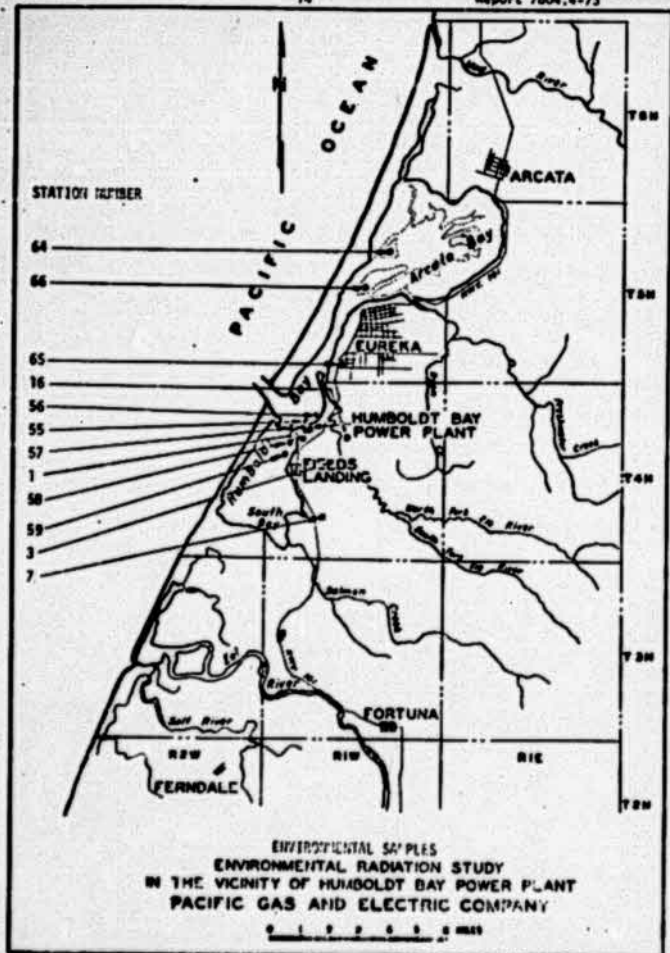


Figure 1

• SURGE CHS

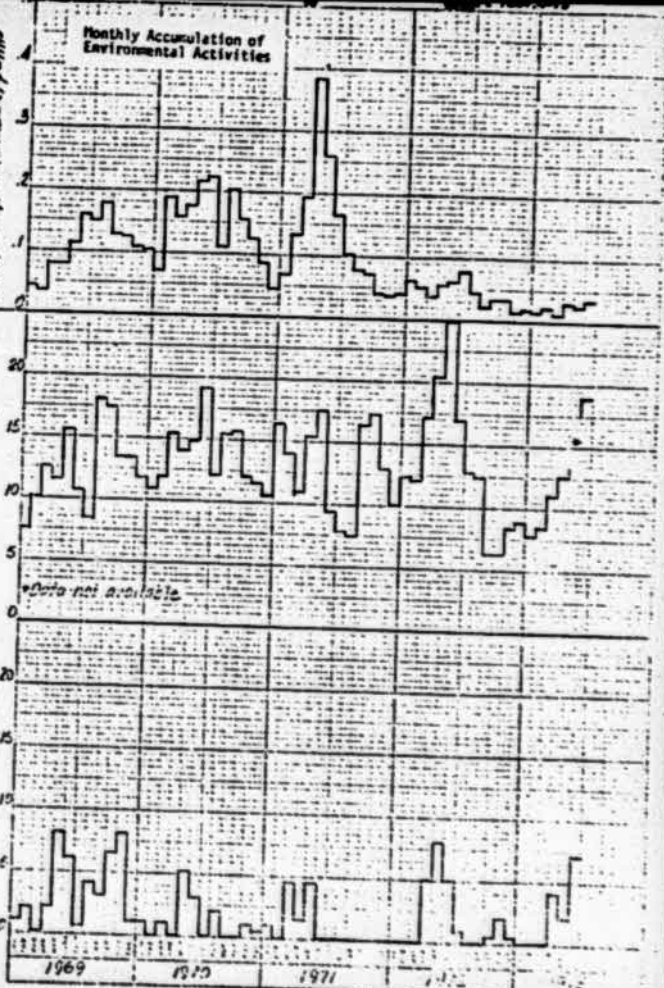
Dosimetry. Station 14
Film Pkts, mg above
background of 8mcrma

Ion Chambers, mr

*Data not available

Station 3
Monthly Average Air Activity, pC/m³

Monthly Accumulation of
Environmental Activities

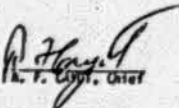


Report Issued: FEB 24 1975

Report 7356.3-74

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 53
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
MORROLET BAY POWER PLANT
EMERALD, CALIFORNIA
QUARTER ENDING JUNE 30, 1974
(Spring)



R. F. Cline, Chief

Report Prepared By:

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C. G. Hensel
D. P. Serpa
R. M. Lorenz

cn/t

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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 mr/year in unrestricted areas.

INTRODUCTION

This is the 53rd quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period April through June 1974. 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 17 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 Public 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-five gross beta analyses and 18 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 HEMP personnel. Film packs were read and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)	
	EE (Environmental)	DER
74185	15.2 \pm 0.8	14.7 \pm 1.4
74187	22.0 \pm 1.0	18.3 \pm 1.4
74189	5.1 \pm 0.3	4.7 \pm 0.6
74193	9.6 \pm 0.5	10.4 \pm 0.9
74195	17.6 \pm 0.6	17.5 \pm 1.0

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The measured contribution from Unit 3 to the total dose at Station 14 was approximately 58 mR above background, which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1970 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - uc per Second*</u>
April 1974	24,599
May 1974	26,700
June 1974	28,501

*The unit was operated between 205 and 215 Mwt during this quarter.

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 P G and E, Attn: F. F. Hutz, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

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

Marine and terrestrial samples are processed quarterly at DCR. 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 45 (Figure 1). The constant flow samplers have flow rates in the range of 1.0 to 1.2 cfm; an IM-70 filter is used. The filters are collected on a weekly basis and mailed to DCR. Gross beta activity is counted 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 HUPP 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), Mountain View, 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	MAINE WHITE-CLAMS & OTHER PLUMS	VERDES-CLAMS INVERTE. SEDIM.	VERDES-CLAMS INVERTE. SEDIM.	DOZ-PAVIC. MEANS	PLUM PACKS
1	CONVENT PLUM PLANT		2		3
2	1000 CONVENT PLANT				3
3	1000 CONVENT PLANT				3
4	1000 CONVENT PLANT				3
5	1000 CONVENT PLANT				3
6	1000 CONVENT PLANT				3
7	1000 CONVENT PLANT				3
8	1000 CONVENT PLANT				3
9	1000 CONVENT PLANT				3
10	1000 CONVENT PLANT				3
11	1000 CONVENT PLANT				3
12	1000 CONVENT PLANT				3
13	1000 CONVENT PLANT				3
14	1000 CONVENT PLANT				3
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19	1000 CONVENT PLANT				3
20	1000 CONVENT PLANT				3
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37	1000 CONVENT PLANT				3
38	1000 CONVENT PLANT				3
39	1000 CONVENT PLANT				3
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96	1000 CONVENT PLANT				3
97	1000 CONVENT PLANT				3
98	1000 CONVENT PLANT				3
99	1000 CONVENT PLANT				3
100	1000 CONVENT PLANT				3

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808

ADDITIONAL INFORMATION:

STA SAMPLE	DESCRIPTION	COLLECTION COUNTING		GROSS ACTIVITY INC/GR GR SAMPLE NET	POSSIBLE CONTAMINANT IN POSSESSION		GROSS DATA ACTIVITY INC/GR GR SAMPLE NET
		DATE	TIME		INC/GR	ACTIVITY	
1	7630A 201A	9/ 9/76	6: 5/76	10.5+-0.70	0.0	0.0	0.32+-0.03
2	7630B 201A	9/ 9/76	9/10/76	11.5+-1.00	0.0	0.0	0.44+-0.15
3	7630C 201A	9/ 9/76	6/25/76	7.13+-0.5	0.0	0.0	0.03+-0.13
4	7630D 201A	1 31	6/ 3/76	9.83+-0.62	10.6	0.0	11.94+-0.12
5	7630E 201A	(1)	6/ 3/76	12.0+-1.48			1.37+-0.18

[illegible]

2001-STER MEASUREMENTS

PERIOD START END	2/26/76 4/2/76	4/2/76 5/1/76	5/1/76 5/21/76	5/21/76 6/1/76	6/1/76 6/18/76	6/18/76 7/1/76	TOTAL NR
ELAPSED TIME Days	7	21	20	10	18	14	
STATION	TOTAL NR	TOTAL NR	TOTAL NR	TOTAL NR	TOTAL NR	TOTAL NR	TOTAL NR
1	1-6	3-6	3-6	3-6	3-6	3-6	18-6
2	1-6	3-6	3-6	3-6	3-6	3-6	18-6
3	1-6	3-6	3-6	3-6	3-6	3-6	18-6
4	1-6	3-6	3-6	3-6	3-6	3-6	18-6
5	1-6	3-6	3-6	3-6	3-6	3-6	18-6
6	1-6	3-6	3-6	3-6	3-6	3-6	18-6
7	1-6	3-6	3-6	3-6	3-6	3-6	18-6
8	1-6	3-6	3-6	3-6	3-6	3-6	18-6
9	1-6	3-6	3-6	3-6	3-6	3-6	18-6
10	1-6	3-6	3-6	3-6	3-6	3-6	18-6
11	1-6	3-6	3-6	3-6	3-6	3-6	18-6
12	1-6	3-6	3-6	3-6	3-6	3-6	18-6
13	1-6	3-6	3-6	3-6	3-6	3-6	18-6
14	1-6	3-6	3-6	3-6	3-6	3-6	18-6
15	1-6	3-6	3-6	3-6	3-6	3-6	18-6
16	1-6	3-6	3-6	3-6	3-6	3-6	18-6
17	1-6	3-6	3-6	3-6	3-6	3-6	18-6
18	1-6	3-6	3-6	3-6	3-6	3-6	18-6
19	1-6	3-6	3-6	3-6	3-6	3-6	18-6
20	1-6	3-6	3-6	3-6	3-6	3-6	18-6
21	1-6	3-6	3-6	3-6	3-6	3-6	18-6
22	1-6	3-6	3-6	3-6	3-6	3-6	18-6
23	1-6	3-6	3-6	3-6	3-6	3-6	18-6
24	1-6	3-6	3-6	3-6	3-6	3-6	18-6
25	1-6	3-6	3-6	3-6	3-6	3-6	18-6
26	1-6	3-6	3-6	3-6	3-6	3-6	18-6
27	1-6	3-6	3-6	3-6	3-6	3-6	18-6
28	1-6	3-6	3-6	3-6	3-6	3-6	18-6
29	1-6	3-6	3-6	3-6	3-6	3-6	18-6
30	1-6	3-6	3-6	3-6	3-6	3-6	18-6

1. 2001-STER MEASUREMENTS READ & ANALYZED FULL SCALE.

2. 2001-STER MEASUREMENTS READ & ANALYZED FULL SCALE.

3. 2001-STER MEASUREMENTS READ & ANALYZED FULL SCALE.

4. DATA FOR 2/26/76-4/2/76, 4/2/76-5/1/76, 5/1/76-5/21/76, 5/21/76-6/1/76, 6/1/76-6/18/76, 6/18/76-7/1/76.

AIR PARTICULATE STATION NO. 3 CROSS RIVER ACTIVITIES

SAMPLE NUMBER	VOLUME (cc)	COLLECTION DATE	COUNTING DATE	CPM/CC
76125	286	6/ 2/76	6/ 8/76	0.057±0.004
76140	276	6/ 6/76	6/11/76	0.133±0.018
76154	286	6/16/76	6/23/76	0.155±0.015
76165	286	6/23/76	6/29/76	0.121±0.012
76171	286	6/30/76	7/ 6/76	0.098±0.010
76186	286	7/ 7/76	7/13/76	0.137±0.007
76201	286	7/14/76	7/19/76	0.103±0.022
76211	286	7/22/76	7/29/76	0.119±0.009
76227	286	7/29/76	8/ 5/76	0.175±0.007
76238	286	8/ 5/76	8/12/76	0.096±0.008
76253	286	8/12/76	8/19/76	0.128±0.017
76276	286	8/19/76	7/ 1/76	0.091±0.010
76299	286	7/ 2/76	7/11/76	0.091±0.010

STATION 43.49 CROSS RIVER ACTIVITY

STATION NO. 93 SOUTH BELL
-410 PARTICULATE-

[illegible]

[The page contains several horizontal lines, likely representing redacted text or a scanning artifact.]

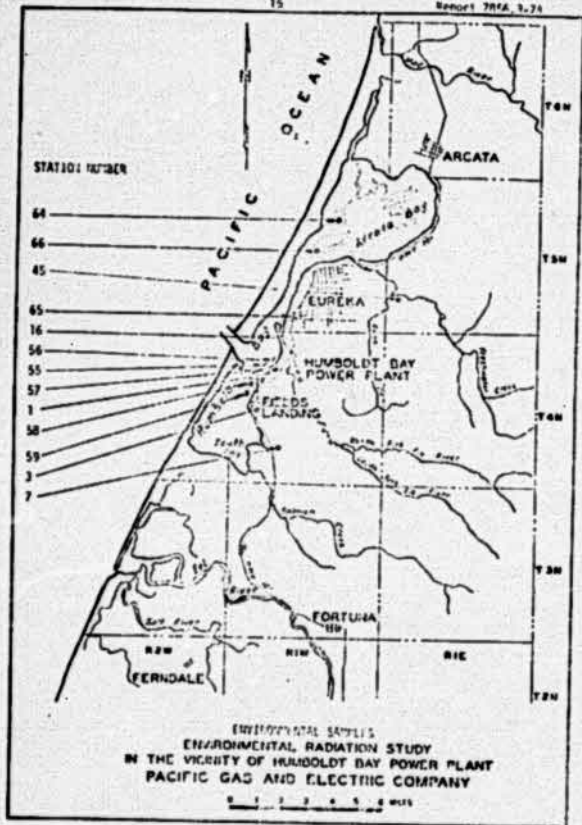
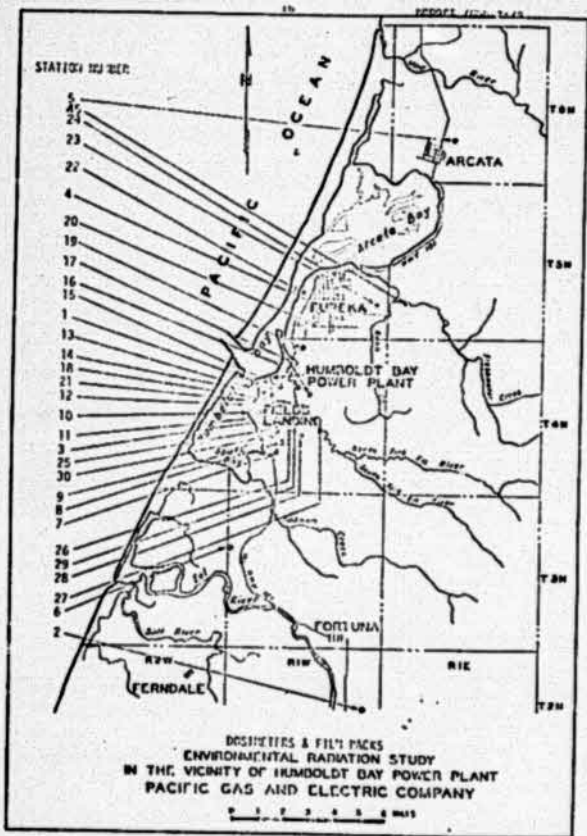
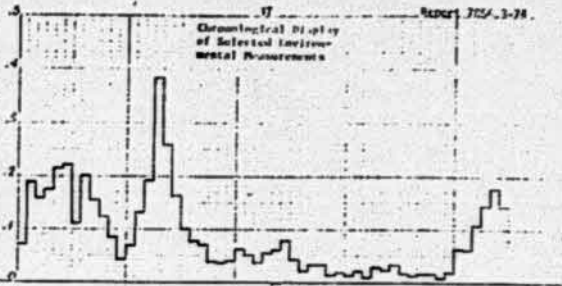


Figure 1.



Chronological Display
of Selected Environmental
Measurements

Station 3
Monthly Average Air Particulate, $\mu\text{g}/\text{m}^3$

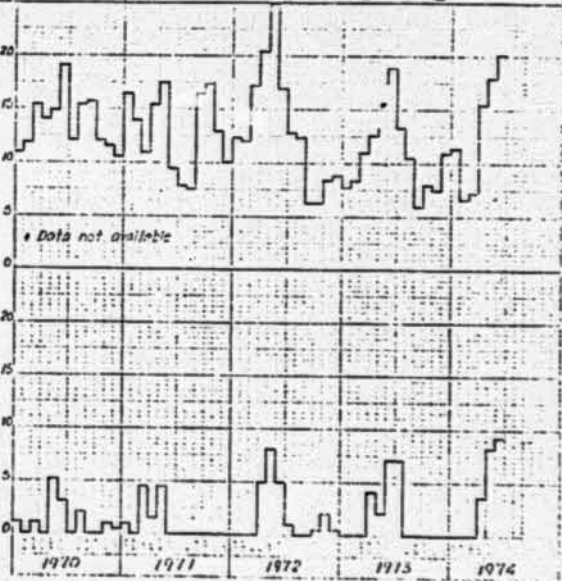


Dosimetry, Station 14

Ion Chambers, mR

* Data not available

film packs, mR above
background of 0 mR/m



Report Issued: OCT 13 1975

Report 7906.2-75

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 57
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING JUNE 30, 1975
(Spring)



R. M. Lorenz, Chief

Report Prepared By:

C. G. Hense
R. M. Lorenz

sm/t

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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 57th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period April through June 1975. 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 18 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 Public Health.⁴ A table of the samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix.

¹See reference page.

