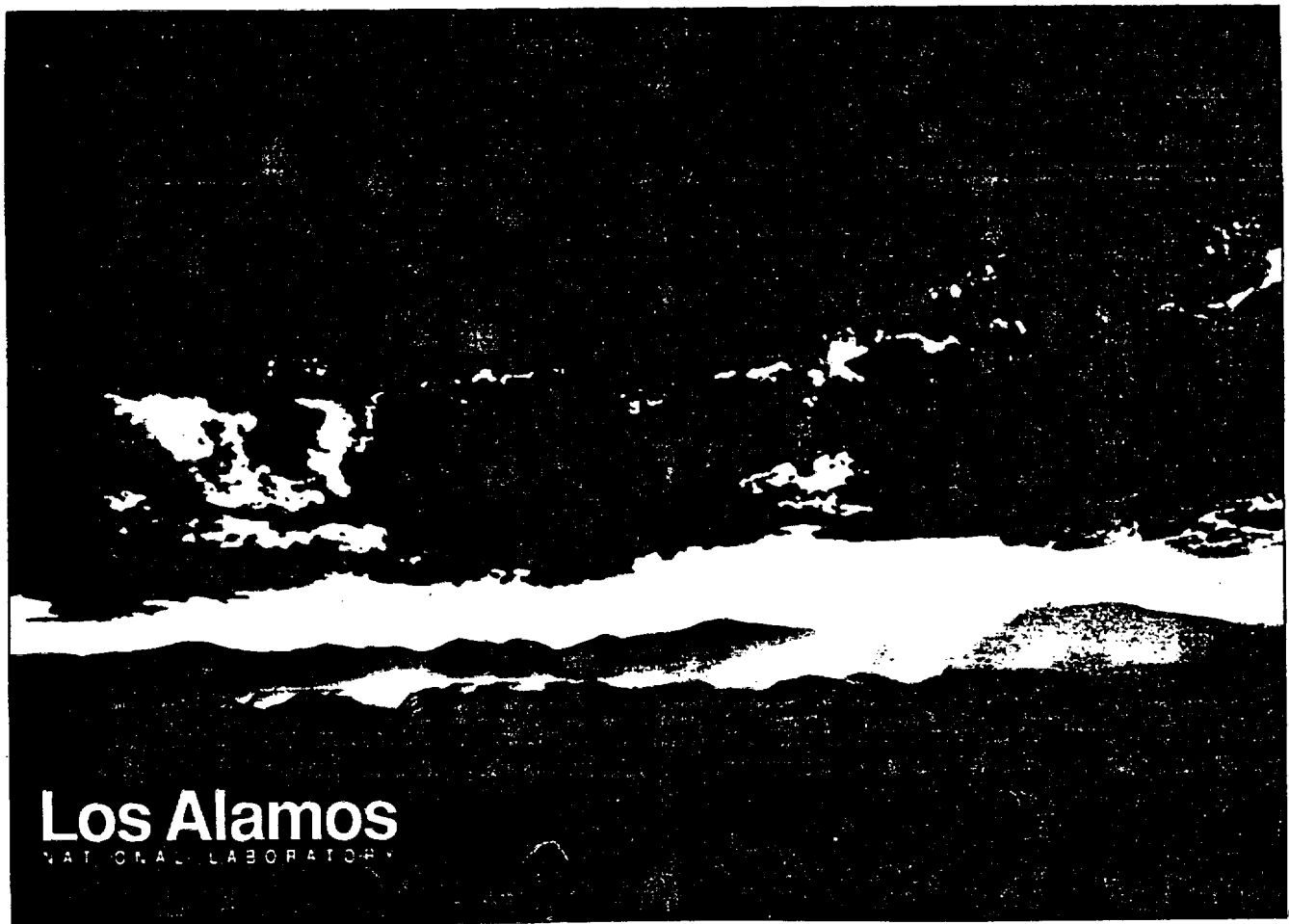


# *Yucca Mountain Site Characterization Project*

## *Monthly Activity Report*

*April 1992*



*Attachment to TWS-EES-13-06-92-054*

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This document has not received formal technical or policy review by Los Alamos National Laboratory or by the Yucca Mountain Site Characterization Project. Data presented in this report represent work progress and are not intended for release from the US Department of Energy.

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# LOS ALAMOS NATIONAL LABORATORY

## YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

### Monthly Activity Report April 1992

#### WBS 1.2.1 Systems

**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.

#### Technical Data (WBS 1.2.1.3.5)

**Activities and Accomplishments**                      Staff received input from principal investigators on the Parameter Normalization List.

**Planned Activities**                      Submit data from B. Crowe and B. Carlos to the Automated Technical Data Tracking System.

Submit input to SAIC on the Parameter Normalization List.

Work on the parameter screens for the Technical Data Base.

Submit data from I. Triay to the Site and Engineering Property Data Base (SEPDB).

Finalize quality procedure 8.3, "Transfer of Data."

#### Caisson Experiment (WBS 1.2.1.4.6)

**Activities and Accomplishments**                      The standard operating procedure (SOP) for the caisson experiment was completed and submitted to the Los Alamos Health and Safety Division for approval.

Arrangements were made with Engineering Division at Los Alamos for the caisson filling on 1 June. A key constraint on this start date is the design and equipment required for the lower-boundary condition.

Work continued on the article for the special issue of *Radioactive Waste Management*.

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April 1992

**Planned Activities**

Discuss the lower boundary condition with Sandia National Laboratory staff.

Prepare the caisson for filling.

Revise SOP as dictated by review.

Write manuscript for special issue of *Radioactive Waste Management*.

**Publications**

E. P. Springer and M. D. Siegel

*An Integrated Intermediate-Scale Caisson Experiment to Validate Models of Fluid Flow and Contaminant Transport in the Unsaturated Zone*

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

In preparation.

**Performance Assessment Calculational Support (WBS 1.2.1.4.7)**

**Activities and Accomplishments**

G. Valentine and K. Birdsell attended a NRC/DOE technical exchange in Albuquerque on 28-29 April. The discussion focused on calculating complementary cumulative distribution functions (CCDFs).

G. Valentine attended the International High-Level Radioactive Waste Management Conference in Las Vegas on the 15-16 April.

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## WBS 1.2.3.1 Site Management and Integration

### Site Management (WBS 1.2.3.1.1)

<b>Objective</b>	The objective of this task is to manage and integrate site characterization activities.
<b>Activities and Accomplishments</b>	<p>Staff continued to participate in the Integrated Test Evaluation group.</p> <p>The RSE and ED division leaders toured the laboratory facilities at Los Alamos and met with key staff to discuss ESF test coordination.</p>
<b>Publications</b>	<p>J. A. Canepa  <i>Strategy for Testing the Applicability and Validity of Radionuclide Transport Models for Yucca Mountain, Nevada</i>            Conference Paper, Migration '91, Jerez de la Frontera, Spain, 14-18 October 1991            In revision.</p> <p>A. M. Simmons and J. A. Canepa  <i>Recent Developments in the Integrated Approach Toward Characteristics of Radionuclide Transport, Yucca Mountain, Nevada</i>            Conference Paper, Waste Management '92 Symposium, 2-6 March 1992            In preparation.</p>

### Surface-Based Test Coordination (WBS 1.2.3.1.1.)

<b>Objective</b>	The goal of this investigation is to provide coordination for Los Alamos surface-based test planning package development.
<b>Activities and Accomplishments</b>	<p>Continued work to develop Tracers, Fluids, and Materials (TFM) Management Program consistent with plan issued by the Project (YM 91-23) prepared by Los Alamos.</p> <p>Began activities to develop ESF-based sample requirements for laboratory tests.</p> <p>Completed Appendix B for YMPO 06-04 as part of the Project. Met with participant's point of contact to discuss strategy for gathering tracers, fluids, and material-related information.</p> <p>Final reviews and Los Alamos approvals in support of the Test Planning Package and Job Packages for UZ-16 Water Movement Tracer Tests were provided.</p> <p>The readiness review for UZ-16 activities was completed with Los Alamos participating as a readiness review team member.</p> <p>Sample collection instructions were developed by the Water Movement Tracer Test Principle Investigator for UZ-16 drilling and submitted to the Sample Management Facility staff.</p> <p>Several sample requests were evaluated and approved by the Sample Overview Committee.</p>

