

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

WBS 1.2.9.1
QA N/A

August 16, 1993

TWS-EES-13-08-93-019

Mr. Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization Project Office
US Department of Energy
P.O. Box 98608
Las Vegas, NV 89193-8608

Dear Mr. Gertz:

Los Alamos Monthly Activity Report—June 1993

Attached is the Los Alamos Monthly Activity Report for June 1993. This internal document describes our technical work in detail; however, the report has not received formal technical or policy review by Los Alamos or the Yucca Mountain Site Characterization Project. Data presented in this document constitute predecisional information, should not be referenced, and are not intended for release from the U.S. Department of Energy as referenceable information.

If you have changes to our distribution list, please call Susan Klein at (505) 667-0916.

Sincerely,



Julie A. Canepa

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- TWS-EES-13-File, MS J521

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*Yucca Mountain
Site Characterization Project
Monthly Activity Report*

June 1993



Attachment to TWS-EES-13-08-93-019

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LOS ALAMOS NATIONAL LABORATORY
YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Monthly Activity Report

June 1993

WBS 1.2.1

Systems Engineering

Objective

The objective of this task is to integrate systems with the Geologic Repository Program, to describe the Yucca Mountain Site Characterization Project Mined Geologic Disposal System, and to evaluate the performance of the natural, engineered barrier, and total systems for meeting regulatory standards.

**Activities and
Accomplishments**

Staff provided comments on the preliminary draft of the Thermal Goals Reevaluation Report prepared by S. Saterlie of the M&O.

**WBS
1.2.3.1.2/3**

**Site Investigation Coordination and Planning/
Test Management and Integration**

Objective

The objective of this task is to manage and integrate Exploratory Studies Facility (ESF) and Los Alamos site characterization test activities and to provide coordination for Los Alamos surface-based test planning and package development.

**Activities and
Accomplishments**

Surface-based Test Coordination. Staff represented the test coordination office at weekly surface-based testing meetings.

Staff continued to support activities pertaining to the use of tracers, fluids, and materials at Yucca Mountain.

B. Carlos and A. Mitchell represented the principal investigators (PI's) at the June SOC meeting on 2 June.

ESF Testing. Staff provided multi-shift field coordination and PI support for ESF north-ramp starter tunnel tests. Staff began formal planning for Phase 3 ESF tests (Hydrochemistry, Radial Boreholes, and Hydrologic Properties of Major Faults). Staff began to revise Phase 2 ESF tests to support potential starter tunnel activities.

Construction of the ESF starter tunnel continued. Geologic mapping, consolidated sampling, and construction monitoring activities proceeded as planned; no perched water was identified this month.

Planned Activities

Continue support of the Los Alamos surface-based and ESF activities in response to the Project program directives.

Problem Areas

None

WBS 1.2.3.2.1.1.1 Mineralogy, Petrology, and Rock Chemistry of Transport Pathways

Objective

The purpose of this activity is to define the important mineralogical and geochemical variables along fracture and rock-matrix transport pathways at Yucca Mountain, in support of performance assessment and to evaluate the impact of repository construction on natural waste-transport barriers.

Activities and Accomplishments

Zeolite '93 Conference in Boise, Idaho, 21-25 June. D. Vaniman and D. Bish presented an invited paper entitled "The Importance of Zeolites in the Potential High-Level Radioactive Waste Repository at Yucca Mountain, Nevada." They evaluated the role of zeolites in waste retardation, site thermal loading, and site hydrology. Two posters were also presented: "Equilibrium Modeling of the Formation of Zeolites in Fractures at Yucca Mountain, Nevada," by S. Chipera, D. Bish, and B. Carlos and "Distribution and Chemistry of Fracture-Lining Zeolites at Yucca Mountain, Nevada" by B. Carlos, S. Chipera, and D. Bish. Chipera presented information on the use of equilibrium thermodynamic modeling to understand the present-day mineral assemblage at Yucca Mountain, particularly the zeolitic assemblages. Carlos' paper discussed the variation in mineralogy and chemistry of fracture-lining zeolites across Yucca Mountain. All authors were preparing full papers for publication in the conference proceedings.

International Congress on Applied Mineralogy in Fremantle, Australia. D. Bish gave an invited paper on the applications of advanced x-ray powder diffraction (XRD) methods to the study of natural zeolites. The Congress included one-day sessions on the health effects of minerals, advanced XRD methods, new image analysis techniques, and a variety of thermal analysis methods. Bish also gave an invited presentation on clay mineralogy at the CSIRO in Melbourne, Australia.

An additional 25 samples of drill core from UE-25 UZ-16 were received from the SMF, bringing the total number of samples from this drill core available for bulk-sample XRD analysis to 84. One final group of samples, covering the central portions of the Topopah Spring Member, is anticipated to arrive shortly to provide a complete sample suite from UZ-16 for examination of major variations in mineralogical stratigraphy. We are continuing to prepare samples for analysis.

A copy of a 23 March memorandum from W. Wilson to R. Dyer (and others) was sent to members of this task by A. Simmons of the DOE. This memorandum discussed the results of XRD experiments on cutting samples from UZ-16; these results indicated that the samples were rich in mordenite. The Wilson memorandum referred to another memorandum from M. L. Pochowski stating that the dusts contained 5-15 percent mordenite. We believe that the Wilson memorandum may be misleading with regard to mineralogy and possible adverse health effects, and because of the importance of mineral health-effects issues, we are drafting a response.

On 2-3 June at the SMF, B. Carlos examined and scraped fractures in the Tram Member of the Crater Flat Tuff in UE-25b #1h and began preliminary examination of USW UZ-14.

G. Guthrie continued to organize the Mineralogical Society of America short course on health effects of mineral dusts. The course will bring together mineralogists and health scientists to discuss issues relating to the evaluation of mineral hazards.

- Planned Activities** Work planned within the next few months includes the following activities: (1) continue to analyze calcites to understand transport and precipitation mechanisms; (2) examine drill core from USW UZ-14 as it becomes available at SMF; (3) sample UE-25 UZ-16 for studies of stratigraphic variability in bulk mineralogy; (4) continue statistical evaluation of XRD quantitative mineral analysis; (5) revise Milestone 3364, "Distribution and Chemistry of Fracture-lining Zeolites at Yucca Mountain, Nevada; and (6) prepare a LAMS report, "Field guide to fracture-lining minerals at Yucca Mountain."
- Problem Areas** None
- Milestone Progress**
- 3152
30 September 1993
Letter Report on Statistical Analysis of Chemical and Mineralogical Data
65 percent complete.
- 3352
31 March 1993
Fibrous Minerals at Yucca Mountain
Submitted to TPO on 16 April 1993; author preparing requested revisions.
- 3353
30 September 1993
Characterization of Airborne Minerals at UZ-16
40 percent complete.
- 3360
30 April 1993
Calcite Deposits in Fractures at Yucca Mountain, Nevada
Completed.
- 3364
30 September 1993
Distribution of Fracture-lining Zeolites at Yucca Mountain, Nevada
Draft completed.
- 3365
30 September 1993
Equilibrium Modeling of the Formation of Zeolites in Fractures at Yucca Mountain, Nevada
- 3369
30 September 1993
Field Guide to Fracture-lining Minerals at Yucca Mountain
25 percent complete.
- 3382
29 June 1993
The Importance of Zeolites in the Potential High-Level Waste Repository at Yucca Mountain
- 4013
30 April 1993
Preliminary Description of Fracture-lining Minerals in Drill Cores UE-25 UZ-16
Completed.

Publications

D. L. Bish

The Importance of Zeolites in a Potential High-Level Waste Repository at Yucca Mountain, Nevada

Conference abstract, *Zeolites '93*

Published.

D. Broxton

Geological Evaluation of Six Nonweleded Tuff Sites in the Vicinity of Yucca Mountain, Nevada, for a Surface-based Test Facility for the Yucca Mountain Project. (3137)

LA-series report

In press.

B. Carlos, D. Bish, S. Chipera, and S. Craven

Fracture-Lining Manganese Oxide Minerals in a Silicic Tuff

Journal article, *Chemical Geology*

Published.

B. Carlos, S. Chipera, and D. Bish

Distribution of Fracture-Lining Zeolites at Yucca Mountain, Nevada

Conference abstract, *Zeolite '93*

Published.

S. J. Chipera, D. L. Bish, and B. A. Carlos

Equilibrium Modeling of the Formation of Zeolites in Fractures at Yucca Mountain, Nevada

Conference abstract, *Zeolites '93*

Published.

G. D. Guthrie, D. L. Bish, and B. T. Mossman

Quantitative Analysis of Zeolite-Bearing Dusts Using the Rietveld Method

Journal article, *Science*

Submitted.

D. T. Vaniman, D. Bish, D. Broxton, B. Carlos, S. Chipera, and S. Levy

Mineralogy as a Factor in Radioactive Waste Transport Through Pyroclastic Rocks at Yucca Mountain, Nevada

Journal article, *Bulletin of the Geological of Society of America.*

Submitted.

D. T. Vaniman

Calcite Deposits in Drill Cores USW G-2 and USW GU-3/G-3 at Yucca Mountain, Nevada

LA-series report

In Los Alamos publication process.

D. T. Vaniman

Calcite Deposits in Fractures at Yucca Mountain, Nevada

Conference paper, *International High-Level Waste Management Conference*

Published.

WBS 1.2.3.2.1.1.2 Mineralogical and Geochemical Alteration**Objective**

The objective of this task is to characterize past and present natural alteration processes that have affected the potential geologic repository and to predict future effects of natural and repository-induced alteration.

Activities and Accomplishments

We continued to make revisions and additions to the Los Alamos-contributed portions of the "Calcite-Silica Topical Report.."

S. Levy presented a dry-run of a talk on the subject of past mineralogical alteration at Yucca Mountain as an analog to potential future repository-induced alteration. D. Bish will present this talk to the Nuclear Waste Technical Review Board on 13 July.

S. Levy met with representatives of the TCO and the ESF Consolidated Sampling Program to discuss the transmission of information about principal investigators' sampling needs to wall-mapping personnel. As a result of the meeting, the TCO sent a memo to the USBR representative, which contained the detailed input that task members had prepared for the wall mappers. We appreciate this response as evidence of the TCO's commitment to good communication on the Project.

G. WoldeGabriel and S. Bish presented invited papers at the Zeolite '93 meeting in Boise, Idaho. WoldeGabriel's paper entitled "K/Ar Dating of Clinoptilolites, Mordenite, and Associated Clays from Yucca Mountain" discussed K/Ar dating of zeolites. Bish's paper, "Thermal Behavior of Natural Zeolites," emphasized the variety of factors, both environmental and structural, that control natural zeolite stability.

Final revisions were made to a paper entitled "Pedogenesis of Siliceous Calcretes at Yucca Mountain, Nevada" (D. Vaniman et al.) This paper will be published in the journal *Geoderma*.

We provided three spring-related calcite samples from the NTS area in Nevada, and from California, to D. Norman of New Mexico Institute of Mining and Technology for fluid-inclusion gas analysis by quadrupole mass spectrometry. Norman will develop a methodology appropriate for analyzing Yucca Mountain samples.

Planned Activities

We will be conducting more work related to reformulation of SCP thermal goals and revisions to "Calcite-Silica Topical Report." Next month, we will hold discussions with the M&O on Los Alamos research supporting the thermal goals reformulation. Sample collection from the starter tunnel will continue on a periodic basis.

The steam-heating experiments will continue, and these samples will be examined for mineralogical changes on a periodic basis. Chemical and mineralogical characterization of samples of bedrock breccias and hydrothermal deposits exposed at the surface will continue, as will calcite-silica laminated deposit studies. Studies are proceeding on the evolution of water from zeolitic tuffs based on the development of characteristic Temperature-pH₂O curves for clinoptilolite and mordenite, the zeolites of importance at Yucca Mountain. These studies will be guided by W. Carey, a Los Alamos postdoctoral researcher.

D. Bish will present information on potential repository hydrothermal effects to the Nuclear Waste Technical Review Board next month in Denver.

Problem Areas

None

Milestone Progress

3138
30 September 1993
Chemical Transport in Zeolitic Alteration
Research 60 percent complete; postponed because TPO redirected efforts to Milestone 3381 to support Focus '93 meeting.

3141
30 September 1992
Pedogenesis of Siliceous Calcretes at Yucca Mountain, Nevada
Completed.

3142
31 January 1993
K/Ar Dating of Clays and Zeolites
Completed.

3150
30 July 1993
Final Report on Bedrock
Research 60 percent complete.

3343
30 September 1993
Zeolite Dating
Submitted to TPO on 16 June 1993.

3361
30 September 1993
Thermal Behavior of Natural Zeolites

3381
30 September 1993
Natural Alteration in Topopah Spring Tuff as an Analog to Waste-Repository Hydrothermal Regime

4012
30 September 1993
Chemical Alteration of Calico Hills Tuff during Zeolitization
(letter report, input to Milestone 3378, due 30 June 1994)

Publications

D. L. Bish and D. T. Vaniman
Thermal Behavior of Natural Zeolites
Conference abstract, *Zeolites '93*
Published.

D. Bish and J. Aronson
Paleothermal and Paleohydrologic Conditions in Silicic Tuff from Yucca Mountain, Nevada
Journal article, *Clay and Clay Minerals*
Submitted.

S. Levy
Surface-discharging hydrothermal systems at Yucca Mountain -- examining the evidence
(3341)
Proceedings paper, *Materials Research Society Fall Meeting*
Published.

S. Levy and C. Naeser
Bedrock Breccias Along Fault Zones near Yucca Mountain, Nevada
Chapter in USGS Bulletin on Yucca Mountain studies
In USGS editorial review.

D. Vaniman, D. Bish, and S. Chipera
Dehydration and Rehydration of a Tuff Vitrophyre
Journal article, *Journal of Geophysical Research* (3143)
Approved by YMPO.

D. Vaniman, S. Chipera, and D. Bish
Pedogenesis of Siliceous Calcretes at Yucca Mountain, Nevada (3141)
Journal article, *Geoderma*
Accepted for publication.