Forty-four gross beta analyses and 17 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned. 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 H&PP personnel. Film packs were read and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)		
	Tele-type Isotopes	LFE Environmental	DER
75316	14.1 \pm 4.2	13.1 \pm 1.2	13.5 \pm 0.6
75321	18.5 \pm 3.6	17.9 \pm 1.8	17.0 \pm 0.7
75325	8.9 \pm 3.6	10.0 \pm 1.0	9.7 \pm 0.5
75327	21.0 \pm 3.8	16.8 \pm 1.8	17.9 \pm 1.1
75328	7.3 \pm 2.5	6.5 \pm 0.8	5.3 \pm 0.4

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The annual contribution from Unit 3 to the total dose at Station 14 was approximately 70 mrem above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

*Extrapolated to one year from actual measurements.

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1971 through this quarter. Reports 37 and 55 contain graphs of 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 average noble and activated gas release rate for each month during the report period was as follows:

	Average Release Rate For Month - $\mu\text{Ci per Second}^*$
April 1975	19,997
May 1975	10,934
June 1975	225

*The unit was operated between 155 and 210 Mwt during April and May, and the unit was not in operation the month of June during refueling.

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 P G and E, Attn: F. F. Hautz, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gest. PG and E 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 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 by using the procedure abstracted in Nuclear Regulatory Commission (NRC, Regulatory Guide 4.3. 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 rates in the range of 1.0 to 1.5 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to CER. 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 bimonthly basis. The lower of the two readings is normally reported since the dosimeters normally read high on failure. The Radiation Detection Company (RDC), Mountain View, 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.

REPORT NO. 6, 2-75

TABLE 5

PERIOD START END ELAPSED TIME DATE	FILM FACT. MEASUREMENTS			
	3-25-75 5-6-75	5-6-75 6-12-75	6-12-75 7-1-75	7-1-75
STATION	N2 TOTAL HP(1)	2R TOTAL HP(1)	20 TOTAL HP(1)	
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0

1. MEASURE EACH GAUGE OF 6 IN/100

REPORT 7906. 2-75

TABLE 6

AIP PARTICULATE
STATION NO. 3 GROSS BETA ACTIVITY

SAMPLE NUMBER	VOLUME (ML)	COLLECTION DATE	COUNTING DATE	PCI/1000
75232	286	4/ 0/75	4/15/75	0.071--0.003
75232	286	4/15/75	4/18/75	0.074--0.003
75263	326	4/23/75	4/30/75	0.083--0.003
75268	286	4/29/75	5/ 2/75	0.079--0.003
75289	286	5/ 6/75	5/14/75	0.106--0.003
75301	206	5/17/75	5/19/75	0.066--0.004
75311	206	5/20/75	5/30/75	0.065--0.003
75312	286	5/27/75	5/30/75	0.088--0.003
75320	286	6/ 3/75	6/ 7/75	0.046--0.002
75341	286	6/10/75	6/13/75	0.052--0.002
75349	286	6/17/75	6/20/75	0.076--0.003
75355	286	6/24/75	6/27/75	0.014--0.001
75393	286	7/ 1/75	7/ 8/75	0.019--0.001

TABLE 7

AIP PARTICULATE
STATION NO. 45 GROSS BETA ACTIVITY

SAMPLE NUMBER	VOLUME (ML)	COLLECTION DATE	COUNTING DATE	PCI/1000
75232	423	4/ 0/75	4/14/75	0.066--0.003
75243	422	4/15/75	4/18/75	0.064--0.002
75244	500	4/23/75	4/30/75	0.127--0.008
75269	369	4/29/75	5/ 2/75	0.055--0.002
75290	423	5/ 6/75	5/14/75	0.076--0.004
75303	418	5/13/75	5/20/75	0.063--0.003
75327	421	5/20/75	5/30/75	0.062--0.003
75343	421	5/27/75	6/ 2/75	0.078--0.003
75351	440	6/ 3/75	6/10/75	0.041--0.003
75362	412	6/10/75	6/13/75	0.047--0.002
75370	441	6/17/75	6/23/75	0.038--0.002
75376	415	6/24/75	6/27/75	0.020--0.001
75384	426	7/ 1/75	7/ 8/75	0.019--0.001

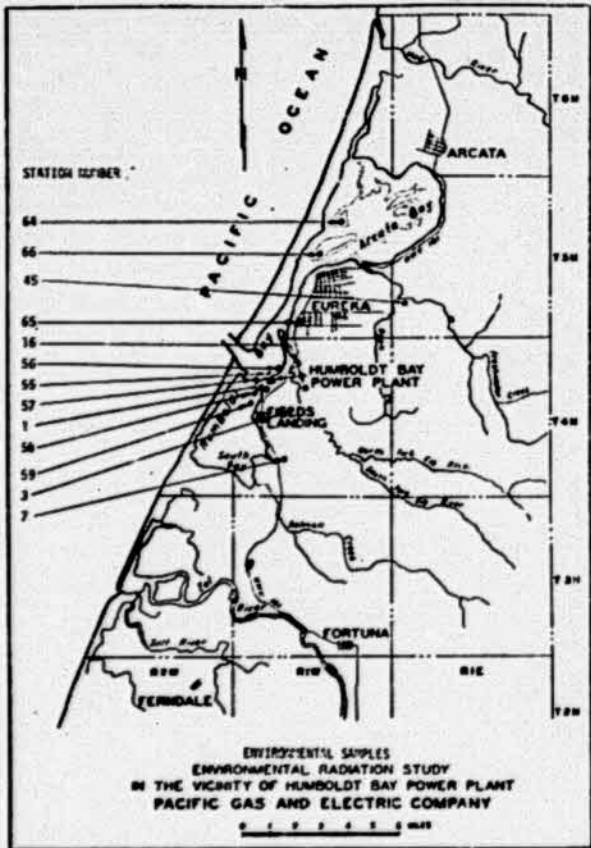


Figure 1

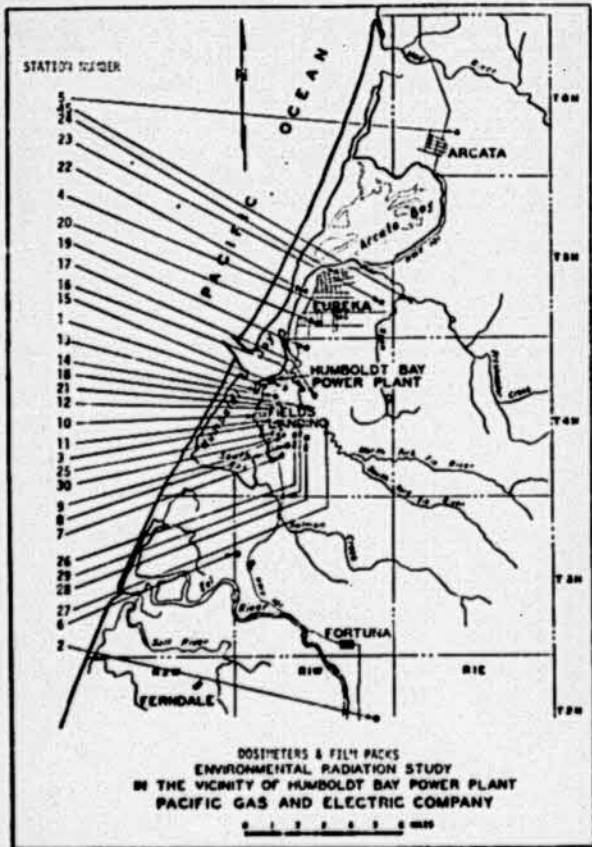


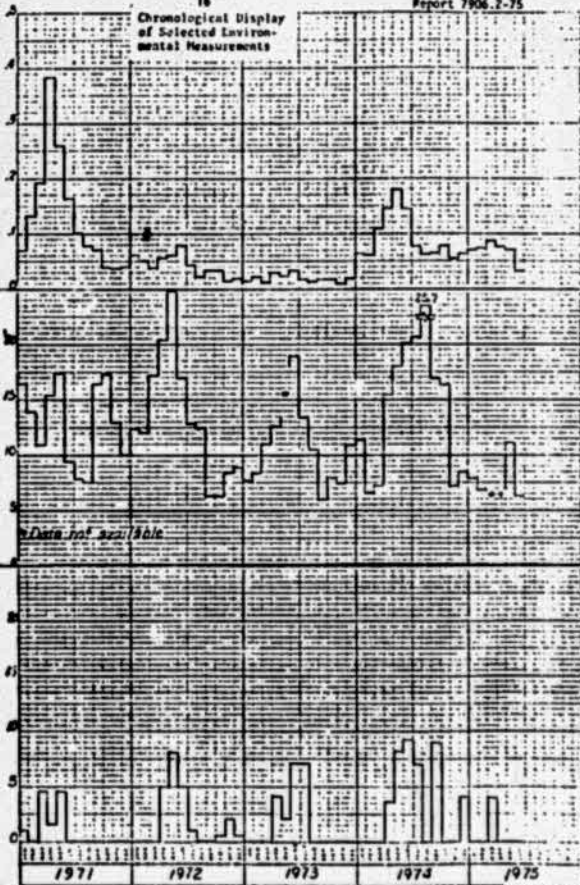
Figure 2

Chronological Display of Selected Environ- mental Measurements

Station 3
Monthly Average Air Temperature, $^{\circ}\text{C}/^{\circ}\text{F}$

Dosimetry, Station A4
Ion Chambers, mr

Fine Acid, mr, above back ground of 8 mr/mr



Chronological Display of Selected Environmental Measurements

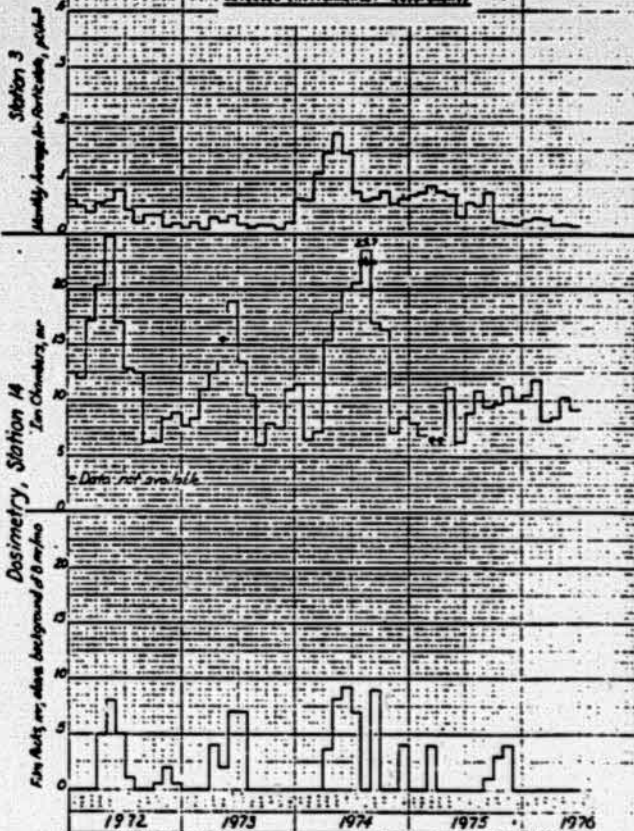


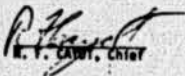
Figure 3

Report Issued: OCT 15 1976

Report 7906.6-76

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 61
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING JUNE 30, 1976
(SPRING)



R. F. Cady, Chief

Report Prepared By:

C. G. Hensel
R. M. Lorenz

sm/t

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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 61st quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period April through June 1976. 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 16 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 Perch species normally collected at Station 55 were not collected since they were not available in sufficient quantities. 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 and 15 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned. 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 and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ As shown below, the confirmatory analyses by an outside contractor are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)	
	Environmental	DER
76273	11.8 \pm 1.0	10.9 \pm 1.2
76274	8.2 \pm 0.6	9.1 \pm 0.8
76280	7.3 \pm 0.8	8.2 \pm 0.6
76281	9.2 \pm 0.8	11.2 \pm 0.7
76208	7.8 \pm 0.8	8.4 \pm 0.4

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The annual contribution from Unit 3 to the total dose at Station 14 was approximately 37 mrem above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

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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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - μCi per Second</u>	<u>Average Power Level - Watt</u>
April 1976	5,440	179
May 1976	4,268	137
June 1976	3,193	125

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 P G and E, Attn: F. F. Meutz, concerning modifications to waste discharge and environmental radiation monitoring requirements, dated May 7, 1965.
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The \pm term in the following tables is the two-sigma error; i.e., the 95 percent confidence level.

REPORT 7006.6-76

TABLE 1

SAMPLES COLLECTED
OTHER
EDITION
INVEST. EDIT.

CLAIMS &
OYSTERS

MAPING
FLOW

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TABLE 2
PROBIONALYSIS OF TIMING

STA	SAMPLE	DESCRIPTION	COLLECTION DATE	BETA DATE	GROSS ACTIVITY		POTASSIUM CONTENT (% OF DRY SAMPLE)	TIM ACTIVITY IN POTASSIUM SAMPLE (2)	GROSS BETA ACTIVITY (% OF DRY SAMPLE)
					BETA	Gamma (1)			
35	74271	SEDIMENT	5/15/76	6/17/76	7.15±0.45 (C1127)	0.89±0.81	6.90	5.29	6.93±0.59
35	74272	SED ALGAE (101-ALGAE 101-2011)	5/15/76	6/23/76	17.9±0.16 (20 45)	2.64±0.28	28.1	16.7	2.69±0.18
35	74273	SED ALGAE (101-ALGAE 101-2011)	5/15/76	6/23/76	10.9±0.15 (20 45)	0.82±0.65	12.6	10.5	1.55±0.16
36	74277	SEDIMENT	5/15/76	6/17/76	5.94±0.93		6.33	5.82	5.95±0.39
36	74278	SED ALGAE (101-ALGAE 101-2011)	5/15/76	7/12/76	18.9±0.22		19.0	16.1	2.99±0.15
36	74279	SED ALGAE (101-ALGAE 101-2011)	5/15/76	7/ 6/76	12.5±0.81 (C0 48)	0.82±0.62	15.2	12.7	2.90±0.16
37	74280	SEDIMENT	5/15/76	6/17/76	9.85±0.27 (C1127)	0.85±0.81	3.43	8.69	7.18±0.68
37	74281	SED ALGAE (101-ALGAE 101-2011)	5/15/76	6/23/76	18.6±0.23 (20 45)	0.81±0.18	18.1	15.8	0.79±0.29
37	74282	SED ALGAE (101-ALGAE 101-2011)	5/15/76	7/ 8/76	11.3±0.99		11.8	9.14	1.68±0.67
45	74286	PACIFIC OYSTER (101-ALGAE 101-2011)	6/ 2/76	6/22/76	0.20±0.29		7.93	6.58	1.87±0.13
39	74281	CARIBBEAN (101-ALGAE 101-2011)	5/14/76	6/23/76	11.2±0.68		8.91	7.40	1.99±0.12

1. ACTIVITY AT TIME OF SAMPLING. NATURALLY OCCURRING RADIOISOTOPES ARE NOT REPORTED.
 2. GROSS ACTIVITY OF BETA FLUX IN WATER POTASSIUM.
 3. SAMPLE ANALYZED AT DEP THEN SENT TO STATE DEPARTMENT OF HEALTH.

TABLE 3
RADIOANALYSIS OF TERRESTRIAL SAMPLES

REPORT 7964.6-76

STA	SAMPLE	DESCRIPTION	COLLECTION DATE	RSTA DATE	GROSS ACTIVITY (PCI-% (BY SAMPLE) RSTA)	POTASSIUM CONTENT (PPM) (BY SAMPLE)	GROSS RSTA ACTIVITY (PCI-% (BY SAMPLE) RSTA)
1	74222	SOIL	5-11-76	6-16-76	9.12-- 0.61	7.73	0.15
1	74261	DOMESTIC WATER	5-23-76	6-16-76	10.4-- 1.71	1.52-- 0.17	(5)
5	74263	SOIL	5-17-76	6-16-76	8.94-- 0.53	0.26-- 0.81	0.57
6	74268	MILK	5-11-76	6-16-76	8.37-- 0.38	0.16	0.69
16	74274	MILK	6-1-76	6-17-76	9.34-- 0.68	0.18	7.55
				6-17-76	0.28	1457-- 166	(5)

1. ACTIVITY AT TIME OF SAMPLING. NATURALLY OCCURRING RADIOISOTOPES ARE NOT REPORTED.

2. FOR 145 ACTIVITY OF 826 PCI-% RSTA POTASSIUM.

3. SAMPLE IS ENRICHED FOR RSTA ANALYSIS AND DISTILLED FOR M-7 ANALYSIS.

4. 100% 131 ACTIVITY, PCI-%, AT TIME OF SAMPLING.

5. 100% 131 ACTIVITY, PCI-%, AT TIME OF SAMPLING.

6. 100% 131 ACTIVITY, PCI-%, AT TIME OF SAMPLING.

7. 100% ACTIVITY IN PCI-%.

10³

ANALYSIS AT TIME OF SAMPLING. NATURALLY OCCURRING RADIOISOTOPES ARE NOT REPORTED.

