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PACIFIC NORTHWEST LABORATORY
MONTHLY ACTIVITIES REPORT
SEPTEMBER 1974

Division of Production and Materials
Management and Hanford Plant
Assistance Programs

Battelle

Pacific Northwest Laboratories
Richland, Washington 99352

OCTOBER 1974

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Division of Production and Materials Management
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Hanford Plant Assistance
Programs

by the

Staff of Battelle-Northwest
E. L. Alpen, Director

October 1974

BATTELLE
PACIFIC NORTHWEST LABORATORY
RICHLAND, WASHINGTON 99352

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PACIFIC NORTHWEST LABORATORY
MONTHLY ACTIVITIES REPORT
DIVISION OF PRODUCTION AND MATERIALS MANAGEMENT
AND HANFORD PLANT ASSISTANCE PROGRAMS

ASSISTANCE TO ATLANTIC RICHFIELD HANFORD COMPANY

Summary

PROCESS TECHNOLOGY - RESEARCH DEPARTMENT

Soil Characteristics in Z Trenches

Data from pulsed neutron source experiments performed on the 216-Z-1A tile field show the effective multiplication constant (k_{eff}) to be ≤ 0.77 in Test Well No. 1, and ≤ 0.29 in Test Well No. 2. Maximum reactivity of the plutonium in the soil in each test well was observed in a zone about 12 ft below the surface.

Tank Farm Support

Characterization analysis of soil properties of soil classes in TX, B, A, SX, and TY Tank Farms has been completed. This data will be input into the data retrieval system.

Prevention of Accidental Releases

● Surficial Contamination and Airborne Release Studies

Studies of the validity of the B-C crib model described in a prior report showed that, for very large values of the ratio of deposition velocity to wind speed, the model predicts negative air concentrations. Study continues to isolate the source of the untenable results.

A seasonal variation in Cs-137 airborne concentrations during west winds has been identified east of U-Area. Airborne concentrations during east winds do not show seasonal variations.

- Groundwater Management Studies

A hydraulic conductivity map of the Hanford Reservation was generated using data supplied by ARHCO personnel and their consultant.

Monitoring of moisture content in the lysimeter soil was continued.

PROCESS TECHNOLOGY - DEVELOPMENT ENGINEERING DEPARTMENT

Storage of High-Level Liquid Radioactive Wastes

Leak Detection

The ultrasonic log "wet wells" have been fabricated. Installation of the breadboard logging system should begin shortly. A preliminary design concept has been established for the prototype ultrasonic logging system.

Discussions were held with ARHCO personnel to determine possible field sites for testing infrared scanning as a leak detection technique. Laboratory testing of the existing scanning infrared system is underway.

ASSISTANCE TO ATLANTIC RICHFIELD HANFORD COMPANY

PROCESS TECHNOLOGY - RESEARCH DEPARTMENT

Soil Characteristics in Z Trenches

Pulsed Neutron Source Measurements to Assess Criticality Safety of Ground Disposal Sites (216-Z-1A Tile Field)

(S. R. Bierman, Criticality Experiments and Operations Section)

Two series of pulsed neutron source measurements have been completed in the first two test wells drilled in the 216-Z-1A tile field. The first series of measurements was made during the period February 28 through March 6, 1974, in the first well drilled. The second series of measurements was made in the second test well on July 12, 1974. The primary objective of each series of measurements was to assess the degree of subcriticality in each well. At the time of the measurements, Test Well No. 1 had been drilled to a depth of approximately 27 feet, and Test Well No. 2 to a depth of approximately 38 feet.

The measurement data from both well locations have been least-squares fit to a constant plus an exponentially decaying term. Both the Garelis-Russel and the Gozani methods were applied to the data to ascertain the maximum reactivity in each well. The effective multiplication constant (k_{eff}) was observed to be ≤ 0.77 in Test Well No. 1, and ≤ 0.29 in Test Well No. 2 ($k_{eff} = 1$ for criticality).

The maximum reactivity in each test well was observed to occur in a zone approximately 12 feet below the surface. The neutron count rate also was observed to peak at about the 12-foot level in each well.