G. WoldeGabriel et al.
Preliminary Assessment of Clinoptilolite K-Ar Results from Yucca Mountain, Nevada
Los Alamos report
Submitted to YMPO.

WBS 1.2.3.2.1.2 Stability of Minerals and Glasses

Objective

The objective of this activity is to produce a model for past and future mineral alteration in Yucca Mountain. The model is intended to explain the natural mineral evolution resulting from the transformation of metastable mineral assemblages to more stable assemblages and the effects of a repository emplacement.

Activities and Accomplishments

Final preparations were made for letting of research contracts for studies of the kinetics and thermodynamics of mineral alteration at Yucca Mountain to Pennsylvania State and Yale Universities.

WBS 1.2.3.2.5**Postclosure Tectonics****Objective**

The objective of these volcanism studies is to determine the hazards of future volcanic activities with respect to siting a high-level radioactive waste repository at Yucca Mountain.

Activities and Accomplishments

We are wrapping up field studies at Lathrop Wells volcanic center so that a final geologic map of the center may be prepared.

Two field sessions were conducted. In the first, the thickness and clast-size distribution of the scoria-fall sheet formed during eruptions of the main cone were measured. In the second, revised contacts of the Q_{s6}/Q_{l6} unit were mapped on aerial photographs. In the third session, we studied the distribution of ash in alluvial deposits several km from the main center and found clear evidence of two distinct tephra units separated by colluvium, with contrasting stages of pedogenic alteration and soil development. These outcrops provide the most convincing evidence to date that the Lathrop Wells volcanic center is a polycyclic volcanic (formed in multiple-time separate eruptive events). Field studies were coordinated with trench studies by the USGS along the Stagecoach fault. We believe that the evidence from both studies is conclusive, and that there were multiple time-separate eruptions at the Lathrop Wells volcanic center.

A task member made a presentation on the application of geophysical methods to Volcanism studies at the Geophysical Technical Exchange with the NRC. Several task members also made presentations and participated in open forums.

This task was the subject of an internal audit this month. All identified deficiencies were corrected during the audit.

Work in progress. Field studies of the distribution of lithic fragments in basaltic tephra at the Alkali Butte and Grants Ridge site in New Mexico were begun.

Final revisions were completed on Section 1 of the "Volcanism Status Report."

Planned Activities

Volcanism task members and staff from the USGS will study the occurrence of basaltic ash in trenches along the Stagecoach fault.

Task members and staff from Golder Associates will study the effects modeling of volcanic releases associated with direct disruption of the repository and controlled area.

Problem Areas

We are concerned because we have not received results of XRF sample analyses for samples submitted early in FY 1992.

Milestone Progress

3075

30 September 1993

Preliminary Geologic Mapping of Volcanic Centers

On schedule.

3129

30 September 1993

Geochemistry of Lathrop Wells (part of 3252)

May be delayed because we have not been able to obtain XRF data.

3252

30 September 1993

Volcanism Status Report

First draft in technical review.

June 1993

Publications

B. M. Crowe et al.
Volcanism Status Report
First draft in technical review.

WBS 1.2.3.2.8.1 Rock-Varnish Dating Support for USGS Neotectonic Studies

Objective	This activity will provide rock-varnish dating support in various areas of surface site characterization activities including erosion, neotectonics, and paleoclimate.
Activities and Accomplishments	Field activities were carried out along the Windy Wash and Solitario Canyon faults. Staff began mapping to determine the extent and character of the scarps and their associated geomorphic features, which might have contributed to their development. Sites were identified along both faults to test the cosmogenic dating techniques and to acquire the surface-exposure ages of the scarps.
Planned Activities	Continue mapping geomorphic features associated with the scarps, which will yield information about the processes and the time of their formation. Continue our scoping study to ascertain the usefulness of cosmogenic dating in determining the age of these scarps.
Problem Areas	None
Milestone Progress	None
Publications	S. Reneau <i>Manganese Accumulation in Rock Varnish in a Desert Piedmont, Mojave Desert, California, and Application to Evaluating Varnish Development</i> Journal article, <i>Quaternary Research</i> Anticipated publication date, September 1993.

WBS 1.2.3.3.1.2.2 Water-Movement Tracer Tests

Objective	The objective of the water-movement tracer tests is to obtain measurements of chlorine isotope distributions to help quantify the percolation of precipitation in the unsaturated zone.
Activities and Accomplishments	<p>Ten samples from UZ-16 were submitted to Purdue University for analysis of ^{36}Cl. Because of budget constraints, any additional precipitates prepared for analysis during FY93 will be archived until FY94, unless the issue to be resolved is particularly pressing.</p> <p>Chloride and bromide were analyzed in a suite of soil samples collected from Test Cell C, as a preliminary step in assessing the feasibility of this operation as a source for the high ^{36}Cl levels observed in cuttings from N-55.</p> <p>J. Fabryka-Martin participated in a field trip to the north-ramp starter tunnel to evaluate the effectiveness of the sampling program with respect to collection of tunnel rock samples for this activity. She also met with the starter tunnel wall mappers to discuss sampling needs for the ^{36}Cl work.</p> <p>The SOC approved our request for collection of ream-bit cuttings from UZ-14 (an amendment to the previously approved request) and SRG-5, as well as a request for transfer of N-55 core from A. Flint.</p>
Planned Activities	Revise existing DPs; prepare new DPs; process soil samples for Cl/Br and chlorine- ^{36}Cl ratios; process cuttings samples from UZ-16 and neutron-access boreholes; participate in planning activities for sample collection from ESF; collect additional soil samples from Yucca Mountain area as opportunities arise.
Problem Areas	None
Milestone Progress	<p>3191 <i>Procedure for Chlorine-36 Analysis of Unsaturated Zone Samples</i> 30 September 1992 Completed</p> <p>3362 <i>Summary of Cl-36 Work</i> 30 September 1993 On schedule.</p>
Publications	Summary of Cl-36 work submitted to Focus '93.

WBS 1.2.3.3.1.2.5 Diffusion Tests in the ESF

Objective The objective of this task is to determine *in situ* the extent to which the nonsorbing tracers diffuse into the water-filled pores of the Topopah Spring welded unit.

Activities and Accomplishments This task has been deferred because of lack of funding.

WBS 1.2.3.3.1.3.1 Site Saturated Zone Ground-Water Flow System (Reactive Tracer Testing)

Objective Experiments will be conducted at the C-Well complex (holes UE-25c #1, UE-25c #2, and UE-25c #3) and other wells in the vicinity of Yucca Mountain using reactive tracers to characterize retardation and transport properties at a larger scale than currently used in laboratory experiments.

Activities and Accomplishments Software QA. B. Robinson continued to serve as CCB Chair and Z. Dash continued to serve as a member of the CCB. A draft of the FEHMN SRS was in review.

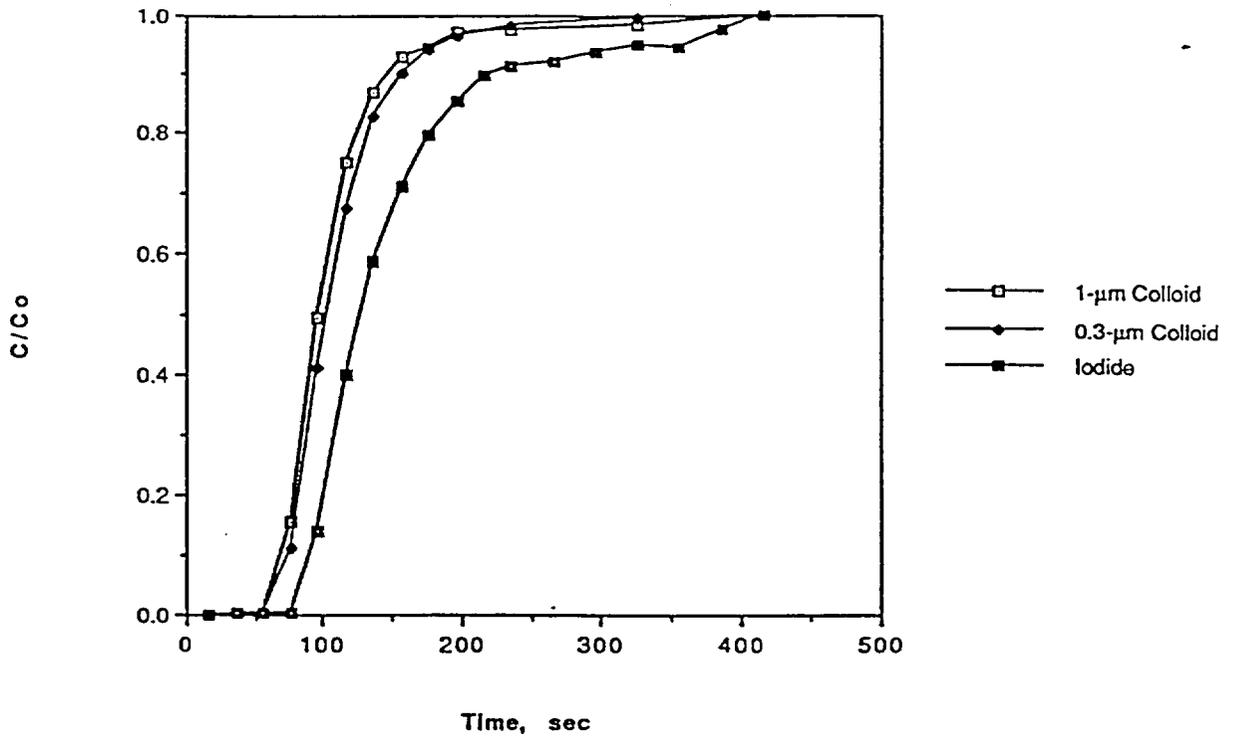
Lithium column sorption experiments. We are fine-tuning the ion chromatograph, which will be used to measure bromide and lithium ion concentrations.

Colloid transport. In preparation for experiments on fractures in C-Wells core, we performed transport experiments using two sizes of modified carboxylate polystyrene microspheres (0.3- and 1- μm diameter) and an iodide ion (a dissolved, conservative tracer); the tracers were injected simultaneously into a Bandelier tuff fracture specimen. The fracture dimensions were approximately 10 cm x 11 cm, with an average hydraulic aperture of 25 μm . The flow rate of 4.47 microliters/s of filtered J-13 water was established using a gravity drive. The tracers were injected as a step change in concentration in the inlet fluid, and the concentration versus time was measured in the outlet stream. After all outlet tracer concentrations had reached their injection values, a negative step-change experiment was run: we injected J-13 water without tracer and monitored the subsequent flushing of tracers from the fracture. The iodide concentrations were measured using an ion-specific electrode, and the microspheres were counted using flow cytometry.

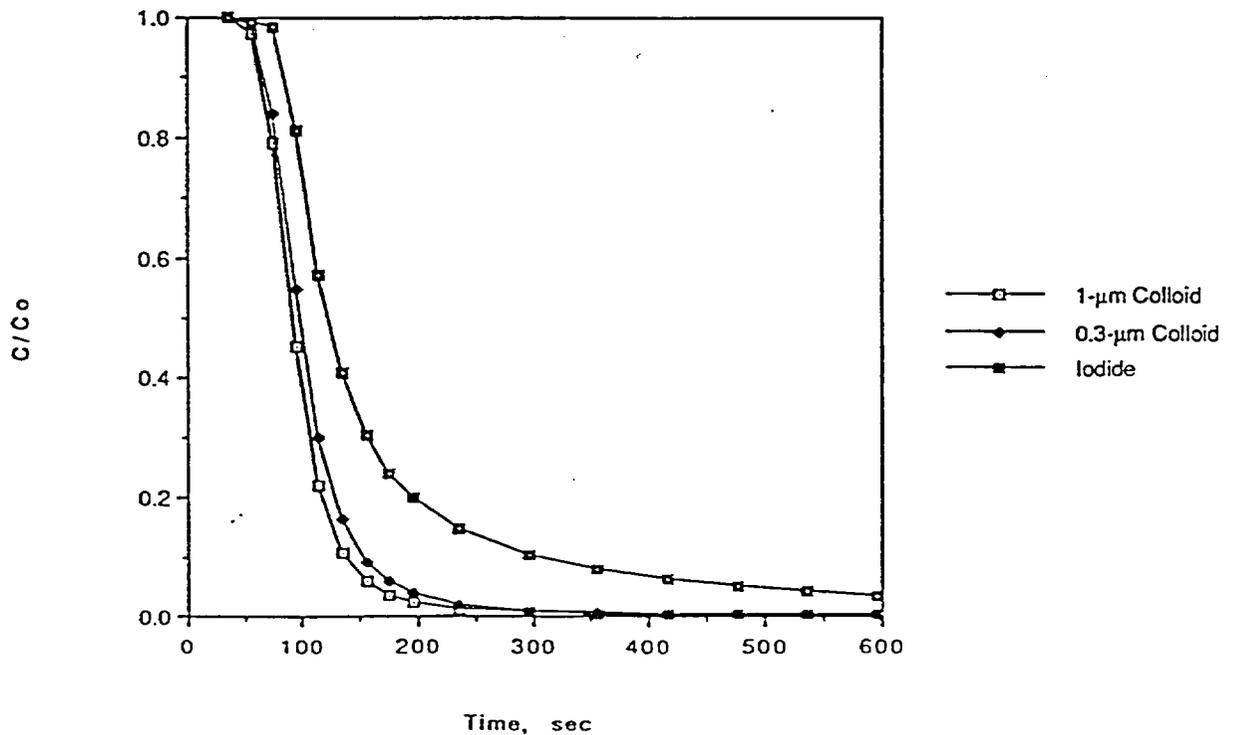
Figure 1 indicates the breakthrough curves for tracers for the injection phase; Figure 2 indicates the results of the tracer washout portion of the test. The microspheres clearly exhibit an earlier breakthrough and a more rapid rise to their injection values than does the dissolved iodide tracer. We believe the increased tailing of iodide, especially noticeable during the washout phase, is caused by matrix diffusion. The microspheres possess very low diffusion coefficients and hence travel only through the fracture, whereas the dissolved species also diffuses into the rock matrix. The earlier breakthrough of the microspheres may be caused by a combination of size exclusion (particles cannot fit into the smallest aperture sections of the fracture), a lack of matrix diffusion, and a tendency for microspheres to not diffuse out of high-velocity stream lines in the center of the fracture. Modeling will be directed toward assessing the relative importance of these phenomena. There also seems to be a reproducible difference in the breakthrough curves of the two microspheres (which differ only in size); the 1- μm particles transported slightly more rapidly through the fracture.