REPORT 7906.6-76

TABLE 6

SAMPLE NUMBER	VOLUME (CM ³)	AIR PARTICULATE STATION NO. 3 CROSS BETA		ACTIVITY COUNTING DATE	PCI/M ² H ² O
		COLLECTION DATE	DATE		
6162	227	4/ 5/76	4/13/76	0.014+-0.001	
6163	226	4/13/76	4/21/76	0.011+-0.001	
6164	226	4/20/76	4/28/76	0.021+-0.002	
6165	226	4/25/76	4/30/76	0.017+-0.001	
6204	224	5/ 4/76	5/10/76	0.018+-0.002	
6212	227	5/11/76	5/17/76	0.012+-0.001	
6223	226	5/18/76	5/25/76	0.023+-0.002	
6243	224	5/25/76	5/28/76	0.031+-0.002	
6263	224	6/ 1/76	6/ 4/76	0.013+-0.001	
6287	243	6/ 8/76	6/18/76	0.016+-0.001	
6288	226	6/15/76	6/30/76	0.010+-0.001	
6305	226	6/22/76	7/ 4/76	0.013+-0.001	

1. SAMPLER PUMP FOUND NOT OPERATING 6/ 8/76.

REPORT 7906.6-76

TABLE 7

SAMPLE NUMBER	VOLUME (H+J)	STATION	AIR PARTICULATE		ACTIVITY DATE	PCI/1003
			NO.45 GROSS	BETA COLLECTION DATE		
7614	416			4/ 5-76	4/13-76	0.020+-0.001
7615	420			4/17-76	4/21-76	0.014+-0.001
7616	423			4/20-76	4/28-76	0.015+-0.002
7617	423			4/27-76	4/30-76	0.016+-0.001
7618	424			5/ 4-76	5/10-76	0.017+-0.001
7619	423			5/11-76	5/18-76	0.014+-0.001
7620	423			5/18-76	5/23-76	0.015+-0.001
7621	422			5/25-76	5/28-76	0.019+-0.001
7622	423			6/ 1-76	6/ 7-76	0.012+-0.001
7623	423			6/ 8-76	6/11-76	0.011+-0.001
7624	423			6/15-76	6/18-76	0.017+-0.001
7625	420			6/22-76	6/30-76	0.006+-0.001
7626	424			6/29-76	7/ 6-76	0.014+-0.001

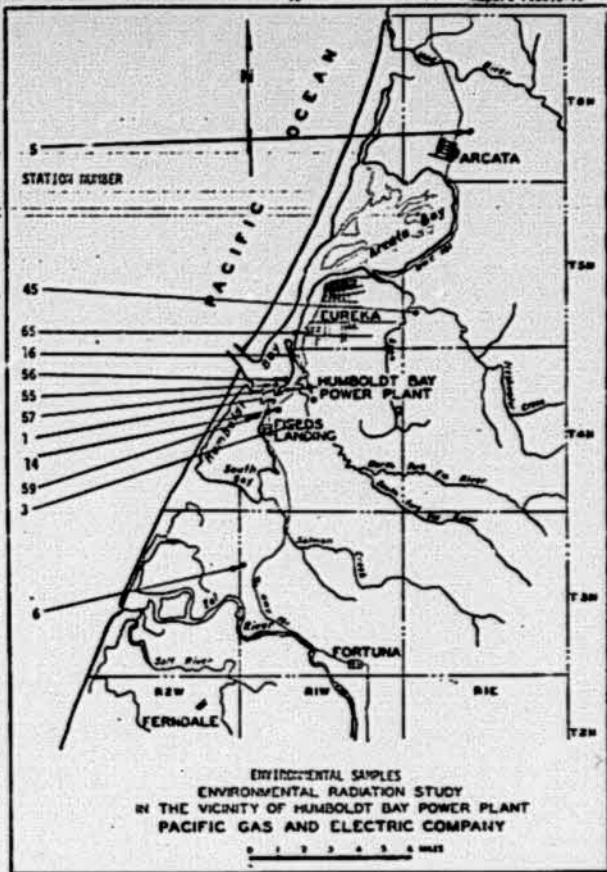
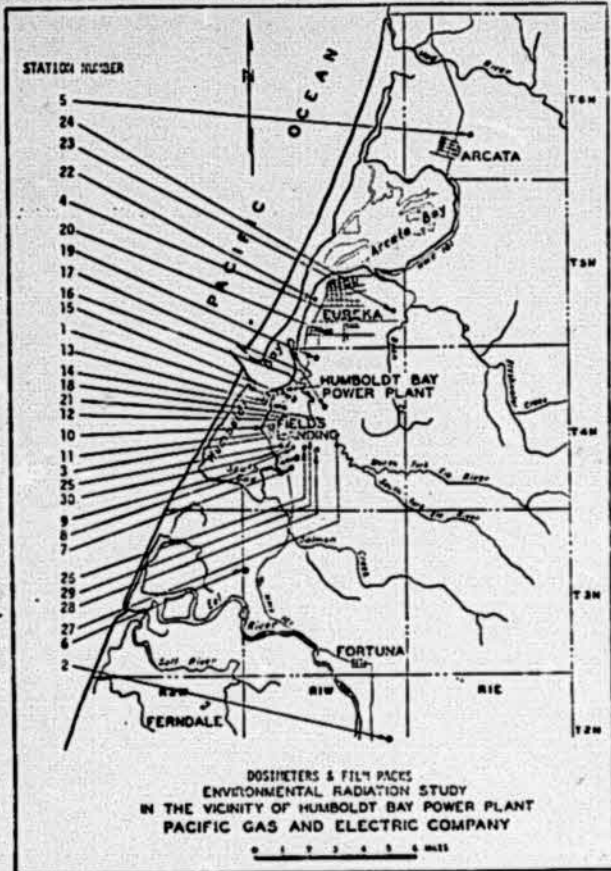


Figure 1



Report Issued: JUN 14 1973

Report 7804.1-73

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 46
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING SEPTEMBER 30, 1972
(Summer)



R. P. CATO, Chief

Report Prepared By:

M. Majteles
V. Cereca

cn/t

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SUMMARY

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

INTRODUCTION

This is the 46th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period July through September 1972. 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 16 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 Public 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

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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - $\mu\text{C per Second}$^a</u>
July 1972	10,950
August 1972	7,250
September 1972	150

^aThe unit was shut down between August 25 and October 6; during the remainder of the quarter, the unit was operated between 50 and 165 Mwt.

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Methods of Sample Collection and Analysis

Table 1	Samples Collected
Table 2	Radioactivities in Marine Samples
Table 3	Radioactivities in Terrestrial Samples
Table 4	Dosimeter Measurements
Table 5	Film Pack Measurements
Table 6	Air Particulate, Station No. 3, Gross Beta Activities
Figure 1	Station Locations of Environmental Samples
Figure 2	Station Locations of Dosimeters and Film Packs
Figure 3	Monthly Accumulation of Environmental Activities

Gamma dosimetry is performed with two ion chambers (Victoreen, Model 230) and a film pack located at each of the 30 stations shown in Figure 2. The ion chambers are read in the field by HSPF personnel on a bi-weekly basis. The lower of the two readings is normally reported since the dosimeters normally read high on failure. The Radiation Detection Company (RDC), Mountain View, 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 2

REF ID: A66113

ACTIVITIES IN THE AREA

STATION	LOCATION	DATE	TIME	ACTIVITY	NO. OF SAMPLES	NO. OF SAMPLES	NO. OF SAMPLES	NO. OF SAMPLES	NO. OF SAMPLES
11	STATION 11	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
12	STATION 12	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
13	STATION 13	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
14	STATION 14	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
15	STATION 15	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
16	STATION 16	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
17	STATION 17	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
18	STATION 18	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
19	STATION 19	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00
20	STATION 20	11/11/71	11:00	11:00	11:00	11:00	11:00	11:00	11:00

1. STATION 11: STATION 11, 11/11/71, 11:00, 11:00, 11:00, 11:00, 11:00, 11:00, 11:00, 11:00, 11:00, 11:00.

11
TABLE 6

REPORT 7004.1-73

COMPARISON OF MEASUREMENTS

MEASUREMENT TIME DATE	01/1/72 01/1/72	01/1/72 01/1/72	01/1/72 01/1/72	01/1/72 01/1/72	01/1/72 01/1/72	01/1/72 01/1/72	01/1/72 01/1/72
FLIGHT TIME HRS	11	12	13	14	15	16	17
STARTED:	0000.00	0100.00	0200.00	0300.00	0400.00	0500.00	0600.00
1	2.00	2.00	2.00	2.00	2.00	2.00	2.00
2	2.00	2.00	2.00	2.00	2.00	2.00	2.00
3	2.00	2.00	2.00	2.00	2.00	2.00	2.00
4	2.00	2.00	2.00	2.00	2.00	2.00	2.00
5	2.00	2.00	2.00	2.00	2.00	2.00	2.00
6	2.00	2.00	2.00	2.00	2.00	2.00	2.00
7	2.00	2.00	2.00	2.00	2.00	2.00	2.00
8	2.00	2.00	2.00	2.00	2.00	2.00	2.00
9	2.00	2.00	2.00	2.00	2.00	2.00	2.00
10	2.00	2.00	2.00	2.00	2.00	2.00	2.00
11	2.00	2.00	2.00	2.00	2.00	2.00	2.00
12	2.00	2.00	2.00	2.00	2.00	2.00	2.00
13	2.00	2.00	2.00	2.00	2.00	2.00	2.00
14	2.00	2.00	2.00	2.00	2.00	2.00	2.00
15	2.00	2.00	2.00	2.00	2.00	2.00	2.00
16	2.00	2.00	2.00	2.00	2.00	2.00	2.00
17	2.00	2.00	2.00	2.00	2.00	2.00	2.00
18	2.00	2.00	2.00	2.00	2.00	2.00	2.00
19	2.00	2.00	2.00	2.00	2.00	2.00	2.00
20	2.00	2.00	2.00	2.00	2.00	2.00	2.00
21	2.00	2.00	2.00	2.00	2.00	2.00	2.00
22	2.00	2.00	2.00	2.00	2.00	2.00	2.00
23	2.00	2.00	2.00	2.00	2.00	2.00	2.00
24	2.00	2.00	2.00	2.00	2.00	2.00	2.00
25	2.00	2.00	2.00	2.00	2.00	2.00	2.00
26	2.00	2.00	2.00	2.00	2.00	2.00	2.00
27	2.00	2.00	2.00	2.00	2.00	2.00	2.00
28	2.00	2.00	2.00	2.00	2.00	2.00	2.00
29	2.00	2.00	2.00	2.00	2.00	2.00	2.00
30	2.00	2.00	2.00	2.00	2.00	2.00	2.00

1. WITH DISCOUNTING AND C AND/OR FULL SCALE,
2. WITH DISCOUNTING METHOD,
3. MEANS OF DATA BY THIS FORM 300

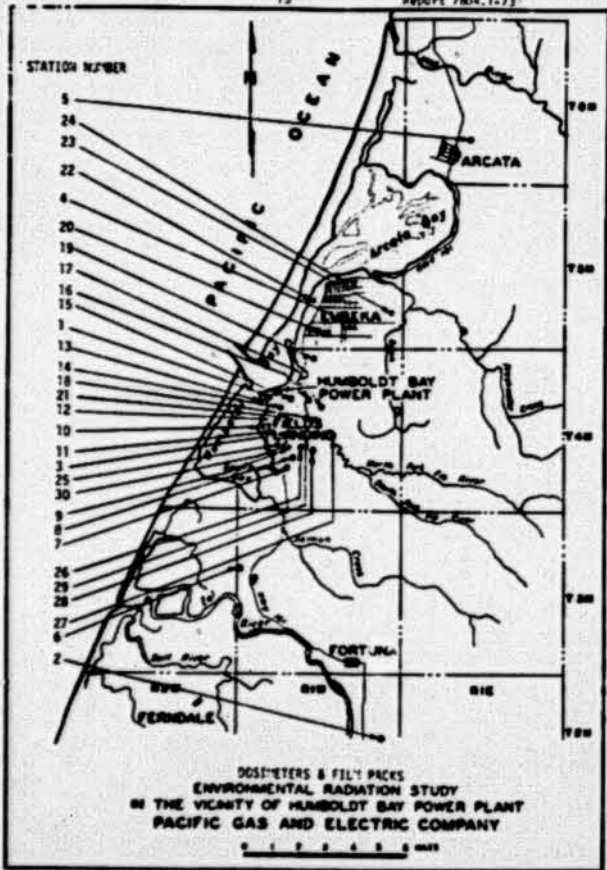
TABLE 2

REPORT TCC-1-73

ATM PARTICULATE
STATION NO. 3 HAULES BETA ACTIVITIES

SAMPLE NUMBER	STATION (P#03)	COLLECTION DATE	COUNTING DATE	COUNTING
72347	2-5	7/11/72	7/18/72	0.072±0.003
72348	2-6	7/11/72	7/31/72	0.014±0.002
72349	2-7	7/11/72	8/ 2/72	0.153±0.003
72350	2-8	8/ 1/72	8/18/72	0.041±0.003
72351	2-9	8/ 8/72	8/21/72	0.014±0.001
72352	2-10	8/15/72	8/25/72	0.014±0.003
72353	2-11	8/22/72	9/ 7/72	0.014±0.001
72354	2-12	9/ 7/72	9/15/72	0.031±0.004
72355	2-13	9/12/72	9/21/72	0.028±0.003
72356	2-14	9/15/72	10/21/72	0.017±0.003
72357	2-15	9/21/72	10/5/72	0.044±0.004

1. SAMPLE NOT AVAILABLE DUE TO PUMP FAILURE.



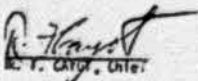


Report Issued: MAY 6 1974

Report 7856-74

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 50
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING SEPTEMBER 30, 1973
(Summer)



R. T. CATCHER, Chief

Report Prepared By:

W. H. Colver
C. Hensel
D. P. Serpa

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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 except for the 65-Zn activity found in the red algae samples. All liquid radiowaste releases from the plant were well within the limits of the existing regulations. The maximum integrated dose measured was well below the permissible contribution of 500 mr/year in unrestricted areas.

INTRODUCTION

This is the 50th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period July through September 1973. 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 14 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 Public Health.⁴ A table of the samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix. During most of July, the air particulate sampler at Station 45 was out of service for repairs.

*See reference page.

Thirty-five gross beta analyses and 16 gamma scans were performed for this report; air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 and confirmatory analyses of three samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/r dry)	
	Teledecne Isotopes	DER
73352	6.6 \pm 0.6	9.8 \pm 0.6
73358	8.3 \pm 0.9	7.7 \pm 0.9
73359	5.7 \pm 0.6	8.7 \pm 0.9

The Zn-65 activities in the red algae samples were again higher than those found during the 1971-72 period. This is probably due to Zn-65 releases from further de-mineralizer regenerations and the relatively long biological half-life of Zn-65. All liquid radwaste releases from the plant were well within the limits of the existing regulations.

Dosimeter readings during this quarter were generally above background levels (measured at Stations 2 and 5) and consistent with stack releases from HBPP Unit 3 for the period. The measured contribution from Unit 3 to

the total dose at Station 14 was approximately 39 mr above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 shows the dosimeter and film pack doses by the month at Station 14 and the air-particulate activity at Station 3 from January 1969 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - uc per Second**</u>
July 1973	13,800
August 1973	9,900
September 1973	170

*Based on 50 weeks of measurements.

**The unit was operated between 160 and 173 Mwt for the first two months of this quarter, and was down for annual maintenance during the third month.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. P G and E 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 45 (Figure 2). The constant flow samplers have flow rates in the range of 1.0 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. Gross beta activity is counted 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 HOPP 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), Mountain View, 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 2

RADIOACTIVITIES IN MARINE SAMPLES

SYS SAMPLE	DESCRIPTION	COLLECTION DATE	DATA COLLECTION DATE	GROSS ACTIVITY SPEC/GM DRY SAMPLES	POTASSIUM CONTENT MG G/D DRY SAMPLES	RAD ACTIVITY IN POTASSIUM SPEC/GM DRY SAMPLES	GROSS NETS SPEC/GM DRY SAMPLES
55	73350 SEDIMENT	8/ 1/73	9/21/73	9.36+- 0.92	0.5	0.4	4.59+- 0.70
55	73351 RED ALGAE ICOGASTRINA PAPILLARIS	8/ 1/73	9/31/73	11.3+- 1.05 (652N) 27.8 +- 2.25	11.0	9.2	2.73+- 0.76
55	73352 RED ALGAE GERARDIA SP.1	8/ 1/73	9/31/73	6.75+- 0.50 (652N) 3.25 +- 2.27	11.7	9.7	2.52+- 0.15
55	73353 RED TAIL SPINCH (MORPHOLOGY SPINOSUS)	7/30/73	9/31/73	13.1+- 1.29	14.5	12.0	2.45+- 0.29
55	73354 SEDIMENT	7/32/73	9/32/73	7.04+- 0.73	0.4	0.4	9.48+- 0.98
56	73355 RED ALGAE ICOGASTRINA PAPILLARIS	7/30/73	9/17/73	11.2+- 1.19	11.0	10.8	1.54+- 0.16
56	73356 RED ALGAE VITICOLA SP.1	7/30/73	9/12/73	9.42+- 1.20	12.2	10.1	2.33+- 0.29
57	73357 SEDIMENT	7/30/73	9/31/73	7.66+- 0.93	0.5	0.4	0.37+- 0.77
58	73358 PACIFIC OYSTER ICRASSOSTRGA GIGAS	6/ 1/73	9/12/73	7.73+- 0.84	9.3	7.7	1.85+- 0.20
58	73359 CARIBBEAN (TRUSS CORAL)	7/30/73	9/12/73	8.72+- 0.84	6.8	5.7	3.53+- 0.38

1. CORRECTED TO COLLECTION DATE, ONLY THOSE RADIOISOTOPES, OTHER THAN K-40, IDENTIFIED BY PULSE HEIGHT ANALYSIS ARE REPORTED.

2. FOR K-40 ACTIVITY OF 230 PC/GM NATURAL POTASSIUM.

TABLE 3

Report 7016-74

RADIOACTIVITIES IN THERMAL SAMPLES

STA SAMPLE	DESCRIPTION	COLLECTION DATE	BEVA COUNTING DATE	GROSS ACTIVITY SPEC/G (NET SAMPLE) BEVA	POTASSIUM CONTENT PPM G/G NET SAMPLES	K40 ACTIVITY IN POTASSIUM SPEC/G ONLY SPEC/G SAMPLES	GROSS NETS ACTIVITY SPEC/G ONLY SPEC/G SAMPLES
6	73404 MILE	8/29/73	9/17/73	5.78 ± 0.69	8.6	9.3	1170 ± 133 (33)
10	73409 MILE	8/30/73	9/16/73	7.06 ± 0.78	8.5	7.0	988 ± 106 (31)
1	73257 S'IL	3/1/73	9/17/73	7.75 ± 1.19	0.8	0.3	9.17 ± 1.04
5	73381 S'IL	8/1/73	8/31/73	9.41 ± 0.97	0.6	0.4	8.65 ± 0.84

1. CORRECTED TO COLLECTION DATE, ONLY THOSE RADIOISOTOPES, OTHER THAN K40, IDENTIFIED BY BASE MIGHT ANALYSIS, ARE REPORTED.

