Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

MAY 20 2 35 PM '93

WBS 1.2.9.1
QA N/A

DIVISION
CC Gertz
CC Lord - w/o
CC Gladney
CC Jones, S
CC See Distribution
CC Just (YMP)
CC:
CC:

May 3, 1993

TWS-EES-13-05-93-026

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—February/March 1993

RECEIVED YMP 5/20/93

Attached is the Los Alamos Monthly Activity Report for February/March 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

Attachment: a/s

Cy w/att:
M. B. Blanchard, YMPO, Las Vegas, NV
J. M. Boak, YMPO, Las Vegas, NV
R. L. Bullock, RSN, Las Vegas, NV
V. J. Cassella, HQ/Washington, DC
W. L. Clarke, LLNL, Livermore, CA
P. L. Cloke, SAIC, Las Vegas, NV
J. L. Cooper, YMPO, Las Vegas, NV
J. Docka, Weston, Washington, DC
J. R. Dyer, YMPO, Las Vegas, NV
L. D. Foust, CRWMS, M&O/TRW, Las Vegas, NV
L. R. Hayes, USGS, Denver, CO
C. Johnson, M&O/WCC, Las Vegas, NV
N. Jones, M&O/TRW, Las Vegas, NV
P. Justus, NRC, Las Vegas, NV
K. Krupka, PNL, Richland, WA
M. Martin, M&O/TRW, Las Vegas, NV
C. W. Myers, EES-DO, MS D446
C. M. Newbury, YMPO, Las Vegas, NV
R. F. Pritchett, REECo, Las Vegas, NV
R. L. Robertson, CRWMS, M&O, Fairfax, VA
L. E. Shephard, SNL, Albuquerque, NM
W. B. Simecka, YMPO, Las Vegas, NV
A. M. Simmons, YMPO, Las Vegas, NV
R. K. St. Clair, M&O/TRW, Las Vegas, NV
J. T. Sullivan, YMPO, Las Vegas, NV
M. Voegele, SAIC, Las Vegas, NV
D. R. Williams, YMPO, Las Vegas, NV
RPC File (2), MS M321
TWS-EES-13-File, MS J521

Cy w/o att.:
J. A. Canepa, EES-13, MS J521
S. H. Klein, IS-11, MS J521
CRM-4, MS A150

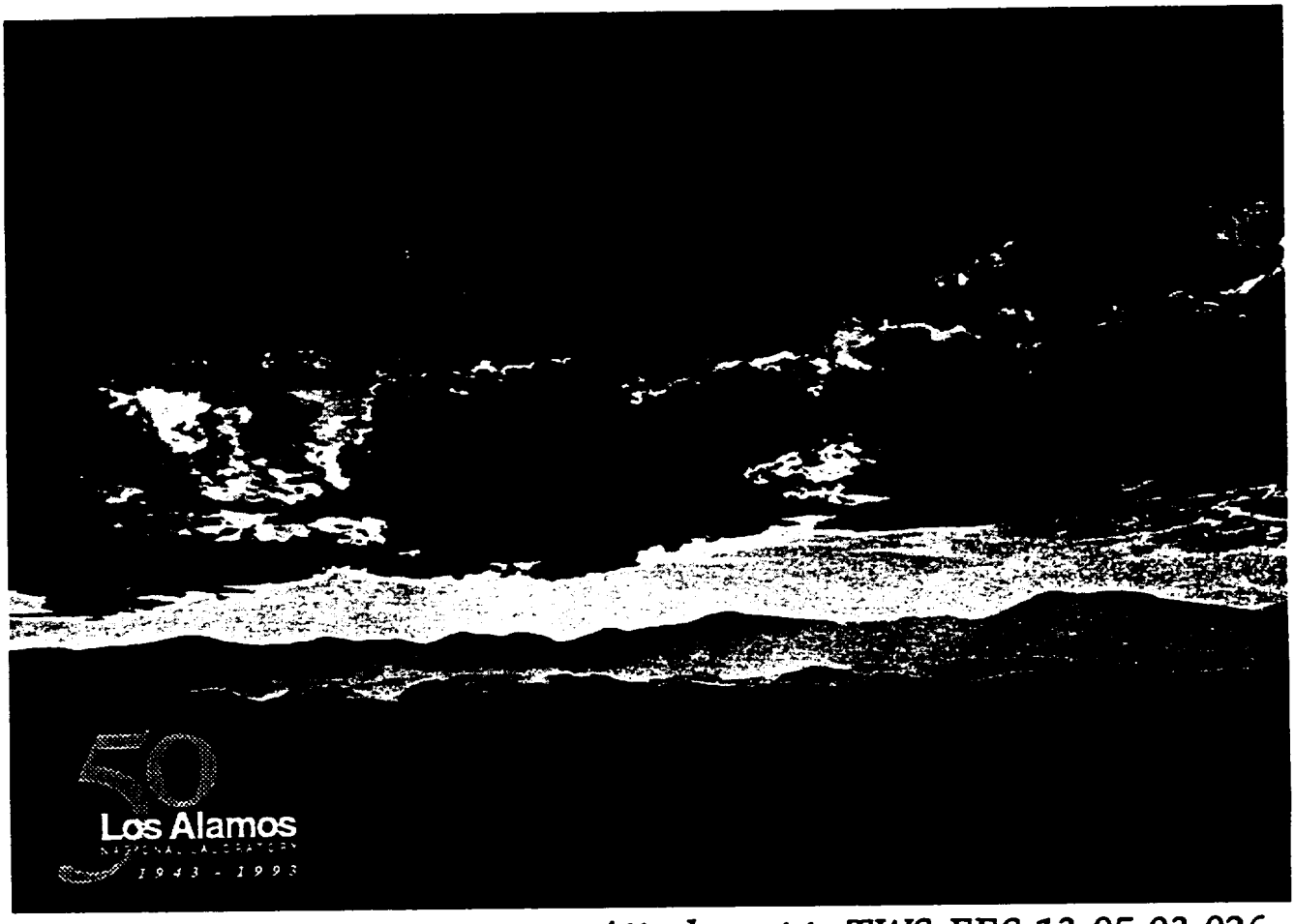
ENCLOSURE 3

I-34194
5-20-93

Yucca Mountain Site Characterization Project

Monthly Activity Report

February/March 1993



Photograph by Chris J. Lindberg

Attachment to TWS-EES-13-05-93-026

CONTENTS

WBS 1.2.1	Systems Engineering (Canepa)	1
WBS 1.2.3.1.1	Site Investigation Coordination and Planning/Site Management (Canepa)	2
WBS 1.2.3.1.2	Site Investigation Coordination and Planning/Test Management and Integration (Oliver)	3
WBS 1.2.3.2.1.1.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways (Bish)	4
WBS 1.2.3.2.1.1.2	Mineralogic and Geochemical Alternation (Levy)	7
WBS 1.2.3.2.1.2	Stability of Minerals and Glasses (Bish)	9
WBS 1.2.3.2.5	Postclosure Tectonics (Crowe)	10
WBS 1.2.3.2.8.1	Rock-Varnish Dating Support for USGS Neotectonic Studies (Harrington)	12
WBS 1.2.3.3.1.2.2	Water-Movement Tracer Tests (Fabryka-Martin)	13
WBS 1.2.3.3.1.2.5	Diffusion Tests in the ESF (Triay)	14
WBS 1.2.3.3.1.3.1	Site Saturated Zone Ground-water Flow System (Robinson)	15
WBS 1.2.3.4.1.1	Ground-water Chemistry Model (Ebinger)	17
WBS 1.2.3.4.1.2.1	Batch Sorption Studies (Triay)	18
WBS 1.2.3.4.1.2.3	Sorption Models (Rogers)	22
WBS 1.2.3.4.1.2.2	Biological Sorption and Transport (Hersman)	23
WBS 1.2.3.4.1.3	Radionuclide Retardation by Precipitation Processes (Morris)	24
WBS 1.2.3.4.1.4	Radionuclide Retardation by Dispersive, Diffusive, and Advective Processes (Triay)	27
WBS 1.2.3.4.1.5.1	Retardation Sensitivity Analysis (Zyvoloski)	33
WBS 1.2.3.4.1.5.2	Demonstration of Applicability of Laboratory Data (Springer)	34
WBS 1.2.5.2.2	Site Characterization Program (Canepa)	35
WBS 1.2.5.3.5	Technical Database Input (Hyer/Eckhardt)	37
WBS 1.2.5.4.6	Development and Validation of Flow and Transport Models (Springer)	38
WBS 1.2.5.4.7	Supporting Calculations for Postclosure Performance Analyses (Zyvoloski)	39
WBS 1.2.6	Exploratory Studies Facility (Elkins)	40
WBS 1.2.6.8.4	Integrated Data System (Elkins)	41
WBS 1.2.9.1.2	Technical Project Office Management (Canepa)	42
WBS 1.2.9.2.2	Project Control (Pratt)	43
WBS 1.2.11.2/.3	Quality Assurance Program Development, Verification, and Engineering (Bolivar)	44
WBS 1.2.12.2/5 1.2.13	Local Records Center Operation/Records Management, and Documentation Control (Pratt)	46
WBS 1.2.15.2	Administrative Support (Pratt)	47
WBS 1.2.15.3	Training (Pratt)	48

LOS ALAMOS NATIONAL LABORATORY

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Monthly Activity Report

February/March 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 attended the CASY meeting on thermal loads in Denver.

Staff attended the kick-off meeting to support a systems-engineering-based thermal decision paper.

D. Bish was appointed to the Working Group on Geochemistry, which will evaluate thermal goals.

Planned Activities

None

Problem Areas

None

WBS 1.2.3.1.1 Site Investigation Coordination and Planning/ Site Management

Objective

The objective of this task is to manage and coordinate site characterization activities.

Activities and Accomplishments

The TPO supported the Geochemistry Integration Team (GIT) meetings and telecon. E. Springer attended a Hydrology Integration Task Force (HITF) meeting on 11 February at LLNL. Participants discussed thermal-loading issues and how characterization of the hydrologic system will be affected. J. Fabryka-Martin replaced E. Springer as Los Alamos representative to the HITF.