## 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 mineralogic 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	<p>Results of the internal February audit were distributed; three deficiencies, which were corrected during the audit, were identified. There were also six observations that will impact upcoming operations and require certain procedures to be revised. The entire staff reviewed and revised several quality procedures.</p> <p>A journal article, "Fracture-lining Manganese Oxide Minerals in Silicic Tuff, Yucca Mountain, Nevada," by B. Carlos, S. Chipera, D. Bish, and S. Craven is in internal review (milestone 3123). Scanning electron microscope (SEM) images will be used as figures in the paper.</p> <p>Assembly of the new INEL microdiffractometer was completed this month. It is now being tested.</p> <p>B. Carlos, D. Vaniman, J. Whelan (USGS), and C. Lewis (SMF) visited the Bond Gold Mine near Beatty to sample calcite, opal, and oxide minerals for comparison to the fracture minerals at Yucca Mountain.</p> <p>J. Whelan of the USGS and E. Roedder of Harvard University visited Los Alamos to coordinate the mineralogic/geochemical studies of deep fracture calcites with the studies of stable isotopes (J. Whelan) and fluid inclusions (E. Roedder). Calcites from both the saturated and unsaturated zones are being studied to evaluate their potential role as markers of relatively recent fracture transport and their possible significance in evaluating paleorecharge.</p> <p>S. Bolivar attended the April SOC meeting at the Sample Management Facility. Several potential sample requests were discussed; a request from the State of Nevada for 7 samples was approved.</p>
Planned Activities	Work planned within the next few months includes the following activities: (1) continued analysis of fracture fillings in the Paintbrush Tuff to determine mineral distribution and factors controlling that distribution; (2) completion of internal review of the paper on Mn-oxides; and (3) continued analysis of calcites to understand transport and precipitation mechanisms.
Problem Areas	None
Milestone Progress	<p>3120 29 May 1992 <i>Calcite in the Upper Paintbrush Tuff</i></p> <p>This milestone will be delayed by about one month because of (1) redirection of a larger part of the author's effort into calcite-silica studies under 1.2.3.2.1.1.2 and (2) expansion of the scope of the milestone to include more data on calcites below the water table.</p>

Continued on next page



3130  
17 August 1992  
*Fracture Mineralogy of the Paintbrush Tuff*

3137  
30 September 1992  
*Mineralogy of Calico Hills for Adit Development*  
90% complete.

Publications

D. E. Broxton  
*Chemical Changes Associated with Zeolitization on the Tuffaceous Beds of Calico Hills at Yucca Mountain, Nevada*  
Conference paper, *Proceedings of the 7<sup>th</sup> Water-Rock Interactions Symposium*, July 1992  
Approved by YMPO.

B. Carlos, D. Bish, S. Chipera, and S. Craven  
*Fracture-Lining Manganese Oxide Minerals in a Silicic Tuff*  
Journal article, *Chemical Geology*  
Undergoing extensive revision.

G. D. Guthrie, D. L. Bish, and B. T. Mossman  
*Quantitative Analysis of Zeolite-Bearing Dusts Using the Rietveld Method*  
Journal article,  
Submitted to *Science*.

D. 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, *Journal of Geophysical Research*  
Draft complete; may be revised for a different journal.

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## WBS 1.2.3.2.1.1.2 Mineralogic 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	<p>Staff reviewed QP-3.5, R1, "Documenting Scientific Investigations."</p> <p>We prepared a DOE position paper on the calcite-silica issue. D. Vaniman and S. Levy attended a press conference at which the National Academy of Science/National Research Council Panel on Coupled Processes issued a report evaluating the data related to possible origins of calcite-silica veins, calcretes, breccias, and other alteration features exposed around Yucca Mountain.</p> <p>Thirty samples of altered rock from Trench 14, Busted Butte, and Yucca Mountain were prepared and submitted for thin-sectioning. D. Vaniman collected samples at Trench 14A in which a different tuff unit (the Rainier Mesa Member of the Timber Mountain Tuff) occurs in the foot wall. This sampling effort will further test how sensitive the calcite-silica veins may be to wall-rock chemistry. Chemical data from previous Trench 14 samples indicate that the detritus mixed in with the calcite silica must have passed through an episode of soil evolution at the land surface, and direct intermixture of calcite silica with the wall rock adjacent to the vertical veins is minimal. These results agree with petrographic and isotopic data that indicate a pedogenic origin for the calcite-silica deposits.</p> <p>D. Vaniman and S. Levy attended a USGS climate workshop in Denver. One workshop participant suggested that proposed and ongoing Yucca Mountain studies be placed in a regional framework. Vaniman presented results of his mineralogic studies, including preliminary results on the mineralogic contributions of plants.</p> <p>G. WoldeGabriel is conducting scanning electron microscope (SEM) studies of Yucca Mountain rock samples used for K/Ar studies to determine a paragenetic sequence from textural relations among secondary minerals; this information will be compared to isotopic dating results.</p>
Planned Activities	Characterization of new materials for hydrothermal experiments will continue, as will ongoing analysis of Trench 14 and other samples. SEM studies of samples from surface exposures of suspected hydrothermal deposits and materials used for K/Ar studies will continue as well.
Problem Areas	None
Milestone Progress	<p>3138 30 October 1992 <i>Chemical Transport in Zeolitic Alteration</i> 58% complete.</p> <p>3141 31 March 1992 (delayed due to participation in the issue resolution process) <i>Laminated Zone in Trench 14</i> 60% complete.</p>

*Continued on next page*

3142

3142  
3 April 1992  
*K/Ar Dating of Clays and Zeolites*  
Approved by YMPO.

3143  
15 January 1992  
*Experimental Dehydration of Volcanic Glasses*  
In program review.

3150  
15 April 1993  
*Final Report on Bedrock*  
22% complete.

#### Publications

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.

G. WoldeGabriel, et. al.  
*Preliminary Assessment of Clinoptilolite K/Ar Results from Yucca Mountain, Nevada: a Potential High-Level Radioactive Waste Repository Site*  
Conference paper, *Proceedings of the 7<sup>th</sup> Water-Rock Interactions Symposium*, July 1992  
Approved by YMPO.

D. Vaniman, D. Bish, and S. Chipera  
*Dehydration and Rehydration of a Tuff Vitrophyre*  
Journal article, *Journal of Geophysical Research*  
Submitted for review.

D. Vaniman, M. Ebinger, D. Bish, and S. Chipera  
*Precipitation of Calcite, Dolomite, Sepiolite, and Silica from Evaporated Carbonate and Tuffaceous Waters of Southern Nevada*  
Conference paper, *Proceedings of the 7<sup>th</sup> Water-Rock Interactions Symposium*, July 1992  
Approved by YMPO.

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April 1992

## **WBS 1.2.3.2.1.2 Stability of Minerals and Gases**

### **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**

This activity has been deferred.

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*Preliminary Data—Do Not Reference*

## 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	<p>A response to the paper by Turrin, <i>et. al.</i>, "<sup>40</sup>Ar/<sup>39</sup>Ar Age of the Lathrop Wells Volcanic Center, Yucca Mountain, Nevada," has been approved for publication in an upcoming issue of <i>Science</i>.</p> <p>We evaluated paleomagnetic data, including new data for the Ql<sub>6</sub>, Ql<sub>5</sub>, and the buried lava flow at Lathrop Wells Volcanic Center and published work by the USGS. We believe the paleomagnetic method provides little useful information for resolving the problems with stratigraphic or geochronology models because the measured field directions overlap the time-averaged quaternary field direction, the quality of outcrops is marginal for sample collection for some flows, and there are problems with lightning. Published data by the USGS are insufficient to document two distinct field directions. Field examination of sample sites used for paleomagnetic studies of the summit of the main cone shows that some bombs are probably redeposited by hydrovolcanic eruptions and are unsuitable for paleomagnetic studies.</p> <p>Four talks were presented at the High-Level Radioactive Waste Management meeting in Las Vegas, and the full papers were published in the proceedings distributed at the meeting.</p> <p>Three talks by members of the volcanism staff were presented at the University of Texas, El Paso, New Mexico State University, and Arizona State University.</p> <p>A field trip was conducted at the Lathrop Wells Volcanic Center with R. Fisher, an expert on emplacement mechanisms of pyroclastic deposits. The group examined the tephra deposits in the quarry at the south end of the main scoria cone, and Fisher agreed that they, with interbedded soil units, are of volcanic origin (hydrovolcanic/strombolian), which implies a complex eruptive history. We traced these deposits to the summit of the cone, using newly cut exposures from the quarrying operation. The uppermost deposits of the cone are mixed hydrovolcanic-strombolian eruptions.</p> <p>A comprehensive two-week audit of the volcanism program was completed. Two DRs were issued for the volcanism program.</p> <p>Thermoluminescence age-determination analysis of soils baked by lava flows from the Snake River Plains was completed.</p> <p>Work continued on the Issue Resolution Report for volcanism, and we met with the DOE and M&amp;O to discuss the report.</p> <p>Sample preparation was completed on sets that will be submitted for INAA and age determinations using the <sup>40</sup>Ar/<sup>39</sup>Ar method.</p> <p>Following several meetings and reviews of OSHA standards for trenching, the EES-13 Field Safety Plan and standard operating procedures (SOPs) for trenching using a truck-mounted backhoe were revised and submitted to Los Alamos management for review and approval.</p>
Planned Activities	Field geochronology studies at Piate Ridge and Crater Flat will continue.

*Continued on next page*

Meet with Los Alamos management to review SOPs for operation of the truck-mounted backhoe.

Final revisions of the Study Plan 8.3.1.8.1.2, "Dynamics of Magmatic Systems and Effects on the Repository," will be completed next month and submitted to DOE.

**Milestone Progress**

3174

8 January 1992

*Effects of Magmatic Disruption on the Repository* (Study Plan 8.3.1.8.1.2, R0)  
Complete.

3071

September 1992

*Status of Geochronology Studies at the Lathrop Wells Volcanic Center*  
Complete.

