MASTER

NUMERICAL MODELLING OF ROCK STRESSES
WITHIN A BASALTIC NUCLEAR WASTE REPOSITORY
PHASE II - PARAMETRIC DESIGN STUDIES

July 1978

Prepared for Rockwell Hanford Operations,
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WASTE ISOLATION PROGRAM
MONTHLY REPORTRHO-BWI--78-100-May
DE84 016180R. A. Deju, Director
Waste Isolation Program

May 31, 1978

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TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	3
PROGRAM SUMMARY	4
SITE STUDIES PROJECT	6
DRILLING PROJECT	8
TECHNOLOGY DEVELOPMENT PROJECT	10
NEAR-SURFACE TEST FACILITY PROJECT	13
REPOSITORY PROJECT	15
MANPOWER SUMMARY	18
VISITORS	19
TRAVELERS	21
DOCUMENTS ISSUED	22
DISTRIBUTION	23

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 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

MAY 1-31, 1978

Interpretation of preliminary hydrologic testing of Core Hole DC-6 was completed for an open interval from 2,260 to 2,711 feet below ground level. The interpretation indicates a slight increase in water pressure with depth and hydraulic conductivity as low as 10^{-13} centimeters per second along with the bulk of the section. A flow-top permeability of 10^0 centimeters per second was detected immediately adjacent to one flow contact. A report compiling the data on 268 wells which penetrated basalts below the Mabton Interbed was completed. Geologic mapping of 1,200 square miles of Columbia River Basalt located in the northeastern part of the Columbia Plateau was completed. Geologic mapping in the Saddle Mountains is essentially complete.

Drilling operations were active at Core Holes DC-4, DC-6, and DC-8. Coring was terminated at a depth of 4,336 feet in DC-6 after obtaining the last scheduled oriented core. Hydrologic testing began on DC-2 with pressure testing of three intervals. Testing of this borehole will continue through July 1978.

Cores from Core Holes DH-4, DH-5, DC-2, and DDH-3 have been described in detail prior to laboratory rock testing for specific rock properties. Preparations were made to oversee the assembly and testing of specific equipment for the downhole laboratory. The work statement for the materials studies part of the Borehole Plugging Task was forwarded to the Material Function and interested contractors have been identified. A quantitative estimate of the mineralogy of the Umtanum Basalt indicates that approximately 37 percent of the basalt is partially crystallized glass. Equilibrium experiments with solutions containing cesium, strontium, and technetium in contact with Umtanum Basalt, heulandite, and nontronite at 25 degrees centigrade have shown that equilibrium has not been attained after 55 days for cesium and, possibly, strontium reacting with basalt and strontium reacting with heulandite. Preliminary construction and installation drawings of the heater and liner assemblies for the Near-Surface Test Facility have been completed.

The functional design criteria for the Near-Surface Test Facility Phase II (Spent Fuel Tests) were completed. The Pre-Title I design for the Near-Surface Test Facility Phase I (Electric Heater Tests) requirements continued and are on schedule. A work statement for a base line conceptual design of the remote handling systems for Phase II was completed. The bid opening for the Near-Surface Test Facility-Tunnels and Excavation was held. The contract will probably be awarded in June 1978. A revised version of the Phase I Environmental Impact Statement was completed and work has begun on Phase II.

The repository site selection study request for proposal was sent to prospective bidders. Studies on the convective transport of heat and the influence of the Vantage Sandstone on the temperature distribution above the repository have been completed. These studies show that the water flow in the Vantage Sandstone will probably have little effect on the regional temperature and stress conditions. A work statement to study the remote handling aspects of the repository was sent to the Material Function.

Program Summary (continued)

MAJOR PROBLEMS

None.

BUDGET VARIANCE

Costs as of May are less than 5 percent under the budget projection. All major contracts are in place and all work will be completed by the end of the year.