The TPO supported planning for the Colloid Workshop to be held in Santa Fe 3-5 May and attended the CASY meeting on thermal loading in Denver.

The TPO assessed the technical progress in geochemistry, hydrology, and geology; evaluated planning, milestones, and variance analysis; and worked with the M&O to prepare the FY94 Annual Plan.

Planned Activities

No planned activities reported.

Problem Areas

None

WBS 1.2.3.1.2 Site Investigation Coordination and Planning/ Test Management and Integration

Objective

The objective of this task is to manage and integrate 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 participated in the work scope consolidation by the M&O for SRG-5. Test planning package(TPP) and job packages (JP)TPP 92-16 and JP 92-17 (USW UZ-14) were signed for Cl-36 sample collection from cuttings during borehole drilling.

Staff continued to develop an administrative database, which will be merged with the YMP GIS, to identify and track Los Alamos interfaces with other participant and Project surface-based testing activities.

B. Carlos represented the principal investigators at the February and March Sample Overview Committee meetings.

ESF Test Coordination. The Test Coordination Office completed coordinating geologic mapping in conjunction with construction at the ESF north-ramp starter tunnel.

Staff completed Phase II of ESF test planning for the following test planning TPPs and JPs: "Geologic Mapping," "Perched Water," and "Monitoring in Conjunction with North-portal Starter Tunnel Construction," and forwarded them to YMPO.

Staff revised the schedule for Phase III ESF testing to reflect the latest construction schedule.

Staff coordinated FY94 ESF testing capital equipment budget requests.

Planned Activities

Continue evolution and 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

D. Vaniman reviewed the Erosion topical report.

D. Vaniman described portions of drill core UE-25 UZ-16 at the Sample Management Facility on 23-24 February. Systematic sampling at spaces of less than 20 ft. apart will be used to define vertical variations in mineralogy, and distributed bulk samples of the lower Topopah Spring Member and of tuff from Calico Hills will be used to concentrate trace minerals for sorption studies. In contrast to previous sampling of other drill cores for XRD mineralogy, sample spacing for this new core is closer and focused on the critical barriers between the welded Tiva and Topopah units and the potential repository horizon and the water table. Vaniman described approximately half of UZ-16; the remainder will be described for sampling after drilling is completed.

On 10-11 March, D. Vaniman obtained samples of opal, calcite, and clay from exposed depths to 18 m in the ramp starter tunnel. Because shallow intervals were often missed in the drilling program, these samples are excellent sources of mineral deposits that have been rarely sampled in drill cores.

B. Carlos examined fractures in core from UE-25 UZ-16 at the SMF and selected samples for further analysis.

R. Raymond obtained probe data on Yucca Mountain clinoptilolites (from UE-25b #1H, UE-25a #1, G-2, G-4) to search for chemical variation, vertically and laterally and within large crystals.

Twenty-four fracture samples from drill holes USW G-1, G-2, GU-3, and G-4 were analyzed using x-ray powder diffraction (XRD), and goethite was seen for the first time at Yucca Mountain in sample USW G-2-2812.1. Re-analysis of previously collected fracture XRD data also confirmed goethite in sample USW G-2-3000.2. Both samples were from below the water table, and each also contained a significant amount of hematite (hematite >> goethite).

R. Raymond and G. Guthrie collected dust samples in the vicinity of UZ-16 to assess their background levels and changes that may have resulted from operations at UZ-16. Arrangements were also made to have air-filter samples collected by D. Chapman of SAIC. Raymond, Guthrie, and D. Bish were preparing a LAMS report on the distribution of hazardous minerals at Yucca Mountain (Milestone 3352).

Images of material collected on filters located near rock saws at the SMF were obtained. New SEM images and analyses of erionite, mordenite, and palygorskite were obtained from Yucca Mountain samples.

G. Guthrie presented a briefing at the March TPO meeting on potentially hazardous airborne minerals at Yucca Mountain. He discussed research dealing with mordenite as a possible carcinogen. He pointed out that although researchers have not demonstrated that mordenite is carcinogenic, the existing data are of poor quality and were obtained with poorly defined samples.

Planned Activities

Collection and compilation of data on zeolites in fractures from "old" core will continue, with emphasis on microprobe and XRD analysis. Preliminary information on fracture-lining minerals in UE-25 UZ-16 will be prepared for inclusion in a preliminary report on UE-25 UZ-16 to be compiled by the USGS.

Work planned within the next few months includes the following activities: (1) continue analysis of fracture-coating minerals in existing drill core, with emphasis on microprobe and XRD analysis, and prepare paper on distribution of fracture-lining zeolites at Yucca Mountain for inclusion in the proceedings volume for Zeolite '93; (2) continue analysis of calcites to understand transport and precipitation mechanisms; (3) sample UE-25 UZ-16 for studies of stratigraphic variability in bulk mineralogy; (4) preliminary information on fracture-lining minerals in UE-25 UZ-16 will be prepared for inclusion in a preliminary report on UE-25 UZ-16 to be compiled by the USGS; (5) continue statistical evaluation of X-ray powder diffraction quantitative mineral analysis.

Problem Areas

We are concerned because it is taking approximately 3 months for the investigator to receive samples from the SMF, once distribution of the samples is approved by the SOC. Because requests for samples must be submitted 3 weeks before the SOC meeting, we must wait a total of more than 4 months from the time we identify a sample to the time we receive it. This is becoming a serious problem, delaying milestones and other reports.

Milestone Progress

3130
15 December 1993
Fracture Mineralogy of the Paintbrush Tuff
Expanded scope.

3352
31 March 1993
Fibrous Minerals at Yucca Mountain

3361
1 July 1993
Thermal Behavior of Natural Zeolites

3364
1 June 1993
Distribution of Fracture-Lining Zeolites at Yucca Mountain, Nevada

3365
1 July 1993
Equilibrium Modeling of the Formation of Zeolites in Fractures at Yucca Mountain, Nevada

Publications

D. L. Bish
Thermal Behavior of Natural Zeolites
Conference paper, *Zeolites '93*
Submitted to YMPO.

D. L. Bish and D. T. Vaniman
The Importance of Zeolites in the Potential High-Level Radioactive Repository at Yucca Mountain
Conference paper, *Zeolites '93*
In preparation.

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
Submitted to YMPO.

B. Carlos, D. Bish, S. Chipera, and S. Craven
Fracture-Lining Manganese Oxide Minerals in a Silicic Tuff
Conference paper, *Zeolites '93*
Approved by YMPO.

B. Carlos, S. Chipera, and D. Bish
Distribution of Fracture-Lining Zeolites at Yucca Mountain, Nevada
Conference paper, *Zeolite '93*
Approved by YMPO.

S. J. Chipera, D. L. Bish, and B. A. Carlos
Equilibrium Modeling of the Formation of Zeolites in Fractures at Yucca Mountain, Nevada
Conference paper, *Zeolites '93*
Approved by YMPO.

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

D. Vaniman
Calcite Deposits in Fractures at Yucca Mountain, Nevada
Conference paper, *International High-Level Waste Management Conference*
Approved by YMPO.

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, submitted to *Bulletin of the Geological of Society of America.*

D. T. Vaniman
Calcite Deposits in Drill Cores USW G-2 and USW GU-3/G-3 at Yucca Mountain, Nevada
LA-series report
Approved by YMPO.

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

D. Bish and S. Levy attended the USGS /CASY symposium on the effects of repository thermal loading on fluid movement and geochemistry at Yucca Mountain. Bish presented data on the mineralogical effects of short- and long-term heating of zeolites, smectite, and glass, and he emphasized that these phases can be affected simply by changing the water vapor pressure. Levy discussed natural hydrothermal alteration during the cooling of the Topopah Spring and Tiva Canyon pyroclastic deposits and its potential for natural analog studies. Bish was appointed to the SCP Thermal Goals Working Group, which is evaluating SCP thermal goals. He will oversee geochemical and mineralogical considerations.

Bish and Levy also discussed thermal loading concerns with staff from LLNL. Specifically, they discussed the assumptions inherent in the calculations performed by T. Buscheck and J. Nitao and the importance of mineralogical and petrological features in their modeling. Bish and Levy also discussed the information on mineralogical effects of heating and natural hydrothermal alteration discussed above. The participants identified numerous experimental and modeling needs that are important in understanding the behavior of a "hot repository."

D. Vaniman and D. Bish attended a meeting on 10-11 March in Las Vegas to discuss thermal loading effects. The discussion focused on cooperative studies on mineral stability by LLNL and Los Alamos. S. Levy and D. Vaniman met at the Sample Management Facility during the week of 15 March with representatives of the ESF wall mappers and others involved in ESF planning to discuss mineralogy-petrology sampling needs.

D. Vaniman, J. Whelan (USGS), and S. Levy and members of the mapping team visited the north ramp portal face, on the east side of Exile Hill, and noted several important features exposed in the portal face. These features included (1) many fractures and lithophysal cavities in the densely welded Tiva Canyon wall rock coated and partly filled with waxy clay accumulations and (2) a few large-aperture fractures contain argillized silicic ash that may correspond to ash flows between the Tiva Canyon and Rainier Mesa tuffs.

Planned Activities

W. Carey will begin a postdoctoral appointment this summer. He will study the thermodynamics of water in zeolites, smectite, and glass at Yucca Mountain and the kinetics of dehydration of these phases.

The steam-heating experiments will continue; the 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.

G. WoldeGabriel will travel to Cleveland in April to do K/Ar analysis of samples from Lake Tecopa and Barstow. The minerals to be dated include feldspars, clays, and clinoptilolite (with or without mordenite), including material subjected to cation exchange at elevated temperatures.

A follow-up field (and perhaps SMF) orientation session for the ESF wall mappers and the mineralogy-petrology researchers is tentatively set for April.

Problem Areas None

Milestone Progress

3138
30 September 1993
Chemical Transport in Zeolitic Alteration

3142
31 January 1993
K/Ar Dating of Clays and Zeolites
Submitted to TPO.