2. FOR NET ACTIVITY OF K40 SPEC/G NATURAL POTASSIUM.

3. BEVA

4. THE "G/L" SAMPLES WERE COUNTESS-SCANNED ON THE FOLLOWING DATE: FROM NET 8/31/73, FOR 1/3/73

FROM NET 9/16/73, FOR 10/1/73

TABLE
POST-CURE ANALYSIS

PERIOD START END	SAMPLE TIME HRS	16				18				19				20				21				22				23				24				25				26				27				28				29				30				31				32				33				34				35				36				37				38				39				40				41				42				43				44				45				46				47				48				49				50				51				52				53				54				55				56				57				58				59				60				61				62				63				64				65				66				67				68				69				70				71				72				73				74				75				76				77				78				79				80				81				82				83				84				85				86				87				88				89				90				91				92				93				94				95				96				97				98				99				100				101				102				103				104				105				106				107				108				109				110				111				112				113				114				115				116				117				118				119				120				121				122				123				124				125				126				127				128				129				130				131				132				133				134				135				136				137				138				139				140				141				142				143				144				145				146				147				148				149				150				151				152				153				154				155				156				157				158				159				160				161				162				163				164				165				166				167				168				169				170				171				172				173				174				175				176				177				178				179				180				181				182				183				184				185				186				187				188				189				190				191				192				193				194				195				196				197				198				199				200				201				202				203				204				205				206				207				208				209				210				211				212				213				214				215				216				217				218				219				220				221				222				223				224				225				226				227				228				229				230				231				232				233				234				235				236				237				238				239				240				241				242				243				244				245				246				247				248				249				250				251				252				253				254				255				256				257				258				259				260				261				262				263				264				265				266				267				268				269				270				271				272				273				274				275				276				277				278				279				280				281				282				283				284				285				286				287				288				289				290				291				292				293				294				295				296				297				298				299				300				301				302				303				304				305				306				307				308				309			
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FILM PACK MEASUREMENTS

PERIOD START END	7/ 3/73 7/31/73	7/31/73 8/20/73	8/28/73 9/25/73
ELAPSED TIME DAYS	28	28	28
STATION	TOTAL MP(1)	TOTAL MP(1)	TOTAL MP(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	3	0	0
12	3	0	0
13	0	0	0
14	7	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	(2)	0	0
30	0	0	0

1. ABOVE BACKGROUND OF B NO/MO
2. FILM PACK MISSING

AIR PARTICULATE
STATION NO. 3 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (ML=3)	COLLECTION DATE	COUNTING DATE	PC1/M=3
73302	286	7/10/73	7/13/73	0.018+-0.002
73306	286	7/17/73	7/23/73	0.012+-0.002
73329	286	7/24/73	7/31/73	0.015+-0.002
73334	286	7/31/73	8/14/73	0.011+-0.002
73340	286	8/ 7/73	8/13/73	0.004+-0.001
73343	286	8/14/73	8/17/73	0.012+-0.001
73362	286	8/21/73	8/24/73	0.013+-0.002
73406	286	8/28/73	9/ 4/73	0.018+-0.001
73414	286	9/ 4/73	9/11/73	0.023+-0.002
73424	286	9/11/73	9/14/73	0.020+-0.001
73431	286	9/18/73	9/21/73	0.015+-0.002
73437	286	9/25/73	9/28/73	0.010+-0.001

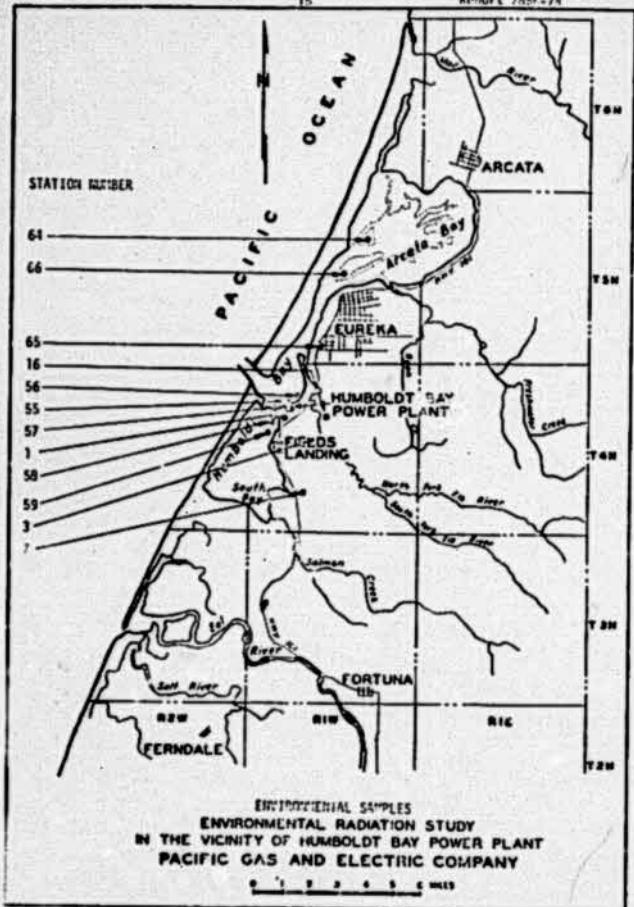
TABLE 7

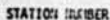
Report 7256-74

AIR PARTICULATE
STATION NO. 45 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (m ³)	COLLECTION DATE	COUNTING DATE	PCI/m ³
(1)				
73335	427	7/31/73	8/14/73	0.010+-0.001
73341	417	8/ 7/73	8/13/73	0.009+-0.001
73344	442	8/14/73	8/17/73	0.010+-0.001
73363	426	8/21/73	8/24/73	0.013+-0.001
73407	427	8/28/73	9/ 4/73	0.014+-0.001
73415	425	9/ 4/73	9/11/73	0.014+-0.001
73425	430	9/11/73	9/16/73	0.023+-0.002
73432	426	9/19/73	9/21/73	0.019+-0.002
73438	431	9/25/73	9/28/73	0.011+-0.001

1. NO SAMPLE FROM 3/27/73 TO 7/24/73, AIR SAMPLER NOT IN OPERATION



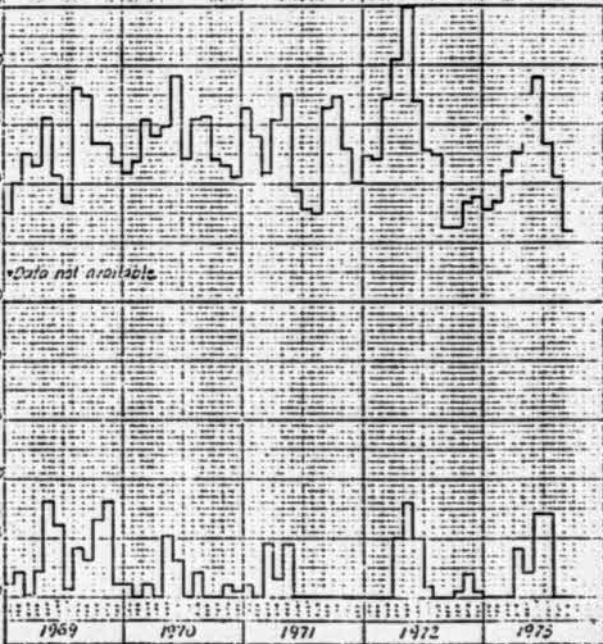


DOSEMETERS & FILM PACKS
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF HUMBOLDT BAY POWER PLANT
PACIFIC GAS AND ELECTRIC COMPANY

Station 14

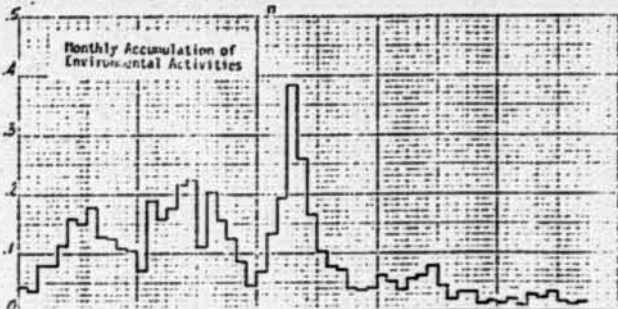
Film Packs, mR above background of 8 mR/yr

Ion Chambers, mR



Station 3

Monthly Average Ion Chamber, pCi/m³

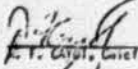


Report Issued: FEB 24 1975

Report 7856.4-71

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 58
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
REDWOOD BAY FUELS PLANT
EMERY, CALIFORNIA
QUARTER ENDING SEPTEMBER 30, 1974
(Summer)



A. T. Catlett, Chief

Report Prepared By:

W. H. Culver
C. G. Hessel
D. P. Sorpa
R. W. Lorenz

SN/T

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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 54th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period July through September 1974. 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 ANALYSIS

Air particulate filters, duststacks, filter packs, and 10 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 Public 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-two gross beta analyses and 19 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 IDPP personnel. Film packs were read and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of stellar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)	
	<u>Total-mn. Isotopes</u>	<u>UO₂</u>
74202	7.2 \pm 0.8	10.1 \pm 0.9
74206	5.2 \pm 0.7	5.7 \pm 0.7
74209	4.6 \pm 0.7	7.5 \pm 0.7
74293	11.8 \pm 1.0	21.6 \pm 2.6
74295	12.0 \pm 0.7	8.3 \pm 0.7

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The measured contribution from Unit 3 to the total dose at Station 14 was approximately 90 mR above background, which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1970 through this quarter. Report 37 contains a graph of 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 analysis of "grab" samples on a multichannel gamma scintillation spectrometer. The average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate</u> <u>for Month - uc per Second*</u>
July 1974	26,200
August 1974	31,000
September 1974	17,700

*The unit was operated between 197 and 150 R/hr during this quarter.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

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

Marine and terrestrial samples are processed quarterly at DLR. 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/g of a standard containing I-40. Activities are reported both per gram of the dry and per gram of the original sample.

The freeze-dried samples and liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 15 (Figure 1). The constant flow samplers have flow rates in the range of 1.0 to 1.5 cfm; an HE-70 filter is used. The filters are collected on a weekly basis and mailed to DLR. Gross beta activity is counted 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 IDPP 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), Mountain View, 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.

CLASSICAL CULTURES

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1. The first section of the report discusses the overall findings of the study, which were conducted over a period of six months. The study aimed to investigate the impact of various factors on the performance of the system.

2. The second section provides a detailed overview of the methodology used in the study. This includes the selection of participants, the design of the experiments, and the data collection process.

3. The third section presents the results of the study. The data shows that there is a significant correlation between the variables studied, with the highest values observed in the control group.

4. The fourth section discusses the implications of the findings. The results suggest that the system can be optimized by adjusting certain parameters, which could lead to improved performance.

5. The fifth section concludes the report by summarizing the key points and providing recommendations for future research. It is suggested that further studies be conducted to explore the long-term effects of the interventions.

6. The sixth section contains a list of references, citing the various sources used in the study to support the findings and conclusions.

7. The seventh section provides a brief biography of the author, highlighting their qualifications and previous work in the field.

8. The eighth section includes a declaration of interest, stating that the author has no conflicts of interest that could influence the results of the study.

9. The ninth section contains a list of acknowledgments, thanking the individuals and organizations that provided support and resources during the study.

10. The tenth section provides a final summary of the report, reiterating the main findings and the importance of the research.

11. The eleventh section includes a list of appendices, which contain additional data and information that support the main text of the report.

12. The twelfth section contains a list of footnotes, providing further details and clarifications on specific points mentioned in the text.

13. The thirteenth section includes a list of abbreviations, defining the terms used throughout the report to ensure clarity and consistency.

14. The fourteenth section provides a list of contact information for the author, including email and phone numbers, for any inquiries or requests for more information.

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21. The twenty-first section contains a list of footnotes, providing further details and clarifications on specific points mentioned in the text.

22. The twenty-second section includes a list of abbreviations, defining the terms used throughout the report to ensure clarity and consistency.

23. The twenty-third section provides a list of contact information for the author, including email and phone numbers, for any inquiries or requests for more information.

24. The twenty-fourth section contains a list of references, citing the various sources used in the study to support the findings and conclusions.

25. The twenty-fifth section provides a brief biography of the author, highlighting their qualifications and previous work in the field.

26. The twenty-sixth section includes a declaration of interest, stating that the author has no conflicts of interest that could influence the results of the study.

27. The twenty-seventh section contains a list of acknowledgments, thanking the individuals and organizations that provided support and resources during the study.

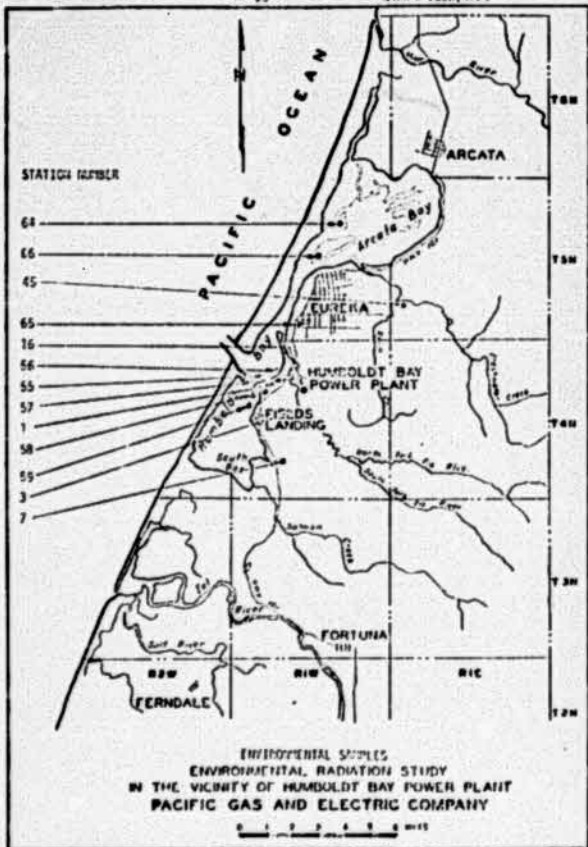
28. The twenty-eighth section provides a final summary of the report, reiterating the main findings and the importance of the research.

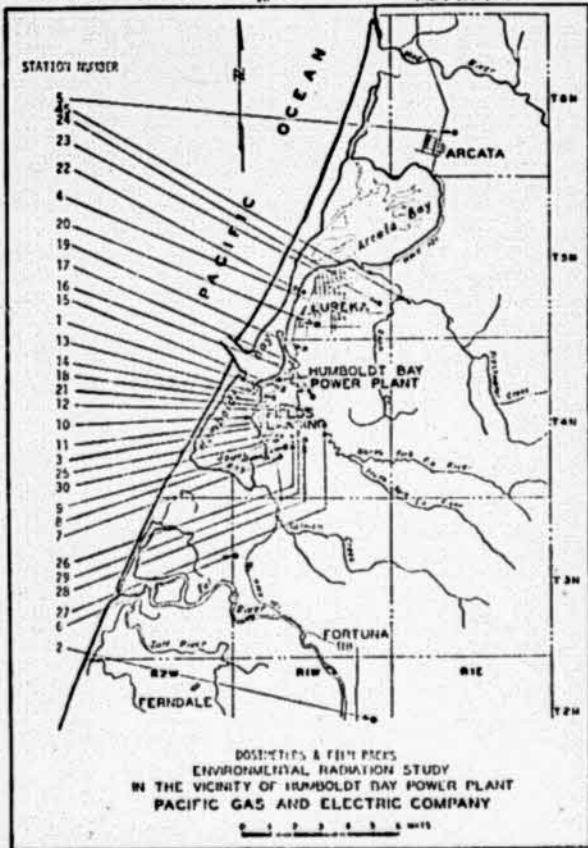
29. The twenty-ninth section includes a list of appendices, which contain additional data and information that support the main text of the report.

30. The thirtieth section contains a list of footnotes, providing further details and clarifications on specific points mentioned in the text.

31. The thirty-first section includes a list of abbreviations, defining the terms used throughout the report to ensure clarity and consistency.

32. The thirty-second section provides a list of contact information for the author, including email and phone numbers, for any inquiries or requests for more information.





Station 5

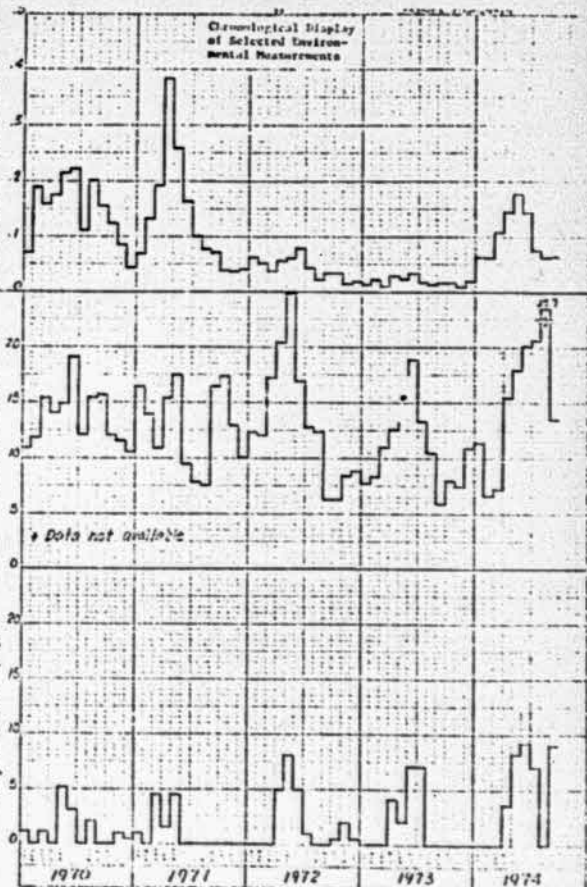
Monthly Average to Particulate, $\mu\text{g}/\text{m}^3$

Chronological Display of Selected Environ- mental Measurements

Dosimetry, Station 16

Time Factor, m^2/sec
Exposure of 8 m/min

1st Quarter, m^2



Report Issued: JAN 14 1976

Report 7005.3-75

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 58
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING SEPTEMBER 30, 1975
(SUMMER)

[Signature]
 B. N. Chatterjee, Chatter

Report Prepared By:

C. G. Hense;
R. M. Lorenz

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PDR FOIA
FIREST005-665 PDR

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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 58th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period July through September 1975. 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.^{1a}

SAMPLE COLLECTIONS AND ANALYSES

Air particulate filters, dosimeters, film packs, and 17 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 Public Health.⁴ A table of the samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix.