This experiment was also a laboratory-scale assessment of the feasibility of using microsphere tracers in the field. These microspheres transport readily through this fracture, as evidenced by the early and complete breakthrough of the spheres. A mass balance of all three tracers for the step and washout phases of the test indicated a nearly identical recovery of each, with a calculated fractional recovery of 102 percent. We believe the slight overestimate of recovery is caused by a small error in the flow rate measurement, since each tracer exhibited virtually the same recovery value; consequently, these experiments indicate that this type of microsphere is an excellent candidate for field tests. It was selected because of its negatively charged surface and hydrophilic character, both of which in theory would facilitate transport. Although this theory appears to have held up in this experiment, additional transport tests with microspheres of different surface charges and hydrophilicities are planned to substantiate the theory and further our understanding of these phenomena.

Normalized Breakthrough Curves for Step Up
6/29/93



Normalized Breakthrough Curves for Step Down
6/29/93



June 1993

Planned Activities Contribute to the SQA effort by serving as CCB Chair (B. Robinson).

Address review comments on the FEHMN SRS. Continue modeling studies using FEHMN to support the design of field tests.

Complete documentation of batch sorption experiments with lithium bromide. Begin lithium column sorption experiments.

Set up colloid transport fracture experiments using our new injection pump and automatic sample collector. These improvements us to establish a steadier flow field and collect more samples so we can more accurately measure the tail of the breakthrough curve.

Problem Areas None

Milestone Progress 3188
31 March 1993
Documentation for SORBEQ
Submitted to TPO.

3194
30 September 1992
Batch Sorption Experiments with Lithium
Rescheduled to September 1993 because of personnel reassignment.

T112
22 June 1992
Final Documentation for FEHM
Rescheduled to June 1993 because of personnel reassignment.

3196
27 July 1992
FRACNET Documentation
Rescheduled to August 1993 because of personnel reassignment.

3201
Preliminary Modeling Using FEHM
Completed.

3367
30 April 1993
Aperture Characteristics, Saturated Fluid Flow, and Tracer Transport Calculations for a Natural Fracture
Completed.

Publications

B. A. Robinson
FRACNET—Fracture Network Model for Water Flow and Solute Transport (3196)
LA-series report
In preparation.

B. A. Robinson
SORBEQ—A One-Dimensional Model for Simulating Column Transport Experiments (3188)
LA-series report
Submitted to TPO.

B. A. Robinson
A Strategy for Validating a Conceptual Model for Radionuclide Migration in the Saturated Zone Beneath Yucca Mountain (3201)
Journal article, *Radioactive Waste Management and the Nuclear Fuel Cycle - Special issue on the Yucca Mountain Project*
Submitted to YMPO.

W. L. Polzer and E. H. Essington
The Use of Selectivity Coefficients to Estimate Modified Langmuir Isotherm Parameters as a Function of Experimental Conditions
Journal article, *Radioactive Waste Management and the Nuclear Fuel Cycle - Special issue on the Yucca Mountain Project*
Submitted to YMPO.

P. Reimus, R. Glass, and B. Robinson
Aperture Characteristics, Saturated Fluid Flow, and Tracer Transport Calculations for a Natural Fracture (3367)
Conference paper, *1993 High-Level Radioactive Waste Management Conference*
Published.

WBS 1.2.3.4.1.1 Ground-Water Chemistry Model

Objective The goal of this investigation is to provide conceptual and mathematical models of the ground-water chemistry at Yucca Mountain. These models will explain the present ground-water composition in relation to interactions of minerals and ground-water and will be used to predict ground-water compositions as a result of anticipated and unanticipated environments.

Activities and Accomplishments **Study Plan.** Staff continued to address reviewers' comments on the Ground-Water Chemistry Model Study Plan, R0. The revision is due on 30 September 1993.

Other Activities. Modeling of different radionuclides using compositions of ground-waters from Yucca Mountain continued. M. Ebinger attended the Radionuclide Integration Group meeting in Las Vegas on 15 June and presented results of modeling activities. Preliminary results of Np solubility modeling showed that the NpO_2^+ species is prevalent in J-13 water (low carbonate) and UE-25p #1 water (high carbonate) and that carbonate complexes become prevalent only in water from UE-25p #1. NpSO_4^- was also predicted from the modeling, but no NpSO_4^- was measured in solubility experiments. Modeling in support of the "most active ground-water" model will be completed by 31 August.

Modeling of pH and Eh stability continued. Tuffaceous and carbonate waters at Yucca Mountain appear well buffered by bicarbonate or carbonate, and the Eh is well poised within oxidizing conditions.

Planned Activities Continue resolution of comments and revision of the study plan.

Complete letter report on "most active ground-water."

We will continue to discuss water chemistry, stable isotope constraints on water composition, and the ground-water chemistry model. Possible analogs related to reaction paths of water in the Los Alamos are currently being considered as test cases for modeling that will be conducted at Yucca Mountain.

Problem Areas None

Milestone Progress 3415
30 September 1993
Letter report on Most-Active Ground-water Chemistry
(input to Milestone 3349 [Dynamic Transport])

Publications None

WBS 1.2.3.4.1.2.1 Batch Sorption Studies

Objective

The objective of this task is to provide sorption coefficients for elements of interest to predict radionuclide movements from the repository to the accessible environment.

Activities and Accomplishments

We continued to measure sorption of Np onto tuffs and pure minerals (in the size range of 75 to 500 μm) as a function of Np concentration, ground-water composition, and temperature. We pretreated the solid phases in ground-water (J-13 or UE-25p #1) in the ratio of 1 g of solid to 20 ml of solution, used centrifugation to separate the solid phases from the ground-water, and equilibrated these solids with 20 ml of Np solution in ground-water (J-13 or UE-25p #1). Following sorption, the phases were separated again using centrifugation and we determined the quantity of ^{237}Np in each phase using liquid scintillation counting. The liquid scintillation counting technique used is capable of discriminating alpha from beta activity; consequently, no interference from the ^{237}Np daughter (^{233}Pa) was expected. The experimental results may be seen in Table I.

Table I. Np Sorption onto Yucca Mountain Tuffs

TUFF	<u>J-13 Water</u>			<u>UE-25p #1 Water</u>		
	Trial 1	Trial 2	Average	Trial 1	Trial 2	Average
G1 - 732	0.6	0.4		0.7	0.7	7E-01
G1 - 1405	1.6	1.7	2E+00	0.6	0.5	6E-01
G1 - 1936	0.9	0.9	9E-01	1.3	1.4	1E+00
GU3 - 747	0.4	0.5	4E-01	0.5	0.4	5E-01
GU3 - 1249	0.1	1.1		0.3	0.4	4E-01
GU3 - 1394	0.2			0.2	0.3	2E-01
GU3 - 1407	0.4	0.3	3E-01	0.5	1.3	
GU3 - 1555	0.9	0.8	9E-01	1.6	1.7	2E+00
GU3 - 2325	0.3	0.3	3E-01	0.7	0.6	7E-01
G2 - 767	0.1			0.4	0.5	4E-01
G4 - 270	0.1	0.6		0.0	0.0	
G4 - 1506	1.9	2.2	2E+00	0.3	0.2	2E-01
G4 - 1529	0.5	1.0		0.5	0.8	
G4 - 1625	1.7	1.3	1E+00	1.2	0.6	
G4 - 1772	1.5	1.8	2E+00	0.7	0.6	7E-01
G4 - 2077	0.7	0.7	7E-01	0.8	0.8	8E-01
G4 - 2570	0.5	0.7	6E-01	0.7	0.7	7E-01

Data scatter for the two trials is caused by low sorption-distribution coefficients, which are difficult to measure using the difference method (counting an aliquot of the solution phase before and after sorption). The average for the Np sorption onto tuff is only given for those tuff samples where at least one figure in the K_d is significant. Next month we will reduce the uncertainty in these results by performing an additional two trials with each tuff.

The results seen in Table I seem to indicate that Np sorption onto tuff is relatively independent of the mineralogy of the tuff samples. All the determined sorption coefficients greater than 1 ml/g appear to be associated with tuff samples having a high zeolite and/or alkali feldspar content. No obvious correlation seems to exist between the sorption distribution coefficients and the iron oxide content of those tuffs that are likely to contain hematite.

Planned Activities	Continue work in all areas discussed above.
Problem Areas	None
Milestone Progress	3009 30 April 1993 <i>Dependence of Radionuclide Sorption on Sample Grinding, Surface Area, and Water Composition</i> Completed.
	3218 30 September 1993 <i>Effects of Water-Rock Ratios on Sorption Coefficients</i> On schedule.
	3345 30 June 1993 <i>Neptunium Sorption onto Feldspar</i> In internal technical review.
	3346 30 September 1993 <i>Sorption as a Function of Temperature</i> On schedule.
Publications	P. S. Z. Rogers and A. Meijer <i>Dependence of Radionuclide Sorption on Sample Grinding, Surface Area, and Water Composition (3009)</i> Conference paper, 1993 International High-Level Waste Management Conference Published.

WBS 1.2.3.4.1.2.3 Sorption Models

Objective	The objective of this task is to provide sorption models for elements of interest to predict radionuclide movements from the repository to the accessible environment.
Activities and Accomplishments	<p>M. Hawley performed the QA-required biannual calibration of the atomic force microscope (AFM), which includes calibrating the piezo electric scanners using a freshly cleaved muscovite sample as a standard. She obtained atomic resolution images and measured and compared the distance between nearest neighbors and next nearest neighbors to the expected values. Particular care was taken to optimize the quality of the atomic resolution images on mica using a new Si₃N₄ tip on a 100 mm triangular cantilever.</p> <p>Our previous work on goethite crystal #9 indicated that it exhibits a variety of surface features; these features were successfully relocated, and they were imaged again with new Si₃N₄ tip. However, the new images did not meet our standards, and we will probably use the older tip type in the future.</p> <p>M. Hawley completed preparation for experiments to be conducted next month in which goethite crystal #9 will be imaged in two ways: (1) under water and (2) while undergoing reaction with HCl, which we hope will provide a "cleaner" goethite surface, one that is at least free of a carbonate surface layer.</p>
Planned Activities	<p>Surfaces such as that of goethite crystal #9 will be reacted with various sorbers, and we will attempt to image the location and relative coverage of the adsorbed species.</p> <p>We plan to characterize examine the surfaces of hematite crystals separated from Topopah Spring tuff using AFM as soon as the complicated sample separation by the Min/Pet staff is complete. We will examine the surfaces for the presence of natural surface coatings</p>
Problem Areas	None
Milestone Progress	<p>3347 30 September 1993 <i>AFM Analysis of Hematite and Goethite</i> On schedule.</p>
Publications	None

WBS 1.2.3.4.1.2.2 Biological Sorption and Transport

Objective	The purpose of this research is to determine whether microbial activity can influence the movement of plutonium in tuff. Because fluids are used extensively in the exploration of locations for a nuclear repository, those micro-organisms capable of utilizing drilling fluids as growth substrates are of special interest.
Activities and Accomplishments	We began work on a series of three experiments to determine the mechanism(s) used by microorganisms to promote mineral dissolution. We are measuring (1) ligand-promoted dissolution using oxalate, ascorbate, desferal, and siderophores obtained from 11c; (2) changes in redox potential when microorganisms are growing with minerals as the sole source of iron; and (3) the kinetics of iron reduction when iron is the sole electron acceptor for microbial metabolism.
Planned Activities	Continue dissolution experiments.
Problem Areas	None
Milestone Progress	<p>3080 30 September 1992 <i>Report on Chelation</i>; Retitled <i>Preliminary Evidence of a Siderphore Plutonium Complex</i> Completed; approved by YMPO on 18 April 1991.</p> <p>3092 30 September 1992 <i>Report on Colloidal Agglomeration</i> Draft completed. Milestone completion delayed until TPO decides on suitable publication vehicle. (Probably will be published as an LAMS report.)</p> <p>3176 30 September 1992 <i>Procedure for Determination of Formation Constants</i> Completed; submitted to QA Project Leader 26 February 1993. (Does not require DOE review.)</p> <p>3177 30 September 1992 <i>Procedure for Determination of Effects on Colloidal Agglomeration</i> Completed; submitted to QA Project Leader. (Does not require DOE review.)</p>
Publications	<p>L. E. Hersman, P. D. Palmer, and D. E. Hobart <i>Preliminary Evidence of a Siderphore Plutonium Complex</i> Conference proceedings, <i>Proceedings of the Fall Meeting of the Materials Research Society</i> Published.</p> <p>L. E. Hersman <i>Report on Colloidal Agglomeration</i> LA-series report. In preparation.</p>

WBS 1.2.3.4.1.3 Radionuclide Retardation by Precipitation Processes

Objective

The objective of the solubility determination task is to determine the solubilities and speciation of important waste elements under conditions characteristic of the repository and along flow paths from the repository into the accessible environment.

Activities and Accomplishments

Study plan. Changes to the study plan were being made to reflect reviewers' comments.

Solubility. D. Clark, D. Morris, H. Nitsche, and D. Tait participated in the second meeting of the YMP Radionuclide Solubility Working Group on 16 June in Las Vegas. R. Silva and J. Johnson of LLNL, M. Ebinger of the Los Alamos Ground-water Chemistry Model task, and A. Simmons of DOE/YMPO also participated. The meeting was an unqualified success and a number of important action items and champions were identified; the final report will be issued in July. The next meeting is tentatively scheduled for January 1994.

