

**YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT**

**TECHNICAL AND MANAGEMENT
SUPPORT SERVICES**

**PROJECT STATUS REPORT
APRIL 1994**

PROJECT STATUS REPORT APRIL 1994

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ACRONYMS

The following is a list of acronyms used throughout the following report.

AFP	Approved Funding Plan
AP	Administrative Procedure
AT	Assessment Team
CMCS	Contract Management Control System
CPAF	Cost Plus Award Fee
CRWMS M&O	Civilian Radioactive Waste Management Systems Management and Operating Contractor
DIGE	Determination of Importance and Grading Enhancement
DOE	U.S. Department of Energy
ESF	Exploratory Studies Facility
ESFDR	Exploratory Studies Facility Design Requirements
FCR	Field Change Report
FDDI	Fiber Distributed Data Interface
FM	Forty Mile Wash
FMP	Field Management Procedures
FOC	Field Operations Center
FOI	Field Operating Instructions
GET	General Employee Training
HQ	Headquarters
ISD	Information Systems Division
JP	Job Package
LRPW	Long-Range Planning for Workstation
M&O	Management & Operating Contractor
NCR	Nonconformance Report
NRG	North Ramp Geologic
NV	Nevada
NWTRB	Nuclear Waste Technical Review Board
OSHA	Occupational Safety and Health Administration
OTCR	Official Tribal Contact Representative
PAA	Project Accumulation Area
PACS	Planning and Control System
PI	Principal Investigator
QA	Quality Assurance
QC	Quality Control
QFR	Quality Finding Report
RDR	Repository Design Requirements
REECO	Reynolds Electric and Engineering Company

ACRONYMS, (Continued)

SAIC	Science Application International Corporation
SD	Systematic Drilling
SMF	Sample Management Facility
SMPGS	Site Maintenance Plan Guidance Survey
SOC	Sample Overview Committee
SP	Special Procedure
SR	Surveillance Report
T&MSS	Technical and Management Support Services
TBM	Tunnel Boring Machine
TPP	Test Planning Package
UE	Underground, Exploratory
USGS	U.S. Geological Survey
USW	Underground, Southern Nevada, Waste
UZ	Unsaturated Zone
VAX/VMS	Mainframe Computer/Operating System
WIEB	Western Interstate Energy Board
YAP	Yucca Mountain Administration Procedure
YMP	Yucca Mountain Site Characterization Project
YMSCO	Yucca Mountain Site Characterization Office
YMSC	Yucca Mountain Science Center

EXECUTIVE SUMMARY

APRIL - 1994

The AT completed a review of the DIGE management plan records package and a recommendation was made for cancellation of the plan.

A notice of technical closure and a monthly report on the results of Quest Integrated Incorporated Research contract was issued.

Completed a technical analysis of the Baker/Hughes drilling research proposal.

Completed a white paper on the "Ejector Sub" assembly in satisfaction of the YMSCO established performance criteria.

Completed and approved JP-94-07, "Drilling and Testing of Borehole SD-9 (Phase 1)," and T-94-01, "Drilling and Testing of Borehole SD-9."

Completed the SMPGS as requested by the DOE/HQ.

Finalized the May AFP input and distribution of prior year uncosted balances.

Conducted an external audit of Net One Northwest.

Completed the Novell Phase II conversion and Phase I installation.

The Spring 1994 OTRC visit was held March 14-16, 1994 in Las Vegas, NV. Native American oversight support, funding initiatives, and archaeological data recovery efforts were discussed.

Staff scientists met with Nevada State Health Department representatives to tour the Yucca Mountain site and discuss the ESF potable water systems, including a design drawing and construction progress review.

The Underground Injection Control permit quarterly report was submitted to the Nevada Division of Environmental Protection.

The Environmental Compliance Summary was submitted to the Office of Environmental, Safety and Health as required by DOE Order 5400.1, "General Environmental Protection Program."

EXECUTIVE SUMMARY, Continued

April 1994

The PAA for hazardous wastes was opened. The PAA is the central location for Project wastes prior to offsite transport.

The initial assessment of radon working levels at the ESF personnel working level area was completed as required for DOE Radcon Manual and OSHA compliance.