^{1a}See reference page.

Forty-three gross beta analyses and 16 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned. 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 and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ As shown below, the confirmatory analyses by an outside contractor are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)	
	LPE Environmental	DER
75420	7.1 \pm 0.8	7.0 \pm 0.4
75423	12.9 \pm 1.4	12.4 \pm 0.7
75426	11.0 \pm 0.8	10.0 \pm 0.7
75431	8.9 \pm 1.0	7.6 \pm 0.6
75433	8.2 \pm 0.8	7.9 \pm 0.6

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 11. The annual contribution from Unit 3 to the total dose at Station 11 was approximately 38 mrem above background,^a which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

^aExtrapolated to one year from actual measurements.

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1971 through this quarter. Reports 37 and 55 contain graphs of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate</u> <u>For Month - μCi per Second*</u>
July 1975	2,100
August 1975	6,700
September 1975	6,400

*The unit was operating at an average of 134 MWt during this quarter.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gest. P G and E 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 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 by using the procedure abstracted in Nuclear Regulatory Commission (NRC) Regulatory Guide 4.3. 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 rates in the range of 1.0 to 1.5 cfm; 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), Mountain View, 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

REPORT 7900-3-79

SAMPLES COLLECTED

STATION	MARINE PLANKTON	WATER SAMPLES	CLAM & OTHER BIVALVE	SOFTS- TRIAL	DOGS- PUBLIC	FISH
1. HAWAIIAN MONK SEAL						
2. HAWAIIAN MONK SEAL						
3. HAWAIIAN MONK SEAL						
4. HAWAIIAN MONK SEAL						
5. HAWAIIAN MONK SEAL						
6. HAWAIIAN MONK SEAL						
7. HAWAIIAN MONK SEAL						
8. HAWAIIAN MONK SEAL						
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38. HAWAIIAN MONK SEAL						
39. HAWAIIAN MONK SEAL						
40. HAWAIIAN MONK SEAL						
41. HAWAIIAN MONK SEAL						
42. HAWAIIAN MONK SEAL						
43. HAWAIIAN MONK SEAL						
44. HAWAIIAN MONK SEAL						
45. HAWAIIAN MONK SEAL						

TABLE 2

APRIL 1964, 3-75

GROSS ACTIVITY IN PPM

STA	SAMPLE	DESCRIPTION	COLLECTION DATE	DATE	GROSS ACTIVITY IN PPM	NET ACTIVITY IN PPM	PERCENTAGE OF GROSS ACTIVITY	PERCENTAGE OF NET ACTIVITY	PERCENTAGE OF GROSS ACTIVITY
55	75420	SEDIMENT	7/23/75	8/7/75	0.400 ± 0.03	0.120 ± 0.01	30.0 ± 2.5	4.77	3.530 ± 0.34
55	75423	SEDIMENT	7/23/75	8/10/75	16.00 ± 0.83	0.640 ± 0.04	4.0 ± 0.2	16.2	3.090 ± 0.32
55	75422	SEDIMENT	7/23/75	8/10/75	0.370 ± 0.07		0.01	5.63	1.090 ± 0.08
55	75423	SEDIMENT	7/24/75	8/10/75	17.40 ± 0.88		19.4	19.2	2.640 ± 0.13
56	75424	SEDIMENT	7/23/75	8/7/75	0.200 ± 0.02	0.030 ± 0.01	5.0 ± 0.5	4.06	3.490 ± 0.33
56	75425	SEDIMENT	7/23/75	8/10/75	15.30 ± 0.85		16.8	16.0	4.020 ± 0.22
56	75426	SEDIMENT	7/23/75	8/10/75	0.540 ± 0.06		12.5	10.4	2.160 ± 0.16
57	75427	SEDIMENT	7/23/75	8/7/75	5.760 ± 0.36		7.83	2.33	0.560 ± 0.38
57	75428	SEDIMENT	7/23/75	8/10/75	16.00 ± 0.80		16.5	12.0	3.910 ± 0.33
57	75429	SEDIMENT	7/23/75	8/10/75	0.370 ± 0.07		7.00	7.67	1.120 ± 0.08
58	75430	SEDIMENT	7/26/75	8/10/75	7.510 ± 0.44		0.21	7.23	1.790 ± 0.10
59	75431	SEDIMENT	7/21/75	8/10/75	7.610 ± 0.46		0.10	6.72	1.760 ± 0.13

1. ACTIVITY OF 100 IS 10000 PPM. ACTIVITY IN PPM IS NOT REPORTED.
 2. PERCENTAGE OF GROSS ACTIVITY IN PPM IS NOT REPORTED.

REPORT 7000.3-15

TABLE 9

FILM PAGE MISPLACEMENTS

PERIOD START END	7/14/75 7/20/75	7/21/75 8/2/75	8/20/75 8/27/75
ELAPSED TIME	20	20	20
DATE			
STATION	TOTAL MISSES	TOTAL MISSES	TOTAL MISSES
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
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30			

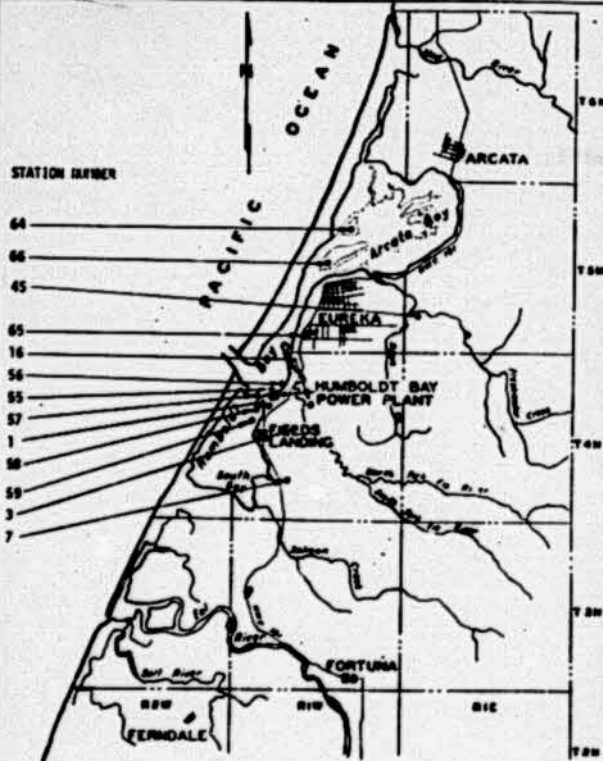
1 - JUNE BALANCE OF 8 MP/MD
2 - FILM PAGE MISSING

TABLE 7

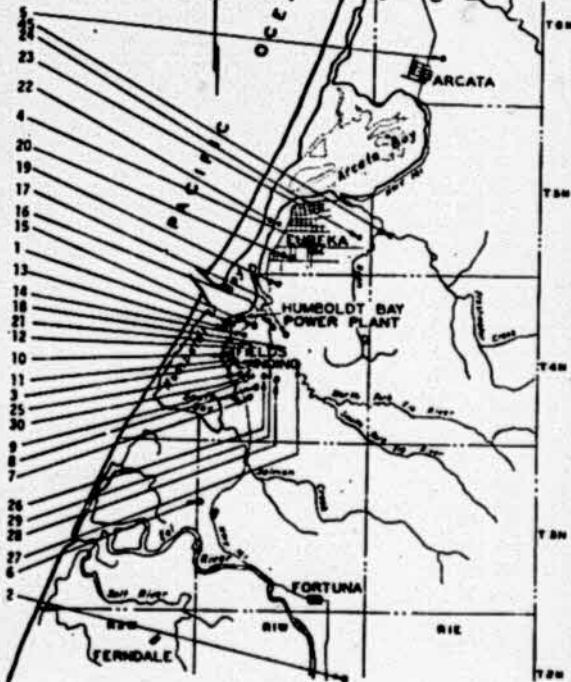
PICKET 7400-3-75

STATION AD-45 UNDER OILS ACTIVITY

STATION NUMBER	VOLUME (GALLONS)	COLLECTION DATE	COMING DATE	PL/NO-3
75307	442	7/ 7/75	7/14/75	P-0110-0-161
75307	353	7/14/75	7/11/75	0-0120-0-162
75308	496	7/17/75	7/20/75	0-0110-0-161
75308	476	7/20/75	7/ 6/75	0-0120-0-162
75308	415	7/ 7/75	7/ 7/75	0-0120-0-161
75308	427	7/17/75	7/ 7/75	0-0120-0-161
75308	415	7/17/75	7/20/75	0-0120-0-161
75308	427	7/20/75	7/ 6/75	0-0120-0-161
75308	427	7/ 7/75	7/12/75	0-0120-0-162
75308	427	7/12/75	7/12/75	0-0120-0-162
75308	427	7/12/75	7/22/75	0-0120-0-162
75308	427	7/22/75	7/20/75	0-0120-0-162
75308	427	7/20/75	10/ 9/75	0-0120-0-162



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



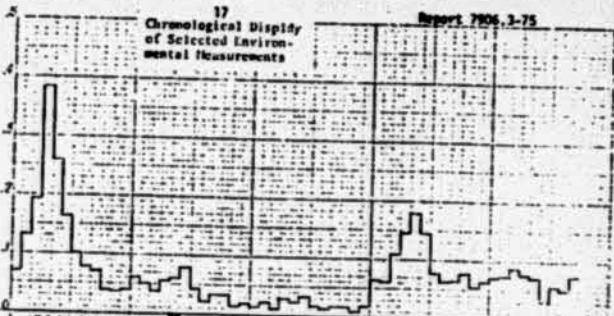
0 1 2 3 4 5 6 7 8 9

17
Chronological Display
of Selected Environ-
mental Measurements

Report 7906.1-75

Station 3

Monthly Average Air Particulate, $\mu\text{g}/\text{m}^3$



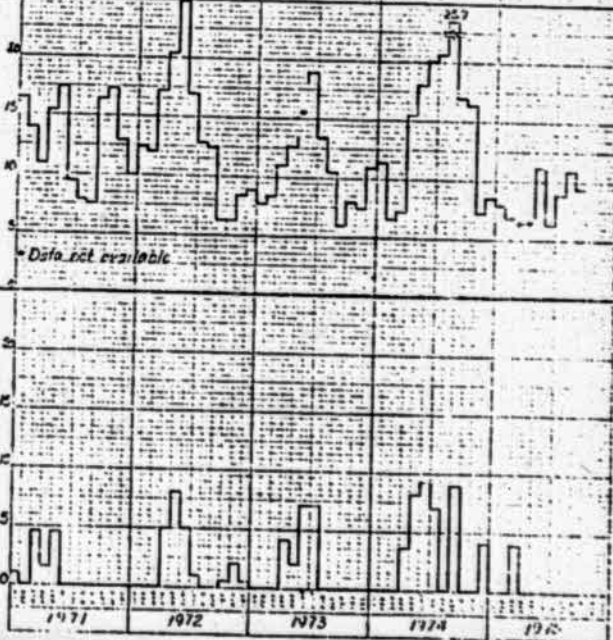
CONTINUED

Dosimetry, Station 14

Ion Chambers, mR

Data not available

From field, mR, above background of 8 mR/m

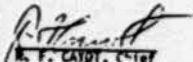


Report Issued: JAN 24 1974

Report 7804.3-73

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 48
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING MARCH 31, 1973
(Winter)



R. F. CAYOT, Chief

Report Prepared By:

V. B. Cereca
W. H. Culver
C. G. Hensel
D. P. Serpa

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SUMMARY

Measurements of radioactivity in marine and terrestrial samples and in air particulate from the environment near the Humboldt Bay Power Plant during this quarter generally remained within the range of preoperational background measurements except for ^{65}Zn concentrations found in several red algae samples. These probably were due to higher than usual ^{65}Zn releases from the plant during October and November 1972 as a result of the annual maintenance outage. All liquid radwaste releases were well within the limits of the existing regulations. The maximum integrated dose measured was well below the permissible contribution of 500 mr/year in unrestricted areas.

INTRODUCTION

This is the 48th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period January through March 1973. 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 24 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 Public Health.⁴ A table of samples collected and maps showing the sampling locations (Figures 1 and 2) are presented in the Appendix.

*See reference page

Forty-nine gross beta analyses and 25 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 NRP personnel. Film packs were read and confirmatory analyses of three samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

<u>Sample No.</u>	<u>Teledyne isotopes</u>	<u>DER</u>
	<u>Gross Beta (pCi/g dry)</u>	
73104	15.3 \pm 0.5	17.7 \pm 2.1
73114	6.6 \pm 0.4	7.3 \pm 0.9
73115	4.3 \pm 0.3	6.1 \pm 0.8

It should be noted, however, that the ^{65}Zn activities found in several red algae (Gigartina) samples collected at Stations 55, 56, and 57 were higher than those during the 1971-72 period. These were probably due to ^{65}Zn discharges from the plant during October and November 1972. The source of the ^{65}Zn activity discharged during this annual maintenance period was the numerous regenerations of the Unit 3 condensate demineralizer resin beds. The ^{65}Zn has sufficient solubility to be found in filtered waste water from the rinse and transfer steps of regeneration. All liquid radwaste releases were well within the limits of the existing regulations.

Dosimeter readings during this quarter were generally above background levels (measured at Stations 2 and 5) and consistent with stack releases from HBPP Unit 3 for the period. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The measured contribution from Unit 3 to the total dose at Station 14 was approximately 52 mrem above background, which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

Figure 3 shows the dosimeter and film pack doses by the month at Station 14 and the air-particulate activity at Station 3 from January 1969 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - μC per Second*</u>
January 1973	7,380
February 1973	13,630
March 1973	14,080

*During this quarter, the unit was operated between 50 and 165 MWt.

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 P G and E, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 6, 1966.
- ⁴ Department of Public Health letter to P G and E, 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

Table 1	Samples Collected
Table 2	Radioactivities in Marine Samples
Table 3	Radioactivities in Terrestrial Samples
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Table 7	Air Particulate, Station No. 45, Gross Beta Activities
Figure 1	Station Locations of Environmental Samples
Figure 2	Station Locations of Dosimeters and Film Packs
Figure 3	Monthly Accumulation of Environmental Activities

METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. P G and E 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 analyses are 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 liquid milk are gamma scanned using a 3" x 3" NaI (TI) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 50 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 45 (Figure 2). The constant flow samplers have a flow rate in the range of 1 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. Gross beta activity is counted 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 bi-weekly basis. The lower of the two readings is normally reported since the dosimeters normally read high on failure. The Radiation Detection Company (RDC), Mountain View, 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.

STATE OF NEW YORK

[illegible]

(3)
7510 AF CASE
INBURA 3-3

31 473 473 15-07-10

17-0

1-0

2-0

3-0

1. CORRECTION IN COLLECTION DATE: ONLY THOSE SAMPLES COLLECTED ON 15-07-10, IDENTIFIED BY HOUSE NUMBER ANALYSIS ARE ACCEPTED.
2. 400' NORTH OF METAIL.
3. 400' SOUTH OF METAIL.

RADIOLOGICAL DATA IN TREATMENT SAMPLES

STA SAMPLE	DESCRIPTION	COLLECTION DATE	DATE	DATA	CRS ACTIVITY PER CPM SAMPLE	POTASSIUM CONTENT PER CPM DATA	ACTIVITY PER CPM DATA	CRS DATA ACTIVITY PER CPM DATA
1	73173 DOMESTIC WATER (S)	3/15/73	3/1/73	0.07±0.03				1.1±0.04 (S)
2	73110 MILK (S)	3/15/73	4/7/73	0.05±0.03		0.2	0.2	100±100 (S)
3	73120 MILK (S)	3/15/73	4/21/73	0.21±0.07		2.5	2.5	117±12±12 (S)
4	73117 MILK	3/15/73	4/1/73	0.05±0.03		0.2	0.2	1.0±0.07
5	73118 MILK	3/15/73	3/1/73	0.07±0.03 (134 Cs)	0.30±0.09	0.3	0.3	5.1±0.5

1. CORRECTION IN COLLECTION DATE. ONLY THOSE RADIOISOTOPES, OTHER THAN ^{40}K , MEASURED BY PURELY ANALYTICAL AND REPORTED.

2. CRS ACTIVITY PER CPM SAMPLE. ONLY THOSE RADIOISOTOPES, OTHER THAN ^{40}K , MEASURED BY PURELY ANALYTICAL AND REPORTED.

3. POTASSIUM CONTENT PER CPM SAMPLE. ONLY THOSE RADIOISOTOPES, OTHER THAN ^{40}K , MEASURED BY PURELY ANALYTICAL AND REPORTED.