REPORTING PERIOD

SITE STUDIES PROJECT

MAY 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

The U. S. Geological Survey personnel have completed mapping (scale: 1:250,000) of 1,200 square miles of Columbia River Basalt located in the northeastern part of the Columbia Plateau, Washington. Washington State Department of Natural Resources' personnel have completed 65 percent of a reconnaissance map (scale: 1:250,000) of the Late Cenozoic sediments overlying the Columbia River Basalt within the western half of the Columbia Plateau, Washington. Geologic mapping in the Saddle Mountains, north of Hanford, is essentially complete. Other mapping projects in the Pasco Basin are on schedule and about 50 percent complete.

Battelle, Pacific Northwest Laboratories' personnel have completed 75 percent of the work required to provide a compilation map of linears noted in available Columbia River Basalt remote sensing literature.

Three hundred twenty-five samples of Grande Ronde Basalt have been collected from Core Holes DH-5, DC-2, and DDH-3 for paleomagnetic analysis. Laboratory analysis of these samples, plus those previously collected on Umtanum Ridge northwest of Hanford, is under way.

Downhole hydrologic testing has begun at Core Hole DC-2. This site is located north of the 200 East Area along the southern flank of the Umtanum-Gable Anticline. The hydrologic test rig and all supporting equipment arrived the third week of May 1978. Water potential measurements are now being acquired along 10 interflow zones within the Grande Ronde Basalt Formation. These data will better define the hydraulic gradient existing within the basalt beneath the Hanford site.

Interpretation has been completed of the preliminary hydrologic testing conducted during March 1978 along a selected interval of Core Hole DC-6. Potential measurements and hydraulic conductivity values were determined

Site Studies Project (continued)

along an open interval between 2,260 and 2,711 feet below ground level. Results indicate a slight increase of water potential with depth through this zone and hydraulic conductivity values along several narrow vesicular flow tops ranging from 2 to 10^{-13} centimeters per second.

A report has been completed on the description of wells penetrating the Wanapum Basalt Formation in the Pasco Basin area, Washington. It is now being reviewed by the staff of the Waste Isolation Program. The report presents all the data available on 268 wells found to penetrate the basalts deeper than the Mabton Interbed or its equivalent.

Additional geophysical and driller log data on 1,000 wells located across the Columbia Plateau were extracted from the files of the Washington State Department of Ecology. These were added to the regional hydrologic data bank maintained by the U. S. Geological Survey. This effort is part of the continuing compilation and analysis of ground water data available for a regional hydrology reconnaissance and for development of a coarse grid flow model.

Field phase of seismic testing is complete. Preliminary analysis of the results indicates that reflection from the basalt surface and several horizons within the basalt is possible. Final processing will improve the quality of the results.

PROBLEM AREAS AND ACTION TAKEN

Access approval has temporarily delayed mapping the Yakima Indian Reservation.

- The Rockwell Hanford Operations' Counsel has been contacted as to the procedure required to gain such access. Attempts are also being made to gain access to private lands in the Pasco Basin for which access has been denied.

Contractual negotiations have delayed implementation of a contract with the U. S. Geological Survey.

- The revised statement of work has been forwarded to the U. S. Department of Energy-Richland Operations Office.

PLANNED WORK FOR SUBSEQUENT MONTHS

The mapping of Rattlesnake Ridge, structures to the southeast, and Late Cenozoic sediments in the Pasco Basin will continue. The regional mapping team of the U. S. Geological Survey will reach full strength in June 1978 and will continue at that level during the summer months. Most of the X-ray fluorescence analyses will be in support of their efforts. The paleomagnetic studies and the draft report on the geology of the Pasco Basin will be completed by the end of June 1978. The waste isolation review will be held and the magnetotelluric test will begin in June 1978.

U-2 remote sensing photography will be gathered in July 1978. The testing of DC-2 and the geophysical tests will be completed by the end of July 1978.

REPORTING PERIOD

DRILLING PROJECT

MAY 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 characterizations.

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 three locations and hydrologic testing at one location during the month of May 1978. Coring operations at DC-6 were terminated May 24, 1978 at 4,336 feet after obtaining the last scheduled oriented core.