3150
15 April 1993
Final Report on Bedrock

3343
30 September 1993
Zeolite Dating

3361
1 April 1993
Thermal Behavior of Natural Zeolites

Publications

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

S. Levy
Surface-discharging hydrothermal systems at Yucca Mountain -- examining the evidence
Proceedings paper, *Materials Research Society Fall Meeting*
Approved by YMPO; submitted.

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.

S. Reneau
Maganese Accumulation in Rock Varnish in a Desert Piedmont, Mojave Desert, California, and Application to Evaluating Varnish Development
Journal article, *Quaternary Research*
Accepted for publication.

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
Approved by 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

D. Bish met with H. Barnes of Pennsylvania State University and A. Lasaga of Yale University to discuss appropriate means of obtaining information on the reaction kinetics of minerals at Yucca Mountain. The study plan entitled "Kinetics and Thermodynamics of Mineral Evolution at Yucca Mountain" was being modified to reflect these recent interactions.

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

A draft of the Volcanism Status Report was completed.

Revisions were completed to Study Plans 8.3.1.8.1.1, "Probability of Magmatic Disruption of the Repository" and 8.3.1.8.5.1, "Characterization of Volcanic Features."

Revised calculations of the recurrence rate of volcanic events (E1); the disruption ratio (E2); and the probability of magmatic disruption of the repository, the controlled area, and the Yucca Mountain region (Pr[E2 given E1] Pr[E1]) were completed. This work differs from previous work in which the calculations established probability bounds. We found that the most likely value of the probability of magmatic disruption of the repository is < 1 in 10,000 in 10,000 years. The most likely values of the probability of magmatic disruption of the controlled area and the Yucca Mountain region are > 1 in 10,000 in 10,000 years.

Lathrop Wells Volcanic Center. Trenching studies resumed. We re-examined the basal contact of the Ql_3 lava flow to determine the thermoluminescence (TL) age of sediments below the lava, and we verified the stratigraphic contact of the sediments. A TL age of the sediments of about 30 ka does not agree with results using other geochronology methods, and we have no current explanation for this.

We examined the field relations of a cluster of small satellite cones located south of the main cone; the cones are marked by a north-south alignment of conduit plugs formed by agglutinated vent scoria and are associated spatially with a distinctive sequence of black tephra-fall deposits containing pyroclastic surge deposits. These deposits cannot be traced to the main cone or to the quarry section, in which we have identified tephra units interbedded with soil with horizon development.

A soil pit was dug and enlarged to a trench (Qs_1); soil units in the trench were interbedded with possible tephra deposits, and the tephra deposits exhibited lateral continuity through the trench walls, except where they were cross-cut by channels and infilled with aeolian sands or where they were bioturbated. Two soil pits were dug on the flanks of a Qs_6 scoria mound.

Staff completed additional measurements of the cosmogenic surface-exposure ages of the volcanic units. Multiple sample sites from the Ql_5 lava showed consistent ages of about 70 ± 4 ka, which suggests that the samples sites share a uniform exposure history and that the ages may be close to the age of the lava flows. A surface scoria sample collected near summit of the main cone yielded an age of about 30 ka. A sample of welded spatter from the Qs_{2b} fissure yielded a cosmogenic helium age of 49 ka.

Surface samples for cosmogenic helium studies were collected from a separate lobe of the Ql_5 lava, new sites were collected from surfaces of the Ql_3 and Ql_4 lavas, and a sample was collected from the Qs_{2d} vents. Samples were collected from the interior of Ql_{4b} and from the main cone.

Activities and Accomplishments (cont.)

Work in Progress. Sample preparations for olivine separations of four new samples were completed. The samples include a spatter mound from the southeast end of the northwest-trending fissure (Qs_{2b}), a lava sample of Ql_6 and surface scoria samples from the main cone (Qs_{2a}).

Staff completed X-axis isotopic measurements to determine the U-Th disequilibrium of a sample from the Little Black Cone center and for a re-analysis of Ql_4.

We are still awaiting results of $^{40}Ar/^{39}Ar$ age determinations of lithic fragments from the Ql_3 lava of Lathrop Wells.

Planned Activities

Field studies of the distribution of lithic fragments in dissected basalt centers will be undertaken at sites in Nevada, Arizona, and New Mexico in April and May.

Problem Areas

We are concerned because commercial quarrying activity at the Lathrop Wells center has increased, and key outcrops that provide the basis for establishing the stratigraphic relations of the youngest volcanic units of the center may be removed or disturbed in the next few months.

Milestone Progress

3075
30 September 1993
Preliminary Geologic Mapping of Volcanic Centers

3129
30 September 1993
Geochemistry of Lathrop Wells

R482/3252
30 September 1993
Volcanism Status Report
First draft complete; revised draft due 1 March 1993.

Publications

B. M. Crowe, et al.
Volcanism Status Report
First draft complete; revised draft due 1 March 1993.

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

No progress during February because all effort was required to complete the Erosion topical report (See 1.2.5.2.2).

C. Harrington began planning with USGS staff for the study of fault scarps along the Windy Wash, Stagecoach Road/Paintbrush Canyon, and Solitario Canyon Faults. Field studies and scoping studies for trying to date formation (exposure) of the scarps were discussed.

Planned Activities

No planned activities reported this month.

Problem Areas

None

Milestone Progress

None

Publications

None

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

Hydro Geo Chem submitted five YMP rock samples to Purdue University for chlorine-36 analysis as part of an interlaboratory comparison, and the Purdue results were within two standard deviations of those of LLNL and the University of Rochester. These results provided us with confidence in the reliability and reproducibility of the analyses over a wide range of concentrations. In addition, all 5 samples submitted to monitor background levels showed acceptably low, and reproducible, chlorine-36 results.

Hydro Geo Chem submitted a suite of 14 rock samples to LLNL for chlorine-36 analysis. The rock samples were derived primarily from the Paintbrush nonwelded area that was intercepted by Neutron-access Boreholes UZ-N11, N37, and N53.

Chlorine-36 results were also obtained for two shallow-rock samples from UZ-N55. Previous chlorine-36 analyses had indicated contamination of cuttings samples collected from the depth interval 165 to 265 ft; the purpose of the most recent analyses was to determine whether the contamination extended to the surface samples. The results were well above meteoric background levels, although not as high as those for the deeper samples. This is probably because of dilution of the high signal by the higher *in-situ* chloride content of these near-surface samples.

Hydro Geo Chem began measuring chloride and bromide profiles on 64 samples from UZ-16; the depths of the samples ranged from surface to 1171 ft.

J. Fabryka-Martin and M. Wickham of Hydro Geo Chem attended a three-day Vadose-Zone Workshop at the University of Arizona (17-19 March), which included presentations and demonstrations of techniques for measuring and modeling moisture movement in the unsaturated zone.

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

3191
Procedure for Chlorine-36 Analysis of Unsaturated Zone Samples
30 September 1992
99% complete

3362
30 November 1993
Summary of Cl-36 Work

Publications

J. Fabryka-Martin
Summary of Cl-36 Work
Conference paper, *Focus '93*
In preparation.

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

B. Robinson revised the Los Alamos SQAP, which will be distributed for review. B. Robinson continued his duties as CCB Chair, and Z. Dash continued as a member of the CCB.

Code development for SORBEQ was completed and staff was preparing the documentation as a Los Alamos report .

We began using a new application, NONLIN_LSQ. This code will allow us to perform nonlinear least-squares fits for any model in a stand-alone program. The application will successively invoke the model program, adjusting the specified parameter values until a fit is obtained. We envision that NONLIN_LSQ will be used to invoke simulators such as FEHMN to obtain fits to laboratory and field experimental data.

The C-Wells fractures selected for colloid transport experiments were cut into shapes appropriate for fitting with inlet and outlet flow ports. The manifolds, which are unique for each fracture specimen, were designed and the parts are ready to be machined.

Staff was preparing to determine the experimental conditions and procedures to carry out flow and transport tests on a fractured sample of Bandelier tuff.

A draft of a paper describing lithium batch sorption experiments was being prepared.

The column to be used for lithium column sorption experiments was being prepared, and the crushed core from Well C-2 was ready for packing.

We continued to explore using the flow cytometer to measure colloid concentrations in solution. Standards in deionized water and J-13 water were prepared, and the samples were tested. Although we are evaluating several techniques for measuring microsphere concentrations, we believe that the flow cytometer will significantly add to our ability to detect microspheres. It will make microsphere-transport field tests, which require that very low concentrations be detected, much more feasible in the future.

Planned Activities

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

Complete documentation of batch sorption experiments with lithium bromide.

Continue modeling studies using FEHMN to support the design of the field tests.

Pack column to be used in Li column tests, develop operating techniques for the experiments.

Manufacture manifolds for fractures to be used in colloid transport tests, and continue to develop techniques for flow and transport tests.

Problem Areas

None

Milestone Progress

3188
31 March 1993
Documentation for SORBEQ
In technical review.

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

T112
22 June 1992
Final Documentation for FEHM
Rescheduled to June 1993 because of personnel reassignment.
(Code has received conditional certification.)

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

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
In technical review.

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

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 (Russell Dyer).

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

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

Staff continued to review comments and revise the "Ground-water Chemistry Model" study plan, R0. Special attention was being given to sensitivity analysis and redox sections, as well as to the section on stable isotope constraints on water composition.

Other Activities. Staff continued modeling related to "most active ground-waters." M. Ebinger met with met with members of the Solubility (WBS 1.2.3.4.1.3) task to discuss aspects of current modeling. A letter report of the results of this exercise has been delayed until May 1993 in order to address needs of both the Sorption (WBS 1.2.3.4.1.2.1) and Solubility tasks.

Modeling of pH and Eh stability continued.

Planned Activities

Continue resolution of comments on study plan.

Continue to model "most-active ground-waters" using input from the Radionuclide and Sorption tasks.

USGS collaboration will continue.

Discussions continued concerning water chemistry, stable isotope constraints on water composition, and the ground-water chemistry model.

Continue support of QA efforts.

