MASTER

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Waste Isolation Program Monthly Report

July 1978

Prepared for the United States
Department of Energy
Under Contract EY-77-C-06-1030

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Rockwell Hanford Operations
Energy Systems Group
Richland, WA 99352

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PRELIMINARY REPORT

This Report contains information of a preliminary nature. It is subject to revision or correction and therefore does not represent a final Report. It was prepared primarily for internal use within The Rockwell Hanford Operations. Any expressed views and opinions are those of the Author and not necessarily of the Company.

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Informal Report

BASALT WASTE ISOLATION PROGRAM
MONTHLY REPORT

R. A. Deju, Director
Basalt Waste Isolation Program

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July 31, 1978

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INTRODUCTION

In February 1976, the U. S. Energy Research and Development Administration (currently the U. S. Department of Energy) expanded the commercial radioactive waste management programs and established the National Waste Terminal Storage Program. Its mission was to provide multiple facilities in various deep geologic formations within the United States. The Office of Waste Isolation was established within the Union Carbide Corporation-Nuclear Division to provide program management to the National Waste Terminal Storage Program. The overall program consisted of investigating a number of geologic rock types to determine their suitability for terminal storage of radioactive waste. Basalts, such as the Columbia Plateau basalts which underlie a large portion of the Pacific Northwest and the Hanford reservation, were selected for initial geologic reconnaissance. Atlantic Richfield Hanford Company was asked in May 1976 by the Office of Waste Isolation to plan and execute a basalt feasibility study. Geologic exploration of Columbia Plateau basalts was needed to determine the feasibility of utilizing those formations as a site for terminal storage of commercial nuclear waste.

In September 1977, the National Waste Terminal Storage Program (now the U. S. Terminal Storage Program) was restructured. While emphasis was still on a salt repository, additional funds were given to support investigations of two U. S. Department of Energy sites (Hanford and Nevada). The Budget Reporting Classification Number for the Hanford study is AG-02-02-10.

The Hanford program is the responsibility of the U. S. Department of Energy-Richland Operations Office. Rockwell Hanford Operations (successor to the Atlantic Richfield Hanford Company) established the Basalt Waste Isolation Program and chartered it with the responsibility for conducting the basalt feasibility studies. Rockwell Hanford Operations is the prime contractor responsible for the Hanford basalt studies. The program is divided into five projects:

Site Studies;

Drilling;

Technology Development;

Near-Surface Test Facility;

Repository.

A summary of major program accomplishments during the reporting period follows.

REPORTING PERIOD

PROGRAM SUMMARY

JULY 1-31, 1978

Washington State Department of Natural Resources has completed the reconnaissance mapping of the late Cenozoic sediments within the western half of the Columbia Plateau. The compilation of 1:250,000 base maps for the Columbia Plateau and of 1:100,000 base maps for the Pasco Basin has been completed by the Washington State Department of Natural Resources.

Hydrologic testing of DC-2 continued.

Seismograph Services Corporation completed their processing of the seismic test data. The results indicate that the basalt surface can be mapped continuously. Lower horizons can be mapped locally.

Preliminary data from Senturion Services, Inc. on the magnetotelluric test suggests that the basalt sequence is about four kilometers thick.

Drilling operations were conducted at two locations and hydrologic testing at one location during the reporting period.

Coring operations at DC-4 advanced from 749 feet to 1,074 feet. DC-4 is 21 percent complete based upon a total depth of 5,000 feet.

Coring operations at DC-8 advanced from 2,959 feet to 3,956 feet. DC-8 is 96 percent complete, based upon a total depth of 4,100 feet.

The Vitro Engineering Title I effort for facility requirements and site work was essentially completed during the month. Rockwell Hanford Operations reviewed the comment issues and returned them to Vitro Engineering. The facility requirements design covers the facility electrical power and mechanical systems. The site work design covers the roads, parking areas, and embankment construction in the portal areas.

A draft report entitled, "Material Properties Review," has been completed by the University of Minnesota and submitted to Rockwell Hanford Operations. This material properties review compared the work done by Dr. J. F. T. Agapito, et al., in 1977 with test results of core taken from the Hanford site and tested by the Colorado School of Mines. The test results from the Pomona Flow core are similar to the properties presented by Dr. Agapito in 1977.

Woodward-Clyde Consultants held a workshop to evaluate and rank possible events that could disrupt a deep geologic waste repository. A list of seven of the most significant events has been approved by Rockwell Hanford Operations and the subcontract is proceeding with development of fault trees.