3129

10 July 1992, expected completion April 1992

*Geochemistry of Lathrop Wells Eruptive Sequences*  
Complete.

3034

30 September 1992

*Report on Magma System Dynamics*

3035

30 September 1992, expected completion April 1992

*Effects of Strombolian Eruption*  
Complete.

3109

30 September 1992

*Report of Subsurface Effects*

3111

30 September 1992

*Preliminary Geologic Mapping of Volcanic Centers*

3164

30 September 1992

*Progress Report on Thermoluminescence*

**Publications**

B. M. Crowe, et. al.

*Issue Resolution Report*

In preparation.

B. M. Crowe, et al.

*Lathrop Wells Volcanic Center: Status of Field and Geological Studies*

Proceedings paper, *The International High-Level Radioactive Waste Management (IHLRWR) Conference*

Published.

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*Continued on next page*

B. M. Crowe, *et al.*

*Recurrence Models of Volcanic Events: Applications to Volcanic Risk Assessment*

Proceedings paper, *The International High-Level Radioactive Waste Management (IHLRWR) Conference*

Published.

F. V. Perry and B. M. Crowe

*Geochemical Evidence for Waning Magnetism and Polycyclic Volcanism at Crater Flat, Nevada*

Proceedings paper, *The International High-Level Radioactive Waste Management (IHLRWR) Conference*

Published.

G. A. Valentine, B. M. Crowe, and F. V. Perry

*Physical Processes and Effects of Magnetism in the Yucca Mountain Region*

Proceedings paper, *The International High-Level Radioactive Waste Management (IHLRWR) Conference*

Published.

S. G. Wells, *et al.*

*Multiple Eruptive Events at Small Volume Basaltic Centers: Evidence From the Cima and Crater Flat Volcanic Fields*

Journal article

In preparation.

## 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>The subcontractor, Hydro Geo Chem, processed 12 ream-bit cutting samples from USW UZ-N54 and -N55, plus 5 USGS water samples from the Yucca Mountain area, for <math>^{36}\text{Cl}</math> analysis. These samples have been submitted to an outside laboratory for analysis.</p> <p>The collection of ream-bit cuttings was completed for three additional neutron-access boreholes being drilled for the USGS study, "Characterization of Unsaturated-Zone Infiltration." Thus far, 11 holes have been drilled for this study and have provided samples for <math>^{36}\text{Cl}</math> analysis. Hydro Geo Chem received from the Sample Management Facility (SMF) a shipment containing the soil samples collected by the J. Fabryka-Martin in February and March, plus the alluvial ream-cutting samples from USW UZ-N37.</p> <p>A draft DP for ion chromatographic analysis (LANL-INC-DP-94) was completed and is ready for technical and QA review. Based on the experience gained from applying various procedures over the past 3 months, we are preparing revisions of several other existing DPs (DP-88, -89, -92, -95, and -97) for review.</p>
Planned Activities	Complete additional DPs; process soil samples for Cl/Br and $^{36}\text{Cl}/\text{Cl}$ ratios; process cuttings samples from neutron-access boreholes; collect additional soil samples from Yucca Mountain area as opportunities arise.
Milestone Progress	<p>3191</p> <p><i>Procedure for Chlorine-36 Analysis of Unsaturated Zone Samples</i></p> <p>25 September 1992</p> <p>75% complete.</p>

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# **WBS 1.2.3.3.1.2.5 Diffusion Tests in the ESF**

<b>Objective</b>	The objective of this task is to determine <i>in situ</i> the extent to which the nonsorbing tracers diffuse into the water-filled pores of the Topopah Spring welded unit.
<b>Activities and Accomplishments</b>	No significant activity in this study.
<b>Milestone Progress</b>	No milestones are planned this fiscal year.

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

<b>Objective</b>	Experiments will be conducted at the C-Well complex (holes UE-25 c#1, UE-25 c#2, and UE-25 c#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.
<b>Activities and Accomplishments</b>	<p>Software Qualification. The review comments of the SRS for FEHMN application are currently being addressed. The cdftools application (tools for using the netCDF software more easily) has been approved and certified for use. Work continued on the GZSOLVE and genplot (general-purpose plotting routine using DISSPLA graphics software) applications, but no new baselines have been completed. Other software required for data acquisition and control of the laboratory experiments has also been certified.</p> <p>Lithium Bromide Studies. Following servicing, performance of the ion chromatograph (IC), which is used to measure the concentration of dissolved ions, has improved, and the measurement precisions are now well below the value stipulated in the IC detailed technical procedure. The standard operating procedure for the IC was also revised to reflect the optimized analysis procedures developed. The hot room in which the experiments will be carried out (38°C is the temperature for the first set of tests) is now operational, and all samples and equipment have now been prepped for the first set of batch sorption experiments. Methods for suspending the solids in solution have been tested, and low fluid-to-rock ratios (1 ml:1 g) have been achieved.</p>
<b>Planned Activities</b>	<p>Continue to bring the computer codes FRACNET, FEHMN, GZSOLVE, and SORBEQ and other software into compliance with the SQAP. This consists of compiling existing documentation on these codes and writing new material required by the SQAP where necessary.</p> <p>Carry out batch sorption experiments with lithium bromide.</p> <p>Continue developing techniques to measure the concentration of polystyrene microspheres in solution.</p> <p>Complete paper on a validation strategy for the matrix diffusion conceptual model.</p>
<b>Problem Areas</b>	None
<b>Publications</b>	<p>W. L. Polzer, W. L., M. G. Rao, H. R. Fuentes, and R. J. Beckman <i>Thermodynamically Derived Relationships Between the Modified Langmuir Isotherm and Experimental Parameters</i> Journal article, <i>Environmental Science and Technology</i> Undergoing revision.</p> <p>B. A. Robinson <i>FRACNET—Fracture Network Model for Water Flow and Solute Transport</i> LA-series report In preparation.</p>

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*Continued on next page*

B. A. Robinson  
*SORBEQ—A One-Dimensional Model for Simulating Column Transport Experiments*  
 LA-series report  
 In preparation.

B. A. Robinson  
 Journal article, *A Strategy for Validating a Conceptual Model for Radionuclide Migration in the Saturated Zone Beneath Yucca Mountain*  
*Radioactive Waste Management and The Nuclear Fuel Cycle*, Special issue on the Yucca Mountain Project  
 In preparation.

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

#### Milestone Progress

3188  
 30 September 1992  
*Documentation for SORBEQ*

3194  
 30 September 1992  
*Batch Sorption Experiments with Lithium*

T112  
 22 June 1992  
*Final Documentation for FEHMN*

3196  
 27 July 1992  
*FRACNET Documentation*

---

## WBS 1.2.3.4.1.1 Groundwater Chemistry Model

### Objective

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

### Activities and Accomplishments

Final revisions of papers for the 7th Water-Rock Symposium to be held in Park City, Utah, in July were completed.

Test matrix for geochemical model runs supporting most active groundwater determinations was begun. Different compositions of groundwater from Yucca Mountain will be used to simulate radionuclide dissolution and possible changes in water composition.

QA Activities. No additional progress to report on the IMOU between LLNL and Los Alamos. IMOU is in review in Las Vegas.

### Planned Activities

Track Study Plan 8.3.1.3.1.1 during YMPO review.

Continue USGS collaboration. Dissolved gas compositions (e.g., fugacities of CO<sub>2</sub>g and O<sub>2</sub>g) from existing and new water-table wells will be used to determine Eh conditions independently of Pt electrode measurements. The gas composition data will also be used in further pH buffering capacity modeling and for refined models of the overall groundwater chemistry.

Continue support of QA efforts. Continue tracking IMOU mentioned above.

### Problem Areas

None

### Milestones Progress

3006

31 August 1992

*Eh and pH Buffering Capacity*

3415

30 September 1992

Letter Report: *Most Active Groundwater Chemistry*

### Publications

M. Ebinger

*Water-Rock Interactions and the pH Stability of Ground waters from Yucca Mountain, Nevada*

Conference paper, *Proceedings of the 7<sup>th</sup> Water-Rock Interactions Symposium*, July 1992  
Approved by YMPO.

D. Vaniman, D. Bish, M. Ebinger, S. Chipera

*Precipitation of Calcite, Dolomite, Sepiolite, and Silica from Evaporated Carbonate and Tuffaceous Waters of Southern Nevada*

Conference paper, *Proceedings of the 7<sup>th</sup> Water-Rock Interactions Symposium*, July 1992  
Approved by YMPO.