Tank Farm Support

Hydraulic Properties of Hanford Sediments
(S. J. Phillips, Resources Systems Section)

Sediment samples from TX, B, A, SX, and TY Tank Farms (200 East and 200 West Areas) have been characterized in the laboratory as to saturated hydraulic conductivity, saturated moisture content, bulk and particle density,

capillary pressure versus saturation, capillary pressure versus relative hydraulic conductivity, and relative hydraulic conductivity versus saturation. These samples were selected for characterization of sediment classes in tank farms. Data obtained from these analyses will be input into the physical characteristics section of the data base. Data display is as yet not available due to delayed shipment of computer software necessary for the Gould electrostatic printer. This printer with a variable scale option will be used for data display in the format requested.

Analyses of hydraulic properties of Hanford sediments are part of the tank farm sediment characterization program.

Prevention of Accidental Releases

- Surficial Contamination and Airborne Release Studies

B-C Crib Studies

(J. Mishima, Gaseous and Particulate Waste Section)

Potential Airborne Release of Contaminated Surface Material During Heating

(Further work on this topic was delayed pending resolution of priorities and funding.)

Safety Analysis of B-C Area Contamination

To investigate the validity of the form proposed last month for the resuspension factor, an attempt was made to make calculations for the asymptotic limit of large deposition. It was found that for very large values of $v_d/\bar{u}$, the ratio of deposition velocity to wind speed, the surface flux model predicts negative air concentrations. It is currently believed that this is due to the use of the vertically homogeneous Gaussian plume model, the use of Briggs expression for the diffusion coefficients, or the use of the deposition velocity form of the lower boundary condition. Calculations were made to verify that it is not due to using a too coarse finite difference grid in the numerical solution of the basic equation. Work is in progress toward isolating the cause of this unrealistic result in order to better understand the limitations of the surface flux model.

U-Pond Contamination Studies

(L. C. Schwendiman, Particulate and Gaseous Waste Research Section)

Homogenization of samples from the U-Pond area is not yet complete. Further analysis will continue when these samples are homogenized and when priorities for on-going tasks are established.

Resuspension from Contaminated Surfaces -- Field Studies

(G. A. Sehmel, Particulate and Gaseous Waste Research Section)

Review and analysis continued of results of large-volume sampling of airborne material carried in winds from the west and winds from the east blowing generally across the U-Pond. It was observed that during the fall and winter of 1973 and the spring of 1974, airborne concentrations on the east side of the pond showed a cyclic fluctuation with season. Although rather large differences in sample to sample concentrations occurred, a trend is evident which shows September with about one-fifth the concentration of August and October (1973). A second minimum concentration occurred in the January-February 1974 interval. This decrease may reflect decreased resuspension caused by colder temperatures and increased precipitation. Resuspension then increased in the spring of 1974. The cycle can be followed only to June 1974, the last date for which samples have been measured.

The average airborne concentration of Cs-137 in the seasons during which samples were taken was insignificantly different for east and west winds. Actual concentrations ranged from 1×10^{-16} to about $5 \times 10^{-13} \mu\text{Ci}/\text{cm}^3$. Airborne concentrations to the west of the pond (easterly winds) did not exhibit seasonal fluctuation as indicated for the westerly winds.

Results obtained this month for measurement of airborne Ce-144 collected on filters as a function of windspeed showed the concentration to increase as the second and third power of the windspeed for windspeeds greater than about 13 mph. Actual concentrations ranged from 1 to $4 \times 10^{-13} \mu\text{Ci}/\text{cm}^3$. Results for Cs-137 were generally too near or below the detection limit to show a relationship with windspeed.

The release guide to uncontrolled areas is $5 \times 10^{-10} \mu\text{Ci}/\text{cm}^3$ for Cs-137 and $2 \times 10^{-10} \mu\text{Ci}/\text{cm}^3$ for Ce-144.

Airborne Pu-239 concentrations are too low for measurements using the routine ARHCO analytical laboratory radiochemical methods. Filters collected will require more sensitive methods for determining plutonium resuspension.

Wind Trajectory Studies

(L. L. Wendell, Atmospheric Physics Section)

This study was delayed pending identification of priorities and funding.

Significance of Dust Devils and Anomalous Winds

(L. C. Schwendiman, Particulate and Gaseous Waste Research Section)

This study was delayed pending identification of priorities and funding.