The socioeconomic monitoring program procurement data report for the period from April 1993 through September 1993 was distributed to representatives of the State of Nevada and effected units of local government.

Thirty tours to Yucca Mountain were arranged and coordinated.

Forty Public Speaking presentations were given during the reporting period.

1.2.1 SYSTEMS

Progress During the Report Period:

The AT completed the first draft of the determination of importance plan, including development of review criteria for both classification of items and impact analysis of activities.

Also completed was a review of the DIGE management plan records package and a recommendation was made for cancellation of the plan.

Issues and Concerns:

No issues or concerns during this report period.

1.2.3 SITE INVESTIGATIONS

Progress During the Report Period:

Test Planning and Support

Initiated the following JPs and TPPs:

- JP-94-08 Construction of Access Road and Drill Pad for SD-7
- JP-94-09 Ghost Dance Fault Trenches
- JP-94-10 Rock Valley Trenches and Test Pits
- JP-94-11 Drilling and Testing of Borehole SD-9
- JP-94-12 Seismic Reflection Program
- JP-94-14 Construction of Access Road and Drill Pad for UZ-7A
- T-94-12 FM-2 Artificial Infiltration
- T-94-13 UZN-7 Artificial Infiltration
- T-94-14 Drilling and Testing of UZ-7A

JP-94-07, SD-9, "Drilling and Testing," was completed and approved.

Completed a review of the ESFDR and RDR current revisions.

PROJECT STATUS REPORT

April 1994

1.2.3 SITE INVESTIGATIONS, (Continued)

To satisfy the YMSCO established performance criteria, a white paper on the "Ejector Sub" assembly was completed.

Performed a technical review of SP 8.3.1.17.3.1, Revision 1, "Relevant to Earthquake Services."

Issued a notice of technical closure and a monthly report on the results of the Quest Integrated Incorporated Research contract.

Completed a technical analysis of the Baker/Hughes drilling research proposal.

Reviewed and approved a REECO Dual Wall Failure Analysis Report.

Prepared a geologic description of the "tube structures" at Yucca Mountain for the YMSCO.

Drilling

Sampled core from 290.8' to 588.8' from USW SD-12. Drilling continued in the Upper Lithophysal Zone of the Topopah Springs.

Core and cuttings from 1596.3' to 2206.7' from USW UZ-14 were sampled and processed. A water table was encountered through a natural fracture at 2185.5' in the Bullfrog Member of the Crater Flats Tuff, and the planned depth will be re-evaluated.

Conducted geophysical logging activities on USW NRG#6 and UE-25 UZ-16 using a Numar Corporation magnetic resonance imaging tool.

Approximately 726 specimens were removed from core at the PI's request.

Conducted 81 core examinations at the SMF for various participants.

Issues and Concerns:

No issues or concerns during this report period.

1.2.7 TEST FACILITIES

Progress During the Report Period:

Fifty-seven photographic service requests for still and video photography and 16 work order requests were processed.

The following JP activities were completed:

- a records list for JP 94-07, "Drilling and Testing of Borehole USW SD-9"
- text to be included in the SD-7 JP and associated documents
- JP 93-01, "NRG-3 Borehole"
- JP 92-19, "NRG-2 Borehole"
- a draft FCR revising JP 92-02, "North Portal Soil and Rock Properties and NRG-1 Borehole"

As requested by the DOE/HQ, the SMPGS was completed.

Prepared 212 badging requests for site visits and daily field work.

Completed revisions and/or draft revisions of the following documents:

- YAP 5.4Q, "Technical Field Work Request"
- GET Manual
- Implementation Plan for ESF Test Operations and Maintenance Support Services

Completed two CPAF Action Items: II.1A, "Review of the FMP and FOI," and II.2A, "Review of the JP Approval Process." Recommendations were made for improvements on both items.

Issues and Concerns:

No issues or concerns during this report period.

1.2.9 PROJECT MANAGEMENT

Progress During the Report Period:

Planning and Control

Statused the LRPW and revised the CMCS and PACS databases to reflect all current month changes. All Summary Accounts were reviewed with the CRWMS M&O to ensure consistency of information.

Finalized the May AFP input and distribution of prior year uncosted balances.

Management Improvement

Conducted Quality Strategic Planning and Team Building Sessions for 21 DOE personnel, and two Covey training sessions for 45 students.