**WBS 1.2.3.4.1.2.1 and 1.2.3.4.1.2.3 Batch Sorption Studies and Sorption Models**

<b>Objective</b>	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.
<b>Activities and Accomplishments</b>	<p>P. Rogers attended two sorption-related symposia at the annual spring meeting of the American Chemical Society. Of particular interest were talks presenting high-resolution scanning-transmission (STM) images of chromium adsorbed on hematite and low-resolution atomic-force microscope (AFM) images of hematite dissolution in the presence of citrate. Keynote addresses by W. Stumm (EAWAG, Switzerland) and G. Sposito (UC Berkeley) stressed the importance of spectroscopic studies (especially using XPS and EXAFS) to understanding sorption mechanisms and developing predictive sorption models. Conversations with several participants yielded suggestions on experimental techniques to improve resolution of AFM images, particularly of hematite.</p> <p>M. Hawley attended the Materials Research Society Meeting, which also emphasized AFM and STM techniques and advances.</p> <p>New AFM tips that reduce the force applied to a sample during a scan were received. Reducing the scanning force is critical to obtaining images of sorbed compounds, the scanning force must be reduced; the force now used pushes most sorbed compounds out of the imaging field.</p>
<b>Planned Activities</b>	Prepare for two new staff who will be joining this task. Prepare for visit by representatives of the Office of Civilian Nuclear Waste Management.
<b>Problem Areas</b>	Work in conjunction with the Stanford contract has been temporarily suspended because of a lack of funds.
<b>Milestone Progress</b>	<p>3009 30 September 1992 <i>Variation of Water-Rock Ratio Sorption Coefficients on Zeolitic Tuff</i></p> <p>3212 30 September 1992 <i>Progress Report on Single Mineral Experiments</i></p>
<b>Publications</b>	<p>A. Meijer <i>A Strategy for the Derivation and Use of Sorption Coefficients in Performance Assessment Calculations for the Yucca Mountain Site</i> Conference proceedings, <i>Proceedings of the DOE/Yucca Mountain Site Characterization Project Radionuclide Adsorption Workshop at Los Alamos National Laboratory September 11-12, 1990.</i> Approved by YMPO.</p>

## 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

Work continued on characterizing of the siderophore(s) produced by microorganism 11c. Specifically, a bioassay of the siderophore, using ethylenediamine di (o-hydroxyphenyl) acetic acid (EDDA) was performed.

A review of the literature on chelation chemistry of mineral dissolution was completed.

Work continued on milestone 3080, "Report on Chelation," and 3092, "Report on Colloidal Agglomeration."

L. Hersman attended the annual meeting of the American Chemical Society.

### Planned Activities

Continue plutonium  $K_d$  experiments.

Continue colloidal agglomeration experiments.

### Problem Areas

None

### Milestone Progress

3080

30 September 1992

*Report on Chelation*

In preparation.

3092

30 September 1992

*Report on Colloidal Agglomeration*

In preparation.

3176

30 September 1992

*Procedure for Determination of Formation Constants*

In progress.

3177

30 September 1992

*Procedure for Determination of Effects on Colloidal Agglomeration*

In preparation.

### Publications

L. R. Hersman, D. E. Hobart, and T. W. Newton

*Preliminary Evidence of Siderophore/Plutonium Complexation*

Journal article, *Journal of Applied and Environmental Microbiology*

Resubmitted.

### 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	<p>A new staff member to assume D. Hobart's responsibilities is in the process of being hired. (Hobart has accepted a two-year appointment in Washington, D.C.)</p> <p>The revised study plan should be complete by the 15 August target date.</p> <p>D. Morris met with representatives of the DOE and proposed continuing solubility and speciation studies for FY93 and postponing solubility and speciation modeling until FY94.</p> <p>Task participants Clark, Hobart, Nitsche, Palmer, and Tait attended the national meeting of the American Chemical Society. Many excellent technical sessions, particularly in nuclear chemistry, geochemistry, and environmental chemistry, were of interest to those associated with Yucca Mountain Project research.</p> <p>Speciation Studies. Pu(IV) EDTA complexation experiments to observe speciation changes for pH 7 to 10 continued and preliminary analysis of the data suggests three species in this pH region. Single crystals of two of species were grown using slow evaporation from aqueous solution, and they will be examined by XRD studies as soon as appropriate standard operating procedures are completed. Line-width measurements made on Pu(VI) and Am(VI) carbonate complexes indicated that ligand substitution follows an associative pathway for uranium through americium. Data reduction on 13-C NMR on the 242-Pu(VI) carbonate system suggests that some additional experiments are warranted to deduce the intimate exchange mechanism. The results of these studies will be written up for publication as a milestone report and submitted to the <i>Journal of the American Chemical Society</i>.</p> <p>Synthesis on model complexes continued, and the letter report on model complex studies is presently being converted to LAMS format.</p> <p>Experimental work on the photoacoustic spectroscopy (PAS) system has focused on determining the absorption spectrum and cross section of bona fide Pu(IV) colloids. This data is necessary to check if any of the peaks observed in the Pu(IV)-carbonate system correspond to that of a colloid. Contrary to our expectations, we observed significant scattering and low signal strength for large sized colloidal particles. Unless we find that the smaller sized particles have significantly larger PAS signals, we believe that the Pu(IV) in bicarbonate media peaks we previously observed did not reflect colloid formation, and we will try to obtain PAS spectra from smaller sized colloidal particles. We will also use T-dependent PAS to measure the temperature effects on dilute Pu(IV)-carbonate systems.</p> <p>The FrameMaker-formatted version of the coding standards for QuickBASIC were submitted to the CCB for approval.</p> <p>Solubility Studies. Three neptunium oversaturation experiments in UE-25 p#1 water at 60°C have been completed, and three neptunium undersaturation experiments under the same conditions have been started. Solids from the oversaturation experiments at the same pH were used, except for a small portion set aside for XRD analysis. The undersaturation</p>

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experiments will be assayed frequently at first; assays will be decreased to every two to three weeks after the experiments are underway. All assays to date have been analyzed.

Alpha-pulse height analysis was used to shorten analyses time of assays from the Am/Nd experiments.

Work continued on a detailed technical procedure (DP), "Concentration Determination of Soluble Radionuclides from Data Provided by a Low-Energy Gamma Counting System." It will be submitted next month for review. Another DP, "Calibration of Low Energy Gamma Counters for the Yucca Mountain Waste Element Solubility Study," is being revised and will be resubmitted in June 1992.

#### Planned Activities

Certification of commercial NMR software will begin, and efforts in all above mentioned areas will continue.

D. Tait will attend the Rocky Mountain Regional Meeting of the American Chemical Society and present a talk at the session on chemistry and environmental issues.

#### Problem Areas

We are concerned about the loss of Software Quality Assurance Program staff as it may significantly impact our efforts in this task.

#### Milestone Progress

3031

30 September 1992

*Plutonium(IV) and Plutonium(VI) Carbonate Speciation Studies by NMR and PAS Spectroscopies*

On schedule.

3329

30 September 1992

*Report on Neptunium, Plutonium, and Americium Solubility Experiments in UE-25p#1 Water from Oversaturation.*

On schedule.

3330

1 January 1993

*Evaluation of Alternative Detection Schemes in Photoacoustic Spectroscopy*

Early completion anticipated.

#### 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  
*Plutonium(IV) and Plutonium(VI) Carbonate Speciation Studies by NMR and PAS Spectroscopies*  
LA-series report  
In preparation.

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

L. E. Hersman, P. D. Palmer, and D. E. Hobart,  
*Preliminary Evidence of a Siderophore/Plutonium Complex*  
 Journal article, *Journal of Applied and Environmental Microbiology*  
 Undergoing revision.

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

D. E. Morris and D. L. Clark  
*Spectroscopic Studies of the Hydrolysis of  $UCl_4$ ; Spectral Effects of Ligand Exchange*  
 LA-series report.  
 In preparation.

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 Groundwater (J-13) from the Yucca Mountain Region*  
 LA-series report  
 Submitted for YMPO review.

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*  
 In preparation.

C. D. Tait, D. E. Morris, S. A. Ekberg, P. D. Palmer, and J. M. Berg  
*Plutonium Carbonate Speciation Changes with pH*  
 Conference abstract, *American Chemical Society National Meeting Program*, April 1992  
 Approved by YMPO.

**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**

This month we continued Np transport work using crushed-tuff columns made from tuffs G4-1530.3 and G4-275. As stated last month, in order to study Np transport, we must obtain sharp breakthroughs for tritium elutions. (Neptunium is expected to sorb to trace minerals [such as hematite] in the tuff, which will tend to broaden the elution curves; consequently, we must ensure that physical dispersion is not responsible for the broadening.) We also completed optimizing all possible parameters (including packing techniques) to minimize elution broadening.

Table 1 shows the parameters used in columns tritium elutions for Columns G-J made with tuff G4-1530. We do not have a dry weight for Columns I and J because a wet-packing technique was used.

Table 1

Fig. No.	Column #	Flow Rate (ml/hr)	Length (mm)	Diameter (mm)	Dry/Wet Weight (g)
1	G4-1530.3G	3.0	1000	4.72	19.4/29.4
2	G4-1530.3H	0.15	1000	4.72	19.4/29.4
3	G4-1530.3I	0.3	1816.1	4.72	*NA/52.25
4	G4-1530.3J	1.0	1816.1	4.72	*NA/52.25

\*NA= not available

Figures 1-4 show the cumulative activity of tritiated water eluted through the columns (A/At) verses the cumulative volume eluted. Each column was injected with 0.5 ml of tritiated water. Column I showed the optimal breakthrough curve; however, the flow rate was too slow for timely completion of these experiments. Column J showed adequate dispersion, and we began the Np elution through this column. The results of these studies will be reported next month.

We observed a distinct amount of black material at the bottom of Column J, and using a magnetic separator, we separated the two fractions of crushed tuff G4-1530 and sent them for chemical and XRD analysis.