Cable tool operations at DC-4 were completed May 5, 1978 at 623 feet. The CP-50 core rig from DC-6 was mobilized to DC-4 on May 31, 1978.

Coring operations at DC-8 advanced from 1,612 feet to 2,339 feet. Considerable downtime was experienced due to hydraulic pump failure.

Hydrological Testing

The workover rig mobilized to DC-2 on May 16, 1978 and the pump arrived on location May 23, 1978. The borehole has been cleaned out and pressure tests have been conducted across three intervals as of May 31, 1978.

PROBLEM AREAS AND ACTION TAKEN

The hydraulic system failed on the CP-50 rig at DC-8. Approximately 6 operating days were lost during repair efforts.

- A factory mechanic was called in to expedite repair efforts.

Swabbing equipment for fiscal year 1978 hydrologic support services were not procured by Fenix & Scisson, Inc. as originally requested by Rockwell Hanford Operations on February 14, 1978.

- Fenix & Scisson, Inc. is procuring swabbing equipment on an emergency basis.

Drilling Project (continued)

PLANNED WORK FOR SUBSEQUENT MONTHS

During the next several months, Boreholes DC-5, DC-7, and DC-8 will be geophysically logged; hydrologic testing efforts will shift from DC-2 to DC-6; and, coring will continue as scheduled at DC-4 and DC-8.

REPORTING PERIOD

TECHNOLOGY DEVELOPMENT PROJECT

MAY 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

Laboratory test cores from Core Holes DH-4, DH-5, DC-2, and DDH-3 have been characterized by the Colorado School of Mines. This characterization accomplished prior to testing, includes hand specimen and thin section description of the mineralogy, fabric, and texture of the rock, as well as a detailed description of all jointing.

A statement of work for the fiscal year 1979 laboratory testing of basalt cores was completed. A request for proposal has been submitted to the Colorado School of Mines, Earth Excavation Institute.

Downhole Laboratory

The contractor's facilities were visited in May 1978 to review the status of work on the revised contract. New Rockwell Hanford Operations' personnel were familiarized with the contractor's activities, facilities, and method of operation. Plans were formulated to oversee the assembly testing to be done in June 1978. Additional requirements for report formatting were forwarded to the Material Function for inclusion in the statement of work.

Borehole Plugging

The statement of work for the material studies part of the Borehole Plugging Task was forwarded to the Material Function and interested contractors were identified.

Multiple Barrier Studies

Scanning electron microscope work on alteration products of DH-5 core samples is 90 percent complete. X-ray diffraction work on zeolite standards is 100 percent complete. Polished samples of altered core material are presently being examined with the petrographic microscope prior to their examination by electron microprobe.

Several waters from the Pasco Basin have been run on the Equilibrium Dissolution Program EQ-3. Saturation of the waters with calcite and a form of SiO_2 , having the thermodynamic properties of cristobalite, is common.

Technology Development Project (continued)

Cation exchange capabilities and surface areas of the 20- to 50-mesh Umtanum Basalt from Umtanum Ridge northwest of the Hanford site, the -2 micron freeze-dried nontronite from Garfield, Washington, and the 50- and 200-mesh heulandite from Poona, India have been measured. These are the standard samples used in the equilibration studies.

A quantitative estimate of the standard sample of Umtanum Basalt mineralogy has been made using an interval scanner (point counter) that, within limits, is able to electronically distinguish between shades or densities of coloring on a photograph of basalt. The glass content comprised 37 percent of the surface area.

The continuing determination of equilibrium K_d values for solutions of ^{137}Cs , ^{85}Sr , ^{95m}Tc , in contact with Umtanum Basalt, heulandite, and nontronite at 25 degrees centigrade have shown little change at 55 days from the previously reported 3-day measurements. The only K_d values which are still increasing seem to include cesium and, possibly, strontium for basalt and strontium for heulandite. These increases would indicate that equilibrium has not yet been reached for these elements.

The isotope ^{237}Pu was used to determine plutonium K_d values at 25 degrees centigrade for basalt, heulandite, and nontronite. The plutonium K_d values seem to stabilize rather rapidly, with the possible exception of heulandite.