Issues and Concerns:

No issues or concerns during this report period.

1.2.11 QUALITY ASSURANCE

Progress During the Report Period:

A revision of the T&MSS Qualified Supplier's List was approved and issued.

Conducted an external audit of Net One Northwest.

Surveillance Report SR-94-01 was opened for the quarterly surveillance of Document Control.

The following is a summary of QA program activity for this report period:

- QFRs: 2 opened; 2 closed; 5 remaining open
- NCRs: 6 opened; 0 closed; 10 remaining open

PROJECT STATUS REPORT

April 1994

1.2.11 QUALITY ASSURANCE, (Continued)

- Plans and Procedures reviewed: 6
- QC Receipt Inspections Performed: 6
- Procurement documents Reviewed: 1
- Supplier Evaluation Reports: 1

Issues and Concerns:

No issues or concerns during this report period.

1.2.12 INFORMATION MANAGEMENT

Progress During the Report Period:

Support to the YMSCO

Performed approximately 200 user work requests which included an initial draft of Wyandotte move and identification of potential scheduling concerns regarding availability of funding.

Support to the YMP Participants

Conducted classes in Lotus Notes, computer fundamentals, Novell, and Timeline.

Telecommunications

Coordination regarding additional proposed leased lines continued at the following locations:

- SAIC and Wyandotte
Coordinated with DOE/NV communication staff regarding planned data requirements.
- SAIC and DOE/NV
Received final approval and performed update to route Internet traffic.

1.2.12 INFORMATION MANAGEMENT, (Continued)

- The FOC and various site buildings
Received approval to procure and install InfraRed 10mb systems from DOE/NV.

System Development

A review of VAX/VMS privileged accounts and the policy regarding the granting of the accounts has been completed. Recommendations were made to reduce the number of privileged user accounts.

A draft disk allocation plan has been produced and is being reviewed.

Performed an informal design review on the FDDI design document.

Novell Transition:

- Completed Novell Phase II conversion and installation of Phase I
- Updated and distributed the transition procedure "Novell Workstation Installation Checklist," to the technicians

Planning, Control, and Compliance Support

A Computer and Telecommunication Systems Configuration Management Plan has been developed and is under ISD review.

The baseline documents for the YMP Computer Room have been created and are now under review by the YMSCO.

Issues and Concerns:

No issues or concerns during this report period.

1.2.13 ENVIRONMENTAL, SAFETY AND HEALTH

Progress During the Report Period:

The Spring 1994 OTCR visit was held March 14-16, 1994 in Las Vegas, Nevada. Native American oversight support, funding initiatives, and archaeological data recovery efforts were discussed.

Staff scientists met with Nevada State Health Department representatives to tour the Yucca Mountain site and discuss the ESF potable water systems, including a design drawing and construction progress review.

The Underground Injection Control Permit quarterly report was submitted to the Nevada Division of Environmental Protection.

A site tour was conducted for Nevada Division of Environmental Protection Representatives.

Environmental Compliance Summary was submitted to the Office of Environment, Safety and Health as required by DOE Order 5400.1, "General Environmental Protection Program."

Staff scientists participated in the 90 percent review of Design Package 2C.

Six environmental approval requests were processed in support of site characterization activities, including a comprehensive review of each activity for permit and land access approvals.

The PAA for hazardous wastes was opened. The PAA is the central location for Project wastes prior to offsite transport.

Environmental compliance and safety surveillances were conducted at the Yucca Mountain site ensuring compliance with permit and programmatic requirements.

All findings of the July 1993 REECO functional appraisal and September 1993 USGS Safety and Health Compliance Inspection were closed.

The initial assessment of radon working levels at the ESF personnel working level area was completed as required for DOE Radcon Manual and OSHA compliance.

PROJECT STATUS REPORT

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1.2.13 ENVIRONMENTAL, SAFETY, AND HEALTH, (Continued)

The description of the methods, process, and schedule for implementing the 1994 survey of DOE-related workers in Nevada was submitted to the YMSCO for review.

The socioeconomic monitoring program procurement data report for the period from April 1993 through September 1993 was distributed to representatives of the State of Nevada and affected units of local government.