We prepared three solutions for a new series of experiments at 25°C in 0.1 M NaClO₄ (i.e., the neutral electrolyte experiments). The pH values, which have fluctuated with time, are being adjusted with CO₂/O₂-free HClO₄ and/or NaOH solutions to return them to their target values. This procedure is important because we cannot begin the actual solubility experiments until these solutions demonstrate pH stability near their target values.

We used absorption spectroscopy to determine the speciation of Np in an undersaturation experiment in UE-25p #1 water at 60°C and pH 6; the spectrum deconvoluted into two peaks. We also determined that this equilibrium solution contained 88.6 ± 5.8 percent NpO₂⁺ and 11.4 ± 6.3 percent neptunium carbonate complex.

We were comparing the Np solid phases isolated from the oversaturation and undersaturation experiments in UE-25p #1 water. Of the three solids isolated from the undersaturation experiments, only that at pH 7 gave a solid that produced an XRD pattern in agreement with its respective pattern from the oversaturation experiment. The powder patterns of the pH 6 and 8.5 solids from the undersaturation experiments were somewhat different than those obtained for the respective solids in the oversaturation experiments. Although the fine structure of these powder patterns (the trace and weak lines with d-spacings smaller than 3 Å) agreed quite well with many of the published ternary sodium neptunium carbonate powder patterns, the strong lines observed in the powder patterns from the experimental undersaturation solid did not match these published patterns. One of the main contributors to these strong lines appears to be hydrate water. We believe it is probable that the solids are in fact ternary sodium neptunyl carbonates with varying hydrate stoichiometry.

Speciation. Speciation studies of the Np(V) carbonate system using conventional absorption spectrophotometry continued. A recent spectrophotometer upgrade has improved our ability to null the strongly temperature-dependent background absorbance caused by water, and the sensitivity of the instrument for future Np(V) studies should be increased.

This month began a stability constant study for Np(V) and Np(VI) using C-13 and O-17 NMR. New stock solutions of oxidation state pure Np(V) and Np(VI) were prepared and characterized, and preliminary modeling of the Np solution was carried out to estimate a pH range. C-13 NMR samples were prepared for pH 9.5 - 6.0 in sealed, double-contained NMR tubes and allowed to come to equilibrium before NMR measurement (at 0 and 23°C). Our results indicate that the trimeric Np(VI) species predominates at near-neutral pH, and the data are consistent with the structure proposed for the uranium analog. We have prepared a new stock solution and will repeat the carbon experiment in early July.

Oxidation-state pure ultra high purity Np(V) was prepared and shipped to the sorption task for EXAFS experiments.

Planned Activities Efforts in all above mentioned areas will continue.

Problem Areas None

Milestone Progress 3031
30 October 1992
Actinide(IV) and Actinide(VI) Carbonate Speciation Studies by NMR and PAS Spectroscopies
Submitted to TPO on 2/12/93; final revisions requested by TPO were made and milestone was resubmitted for policy review..

3329
30 September 1992
Measured Solubilities and Speciations from Oversaturation Experiments of Neptunium, Plutonium, and Americium in UE-25p #1 Well Water from the Yucca Mountain Region
Technical review completed; reviewer comments returned to LBL.

3330
30 January 1993
Evaluation of Alternative Detection Schemes in Photoacoustic Spectroscopy
Completed.

3344
30 September 1993
Report on Comparison of Solubilities of Np, Am, and Pu Between J-13 and UE-25p #1 Waters
On schedule.

3350
30 September 1993
PAS Analysis of Pu(IV) Carbonate Systems
On schedule.

3351
30 September 1993
NMR Analysis of Np(V) and Pu(IV) Carbonate Systems
On schedule.

3363
30 April 1993
Radionuclide Solubility and Speciation Studies for the Yucca Mountain Site Characterization Project
Completed.

Publications

D. L. Clark, D. E. Hobart, P. D. Palmer, J. C. Sullivan, and B. E. Stout
Carbon-13 NMR Characterization of Plutonyl(VI) Aqueous Carbonate Complexes
Journal article, *Journal of the American Chemical Society*
In preparation.

D. L. Clark, C. D. Tait, D. E. Morris, D. E. Hobart, S. A. Ekberg, and P. D. Palmer
Actinide(IV) and Actinide(VI) Carbonate Speciation Studies by NMR and PAS Spectroscopies (3031)
LA-series report
In Los Alamos YMP review process.

D. L. Clark, J. G. Watkin, D. E. Morris, and J. M. Berg
Molecular Models for Actinide Speciation
LA-series report
In preparation.

H. Nitsche et al.
Radionuclide Solubility and Speciation Studies for the Yucca Mountain Site Characterization Project
Conference paper, *1993 International High-Level Waste Management Conference* (3363)
Published.

H. Nitsche, R. C. Gatti, E. M. Standifer, S. C. Lee A. Miller, T. Prussin, R. S. Deinhammer, H. Maurer, K. Becraft, S. Leung, and S. A. Carpenter
Measured Solubilities and Speciations of Neptunium, Plutonium, and Americium in a Typical Ground-water (J-13) from the Yucca Mountain Region (3010)
LA-series report (LA 12562 MS)
Published.

C. D. Tait, D. E. Morris, J. M. Berg and W. H. Woodruff
Evaluation of Alternative Detection Schemes in Photoacoustic Spectroscopy
Journal article, *Analytical Chemistry or Reviews of Scientific Instrumentation* (3330)
Approved.

C. D. Tait, S. A. Ekberg, P. D. Palmer, and D. E. Morris
Plutonium (IV) Carbonate Speciation Changes (3350)
Journal article, *Inorganic Chemistry*
In internal review.

WBS 1.2.3.4.1.4 Radionuclide Retardation by Dispersive, Diffusive, and Advective Processes

Objective

The objectives of this task are to determine the rate of radionuclide movement along the potential flow paths to the accessible environment and to examine the effect of diffusion, adsorption, dispersion, anion exclusion, sorption kinetics, and colloid movements in the flow geometries and hydrologic conditions expected to exist along the flow path to the accessible environment in the scenarios used for performance assessment.

Activities and Accomplishments

Colloid Strategy. This month we began to address the issues delineated in our Colloid Strategy (Los Alamos Monthly Activity Report, May 1993). A. Wistrom, a post-doctoral researcher, will contribute to this effort. In an effort to ascertain if potential colloids at Yucca Mountain are stable, we will conduct a series of laboratory experiments to determine the stability of anthropogenic colloids in synthetic ground-waters under various water-chemistry and temperature conditions. Based on the results of these experiments, we will determine the aggregation efficiency for potential colloids (such as silica and clay colloids) in these synthetic waters, which are representative of the ground-waters at Yucca Mountain. We will characterize the washed silica particles in a CaCl₂ solution and observe the formation of larger colloids that result from agglomeration.

Experimental set-up. We obtained well-defined amorphous silica (SiO₂) particles measuring between 50 and 80 nm in diameter (Snowtex YL, manufactured by Nissan Chemical Industries, Ltd.). Initially, the silica particles were carefully washed to obtain a stock solution of uniform chemical composition. Following this, approximately 70 grams of the silica particles were suspended in ultra-pure water (Milli-Q) and centrifuged at 13,000 rpm for 60 minutes. Following centrifugation, the supernatant was discarded, and the washing process was repeated until the electrical conductivity of the supernatant was less than 37 μS/cm for three consecutive washings (Fig. 1).

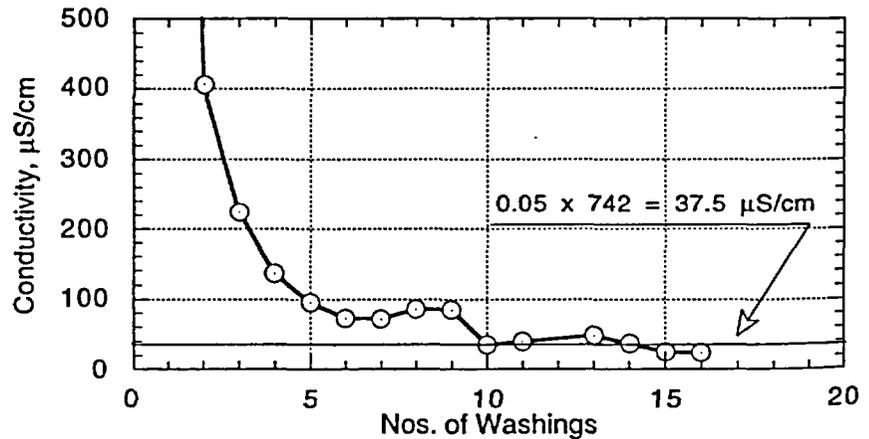


Fig. 1. Electrical conductivity of the supernatant after centrifugation when washing Snowtex YL particles in Milli-Q water.

The level of conductivity described in Fig. 1 corresponds to 5 percent of the estimated electrical conductivity of the synthetic ground-waters proposed for future aggregation experiments. (The contribution of ions from the stock silica particle solution to the actual experimental suspensions will be at least one order of magnitude smaller because of dilution.)

Our future plans for design and analysis of the aggregation experiments to study colloid stability are based on the population balance model, Equation 1.

$$\frac{\partial n_i}{\partial t} + \nabla \cdot (\vec{v} n_i) - \nabla \cdot (D_b \nabla \cdot n_i) + \sum_{j=1}^m \frac{\partial (v_j n_j)}{\partial \xi_j} + D_i - B_i = 0 \quad (1)$$

where:

n_i = number density of colloid type 'i'

ξ_j = property axis (e.g. size)

$$v_{ij} = \frac{d\xi_i}{dt} =$$

D_b = Brownian motion diffusion coefficient

B_i = particle birth function

D_i = particle death function

The birth function, which introduces new particles (created by aggregation as a function of time) in larger size classes will be modeled using the Smoluchowski (1917) equation, Equation (2). Transport by Brownian motion will be described by Equation (3).

$$\frac{\partial n_i}{\partial t} + \nabla \cdot (\vec{v} n_i) - \nabla \cdot (D_b \nabla \cdot n_i) + \sum_{j=1}^m \frac{\partial (v_j n_j)}{\partial \xi_j} + D_i - B_i = 0 \quad (2)$$

where:

$$\frac{\partial n_k}{\partial t} = \text{net generation of particles of size } k$$

β = transport mechanism

α = aggregation efficiency

$$\beta(v_i, v_j) = \frac{2k_b T}{3\mu} \left(\frac{1}{d_i} + \frac{1}{d_j} \right) (d_i + d_j) \quad (3)$$

where:

k_b = Boltzman's constant

T = absolute temperature

μ = viscosity of medium

d_i, d_j = diameter of particles i and j

Planned Activities

Work in all the above mentioned areas will continue.

Problem Areas

None

Milestone Progress

3040

30 January 1993

Kinetics of Sorption on Columns of Pure Minerals
Completed.

3044

30 October 1993

Measurement of Unsaturated Hydraulic Conductivity in Yucca Mountain Tuff
(Completed as Level IV Milestone in 1992; TPO requested that it be published; a TIP review was completed and the TIP was submitted to YMPO.)
Completed.

3212

Far-Field Transport of Carbon Dioxide: Retardation Mechanisms and Possible Validation Experiments
Completed.

3065

Techniques to Study Diffusion in Saturated Tuffs
30 October 1992
Completed.

3348

30 September 1993

Colloid Workshop Report

3349

30 September 1993

Summary Report on Np Transport through Yucca Mountain Tuffs
On schedule.

Publications

J. Conca

Measurement of Unsaturated Hydraulic Conductivity in Yucca Mountain Tuff (3044)
Conference paper, *Focus '93 Site Characterization and Validation*
Submitted to YMPO.

A. Meijer

Far-Field Transport of Carbon Dioxide: Retardation Mechanisms and Possible Validation Experiments
Conference paper, *Focus '93 Site Characterization and Validation*
Submitted to YMPO.

I. R. Triay, K. H. Birdsell, A. J. Mitchell, and M. A. Ott

Diffusion of Sorbing and Nonsorbing Radionuclides in Tuff (3065)
Conference paper, *1993 International High-Level Waste Management Conference*
Published.

I. R. Triay, M. A. Ott, A. J. Mitchell, and C. M. Overly

Transport of Np through Yucca Mountain Tuffs
Conference paper, *Proceedings of the fall meeting of the Materials Research Society, November 30 - December 4, 1992*.
Published.

I. R. Triay, B. A. Robinson, R. M. Lopez, A. J. Mitchell, and C. M. Overly

Neptunium Retardation with Tuffs and Ground-waters from Yucca Mountain (3040)
Conference paper, *1993 International High-Level Waste Management Conference*
Published.

WBS 1.2.3.4.1.5.1 Retardation Sensitivity Analysis**Objective**

The objectives of this task are to construct a geochemical/geophysical model of Yucca Mountain and to use this model to examine the physical and chemical controls on radionuclide transport along flow paths to the assessable environment.

Activities and Accomplishments

Physical/Chemical Processes Affecting Transport. We continued to develop software for automatic generation of finite-element meshes to model flow and transport at Yucca Mountain. We have now generated a mesh using the full stratigraphy data base provided by SNL. We also made several automatic two-dimensional cross sections from this data.

Fracture/Matrix coupling. E. Kwicklis of the USGS reported on a recent thermal load meeting (29 June) that there is evidence that the equivalent-continuum model may be adequate to describe thermal repository performance if only one geologic unit is used. Following presentation of this information, those attending the meeting discussed the possibility that the equivalent-continuum model assumptions in a multiple-layer environment may not be valid.

Modeling of Relative Permeability of Fractures. Clustering of flow paths is a common phenomena in two-phase fracture flow. If we can understand the connectivity of the clusters, they can be mimicked in the numerical scheme and a much higher resolution problem can be run. S. Kelkar is conducting this research.

QA and Programmatic. G. Zivoloski attended a talk on POSC, the oil industry standard for information and oil reservoir data, which is sponsored by approximately sixty oil companies. We will need this information for passing data sets on relative permeabilities and other related areas, and we plan to explore this further.