We tested all waters in storage (J-13, H-3 and P-1) for microbial activity; most of the J-13 water showed considerable microbial contamination and was discarded; one container that will be monitored long-term was retained. We found no microbial contamination in the USWH-3 and UE-25 p#1 waters.

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Fig. 1 HTO elution through G4-1530.3G

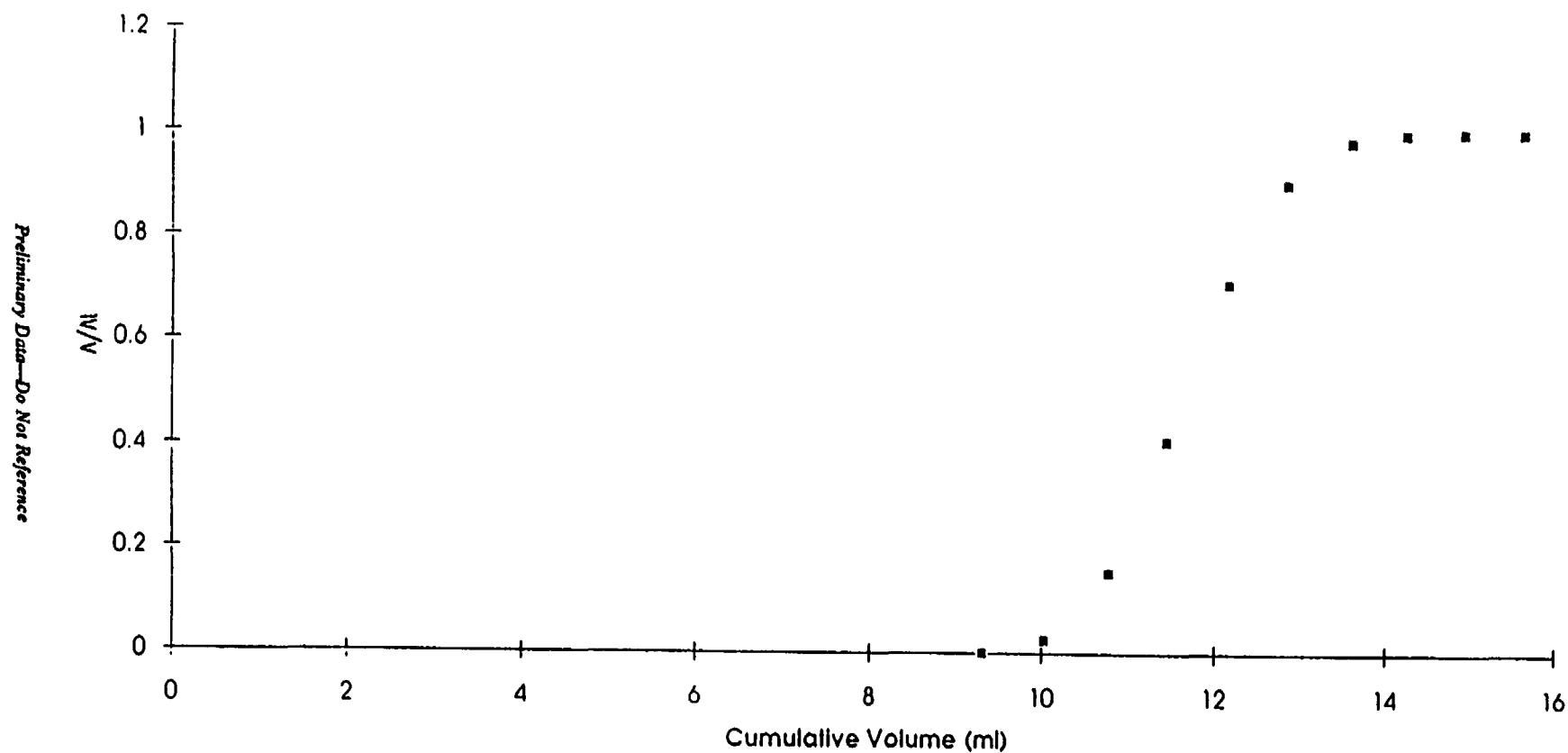


Fig. 2 HTO elution through G4-1530.3H

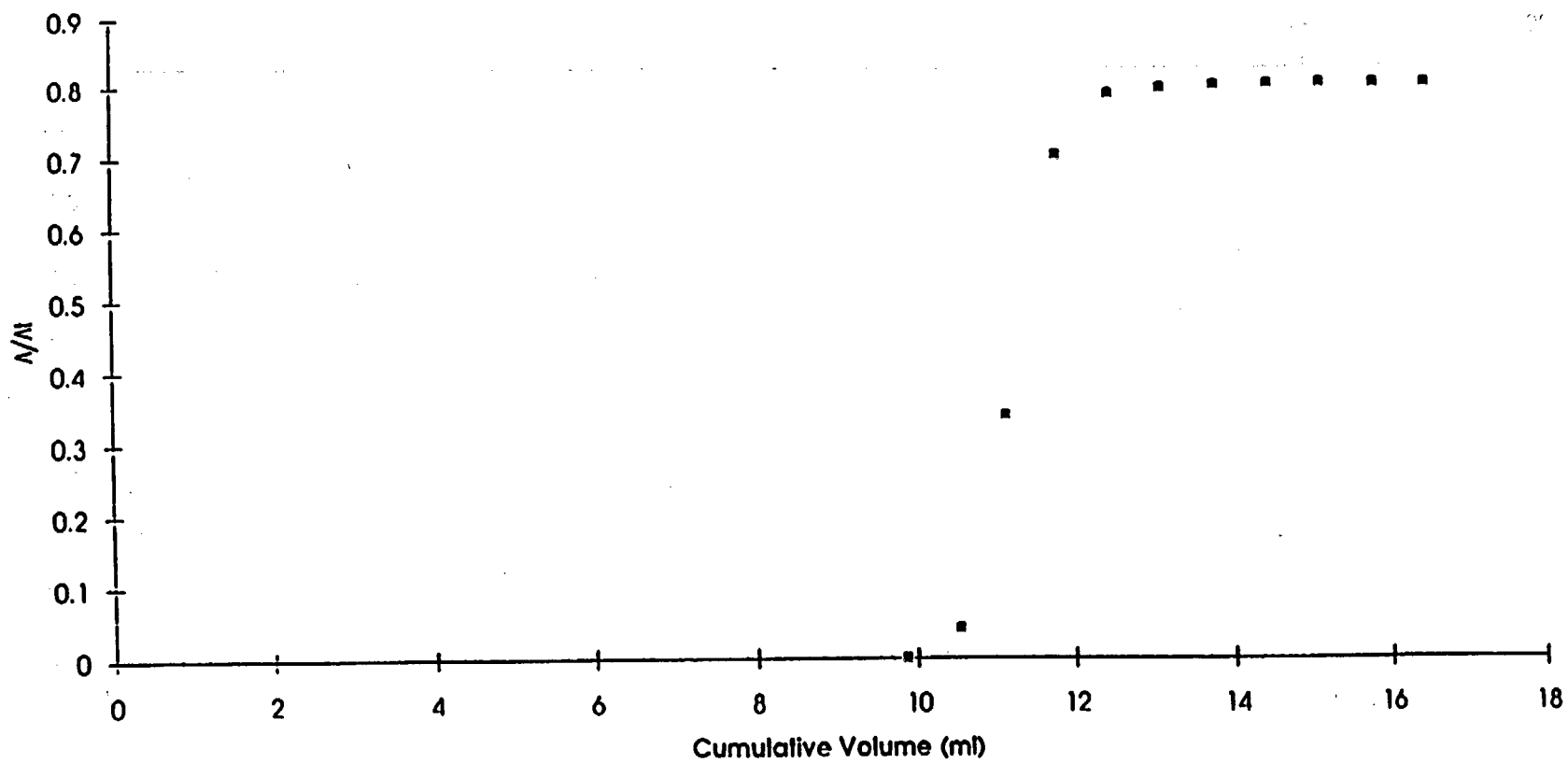
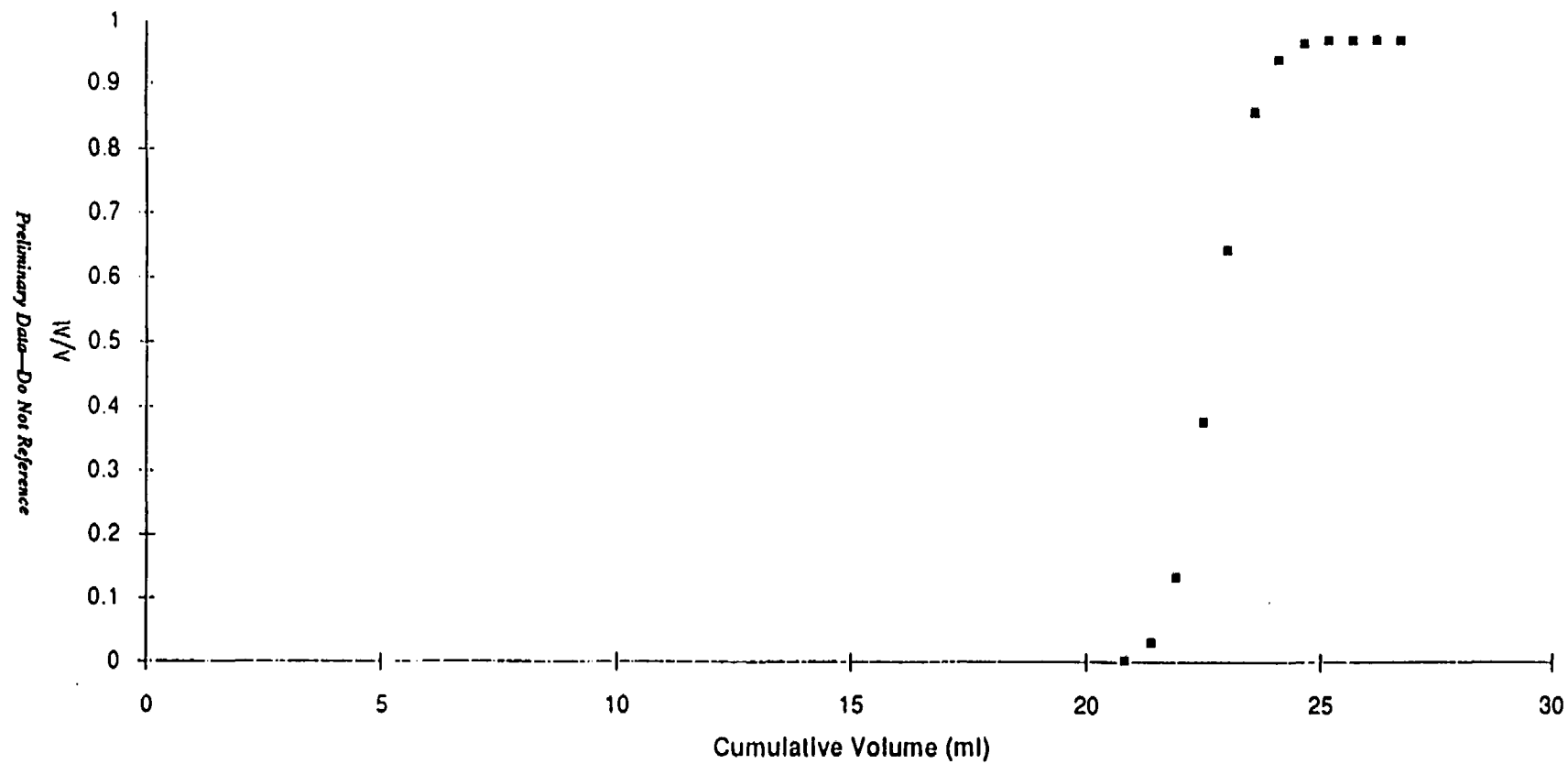
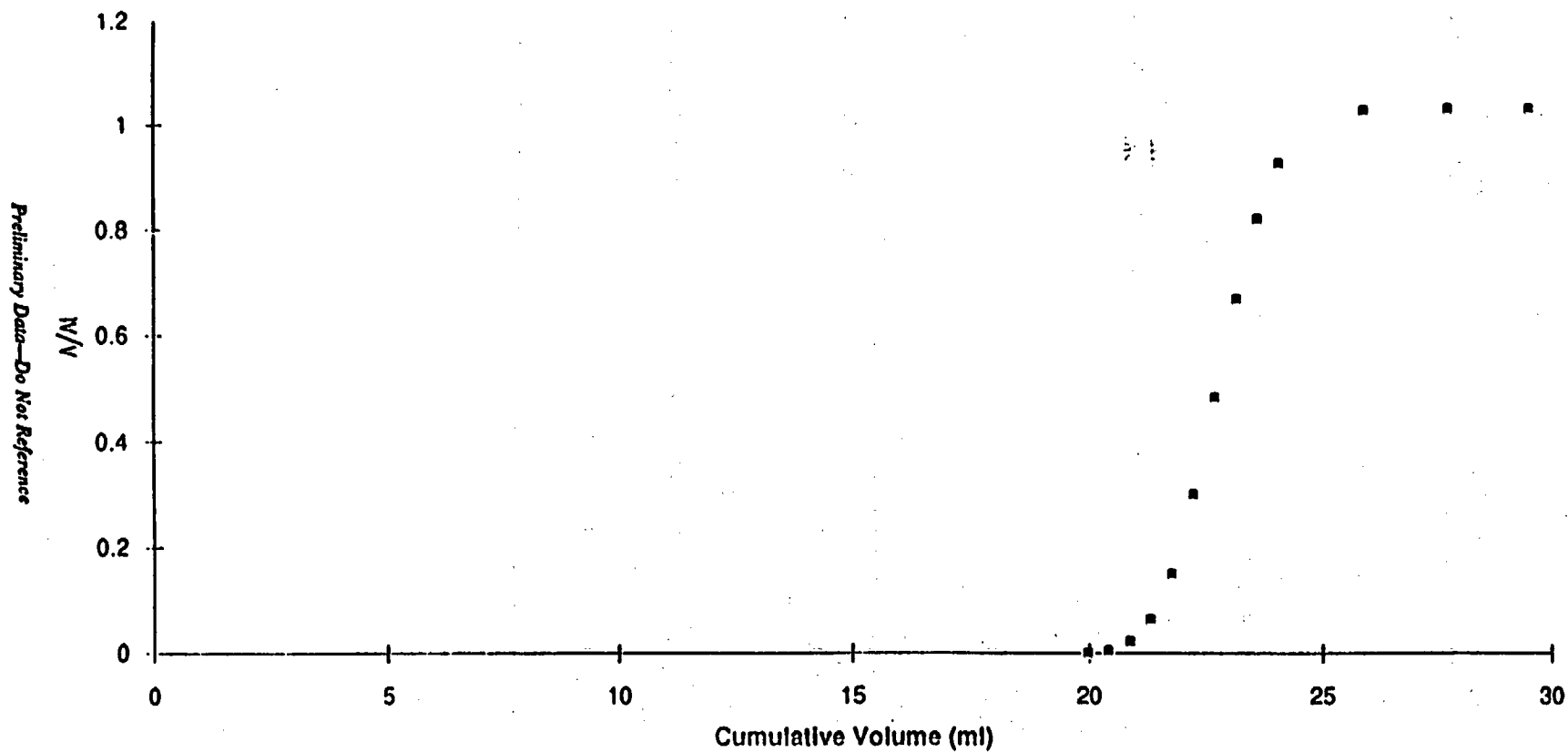


Fig. 3 HTO elution through G4-2530.3I



April 1992

Fig. 4 HTO elution through G4-1530.3J



Using sterile containers, A. Mitchell and M. Ott collected water from the J-13 well (L. Hersman advised the staff about a study regarding the optimal procedure to use to avoid microbial contamination.) The new J-13 water will be received at Los Alamos next month.

To support our transport experiments, we began Np batch-sorption experiments with tuffs G4-1530 and G4-275 with waters from USWH-3 and UE-25 p#1.

A. Mitchell served as a briefer at the Los Alamos exhibit for the April 1992 YMP open house, and A. Mitchell and M. Ott briefed a high-school tour at the FOC.

**Planned Activities** Continue work described above.

**Milestone Progress** 3040  
30 September 1992  
*Kinetics of Sorption on Columns of Pure Minerals*

3044  
31 August 1992  
*Letter Report on Assessment of Available Techniques for Unsaturated Column Transport Experiments*  
In preparation.

3027  
31 March 1992  
*Report on Sorption by Batch and Column Techniques*

**Publications** I. R. Triay  
*Radionuclide Migration in Tuff under Diffusive Conditions*  
Conference Paper, *Proceedings of the Migration '91, Jerez de la Frontera, Spain, 14-18 October 1991*  
In preparation.

I. R. Triay, A. J. Mitchell, and M. A. Ott  
*Radionuclide Migration Studies for Validating Sorption Data—Past, Present, and Future*  
Conference paper, *Proceedings of the DOE/Yucca Mountain Site Characterization Project Radionuclide Adsorption Workshop at Los Alamos National Laboratory September 11-12, 1990.*  
Responding to YMPO comments.