MAJOR PROBLEMS

None.

Program Summary (continued)

BUDGET VARIANCE

The current month underrun of \$148,000 reflects a two-week delay in the drilling effort caused by lost circulation problem in DC-4. The delay in drilling may cause a small part of the fiscal year 1978 effort to be carried into the early months of fiscal year 1979. Total program costs will accelerate greatly during the months of August and September 1978, as the tunnelling contractor (Genstar Construction Company) for the Near-Surface Test Facility is now on board and is starting the box cuts.

REPORTING PERIOD

SITE STUDIES PROJECT

JULY 1-31, 1978

OBJECTIVE

All site studies are provided to support site selection and evaluation as well as to prepare for the preliminary safety analysis report, environmental report, and draft environmental impact statement. These studies are aimed at establishing areas that potentially will provide geologic and hydrologic barriers adequate to prevent release of the waste to the biosphere. When a site is selected, site studies will thoroughly characterize that site geologically and hydrologically and provide service to construction activities during construction. At the same time, the studies will develop a monitoring plan that will be initiated as soon as a final site is selected and continue through the life of the repository. The monitoring is to continually evaluate natural risks and provide early warning of any potential hazard to the waste confinement.

DESCRIPTION OF WORK ACCOMPLISHEDPreliminary Site Characterization

Washington State Department of Natural Resources has completed the reconnaissance mapping of the late Cenozoic sediments within the western half of the Columbia Plateau. The compilation of 1:250,000 base maps for the Columbia Plateau and of 1:100,000 base maps for the Pasco Basin has been completed by the Washington State Department of Natural Resources.

The U. S. Geological Survey completed mapping the Columbia River Basalt within the Chelan, Washington 1:100,000 map sheet.

Dr. R. Black has completed a reconnaissance examination of clastic dikes in this vicinity of Hanford. His evaluation will be presented in a report by the end of this fiscal year.

Western Washington University presented the report interpreting the paleomagnetic analysis of selected basalt samples. The report indicates that paleomagnetic studies will aid in stratigraphic studies.

The geohydrologic bibliographies have been completed for the Columbia Plateau and the Pasco Basin. These contain more than 1,000 entries and more than 230 annotated references.

Hydrologic testing of DC-2 continued.

Seismograph Services Corporation completed their processing of the seismic test data. The results indicate that the basalt surface can be mapped continuously. Lower horizons can be mapped locally.

Site Studies Project (continued)

Preliminary data from Senturion Services, Inc. on the magnetotelluric test suggests that the basalt sequence is about four kilometers thick.

PROBLEM AREAS AND ACTION TAKEN

None.

PLANNED WORK FOR SUBSEQUENT MONTHS

Geologic mapping of the Columbia Plateau and Pasco Basin will continue. U-2 photography will be completed in August 1978. The final reports for seismic and magnetotelluric tests will be submitted in August. Hydrologic testing of Hanford wells will continue through September.

REPORTING PERIOD

DRILLING PROJECT

JULY 1-31, 1978

OBJECTIVE

The Drilling Project provides the boreholes necessary to investigate the subsurface geologic, hydrologic, and engineering properties of the Columbia River basalts. This investigation is being conducted to determine the suitability of the basalts for the construction of an environmentally acceptable waste repository. These studies are in direct support to the Site Studies Project for preliminary and final site characterization.

The Drilling Project will also provide services in the area of drilling technology which will assist the Repository Project and the Near-Surface Test Facility Project.

DESCRIPTION OF WORK ACCOMPLISHEDDrilling

Drilling operations were conducted at two locations and hydrologic testing at one location during the reporting period.

Coring operations at DC-4 advanced from 749 feet to 1,074 feet. DC-4 is 21 percent complete based upon a total depth of 5,000 feet.

Coring operations at DC-8 advanced from 2,959 feet to 3,956 feet. DC-8 is 96 percent complete, based upon a total depth of 4,100 feet.

Geophysical Logging

None during the reporting period. Additional logging is scheduled for August.

Hydrologic Testing

Lawrence Berkeley Laboratory conducted hydrologic fracture testing in DC-11.

Science Applications, Inc. is performing hydrologic testing in DC-2. Twelve intervals were tested during the reporting period.

PROBLEM AREAS AND ACTION TAKEN

- DC-4 and DC-2 (deviated coring) will not be completed in fiscal year 1978.
- Current estimate for DC-4 completion is mid-November 1978 for a 5,000-foot total depth. Currently evaluating a shallower completion. The Boyles Brothers Drilling Company core rig has been mobilized to DC-2.

