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PACIFIC NORTHWEST LABORATORY
MONTHLY ACTIVITIES REPORT
OCTOBER 1974

Division of Production and Materials
Management and Hanford Plant
Assistance Programs

Battelle

Pacific Northwest Laboratories
Richland, Washington 99352

NOVEMBER 1974

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Division of Production and Materials Management
and
Hanford Plant Assistance
Programs

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

NOVEMBER 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 DEVELOPMENT - RESEARCH DEPARTMENT

Studies are in progress toward developing reliable operating control instrumentation for an air filter array used in resuspension studies.

PROCESS TECHNOLOGY - RESEARCH DEPARTMENT

Tank Farm Support

Characterization of sediment samples from T and S tank farms as to bulk and particle density, hydraulic conductivity, and fluid retentivity has been completed.

Prevention of Accidental Releases

o Surficial Contamination and Airborne Release Studies

Additional samples were processed to complete the experiments on potential release of Cs-137 during cleaning of surface material from the B-C crib area.

The basic formulation of the surface flux model, which incorporates the Gaussian plume model, was verified with an exact solution of the problem for the special case of constant eddy diffusivity. This agreement gave assurance that the basic formulation and programming was correct.

Samples of soil gathered from typically contaminated U-pond areas were analyzed. The results will be used in extending analyses more meaningfully to other samples collected in the vicinity.

Airborne Cs-137, Zr-Nb-95, and Ce-144 concentrations at the east side of U-pond were essentially constant for heights up to 30 meters during March 21 to May 20, 1974.

The transport and diffusion program was thoroughly checked against the continuous plume model for a steady wind. A study was initiated to compare downwind doses calculated from the model and doses calculated assuming source winds.

o Groundwater Management

New well elevation surveys were entered into the data storage and retrieval systems.

Water elevation measurements in the BNW monitored wells were taken during October 14-16.

PROCESS TECHNOLOGY - DEVELOPMENT ENGINEERING DEPARTMENT

Storage of High-Level Liquid Wastes

Leak Detection

Initial tests with the breadboard ultrasonic logging system installed in Tank 111S indicate liquid levels can be located accurately and that it is possible to detect the depth of liquid over sludge or salt cake.

In other liquid level measurement studies, a 33-ft probe containing four sensors for various electronic measurements was inserted in Tank 111S.

For external measurements to detect tank leaks, connections to three underground waste tanks and adjacent wells have been made in preparation for AC impedance, DC potential and short-circuit current measurements.

ASSISTANCE TO ATLANTIC RICHFIELD HANFORD COMPANY

PROCESS DEVELOPMENT - RESEARCH DEPARTMENT

Control Instrumentation for Resuspension Studies
(O. H. Koski, Chemical Development Section)

Control instrumentation is being developed to select and operate, as a function of wind speed and direction, filters used in radioactivity resuspension studies. Five different filters are used to provide data on particle resuspension at five different wind speeds provided the wind direction is within a given sector.

Two different instrumentation systems are being considered. A commercially available system in use became inoperable due to wind direction logic failure. An instrumentation device was developed to provide an identical control function until necessary replacement parts can be obtained from the manufacturer.

PROCESS TECHNOLOGY - RESEARCH DEPARTMENT

Tank Farm Support

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

Characterization of sediment samples from T and S tank farms, as to bulk and particle density, hydraulic conductivity, and fluid retentivity is complete. Data collected from TX, B, A, SX and TY tank farm sediment samples are being coded for computer input into the physical characteristics section of the data base. The Gould electrostatic printer and computer software system has arrived and is being interfaced to the PDP-11/45 computer. Data will be displayed in the requested format during the next reporting period.

Characterization of Hanford sediments as to hydraulic parameters is part of the ARHCO Physical and Life Sciences Geology program.

Prevention of Accidental Releases

o Surficial Contamination and Airborne Release Studies

B-C Crib Studies

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

Potential Airborne Release of Contaminated Surface Material During Heating

Experiments to determine the fractional release of Cs-137 and Sr-90 during charring of contaminated materials from the B-C crib were essentially completed. Some samples were repeated to confirm results.