In Situ Tests

Preliminary drawings of the Near-Surface Test Facility heater assemblies have been received from the Lawrence Berkeley Laboratory. The drawings include construction and installation drawings of the heater and liner assemblies for the full- and time-scale tests.

A review of the instrumentation and heater drawing of borehole arrays for the Near-Surface Test Facility were reviewed by Rockwell Hanford Operations and Lawrence Berkeley Laboratory staffs. Final drawings with hole specifications will be completed in July 1978.

A draft of the Near-Surface Test Facility data acquisition system functional specifications has been completed by the Lawrence Berkeley Laboratory and is currently in the review stage.

Preliminary work has been completed by Lawrence Berkeley Laboratory on the U. S. Department of Energy Manual Chapter 1830 procurement requirements for the Near-Surface Test Facility data acquisition system.

PROBLEM AREAS AND ACTION TAKEN

None.

Technology Development Project (continued)

PLANNED WORK FOR SUBSEQUENT MONTHS

Lawrence Berkeley Laboratory will continue their characterization study of samples of alteration product material taken from Core Holes DH-5 and DC-2. They will also sample Core Holes DC-6 and DC-8 for future X-ray diffraction and scanning electron microscope work.

Battelle, Pacific Northwest Laboratories will continue their study of the length of time needed to reach equilibrium in their sorption experiments. Should equilibrium not be attained in an additional 4-week equilibration period, other longer equilibration runs using longer-lived radionuclides will be initiated.

A proposal for the laboratory testing of the physical and thermal properties of irradiated basalt cores was received from Battelle, Pacific Northwest Laboratories' Waste-Geologic Media Interactions Section. This proposed study would be undertaken as a portion of the fiscal year 1979 laboratory rock testing program. The proposal is currently being reviewed by the Rockwell Hanford Operations' staff.

A report on the laboratory testing of the first one-third of the core samples from DH-4, DH-5, DC-2, and DDH-3 will be submitted by the Colorado School of Mines. This report will be completed as a portion of the fiscal year 1978 laboratory testing of rock cores.

The U. S. Department of Energy Manual Chapter 1830 procurement process forms will be submitted to the U. S. Department of Energy-San Francisco Operations Office by the Lawrence Berkeley Laboratory for purchase of Near-Surface Test Facility data acquisition equipment.

The functional specifications for the Near-Surface Test Facility data acquisition system will be completed.

A visit to the Lawrence Berkeley Laboratory is planned on June 8, 1978 to review their latest statement of work for the Near-Surface Test Facility heater tests.

The borehole plugging material studies proposals and contractors will be evaluated in preparation for awarding the contract.

REPORTING PERIOD

NEAR-SURFACE TEST FACILITY PROJECT

MAY 1-31, 1978

OBJECTIVE

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

DESCRIPTION OF WORK ACCOMPLISHEDFacility Design

Pre-Title I design of the Phase I (Electric Heater Tests) facility requirements by Vitro Engineering has continued through the month and has been on schedule. The facility requirements consist of the mechanical system, which provides facility heating, ventilating, air conditioning, and de-watering, and the electrical utility system, which provides power to the test system and to facility services. Lawrence Berkeley Laboratory personnel attended a meeting on May 23, 1978, wherein they presented information which allows the heating, ventilating, and air conditioning system to be sized and the electrical utility to provide ample power for the electrical heater tests.

Design of the inlet air house located at the portal of the east tunnel of the Near-Surface Test Facility Phase I (Electric Heater Tests) was started on May 11, 1978. The inlet air house provides the support for the main ventilation fan and filter bank and provides the necessary sealing and access through sealed doors for the east tunnels. Ventilation air for the facility is pushed down the east tunnel under positive pressure and exhausts at the west tunnel portal.

A kick-off meeting was held with Vitro Engineering on May 16, 1978 to begin the Pre-Title I design of the Phase I (Electric Heater Tests) site work. This work includes all roadway, walkway, and trailer siting requirements.