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 performed batch sorption experiments to study the effect of organic coatings on metal sorption onto minerals in Yucca Mountain tuffs. Based on the results of Minai et al., we chose 3-(3,4-dihydroxypheny)-DL-analine, DOPA, as the model organic compound and Al and Fe oxides (boehmite and goethite) as the solid phases. Isotherm results for DOPA sorption onto Al and Fe oxides showed that DOPA adsorbs strongly onto these solid phases.

We also began experiments to evaluate the effect of organic coatings on the sorption of cadmium (Cd). We obtained sorption isotherms for Cd via the batch sorption method, with initial $CdCl_2$ concentrations of 2, 4, 6, 8, and 10 x 10^{-5} M. The solid-to-solution ratio in these batch experiments was 3-4 grams oxide/liter of solution. The adsorption isotherms for the Cd ion on pure and DOPA-coated oxide surfaces at pH 6.5 are given in Figure 1 (where the DOPA concentrations used for coating are given in molarity). The quantity of DOPA left in solution following sorption was very low.

Our results indicate that the sorption of Cd onto Fe oxide is enhanced by the presence of the organic coating; however, Cd sorption onto Al oxide decreases as the amount of organic coating increases. The enhancement or decrease of Cd sorption was small (20%).

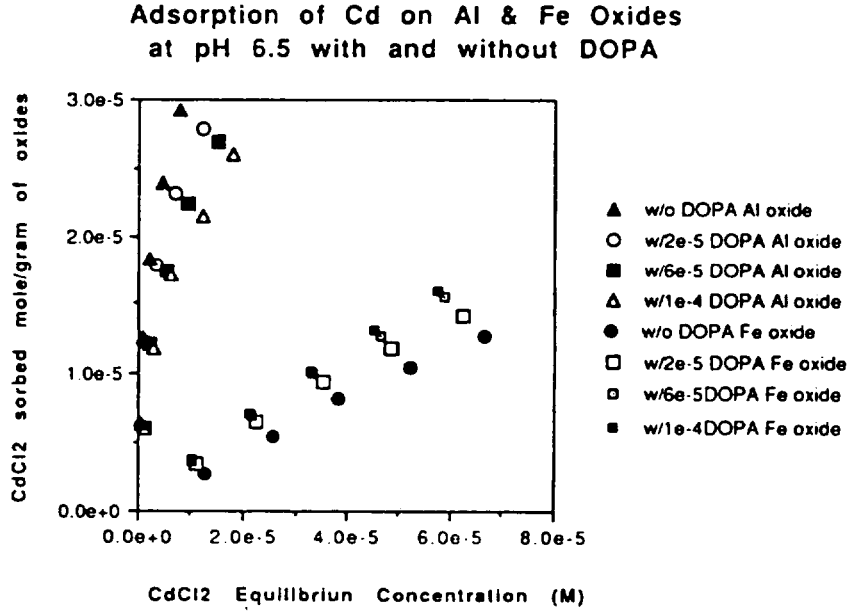


Fig. 1

We measured sorption of Np onto tuffs and pure minerals as a function of Np concentration, ground-water composition, and temperature and completed a set of batch sorption experiments using the following minerals: hematite, calcite, quartz, and clinoptilolite; and tuffs G4-270 and G4-1506. The tuff, quartz, and natural calcite samples were wet-sieved to obtain particles in the size range of 75 to 500 μm, and we pretreated the solid phases for two weeks with the ground-water (J-13 or UE-25p #1) in the ratio of 1 g of solid to 20 ml of solution. The Np solution was contained in Oak-Ridge tubes (Fig. 2) ; the initial concentration was 10^{-7} M; and the experiments were run at 25, 60, and 90°C. Preliminary results (Table I and II) indicated that for Np, temperature has a very limited effect on the batch sorption coefficients.

For all cases but calcite, the batch sorption coefficient for Np remained constant or increased very slightly as temperature increased. For calcite, the Np sorption distribution coefficient decreased with increasing temperature.

Table I. Np Sorption as a function of T in J-13 Ground-water

		Kd (ml/g)		
Solid Phase	**Origin**	**30°C**	**60°C**	**90°C**
Hematite	synthetic	~10^3	~10^3	~10^3
Calcite	Mexico	90	30	10
Calcite	synthetic	50	30	
Clinoptilolite	Idaho	3	4	3
Quartz	Arkansas	0	0.4	3
Tuff	G4-270	1	1	1
Tuff	G4-1506	3	4	4

Table II. Np Sorption as a function of T in UE25p #1 Ground-water

		Kd (ml/g)	
Solid Phase	**Origin**	**30°C**	**60°C**
Hematite	synthetic	~10^3	~10^3
Calcite	synthetic	50	30
Clinoptilolite	Idaho	1	2
Quartz	Arkansas	0.1	4
Tuff	G4-270	1	3
Tuff	G4-1506	1	2

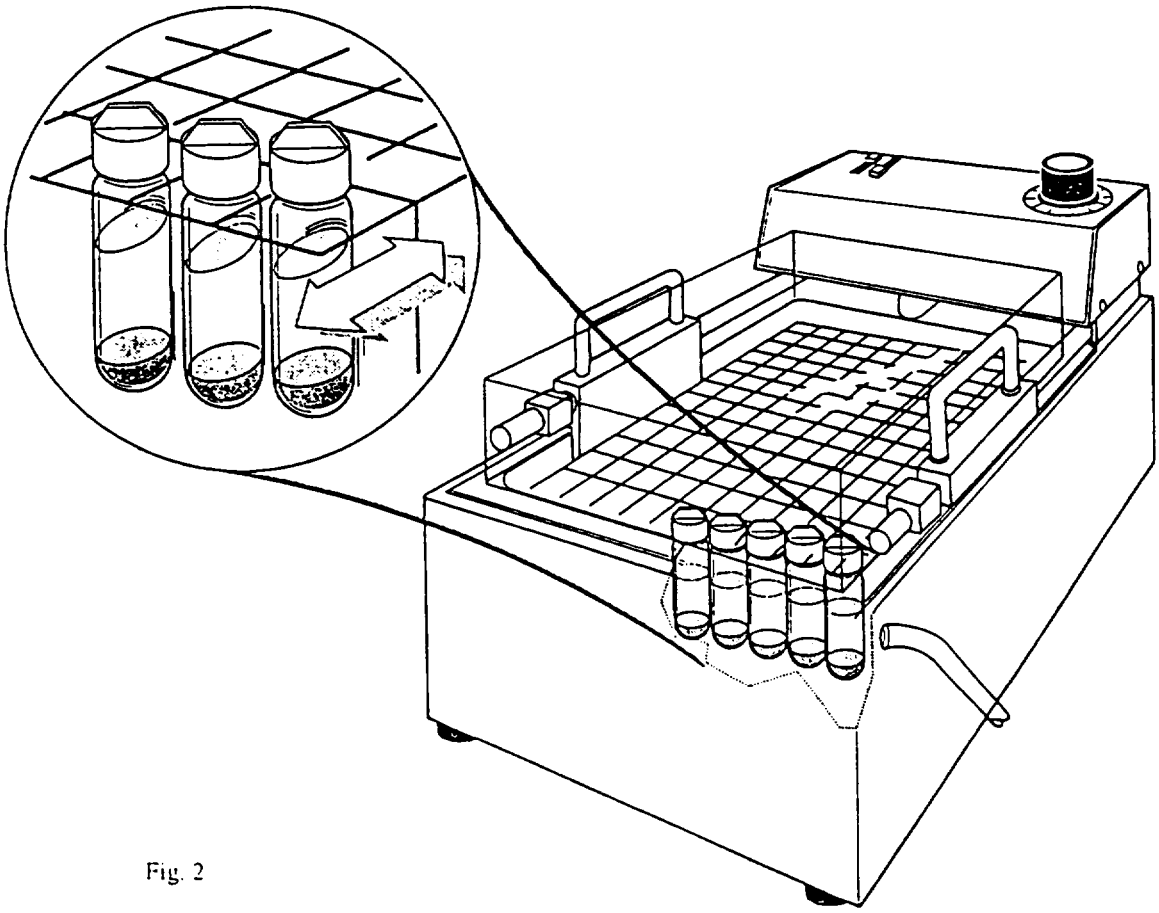


Fig. 2

Planned Activities Continue work in all areas discussed above.

Problem Areas None

Milestone Progress

3218
30 September 1993
Effects of Water-Rock Ratios on Sorption Coefficients

3345
30 June 1993
Neptunium Sorption onto Feldspar

3346
30 September 1993
Sorption as a Function of Temperature

Publications

P. S. Z. Rogers and A. Meijer
Dependence of Radio nuclide Sorption on Sample Grinding, Surface Area, and Water Composition
Conference paper, *1993 International High-level Waste Management Conference*
Approved by YMPO. (Milestone 3009)

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

Discussions with J. Leckie of Stanford University have sparked renewed interest in his surface-complexation approach to modeling of Np adsorption onto Yucca Mountain tuffs. We will supply him with existing batch sorption results and well-characterized samples of devitrified tuff from the Topopah Springs member, and Leckie will attempt to model Np sorption on these samples. The desired result is a model capable of calculating the change in sorption caused by changes in solution pH, composition, or competing cation content.

Leckie is also modeling (using the surface complexation approach) Np adsorption on the pure minerals silica, albite, gibbsite, and kaolinite, and experimental results for U adsorption on goethite and hematite are also being treated. Modeling of UO_2^{2+} adsorption on goethite and hematite continued, and the results will be included in the milestone report now in preparation. A separation procedure for cleanup of ^{232}U from daughter products was tested and found acceptable.

P. Rogers and M. Hawley continued atomic force microscopy studies of natural goethite samples. As expected, several freshly cleaved surfaces of goethite crystals had surface coverings, and they could not remove these compounds without damaging the underlying surface. They plan to spend time looking at hematite surfaces, with the hope that less reactive, clean surfaces will be found. They will coordinate this work with a study of the surfaces of hematite crystals, separated from Topopah Spring tuff, which will be examined for natural surface coatings.