Planned Activities

We will continue simulation using coarse to fine grids in three dimensions for the isothermal flow calculations because we believe this successive interpolation will give us a rapid steady-state solution.

We will address some minor problems associated with grid building: angular constraints, which must be more carefully checked to ensure positive transmissibility in the flow calculations, and the resolution around faults.

Problem Areas

None

Milestone Progress

3052

30 January 1993

Baseline Documentation for TRACRN

Received conditional certification; documentation is available from the Los Alamos Software Manager.

Completed.

3355

30 September 1993

Interim report—Update of Geophysical/Geochemical Models

Publications

K. Birdsell, K. Eggert, and B. Travis

Three-Dimensional Simulations of Radionuclide Transport at Yucca Mountain

Journal article, *Radioactive Waste Management and the Nuclear Fuel Cycle - Special issue on the Yucca Mountain Project*

Approved by YMPO.

June 1993

WBS 1.2.3.4.1.5.2 Demonstration of Applicability of Laboratory Data

Objective

The purpose of this study is to design and conduct experiments to evaluate the applicability of laboratory data and to test models used in the radionuclide transport program to determine far-field radionuclide transport. Both intermediate- and field-scale experiments and natural analogs will be assessed for their potential to provide the required data.

Activities and Accomplishments

This task has been deferred because of lack of funds.

WBS 1.2.5.2.2 Site Characterization Program

- Objective** The purpose of this task is to coordinate the regulatory Project requirements within the Los Alamos programmatic structure. The focus of this coordination effort is on the integration of the technical work within the regulatory framework.
- Management and Integration** Task members made presentations and discussed the "Volcanism Status Report" in open forums at the NRC Volcanism Technical Exchange in Las Vegas. One of our staff members made a presentation on the application of geophysical methods and the implications of these results to volcanism studies at the Geophysical Technical Exchange with the NRC, also held in Las Vegas. Our staff continued to support the "Calcite-Silica Topical Report."
- Study Plans**
- Water Movement Test, R1 (8.3.1.2.2.2).** Review comments on Rev. 1 of the Study Plan were received from the YMPO in May 1992; they were addressed and returned to YMPO in December 1992. This study plan was approved on 10 February 1993 by the DOE. It was submitted to the NRC for a Phase I review and accepted on 8 April 1993.
- Diffusion Test in the Exploratory Studies Facility, R0 (8.3.1.2.2.5).** In April 1992, this study plan was accepted by DOE. In June 1992 it was submitted to the NRC for review.
- Testing of the C-Hole Sites With Reactive Tracers, R0 (8.3.1.2.3.1.7).** In February 1990, DOE/HQ issued the study plan (8.3.1.2.3.1) as a controlled document; it was then sent to the NRC for comments. The Los Alamos study plan (8.3.1.2.3.1.7) was approved. Staff reviewed NRC comments on the USGS study plan related to the first six C-wells activities and notified the DOE that they agreed with all NRC comments.
- Ground Water Chemistry Modeling, R0 (8.3.1.3.1.1).** This study plan was returned in May 1992 from YMPO review; comments are now being addressed.
- Mineralogy, Petrology, and Chemistry of Transport Pathways, R0 (8.3.1.3.2.1).** In January 1992, we submitted revised NRC comments to T. Bjerstedt. In August 1992, YMPO requested that we word process the changes to be incorporated in the revision. That revision is in progress and staff is also responding to review comments from the State of Nevada received in January 1993.
- History of Mineralogy and Geochemical Alteration at Yucca Mountain, R0 (8.3.1.3.2.2).** The YMPO approved the study plan on 18 December 1991 and submitted it to the NRC on 31 January 1992. No further action has been required.
- Natural Analog Hydrothermal System in Tuff (8.3.1.3.3.1).** This is an out-year activity.
- Kinetics and Thermodynamics of Mineral Evolution and Conceptual Model of Mineral Evolution, R0 (8.3.1.3.3.2; 8.3.1.3.3.3).** No progress during the recording period because of funding.
- Sorption Studies and Sorption Modeling, R0 (8.3.1.3.4.1; 8.3.1.3.4.3).** A new draft of the study plan combining studies 8.3.1.3.4.1 and 8.3.1.3.4.3) was submitted to YMPO for review in October 1992. Review comments were returned to Los Alamos in February 1993; these comments are being incorporated in the study plan.
- Biological Sorption and Transport, R0 (8.3.1.3.4.2).** A revision addressing the Exploratory Shaft Design was submitted in September 1992. The study plan was approved by YMPO on 25 November 1992 and accepted by the NRC on 25 March 1993.

Dissolved Species Concentration Limits, and Colloid Formation and Stability, R0 (8.3.1.3.5.1; 8.3.1.3.5.2). All YMPO comments on the study plan were resolved by the principal investigator in September 1992. Rev. 0 was submitted to YMPO for comment resolution, verification, and approval on 9 October 1992.

Dynamic Transport Column Experiments, R0 (8.3.1.3.6.1). All YMPO comments on the study plan were resolved by the principal investigator in September 1992. This study plan was revised, incorporating YMPO and DOE review comments. It was returned to YMPO in March 1993 for technical review. YMPO comments were completed in June 1993.

Diffusion, R0 (8.3.1.3.6.2). All YMPO comments on the study plan were resolved by the principal investigator in September 1992. The study plan was revised in response to YMPO comments and returned to YMPO in April 1993. Verification of comment resolution was completed on 28 June 1993.

Retardation Sensitivity Analysis, R0 (8.3.1.3.7.1). This study plan was approved by the DOE and sent to the NRC for review in July 1992. It was accepted by the NRC on 19 January 1993.

Demonstration of the Applicability of Laboratory Data to Repository Transport Calculations, R0 (8.3.1.3.7.2). This study plan is deferred because no funds were allocated.

Gaseous Radionuclide Transport Calculations and Measurements, (8.3.1.3.8.1). This study plan is deferred because no funds were allocated.

Probability of Magmatic Disruption of the Repository, R0 (8.3.1.8.1.1). A detailed technical review was completed in July 1992 by the NRC. In August 1992, a one-day video conference was held with the NRC to discuss their technical review comments. In response to those comments, this study plan was revised and submitted to YMPO for review in February 1993. It was accepted and sent to the NRC in March 1993 for review.

Physical Processes of Magmatism and the Effects on the Repository, R0 (8.3.1.8.1.2). A draft study plan was submitted to DOE for review in October 1992. The review comments were returned in January 1993 for comment resolution. Those comments have now been addressed, and the study plan was sent to YMPO in May 1993.

Characterization of Volcanic Features, R0 (8.3.1.8.5.1). This study plan was accepted by NRC on 4 September 1990. A minor revision was added in March 1993; this revision does not require a review by YMPO and the DOE.

WBS 1.2.5.3.5

Technical Database Input

Objective

The objective of this task is to coordinate input of technical data to the Project Technical Database (TDB) and the Automatic Technical Data Tracking System (ATDT).

Activities and Accomplishments

R. Eckhardt reviewed the RPC listing of technical data packages received and checked this against his list of submitted packages. He met with RPC staff to clarify procedures for submitting record packages.

R. Eckhardt attended the quarterly meeting of YMP technical data managers in Las Vegas. Participants discussed forthcoming changes in procedures.

Staff entered information into the ATDT and completed TDIF forms on two reports:

- "The Importance of Zeolites in the Potential High-Level Radioactive Waste Repository at Yucca Mountain, Nevada," which was assigned DTN LA000000000050.001 and TDIF #301660, and
- "Actinide (IV) and Actinide (VI) Carbonate Speciation Studies by PAS and NMR Spectroscopies," which was assigned DTN LA000000000053.001 and TDIF #301670.

Staff established files and data tracking numbers for two reports that serve as source data for LA000000000050.001 above. These will be entered into the ATDT as soon as completed information is received..

Staff resolved problems associated with data submitted to YMP TDB on LA000000000036.001 and LA000000000011.001 and worked with principal investigators on solving problems related to LA000000000015.001 and LA000000000023.002.

Planned Activities

We will examine ongoing work on zeolites, saturated fluid flow, and other areas and determine which technical data should be logged into the ATDT, and which data should be submitted to the TDB.

Problem Areas

None

June 1993

WBS 1.2.5.4.6 Development and Validation of Flow and Transport Models

Objective Model testing is necessary to assess performance at Yucca Mountain. This task will conduct an experiment in a caisson facility to provide a baseline of confidence in models for transport.

Activities and Accomplishments The caisson was filled and the instrumentation was placed, and we began to fill the caisson with water from the bottom to force out the air. The surface distribution system was fabricated and we began testing it.

Planned Activities We will saturate the caisson and begin applying tracers.

Problem Areas None

Milestone Progress 3357
30 September 1993
Caisson Experiments to Test Flow and Transport Models

3368
30 April 1993
Testing models of flow and transport in unsaturated porous media
Completed.

Publications E. P. Springer, M. D. Siegel, P. L. Hopkins, and R. J. Glass
Testing models of flow and transport in unsaturated porous media
Conference paper, 1993 High-Level Radioactive Waste Management Conference
Published.

WBS 1.2.5.4.7**Supporting Calculations for Postclosure Performance Analyses****Objective**

This task will provide documentation and results of calculations used in analyses of postclosure performance that supports design of repository, seals, and waste package and perform calculations of postclosure performance needed to support activities carried out under other performance assessment WBS elements.

Activities and Accomplishments

G. Zyvoloski attended a meeting on thermal loads on 29 June in Las Vegas. This meeting was significant because participants stated that recent calculations generally indicated that uncertainty in hydrology must still be addressed. It now appears that the "thermal repository" concept is now being considered as only one among a continuum of designs; however, we must continue to study "isothermal" hydrology.

In the area of modeling, we have identified some problems and needs. The Project database defines only the repository region; however, we believe that stratigraphy, fracture spacing, and heterogeneity outside of this region (for example, Solitario Canyon) must be included in the database. We have discussed this matter with staff at SNL and will meet with them in the near future to discuss it further.

Planned Activities

No planned activities reported.

Problem Areas

None

Milestone Progress

4004

30 September 1993

Letter Report on Thermal Repository Calculations

Publications

None

June 1993

WBS 1.2.6 Exploratory Studies Facility

Objective	These Exploratory Studies Facility (ESF) tasks address the issues and information needs associated with the ES-based characterization of Yucca Mountain to determine the suitability of permanently isolating high-level nuclear waste from biosphere in a geologic repository.
Activities and Accomplishments	<p>Staff continued planning for the LLNL large-block test. Staff selected a test site at Fran Ridge, reviewed the LLNL activity for compliance with the preliminary Safety Analysis Report, and initiated a work order to clear the site.</p> <p>Staff attended the weekly design and construction meetings. Staff provided input to changes in field design. Staff developed Title II test packages.</p>
Planned Activities	<p>Staff will support the finalizing of Title II design packages for the north portal surface facility and starter tunnel extension in preparation for the 90 percent design review.</p> <p>Staff will meet with the testing organization to consolidate thermal mechanical testing in the ESF.</p>
Publications	<p>N. Elkins <i>Planning and Implementation of Underground Testing in the ESF</i> Conference paper, <i>Rock Mechanics Conference</i> Approved by YMPO.</p> <p>N. Elkins <i>Prioritization of ESF Testing and Integration with Design and Construction</i> Conference paper, <i>1993 International High-Level Radioactive Waste Management Conference</i> Published.</p> <p>H. Kalia <i>Control of Tracers, Fluids, and Materials for the Yucca Mountain Site Characterization Project</i> Conference paper, <i>1993 International High-Level Radioactive Waste Management Conference</i> Published.</p>
Problem Areas	None

WBS 1.2.6.8.4 Integrated Data System

Objective The integrated data system (IDS) supports the Exploratory Studies Facility (ESF) test program by providing a central facility to automatically measure and control aspects of the ESF tests. The primary purposes of the IDS are to assist the principal investigators (PI's) in acquiring high-quality test data in a uniform, controlled fashion and to transfer those data to the PI's organizations for data management and analysis.

Activities and Accomplishments IDS design and development oversight continued on schedule. The OCRWMS M&O has been responsible for designing and development of IDS for various principal investigators. Staff was briefed by the M&O on the current status of the IDS design.

Planned Activities Staff will continue to oversee M&O design and development of the IDS. Staff will develop IDS technical requirements documents as a source of information for the IDS designers. Meetings are planned to discuss the IDS requirements of various PI's and the current IDS design status. Staff will continue to review design documents as they are developed by the M&O.

Publications H. Kalia
Acquisition of Test Data from the Exploratory Studies Facility for the Yucca Mountain Site Characterization Project
Conference paper, *Second International Symposium on Mine Mechanization and Automation*
Approved by YMPO.

Problem Areas None

June 1993

WBS 1.2.9.1.2 Technical Project Office Management

Objective

The objective of this task is to manage the Los Alamos Yucca Mountain Project Site Characterization Program.

Activities and Accomplishments

The TPO hosted a 7 July visit to Los Alamos by DOE/YMP and Project Control staff of the M&O; the visit was arranged specifically to discuss Los Alamos Project Control concerns, interface needs, and integration. We received a favorable review.

The TPO attended the TAG meeting on 15-16 July in Denver to consolidate FY94 site and ESF annual plan.

The TPO and staff supported a technical exchange with the Spanish High-Level Radioactive Waste Program, ENRESA, on 22 July in Las Vegas. The TPO presented an overview of the Los Alamos YMP and suggested areas of potential technical exchange.

The TPO initiated a management assessment of the Los Alamos YMP QA program. This is a requirement defined by the QARD.

Staff began a review of training records and began incorporating Los Alamos ES&H training records into YMP files. The TPO continued our monthly ES&H initiative as part of ongoing self-assessment and continued support of Project Control's efforts to complete the wall-to-wall audit of Nuclear Waste Fund property. Staff continued development of ES&H requirements matrix, meshing DOE requirements as implemented by Los Alamos with DOE requirements as implemented or defined by DOE/YMP. Staff identified issues to be presented to the S&H Committee.