Safety Analysis of B-C Area Contamination

The basic formulation and computer implementation of the surface flux model, incorporating the Gaussian plume model, was verified by comparison with an exact solution of the problem for the special case of a constant eddy diffusivity. The agreement of these two solutions has shown that the negative air concentration results reported last month were not inherent to the use of the Gaussian plume model or to the deposition velocity parameterization of the lower boundary condition. Rather they were caused by the particular form used for the diffusion coefficients. These are a consequence of fitting the vertically homogeneous Gaussian plume model to experimental diffusion data. It is planned to replace the Gaussian plume model with one based on Lagrangian similarity, which should more realistically reproduce diffusion near the ground.

U-Pond Contamination Studies

(L. C. Schwendiman and J. Mishima, Particulate and Gaseous Waste Studies)

Soil samples from three locations near the joining point of three ditches with the U-pond were analyzed for the principal isotopes anticipated. The results will be used to determine the analyses to be performed on several more samples taken in the U-pond area.

Resuspension from Contaminated Surfaces - Field Studies

(G. A. Sehmel, F. D. Lloyd and L. C. Schwendiman, Particulate and Gaseous Waste Research Studies)

Initial radiochemical results were received for the 8 in. x 10 in. air filters mounted on a 30 m tower at the U-pond. These filters sampled all west winds blowing from 170 to 340° during March 21 to May 20, 1974. Filters were mounted at 0.3, 1, 3, 4, 11, and 30 m elevations.

Airborne concentrations were generally uniform for heights from 0.3 to 30 m for Cs-137 (5 to 6×10^{-15} $\mu\text{Ci}/\text{cm}^3$), Zr-95 (2 to 3×10^{-15} $\mu\text{Ci}/\text{cm}^3$), Ce-144 (2 to 3×10^{-14} $\mu\text{Ci}/\text{cm}^3$), and Nb-95 (5 to 6×10^{-15} $\mu\text{Ci}/\text{cm}^3$). Maximum concentrations were observed at 1 m height for Ce-144 and at 10 m height for Nb-95, but it is doubtful if these represent significant differences from the averages. The release guides to uncontrolled areas for the above listed radionuclides are: Cs-137 (5×10^{-10} $\mu\text{Ci}/\text{cm}^3$), Zr-95 (1×10^{-9} $\mu\text{Ci}/\text{cm}^3$), Ce-144 (2×10^{-10} $\mu\text{Ci}/\text{cm}^3$) and Nb-95 (3×10^{-9} $\mu\text{Ci}/\text{cm}^3$).

Air filters west and upwind of U-pond were operated simultaneously, but as a function of wind speed at 1 and 3 m heights. Airborne concentrations of Cs-137, Ce-144 and Nb-95 all increased with an increase in windspeed. In each case, the average upwind concentration was about twice the downwind concentration. In previously reported data, downwind concentrations have always exceeded upwind concentrations. Increased downwind concentration would be attributed to resuspension of contamination from the vicinity of the U-pond.

One additional Pu analysis has been received for U-pond for August 20 to September 10, 1973. This sample indicates an airborne concentration of 6.9×10^{-17} $\mu\text{Ci}/\text{cm}^3$ which is comparable to the average of 1.16×10^{-16} $\mu\text{Ci}/\text{cm}^3$ (76 to 184 range) for the previous time period of August 20 to September 10, 1973. Plutonium has been identified in all seven air filter samples so far analyzed. The release guide to uncontrolled areas for Pu-239 is 6×10^{-14} $\mu\text{Ci}/\text{cm}^3$.

An instrument is being used to pre-assess additional filters prior to detailed Pu analysis. This instrument consists essentially of a zinc sulfide phosphor sheet attached to a photomultiplier tube and placed adjacent to a filter. Counts on the photomultiplier tube are much greater than can be attributed to either the α from Pu on one filter or the uranium on the filter. The source of counts from the zinc sulfide is being sought.

Wind Trajectory Studies

(L. L. Wendell, Atmospheric Physics Section)

Preparation for the numerical diffusion experiment was resumed. The transport and diffusion program has been thoroughly tested and checked against the continuous plume model for a steady wind. The experiments will consist of computing the exposure patterns, resulting from the same hypothetical continuous release but using transport determined from a wind field, on one hand, and the source wind only, on the other. The wind data will be for the three-week period in April-May 1973. A computer program for determining the diffusion stability

categories and the mixing depths was developed during this reporting period and will be used to generate this type of input data for the transport and diffusion program.