Planned Activities

Continue integration with J. Leckie.

Continue characterization of natural goethite surfaces and tests of surface cleaning methods.

Characterize the surfaces of hematite crystals separated from Topopah Spring tuff.

Problem Areas

None

Milestone Progress

3347
30 September 1993
AFM Analysis of Hematite and Goethite

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

Work is continuing at UC Berkeley on microbial mineral dissolution experiments. There does appear to be a slight difference in the growth of microorganisms on hematite, when compared to an iron free control. This difference does not appear to be statistically significant; however, experimental conditions will be modified to optimize the difference. For example, the energy source (succinate) concentration and the incubation temperature will be reduced. These changes will retard the growth of the microorganisms, thus enabling them to have a longer exposure time to the hematite.

Work has continued on the crushed tuff column studies at Los Alamos. Currently columns are being refitted to eliminate leaks.

Planned Activities

Continue soil column and mineral dissolution experiments.

Problem Areas

None

Milestone Progress

3080
30 September 1992
Report on Chelation; Retitled *Preliminary Evidence of a Siderphore Plutonium Complex*
Completed; approved by YMPO on 18 April 1991.

3092
30 September 1992
Report on Colloidal Agglomeration
Draft completed. Milestone completion delayed until TPO decides on suitable publication vehicle. (Probably will be published as an LAMS report.)

3176
30 September 1992
Procedure for Determination of Formation Constants
Completed, Submitted to QA project leader 26 February 1993.
(Does not require DOE review.)

3177
30 September 1992
Procedure for Determination of Effects on Colloidal Agglomeration
Completed; submitted to QA project leader
(Does not require DOE review.)

Publications

L. E. Hersman, P. D. Palmer, and D. E. Hobart
Preliminary Evidence of a Siderphore Plutonium Complex
Conference proceedings, *Proceedings of the Fall Meeting of the Materials Research Society*

L. E. Hersman
Report on Colloidal Agglomeration
LA-series report.
In preparation.

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. Palmer was recognized as the National Technician of the Year at the 205th National Meeting of the American Chemical Society in Denver, CO, March 28 - April 2, 1993. In addition to Palmer, D. Clark, S. Ekberg, D. Morris, H. Nitsche, and D. Tait represented this task at the meeting.

Speciation. We obtained results for our UV/V absorption study of NpO_2^+ species in (bi)carbonate media. At least three species were observed consistently for 0.4 mM Np at 0.9 M (bi)carbonate concentrations from pH 8.4 to 13. This information will serve as a starting point for parallel NMR studies and bicarbonate-concentration and temperature-dependent UV/V experiments.

We continued PAS oxidation-state determinations of 250 nM Pu / bicarbonate solutions at pH = 8.5 to 9 at elevated (75°C) temperatures, and inconsistencies in results have forced us to consider the possibility of sample deterioration. We are concerned about photo-reduction of the Pu by the intense laser pulses operating at 450 nm (2.8 eV); to test this possibility, we have subjected a concentrated (1 mM) Pu(VI) carbonate solution to hours of laser irradiation. The results of this study are pending.

A technical review of "Evaluation of Alternative Detection Schemes for Actinide Speciation using Photoacoustic Spectroscopy" by Tait et al. (Milestone 3330), which describes the development phase of our photoacoustic spectrometer system has been completed. This milestone was forwarded to the TPO for policy review. Staff incorporated internal review comments on Milestone 3031, "Actinide(IV) and Actinide(VI) Carbonate Speciation Studies by PAS and NMR Spectroscopies" by Clark et al. This report was also forwarded to the TPO.

Carbon-13 NMR experiments on U(VI) and Np(V) carbonates continued. Ionic strength corrections were applied to Nuclear Energy Agency data used by Project EQ3/6 modelers and compared to our recent carbon-13 and oxygen-17 NMR data. This comparison showed that NMR did an outstanding job of working out thermodynamic binding constants and revealing which species were present in solution, albeit at higher concentrations. This data will be compared to low-concentration speciation data, which was collected using PAS.

Solubility. The Np undersaturation experiment at pH 8.5 was concluded by examining the last of the supernatant by adsorption spectroscopy. All of the Np(V) in the pH 8.5 solution was complexed by carbonate.

The oxidation-state assay for the Np experiment in UE-25p #1 at pH 8.5 and 60°C was completed, and no Np(IV) was found; however, 17% of the total Np may be in the hexavalent oxidation state (NpO_2^{2+}). For the Am/Nd undersaturation experiments in UE-25p #1 water at 60°C, the initial solution concentrations at all pH values were comparable to those obtained at the end of the oversaturation experiments.

Milestone 3329, "Measured Solubilities and Speciations from Oversaturation Experiments of Neptunium, Plutonium, and Americium in UE-25p #1 Well Water from the Yucca Mountain Region" was revised in response to reviewer comments. Four Technical Data Information Forms were completed for Milestones 3010, "Measured

Activities and Accomplishments (cont.)

Solubilities and Speciations of Neptunium, Plutonium, and Americium in a Typical Ground-water (J-13) from the Yucca Mountain Region," and 3329, "Measured Solubilities and Speciations from Oversaturation Experiments of Neptunium, Plutonium, and Americium in UE-25p #1 Well Water from the Yucca Mountain Region."

Planned Activities

Continue work in all areas described above.

Problem Areas

A cooling problem has prevented operation of the PAS system for the past several months.

Milestone Progress

3031
30 September 1992
Actinide(IV) and Actinide(VI) Carbonate Speciation Studies by NMR and PAS Spectroscopies
Submitted to TPO.

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
Submitted to TPO.

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 preparation.

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, 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
Approved by YMPO; accession numbers being obtained; camera-ready.

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*
Approved by YMPO. (Milestone 3363)

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)
In preparation.

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

Activities and Accomplishments

We began two sets of experiments to continue study of the transport of Np through Yucca Mountain tuffs. In the first set, we studied the kinetics of Np sorption using wafers of intact tuff, which were placed in contact with a Np solution in water from Well J-13 or from UE-25p #1. To determine the uptake of Np by the wafer, aliquots were taken as a function of time. The wafers were made of tuffs G4-270 and G4-1532.

In the second set of experiments, we eluted a Np solution through crushed-tuff columns to determine whether Np sorption onto tuff is reversible, linear, and instantaneous in waters from J-13 and UE-25 p#1. Four crushed-tuff columns were prepared from tuffs G4-270 and G4-1506, and we established flow rates through them using water from J-13 and UE-25 p#1.

We also eluted tritiated water from J-13 and UE-25p #1 through columns of intact tuff G4-1531 to determine their hydrologic parameters. The flow rate for both of these columns was 0.05 ml/hr, and the porosity of tuff G4-1531 was 0.39. The cumulative activity recovered as a function of volume eluted may be found in Figures 1 and 2.

Considerable effort was spent preparing data for submission to the YMPO database. S. Weaver investigated how to electronically submit the data.