The Functional Design Criteria for the Near-Surface Test Facility Phase II (Spent Fuel Tests) were completed on May 17, 1978, and issued for U. S. Department of Energy review and approval. This document establishes the function design basis for governing the subsequent design and construction. The spent fuel phase will demonstrate the feasibility of storing spent fuel canisters in an actual in situ layer of basalt and verify that basalt is a suitable geologic medium for long-term storage of spent fuel.

Rockwell Hanford Operations started work on formulating a conceptual design plan on May 31, 1978 for the Near-Surface Test Facility Phase II (Spent Fuel Tests). This plan will establish the basis for performing the conceptual design and will contain a project summary, method of accomplishment, schedule, and cost estimate.

Near-Surface Test Facility Project (continued)

Remote Handling

A work statement for a base line conceptual design of the remote handling systems for the spent fuel test was completed during May 1978. The concept to be developed is based on the existing tunnel configuration and the functional design criteria. The sequence of handling operations prepared is: (1) truck delivery of shipping cask; (2) cask unloading with a bridge crane in an underground transfer room; and, (3) a shielded transporter.

Construction

The bid opening for the Near-Surface Test Facility Tunnels and Excavation was held by J. A. Jones Construction Company on May 19, 1978. Ten companies submitted bids for the work. It is anticipated that the contract will be awarded in late June 1978 as scheduled.

Safety and Environmental Analysis

A revised version of the Phase I Environmental Impact Assessment (Electric Heater Phase) was completed and submitted to the U. S. Department of Energy-Richland Operations Office for review and transmittal to the U. S. Department of Energy-Headquarters.

Work is continuing on the preparation of an addendum to the Phase I Environmental Impact Assessment. This addendum treats the Phase II experiments in which spent fuel elements will be temporarily stored in the facility.

PROBLEM AREAS AND ACTION TAKEN

None.

PLANNED WORK FOR SUBSEQUENT MONTHS

The construction of the Near-Surface Test Facility is to begin in June 1978 with the award of the tunnels and excavation contract. Vitro Engineering is to continue Near-Surface Test Facility design activity, beginning Title I design on the Electric Heater Phase upon receipt of the directive authorization. Conceptual design for the Spent Fuel Phase is scheduled to begin in June 1978 upon approval of the functional design criteria.

REPORTING PERIOD

REPOSITORY PROJECT

MAY 1-31, 1978

OBJECTIVE

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

DESCRIPTION OF WORK ACCOMPLISHEDRepository Siting

The request for proposal was sent to prospective bidders on May 23, 1978 for the site selection study. Proposals were requested by June 19, 1978. Preparation of evaluation criteria to be used in selection of the subcontractor has been initiated.

Engineering Studies

Studies on the convective transport of heat and the influence of the Vantage Sandstone on the temperature distribution above the repository have been completed. The explicit finite element code used for this analysis was debugged and compared to a simple closed form solution with excellent agreement. The code has now been run to investigate the influence of heat transported by lateral ground water flow in the Vantage Sandstone. Input parameters assumed a flow of 0.12 feet per day in the Vantage Sandstone, which was assumed to be 4 meters thick. Additional runs were performed assuming a flow rate of 1.2 feet per day, or 10 times the original figure. Analyses of both of the above cases indicate that, in all probability, the flow in the Vantage Sandstone will have little effect on the temperature and stress conditions in a regional sense.

Studies modeling the temperatures and stresses around a single canister were completed. Finite element, axisymmetric analysis of a single canister of 5 meters in length, 0.4 meter in diameter, and 1 kilowatt of thermal output results in temperature increases in the rock of less than 50 degrees centigrade in the first year. The thermally induced stresses are correspondingly small. These short-term results indicate that it will be possible to place more than 1 kilowatt of thermal power in a single borehole. The actual maximum temperature of the rock is a function of the spacing of the boreholes.