● Groundwater Management Studies

Groundwater Model and Data Storage and Retrieval

(K. L. Kipp, D. R. Friedrichs and A. E. Reisenhauer, Resources System Section)

Review and updating of the model documentation is underway. Entry of newly surveyed well elevations into the data storage system was completed.

Field Measurement and Monitoring Assistance

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

The responsibility for monitoring water table elevations is now being shared with the ARHCO Physical and Life Science Section. Water elevations were measured during the period October 14 to 16 in the Hanford Reservation wells monitored by BNW's Resources Systems Section.

Responsibility for monitoring the moisture content of the lysimeter soil was assumed by ARHCO during the first week in October; at that time the neutron probe equipment was also transferred to ARHCO.

PROCESS TECHNOLOGY - DEVELOPMENT ENGINEERING DEPARTMENT

Storage of High-Level Liquid Wastes

Leak Detection

Ultrasonic Logging Liquid Level Measurement

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

The ultrasonic log "wet wells" have been installed in tank 111S in the 200-West Area tank farm and initial field tests have begun. Three "wet wells" were installed in existing tank risers; only two of the wells are available for testing due to an obstruction within one. Efforts are currently underway to remove the obstruction. The two operational "wet wells" are located in risers approximately 15 feet apart near the center of the tank. Initial tests with the breadboard ultrasonic logging system have been encouraging. A significant ultrasonic signal has been transmitted across approximately 15 feet of concentrated liquid wastes in tank 111S. This amount of signal transmission

should be sufficient for making accurate liquid level measurements. Early tests indicate that signal amplitude detection can be used to detect the liquid-air interface and thereby the liquid level in the tank.

When the transmitter and receiver ultrasonic probes were lowered, in 1/8-in. increments, from about 1/2-in. above to 1/2-in. below the liquid-air interface, a significant increase in the signal amplitude occurred at the interface. Such tests indicate that liquid level measurements with an accuracy of 1/8-in. are possible with a properly designed ultrasonic logging system.

Tank 111S was selected for these tests because it is an active storage tank in which the liquid level may fluctuate on a day to day basis. Apparent slight liquid level variations have been observed with the ultrasonic logging system and have been confirmed by FIC gauge readings. The amount of level change detected by the two independent systems agreed to within approximately 0.1 inches. Further tests are planned in the next few weeks to confirm the liquid level measuring capability of the ultrasonic logging system and to obtain a more absolute correlation of FIC gauge vs. ultrasonic log liquid level measurements. All comparisons of FIC vs. ultrasonic log data to date have been on a relative basis only.

Tests were also made to determine the capabilities of the ultrasonic logging system for determining the subsurface characteristics of the waste material. Although the separation distance between the ultrasonic probes is greater than desired (approximately 15 feet), ultrasonic thru-transmission measurements have been made at depths down to the lower limit of the "wet wells" (approximately 4-1/2 feet below the apparent liquid surface). Significant variations in signal attenuation were noted at various depths beneath the liquid surface. An increased attenuation of the ultrasonic signal, possibly due to the presence of salt cake or sludge, occurred at about 3 ft below the liquid-air interface in this particular tank. These results indicate that pockets of interstitial liquid can be detected by an ultrasonic logging system. Further tests will be run when the third "wet well" is made usable for testing.

After minor modifications, operation of the breadboard electronic system is now satisfactory. The logging system is limited in accuracy, repeatability,

and convenience due to the manual probe positioning mechanisms. These positioning devices should be sufficient for feasibility tests, but they will limit the accuracy of the test data. The transducers and positioning devices have been, on at least one occasion, removed from the "wet wells" for repair. A rigorous examination by ARHCO radiation monitoring personnel revealed no radioactive contamination of the probes or positioning devices. This points out a definite advantage of the ultrasonic logging, sealed "wet well" concept.