Efforts to complete the socioeconomic monitoring program employment data report for the period from January 1994 through March 1994 are ongoing.

Issues and Concerns:

No issues or concerns during this report period.

1.2.14 INSTITUTIONAL

Progress During the Report Period:

A "Neighborhood Dialogue" to discuss studies at Yucca Mountain was held with scientists from the DOE and the State of Nevada, in Las Vegas, Nevada. The event was co-sponsored by the state, the YMP, and Clark County.

Thirty tours to Yucca Mountain were arranged and coordinated, and forty public speaking presentations were given during the reporting period. These included 22 educational presentations and 18 general YMP overviews.

In addition to the special groups tours, a Public Open House tour of Yucca Mountain was coordinated and conducted on April 16, 1994 for 330 people. Tour participants visited the YMSCs, the FOC, two laboratories, the ESF North Portal construction area, and the top of Yucca Mountain.

An Affected Units of Government meeting was held on April 8, 1994 in Las Vegas, Nevada. The agenda included discussions of the Administration's Funding Proposal, a variety of technical issues, and preparations for the Stakeholders Meeting to be held on May 21, 1994 in Las Vegas, Nevada.

PROJECT STATUS REPORT

April 1994

1.2.14 INSTITUTIONAL, (Continued)

Supported the YMP staff at a meeting of the Steering Panel for the Independent Management and Financial Review, the Clark County Nuclear Waste Division Peer Review Committee meeting, and the Clark County Steering Committee meeting in Las Vegas, Nevada; the NWTRB meeting in Reno, Nevada; and the WIEB meeting in Lake Tahoe, Nevada.

Assisted the YMP in conducting four "Of Science and Mountains" teacher workshops and four "Critical Thinking" teacher workshops. Twenty teachers participated in each of the workshops.

Development of new ESF exhibit at the Las Vegas YMSC was completed. The exhibit features a large three-dimensional model of the ESF, as well as a brief video, four dioramas on planned tests, and a diorama on the LM-300 Drill Rig at Yucca Mountain.

Supported Various YMP staff who participated in a Discovery Day at the Las Vegas YMSC. Approximately 100 people participated in the hands-on geology and science activities.

A media availability conference was held on April 11, 1994 in Las Vegas, Nevada to brief local reporters on the arrival of the TBM. A completed revision of the fact sheet, "Drilling and Blasting the TBM Starter Tunnel," was made available at the media availability briefing.

Ten groups of fifth grade students toured the Las Vegas YMSC and attended educational presentations on geology. A total of 630 students participated.

The Yucca Mountain Speaker Series presentation, "Tunneling Your Way Through a Mountain," was presented at the Las Vegas YMSC and at the Pahrump YMSC. A total of approximately 58 people attended these presentations. April Speakers Series flyers were completed and distributed.

A scoreboard was presented by the YMP to the Beatty community for Little League events. Over 250 children and parents attended the season's opening day event on April 9, 1994.

PROJECT STATUS REPORT

April 1994

1.2.14 INSTITUTIONAL, (Continued)

Assisted various YMP staff with a science experiment competition. For this event, students engineered devices to protect an egg when dropped from several heights, and approximately 300 students participated in the event.

Supported the YMP set up and staff four exhibits. These included the Clark County Fair, the Las Vegas Home and Garden Show, an exhibit for Churchill County in Fallon, Nevada, and the Earth Day Fair in Las Vegas, Nevada. A total of approximately 1,411 people visited the displays.

Completed 174 external information requests. This was accomplished by providing written responses to written and verbal queries and/or by supplying existing literature.

Issues and Concerns:

No issues or concerns during this report period.

1.2.15 SUPPORT SERVICES

Progress During Report Period:

Training

Conducted 100 training sessions and trained 1,154 personnel for a total of 4,183 contact hours and processed 423 training records.

Conducted the following special training sessions:

- Introduction to Federal Records
- Special General Employee Training
- General Employee Radiological Training
- Initial Instructor Training
- PACS Planning, Scheduling and Cost Estimating
- Introduction to Conduct of Operations

Issues and Concerns:

No issues or concerns during this report period.