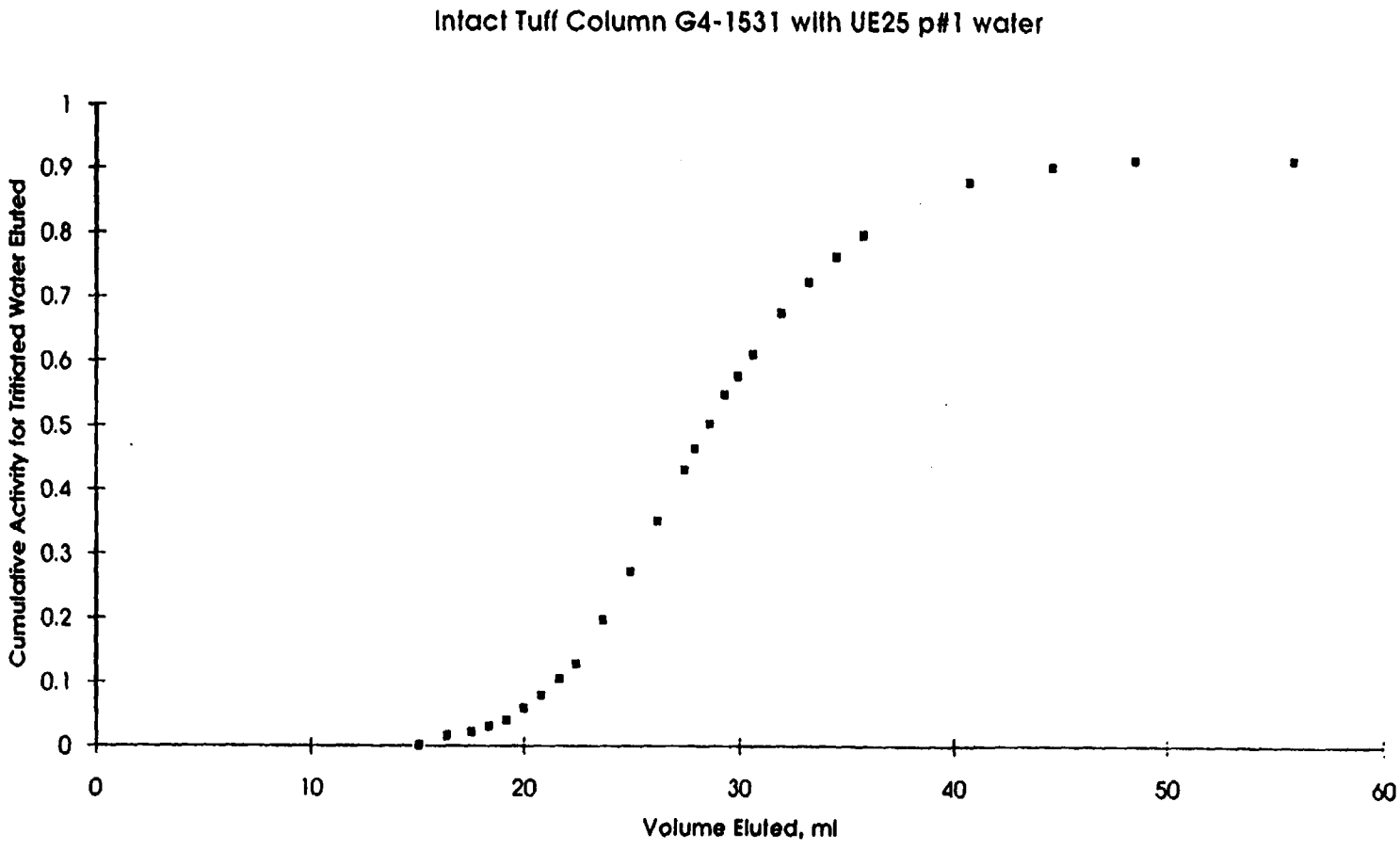


Fig. 1

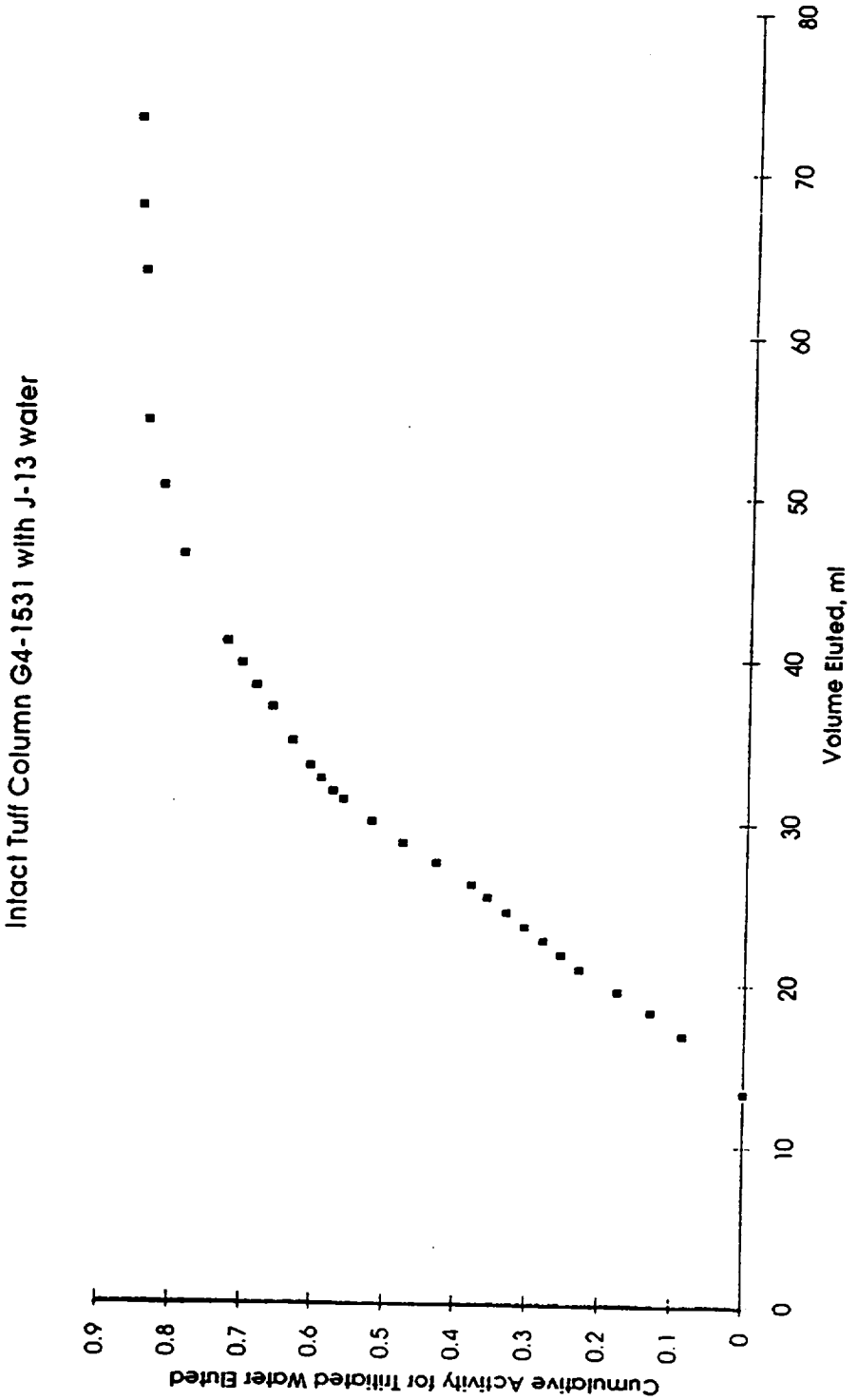

Intact Tuff Column G4-1531 with J-13 water
Cumulative Activity for Tritiated Water Eluted
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
Volume Eluted, ml

Fig. 2

I. Triay completed the first draft of the Colloid Workshop report entitled "Colloid-Facilitated Radionuclide Transport at Yucca Mountain." This report describes YMP colloid research, which will evaluate whether colloids will significantly increase radionuclide release from a potential repository at Yucca Mountain to the accessible environment. She identified research needs in the following areas: colloid sampling, colloid generation, colloid stability, radionuclide sorption onto colloids, and colloid migration. She also presented the colloid transport calculations that will be used to evaluate the data.

In planning strategy for colloid research, the following questions will be addressed:

1. Are far-field naturally-occurring colloids present in the ground-water?

Possible colloid studies to address this question include sampling and characterization of colloids to measure concentrations of inorganic colloids, organics, and microorganisms in waters from the saturated zone. Because of the relatively sparse vegetation at Yucca Mountain, we expect that organic colloids and microorganisms will not play a major role in the transport of colloids at Yucca Mountain. We must also determine the total organic carbon in the saturated zone ground-waters to address this question.

2. Can colloids be formed in the near field at the proposed repository?

Possible colloid studies to address this question include laboratory experiments that simulate near-field conditions, which would yield colloids that can carry radionuclides to the far field. The experiments will address formation of colloids from the waste form and the degradation of potential canister materials.

3. Are the near- and far-field colloids stable in likely ground-waters (as a function of water chemistry and temperature)?

Possible colloid studies to address this question include studying the stability of near-field colloids as a function of temperature; to address near-field colloid formation, we will study likely water chemistries in the unsaturated zone using colloids generated from laboratory experiments. The stability of far-field colloids (silica, zeolites, and clays) will be studied as a function of saturated water chemistry and temperature. Variations of Ca concentration to simulate the range of Ca concentrations at the Yucca Mountain Site will be undertaken. (Given the high near-field temperatures of the proposed repository that may result from possible thermal loads, it is expected that near-field colloids will not be stable.)

4. Can near- and far-field colloids carry radionuclides? What is the capacity of the colloids to carry radionuclides? What is the mechanism for the reaction of radionuclides with the near- and far- field colloids to form radiocolloids?

Possible colloid studies to address this question: Laboratory experiments that address the formation of near-field colloids can address all the questions for colloids that result from the waste form. For colloids that result from canister degradation and for far-field colloids, the most likely mechanism for radiocolloid formation is radionuclide sorption onto the colloid. The sorption behavior of actinides (Pu, Am, U, and Np) onto these colloids will be studied to determine radionuclide distributions between the colloids and the ground-waters and assess the reversibility of the sorption mechanism of radionuclides onto colloids. Spectroscopy studies will be used to identify the chemical reactions between the radionuclides and the colloids. Formation of humic or fulvic radiocolloids will be studied with the actinides and the organic fractions isolated from the far-field colloidal fraction in order to assess the importance of actinide-humate or fulvate species.

5. Can the radiocolloids migrate over field-scale distances without being filtered?

Possible colloid studies to address this question: The mobility of colloids through the medium at Yucca Mountain will be addressed using transport experiments. Laboratory-scale column experiments, which involve eluting well-characterized colloids (such as polysterene spheres) and near-field and far-field radiocolloids through porous and fractured tuff columns, will be used to validate the colloid transport code CTCN. Elution of colloids through a large block (~ 1 m) of fractured tuff will be performed to bridge the gap between laboratory and field scales. Field-scale colloid transport will be studied by injecting polysterene microspheres into the C-Wells, a group of boreholes located near the proposed repository at Yucca Mountain. These wells provide an opportunity to study colloid transport through saturated, fractured tuff, and the results will simulate formation of a radiocolloid that reaches the water table at Yucca Mountain. The C-Wells field experiments included injecting various tracers (including well-characterized colloids) into the saturated zone via an injection well and observing the appearance of these tracers in sampling wells at down-gradient locations. The C-Wells experiment will allow the validation of transport codes used to predict colloid transport through fractured tuff through large scales. When the transport code is validated, it can address the importance of colloid-facilitated radionuclide transport for performance assessment.

If the answer to any part of questions 1 to 4 is no, the remainder of the questions need not be answered. In other words, in order for colloids to facilitate radionuclide transport at Yucca Mountain, they must be present in stable suspensions in sufficient quantities, the radionuclides must be associated with the colloids (radiocolloid formation needs to occur), and the radiocolloids must be transported over field-scale distances.

The draft report for the Colloid Workshop (Milestone 3348) was under review by the members of the Geochemistry Integration Team. It will be refined following the Colloid Workshop.

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 on 30 October 1992; to be published in IHLWMC Proceedings.

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, and a TIP review was initiated.

3065
Techniques to Study Diffusion in Saturated Tuffs
30 October 1992
Completed on 30 October 1992; to be published in IHLWMC Proceedings.

3348
30 September 1993
Colloid Workshop Report

3349
Summary Report on Np Transport through Yucca Mountain Tuffs
30 September 1993
On schedule.

Publications

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

J. Conca
Measurement of Unsaturated Hydraulic Conductivity in Yucca Mountain Tuff (3044)
Conference paper, *Focus '93 Site Characterization and Validation*
In technical review.

I. R. Triay, K. H. Birdsell, A. J. Mitchell , and M. A. Ott
Diffusion of Sorbing and Nonsorbing Radionuclides in Tuff
Conference paper, *1993 International High-level Waste Management Conference*
Approved by YMPO.

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* .
Approved by YMPO.