Development of models for the coupling of fluid flow and heat transfer continues. Dames and Moore, Inc. has completed the coding of an explicit/implicit finite difference code that incorporates complete coupling of fluid flow and heat transfer. Buoyancy forces are included in the fluid flow analysis and convection and conduction heat transfer in the thermal analysis. This code is now being coupled to their DAMSEL stress analysis code to allow incorporation of stress influences on the rock mass permeability. Hence, a weak coupling will be provided for fluid heat and stress.

Repository Project (continued)

Development of boundary element codes for transient heat flow analysis continues. The theory for a two-dimensional line heat source has been developed and incorporated in a boundary element transient heat conduction code. This work is being continued to determine the closed form thermally induced stresses from a live heat source so that the heat flow/thermal stress analysis can be performed using boundary element techniques. Good agreement has been achieved between the model and the analytical solution for a disc whose boundary is instantaneously heated to 100 degrees centigrade at time zero and allowed to remain at that temperature. Future analysis using this technique will include investigation of the temperature and stress conditions around an excavation in which ventilation causes significant heat removal.

A performance review of the University of Minnesota mine modeling activities was held at Minneapolis, Minnesota on May 11-12, 1978.

Functions of the repository and sub-parts have been established and logic diagrams and explanatory text will be used in the presentation.

Dr. J. F. T. Agapito, mining consultant, was requested to prepare a ventilation study. The scope of work included definition of design requirements, preparation of requirements for parametric studies, and assistance in identifying additional parametric studies.

A purchase requisition to study remote handling aspects of the repository was issued. A sole source procurement was requested to utilize the experience of a subcontractor designing similar equipment for the Waste Isolation Pilot Plant Project. The study will cover cask and canister transfer and transport, hot cells, storage areas, and other aspects of remote handling design and trade studies.

Safety and Environmental Analysis

The statement of work for the development of a basalt repository licensing plan has been drafted and is being circulated for comment.

An informal report, "An Initial Attempt to Model Flow Into an Overlying Permeable Interbed from a Tunnel in a Shattered Dense Basalt Layer," was received from Boeing Computer Services Richland, Inc. and is being reviewed internally. The report summarizes the development effort, as well as the adequacy, of the solution method. A recommendation for the solution of an alternate problem was also received.

The draft of the repository environmental report outline has been completed and circulated for comment.

PROBLEM AREAS AND ACTION TAKEN

None.

Repository Project (continued)

PLANNED WORK FOR SUBSEQUENT MONTHS

Receipt and evaluation of site selection proposals will be completed, allowing award of the subcontract by September 1, 1978. The draft report on the repository parametric design studies will be completed and submitted to Rockwell Hanford Operations for review. The ventilation study will begin in late June 1978, and a report defining functions for the repository will be completed. A letter describing the program research efforts and their relationship to the licensing effort will be completed and submitted to the U. S. Department of Energy-Richland Operations Office. An outline for the safety analysis report of the repository will be prepared for review, and a statement of work prepared. The outline for the environmental report will be submitted to the U. S. Department of Energy-Richland Operations Office for review and comment.

REPORTING PERIOD

MANPOWER SUMMARY

MAY 1-31, 1978

	<u>Man-Months</u>
ROCKWELL HANFORD OPERATIONS	55.0
J. F. T. AGAPITO	.5
BATTELLE, PACIFIC NORTHWEST LABORATORIES	4.0
BOEING COMPUTER SERVICES RICHLAND, INC.	.5
COLORADO SCHOOL OF MINES	3.0
ENSCO, INC.	4.5
FENIX & SCISSON, INC. AND SUBCONTRACTORS	23.0
GEOSCIENCE RESEARCH CONSULTANTS	6.0
J. A. JONES CONSTRUCTION COMPANY	.5
LAWRENCE BERKELEY LABORATORY	13.5
THE PENNSYLVANIA STATE UNIVERSITY	3.5
SEISMOGRAPH SERVICES CORPORATION	27.0
W. K. SUMMERS AND ASSOCIATES	2.0
UNIVERSITY OF MINNESOTA	5.0
U. S. GEOLOGICAL SURVEY-WESTERN DIVISION	2.0
VITRO ENGINEERING	8.5
WASHINGTON STATE DEPARTMENT OF ECOLOGY	1.0
WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES	4.0
WASHINGTON STATE UNIVERSITY	<u>2.5</u>
 TOTAL WASTE ISOLATION PROGRAM MANPOWER SUPPORT	 <u>166.0</u>