WBS 1.2.11.2/3/5 Quality Assurance Program Development, Verification, and Engineering

Objective	The Quality Assurance (QA) Program supports Los Alamos Yucca Mountain Site Characterization Project participants and ensures that their efforts provide data and evidence admissible for the repository-licensing process.
Program Development (WBS 1.2.11.2)	<p>We anticipate that the new QARD will be completed by 31 August. Our major emphasis has been on procedure revisions. Budget estimates for FY94 were submitted to DOE. S. Bolivar received a Los Alamos Quality Achievement Award for quality improvements in YMP.</p> <p>Personnel. Applicants were interviewed for Quality Assurance Liaison position in anticipation of an October vacancy.</p> <p>Travel. S. Bolivar, M. Clevenger, J. Day, C. Martinez, P. Gillespie, and A. Burningham attended QARD training in Las Vegas.</p> <p>Procedure Revisions. Twenty-four procedures were in revision and six were in formal review. Four procedures were completed and await entry into the RTN system. Detailed technical procedures LANL-INC-DP-92-R1, "Sample Leaching to Extract Soluble Chloride and Bromide," and LANL-INC-DP-95,R1, "Preparation of Samples for Chloride-36 Analysis," were issued.</p> <p>Training. Staff continued to redesign the records management class. S. Bolivar attended the fifth session of a video conference training course entitled "Radioactive Waste Management." S. Bolivar and M. Clevenger attended a four-hour class on independent assessment concepts. The training database was being tested.</p>
Audits and Surveys (WBS 1.2.11.3)	The audits for the Los Alamos office in Las Vegas (AR-93-04), Volcanism (AR-93-04), University of New Mexico (AR-93-05), and Ohio State University (AR-93-06) audits were in process. The DOE issued Corrective Action Reports YM-93-049, 50, and 51 identified during Audit YM-93-11. Corrective actions for stop work order SWO-03 are being examined by verification personnel. S. Bolivar provided a QA overview at the University of New Mexico pre-audit conference meeting.
Quality Engineering (WBS 1.2.11.5)	The procedures describing the software process were being revised to better reflect the way business is conducted, to better meet the needs of the DOE (as described in the QARD), and to make the process more efficient for the investigators. The new guidelines will be distributed for review. One CCB meeting was held.
Planned Activities	We will continue to revise the class on records management. The majority of staff time will be directed at revising procedures to satisfy the new QARD. Corrective actions for stop work order SWO-03 will be verified. The audits of the University of New Mexico, Ohio State University, the Los Alamos office in Las Vegas, and Volcanism will be completed and an audit plan for the Los Alamos YMP Project Office will be issued. Compilation of both the 1992 Quality Assurance Status Report and training files database will also continue.
Problem Areas	None
Publications	S. Bolivar and J. Day <i>The Quality Assurance Liaison—Combined Technical and Quality Assurance Support</i> Conference abstract Published.

WBS 1.2.12.2 Local Records Center Operations/Records Management and
1.2.12.5 Document Control
1.2.13

Objective The objective of this task is to satisfy the records management requirements of the YMP and NQA-1.

Activities and Accomplishments Twenty-nine records and/or record packages were received by the RPC; five of these were rejected and returned to their originators for corrections.

Fifty-five records and/or record packages were submitted to the CRF, and all of them were accepted. One previously rejected record package was resubmitted to the CRF.

Staff attended the DOE Records Management Conference in Seattle, Washington, 14 -18 June. Information on a wide variety of topics was presented.

Planned Activities No planned activities reported.

Problem Areas None

June 1993

WBS 1.2.15.2 Administrative Support

Objective The objective of this task is to provide administrative support for the Los Alamos YMP and the YMPO.

Activities and Accomplishments S. Klein, Los Alamos editor, reviewed and edited twelve technical information products (TIPs); following TPO review and approval, she forwarded the TIPs to YMPO. She also prepared YMP weekly reports each week and monthly highlights for May. All reports were transmitted to the M&O and YMPO.

The April YMP Monthly Activity Report was published and distributed. The editor completed the first draft of the May YMP Monthly Activity Report.

The FY 1993 TIP database was updated and distributed to Los Alamos YMP management.

Planned Activities Continue work in all areas discussed above.

Problem Areas None

WBS 1.2.15.3

Training

Objective

The objective of this task is to fulfill the training requirements of the Yucca Mountain Project and maintain appropriate training records.

Activities and Accomplishments

Staff toured Yucca Mountain and attended various training classes in Las Vegas from 9-12 May.

Staff participated in the DOE audit on 24-28 May.

Staff processed training records for May.

Planned Activities

No planned activities reported.

Problem Areas

None

Appendix

Los Alamos

Los Alamos National Laboratory
101 Convention Center Drive, Suite 820
Las Vegas, NV 89109

memorandum

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July 7, 1993
702/794-7095
M/S 527

TO: J. Russell Dyer, DOE/YMPO
W. Simecka, DOE/YMPO

FROM: R. Oliver, LANL 

SUBJECT: EXPLORATORY STUDIES FACILITY TESTING ACTIVITIES - JUNE
1993 - MONTHLY PROGRESS REPORT

GENERAL EXPLORATORY STUDIES FACILITY (ESF) ACTIVITIES

SITE CONSTRUCTION

Job Package (JP) 92-20 ESF North Portal Pad and Facilities

Construction of the ESF Starter Tunnel continued through the month of June, 1993, with the face of the pilot drift and side slashes being extended to CS 1+34. Rock bolting, wire mesh, and extensive shotcreting has been continued from the portal to CS 1+20. Some permanent bolting and shotcreting remains to be done in the lattice girder area between CS 0+00 and 0+30. Permanent rock bolting and grouting has been ongoing up to CS 1+00 with a request for permission to continue the grouting beyond CS 1+00. To date, this has been granted with certain stipulations regarding activity at the alcove to be used for radial borehole and hydrochemistry tests.

Site selection cleaning activities were completed at the Fran Ridge site in support of the Engineered Barrier - Large-Block Test.

TEST PROGRAM

A summary of ongoing ESF testing activities is provided as Table I. The general strategy for test planning and implementation is a function of starter tunnel construction progress, a general ESF test working schedule and supporting illustrations are provided as Attachment 1. Geologic mapping, consolidated sampling, and construction monitoring activities are proceeding as planned, no perched water was identified during the period. Sites at Fran Ridge were identified and flagged for rock saw demonstration cuts and the Engineered Barrier - Large Block location. Test support trailers and site configuration illustrations are provided in Attachment 2.

JUL 14 '93

TABLE I
ESF Testing Field Activity
North Ramp Starter Tunnel

<u>SCP PROGRAM</u>	<u>STUDY NAME</u>	<u>SCP Study PLAN NUMBER</u>	<u>TEST NAME</u>	<u>TPP #</u>	<u>JP #</u>	<u>CONTROL LED</u>	<u>FIELD START</u>
Rock Characteristic Program	Characterization of Structural Features in the Site Area	8.3.1.4.2.2	Geologic Mapping of the ESF	TPP 92-10	JP 92-20A	4/2/93	4/8/93
Geohydrology Program	Characterization of YM Percolation in the Unsaturated-Zone ESF Investigation	8.3.1.2.2.4	Perched Water Testing in the ESF	TPP 92-11	JP 92-20B	4/2/93	4/8/93
Thermal and Mechanical Rock Properties Program	In Situ Design Verification	8.3.1.15.1.8	Construction Monitoring in the ESF	TPP T-93-2	JP 92-20D	4/2/93	4/8/93
Geohydrology Program & Geochemistry Program	Water Movement Tests, Rev. 0 Water Movement Tests, Rev. 1 Characterization of the Percolation in the Unsaturated-Zone Surface-Based Study History of Mineralogic and Geochemical Alteration of YM	8.3.1.2.2.2 8.3.1.2.2.3 8.3.1.3.2.2	Consolidated Sampling in the ESF	TPP 92-14	JP 92-20C	5/19/93	5/27/93

ENVIRONMENTAL, SAFETY, AND HEALTH (ES&H) ACTIVITIES

No unusual ES&H Testing activities occurred during the period. A safety analysis review of the test planning packages (TPPs), JPs, work plans, technical procedures, and sample plans in conjunction with the appropriate section of the Preliminary Safety Analysis Report, YMP 91/37, was completed for each of the ongoing ESF starter tunnel testing activities. No actions were identified.

TRACERS, FLUIDS, AND MATERIALS (TFM)

Approximately 58,800 gallons of water with lithium-bromide tracer was reported used during the period by the constructor. The total construction water used to date is approximately 132,700 gallons. A previous usage limit for traced water had been set at 112,000 gallons. Explosives and tunnel support materials were consumed and/or installed during tunnel construction. No other significant TFM usage was reported by test organizations during the period.

TEST EXCLUSION AREAS AND TCO TURN OVER

A total of 14 samples have been collected for the Principal Investigators (PIs) in conjunction with the consolidated sampling program. The geologic mapping investigator also established numerous mapping targets that were surveyed and recorded.

None of the target areas or sample locations are considered permanent testing exclusion areas.

Three "Tests Released to Construction" forms were submitted for geologic mapping activities in conjunction with starter tunnel construction during the period (Attachment 3).

TEST SPECIFIC ESF ACTIVITIES

Appendix I - Underground Geologic Mapping (JP 92-20A)

Appendix II - Perched Water (JP 92-20B)

Appendix III - Consolidated Sampling (JP 92-20C)

Appendix IV - Construction Monitoring (JP 92-20D)

Appendix V - Fran Ridge - Engineered Barrier - Large Block Site Preparation (work order)

Attachments "Limited Value Material"

RDO:jp49

Cy w/o attachment 3:

D. Williams, DOE/YMPO, MS 523
D. Harrison, DOE/YMPO, MS 523
W. Girdley, DOE/YMPO, MS 717
R. Crawley, DOE/YMPO, MS 532
K. Skipper, DOE/YMPO, MS 523
E. Petrie, DOE/YMPO, MS 523
V. Iorii, DOE/YMPO, MS 523
W. Kopatich, RSN, MS 403
B. Gardella, REECO, MS 408
R. McDonald, CRWMS/M&O, MS 423
L. Hayes, USGS, Denver, CO
D. Edwards, USGS/LV, MS 509
L. Shephard, SNL, Dept. 6302, Albuquerque, NM
D. Kessel, SNL/LV, MS 509
W. Clarke, LLNL, Livermore, CA
J. Blink, LLNL/LV, MS 527
J. Canepa, LANL, EES-13, MS J521
A. Mitchell, LANL, EES-13/LV, MS 527
K. Dye, LANL/FOC, MS 735
R. Kovach, LANL/FOC, MS 735
N. Elkins, LANL, EES-13/LV, MS 527
D. Boak, LANL, EES-13/LV, MS 527
D. Weaver, LANL, EES-13/LV, MS 527
F. Homuth, LANL, EES-13/LV, MS 527
D. Rashid, LANL, EES-13/LV, MS 527

Predecisional information—preliminary data—do not reference

J. Dyer, W. Simecka, DOE/YMPO
MONTHLY PROGRESS REPORT
July 7, 1993

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Cy: cont'd:

J. Berry, LANL, EES-13/FOC, MS 735
EES-13/LV, LANL, MS 527
CRMO, LANL, MS A150

TWS-EES-13-LV-07-93-02
Attachment 1
4 Pages



United States Department of the Interior



GEOLOGICAL SURVEY
BOX 25046 M.S. 425
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

IN REPLY REFER TO:

WBS: 1.2.9.2.2
QA: N/A

August 18, 1993

Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization Project Office
U.S. Department of Energy
P.O. Box 98608
Las Vegas, Nevada 89193-8608

SUBJECT: U.S. Geological Survey Yucca Mountain Project Monthly Summary for July 1993

Dear Carl:

In compliance with Yucca Mountain Project monthly reporting procedures, following is the YMP USGS input for July 1993. If you have any questions, please contact Raye Ritchey at (303)236-0517.

WBS 1.2.1 - SYSTEMS ENGINEERING

1.2.1.6 - Configuration Management

Impact assessments were performed and Affected Document Notices (ADNs) completed for Change Request Nos. 93/329, 93/329, 93/380, 93/384, 93/385, 93/378, 93/379, 93/381, and 93/382.

OCRWM QAP-6.2 reviews were performed for three Document Action Requests.

WBS 1.2.3 - SITE INVESTIGATIONS

1.2.3.1 - Site Investigations Coordination and Planning

The scientific reports processing unit is currently processing 81 YMP-HIP publications, 44 YMP-GSP publications, 8 YMP-LBL publications, and 47 abstracts.

1.2.3.2.2.1.1 - Surface and Subsurface Stratigraphic Studies of the Host Rock and Surrounding Units

Staff continued developing partial and preliminary descriptions of core from UZ-14 (in the Topopah Springs interval) for depths from 241 feet to 1213 feet. Partial and preliminary descriptions of core from NRG-1 were started for depths from 9.5 feet to total depth at 150.1 feet, and NRG-5 for depths from 690 feet to 996 feet. A downhole video log was completed from surface to standing water in drillhole UZ-16. The video images showed thick coating of the walls with dust and water-saturated mud covering the walls at several intervals in the Calico Hills Formation and Prow Pass Formation.

A series of geologic cross sections along the new north ramp alignment were

I-346084

BAM

created, with several cross sections cross-cutting the main north ramp cross section. All new cross sections are based on the latest isopach data, new borehole data, and recent geophysical data. A new structural interpretation of Drill Hole Wash was completed that incorporates all the new borehole data, and reconciles this with past surface and subsurface geological and geophysical data. This new structural interpretation has been incorporated into the latest north ramp cross sections.

In support of borehole geophysical surveys, a new method was developed to treat density and epithermal neutron logs which are corrupted by the rugose borehole in the unsaturated zone. The algorithm finds the right-hand bound to the density log, and the left-hand bound to the epithermal neutron log, based on the observation that air gap causes an erroneous increase in count rate. The low-count bound selects the portion of the record where the tool face was against the borehole wall.