Drilling Project (continued)

PLANNED WORK FOR SUBSEQUENT MONTHS

Coring operations will continue at DC-4. DC-8 will be completed in early August 1978. Science Applications, Inc. will complete hydrologic testing in DC-2 in mid-August. Deviated coring of DC-2 will commence when Science Applications, Inc. testing is complete. Lawrence Berkeley Laboratory will begin hydrologic tests in DC-2 in early August. Gyro-directional surveys will be run in DC-1, DC-2, DC-3, DC-4, DC-5, DC-6, DC-7, DC-8, and DDH-3 in mid-September.

**BASALT WASTE ISOLATION PROGRAM
DRILL HOLES AS OF 7/31/78**

REPORTING PERIOD

TECHNOLOGY DEVELOPMENT PROJECT

JULY 1-31, 1978

OBJECTIVE

Technology development supports the mission of building a repository by providing solutions to technical problems related to the design and monitoring of the repository. Data developed during solution of technical problems will also be used in the safety analysis report and the environmental report.

DESCRIPTION OF WORK ACCOMPLISHEDRock Testing

A report entitled, "Rock Mechanics Methods and In Situ Tests for Nuclear Waste Repository Design in Basalt," was prepared to discuss rock mechanics investigations to be conducted in connection with the heater tests.

Downhole Laboratory

The downhole laboratory effort was stopped pending a complete evaluation of need and current requirements. The revised program will complete testing of the seismic component and the acoustic component of the downhole laboratory in accordance with the subcontract requirements, prepare the final report including any recommendations the subcontractor may have for improving the performance and reliability of the downhole laboratory, and pack the Government-owned hardware for shipping to Rockwell Hanford Operations.

Comments regarding need and requirements for a downhole laboratory have been solicited and received from numerous persons and groups who might have an interest in the laboratory or data it can acquire. These comments were consolidated and a meeting was called to resolve the inconsistencies and uncertainties that arose. Additional effort is required to get input from other than Basalt Waste Isolation Program personnel and to determine what data are already being gathered by other methods and programs.

Borehole Plugging

Requests for proposals were sent to prospective suppliers to conduct the borehole plugging effort. Nine suppliers were invited to submit proposals; proposals were received from three. These proposals are currently being evaluated.

Multiple Barrier Studies

A work plan for the follow-up work on multiple barrier studies was completed. Reports were received from the subcontractor detailing the completion of preliminary experiments to examine reaction products of waste/basalt interactions. The characterization effort of the ground water system

Technology Development Project (continued)

continued. A report was drafted detailing the characteristics of ground waters obtained from various aquifers in the subsurface of the Hanford reservation. Resulting data show that the waters are basically of the sodium bicarbonate type and of ages in excess of 20,000 years. The characterization of the waters is aimed at establishing a reference composition to be used in further multiple barrier experiments.

In Situ Tests

Preliminary drawings for the Near-Surface Test Facility heater test have been received from Lawrence Berkeley Laboratory. A review of the drawings by Rockwell Hanford Operations' staff was completed. A technical meeting between Lawrence Berkeley Laboratory, Rockwell Hanford Operations, and Vitro Engineering was convened and minutes of the meeting were written and distributed. Comments were returned to Lawrence Berkeley Laboratory for resolution.

Instrumentation and instrument borehole arrays for the Near-Surface Test Facility heater experiments and the layout of electrical wire ways and power connections for Title II electrical utility design were submitted by Lawrence Berkeley Laboratory. These have been reviewed and comments are being prepared for Lawrence Berkeley Laboratory.

PROBLEM AREAS AND ACTION TAKEN

None.

PLANNED WORK FOR SUBSEQUENT MONTHS

The borehole plugging contract will be written and awarded. The final results of the downhole laboratory first-phase effort will be documented. A review of the program, requirements, and direction will be conducted and the new direction will be initiated.

Work plans and work packages will be completed for all fiscal year 1979 technology development work. Reviews will be completed with concerned organizations, and contracts covering the fiscal year 1979 work will be awarded.

REPORTING PERIOD

NEAR-SURFACE TEST FACILITY PROJECT

JULY 1-31, 1978

OBJECTIVE

To design and construct a multipurpose test facility for in situ testing of basalt.