## 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	<p>K. Birdsell met with P. Rogers, the new principal investigator for the sorption task, to discuss our approach to modeling the minimum <math>K_d</math> sorption strategy. Rogers suggested specific radionuclides to focus on.</p> <p>QA and Programmatic. Certification of TRACRN is continuing, and the design phase will be submitted to the CCB in a few weeks. As part of the design phase, variable descriptions were written for 500 variables, and pseudocode was written for the new memory management subroutines and the restart subroutines. The Verification and Validation Plan is nearly complete; several additional verification problems were run, and the results were added to the Verification Report. We have almost completed work on a program that automatically reruns and verifies the verification problems and on the user's manual.</p> <p>G. Valentine chaired a review committee for the Software Requirements Specification Documents for the software CONAPS and MIEEQA, which are used for the dynamic transport task. He also performed a formal technical review of the FEHMN SRS.</p> <p>Pseudocode and variables descriptions were written for the matrix solver GZSOLVE, which will be a re-use component of several Los Alamos YMP codes.</p>
Planned Activities	We will continue certification of TRACRN.
Milestone Progress	<p>3052</p> <p>31 July 1992</p> <p><i>Baseline Documentation for TRACRN</i></p>
Publications	<p>K. Birdsell, K. Eggert, and B. Travis</p> <p><i>Three-Dimensional Simulations of Radionuclide Transport at Yucca Mountain</i></p> <p>Journal article, <i>Radioactive Waste Management and The Nuclear Fuel Cycle</i>, Special issue on the Yucca Mountain Project</p> <p>Responding to comments from YMPO.</p>

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**WBS 1.2.3.4.1.5.2 Demonstration of Applicability of Laboratory Data**

<b>Objective</b>	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 analogues will be assessed for their potential to provide the required data.
<b>Activities and Accomplishments</b>	<p>On 1 April a schedule and budget for the LBL component of this task was developed and loaded on software at Los Alamos for eventual PACS input to the Project. On 22 April, A. Simmons of the DOE was briefed on the techniques, plans, and status of field-test activity. A revised FY92 budget for LBL will allow more effort in planning. A change request to PACS will be prepared for LBL.</p> <p>A Hydrology Integration Task Force (HITF) meeting was held on April 16 in Las Vegas.</p>
<b>Planned Activities</b>	<p>Continue to develop study plan.</p> <p>Review LBL N and P Tunnels report.</p>
<b>Problem Areas</b>	None
<b>Milestone Progress</b>	No FY91 milestones.
<b>Publications</b>	<p>C. Loeven  <i>A Summary and Discussion of Hydrologic Data from the Calico Hills Nonwelded Hydrogeologic Unit at Yucca Mountain, Nevada</i>            LA-series report            Approved by YMPO.            Accession numbers for references are being obtained.</p>

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## **WBS 1.2.5 Regulatory and Institutional**

<b>Objective</b>	The purpose of this task is to coordinate the regulatory and institutional 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 and institutional framework.
<b>Management and Integration</b>	Significant effort was made to put forth changes to the SCP Baseline. In particular, the rock-varnish work to support volcanism, erosion, and neotectonic studies was identified discretely. PACs changes were initiated. Work began to evaluate rock-varnish data in support of the erosion issue resolution.
<b>Study Plans</b>	<p>Water Movement Test, R1 (8.3.1.2.2.2). R1 has been approved by DOE but not by NRC. A revision incorporating NRC and State of Nevada comments was submitted to the YMPO on 17 October 1991.</p> <p>Diffusion Test in the Exploratory Studies Facility, R0 (8.3.1.2.2.5). A revision incorporating DOE/HQ and Project Office comments was submitted to Dr. Dobson in June 1991.</p> <p>Testing of the C-Hole Sites With Reactive Tracers, R1 (8.3.1.2.3.1.7). In February 1990 DOE/HQ issued this study plan as a controlled document; it was then sent to the NRC for comments. In January 1992 we were requested by DOE to revise NRC comments. The revision is in progress.</p> <p>Ground Water Chemistry Modeling, R0 (8.3.1.3.1.1). In March 1991 this study plan was submitted to the project office for review.</p> <p>Mineralogy, Petrology, and Chemistry of Transport Pathways, R3 (8.3.1.3.2.1). In August 1990 the NRC approved the study plan. In October 1991 we were asked to revise the study plan; in January 1992 we submitted revised comments to T. Bjerstedt.</p> <p>History of Mineralogy and Geochemical Alteration at Yucca Mountain, R0 (8.3.1.3.2.2). The Project Office approved the study plan in December 1991 and submitted it to the NRC in January 1992 for comments.</p> <p>Natural Analogue Hydrothermal System in Tuff (8.3.1.3.3.1). This is an out-year activity.</p> <p>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). A comment resolution meeting for DOE/HQ and Project Office comments was held in March 1990; revision on this activity has been deferred because funds have not been allocated.</p> <p>Sorption Studies and Sorption Modeling, R0 (8.3.1.3.4.1; 8.3.1.3.4.3). A revision is in progress.</p> <p>Biological Sorption and Transport, R1 (8.3.1.3.4.2). Revisions incorporating DOE/HQ and Project Office comments were submitted in May 1991. Additional revised text were submitted in August 1991.</p>

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**Dissolved Species Concentration Limits, and Colloid Formation and Stability, R0 (8.3.1.3.5.1; 8.3.1.3.5.2).** In November 1990 the project office submitted comments to Los Alamos to revise; that revision is in progress.

**Dynamic Transport Column Experiments, R0 (8.3.1.3.6.1).** A comment resolution meeting for DOE/HQ and Project Office comments was held in August 1990; revisions are in progress and are expected to be completed by April 1992.

**Diffusion, R0 (8.3.1.3.6.2).** A comment resolution meeting for DOE/HQ and Project Office comments was held in August 1990; revisions are in progress and are expected to be completed by April 1992.

**Retardation Sensitivity Analysis, R0 (8.3.1.3.7.1).** A revision incorporating DOE/HQ and Project Office comments was submitted in June 1991. In October additional comments were received from SAIC, P. Cloke. The comments have been addressed and were submitted to the P. Cloke in March 1992.

**Demonstration of the Applicability of Laboratory Data to Repository Transport Calculations, R0 (8.3.1.3.7.2).** This study plan is in preparation.

**Gaseous Radionuclide Transport Calculations and Measurements, (8.3.1.3.8.1).** Funds have not been allocated.

**Probability of Magmatic Disruption of the Repository, R0 (8.3.1.3.1.1).** This study plan was approved by the Project Office in September 1990 and by the NRC in October 1991.

**Effects of a Volcanic Eruption Penetrating the Repository, R0 (8.3.1.3.1.2).** In preparation, expected target date is May 1992.

**Characterization of Volcanic Features, R0 (8.3.1.3.5.1).** Accepted by NRC in September 1990.

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## 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>Supported ED&amp;D in developing briefing material for Prototype Test Facility and started work to prepare draft Prototype Test Facility rationale and justification.</p> <p>Developed a draft summary-level document to assess sample needs from ESF.</p> <p>Continued to participate in Test Integration (TIG) meetings and SMF meetings.</p> <p>Prepared briefings for bi-weekly ESF management meeting.</p> <p>We have started developing test information for tests to be performed in north-portal area and started preparation of test planning packages for launch chamber tests.</p>
Planned Activities	<p>Prepare test planning packages for launch chamber tests.</p> <p>Continue gathering TFM information from participants.</p> <p>Continue to develop definitive design-related information for tests to be performed in the launch chamber.</p> <p>Continue to support integration meetings such as ESF design, TIG, SMF, surface-based testing and its interface with ESF testing.</p> <p>Support ED&amp;D effort in developing rationale and justification for the need to have a prototype test facility for Yucca Mountain.</p> <p>Continue to support Los Alamos surface-based test planning process.</p> <p>Develop interfaces for testing and the ESF design.</p> <p>Revise and update PSAR as required.</p> <p>Work will be initiated to prepare Title II Test Planning Packages.</p> <p>Initiate work to develop new networks for ESF testing.</p> <p>Complete YMP prototype concept paper with recommendations.</p> <p>Schedule Exploratory Studies Facility Test Coordination meeting for 12 May.</p>
Problem Areas	None
Milestones	None

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#### 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**      This activity has been deferred.

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#### **WBS 1.2.9.1.2.4 Technical Software Management**

**Objective**

The purpose of this activity is to manage the development, implementation, and use of all software employed on activities that will support a license application; to manage the configurations of all software and computational data; and to provide tools and procedures that support these activities. Technical software management continued to perform the quality assurance, configuration management, and engineering tasks that are required by the Los Alamos Software Quality Assurance Plan for the Yucca Mountain Project.

**Activities and  
Accomplishments**

This activity has been deferred because of lack of funds.

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#### WBS 1.2.9.1.4 Records Management

**Objective** The objective of this task is to manage records and documents related to the licensing of a geologic repository for the disposal of high-level radioactive waste by developing, implementing, and maintaining a comprehensive, automated, and integrated information management system.

**Activities and Accomplishments** An eight-month record backlog was processed, following lifting of the stop work order. Approximately 800 records were shipped to the Central Records Facility, and only 52 records were returns for corrections.

Fifty-nine new records were received during April.

Staff worked with the training coordinator to develop and implement formal records training. The course will be available as soon as revisions to the records procedures are finalized.