4. DATA. ONLY THOSE RADIOISOTOPES, OTHER THAN ^{40}K , MEASURED BY PURELY ANALYTICAL AND REPORTED.

5. The milk samples were again scanned on the following dates: 3/16/73, 3/21/73, 4/11/73.

13
TABLE 5

REPORT 7104.3-7

FILM PACK MEASUREMENTS

PERIOD START END	1/11/73 1/30/73	1/30/73 2/27/73	2/27/73 3/27/73
ELAPSED TIME DAYS	14	28	21
STATION	TOTAL HR(1)	TOTAL HR(1)	TOTAL HR(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	(2)	0	0
27	0	0	0
28	0	0	0
29	0	0	0
30	0	0	0

1. SPOKE PACKAGING OF 8 HR/ND

2. Film pack missing

ATA PARTICULATE
STATION NO. 3 CROSS PETA ACTIVITIES

SAMPLE NUMBER	VOLUME (LITERS)	COLLECTION DATE	COUNTING DATE	PC1/P2#2
72005	256	1/ 9/72	1/16/72	0.012+-0.001
72012	256	1/16/72	1/23/72	0.010+-0.001
72031	256	1/23/72	2/12/72	0.007+-0.001
72047	256	1/30/72	2/11/72	0.012+-0.002
72057	256	2/ 6/72	2/16/72	0.013+-0.002
72070	256	2/12/72	2/21/72	0.009+-0.001
72179	256	2/20/72	3/ 2/72	0.041+-0.002
72092	256	2/27/72	3/ 8/72	0.018+-0.002
72100	256	3/ 6/72	3/13/72	0.016+-0.001
72163	256	3/13/72	4/12/72	0.004+-0.001
72164	256	3/20/72	4/13/72	0.005+-0.001
72174	256	3/27/72	4/11/72	0.015+-0.002

401 PARTICULATE
STATION 70C43 GROSS BETA ACTIVITIES

SAMPLE NUMBER	VOLUME (LITERS)	COLLECTION DATE	COUNTING DATE	PC1/9493
73006	427	1/9/73	1/16/73	C.014+-C.001
73011	427	1/16/73	1/23/73	C.012+-C.001
73032	432	1/22/73	2/17/73	C.011+-C.001
73040	431	1/30/73	2/15/73	C.010+-C.002
73056	432	2/6/73	2/16/73	C.017+-C.001
73071	426	2/13/73	2/21/73	C.011+-C.002
73080	426	2/20/73	3/ 2/73	C.012+-C.001
73091	417	2/27/73	3/ 1/73	C.021+-C.002
73101	421	3/ 6/73	3/13/73	C.012+-C.001
73122	421	3/13/73	4/12/73	C.010+-C.001
73164	426	3/20/73	4/12/73	C.020+-C.001
73169	435	3/27/73	4/12/73	C.015+-C.001

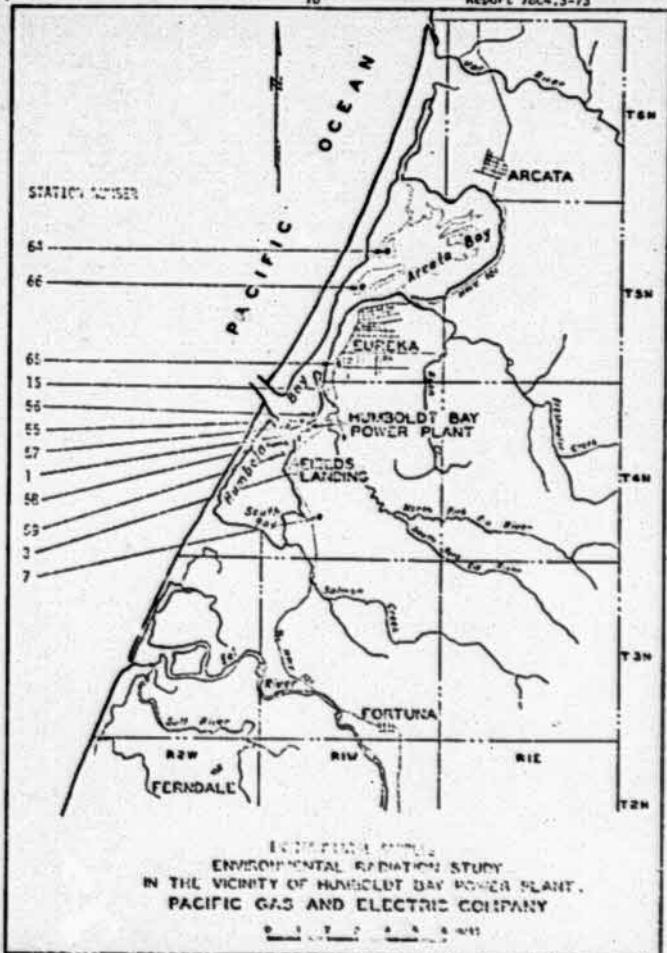


Figure 1

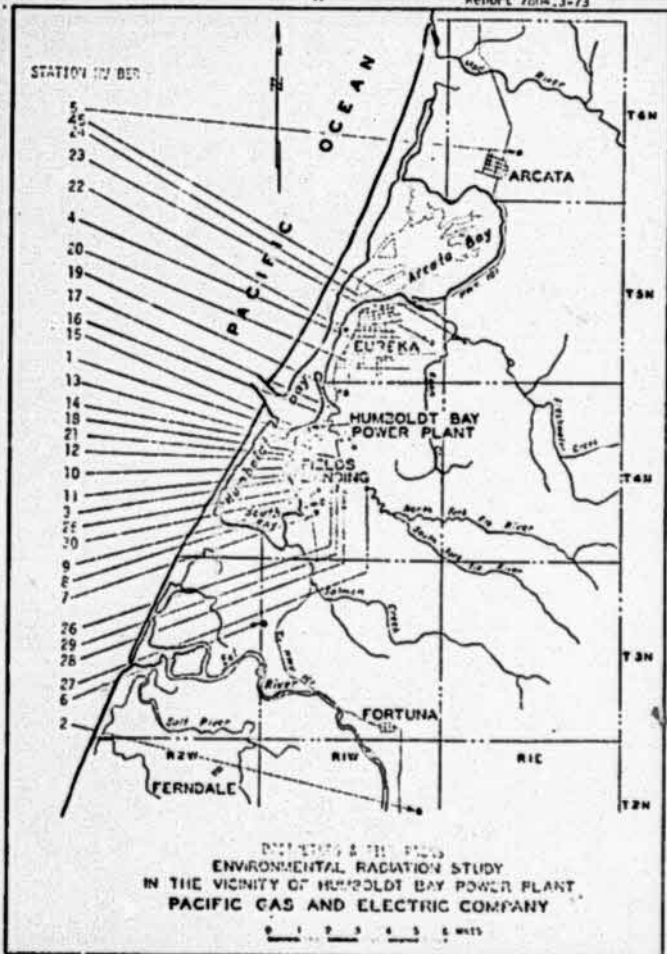


Figure 2

Report Issued: JAN 31 1975

Report 7856.2-74

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 52
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EMEREA, CALIFORNIA
QUARTER ENDING MARCH 31, 1974
(Winter)



E. E. Cayo, Chief

Report Prepared By:

M. H. Culver
C. G. Hunsel
D. P. Serpa

sm/t

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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. All liquid radiowaste releases from the plant were well within the limits of the existing regulations. The maximum integrated dose measured was well below the permissible contribution of 500 mR/year in unrestricted areas.

INTRODUCTION

This is the 52nd quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period January through March 1974. 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 18 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 Public 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-two gross beta analyses and 19 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ No iodine was detected in the milk samples. As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (nCi/g dry)	
	Iodine isotopes	Yttr
74131	13.1 \pm 1.8	16.4 \pm 1.7
74137	12.2 \pm 0.3	19.9 \pm 1.6
74139	7.5 \pm 1.3	10.5 \pm 0.9
74142	7.4 \pm 0.9	6.9 \pm 0.6
74038	4.0 \pm 0.9	4.6 \pm 0.6

Dosimeter readings during this quarter were generally above background levels (measured at Stations 2 and 5) and consistent with stack releases from HBPP Unit 3 for the period. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The measured contribution from Unit 3 to the total dose at Station 14 was approximately 49 mR above background,⁶ which is well below the permissible dose contribution in unrestricted areas of 500 cRm/year.⁶

⁶Based on 50 weeks of measurements.

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1970 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate For Month - μC per Second*</u>
January 1974	18,500
February 1974	11,900
March 1974	15,700

*The unit was operated between 60 and 215 MBt during this quarter.

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 P G and E, Attn: F. F. Neutz, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. P G and I 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

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 airborne particulate samplers are located at Stations 3 and 45 (Figure 1). The constant flow samplers have flow rates in the range of 1.0 cfm; an HV-70 filter is used. The filters are collected on a weekly basis and mailed to DER. Gross beta activity is counted 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), Mountain View, 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 SUPPLIES ENCUMBERED REPORT 7894-2-78

STATION	MAINT. PLANS	VEHIC. PARTS	CLAS. & OTHER CYSTERS INVENT.	BOTTOM STOCK	STRESS- IN TOTAL	DIS- PARTS. MISSIS. MISSIS. PACES
1 MONROE POWER PLANT					2	
2 1st ST. STATION						
3 MONROE MILL						
4 WELLS, L. LUTHER					12	
5 ARCADE						
6 FOLEY STUFFLECRATE					1	
7 WILCOX STREET						
8 MONROE MILL						
9 MONROE MILL						
10 FOLEY LANCING						
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Direct Total J-10

53700- 2 07001

ITA SAMPLE	DESCRIPTION	NETA		GROSS ACTIVITY		GROSS ACTIVITY		GROSS ACTIVITY	
		COLLECTION DATE	DATE	INCL/CM DRY	INCL/CM DRY	INCL/CM DRY	INCL/CM DRY	INCL/CM DRY	INCL/CM DRY
55	76126 S21MINT	3/23/76	4/10/76	4.79±0.02	0.3	0.3	0.31±0.06		
55	76120 R9N ALGAE (GROSSING PILLULAS)	4/ 1/76	4/23/76	21.6±1.57	26.0	16.9	5.78±0.42		
55	76121 R2D ALGAE (GROSSING SP-1)	4/ 1/76	4/23/76	10.4±1.08	16.0	15.0	2.03±0.27		
55	76122 R2D TAILLED SURFROG (GROSSING SP-1)	4/ 1/76	4/23/76	16.6±0.65	16.3	13.5	2.78±0.17		
56	76123 S21MINT	3/23/76	4/10/76	9.1±0.55	0.4	0.4	0.09±0.15		
56	76124 R2D ALGAE (GROSSING PILLULAS)	3/23/76	4/17/76	10.4±1.06	20.6	17.1	0.09±0.04		
56	76125 R2D ALGAE (GROSSING SP-1)	3/23/76	4/17/76	37.1±3.52	36.2	11.9	2.68±0.29		
57	76126 S21MINT	3/23/76	4/17/76	9.1±0.55	0.5	0.4	0.09±0.15		
57	76127 R2D ALGAE (GROSSING PILLULAS)	4/ 1/76	4/25/76	19.4±1.63	21.7	18.0	0.09±0.03		
57	76128 R9N ALGAE (GROSSING SP-1)	4/ 1/76	4/17/76	15.2±0.87	16.2	13.4	5.13±0.10		
58	76129 Pacific Ocean (3)	2/10/76	2/20/76	0.31±0.21	9.5	7.9	1.09±0.11		
59	76130 Pacific Ocean (GROSSING PILLULAS)	4/ 8/76	4/23/76	10.1±0.993	11.0	0.2	2.15±0.19		
59	76131 Pacific Ocean (GROSSING SP-1)	4/ 1/76	4/23/76	0.10±0.06	7.0	9.0	1.01±0.11		

1. COLLECTOR PL COLLECTION NAME, ONLY. ONLY ONE COLLECTION NAME TO BE SUBMITTED FOR EACH SITE.

2. This Pacific oyster sample was collected as a joint sample to be split for analysis by the State Health Department and PH and P.

RADIONUCLIDES IN HAWAIIAN SOILS

SOL SAMPLE	DESCRIPTION	COLLECTION DATE		DATE		GROSS ACTIVITY (PC/KG NET SAMPLE)		POTASSIUM CONTENT (% BY SAMPLE)		GROSS ACTIVITY (PC/KG NET SAMPLE)		GROSS ACTIVITY (PC/KG NET SAMPLE)	
		1	2	3	4	5	6	7	8	9	10	11	12
1	74141 SOIL	3/17/76	4/17/76	5/12/76	0.78			0.0	0.5	0.500	0.30		
2	74142 SOIL	4/1/76	4/17/76	4/10/76	0.46			0.5	0.4	0.400	0.30		
3	74542 DOMESTIC WATER	3/31/76	3/7/76	3/7/76	37.00	1.75				1.100	0.16	1.51	
4	74238 MILK	1/43	2/1/76	3/12/76	4.57	0.50		5.3	0.6	10030	125	1.51	
5	74239 MILK	1/43	2/1/76	2/23/76	8.79	0.89		10.1	0.6	22100	126	1.51	

1- CORRECTION TO COLLECTION DATE, ONLY 1-018 RADIONUCLIDES, OTHER DATA NOT IDENTIFIED BY POST. ANALYSIS, AND REPORTED.

2- PC/KG AND ACTIVITY OF SOIL PC/KG NATURAL POTASSIUM.

3- UNCLASSIFIED SAMPLE

4- THE MILK SAMPLES WERE SAMPLED ON THE FOLLOWING DATES: 74238 WAS 2/1/76, 2/2/76
74239 WAS 2/12/76, 2/23/76

[illegible]

1. 80W C55141808 READ 0 ANOMAL FULL SCALE.
2. ACW POSTING TIME MISSING.
3. AHEAD OF DATA, IF 1955 TUNING 32.

AIR PARTICULATE STATION NO. 3 CROSS DATA ACTIVITIES

SAMPLE NO./SEA	VOLUME (LPM-2)	COLLECTION DATE	EXPOSURE DATE	PC1/PM10
7-276	263	1/ 6/76	1/11/76	0.0441-0.007
7-278	266	1/15/76	1/18/76	0.0341-0.002
7-279	266	1/22/76	1/23/76	0.0421-0.004
7-282	264	1/29/76	2/ 1/76	0.0401-0.004
7-284	266	2/ 6/76	2/11/76	0.0431-0.005
7-286	266	2/12/76	2/25/76	0.0331-0.003
7-288	266	2/19/76	2/25/76	0.0351-0.003
7-290	266	2/26/76	2/27/76	0.0351-0.003
7-292	266	3/ 5/76	3/12/76	0.0351-0.003
7-294	266	3/12/76	3/22/76	0.0351-0.003
7-296	266	3/19/76	4/ 8/76	0.0351-0.003
7-298	266	3/26/76		

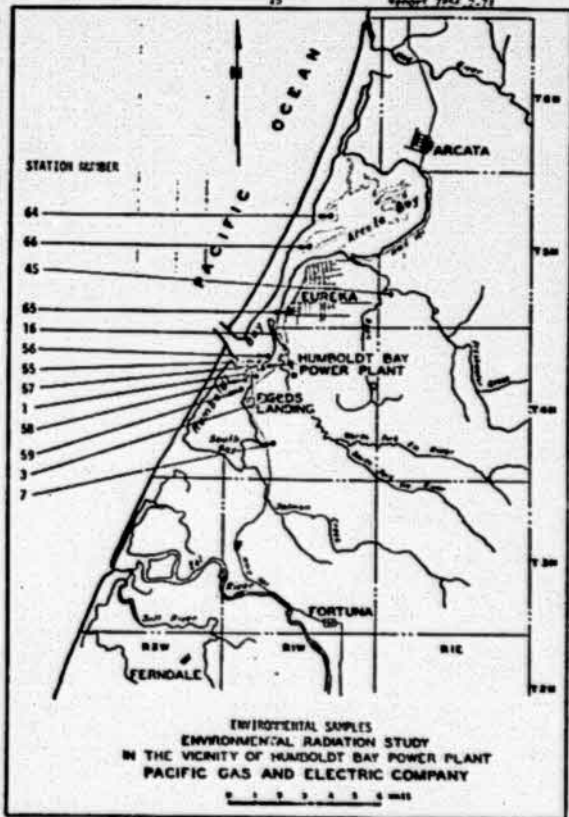


Figure 1.

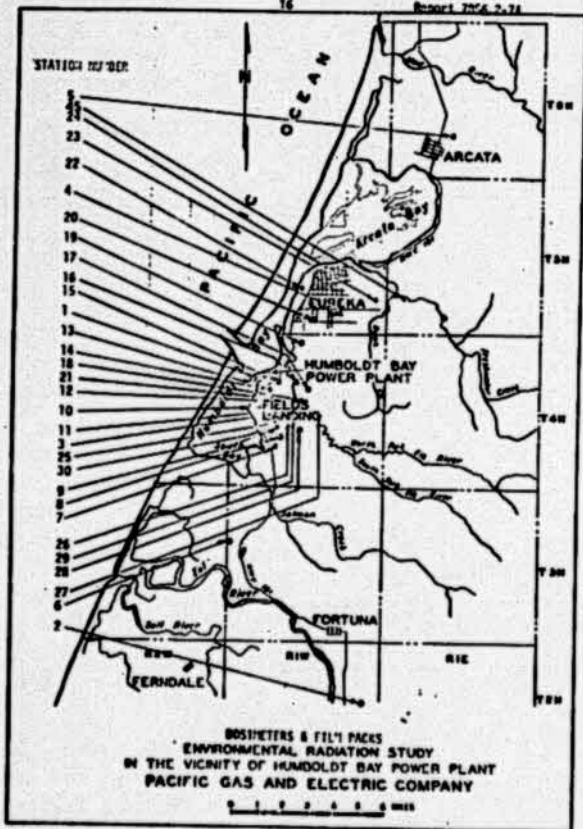


Figure 2.

Station 8

Monthly Average Air Particulate, $\mu\text{g}/\text{m}^3$

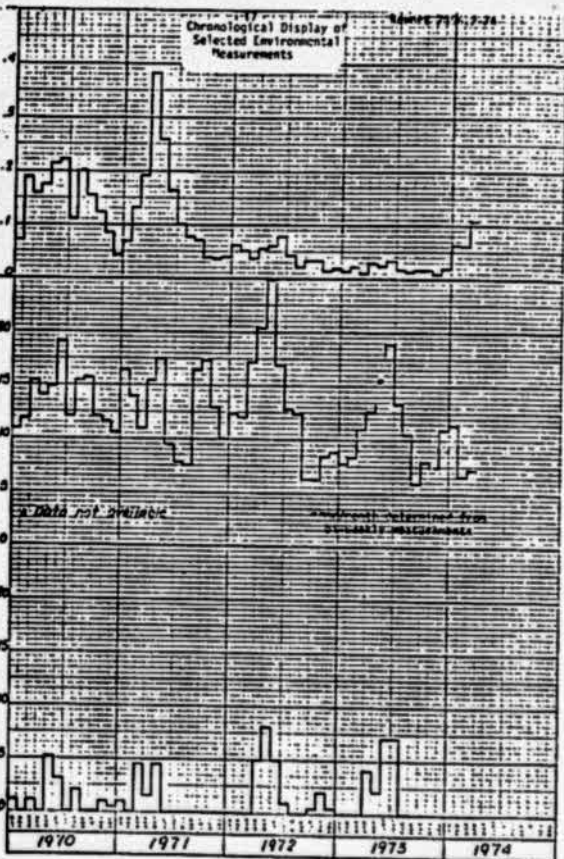
Chronological Display of
Selected Environmental
Measurements

Station 79419-26

Dosimetry, Station 16

San Chambers, mcr-10

Five Facts per above
background of 8 mcr/line

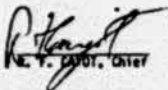


Report Issued: JUL 11 1975

Report 7906.1-75

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 56
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING MARCH 31, 1975
(Winter)



R. T. Hensel, Chief

Report Prepared By:

C. G. Hensel
R. W. Lorenz

sm/t

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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 56th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period January through March 1975. 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 17 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 Public 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-three gross beta analyses and 18 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned; milk was scanned both wet and dry. 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 IBPP personnel. Film packs were read and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of stiller samples.⁵ As shown below, the confirmatory analyses by outside contractors are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)		
	LE (Environmental)	Teleme Isotopes	DER
75061	5.1 \pm 0.6	3.7 \pm 1.1	5.4 \pm 0.4
75066	16.6 \pm 1.6	15.8 \pm 1.5	13.3 \pm 0.7
75068	16.6 \pm 1.6	15.1 \pm 1.8	14.0 \pm 0.8
75071	8.9 \pm 1.0	7.3 \pm 1.0	7.8 \pm 0.6
75158	8.6 \pm 1.0	8.2 \pm 1.1	8.1 \pm 0.9

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The annual contribution from Unit 3 to the total dose at Station 14 was approximately 93 mrem above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

*Based on 50 weeks of measurements.