Science Applications International Corporation

WBS 1.2.9.2
QA: N/A

May 31, 1994

Robert M. Nelson, Jr., Acting Project Manager
ATTN: Vince F. Iorii
U.S. Department of Energy
Yucca Mountain Site Characterization Office
P.O. Box 98608
Las Vegas, Nevada 89193-8608

TRANSMITTAL OF TECHNICAL AND MANAGEMENT SUPPORT SERVICES
PROJECT STATUS REPORT FOR THE MONTH OF APRIL 1994,
CONTRACT #DE-AC08-87NV10576 (SCP: N/A)

This letter transmits the subject report showing accomplishments for the month of April 1994. A Cost Performance Report, the Milestone Schedule and Status Report for the reporting period have not been included due to system problems encountered. We should be able to reinstate these reports in subsequent periods. Please contact Mary Brodeur at 794-7682 if you have comments or suggestions.

Michael D. Voegle, Project Manager
Technical and Management
Support Services

MDV:MB:brk:L94-207

Enclosure:
1. Project Status Report

1-358231
AMH

10/2/94

cc:

J. M. Schrecongost, YMSCO, NV, MS/523
G. K. Beall, SAIC, Las Vegas, NV, 517/T-17
R. S. Bostian, SAIC, Las Vegas, NV, 517/T-28
D. K. Chandler, SAIC, Las Vegas, NV, 517/T-44
J. B. Harper, SAIC, Las Vegas, NV, 517/T-38
M. W. Harris, SAIC, Las Vegas, NV, 517/T-29
T. K. McCusker, SAIC, Las Vegas, NV, 517/T-31
B. E. Reilly, SAIC, Las Vegas, NV, 517/T-18
K. K. Shrivastava, SAIC, Las Vegas, NV, 517/T-31
T. D. Tait, SAIC, Las Vegas, NV, 517/T-46
M. D. Voegle, SAIC, Las Vegas, NV, 517/T-44
J. D. Weaver, SAIC, Las Vegas, NV, 517/T-04



EG&G ENERGY MEASUREMENTS

Santa Barbara Operations

EG&G ENERGY MEASUREMENTS, INC., 101 CONVENTION CENTER DRIVE, LAS VEGAS, NEVADA 89109

TEL (702)794-7463

WBS 1.2.13.4
NQA

July 6, 1994
LV94-RAG-040

Wendy Dixon, Director
Project and Operations Control Division
Yucca Mountain Project Office
DOE Field Office, Nevada
P. O. Box 98518
Las Vegas, NV 89193-8518

JUNE 1994 PROGRESS REPORT

Attached is the June 1994 progress report on biological studies and support activities conducted by EG&G/EM for the Yucca Mountain Site Characterization Project. Please contact Tom O'Farrell (293-7762) or me (794-7474) if you have questions regarding this report.

W. Kent Ostler, Manager
Environmental Science Department

RG:vk

Attachment

cc: G. Ryder, DOE/YMP
D. Sorensen, SAIC
P. Schilling, SAIC

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DIXON
RYDER
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McCANN-SAIC
PYSTO-SAIC
Nesbit-JC

7-7-94 Williams-D
Nelson-R

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ENCLOSURE 2

**YUCCA MOUNTAIN PROJECT
BIOLOGICAL RESOURCES PROGRAM
MONTHLY PROGRESS REPORT
JUNE 1994**

Summary of Work Accomplished During Report Period

EG&G Energy Measurements (EG&G/EM) conducted work for the Biological Resources Task (WBS 1.2.13.4.11) for the Project Office.

ISSUES and CONCERNS

- None

WORK PROGRESS

- EG&G/EM conducted two preactivity surveys to assess potential impacts on biological resources and one reclamation inventory. Resurveys for tortoises were conducted at three construction sites. Four casual access surveys were conducted. The C-Well pipeline was monitored for tortoises throughout the month to ensure tortoises were not trapped or injured.
- Measurements of vegetation production were completed on the 12 ecological study plots in the *Larrea-Lycium-Grayia* association and on the six ecological study plots with small mammal trapping grids in the *Coleogyne*, *Larrea-Ambrosia*, and *Lycium-Grayia* associations. All vegetation measures to monitor the effects of Site Characterization Activities now have been completed for FY94.
- Seedling density measurements were completed at Site #1E (soil quality and depth study). All reclamation monitoring measurements (cover and seedling density) have been completed for FY94.
- All other work was part of continuing studies. Radiomarked desert tortoises were located at least twice each week. Blood samples were drawn from desert tortoises to assess and monitor health condition. Small mammals were captured, marked, and released on eight plots to monitor the effects of site characterization activities on population abundance and survival.
- EG&G/EM (R. Green and M. Hessing) met with USGS (A. Flint, L. Flint, B. Guertal, J. Hevesi, and D. Hudson) and DOE/EPA (J. D'Lugoza and R. Keeler) to discuss common data needs related to plant communities and plant-water dynamics.
- A draft of EG&G/EM's scope of work for FY95 was provided to the Project Office.