REPORTING PERIOD

VISITORS

MAY 1-31, 1978

<u>Name</u>	<u>Affiliation</u>	<u>Date</u>	<u>Reason or Person Contacted</u>
G. Christie W. O. Murphy J. O. Cowles	TRW	May 2	R. A. Deju
R. Dugal	R. M. Parsons	May 3	H. B. Dietz
F. C. Olds	Power Engineering	May 3	R. A. Deju
J. G. Rigley	Washington Division of Geology	May 3	S. M. Price
R. H. Chesworth J. G. Asquith	Norman Engineering Company	May 4	H. B. Dietz
T. Doe M. Murphy	Lawrence Berkeley Laboratory	May 4	R. E. Gephart
H. Ewoldsen R. Moorhouse	Woodward-Clyde	May 5	R. A. Deju
J. Singer	Sundstrand	May 5	J. F. Marron
L. Wilkinson	Foundation Sciences, Inc.	May 9	B. H. Richard
T. Doe M. Murphy	Lawrence Berkeley Laboratory	May 10	R. E. Gephart
A. J. Watkinson D. Minkel W. Saur	Washington State University	May 12	S. P. Reidel
T. Doe	Lawrence Berkeley Laboratory	May 15	R. E. Gephart
M. Galbraith	Lawrence Berkeley Laboratory	May 17	R. E. Gephart
D. B. Sapik	U. S. Geological Survey	May 17	Meeting
P. Reinig	Los Alamos Technical Associates, Inc.	May 18	G. C. Evans
T. Hoover R. Holdsmith	Parsons Brinckerhoff	May 19	H. B. Dietz

Visitors (continued)

<u>Name</u>	<u>Affiliation</u>	<u>Date</u>	<u>Reason or Person Contacted</u>
K. D. Russell	Mine Safety and Health Administration	May 22	V. H. Stiessberger
T. Doe	Lawrence Berkeley Laboratory	May 22	R. E. Gephart
D. J. Rondeau A. W. Strondahl A. O. Dubois	Lawrence Berekeley Laboratory	May 23	M. P. Board
H. R. Pratt	Terra Tek	May 23	M. P. Board
R. R. Boyle E. P. Regnier F. A. Donath R. B. McMullen E. F. Hawkins J. T. Conway	U. S. Nuclear Regulatory Commission	May 24	R. A. Deju

REPORTING PERIOD

TRAVELERS

MAY 1-31, 1978

<u>Name</u>	<u>To</u>	<u>Date</u>	<u>Reason</u>
R. A. Deju S. M. Price R. C. Arnett R. E. Gephart J. L. Wells	Olympia, Washington	May 7	Performance review of U. S. Department of Energy subcontracts (Washington State Departments of Natural Resources and Ecology)
J. L. Wells M. P. Board	Minneapolis, Minnesota	May 11	Performance review of University of Minnesota
S. P. Reidel	Lewiston, Idaho	May 14	To examine the Grande Ronde Basalt stratigraphy
M. W. Grutzeck P. R. Dahlberg R. T. Wilde J. T. Meyer	University Park, Pennsylvania	May 22	Performance review of The Pennsylvania State University
M. R. Kasper J. T. Meyer	Washington, D. C.	May 23	Performance review of ENSCO, Inc.
R. A. Deju	Tokoy, Japan	May 27	International Tunnel Symposium '78 - Seikan and Kan-Etsu Tunnels

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PREVIOUS MONTH

RHO-BWI-ST-2 (unclassified), January 1978, C. W. Myers, et al.,
"Paleomagnetism of the Grande Ronde (Lower Yakima) Basalt Exposed
at Sentinel Gap: Potential Use for Stratigraphic Correlation."

THIS MONTH

None.

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