



REGIONAL MONITORING - DATA SUMMARY

Regional Monitoring collects about 56,000 samples a year, with about 100,000 analyses performed on the samples. An additional 40,000 measurements are recorded from monitoring equipment, such as pencils, ionization chambers, and survey instruments. Nineteen people are engaged in collection of the samples and measurements; an additional 18 people are concerned with laboratory analysis, counting, and result calculation. Evaluation and reporting of results involves seven people, including a secretary and field clerk. Seven of the 40 people listed, are engaged in sampling, analysis, and reporting of test well samples to Chemical Effluents Technology for liquid waste discharge control purposes which to date have no effect on the environs.

Gaseous waste discharged to the air is measured by collecting 26,000 samples per year and by continuous monitoring at the point of discharge. Radiation levels and concentrations of radioactive materials in the atmosphere are monitored in the environs.

The waste discharged to surface and underground waters is monitored by collecting 17,000 samples and making 48,000 specific measurements per year. Sanitary waters, Columbia River water, ground water, and swamp and ditch water are sampled. Isotopic analysis is performed routinely on 100-F Area raw and sanitary waters, Pasco raw and sanitary waters, and Kennewick sanitary water.

The deposition of radioactive materials on vegetation and ground is measured by collecting 13,000 samples and making 17,000 measurements per year. Gamma spectrometric techniques allow rapid analysis for a variety of isotopes on vegetation. Crop sampling is conducted during the growing season.

REGIONAL MONITORING - B. V. ANDERSEN  
All Results for Year 1957

GAS SAMPLING 26,000 Samples per year.

STACK EFFLUENT-SEPARATIONS AREAS

1. Means - continuous, countercurrent, caustic scrubber, and recording monitor for  $I^{131}$  downstream from a continuous HV-70 asbestos filter strip and recording monitor for  $Ru^{103+106}$ . Preset alarm system.
2. Sampled and analyzed daily for  $I^{131}$ , total beta, and  $Ru^{103+106}$ .
3. Complete isotopic analysis of high filter samples.
4. Average Results -  $I^{131}$ , 1.0; RE+Y, 0.02;  $Nb^{95}$ , 0.01;  $Zr^{95}$ , 0.004;  $Ru^{103}$ , 0.004;  $Ru^{106}$ , 0.002;  $Sr^{89}$ , 0.0035; and  $Sr^{90}$ , 0.005. All are curies per day.

STACK EFFLUENT-REACTOR AREAS

1. Particulates - gas filtered continuously by 2-1/2" diameter HV-70 asbestos type filter; changed twice weekly; Analysis: Beta -  $9.0 \times 10^{-4}$  c/day (average); Alpha -  $< 6 \times 10^{-8}$  c/day (average).
2. Gases -  $H^3$ -monthly spot samples silica gel scrubbers (1.4 c/day);  $C^{14}$  and  $S^{35}$ -monthly spot samples by caustic scrubbers ( $C^{14}$  - 0.10 c/day;  $S^{35}$  - 0.015 c/day) yearly average all reactors.

ATMOSPHERE - PARTICLE DEPOSITION

1. Fallout - measured and differentiated by HV-70 asbestos 2" x 4" filters operated continuously by motor air pump (air pump operated by electric motor) 31 locations on project; 15 off-project; 4.25 meters<sup>3</sup>/hr; Analysis: counted directly (normal - 1 to 2 d/m/m<sup>3</sup>; abnormal 3 to 100 d/m/m<sup>3</sup>); autoradiographed for particle frequency (normal - 0.001 to 0.1 ptles/meter<sup>3</sup>; abnormal - 0.1 to 10 ptles/meter<sup>3</sup>).

GASES IN ATMOSPHERE

1.  $I^{131}$ , 14 locations; continuous caustic air scrubbers; changed and analyzed weekly; ( $1.7 \times 10^{-13}$   $\mu$ c/cc average) (Flow Rate - 2.5 cfm).

RADIATION LEVELS IN AIR

1. Measurable Ionization Chambers - pairs of chambers in 24 locations; dosage rate mrad/day (1.1 mrad/day average).
2. EM Chambers and Integrans - 31 locations; recorded dosage rate (Project average, 4.5 mrad/day; Perimeter average, 1.4 mrad/day).