Isotope and Geochemistry Group (IGG) work in support of stratigraphic studies and mapping of zonal features included geochemical analysis of rock samples from outcrops to the north and south of Crater Flat in support of ongoing mapping, and continued progress in preparation for U-series dating of calcite from the Ghost Dance Fault by mass spectrometry.

1.2.3.2.2.1.2 - Structural Features within the Site Area

Field checking was completed of the southern area maps for the Broken Limb, Whale Back, and Antler Ridge areas. Fracture mapping continued on the East Wing and in Split Wash. Compilation of fracture data acquired during FY93 began. A table was prepared describing Tiva Canyon Tuff rock textures relating to stratigraphy from the south flank of Antler Ridge. The table summarizes criteria used to differentiate lithostratigraphic subunits within the Tiva Canyon ash flow tuff. Criteria are based on shard shape, devitrification textures, and vapor phase mineralization of the shardy groundmass. Preliminary petrographic analysis of thin sections of samples collected in Fortymile Wash indicates deformed vitroclastic textures occur in some of the rocks that were mapped by previous workers as lava flows. These petrographic textures support field evidence that indicates some of these rocks are densely welded tuffs. This evidence includes gradational contacts from massive nonwelded tuffaceous deposits that have been zeolitized to vitrophyre with moderately developed fiamme.

Mapping of the north ramp starter tunnel continued with excavation still in the upper lithosphysal zone of the Tiva Canyon Tuff. The upper half of the tunnel was mapped to station 1+95 including stereophotography, full-periphery mapping, and detailed line surveys. Geologists collected 19 samples as part of the Consolidated Sampling program. The samples were collected between stations 1+18 and 1+95, and included fracture fillings, representative lithology samples, smectite from lithophysae, and contaminated and uncontaminated wall rock. Photogrammetric processing of stereophotos of the upper half of the starter tunnel continued. Initial stereonet show good agreement with the stereonet generated by the detailed line surveys and full-periphery mapping.

1.2.3.2.8.3.1 - Relevant Earthquake Sources

Staff worked on the final review and revision of the fault parameter table for relevant seismic sources, including potential magnitudes and recurrence intervals, and conducted field work on the Solitario Canyon Fault to examine trenches and update preliminary interpretation. Compilation of existing information is complete and is not expected to change markedly for a year or so, but as new information becomes available, it will be added.

1.2.3.2.8.3.4 - Effects of Local Site Geology on Surface and Subsurface Motions

The initial site response was obtained for 12 Midway Valley stations. Staff reviewed three components of 457 seismograms recorded at portable stations in Midway Valley.

1.2.3.2.8.4.1 - Historical and Current Seismicity

Records at Cal Tech relating to earthquakes near Yucca Mountain were photographed. 1978-1992 G=SGB catalogs were merged with Rogers et al historical catalog for the SGB, and events for further analysis were identified.

1.2.3.2.8.4.2 - Location & Recency of Faulting Near Prospective Surface Facilities

The final geologic map of Midway Valley was not completed as planned, by July 30, 1993, because inconsistencies between the geologic map of Midway Valley and the regional Quaternary map need to be resolved before a final map of Midway Valley is published. Data from undescribed soil pits need to be incorporated onto the map.

Staff prepared reports of trenching investigations near the proposed ESF, and drafted maps of trench walls. A report of MWV-T4 was completed.

1.2.3.2.8.4.3 - Quaternary Faulting within 100 km of Yucca Mountain

Work began on the report evaluating faults to the southwest of Yucca Mountain, and this report should be completed by September 30, 1993.

Work continued on the detailed Quaternary surficial geologic map. Two soil pits, BMPT-6 and BMPT-7, were excavated and the soils described. The lack of archeological clearances for trench BMT-1 (Tarantula Canyon) has delayed excavation. Trench BMT-2 was re-excavated due to safety concerns. Because of the delays in trench excavations, it is anticipated that the preliminary report on the Bare Mountain Fault will summarize only progress to date and will not include trench logs and interpretations.

1.2.3.2.8.4.4 - Quaternary Faulting in NE Trending Fault Zones

Staff evaluated the Rock Valley fault system in the field, examining fault structures and the nature of deformation of adjacent rocks. Field notes were assembled in preparation for writing the fault-slip analysis of the Rock Valley fault, which should be completed as planned by September 30.

1.2.3.2.8.4.5 - Detachment Faults

Ten days were spent in the field at Calico Hills. A new, tectonically important Paleozoic unit in Paleozoic rocks in the core of the Calico Hills dome was mapped. The Miocene-Paleozoic contact also was examined during the field trip, and observations recorded. Due to the unanticipated complexity of the geology being mapped in the Calico Hills, and the need to determine the ages of stratigraphic units before making final interpretations, the Final Report: Map of Calico Hills, has been delayed from June 30, 1993 to September 30, 1993. The map and report may have to be revised in FY1994 when ages are obtained for key stratigraphic units.

Staff continued work on the maps of the East of Beatty Mountain and Big Dome 7.5 minute quadrangles, including finishing field map compilations, cataloguing and submitting samples for argon dating, petrographic and chemical analyses, and using photogrammetry to get strikes and dips where they were not obtainable on the ground. Field work was compiled and preliminary maps drafted and colored showing the geology in Crater Flat adjacent to the Bare Mountain fault zone. The map/TDIF of Crater Flat is expected to be completed

by August 30, 1993, and other milestones for 8.3.1.17.4.5.2 are planned to be completed as scheduled.

The progress report on the age of detachment faults may not be completed by the planned September 30, 1993 date. Samples have been prepared for dating, but appropriate samples must be selected, so age dates may not be back in time.

1.2.3.2.8.4.6 - Quaternary Faulting within the Site Area

Staff has begun revising map and writing text of accompanying explanations for the Quaternary fault map. Field notes have been prepared for TDIF submittal. The completion date for the Quaternary fault map has slipped from March 13, 1993 to August 25, 1993. This delay can be attributed to DOE requests for erosion issue closure being given a higher priority, and the lack of full time personnel to work on this task both in the field and in the office. The map and text are essentially complete at this point, and no long term schedule impact is expected.

Geomatrix personnel were oriented to Busted Butte exposures 1 and 4 in preparation for their involvement in completion of logs. Additional U-series samples were collected from exposure 4, and the preliminary log of exposure 4 was annotated and replotted. Staff continued to prepare trench logs for SCR-T1 and SCR-T3 on the Stagecoach Road trenches. Field logging was completed of structures and contacts on photography on the north wall (mainly the west half) of both trenches; grids were established for conventional logging of the south wall, east half, of both trenches; and contacts and structures were plotted for two-thirds of a conventional log for SCR-T3. Staff coordinated with DOE and USGS onsite field coordinators for excavation of 4 new trenches and exposures on Solitario Canyon fault, and 2 new or modified trenches at Alice Ridge on North Paintbrush Canyon fault. Excavation is scheduled for August.

1.2.3.3.1.1.1 - Precipitation and Meteorological Monitoring for Regional Hydrology

1.2.3.3.1.1.2 - Runoff and Streamflow

The scope of the reduction of data and report activity has been modified to cover data collected during the period FY1986-1990. Data collected during FY1991-1993 is planned to be published as part of the USGS Nevada District's 1993 Annual Data Report. This revised strategy for grouping and publishing selected years of data collection will enable publication of data on a more timely basis than experienced previously.

There were no storms or events reported or observed in or around the monitoring network during July; therefore, no precipitation or flow was noted at any of the network streamflow sites.

1.2.3.3.1.1.3 - Regional Ground-Water Flow System

Due to data collection activities associated with the rainfall, streamflow, and ground-water recharge in FY1993, the Fortymile recharge data report, and the report on the evaluation of southern Nevada and California streamflow are behind schedule. The draft of the Fortymile recharge data report will be ready for colleague review by September 30, 1993, and is planned for submittal to DOE by December 31, 1993. The southern Nevada and California streamflow report will follow the recharge report, and given this, the earliest date for submission to DOE would be March 31, 1994.

1.2.3.3.1.1.4 - Regional Hydrologic System Synthesis and Modeling

The draft report on the preliminary simulation of the large hydraulic gradient has been delayed due to delays in receipt of software compatible with the SUN computer. The vendor of the plotting software has been notified, and receipt of the software is pending final development by the vendor. The impact of this delay cannot be assessed at this time. Considerable progress has been made in constructing the new finite element mesh for calibrating the 2-D finite element model. However, this activity is delayed, largely due to the overcommitment of the responsible PI to both scheduled and unscheduled tasks.

In support of refinement of the 3-D hydrogeologic model, preliminary gridded surfaces of the 10 hydrogeologic units in the region were refined using major regional faults. These faulted surfaces were visualized in 3-D. Surfaces were clipped and refined using geological rules. The text of the paper on structural analysis is completed. Final maps and figures are being prepared. The paper on model units will be delayed until next fiscal year, stemming from the decision to produce an intermediate report, "Preliminary Digital Geologic Maps of the Mariposa, Kingman, Trona, and Death Valley Sheets, California", documenting the construction and limitations of digital data sets used in developing the hydrogeologic map of the Death Valley region. This decision was made as a result of a recent request by DOE for GIS digital data sets.

The activity Continue Testing with Chemical Models, and the paper on structural flow paths, in support of regional 3-D modeling activities, has been delayed for a number of reasons. The activity requires regional hydrochemical data of major cations and anions, which required development. Since the data set is extremely large, gathering, entering, and quality checking of data was very time consuming. As the regional chemistry data base was being developed, gaps in data coverage became apparent, and field trips were conducted to fill the gaps. Additional data on the locality and chemical characteristics of regional springs indicate a correlation to structurally controlled flow and required incorporation into the study. Impacts of this delay are more positive than negative. While the report is delayed into next fiscal year, it has been expanded into two reports that have far reaching significance to at least two studies. A report on the structural analysis of regional faults and fractures will indicate potential regional flow paths that control movement of groundwater from recharge areas to discharge areas, thus indicating flow paths for 3-D hydrologic modeling and mechanisms for regional discharge in past discharge studies. Both products are extremely important to the successfully achieving the goal of each study. The second report will examine the groundwater flow characteristics and properties of pathways. This product also has far reaching importance to these studies. While the delay does prevent incorporation of these findings into the existing hydrogeologic conceptual model, they can be included in later iterations of both the conceptual and numerical models.

1.2.3.3.1.2.1 - Unsaturated Zone Infiltration

In support of the characterization of hydrologic properties of surficial materials, a landscape unit map has been completed for WT-2 Wash and most of Split Wash. Map unit descriptions are being tested in other washes. A three unit depth to bedrock map has been completed for WT-2 Wash. This depth to bedrock map will be expanded into Split Wash. Evaluation of geomorphic surface map units has been completed, and mapping of these surfaces will begin soon.

Natural infiltration staff compiled and organized weather data for use in the small scale watershed models. Work continued on maps to provide preliminary spatial boundaries and to identify hydrologic units in WT-2 Wash watershed. Data from field soil water retention relationships for each potential hydrologic unit were plotted to help identify hydrologic units. Work continued on radiation load monitoring for WT-2 Wash. Analysis and modeling of UZ-16 continued. Refinements were made in the modeled stratigraphy to

correspond more closely with the core data. Hydraulic property relationships used in the modeling were re-estimated using more of the core data and different formulations of the hydraulic property equations. Effects of changing hydraulic properties on the modeled UZ-16 water content profile will be investigated. The report on the historical neutron hole data will be delayed until next fiscal year, due to lack of calibration equations for the neutron probes resulting from slow procurement of software to manipulate the data base.

In support of artificial infiltration studies, preliminary designs were begun for a large plot rainfall simulator (LPRS). A literature review is underway of various types of commercially available LPRSs. Different types of water delivery systems and sprinkler head setups are being explored, with the goal being to develop a low cost, variable delivery rate, low maintenance system. It is becoming apparent that no commercially available system will achieve these goals.

1.2.3.3.1.2.3 - Percolation in the Unsaturated Zone, Surface-Based Study

In support of VSP prototype field testing and analysis, data acquisition is expected to be completed in August, a preliminary report by the end of September, and the final report is now projected for March 1994. Work was delayed by a series of equipment malfunctions and borehole problems, delayed equipment availability and access to the testing site. Velocity data is expected to be ready to submit to the Participant Data Archives by the end of September 1993.

Additional work was done to debug and refine the HDAS system by installing an additional data acquisition system in the instrument shelter at the HRF. Several minor problems were detected and corrected. In the shelter, the DAS is monitoring several thermistors that monitor room temperature and the temperature in the air conditioning lines.

The air permeability and gaseous tracer testing project reports that the surface based support trailer officer was outfitted with the Data Acquisition and Storage System computer. The electrical wiring which connects the DASS to the downhole packer assembly was completed and is scheduled for testing in August. Staff at Test Cell C continued to prepare the support trailer for field testing in UZ-16. Arrangements have been made to use the c-hole complex to field test the support trailer and packer assembly in mid-August. Air permeability testing of UZ-16 has been postponed due to delays in the geophysical logging program. Both the geophysical logging and geochemistry gas sampling must be completed before the air permeability testing can be conducted. The most recent schedule calls for air-permeability testing to begin October 4, 1993 and continue until December 20.

1.2.3.3.1.2.4 - Percolation in the Unsaturated Zone - ESF Study

The analytical report on imbibition experiments will be delayed because extra tests were required on the large fractured welded tuff, including gas permeability measurements and microbiological tests. These tests, as well as some to be performed by SNL, are to see if an explanation can be obtained as to why water did not flow through the fractured block, even when water pressure on top of the block was positive.

Staff supporting hydrochemical tests in the ESF report that the investigation of locations for short hole drilling is delayed because the starter tunnel will be longer than planned. Drilling and blasting will continue beyond the 200' length, probably to 600'. The short hole drilling and gas sampling will not begin until the tunnel construction is completed beyond the location of the first alcove but prior to construction of the first alcove. The status report on gas sampling is delayed until September 30, 1994, because data for

this report will not be available until tunnel progress is sufficient so that alcoves and sampling systems are in place.