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1971 through this quarter. Report 37 contains a graph of 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 average noble and activated gas release rate for each month during the report period was as follows:

	<u>Average Release Rate</u> <u>for Month - μCi per Second*</u>
January 1975	8,223
February 1975	9,615
March 1975	20,177

*The unit was operated between 160 and 215 MWt during this quarter.

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 P G and E, Attn: F. F. Maulz, 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 P G and E, Attn: Mr. P. Matthew, concerning modifications to waste discharge requirements, dated April 8, 1966.
4. Department of Public Health letter to P G and E, 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.

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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. PG and E 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 liquid milk are gamma scanned, using a 3" x 3" NaI(Tl) detector and multichannel pulse height analyzer. The limit of detectability attained in the gamma scan is typically 10 pCi/l of water solution containing the radionuclide I-131 and 5 pCi/l for Co-60.

Radiiodine analyses are performed on milk samples by using procedure abstracted in Nuclear Regulatory Commission (NRC) Regulatory Guide 4.3. 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 rates in the range of 1.0 to 1.5 cfm; 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 237) and a film pack located at each of the 33 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), Mountain View, 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
ISOPHYS COLLECTION

STATION	WIND- FLICK	CLAMS & OTHER INVERTEB.	BUTTER- FLY LARVAE	SPID- WEB LARVAE	WATER BUGS	WATER BUGS	WATER BUGS
1. HONOLULU MOBILE PLANT							
2. 1142 W. 11th St.							
3. HONOLULU W. 11th St.							
4. W. 11th St. E. 11th St.							
5. HONOLULU							
6. HONOLULU							
7. HONOLULU							
8. HONOLULU							
9. HONOLULU							
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33. HONOLULU							
34. HONOLULU							
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36. HONOLULU							
37. HONOLULU							
38. HONOLULU							
39. HONOLULU							
40. HONOLULU							

TABLE 2
RADIOANALYSIS OF MARINE SAMPLES

SIA SAMPLE	DESCRIPTION	COLLECTION DATE	NETA COUNTING DATE	GROSS ACTIVITY SPECIFIC BY SAMPLE	GROSS I-131 BY SAMPLE	POTASSIUM CONTENT IN POTASSIUM I-131 BY SAMPLE		GROSS I-131 BY SAMPLE	GROSS ACTIVITY SPECIFIC BY SAMPLE	GROSS I-131 BY SAMPLE	GROSS ACTIVITY SPECIFIC BY SAMPLE
93	75008 5/10/67	1/26/75	2/10/75	5.38--0.19		0.44	0.37	0.71--0.34			
95	75052 8/10 ALGAE (GORGONIA SP.)	1/26/75	2/26/75	15.0--0.95	20-45	7.82 27.70	15.4	6.58--0.25			
95	75063 8/10 ALGAE (GORGONIA SP.)	1/26/75	2/23/75	17.1--0.67	20-34	8.78 25.46	15.5	2.66--0.16			
96	75164 8/10 74110 SQUID RING (GORGONIA SP.)	1/26/75	5/1 1975	15.9--1.02		16.0	15.8	3.57--0.75			
96	75206 5/10/67	1/26/75	2/10/75	5.60--0.65		0.38	0.32	5.40--0.63			
96	75208 8/10 ALGAE (GORGONIA SP.)	1/26/75	2/26/75	16.7--0.95	20-45	8.22 27.16	16.5	5.68--0.32			
96	75206 8/10 ALGAE (GORGONIA SP.)	1/26/75	2/23/75	11.1--0.75	20-45	2.48 27.00	16.3	3.19--0.19			
97	75287 5/10/67	1/26/75	2/10/75	5.56--0.65		0.46	0.38	6.74--0.36			
97	75288 8/10 ALGAE (GORGONIA SP.)	1/26/75	2/26/75	16.0--0.75		17.0	16.9	5.78--0.28			
97	75295 8/10 ALGAE (GORGONIA SP.)	1/26/75	2/26/75	10.7--0.75		16.1	11.7	3.16--0.25			
98	75370 PACIFIC TARTAR (GORGONIA SP.)	1/20/75	3/12/75	7.77--0.65		6.93	5.75	1.21--0.637			
98	75378 GORGONIA (GORGONIA SP.)	1/26/75	3/12/75	7.78--2.61		8.56	6.75	1.65--0.112			

3. CORRECTED TO COLLECTION DATE, DATA FOR RADIOANALYSIS, OTHER THAN 8/10, IDENTIFIED BY MASS WEIGHT ANALYSIS ARE REPORTED.
 4. 75052 ACTIVITY OF SPECIFIC SAMPLES, IDENTIFIED.

STANLEY T. HARRIS, JR. and VICTOR D. HARRIS
ATTORNEYS

SPR SAMPLE	DECONTAMINATION	NETS COLLECTION DATE	GROSS ACTIVITY 100% OF NETS OF 10	NETS ACTIVITY 100% OF NETS OF 10	NETS ACTIVITY 100% OF NETS OF 10
1. 15102 501K		1/15/75	0.140	0.10	0.100
2. 15103 501K		2/1/75	0.100	0.10	0.100
3. 15104 501K		3/1/75	0.110	0.10	0.100
4. 15105 501K		4/1/75	0.110	0.10	0.100
5. 15106 501K		5/1/75	0.110	0.10	0.100
6. 15107 501K		6/1/75	0.110	0.10	0.100
7. 15108 501K		7/1/75	0.110	0.10	0.100
8. 15109 501K		8/1/75	0.110	0.10	0.100
9. 15110 501K		9/1/75	0.110	0.10	0.100
10. 15111 501K		10/1/75	0.110	0.10	0.100
11. 15112 501K		11/1/75	0.110	0.10	0.100
12. 15113 501K		12/1/75	0.110	0.10	0.100

1. **CRACKING IN CALCIFICATION ZONE.** TWO TYPES CRACKS DEVELOP, OFTEN FROM END, IDENTIFIED BY POLARIZATION MICROSCOPE AND X-RAY.

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2. **67th Congress, 1st Session, 1921**

U.S. DEPT. OF JUSTICE

TABLE 5
SILICA IN WATER INTAKE

DATE OF SAMPLE 12/21/76 12/24/76 12/25/76 12/26/76
TIME 1000 1200 1400 1600

STATION 1000 1000 1000 1000

ANALYSIS TOTAL SILICA TOTAL SILICA

1 1 1 1

2 2 2 2

3 3 3 3

4 4 4 4

5 5 5 5

6 6 6 6

7 7 7 7

8 8 8 8

9 9 9 9

10 10 10 10

11 11 11 11

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19 19 19 19

DATE OF ANALYSIS 12/21/76 12/24/76 12/25/76 12/26/76

ANALYST J. L. HARRIS

LABORATORY 1000

STATION 1000

ANALYSIS TOTAL SILICA

1 1 1 1

2 2 2 2

3 3 3 3

4 4 4 4

5 5 5 5

6 6 6 6

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9 9 9 9

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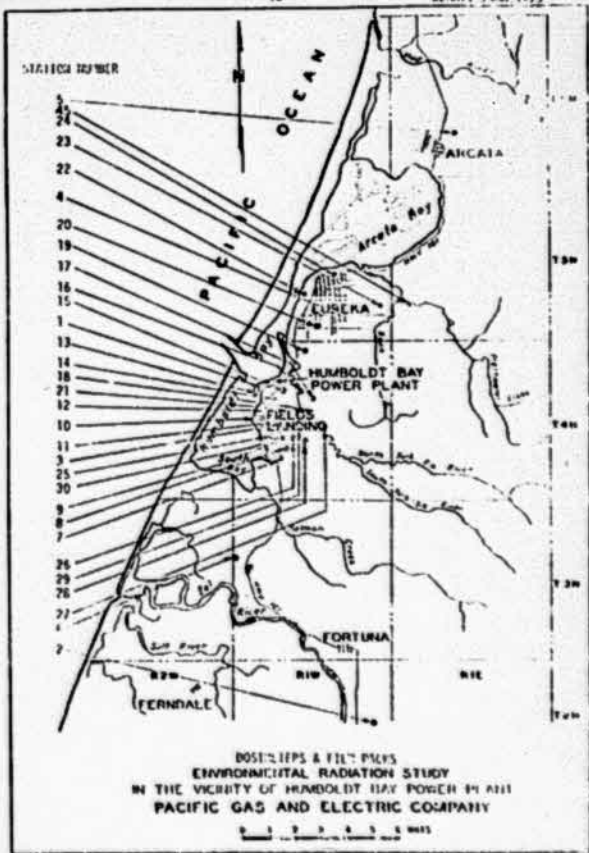


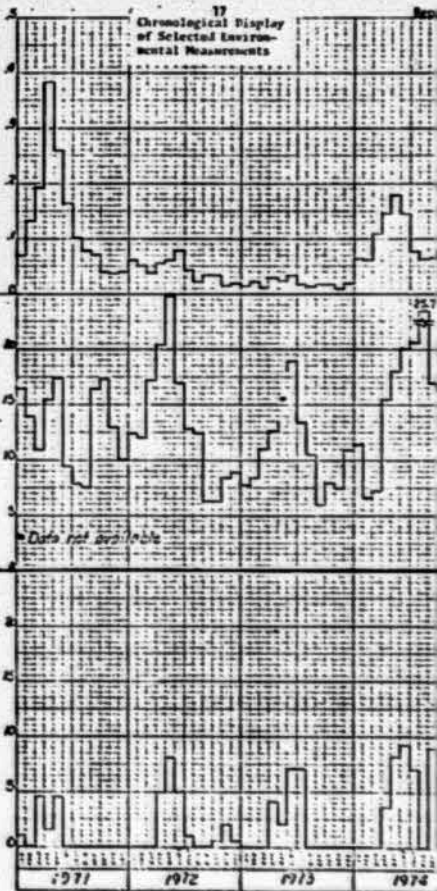
FIGURE 2

Five Rock, near above background of 8 micro

Dosimetry, Station 14

San Chambers, m/r

Station 3
Monthly Average Air Pressure, m/r

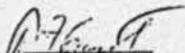


Report Issued: JUL 5 1976

Report 7906.5-76

PACIFIC GAS AND ELECTRIC COMPANY
DEPARTMENT OF ENGINEERING RESEARCH

REPORT NO. 60
ENVIRONMENTAL RADIATION STUDY
IN THE VICINITY OF
HUMBOLDT BAY POWER PLANT
EUREKA, CALIFORNIA
QUARTER ENDING MARCH 31, 1976
(WINTER)


R. F. CAYOT, Chief

Report Prepared By:

C. G. Hense
R. W. Lorenz

sm/t

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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 60th quarterly report on radiation in the environment near Humboldt Bay Power Plant (HBPP) covering the period January through March 1976. 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 Algae species normally collected at Station 55 were not collected since they were not available in sufficient quantities. 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 and 14 gamma scans were performed for this report; domestic water and air particulate filters were not gamma-scanned. 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 IBPF personnel. Film packs were read and confirmatory analyses of five samples were performed by outside contractors.

DISCUSSION OF ANALYTICAL RESULTS

The environmental samples analyzed for this report contained, in general, activities comparable to the preoperational activity levels of similar samples.⁵ As shown below, the confirmatory analyses by an outside contractor are in good agreement with the DER results.

Sample No.	Gross Beta Activity (pCi/g dry)	
	LFE Environmental	DER
76042	7.6 \pm 0.8	7.8 \pm 0.8
76050	12.1 \pm 1.2	11.0 \pm 0.6
76047	16.9 \pm 1.6	14.0 \pm 1.1
76048	7.0 \pm 0.8	7.5 \pm 0.4
76084	8.0 \pm 0.8	7.7 \pm 0.9

Dosimeter readings at sites generally downwind were above background levels as measured at Stations 2 and 5 during this quarter. During the preceding 52-week period, the maximum integrated dose was measured at Station 14. The annual contribution from Unit 3 to the total dose at Station 14 was approximately 40 mrem above background,* which is well below the permissible dose contribution in unrestricted areas of 500 mrem/year.⁶

*Extrapolated to one year from actual measurements.

Figure 3 is a chronological display of dosimeter and film pack doses per month at Station 14 and the air-particulate activity at Station 3 from January 1972 through this quarter. Reports 37 and 55 contain graphs of 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 average noble and activated gas release rate for each month during the report period was as follows:

	Average Release Rate For Month - μCi per Second*
January 1976	13,500
February 1976	5,500
March 1976	3,300

*The unit was operating between 100 and 209 lb/it except for the period March 17 to March 20 during which the unit was down for maintenance.

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 P G and E, Attn: F. F. Nautz, concerning modifications to waste discharge and environmental radiation monitoring requirements, dated May 7, 1965.
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METHODS OF SAMPLE COLLECTION AND ANALYSIS

Marine samples are collected by Humboldt State College Foundation personnel under the direction of Dr. J. A. Gast. P G and E 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 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 by using the procedure abstracted in Nuclear Regulatory Commission (NRC) Regulatory Guide 4.3. 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.

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The airborne particulate samplers are located at Stations 3 and 45 (figure 1). The constant flow samplers have flow rates in the range of 1.0 to 1.5 cfm; 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 233) and a film pack located at each of the 30 stations shown in Figure 2. The ion chambers are read in the field by IBPP 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), Mountain View, 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.

PERIOD START ELAPSED TIME LAT STATION	12-28-75 1-13-76	1-13-76 1-27-76	1-27-76 2-16-76	TABLE 2 DOSIMETER READINGS		2-24-76 3-9-76	2-24-76 3-9-76	REPORT PMS-5-76	
	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP	IN TOTAL HP
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0
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58	0	0	0	0	0	0	0	0	0
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79	0	0	0	0	0	0	0	0	0
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82	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0
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85	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0
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98	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0

1. SOME DOSIMETERS READ A TWO-HP FULL SCALE.

2. USABLE TO COMING DOSIMETER.

3. LESS OF DATA, IF LESS THAN 50.

REPORT 7906.5-76

TABLE 5		FILM PACK MEASUREMENTS		
PERIOD START	ELAPSED TIME	FILM PACK MEASUREMENTS	FILM PACK MEASUREMENTS	
			12/20/76	12/21/76
END	DAYS	STATION	FILM PACK MEASUREMENTS	
			12/20/76	12/21/76
TOTAL HR(1)	TOTAL HR(1)	TOTAL HR(1)	FILM PACK MEASUREMENTS	
			12/20/76	12/21/76
1	20	20	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
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27	0	0	0	0
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73	0	0	0	0
74	0	0	0	0
75	0	0	0	0
76	0	0	0	0
77	0	0	0	0
78	0	0	0	0
79	0	0	0	0
80	0	0	0	0
81	0	0	0	0
82	0	0	0	0
83	0	0	0	0
84	0	0	0	0
85	0	0	0	0
86	0	0	0	0
87	0	0	0	0
88	0	0	0	0
89	0	0	0	0
90	0	0	0	0
91	0	0	0	0
92	0	0	0	0
93	0	0	0	0
94	0	0	0	0
95	0	0	0	0
96	0	0	0	0
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98	0	0	0	0
99	0	0	0	0
100	0	0	0	0

1. ABOVE BACKGROUND OF 8 HP/MO
2. FILM PACK HISsing

REPORT 7906.5-76

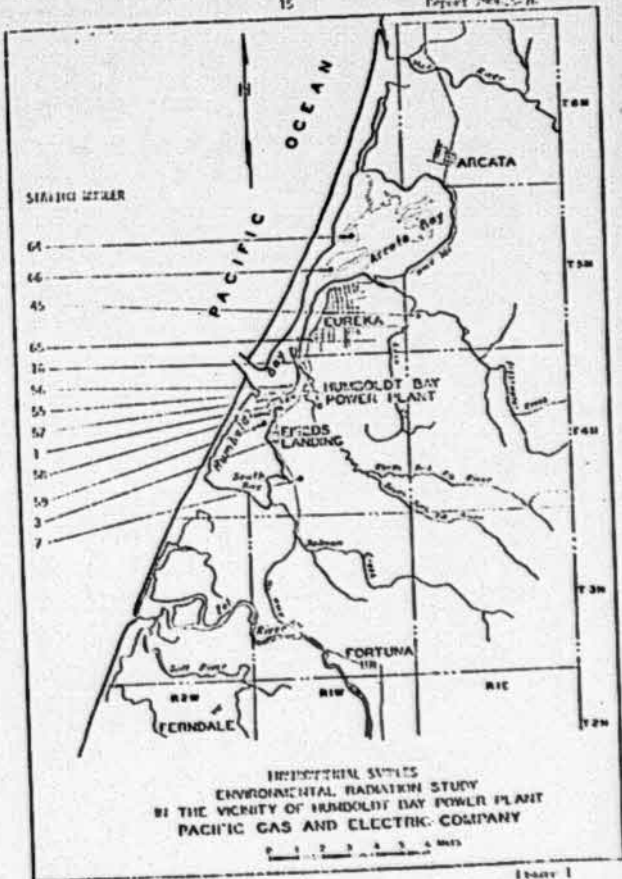
TABLE 6

SAMPLE NUMBER	STATION VOLUME (M ³)	AIR PARTICULATE		ACTIVITY COUNTING DATE	PCI/M ³
		NO. 3 GROSS BETA COLLECTION DATE	DATE		
7-601	286	1/6/76	1/14/76	0.016+-0.001	
7-608	286	1/13/76	1/21/76	0.011+-0.008	
7-615	286	1/20/76	1/26/76	0.018+-0.001	
7-625	286	1/27/76	1/30/76	0.044+-0.003	
7-632	286	2/3/76	2/6/76	0.035+-0.003	
7-639	286	2/10/76	2/13/76	0.043+-0.002	
7-643	286	2/17/76	2/23/76	0.022+-0.002	
7-649	286	2/24/76	2/27/76	0.044+-0.001	
7-656	286	3/1/76	3/9/76	0.010+-0.001	
7-661	286	3/1/76	3/12/76	0.035+-0.003	
7-671	286	3/15/76	3/19/76	0.023+-0.001	
7-675	286	3/23/76	3/29/76	0.016+-0.001	
7-683	286	3/29/76	4/5/76	0.015+-0.002	