WATER OR LIQUIDS 17,000 Samples per year

SANITARY-ON-SITE

1. One liter samples; weekly; each reactor area; each exclusion area in separations; Analysis: Total Beta -  $10^{-8}$  to  $10^{-6}$   $\mu\text{c}/\text{cc}$ ; Total Alpha -  $5 \times 10^{-9}$  to  $1 \times 10^{-8}$   $\mu\text{c}/\text{cc}$ .
2. Two 9 gallon samples weekly; Pasco and Kennewick sanitary waters; Analysis: isotopically for 19 constituents. (See Table III for results)

RIVER 2,800 Samples per year

1. From 100-B to McNary - 28 locations; one liter samples; weekly; Snake and Yakima Rivers at mouth.
2. McNary to Portland - 10 locations; one gallon samples; monthly.
3. Analysis: Total Beta -  $10^{-8}$   $\mu\text{c}/\text{cc}$  above reactors;  $10^{-5}$   $\mu\text{c}/\text{cc}$  below reactors;  $10^{-7}$  to  $10^{-8}$   $\mu\text{c}/\text{cc}$  at McNary Dam;  $10^{-8}$   $\mu\text{c}/\text{cc}$  near Portland; Total Alpha -  $< 5$  to  $8 \times 10^{-9}$   $\mu\text{c}/\text{cc}$ .
4. Pasco - continuous sampler; ion exchange bed; collected weekly - Isotopic analysis for MPE calculation. (See Table III for results)

WASTE WATER

1. Reactor Effluent - 500 cc samples; each reactor: daily; outlet pipe; 20,000 curies/day of beta particle emitters discharged to river; Alpha particle emitters -  $< 0.04$   $\mu\text{c}/\text{sec}$ . (See Table IV)
2. Reactor Effluent - two samples; monthly; each reactor; analyzed for IPD isotopically. (See Table V for results)
3. Separations Waste - Swamps, ditches, 14 locations sampled weekly; one liter samples; Analysis: Total Beta -  $< 5$  to  $20 \times 10^{-7}$   $\mu\text{c}/\text{cc}$ ; Total Alpha -  $< 5$  to  $13 \times 10^{-7}$   $\mu\text{c}/\text{cc}$ ; Uranium -  $10^{-9}$  to  $10^{-5}$   $\mu\text{c}/\text{cc}$  (See Table VI for other wastes)
4. Test Wells Environs - sampled weekly to quarterly; 78 wells; Analysis: Total Beta -  $< 10^{-7}$  to  $10^{-5}$   $\mu\text{c}/\text{cc}$ ; Uranium -  $10^{-9}$   $\mu\text{c}/\text{cc}$ .
5. Test Wells - 100,200, and 300 Areas - 148 locations; one liter samples; Analysis: Beta -  $< 10^{-7}$  to  $10^{-2}$   $\mu\text{c}/\text{cc}$ ; Uranium -  $< 10^{-9}$  to  $10^{-8}$   $\mu\text{c}/\text{cc}$ .

SOLIDS 13,000 Samples per year

VEGETATION

1. Sampled weekly at 170 locations; monthly at 80 locations; composited 25 zones; 10 samples each composited. Analysis: Gamma scan -  $\text{Zn}^{95}$ - $\text{Nb}^{95}$ ,  $\text{Ru}^{103+106}$ ,  $\text{I}^{131}$ ,  $\text{Ba}^{140}$ - $\text{La}^{140}$ ,  $\text{Ce}^{141-144}$ ; Total Alpha-(See Table II and Table VII)

SOIL OR MUD

1. River - Five foot from shore samples; weekly; 16 locations; 1 to 10 gram samples; Analysis: Beta -  $10^{-6}$  to  $10^{-3}$   $\mu\text{c}/\text{gm}$ .
2. Swamps and Ditches - sampled weekly at 11 locations; 1 to 10 gram samples; Analysis: Beta -  $10^{-5}$  to  $10^{-1}$   $\mu\text{c}/\text{gm}$ ; Alpha -  $10^{-7}$  to  $10^{-2}$   $\mu\text{c}/\text{gm}$ .

GROUND SURVEYS 6,000 Measurements per year

REACTOR AREAS

1. 25 to 30 plots in each area; survey 100 square feet; surveyed on a quarterly frequency

SEPARATIONS AREAS

1. One hundred fifty plots; surveyed quarterly; 400 square feet; Results: Redox-average 6 particles/400 square feet; Purex - average 2 particles/400 square feet.

GROUND SURVEYS - contd

ENVIRONS

1. A ground survey of 2,000 square foot areas every second mile is made quarterly adjacent to the main roads. Results: 0 to 2 particles/thousand square feet on project; Tri-Cities - 15,000 square feet/particle.