DESCRIPTION OF WORK ACCOMPLISHEDFacility Design

The Vitro Engineering Title I effort for facility requirements and site work was essentially completed during the month. Rockwell Hanford Operations reviewed the comment issues and returned them to Vitro Engineering. The facility requirements design covers the facility electrical power and mechanical systems. The site work design covers the roads, parking areas, and embankment construction in the portal areas.

The Vitro Engineering Title II effort for facility requirements was initiated at a kickoff meeting on July 25, 1978. The Title I design basis was approved pending incorporation of comments.

Rockwell Hanford Operations transmitted to the U. S. Department of Energy-Richland Operations Office the functional design criteria for the Near-Surface Test Facility - Phase II on July 25, 1978. This incorporated the U. S. Department of Energy-Richland Operations Office comments provided on June 19, 1978. The conceptual design plan for Phase II was transmitted to the U. S. Department of Energy-Richland Operations Office on July 21, 1978.

Remote Handling

Preconceptual design work by Rockwell Hanford Operations on the Spent Fuel Remote Handling System continued during July. A preconceptual design description was prepared and included as an appendix to the functional design criteria (Phase II). A work statement for remote handling engineering studies was submitted to the U. S. Department of Energy-Richland Operations Office on July 17, 1978.

Construction

Construction activity at the Gable Mountain site of the Near-Surface Test Facility was initiated by Genstar Construction Company, Bellevue, Washington. This work included mobilization, developing pioneer roads, and dirt removal at the portal areas. Work on the electrical distribution line was also initiated with procurement activities. The new portion of the line is to be developed by a Genstar Construction Company subcontractor and the existing portion of the line upgraded by Rockwell Hanford Operations' plant forces.

Near-Surface Test Facility Project (continued)

Safety and Environmental Analysis

The safety plan for the Near-Surface Test Facility was completed and submitted to the U. S. Department of Energy-Richland Operations Office. This overall safety plan delineated the areas of responsibility and content to assure the inclusion of all safety-related considerations in Near-Surface Test Facility construction. Work is progressing on an emergency plan for the construction phase.

The environmental assessments covering the Near-Surface Test Facility have been combined into a single assessment for the U. S. Department of Energy-Headquarters. Review and approval of the combined assessment have been requested.

PROBLEM AREAS AND ACTION TAKEN

None.

PLANNED WORK FOR SUBSEQUENT MONTHS

The Vitro Engineering Title I design effort is to be completed. Title II work on facility requirements is to continue and site work design (Title II) is to be initiated. Work on the remote handling engineering studies is to be initiated along with conceptual design of the Near-Surface Test Facility-Phase II. Construction of the Near-Surface Test-Facility box cuts is to be completed and tunneling initiated by September 1978. The electric distribution line is scheduled for completion by early September.

REPORTING PERIOD

REPOSITORY PROJECT

JULY 1-31, 1978

OBJECTIVE

The objectives of this program are to select and evaluate a repository site in basalt, establish design criteria, and design and construct a repository for storage of nuclear waste.

DESCRIPTION OF WORK ACCOMPLISHEDEngineering Studies

A draft report entitled, "Material Properties Review," has been completed by the University of Minnesota and submitted to Rockwell Hanford Operations. This material properties review compared the work done by Dr. J. F. T. Agapito, et al., in 1977 with test results of core taken from the Hanford site and tested by the Colorado School of Mines. The test results from the Pomona Flow core are similar to the properties presented by Dr. Agapito in 1977.

Code development continued both at the University of Minnesota and Dames and Moore. The boundary element formulation for transient heat flow was completed and coupling with the thermal elastic stresses is under way. This code will reduce analysis costs of problems simulating the effects of ventilation on heat flow and stress redistribution.

A third draft of the functions and design criteria for the repository have been received and are presently being reviewed by Rockwell Hanford Operations.

Safety and Environmental Analysis

Woodward-Clyde Consultants held a workshop to evaluate and rank possible events that could disrupt a deep geologic waste repository. A list of seven of the most significant events has been approved by Rockwell Hanford Operations and the subcontract is proceeding with development of fault trees.

The statement of work for the second phase of the risk assessment program has been incorporated into a statement of work for license application (preliminary safety analysis report) support. The long-term safety analysis of the repository will be covered by this statement of work.

A second draft of the outline for the environmental report of the repository was completed and circulated for comment. Work was under way at the end of the month on a revised format for the license application (preliminary safety analysis report) outline.

PROBLEM AREAS AND ACTION TAKEN

None.