1.2.3.3.1.2.6 - Gaseous-Phase Movement in the Unsaturated Zone

All but four Carbon 14 and Carbon 13/12 results, from the SMU radiocarbon lab for the March, 1993 UZ-6 UZ-6s and neutron access boreholes sampling trip, were received. Results are similar to past results from these boreholes. Data have been tabulated and are being analyzed. All gas chemistry data (1987-1993) are being tabulated in preparation for submittal of a September 1993 TDIF. Results were received of CFC (freon) analysis from the March trip, with UZ-6s showing slightly lower concentrations than last year and neutron hole concentration consistent with last year. There appears to be no correlation to Carbon 14 results that would help explain the decrease in CFC concentrations at UZ-6s.

1.2.3.3.1.2.7 - Unsaturated Zone Hydrochemistry

Gas tracer injection and monitoring were conducted at UZ-14 and NRG-4. Equipment set-up was planned for NRG-2B. UZ-1 gas samples were collected and analyzed for SF₆ concentrations. Monitoring data are likely to be delayed until April 1, 1994, because UZ-14 will not be complete until October 1993, and UZ-16 trace-gas sampling will not be complete until October 1993. The lack of available personnel from the USGS National Research Program has resulted in delays in the evaluation of existing export models, which will delay the geo-phase investigation results on modeling which are to be used for performance assessment. The TDIF for work through March 29, 1993 at UZ-16 and NRG-6, -2A, and -3 is being prepared and will be submitted by September 1, 1993.

1.2.3.3.1.2.8 - Fluid Flow in Unsaturated Zone Fractured Rock

Preliminary work on imbibition experiments titled "Numerical and laboratory investigations of transient and steady-state flow in a fractured core" was published in June 1993 in a NRC report (NUREG/CP-0040). Additional data collected to help resolve uncertainties described in this report is being processed and is not yet available for modeling. The report titled "Numerical investigation of steady liquid flow in a variably saturated fracture network" was accepted for publication in Water Resources Research. This report examined the fundamental behavior of unsaturated fracture systems by way of numerical experiments, but did not draw extensively on site-specific information. Analyses and compilation of existing fracture data from the site is underway and will continue as new information becomes available to develop fracture network models specific to the unsaturated zone at Yucca Mountain. Work is ongoing and will continue into FY1994.

1.2.3.3.1.2.9 - Site Unsaturated Zone Modeling and Synthesis

In preparation for 2-D cross-sectional simulation of Pagany Wash, a 1-D model was constructed with stratigraphy representative of UZ-4 and UZ-5 in the upper 120 m. Derived statistical correlations between porosity and hydraulic parameters were used in conjunction with porosity profiles to estimate the hydraulic properties at these boreholes. Attempts to numerically simulate the measured saturation profiles at UZ-5 have so far suggested the following: 1) the measured profiles do not appear consistent with steady 1-D flow; 2) saturation and capillary pressure profiles for 1, 2.5 and 5.0 mm/yr percolation fluxes are nearly identical, suggesting that while it would be difficult to accurately estimate fluxes in this range from measured profiles, it is relatively straightforward to predict the observed saturation and water potential profiles during past pluvial events, since these are relatively insensitive to flux; 3) hysteresis resulting from the distribution of nonwelded and fractured welded stratigraphic layers causes a fundamental

asymmetry in time-scales required to establish steady-flow under conditions of wetting and draining. Drainage from a high flux to gravitational equilibrium profile required time periods on the order of a hundred thousand years or more, whereas for wetting conditions, steady flow may be established in ten-thousand years or less if significant fracture flow is involved; 4) the vitric caprock of the Topopah Spring Member, although assumed to be significantly fractured, restricts the drainage of water from layers above it causing the capillary profile above it to approach a gravity equilibrium profile; and 5) due to slow drainage above the vitric caprock some of the water in the upper unsaturated zone probably dates to the last (and even the previous) ice age.

1.2.3.3.1.3.1 - Site Saturated Zone Ground Water Flow System

The site saturated fractured rock hydrology project reports that a major obstacle is creating a high level of uncertainty in scheduling operations. The DOE-YMP safety officer, R. Baumeister, is adamantly opposed to allowing the USGS to operate its pump in the c-holes unless the power cable is a 4-conductor cable, with one of the conductors a ground wire. No such cable can be found "off the shelf", and an effort to fabricate such a cable through Centerlift Inc. and approve it by Underwriters Laboratory, has not gotten off the ground yet. As a result of this issue, DOE has prepared a draft Stop Work Order to the USGS on all pumping activities until the power cable issue is resolved. An interim plan has been developed to conduct non-pumping tests at the c-holes until the discharge pipeline is completed, and the power cable issue is resolved. This plan involves monitoring for hydraulic effects of barometric pressure changes with open-holes (transducers set in holes the week of 7/12/93), and for the hydraulic effects of barometric pressure changes and earth tides with packer-string-instrumented holes (planned to start the week of 9/6/93). The plan takes advantage of REECO drill-crew availability starting on 9/6/93. This work is being referred as Phase I and a specific Work Program has been written for it by RSN and reviewed by the USGS.

Reduction of all 1992 periodic water-level data has been completed, and checked. Water-level altitudes were recomputed for VH-1, based on revised measuring points. Water-level altitudes also have been computed for wells J-11 and J-12, based on new information on reference point altitudes provided by environmental monitoring personnel. The 1990-1991 water-level data report continues to be behind schedule, due to delays in evaluating the transducer and converted water-level data. Transducer data for several wells have been particularly difficult to evaluate and convert to valid water levels. Part of the delays are due to time spent on evaluating and documenting the effects of seismic activity in late May/early June on water levels in the Yucca Mountain area, and insuring that monitoring equipment is able to document those effects.

1.2.3.3.1.3.2 - Saturated Zone Hydrochemistry

It was determined that location (latitude/longitude) data were incorrect for a few sites in the data base. This deficiency derived both from typographic errors and from the fact that several individuals were involved in the earliest data entries and conversion of township/range locations to latitude/longitude information were not uniformly and consistently understood or accurate. This necessitated verification of all of the location data that could be checked against map information, adding about three weeks of unanticipated work. It is expected that the data base and text of the report/TDIF on the assessment of site saturated zone hydrochemical data will be completed before the end of August; however, it is unlikely that reviews of both the text and data can be completed prior to September 30. Therefore, the planned concurrence submittal to DOE is forecast to slip to December 1, 1993.

1.2.3.3.1.3.3 - Site Saturated Zone Hydrologic System Synthesis and Modeling

Physical properties (bulk density, porosity, and particle density) were measured for 21 outcrop samples collected previously from east of Little Skull Mountain in the Bullfrog Member of the Crater Flat Tuff.

1.2.3.6.2.1.2 - Paleoclimate Study of Lake, Playa and Marsh Deposits

Thirty-one samples from cores and outcrops were prepared for analysis of calcareous microfossils, stable isotopes, and possible Sr isotopes. Material will be selected from these samples for radiocarbon dating. Initial samples from the Pahranaagat Marshes were prepared for analysis of calcareous microfossils, which together with pollen studies, should provide a terrestrial and aquatic climate record for the Holocene in southern Nevada.

IGG work in support of paleoclimate studies included data collection activities in support of eolian history and the evaluation of past discharge areas. Sediment samples from playas to the north of Beatty were prepared for analysis; these samples will provide data pertinent to characterizing the Oasis Valley groundwater flow system. Compilation of isotopic and chemical data on the Ash Meadows system was started in order to identify data needs and evaluate groundwater flow paths in this system. Many data needs were identified and further analysis of these sites will be proposed.

1.2.3.6.2.2.1 - Quaternary Regional Hydrology

In support of regional paleoflood studies, drainage basin maps and hydrologic charts and tables were prepared that present recorded and numerically-derived data of modern and ancient streamflow runoff in the Yucca Mountain area. These summary materials illustrate the discharge rates and frequencies of specific surface-water runoff events, seasonal and annual runoff volumes, annual spring discharge, evaporation rates from playa lakes that formed in Death Valley at the terminus of the Amargosa River, and estimated paleoflood runoff volumes for the Amargosa River and other drainages of the Death Valley watershed. A preliminary evaluation of precipitation-runoff volumes for these drainages was begun following preparation of computerized drainage basin maps. The relationships between regional precipitation, peak and daily mean discharge rates, storm duration, and surface-water runoff volumes for the watershed are important because of their regional paleoflood implications in the Yucca Mountain site area. Together, these hydrologic properties will lead to regional estimations of potential magnitudes and frequencies of storm runoff.

Staff supporting analog recharge studies continued to synthesize results of model applications to estimate ground-water recharge rates in Kawich and Stewart Creek watersheds by compiling and comparing model estimates of winter season interception losses using comparably detailed configurations of hydrologic response units (slope, aspect, cover type and density). Estimates of interception losses by the chloride method are substantially higher than those computed from PRMS and this outcome is a reflection of basic differences in model assumptions regarding the duration of time snow is held in the forest canopy. A review and verification of PRMS code pertaining to snow interception storage is being conducted.

The geochemistry of arid-zone infiltration project reports that no watershed and remote sensing data will be submitted to the Participant Data Archives this fiscal year, because no instrumentation has been installed and no data have been collected. The primary reason for the delay is that soil-moisture tension probes are still in calibration, with the calibration facility experiencing difficulties. The report "Chlorine-36 ages of soil" will be delayed until January 1994 because of delays in analysis of samples and the consequent delay in interpretation of data. Unanticipated complexity in the alluvial system has contributed to the delay in interpretation.

In support of calcite silica studies, the $d^{13}C$ and $d^{18}O$ values were determined for 132 carbonate extractions, mostly from drill core but including 37 standards. Data collection from drill cores UZ-16 and UZN-35 is almost complete. Four days were spent measuring concentrations of soil gas CO_2 and collecting soil profiles and soil gas profiles for measurement of the stable isotopic compositions of H_2O and CO_2 . Permanent soil gas sampling probe arrays were monitored at Fran Ridge, Forty Mile Was, Pagany Wash, the southern flank of Rainier Mesa (roadcut on Holmes Road), and at the US Ecology low-level waste disposal site near Beatty. Approximately 190 samples of soil, soil gases, and soil carbonates were collected.

Work by IGG staff included continued dating by thermoluminescence and U-series methods. Initial U-series results from Trench 14C suggest that uppermost soil horizons may be as young as 20 ka, but buried carbonate-rich horizons may be around 180 ka. Additional samples are being processed to clarify this relationship.

1.2.3.7.2.1 - Natural Resource Assessment

Compilation of data relating to ages of mineralization in the vicinity of Yucca Mountain was completed. Work continued on the 1:250,000 map showing relationships of mines, geology, and ages of mineralization. The map is being prepared digitally and will be available as a digital file. The manuscript for a report on ages of mineralization in the vicinity of Yucca Mountain was submitted for internal review.

IGG work in support of potential mineralization increased this month with trips to two gold deposits west and north of Yucca Mountain. Samples were taken in order to assess the traceability of these types of mineralization using chemical and isotopic methods. Also, viewing the geologic setting of these deposits will allow more accurate assessment of potential mineralization at Yucca Mountain. Preliminary strontium data indicate that mineralizing fluids carried strontium with a radiogenic signature.

WBS 1.2.5 - REGULATORY

1.2.5.2.2 - Site Characterization Program

USGS responses to NRC comments on Study Plan 8.3.1.2.1.4, R0, Regional Hydrologic System Synthesis and Modeling, were submitted to YMPO.

1.2.5.3.5 - Technical Data Base Input

Seventy Technical Data Information Forms (TDIFs) were received into the Participant Data Archives (PDA), and 42 new entries in the Automated Technical Data Tracking System (ATDT) were quality checked. Twenty new TDIFs were created for backlog publications; 21 previously submitted TDIFs were corrected to meet minimum current standards; and 7 publications were received for processing into the Project Technical Data Base (TDB).

1.2.5.4.4 - Site Performance Assessment Modeling

The paper presenting the 2-D matrix model, "Numerical modeling of lateral infiltration into the Paintbrush unit at Yucca Mountain, Nevada", is currently in review by SNL and USGS, and will be published as a LBL report. A technical report detailing a fracture and fault model is being written.

1.2.5.4.6 - Development & Validation of Flow & Transport Models

A technical report on functional relations is being written, with additional functional relations being tested after considering comments obtained at a

thermal loading workshop held in Denver.

1.2.5.4.7 - Supporting Calculations for Postclosure Performance Analysis

A technical report on thermal effects is being prepared.

1.2.11 - QUALITY ASSURANCE

1.2.11.3 - Quality Assurance Verification

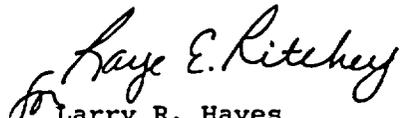
Supplier evaluations of Eppley Laboratories, Inc., SATEC Systems, Ball Corp., and Scott Specialty Gases, Inc. were performed and reports submitted with the recommendation that these suppliers be retained on the Approved Suppliers List. The evaluations of Radiation Energy Balance Systems and Certified Balance Service, Inc. were completed. The planned evaluation of REECO was delayed until August 30, to allow for review of a YMPO Audit Report due by the end of July. Two supplier requalification audits were completed.

WBS 1.2.12 - INFORMATION SYSTEMS

1.2.12.2.2 - Local Records Center Operation

All records were received into the LRC within the 10-day submittal period, and no corrective actions were requested of the USGS by the CRF. The LRC received 332 individual records, along with 32 current criteria packages and 1 data package, with corrective actions being required on 3% of these. Current material transmitted to the CRF from the LRC included 45 individual records, 55 criteria packages (1,510 pages), and 1 data package (2,657 pages). Backlog material included 10 publications packages, 27 other criteria packages, and 1 backlog cited reference (7,347 pages).

Sincerely,


for Larry R. Hayes
Technical Project Officer
Yucca Mountain Project
U.S. Geological Survey

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YMP-USGS Local Records Center File 1.1.02