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### WBS 1.2.9.3 Quality Assurance

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.
Activities and Accomplishments	<p>Software. A software Configuration Control Board (CCB) meeting was held; 158 software change requests were submitted, and 95 were approved.</p> <p>Grading Reports. Los Alamos has 33 approved grading reports. A revised grading report is in review at the Project Office.</p> <p>Records/Document Control. Five detailed technical procedures (DP-07, -112, -125, -129, and -605) and one quality administrative procedure (QP 6.1, R4, Controlled Documents) were issued. Detailed technical procedures DP-06, -50, -122, and -123 were deleted.</p> <p>Training. The April orientation class was attended by 24 YMP staff. At this time approximately 75% of all YMP personnel have completed the new orientation course.</p> <p>Program Development. Eighteen quality administrative procedures (QPs) are in various stages of revision. The QAPL presented a semi-annual update of the QA program to EES-13/Las Vegas personnel. Work began on the FY93 budget. The QAL attended a Los Alamos root-cause training class.</p> <p>Deficiencies. The Project Office closed CAR-92-003. A trend evaluation for the first quarter of 1992 was submitted to the TPO; no new adverse trends were recognized, and two existing trends were closed.</p> <p>Audits. Audit reports for EES-13/Volcanism (LANL-AR-92-02), and subcontractors University of New Mexico (LANL-AR-92-03), Ohio State University (LANL-AR-92-04) and University of California at Riverside (LANL-AR-92-05) were approved and issued. The EES-13/Las Vegas TCO portion of audit LANL-AR-92-02 was postponed. Subsequently, audit plan LANL-AR-16 for EES-13/Las Vegas TCO was approved. Audit plan LANL-AR-06 for EES-5 was also approved. The annual management assessment of the Los Alamos QA program was completed.</p> <p>A quality assurance management assessment was conducted as required by the QA Plan.</p>
Planned Activities	QP revisions will continue and three 1991 survey reports will be completed. The annual quality assurance status report of 1991 will be published. An orientation class will be offered in May. Audits of EES-13/Las Vegas and EES-5 will be conducted.
Problem Areas	The current software quality assurance plan is under internal review and may be modified to accommodate current budget constraints.
Publications	<p>S. L. Bolivar <i>The Los Alamos National Laboratory Yucca Mountain Site Characterization Project Quality Program,</i> A Progress Report for January 1, 1990 - December 31, 1991. In internal review.</p>

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S. L. Bolivar and J. L. Day

*The Role of the Los Alamos National Laboratory Quality Assurance Liaison for the Yucca Mountain Site Characterization Project*

Conference paper, ASQC Energy Division annual meeting

In preparation.

S. L. Bolivar

*LATA, 1992, Evaluation Report on the March 13, 1992 Orientation to the Los Alamos National Laboratory Yucca Mountain Site Characterization Project*

In preparation.

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# EG&G ENERGY MEASUREMENTS

Santa Barbara Operations

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## PROGRESS REPORT - JUNE 1992

Attached is the June 1992 progress report on biological studies and support activities conducted by EG&G/EM for the Yucca Mountain Project. Please contact me (293-7762) or Kent Ostler (794-7474) if you have questions regarding this report.

EG&G Energy Measurements, Inc.

*Thomas P. O'Farrell*

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Enclosure

cc: W. Dixon, DOE/YMP  
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cc: LORRI / Gertz - oyo  
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cc: E. Jones

REC'D in YMP

7/10/92

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**YUCCA MOUNTAIN PROJECT  
BIOLOGICAL RESOURCES PROGRAM  
MONTHLY PROGRESS REPORT  
JUNE 1992**

**Summary of Work Accomplished During Report Period**

EG&G Energy Measurements (EG&G/EM) conducted work for the Biological Resources task (WBS 1.2.5.4.7) for the Project Office. Activities included conducting preactivity surveys; continuing site characterization effects studies, support studies for the radiological monitoring program, desert tortoise studies, and habitat reclamation studies; development of work instructions and study designs for new studies; and responding to requests for biological support by Project Office.

**Monitoring and Mitigation**

- Preactivity survey reports were submitted to Project Office for Radiological and Environmental Monitoring Stations NF14 and NF103 (#91-006), the Busted Butte pavement study (#92-007b), the 52 rock and soil test pits (#92-008b), and parts 1 and 2 of the Midway Valley Phase II activities (#92-009b). Trenches A-1, A-2, and MWV-T3 near Alice Hill still need to be surveyed to complete request 92-009b. Reclamation stipulations also were submitted for the rock and soil test pits and the Midway Valley Phase II activities.
- Surveys and reclamation inventories were conducted for the new trench sites on the Solitario Canyon and Fatigue Wash faults (#92-010b). The site for the RSN radio tower also was surveyed (#92-017b).
- A biologist was provided to monitor activities at Cima Dome (#91-010a) as required in the BLM right-of-way agreement.
- EG&G/EM attended a meeting concerning the proposed design, field work schedules, and information needs to assist in obtaining land access for the Exploratory Studies Facilities and the USGS proposed seismic reflection study.
- Tortoises were monitored in Midway Valley during construction activities. No tortoises were harmed or had to be moved because of site characterization activities (SCA).
- EG&G/EM provided biologists at the Project Office request to assist USGS scientists with land access following the earthquake in Rock Valley. Biologists were needed to search for tortoises when USGS scientists needed access into previously uncleared areas to place seismic monitors.

## **Habitat Reclamation**

- Plant seedling density was measured at neutron boreholes 54 and 55 on sites that were seeded in February.
- Twelve trial plots were irrigated at the Forty-Mile reclamation site. The trial plots containing shrub transplants were fenced to prevent grazing by cottontail rabbits and jackrabbits.
- A soil stabilization study plot was established on the reclamation site at the north end of Yucca Mountain.

## **Site Characterization Effects Program**

- Small mammals were trapped and released on eight ecological study plots (ESPs) to monitor population abundance, recruitment, and survival in relation to SCA. Large numbers of juvenile animals were captured indicating good reproductive success.
- Counts of reptiles were conducted on belt transects on 11 ESPs. These counts were made to supplement the mark-recapture populations estimates on the three ESPs with pitfall traps and drift fences.
- Soil moisture and temperature, precipitation, and air temperature data were recorded at the 48 ESPs at least once during the month. Data are being recorded only once each month at most ESPs because soil moisture has decreased to undetectable levels.
- Traffic count data were recorded weekly at eight locations. Three additional counters were added in mid-June.
- Vegetation cover was measured on nine ESPs. Cover measurements on the 48 ESPs now are completed for this year. Perennial and annual plant seedling densities were measured on nine ESPs. Seedling density measures now have been completed on 45 ESPs. Vegetation biomass (current years production) samples were collected on nine ESPs. Ten additional staff members were trained in vegetation identification.
- Fugitive dust samples were collected from 42 ESPs. Dust samples collected in May were weighed.

## **Radiological Monitoring Program**

- Small mammals were trapped on NF37 and NF59 to monitor the effects of the April collection on population abundance and recruitment. Large numbers of juvenile animals were captured indicating good reproductive success.
- The radiomarked quail were located each week. Only six of the ten quail radiomarked have survived. The other four were lost to predation. Two of the six radiomarked quail are still nesting. Nest success of the radiomarked quail has been good. Approximately 100 chicks were observed in one day. During the last week of June, one of the quail originally marked near Forty-Mile Wash was located 5 km west near the subdock. This movement has implications of whether the quail in Forty-Mile Wash can be considered a separate control population if quail are collected for radionuclide analysis.
- EG&G/EM (R. Green and M. Cox) met with the SAIC Radiological Monitoring staff (D. Sorenson and K. Prince) to discuss the current and future status of support studies EG&G/EM is conducting for the Radiological Monitoring Program. SAIC confirmed that land access approval was received for the new locations of two small mammal trapping locations. EG&G/EM will be responsible for moving the existing trap grids at NF5 and NF14 to the new locations. SAIC also confirmed that they would like to collect quail for radionuclide analysis during calendar year 1992.

## **Desert Tortoise Program**

- Seventeen new tortoises were found in the Yucca Mountain area. Three were marked with radio transmitters, seven were marked only with numbers, and seven were left unmarked. An attempt is made to mark all tortoises with individual numbers. Tortoises are not marked when sightings are not immediately reported or when a biologist is not immediately available to mark the tortoise. At the end of June, 165 tortoises had been marked in the Yucca Mountain area. Of these, 108 are fitted with radio transmitters. Most of the radiomarked tortoises were located twice each week. One radiomarked tortoise was found dead this month, apparently of natural causes.
- Selected female tortoises were weighed weekly to monitor weight changes that may be indicative of egg-laying. Eight tortoise nests were found in June. Eleven nests now have been found. Some natural weight loss is expected because forage plants are drying and water availability has decreased. Three male tortoises also were weighed to estimate the expected natural weight loss. This will help separate natural weight loss in females from weight loss attributable to egg-laying.
- Tortoise # 423 (relocated from Midway Valley) returned to within 3 km of its original release site. At the beginning of June, the tortoise was 800 m east of well J-11 (northeast corner of Area 25 Camp). During the following weeks, it moved

west and north and spent about two weeks in the area west of the E-MAD facility and south of the Canyon Substation. It now is located north of the Canyon Substation.

- Surveys were conducted for ravens in the Yucca Mountain area and in a control area near the Bare Mountains. Each area was surveyed five times.
- The design was started for studies to evaluate impacts on tortoises from proposed seismic studies and blasting activities.

#### **Support Items**

- The May monthly report of Yucca Mountain Site Characterization Project activities and accomplishments was sent to the Project Office. Weekly reports of activities also were submitted to Project Office and SAIC.
- The annual report of animal collection and handling conducted under EG&G/EM's State of Nevada Scientific Collection Permit was submitted to the Nevada Department of Wildlife. This report was submitted as part of EG&G/EM's permit renewal application.
- Budget estimates and scopes of work were submitted to the Project Office for FY93, FY94, and FY95-01 for inclusion in the PACS system.