Repository Project (continued)

PLANNED WORK FOR SUBSEQUENT MONTHS

The outlines for the license application (preliminary safety analysis report) and the environmental report will be completed and submitted to the U. S. Department of Energy-Richland Operations Office. The functions and design criteria for the repository will complete Rockwell Hanford Operations' review and will be submitted to the U. S. Department of Energy-Richland Operations Office. It is expected that the contract for the site selection study will be awarded.

REPORTING PERIOD

MANPOWER SUMMARY

JULY 1-31, 1978

Man-Months

ROCKWELL HANFORD OPERATIONS	68.0
J. F. T. AGAPITO	1.0
BATTELLE PACIFIC NORTHWEST LABORATORY	3.0
COLORADO SCHOOL OF MINES	2.0
FENIX & SCISSON, INC. AND SUBCONTRACTORS	23.0
GEOSCIENCE RESEARCH CONSULTANTS	7.0
IDAHO BUREAU OF MINES AND GEOLOGY	0.5
J. A. JONES CONSTRUCTION COMPANY	1.0
LAWRENCE BERKELEY LABORATORY	25.5
OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES	1.0
THE PENNSYLVANIA STATE UNIVERSITY	5.0
SENTURION SERVICES CORPORATION	1.0
W. K. SUMMERS AND ASSOCIATES	1.0
UNIVERSITY OF MINNESOTA	7.0
UNIVERSITY OF OREGON	1.5
U. S. GEOLOGICAL SURVEY-WESTERN DIVISION	5.0
U. S. GEOLOGICAL SURVEY-WATER RESOURCES	1.0
VITRO ENGINEERING	7.0
WASHINGTON STATE DEPARTMENT OF GEOLOGY	1.5
WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES	4.0
WASHINGTON STATE UNIVERSITY	2.5
WESTERN WASHINGTON UNIVERSITY	0.5
WOODWARD-CLYDE CONSULTANTS	<u>1.0</u>

TOTAL WASTE ISOLATION PROGRAM MANPOWER SUPPORT

170.0

REPORTING PERIOD

VISITORS

JULY 1-31, 1978

<u>Name</u>	<u>Affiliation</u>	<u>Date</u>	<u>Person Contacted</u>
T. Doe B. C. Haxmon S. Doty D. Altham	Lawrence Berkeley Laboratory	July 5	M. P. Board
K. Kennedy	Science Applications, Inc.	July 5	R. E. Gephart
S. Doty T. N. Narasimhan	Lawrence Berkeley Laboratory	July 6	R. C. Arnett
L. Wilkinson L. E. Morlan	Foundation Sciences, Inc.	July 6	J. F. Marron
D. Bernstein D. Maxwell	Science Applications, Inc.	July 6	J. F. Marron
T. N. Narasimhan	Lawrence Berkeley Laboratory	July 7	R. C. Arnett
D. A. Brauer	Battelle Pacific Northwest Laboratory	July 7	R. A. Deju
R. D. Bentley	U. S. Geological Survey	July 10	R. C. Arnett
S. Scurlock	Science Applications, Inc.	July 10	R. E. Gephart
C. N. Wilson J. W. Shade R. L. Gibby	Hanford Engineering Development Laboratories	July 11	M. W. Grutzeck
S. Scurlock	Science Applications, Inc.	July 12	R. E. Gephart
K. Kennedy	Science Applications, Inc.	July 14	R. E. Gephart
P. Querna D. Schafer	Johnson Division of Universal Oil Products	July 14	R. E. Gephart
K. Kennedy	Science Applications, Inc.	July 17	R. E. Gephart
K. Kennedy	Science Applications, Inc.	July 19	R. E. Gephart

Visitors (continued)

<u>Name</u>	<u>Affiliation</u>	<u>Date</u>	<u>Person Contacted</u>
K. Raven G. E. Grisar	Environment Canada	July 19	R. E. Gephart
J. M. Hilliard	Woodward-Clyde Consultants	July 19	D. R. St. Laurent
N. Campbell	Wash. St. Department of Natural Resources	July 19	S. M. Price
G. Magnus	Science Applications, Inc.	July 19	D. R. St. Laurent
J. Hohl	Washington Public Interest Research Group	July 20	R. A. Deju
J. Blomquist	Sierra Club	July 20	R. A. Deju
C. Wilson	Hanford Engineering Development Laboratories	July 20	M. W. Grutzeck
R. Gibby J. Shade T. Weber D. Cantley	Hanford Engineering Development Laboratories	July 20	G. C. Evans
T. R. Krueal T. E. Hoover E. M. King B. A. Gulurt	Parsons-Brinckerhoff	July 21	H. B. Dietz
D. Cantley	Hanford Engineering Development Laboratories	July 21	G. C. Evans
S. E. Logan	Los Alamos Technical Associates	July 24	H. B. Dietz
J. Oilliver	Senturion Services	July 25	R. C. Edwards
R. H. Lileram	Leeds-Hill	July 25	H. B. Dietz
S. Stromdahl K. Olson P. A. W therspoon C. A. Brown K. F. Mirk	Lawrence Berkeley Laboratory	July 26	R. A. Deju

