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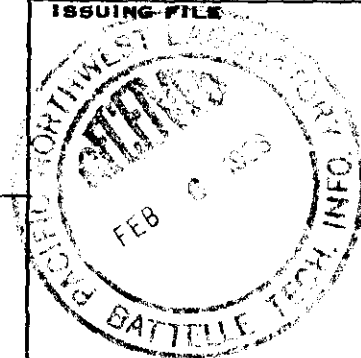
HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

TITLE

REGIONAL MONITORING - DATA SUMMARY
ALL RESULTS FOR YEAR 1957

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(CLASSIFICATION)

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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 - 9.0×10^{-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 meters³/hr; Analysis: counted directly (normal - 1 to 2 d/m/m³; abnormal 3 to 100 d/m/m³); autoradiographed for particle frequency (normal - 0.001 to 0.1 pte/meter³; abnormal - 0.1 to 10 ptes/meter³).

GASES IN ATMOSPHERE

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

RADIATION LEVELS IN AIR

1. Detachable Ionization Chambers - pairs of chambers in 24 locations; dosage rate mrad/day (1.1 mrad/day average).
2. EM Chambers and Integrators - 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} $\mu\text{c/cc}$; Total Alpha - 5×10^{-9} to 1×10^{-8} $\mu\text{c/cc}$.
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} $\mu\text{c/cc}$ above reactors; 10^{-5} $\mu\text{c/cc}$ below reactors; 10^{-7} to 10^{-8} $\mu\text{c/cc}$ at McNary Dam; 10^{-8} $\mu\text{c/cc}$ near Portland; Total Alpha - < 5 to 8×10^{-9} $\mu\text{c/cc}$.
4. Pasco - continuous sampler; ion exchange bed; collected weekly - Isotopic analysis for MFE 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 $\mu\text{c/sec}$. (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 20×10^{-7} $\mu\text{c/cc}$; Total Alpha - < 5 to 13×10^{-7} $\mu\text{c/cc}$; Uranium - 10^{-9} to 10^{-5} $\mu\text{c/cc}$ (See Table VI for other wastes)
4. Test Wells Environs - sampled weekly to quarterly; 78 wells; Analysis: Total Beta - $< 10^{-7}$ to 10^{-5} $\mu\text{c/cc}$; Uranium - 10^{-9} $\mu\text{c/cc}$.
5. Test Wells - 100, 200, and 300 Areas - 148 locations; one liter samples; Analysis: Beta - $< 10^{-7}$ to 10^{-2} $\mu\text{c/cc}$; Uranium - $< 10^{-9}$ to 10^{-8} $\mu\text{c/cc}$.

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 - Zn^{95} - Nb^{95} , $\text{Ru}^{103+106}$, I^{131} , Ba^{140} - 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} $\mu\text{c/gm}$.
2. Swamps and Ditches - sampled weekly at 11 locations; 1 to 10 gram samples; Analysis: Beta - 10^{-5} to 10^{-1} $\mu\text{c/gm}$; Alpha - 10^{-7} to 10^{-2} $\mu\text{c/gm}$.

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 - contdENVIRONS

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 IATMOSPHERIC DISPOSAL OF SEPARATIONS PLANTS GASEOUS EFFLUENTS

| Year | I-131 Emitted Curies Per Day | I-131 on Vegetation 10^{-6} $\mu\text{c/gm}$ | Fission Products Less I-131 On Vegetation |
|------|---------------------------------|---|--|
| | | | 10^{-5} $\mu\text{c/gm}$ |
| 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 IIMEASURED 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 $\mu\text{c/cc} \times 10^{-13}$ | | | | | Particles/ m^3 | |
| 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_{GI} 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 | Columbia River Water at Pasco | |
|------|---|--|--|
| | To Columbia River 10 ³ Curies Per Day | Activity Density 10 ⁻⁷ μ c Beta/cc | Percent Public MPE _{GI} 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 |