● Groundwater Management Studies

Groundwater Model and Data Storage and Retrieval

(K. L. Kipp and D. R. Friedrichs, Resources Systems Section)

Using hydraulic conductivity values and reference lines supplied by Dr. Raul Deju and Roy Gephart, a new hydraulic conductivity map for the Hanford Reservation was generated with the Transmissivity Iterative Routine model. The gross features of the presently used map are similar to this latest computed map. As a result of this study, reproducibility of hydraulic conductivity maps was significantly enhanced.

Field Measurement and Monitoring Assistance

(K. L. Kipp, A. E. Reisenauer, and V. L. McGhan, Resources Systems Section)

Moisture content of the lysimeter soils was monitored with the neutron probe on September 9, 10, and 13. Measurements were made at meter and half-meter depth intervals to seven meters and meter intervals from there down.

PROCESS TECHNOLOGY - DEVELOPMENT ENGINEERING DEPARTMENT

Storage of High-Level Liquid Radioactive Wastes

Leak Detection

Internal Measurements - Ultrasonic Scanning

(G. J. Posakony and J. C. Crowe, Nondestructive Testing Section)

The ultrasonic log "wet wells" have been fabricated and preparations are currently underway for installation of the wells in the waste tank. Final preparations are being made for field installation of the breadboard ultrasonic

logging system. Although the wet wells have been made from thicker wall tubing than was originally planned (0.095 in. vs 0.065 in.) the operation of the ultrasonic logging system is not expected to be seriously affected. The test installation should provide sufficient data to confirm feasibility of the concept and should allow final design parameters to be established for the prototype logging system design.

A preliminary design concept has been established for the electronics portion of the prototype ultrasonic logging system. The design concept provides for data storage at each tank location through the use of semiconductor memory devices. This memory can be interfaced to a centralized computer to allow automatic readout of the liquid level data at selected intervals. Operation of the ultrasonic logging instrumentation would be independent of the computer under normal operating conditions. Evaluation of this concept is continuing. A review of the signal processing electronics is currently being conducted to identify areas of potential signal instability due to temperature variations. Efforts are underway to eliminate these potential sources of error from the prototype system design.

The ultrasonic probe design has been revised to allow more positive sealing than the previous design. The revised design will facilitate initial assembly and transducer element replacement.

Internal Measurements - Liquid Level Probe (O. H. Koski, Chemical Development Section)

Preparations were made for in-tank placement of the liquid level probe and associated instrumentation.

Required construction included instrument shelter, mounting fixtures for the probe head and switch gear. The probe is complete and ready for delivery, which is scheduled for October 1.

External Measurements - Infrared Scanning (G. J. Posakony and J. C. Crowe, Nondestructive Testing Section)

Work on infrared scanning as a method for leak detection was begun during September. An existing scanning infrared detector and visual readout system has been operated in the laboratory. Initial work will include infrared scans of simulated waste piping leaks on a laboratory scale. Field tests on actual waste piping are scheduled later in the program.

Discussions were recently held with H. F. Jensen (ARHCO) regarding possible field test sites and the applicability of the scanning system to the existing waste handling facilities. It appears that infrared systems have potential in in two general areas: (1) air and/or ground infrared scans of the soil covering buried waste transfer lines to detect leaks in piping, and (2) infrared scans of the material inside the waste tanks themselves.

External Measurements - Electronic Measurements
(O. H. Koski, Chemical Development Section)

Resistance, potential and current measurements were made in the BX103 tank test system for detection of tank leaks by external measurements. Well to tank and well to well measurements were made during and after addition of water to a well adjacent to the tank. Evaluation of the data obtained in terms of the ability to detect tank leaks is in progress.

Contacts to identify a vendor for an automatic logging system were continued. Vendors which appear to have an interest in total system capability include Datel and Foxboro. Foxboro is studying the application and modification of equipment which they currently manufacture for this use. Datel would team up with an unnamed California firm to produce the total system.

TECHNICAL ASSISTANCE TO THE HANFORD PLANT

Summary

Environmental Evaluations

Low levels of Ru-106 have been detected in river water just below 100-N Area but not downstream. Routine quarterly waste site surveys were conducted. Revised environmental, including groundwater, sampling schedules were prepared.