Visitors (continued)

<u>Name</u>	<u>Affiliation</u>	<u>Date</u>	<u>Person Contacted</u>
P. W. Levy D. L. Haysly	Brookhaven National Laboratory	July 31	C. E. Hodge
D. J. Rondeau A. Dubois J. West M. Hallwell E. P. Binnall	Lawrence Berkeley Laboratory	July 31	M. P. Board

REPORTING PERIOD

JULY 1-31, 1978

TRAVELERS

<u>Name</u>	<u>To</u>	<u>Date</u>	<u>Reason</u>
D. R. St. Laurent H. B. Dietz	Nevada Test Site Las Vegas, Nevada	July 10	View underground facilities at the Nevada Test Site.
M. P. Board R. A. Deju	Berkeley, California	July 16	Attend "Geotechnical Assessment and Instrumentation Needs for Radioactive Waste Storage in Crystalline and Argillaceous Rocks."
D. R. St. Laurent	Columbus, Ohio	July 24	Participate in all-contractor review meeting on "Issues in Design, Construction, Operations, and Decommissioning of Repositories in Salt."
D. J. Carrell	San Francisco, California	July 25	Attend workshop on the "Disruptive Event Analysis" being performed by Woodward-Clyde Consultants.
R. C. Edwards B. H. Richard	Tulsa, Oklahoma	July 25	Discuss results of the seismic survey, talk with Senturion Services Corporation on magnetotelluric survey.

REPORTING PERIOD

DOCUMENTS ISSUED

JULY 1-31, 1978

PREVIOUS MONTH

RHO-BWI-C-4 (unclassified), July 1977, B. H. Richard, J. T. Lillie, and R. A. Deju, "Gravity Studies of the Hanford Reservation, Richland, Washington"

RHO-BWI-C-5 (unclassified), July 1977, R. A. Deju and B. H. Richard, "Three Dimensional Gravity Investigation of the Hanford Reservation"

RHO-BWI-C-6 (unclassified), July 1977, J. T. Lillie and B. H. Richard, "An Analysis of Selected Gravity Profiles on the Hanford Reservation, Richland, Washington"

RHO-BWI-C-11 (unclassified), May 1978, W. I. Duvall, R. J. Miller, and F. D. Wang, (Earth Excavation Institute, Colorado School of Mines), "Preliminary Report on Physical and Thermal Properties of Basalt, Drill Hole DC-10, Pomona Flow, Gable Mountain"

RHO-BWI-LD-1 (unclassified), May 4, 1978, R. K. Ledgerwood, C. W. Myers, and R. W. Cross, "Pasco Basin Stratigraphic Nomenclature"

RHO-C-12 (unclassified), May 1, 1978, G. J. McCarthy (The Pennsylvania State University) and M. W. Grutzeck (Rockwell Hanford Operations), "Characteristics of Nuclear Wastes Relevant to Geologic Isolation in Basalt."

THIS MONTH

RHO-BWI-78-100 MAR (unclassified), March 31, 1978, R. A. Deju, "Waste Isolation Program Monthly Report"

RHO-BWI-78-100 APR (unclassified), April 30, 1978, R. A. Deju, "Waste Isolation Program Monthly Report"

RHO-BWI-C-3 (unclassified), February 1978, P. Goldstein, G. O. Hultgren, and R. W. Nelson (Boeing Computer Services Richland, Inc.), "A Model of Contaminant Diffusion from a Finite Line Source in a Dense Basalt Stratum to an Overlying Permeable Interbed"

RHO-BWI-ST-3 (unclassified), November 1977, C. W. Myers (Rockwell Hanford Operations), F. Asaro and M. V. Michel (Lawrence Berkeley Laboratory), "A Statistical Evaluation of Some Columbia River Basalt Chemical Analyses--An Interim Report"

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