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
Conference paper, *1993 International High-level Waste Management Conference*
Approved by YMPO. (Milestone 3040)

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

Three-dimensional grids for Yucca mountain were generated. These grids follow the stratigraphy closely and will be compared with previous three-dimensional runs on regular meshes. The advantage of our gridding technique is that the coarse grid can automatically be refined to a fine grid, while at the same time preserving the stratigraphy. As soon as we receive the newest three-dimensional stratigraphy from the USGS, we will discontinue using the SNL data we are now using.

Planned Activities

Begin calculations for ^{36}Cl transport.

Perform near-field, double-permeability calculations to test the performance of various thermal load designs.

Build grids for YMP isothermal infiltration and transport calculations.

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.

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.

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.

Publications

None

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

The DOE topical report entitled "Evaluation of the Potentially Adverse Condition 'Evidence of Extreme Erosion during the Quaternary Period' at Yucca Mountain" was completed and published (DOE report YMP/92-41-TPR [March 1993]). C. Harrington provided significant input to the technical section of this 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 on 18 February 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.

Study Plans (cont.)

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.

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.

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 November 1992.

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.

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 are being addressed.

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

Submitted data on the following items to the TDB:

- Calcite Deposits in Drill Cores USW G-2 and USW GU-3/G-3 at Yucca Mountain, Nevada (LA000000000014.002).
- Geological Evaluation of Six Non-welded Tuff Sites in the Vicinity of Yucca Mountain, Nevada, for a Surface Based Test Facility for the Yucca Mountain Project (LA000000000015.002).
- Dehydration and Rehydration of a Tuff Vitrophyre (LA000000000017.002).
- Preliminary Assessment of Clinoptilolite K/Ar Results from Yucca Mountain, Nevada, USA; A Potential High-level Radioactive Waste Repository Site (LA000000000023.002).

Planned Activities

Resolve backlog issues of missing information on previous submittals to SEPDB.

Review data files to resolve difficulties and bring records up to date.

Determine if technical data needs to be logged into ATDT for current work on zeolites, saturated fluid flow, and other ongoing work of various principal investigators.

Problem Areas

None

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

Final approval of the Special Work Permit for the caisson was received, and work began on installing the lower-boundary device on 17 March.

Planned Activities

Complete filling of the caisson. The lower-boundary device should be installed by 7 April.

Problem Areas

None

Milestone Progress

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

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*
Approved by YMPO.

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

Air-water diffusion terms were added to the computer code FEHM; this part of the code will be the subject of a new milestone entitled "Summary Report on Thermal Repository Calculations," due 30 September 1993.

Planned Activities

No planned activities reported.

Problem Areas

None

Milestone Progress

4004
30 September 1993
Summary Report on Thermal Repository Calculations

Publications

None

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

Staff scheduled and coordinated a meeting on consolidation of thermal testing in the ESF; it was attended by representatives of SNL, LLNL, CRWMS M&O, and Los Alamos. Staff met with representatives of the Colorado School of Mines to discuss mechanical methods for the mining of the ESF.

Staff continued to support activities pertaining to the use of tracers, fluids, and materials (TFM) at Yucca Mountain with emphasis on FY 1993 and starter-tunnel requirements. Staff was finalizing the Los Alamos TFM database. Staff requested information on waste-isolation impact and test-interference analysis for the TFMs from M&O. Staff participated in weekly field engineering/PA/QA meetings.

Staff attended a USGS-hosted meeting of CASY in Denver .

Planned Activities

Staff will continue to focus on consolidating ESF thermal and mechanical testing and work with CRWMS M&O to develop mechanical mining techniques for the main test area of the ESF. Staff will work toward consolidating ESF thermal tests and developing integrated network and will continue to support Director of ED&D in the area of ESF testing in particular, testing for WBS 1.2.2 and 1.2.4. Staff will continue to gather information on TFM and coordinate IDS design.

Staff will meet 7-8 April at the Waste Isolation Pilot Plant (WIPP) to obtain information on IDS used at the WIPP site.

Publications

N. Elkins
Prioritization of ESF Testing and Integration with Design and Construction
Conference paper, *1993 International High-Level Radioactive Waste Management Conference*
Approved by YMPO.

H. Kalia
Control of Tracers, Fluids, and Materials for the Yucca Mountain Site Characterization Project
Conference paper, *1993 International High-Level Radioactive Waste Management Conference*
Approved by YMPO.

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

No significant activities reported this month.

Planned Activities

No planned activities reported.

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

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 attended TPO, TAG, CASY, and Program Review meetings.

The TPO presented a Los Alamos colloquium on YMP.

The TPO established weekly meetings with ES&H advisory staff and implemented a review of Los Alamos regulations, DOE orders, and DOE/YMP administrative procedures regarding ES&H requirements. A matrix is being developed to clarify how the Laboratory implements ES&H regulations and whether this implementation satisfies the requirements as interpreted by YMPO.

The TPO provided Los Alamos/YMP orientation to approximately 30 members of the Los Alamos staff.

WBS 1.2.9.2.2 Project Control

Objective

The objective of this task is to support management's efforts in planning, scheduling, and controlling the technical work. This task will develop, implement, and maintain computerized cost, schedule, and technical milestone data bases and develop strategies to meet management information requirements.

Activities and Accomplishments

Staff completed the resource requirements exercise for SAIC.

Staff completed the Los Alamos YMP Budget Submission and forwarded it to DOE/AL.

Staff submitted PACS status to YMPO on 11 February and 11 March.

Staff submitted the FY 1993 Basis of Estimates to YMPO.

Planned Activities

Download actual costs and forecasts from the Los Alamos central accounting system to our local workstation.

Problem Areas

None

WBS 1.2.11.2/3 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.

WBS 1.2.11.2 Program Development

Program Development. The annual YMP "All Hands" meeting was held on 26 February, and five speakers addressed the group. They discussed Laboratory QA, the regulatory arena, YMP quality assurance achievements, TCO duties, and general YMP news. The QAPL evaluated the Orientation Plan and sent suggested changes to the training coordinator. *The Quality Connection* was issued, covering topics for the first quarter of 1993. Staff submitted drafts of "Implementation Matrix (R1)," "Detailed Transition Plan (R2)," and "Impact Analysis (R1)" to YMPO. We anticipate completion of activities to implement the new QARD by August; our major emphasis will be on procedure revisions.

Personnel. C. Mechels was hired as Software Management Coordinator.

Travel. S. Bolivar, J. Day, and P. Gillespie attended a conflict resolution class in Las Vegas on 22 February. Meetings were also held with YMP/QAD and TCO personnel concerning QARD requirements. S. Bolivar attended the Total Quality Forum on 17-19 of February in Albuquerque.

Procedure Revisions. Twenty-one quality administrative procedures (QPs) were in various stages of revision. Issues concerning changes to the records system and the responsibilities of resident file custodians have been resolved, and the process will not be changed. The first two procedures containing changes as required by the QARD were being edited and will be released for formal review in the near future. Detailed technical procedures LANL-EES-DP-101, R2 (Sample/Specimen Collection, Identification, and Control for Mineralogy Studies); LANL-EES13-DP-606, R2 (Volcanism Field Studies); and LANL-EES13-DP-608, R1 (Procedure for Preparation of Splits and Powders from Soil Samples) were approved and distributed. Forty-three quality administrative procedures (QPs) must be revised to satisfy new QARD requirements.

Training. S. Bolivar and P. Gillespie attended the Requirements Traceability Network (RTN) training in Las Vegas on 25-26 February. Training requirements for the new records management procedure were discussed with our training consultant. A YMP orientation class was held 25 February and was attended by 24 people. S. Bolivar attended two classes of a video conference training course entitled "Radioactive Waste Management" on 3 and 31 March. Training requirements for the new records management procedure were discussed, and issues to be addressed and documented in a survey by our training consultant. The training database program was completed and was being tested.

WBS 1.2.11.3 Audits and Surveys

Audits and Surveys Six audit reports were in various stages of completion. Corrective action reports CAR-YMP-92-058 and CAR-YM-93-018 were closed by YMPO. The conditions for lifting stop work order SWO-03 were evaluated by verification personnel, and based on their recommendations, SWO-03 was revised and reissued. The Trend Report for the last quarter of 1992 was issued. Five audit reports were completed, and eight deficiency reports were issued to the following organizations: CAR-92-10, Lawrence Berkeley Laboratory; AR-92-11, Hydro Geo Chem; AR-92-13, EES-4 & EES-15; AR-92-16, Test Coordination Office; and AR-92-17, EES-13 software). The 1993 audit schedule was released. The audit plan for the Test Coordination Office (AR-93-01) was approved and the audit was conducted 9-12 March.

WBS 1.2.11.5 Quality Engineering

Software. The initial revision of the six software procedures has been completed; these documents will be reviewed internally for clarity. The Software Quality Assurance Plan is now being revised.

Planned Activities

The training coordinator will continue to develop a training class for QP-17.6. Outstanding 1992 audit reports will be completed; the majority of efforts will be directed at revising documents that outline our transition to the new QARD, as well as revising the procedures that will implement the QARD. Corrective actions for stop work order SWO-03 will be completed.

An audit of the Mineralogy/Petrology and Alteration History tasks will be conducted. Compilation of the 1992 Quality Assurance Status Report will continue. Training files for active personnel will be entered into the new database.

Problem Areas

None

Publications

S. Bolivar and J. Day
The Quality Assurance Liaison—Combined Technical and Quality Assurance Support
Conference abstract
Approved by YMPO.

WBS 1.2.12.2/2.5 1.2.13 Local Records Center Operations/Records Management and Document Control

Objective

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

Activities and Accomplishments

Two hundred and eleven records and/or record packages were received by the RPC; seven of these were rejected and returned to their originators for corrections.

Two hundred and fifteen records and/or record packages were submitted to the CRF. The CRF rejected one record package.

Staff attended the YMP Training Coordinators' meeting and participated in a class on performance-based training.

L. Sanders participated in a Technology Integration and Methodology Analysis (TIMA) Process Analysis/Outcomes Committee meeting in Las Vegas, NV, on 15-17 February.