Radiation Protection

The use of disposable clothing at the Whole Body Counter will be tried. If successful, a cost saving through reduced laundry service will be possible.

Radiation Standards and Engineering

Effort is continuing towards the purchase of new Hanford CPs. New x-ray filters have been developed for use in comparing spectra with NBS.

TECHNICAL ASSISTANCE TO THE HANFORD PLANT

Environmental Evaluations

(J. P. Corley, Environmental Evaluations Section)

Beta radioactivity has been detected on monthly grab samples of river water immediately downstream from 100-N Area since the high water period. Gamma scans have identified the predominant nuclide in one sample to be Ru-106, at a concentration of 6.3×10^{-7} $\mu\text{Ci/ml}$, less than 10 percent of the Concentration Guide for drinking water. Drinking water samples at 100-N area and river samples further downstream have not shown a corresponding level of activity.

A temporary increase in airborne particulate alpha-emitters to about 0.005 pCi/m^3 gross alpha, about twice normal, was observed at air sampling stations in the vicinity of the 200 Areas during the first week in September. During this period, very high winds occurred, marked by blowing dust, but a relationship is not certain. Specific isotopic analyses of air filters are not yet available.

Routine road and control plot surveys were negative with the exception of one control plot near 200-East Area where several particles to 100 c/m (GM) were found. Routine quarterly waste disposal site surveys detected low levels of radioactivity on a few tumbleweed accumulations at several fenced locations around 200-East Area. These and locations of other measurable surface radioactivity were reported to the appropriate contractors for clean up.

The annual revision of the routine environmental monitoring schedule was made, with emphasis on increasing the portion of the overall effort allotted to groundwater monitoring. The most significant changes involve fewer radioiodine analyses on air and milk samples, and a reduced frequency for on-site air and waste water samples.

Major changes in the ARHCO 200 Areas groundwater sampling schedule resulted in a reduction in sampling frequency and types of analyses and considerable adjustment to the network of wells sampled. The BNW schedule for 200 Area wells was expanded to continue the collection of data at some wells dropped by ARHCO

so that the plume maps can be drawn. These and other additions and changes to the BNW monitoring schedule were formulated to start in November. These revisions will be in effect until agreement is reached with ARHCO on a revised monitoring well network, including identification of wells which are to be upgraded and additional sampling frequency modifications.

Radiation Protection
(K. R. Heid, Personnel Dosimetry Section)

Bids were received for the mini-computer being procured for the Whole Body Counter. Review is being conducted by Bob Mahan of BNW Computer Technology. Low bidder, Data General, exceeded our AR budget (\$21,000) by about \$2,370, but we do not anticipate this causing a delay in procurement.

A sample supply of disposable coveralls, pants, and shirts was procured for trial at the Whole Body Counter. If they prove acceptable for this service, a cost saving will be experienced through reduced laundry service.

Radiation Standards and Engineering
(J. M. Selby, Radiation Standards and Engineering Section)

Assistance was provided to another Hanford contractor to determine the cause of frequent alpha hand contamination of one of their employees as evidenced by high counts on a hand and shoe counter. Two counting systems were assembled at Calibrations to help resolve the problem. One system consisted of a standard hand and shoe counter connected to a multichannel analyzer and the second system involved a diode detector. The hand and shoe counter probe had sufficient energy resolution to indicate that the contamination was in the 6 to 8 MeV range. It appears that the employee is electrostatically attracting and concentrating radon and thoron.

Effort is continuing towards the purchase of new CPs. One manufacturer has been notified that his proposal is not responsive to Hanford requirements. It appears that two manufacturers will meet the technical and quality assurance requirements. These will be requested to submit a bid for the manufacture of the CPs.

A complete set of "moderately filtered" and "heavily filtered" x-ray filters has been assembled for use with the 320 KVCP x-ray machine. The filters match the NBS and Victoreen filters and allow us to make cross calibrations and exposures with very similar spectra.

Meteorological Services
(E. H. Phinney, Synoptic Meteorology Section)

Meteorological services, viz., weather forecasts and observations and climatological services were provided to plant operations and management on a routine basis.

September 1974

<u>Type</u>	<u>No. Made</u>	<u>% Reliability</u>
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