Electronic Liquid Level Detection
(O. H. Koski, Chemical Development Section)

A 33-ft probe containing four sensors for various electronic measurements to determine liquid level was delivered and installed in Tank 111S. Additional effort required before data generation can begin includes calibration of the sensors and read-out instrumentation and field assembly of the automatic data recording instruments.

Tank Leak Detection by External Measurements
(O. H. Koski, Chemical Development Section)

Several underground waste storage tanks in the BX, BY and C tank farms have been selected for leakage surveillance by AC impedance, DC potential and short-circuit current measurements between the tanks and adjacent monitoring wells. Electrical connections have been made on three tanks and adjacent wells. Initial measurements will be made by BNW personnel and the system will then be operated by ARHCO.

TECHNICAL ASSISTANCE TO THE HANFORD PLANT

Summary

Environmental Evaluations

Several groundwater sampling wells have been returned to the routine sampling schedule after structural modifications. Additional routine river samples from the 300 Area are being analyzed following the switch of 300 Area process water from the north to the south process pond. Hanford and Washington State background radiation measurements at Richland agreed within practical limitations for the first nine months of 1974.

Radiation Protection

Recalibration of nuclear accident dosimeters for the 10 - 10,000 R range was initiated.

A proposal for quality control and associated engineering studies for the personnel dosimeter program was initiated.

Radiation Standards and Engineering

The vendor qualification step of the CP procurement plan should be completed this month. Restandardization of the calibration fields to BNS is continuing.

TECHNICAL ASSISTANCE TO THE HANFORD PLANT

Environmental Evaluations

(J. P. Corley, Environmental Evaluations Section)

Several groundwater monitoring wells were returned to the routine sampling schedule following modifications to eliminate the possibility of sampling stagnant water columns.

The 300 Area process water was switched from the north to the south process pond during September. Since it is known that the south pond has a much shorter groundwater flow path and, hence, travel time to the Columbia River than the north pond, additional routine river samples are being collected at the 300 Area and analyzed.

All routine road, railroad, and aerial surveys were completed with no unusual measurements except the detection of a 20,000 c/m particle on the east side of the 200-East Area. Several waste disposal sites were surveyed; at a few sites dense vegetation growth has been allowed to accumulate. The responsible contractors have been contacted.

The Richland location of Washington State penetrating radiation monitoring network was changed to the 747-A Building from the Richland Airport to coincide with our routine Richland Monitoring station. Both programs use thermoluminescent dosimeters but of a different type. Comparison of data for the first nine months of 1974, with the State dosimeter at the Richland Airport, showed an insignificant difference of 0.01 mR/day (0.19 vs. 0.18).

Radiation Protection

(K. R. Heid, Personnel Dosimetry Section)

AECM-0545 requires our nuclear accident (criticality) dosimeters to be capable of gamma dose measurement between 10R and 10,000R. This range is within the capability of our criticality dosimeter, but our calibration only covered 10R to 5,000R. Recalibration for the broader range was initiated.

A proposal for quality control and associated engineering studies for the personnel dosimeter program was submitted to RL-AEC at their request. This program identifies efforts required to bring the program up to an acceptable level of performance and for an on-going program thereafter.

A recent RL-AEC appraisal of criticality dosimetry program identified needs that exist. Responsibility for coordination of a Hanford-wide program had not been identified by RL-AEC since de-centralization had been implemented. However, BNW had informally kept the former program going adequately enough to meet AECM-0545 requirements. Responsive to RL-AEC's request, BNW has submitted a proposal to carry on the over-all coordination effort for this program at Hanford including replacement of the existing dosimeters.

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

Technical evaluation of the prototype CPs is continuing. Evaluation of the quality assurance program of potential suppliers should be completed during October. Suppliers meeting the requirements of the technical proposal will be asked to submit bids for new CPs.

A series of three pocket sized electronic dosimeters was evaluated for possible use at Hanford. The series consisted of two dose rate devices and one dose integrater. Performance was marginal on all three instruments and completely unreliable on one. This work makes a total of four pocket sized electronic dosimeters that have been evaluated in recent months - all with disappointing results.

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.

October 1974

<u>Type</u>	<u>No. Made</u>	<u>% Reliability</u>
Production Forecasts:	93	87.6
General Forecasts:	62	92.7
Special Forecasts	148	95.9
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