Planned Activities

No planned activities reported.

Problem Areas

None

WBS 1.2.15.2 Administrative Support

Objective

The objective of this task is to provide administrative support for Group EES-13 and the YMPO.

Activities and Accomplishments

S. Klein, Los Alamos editor, reviewed and edited nine 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 January and February. All reports were transmitted to the M&O and YMPO.

The editor completed and transmitted the January and February YMP Monthly Activity Reports.

The editor completed and transmitted the Los Alamos input to the 8th YMP Progress Report.

The editor prepared 40 view graphs for management presentation.

Planned Activities

S. Klein will continue to refine the TIP database.

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 wrote procedure on selection of training materials and evaluation of training needs.

Staff began inputting information into the new training database.

Staff submitted 84 records packages to the RPC. These packages contained 1992 training files for all active YMP personnel.

A YMP orientation class was held on February 25, 1993; it was attended by 24 people.

Planned Activities

Staff is working toward maintaining duel storage of training files.

Problem Areas

None

[redacted]

Los Alamos National Laboratory
Los Alamos,New Mexico 87545

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

MAY 20 2 50 PM '93

WBS 1.2.9.1
QA N/A

May 17, 1993

TWS-EES-13-05-93-029

DIVISION
CC: Gertz
CC: Brodsky
CC: Jones, S
CC: Dist. List (YMP)
CC:
CC:
CC:

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:

Highlights of the Los Alamos Monthly Activity Report—April 1993

RECD IN YMP 5/20/93

Attached are the highlights of the Los Alamos Monthly Activity Report for April 1993. This internal document describes our technical work; 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

Julie A. Canepa

SHK/elm

Attachment: a/s

Cy w/att:
M. B. Blanchard, YMPO, Las Vegas, NV
W. L. Clarke, LLNL, Livermore, CA
W. R. Dixon, YMPO, Las Vegas, NV
J. R. Dyer, YMPO, Las Vegas, NV
N. Z. Elkins, EES-13/LV, MS J900/527
L. D. Foust, CRWMS, M&O/TRW, Las Vegas, NV
L. R. Hayes, USGS, Denver, CO
V. F. Iorii, YMPO, Las Vegas, NV
S. H. Klein, EES-13, MS J521
M. Martin, M&O/TRW, Las Vegas, NV
A. R. Pratt, EES-13, MS J521
L. Shephard, SNL, Albuquerque, NM
W. Simecka, YMPO, Las Vegas, NV
M. Voegele, SAIC, Las Vegas, NV
RPC File (2), MS M321

Cy w/o att.:
CRM-4, MS A150

I-3419.73
BAA

5-17-93

ENCLOSURE 4

Los Alamos Monthly Highlights
April 1993

WBS 1.2.1 Performance Assessment. Some initial calculations, based on Covela data and canister heating loads developed by SNL, were made using a two-dimensional grid, and the run was of a section across the mountain. Cartoons provided by D. Vaniman suggest that infiltration and bulk permeability in Solitario Canyon may be important for the thermal repository issue.

WBS 1.2.3.1 Management. Eight Los Alamos YMP staff members presented papers at the 1993 International High-Level Waste Management Conference in Las Vegas (April 26-30). The topics presented follow: (1) Calicite deposits in fractures at Yucca Mountain (Vaniman); (2) Prioritization of ESF Testing and Integration with Design and Construction (Elkins); (3) Radionuclide Solubility and Speciation Studies for the Yucca Mountain Site Characterization Project (Nitsche); (4) Aperture Characteristics, Saturated Fluid Flow, and Tracer Transport Calculations for a Natural Fracture (Reimus); (5) Dependence of Radionuclide Sorption on Sample Grinding, Surface Area, and Water Composition (Rogers); (6) Testing Models of Flow and Transport in Unsaturated Porous Media (Springer); (7) Neptunium Retardation with Tuffs and Groundwaters from Yucca Mountain (Triay); (8) Diffusion of Sorbing and Non-sorbing Radionuclides in Tuff (Triay); and (9) Control of Tracers, Fluids, and Materials at the Yucca Mountain Site Characterization Project (Kalia).

WBS 1.2.3.2.1.1.1 Mineralogy/Petrology. D. Vaniman visited the Nevada Test Site on 13-14 April and on 28 April to finish sample selection for mineralogy-petrology studies of UE-25 UZ-16. Initial sample selections were also made from core NRG-6. Together, these two cores will provide needed mineralogical information for sections associated with the eastern imbricate fault zone and the northern boundary of the potential repository, respectively.

Twenty-five polished one-inch rounds of devitrified, vitric nonwelded, and zeolitic tuff were prepared for microautoradiography experiments to be done in conjunction with staff from the Sorption task. The goal of these studies is to determine the potential effect of trace minerals on sorption of heavy radionuclides.

B. Carlos visited the SMF on 12-14 April to complete preliminary examination of fractures in UE25 UZ-16; she also examined the first 460 ft of USW NRG-6.

Staff noted a strong need for a "field-guide" to fracture-lining minerals for well-site geologists and those mapping in the underground excavations in the area of Yucca Mountain. Therefore, a new milestone, which will consist of a short LAMS report on this topic, has been added to the schedule.

WBS 1.2.3.2.3.1.A Volcanism. Five staff members attended a field conference on Quaternary dating methods.

A suite of new Ar-Ar whole rock age determinations were obtained for basalt samples from the Yucca Mountain area. Analysis of samples from the Thirsty Mesa Center yielded ages of 4.68 +/0.03 and 4.88 +/- 0.04 Ma, which is consistent with other results for this center. A sample of cuttings collected from an exploratory well drilled by a private company at the Amargosa Valley aeromagnetic anomaly yielded an age of 3.85 +/0.05 Ma, which is consistent with the ages of the basalt of southeast Crater Flat. Three additional ages of about 3.7 Ma were obtained for samples from the basalt of southeast Crater Flat, and as things presently stand, we now have consistent K-Ar and Ar-Ar results from several laboratories for multiple samples collected from this unit and consider the age of the event to be resolved with reasonable confidence.

WBS.2.3.3.1.2.2 Water Movement Test. J. Fabryka-Martin sponsored a three-day workshop in Las Vegas entitled Chloride and Chloride-36 Studies in the Arid Southwest. Alan Flint of the USGS and scientists from seven other organizations that are pursuing infiltration studies for non-YMP programs attended the workshop.

A suite of 19 cuttings samples collected from UZ-16, from depths ranging from the surface down to 1171 ft, began to be processed for chlorine-36 analysis by the contractor.

Soil samples were collected from a shallow profile near Test Cell C (NTS Area 25) in order to test the hypothesis that high concentrations of chlorine-36 were produced in this area during the nuclear reactor engine tests that were conducted here in the 1960's.

Revisions of two detailed technical procedures dealing with sample processing for chlorine-36 analysis were completed and submitted to the records coordinator for distribution.

WBS 1.2.3.4.1.2.1 Sorption. Ines Triay reported that experiments to describe neptunium sorption onto tuff minerals in J-13 and UE-25p #1 water at high temperatures (60°C) were completed. Previous studies had been performed at ambient temperatures (25°C).

WBS 1.2.3.4.1.3 Solubility. Plutonium (Pu) undersaturation experiments at pH 8.5 in UE-25p #1 were completed following completion of oxidation-state determinations on the supernatant. After almost 300 days of equilibration time for the oversaturation experiments, the predominant Pu species in solution at all pH values was PuO_2^{2+}. This was also the case for the undersaturation experiments.

WBS 1.2.11.2/.3/.5 Quality Assurance. Twenty-two procedures were being revised, and an additional seven were in formal review. Two procedures were completed and await entry into the RTN system. Two technical detailed procedures (DPs) were issued: 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."

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

MAY 20 2 35 PM '93

WBS 1.2.9.1
QA N/A

DIVISION
cc Gertz
cc Lawn-Jo
cc Brodsky
cc Jones, S.
See Distribution
List (ym18)
cc
cc

REC 5/20/93

May 3, 1993

TWS-EES-13-05-93-026

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—February/March 1993

Attached is the Los Alamos Monthly Activity Report for February/March 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

Julie A. Canepa

Attachment: a/s

I-241946
5-3-93

Cy w/att:
M. B. Blanchard, YMPO, Las Vegas, NV
J. M. Boak, YMPO, Las Vegas, NV
R. L. Bullock, RSN, Las Vegas, NV
V. J. Cassella, HQ/Washington, DC
W. L. Clarke, LLNL, Livermore, CA
P. L. Cloke, SAIC, Las Vegas, NV
J. L. Cooper, YMPO, Las Vegas, NV
J. Docka, Weston, Washington, DC
J. R. Dyer, YMPO, Las Vegas, NV
L. D. Foust, CRWMS, M&O/TRW, Las Vegas, NV
L. R. Hayes, USGS, Denver, CO
C. Johnson, M&O/WCC, Las Vegas, NV
N. Jones, M&O/TRW, Las Vegas, NV
P. Justus, NRC, Las Vegas, NV
K. Krupka, PNL, Richland, WA
M. Martin, M&O/TRW, Las Vegas, NV
C. W. Myers, EES-DO, MS D446
C. M. Newbury, YMPO, Las Vegas, NV
R. F. Pritchett, REECo, Las Vegas, NV
R. L. Robertson, CRWMS, M&O, Fairfax, VA
L. E. Shephard, SNL, Albuquerque, NM
W. B. Simecka, YMPO, Las Vegas, NV
A. M. Simmons, YMPO, Las Vegas, NV
R. K. St. Clair, M&O/TRW, Las Vegas, NV
J. T. Sullivan, YMPO, Las Vegas, NV
M. Voegele, SAIC, Las Vegas, NV
D. R. Williams, YMPO, Las Vegas, NV
RPC File (2), MS M321
TWS-EES-13-File, MS J521

Cy w/o att.:
J. A. Canepa, EES-13, MS J521
S. H. Klein, IS-11, MS J521
CRM-4, MS A150

ENCLOSURE 3