TABLE I

ATMOSPHERIC DISPOSAL OF SEPARATIONS PLANTS GASEOUS EFFLUENTS

Year	I-131 Emitted Curies Per Day	I-131 on Vegetation 10 <sup>-6</sup> µc/gm	Fission Products Less I-131
			On Vegetation 10 <sup>-5</sup> µc/gm
1947	14	--	---
1948	3.0	--	---
1949	12	20	< 1.0
1950	5.6	8.0	< 1.0
1951	50	20	2.0
1952	2.6	7.0	4.5
1953	2.0	10	6.5
1954	1.5	7.0	10
1955	3.2	< 3.0	7.5
1956	1.0	3.0	8.0
1957	1.0	4.0	6.0

TABLE II

MEASURED AIR CONCENTRATIONS - 1957

Month	I-131 Perimeter	Alpha Emitters		Beta Emitters		Particulates		
		Perimeter	Perimeter	40-100 mi.	> 100 mi.	Perimeter	40 - 100 mi.	> 100 mi.
		Units of µc/cc x 10 <sup>-13</sup>				Particles/m <sup>3</sup>		
January	0.5	0.03	1.7	1.8	3.5	0.02	0.03	0.05
February	0.9	0.02	2.2	2.0	3.4	0.02	0.02	0.04
March	0.9	0.02	2.5	1.9	3.3	0.006	0.006	0.02
April	0.09	0.004	2.2	3.4	5.9	0.02	0.03	0.05
May	0.9	0.03	5.4	4.5	7.9	0.04	0.06	0.09
June	5.4	0.02	11	12	42	0.08	0.10	0.19
July	2.0	0.01	3.1	2.1	4.8	0.02	0.02	0.03
August	1.6	0.02	2.5	2.2	38	0.01	0.02	0.65
September	1.1	0.01	3.2	2.7	8.0	0.02	0.02	0.04
October	3.4	0.02	7.0	11	32	0.04	0.1	0.50
November	0.9	0.03	2.2	1.6	3.8	0.01	0.02	0.02
December	1.8	0.02	2.0	2.4	8.5	0.06	0.1	0.02
AVERAGE	1.7	0.02	4.0	4.0	13	0.02	0.03	0.14

The influence of debris from nuclear detonations is marked in these data as is indicated by the relatively small difference between locations close to the plant and at great distances. The perimeter points are mostly concentrated in the Richland, Kennewick, Pasco area, while those at > 100 miles are primarily in southern Oregon, southern Idaho, and western Montana.

TABLE III

PERCENT OF OCCUPATIONAL MPE<sub>ST</sub> IN COLUMBIA RIVER AND SANITARY WATERS  
JANUARY AND FEBRUARY, 1958

100-F Area				Pasco				Kennewick	
Raw		Sanitary		Raw		Sanitary		Sanitary	
January	February	January	February	January	February	December (57)	February	January	February
9.6	9.6	3.3	2.9	3.0	2.0	0.5	0.6	2.6	1.0

TABLE IV

COLUMBIA RIVER DISPOSAL OF REACTOR EFFLUENT WATER

Year	Gross Beta Discharged To Columbia River 10 <sup>3</sup> Curies Per Day	Columbia River Water at Pasco	
		Activity Density 10 <sup>-7</sup> µc Beta/cc	Percent Public MPE <sub>GI</sub> for Drinking River Water
1947	---	1.0	---
1948	---	1.1	---
1949	---	2.2	---
1950	---	5.2	---
1951	---	9.9	---
1952	---	14.1	---
1953	6.0	21.2	8.1
1954	9.0	17.5	8.9
1955	10.0	21.6	6.9
1956	11.0	30.0	10.4
1957	20.0	70.4	21.8

TABLE V

ISOTOPIC FRACTIONAL COMPOSITION OF REACTOR EFFLUENT AT DIFFERENT DECAY TIMES

Isotope	Fraction	
	4 Hours	24 Hours
Mn-56	0.28	0.005
Cu-64	0.196	0.196
Na-24	0.14	0.168
Cr-51	0.084	0.240
Np-239	0.084	0.186
As-76	0.078	0.140
Si-31	0.048	0.001
Zn-69	0.020	-----
Ga-72	0.010	0.011
Sr-92	0.008	0.0001
U-239	0.008	-----
I-133	0.007	0.011
Y-92	0.006	0.004
Nb-97	0.006	-----
Sr-91	0.005	0.004
Zn-65	0.004	0.013
P-32	0.003	0.008
Y-90	0.003	0.007
I-135	0.003	0.001
Y-93	0.003	0.002