REPORT 7906.5-76

TABLE 7

SAMPLE NUMBER	VOLUME (CM ³)	STATION	AIR PARTICULATE NO. 95 CROSS FETA COLLECTION DATE	ACTIVITY COUNTING DATE	FCI/M ²
5602	421		1/5/76	1/14/76	0.013+-0.001
5603	421		1/13/76	1/21/76	0.011+-0.001
5614	418		1/29/76	1/26/76	0.017+-0.001
5621	476		1/27/76	1/30/76	0.033+-9.003
5622	421		2/1/76	2/1/76	0.020+-0.002
5623	421		2/10/76	2/13/76	0.044+-0.002
5624	421		2/17/76	2/27/76	0.022+-0.002
5625	421		2/24/76	3/1/76	0.019+-0.001
5626	419		3/1/76	3/9/76	0.009+-0.001
5613	444		3/1/76	3/12/76	0.022+-0.001
5612	418		3/1/76	3/19/76	0.022+-0.001
5619	434		3/23/76	3/23/76	0.019+-0.001
5616	421		3/23/76	4/2/76	0.014+-0.001



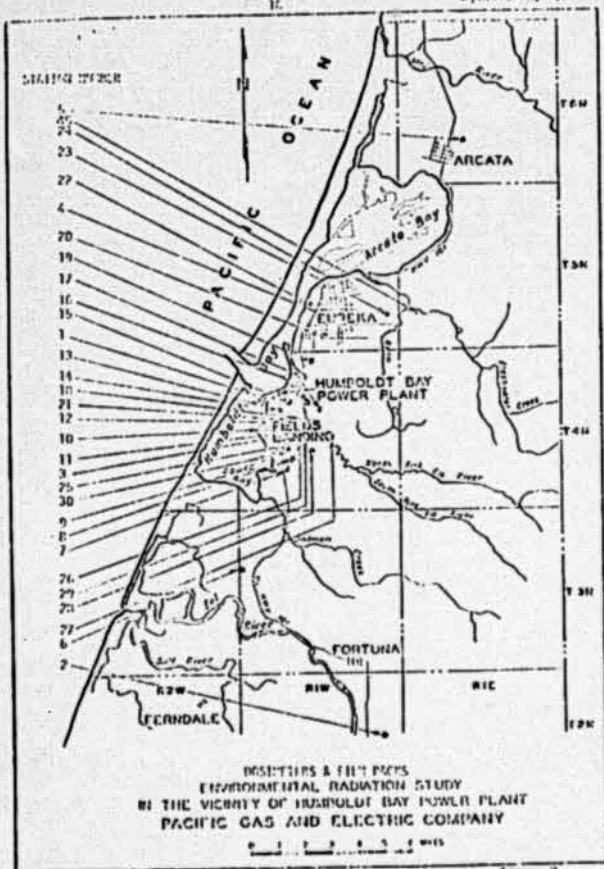
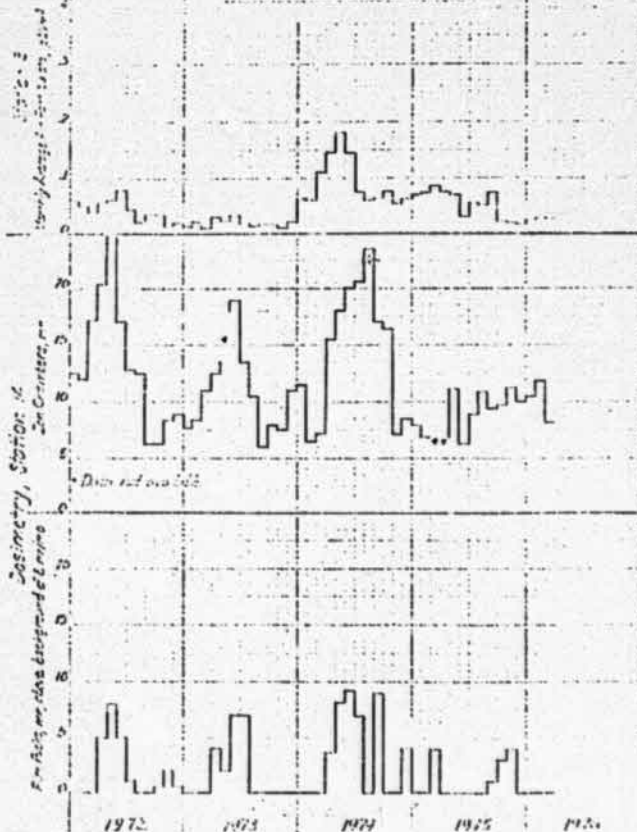
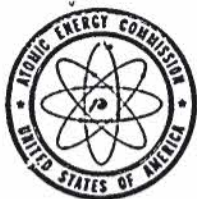


Figure 2

Thomson Display of Selected Environmental Parameters





UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Formal File
FORMAL DOCKET
COPY

JUL 1 1968

50-275

Mr. C. D. Calsoyas
1638 10th Avenue
San Francisco, California 94122

Dear Mr. Calsoyas:

I am pleased to furnish the information requested in your letter of June 5, 1968, to the Chairman of the Atomic Safety and Licensing Board Panel with respect to radioactive effluent control of the Humboldt Bay Reactor and the Diablo Canyon Reactor.

As you are aware the Humboldt Bay Reactor and the Diablo Canyon Reactor are fundamentally different reactor designs, the former being a boiling water reactor and the latter a pressurized water reactor. This fundamental difference in reactor types is not particularly relevant to the processing of liquid effluents; however, the radioactive gas treatment system for the Diablo Canyon Reactor is different from that at the Humboldt Bay Reactor. I would not characterize the gas treatment system, however, as being new because similar systems are used or proposed for other pressurized water reactors. The radioactive gas disposal system at Diablo Canyon uses decay tanks which receive gases pumped from various collection points. These gases are to be stored until monitoring indicates that controlled releases would be within allowable limits. At the Humboldt Bay Reactor, decay tanks are not used, rather delay pipes are incorporated in the discharge lines to permit the short half-lived isotopes to decay prior to release.

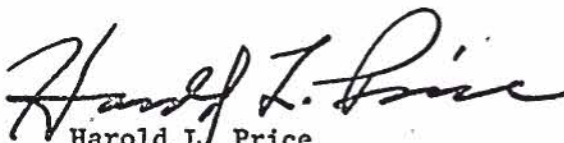
For either facility, the radioactive releases to the environment, either liquid or gaseous, are specified to be within the limits prescribed in 10 CFR Part 20. In addition, Technical Specifications for the Humboldt Bay Reactor include allowable release limits as part of the operating license (this is not the case for Diablo Canyon since an operating license has not been issued). As part of our regulatory program, periodic inspections are made of all reactor licensees by

Mr. C. D. Calsoyas

-2-

personnel within the Compliance Division and radioactive releases are one item investigated in these visits to ensure compliance with AEC regulations and license limits.

Sincerely,

A handwritten signature in dark ink, appearing to read "Harold L. Price". The signature is fluid and cursive, with the first name "Harold" being more prominent and the last name "Price" following in a similar style.

Harold L. Price
Director of Regulation

1638 10th Avenue
San Francisco, California
June 5, 1968 94123

Dr. Algio A. Wolls, Chairman
Atomic Safety and Licensing Board
United States Atomic Energy Commission
Washington, D. C.

Dear Dr. Wolls:

As you know the California Public Utilities Commission is now investigating the failure of the Pacific Gas and Electric Company to establish the low-level radiation safety of the Diablo Canyon Nuclear Power Station and the radioactive contamination of the natural gas produced by the Gasbuggy nuclear explosion of December 10, 1967, under the Plowshare Program of the United States Atomic Energy Commission.

I refer to my letter of June 4, 1968, to Mr. S. L. Sibley, President of the Pacific Gas and Electric Company, concerning the Diablo Canyon reactor. It is my understanding that you were the Chairman of the Atomic Safety and Licensing Board which on April 23, 1968, approved the application of the Pacific Gas and Electric Company to construct the Diablo Canyon Station.

I would appreciate knowing whether the Diablo Canyon reactor contains any new designs that would decrease the rates of release of dangerous radionuclides in comparison with the Humboldt Bay nuclear reactor.

Sincerely,

C. D. Calsoyas
C. D. Calsoyas

276730

DR-1756

50-133

50-275

8/5/68

DISTRIBUTION

DR Reading

DRL Reading

Branch Reading

H. L. Price, DR

OGC

P. A. Morris, DRL

R. S. Boyd, DRL

D. Skovholt, DRL

Mr. C. D. Calsoyas
1638 10th Avenue
San Francisco, California 94122

Dear Mr. Calsoyas:

In your letter of July 5, 1968, you inquire concerning the release rates of radionuclides from the Humboldt Bay reactor and the estimated rates from the Diablo Canyon reactor. Both the releases from Humboldt Bay and the projected releases from Diablo Canyon are within the limits established by the Commission in Title 10, Part 20, Code of Federal Regulations, entitled "Standards for Protection Against Radiation," a copy of which is enclosed for your information.

In order that you may personally evaluate the quantities of the radionuclides in which you are interested, I am attaching a list of the semiannual reports of operation concerning the Humboldt Bay reactor that have been filed since the beginning of operations. These documents contain data concerning the activity releases. In addition, the attached list includes references to the Preliminary Safety Analysis Report for the Diablo Canyon Nuclear Power Plant and Transcript of the Public Hearing on the Diablo Canyon case which contain information concerning radioactivity releases. All of these documents are on file in the Commission's Public Document Rooms at USAEC San Francisco Operations Office, 2111 Bancroft Way, Berkeley, California 94704 and 1717 H St., N. W., Washington, D. C. 20005. The documents may be inspected at either office and copies of them may be obtained from the Washington office for a nominal page charge.

The radiological monitoring program for the Humboldt Bay reactor is described in a letter from the Pacific Gas and Electric Company to the Division of Reactor Licensing, dated August 22, 1966. This letter is also on file in the Public Document Rooms.

Sincerely,

DRL
D.J. Skovholt:gw
x7380
7/30/68

Harold L. Price
Director of Regulation

Enclosures:

10 CFR Part 20

List of Semiannual Reports
for Humboldt Bay Reactor

References Concerning Diablo Canyon

DRL

R.S. Boyd

7/ /68

DRL

PAMorris

7/ /68

OGC

7/ /68

DR

HLPrice

8 7/ /68

SEMI ANNUAL REPORTS FOR THE HUMBOLDT BAY REACTOR

Period Covered by Report

Date of Report

2/16/63 to 8/16/63	10/15/63
8/16/63 to 2/15/64	5/13/64
2/16/64 to 8/15/64	9/30/64
8/16/64 to 2/15/65	4/8/65
2/16/65 to 8/15/65	9/24/65
8/16/65 to 2/15/66	4/1/66
2/16/66 to 8/15/66	9/26/66
8/15/66 to 2/15/67	4/5/67
2/16/67 to 8/15/67	9/29/67
8/16/67 to 2/15/68	4/11/68

REFERENCES CONCERNING DIABLO CANYON

1. Preliminary Safety Analysis Report for the Diablo Canyon Nuclear Plant, Vol. II, Section II, "Radioactive Wastes and Radiation Protection" dated January 16, 1967.
2. Transcript of the Public Hearing in the matter of Pacific Gas and Electric Co. (Diablo Canyon Nuclear Power Plant) on February 21, 1968, pp. 404-492.

Pacific Gas and Electric Company
Humboldt Bay Power Plant
Terry Nelson
Nuclear Director and Plant Manager

1000 King Salmon Avenue
Eureka, CA 95503
707/444-0700

July 31, 2006

PG&E Letter HBL-06-17



Mr. Stuart A. Richards, Deputy Director
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Docket No. 50-133, OL-DPR-7
Humboldt Bay Power Plant, Unit 3
Groundwater Protection – Data Collection Questionnaire

Dear Mr. Richards:

The nuclear industry, in conjunction with the Nuclear Energy Institute, has developed a questionnaire to facilitate the collection of groundwater data at commercial nuclear reactor sites. The objective of the questionnaire is to compile baseline information about the current status of site programs for monitoring and protecting groundwater and to share that information with NRC. The completed questionnaire for Humboldt Bay Power Plant, Unit 3 is enclosed.

This submittal contains no new regulatory commitments.

Please contact John Albers at 707-444-0877 if you have questions about the enclosed information.

Sincerely,

A handwritten signature in black ink, appearing to read "T. Nelson", written over a horizontal line.

TERRY NELSON

Enclosure

cc: USNRC Document Control Desk
Bruce S. Mallett
John B. Hickman
Emilio M. Garcia
Ralph Andersen, Nuclear Energy Institute

NMSSO1

Designated original
per T. Gorham

**Industry Groundwater Protection Initiative
Voluntary Data Collection Questionnaire**

Plant: Humboldt Bay Power Plant

1. *Briefly describe the program and/or methods used for detection of leakage or spills from plant systems, structures, and components that have a potential for an inadvertent release of radioactivity from plant operations into groundwater.*

Since Unit 3 is in SAFSTOR status only limited operations are currently performed. Most systems that contained radioactive liquids during operation have been drained. The spent fuel pool has a leakage monitoring system in place. All tanks containing radioactive liquids are monitored daily for level changes. Unexplained trends in tank levels are investigated. Periodic inspections of the plant are conducted to identify leaks or other abnormal conditions.

2. *Briefly describe the program and/or methods for monitoring onsite groundwater for the presence of radioactivity released from plant operations.*

Groundwater monitoring is performed by sampling five monitoring wells located to detect leakage from the spent fuel pool. Four of the wells are located inside the Unit 3 yard and one of the wells is located outside of Unit 3 on the site property. Three of the five wells are located down gradient of Unit 3. Sampling of these monitoring wells is performed quarterly. The samples are routinely analyzed for gamma emitting isotopes, Gross Alpha/Beta, and Tritium.

Alpha and Beta radioactivity analyses of the saline ground water are less effective than Tritium and gamma radioactivity analyses for monitoring potential spent fuel pool leakage. The Offsite Dose Calculation Manual (ODCM) does not currently require Alpha and Beta radioactivity analyses to be part of the SAFSTOR Radiological Effluent Monitoring Program (REMP). Nevertheless, Alpha and Beta radioactivity analyses are performed as a matter of plant policy.

The high salinity of the groundwater makes the achievement of the required minimum detectable activities (MDAs) problematic for gross Alpha and Beta radioactivity. Because of this problem, starting in the first quarter of 2006, isotopic Am-241 and isotopic Sr-90 analysis of the groundwater wells has been performed for samples that are unable to meet the required MDAs.

Groundwater leakage into the reactor caisson is also routinely sampled. The caisson sump is sampled monthly, and analyzed for gamma emitters and Tritium as a matter of plant policy.

Industry Groundwater Protection Initiative
Voluntary Data Collection Questionnaire

Routine MDAs are:

Cs-137	18 pCi/L
Surface water H-3	400 pCi/L (ODCM required MDA = 3000 pCi/L)
Other waters H-3	400 pCi/L (ODCM required MDA = 2000 pCi/L)
Gross Beta	4 pCi/L
Gross Alpha	3 pCi/L
Sr-90	5 pCi/L
Am-241	1 pCi/L

Additional non-routine samples were collected in January 2006 from the three wells down gradient of the offgas tunnel. These were analyzed for gamma emitters, gross Alpha and Sr-90. No activity was detected above the detection limits.

3. *If applicable, briefly summarize any occurrences of inadvertent releases of radioactive liquids that had the potential to reach groundwater and have been documented in accordance with 10 CFR 50.75(g).*

Numerous spills of radioactive liquids occurred during plant operations from 1963 to 1976. The following information is from appendix 6.1 of Humboldt Bay Administrative Procedure (HBAP) D-500 "Documenting Site Contamination During SAFSTOR". It is used to document spills in accordance with 10CFR 50.75(g).

<u>Area/Incident:</u>
Acid Tank water spill/Gate 5
Overflow of LRW Concentrator
Overflow of Condensate Tank
Overflow of Condensate Demineralizers
Ultrasonic Water spill
Radwaste Spills
Condensate Pump spill to Yard Drain

Specific details and other known contamination events are documented in HBAP D-500.

In addition, in August of 2005 a leak of contaminated resin occurred in the offgas tunnel. This leak was determined not to have released radioactivity outside of the offgas tunnel.

**Industry Groundwater Protection Initiative
Voluntary Data Collection Questionnaire**

4. *If applicable, briefly summarize the circumstances associated with any onsite or offsite groundwater monitoring result indicating a concentration in groundwater of radioactivity released from plant operations that exceeds the maximum contaminant level (MCL) established by the USEPA for drinking water.*

No concentrations of radioactivity above USEPA MCL's have been detected in onsite groundwater. Offsite groundwater is not routinely monitored due to the nature of site hydrology. This hydrology makes the contamination of offsite groundwater extremely unlikely.

5. *Briefly describe any remediation efforts undertaken or planned to reduce or eliminate levels of radioactivity resulting from plant operations in soil or groundwater onsite or offsite.*

Unit 3 is currently in SAFSTOR status. Decommissioning is scheduled to begin after the ISFSI is constructed and loaded with HBPP fuel. The levels of radioactivity in the soil onsite will be reduced as necessary to meet decommissioning requirements. No concentrations of radioactivity above USEPA MCL's have been detected in onsite groundwater. No radioactivity above background has been detected in soil offsite. Due to the nature of site hydrology, no offsite groundwater contamination is likely to have occurred.