Lawrence Livermore National Laboratory

LLYMP9406134
June 27, 1994

WBS 1.2.9
QA: N/A

Robert M. Nelson, Jr., Acting Project Manager
Yucca Mountain Site Characterization Office
Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

318
Williams, D. (asst Mgr)
Amstad (6)
Smith, M
Stucker
Synar
Dyer
Harkin
Spence
Darton
Lewis
Summitt
7/7/94

SUBJECT: Yucca Mountain Project Status Report - May 1994
SCP: N/A

Attached is the May Project Status Report for LLNL's participation in the Yucca Mountain Project.

If further information is required, please contact Carol Passos at 702-794-7511 or Jim Blink at 702-794-7157.

Sincerely,

for 
W.L. Clarke
LLNL Technical Project Officer
for YMP

WC/CP

cc: Distribution

DISCLAIMER

The LLNL Yucca Mountain Project cautions that any information is preliminary and subject to change as further analyses are performed, or as an enlarged and perhaps more representative data base is accumulated. These data and interpretations should be used accordingly.

94071400 79 42pp.

ENCLOSURE 3

1-359206 BAH

RPPTS 1.4



LAWRENCE LIVERMORE NATIONAL LABORATORY
(LLNL)
YUCCA MOUNTAIN PROJECT (YMP) STATUS REPORT

May 1994

EXECUTIVE SUMMARY
(Items Proposed for Reporting in YMSCO or OGD Reports)

1) **WBS 1.2.1.5, Special Studies:** LLNL has conducted a series of analyses in support of the Thermal Loading Systems Study, to evaluate an assumption of TSPA-93. The Total Systems Performance Assessment assumed that Waste Packages (Wps) re-wet at the end of the boiling period. The new calculations show that the assumption, which resulted in accelerated corrosion at the end of the boiling period for high thermal loads, is flawed. For example, areal mass loadings of 55.3 and 110.5 MTU/acre were compared. The inner half of the low thermal load repository has a relative humidity of 81% at the end of boiling (1760 yr). The same region of the high thermal load repository boils until 6130 yr, and has a much lower relative humidity (44%) at the end of boiling. It doesn't re-wet to 81% relative humidity until 29,000 yr, and the temperature at that time is only 53°C. Clearly, assumption of hot wet conditions at 6130 yr for the high thermal load repository was overly conservative. Since the same conservatism was not applied to the lower thermal load, the comparison between the two cases was not appropriate.

2) **WBS 1.2.2.3.1.1, Waste Form Testing - Spent Fuel:** There has been a suspension of radiological work in Pacific Northwest Laboratories Bldg. 325. Work conducted by the YMP was not a contributory element in the closure of this facility; however, this action has had a major impact on our work schedule. Formal documentation of the justification for closure of the building has been requested; it will be provided to LLNL and placed in the YMP records. At this time, there is no projected date for re-opening the facility; therefore, overall impact on the YMP cannot be determined. More information should become available in June.

3) **WBS 1.2.2.3.1.1, Waste Form Testing - Spent Fuel:** A comparison has been made for unsaturated (drip) tests on spent fuel fragments in a Zircaloy retainer conducted at Argonne National Laboratory and earlier saturated tests on bare spent fuel conducted at Pacific Northwest Laboratory. Both sets of tests are sponsored by Lawrence Livermore National Laboratory. Leachates from the tests were compared with regard to the amount of cesium and actinides in ionic (passes a 50A filter) and colloidal forms. Acid stripping was used to determine the amounts of the radionuclides precipitated on the vessel. There was considerable variability between the two PWR fuels (which had different variables) and between them and the bare samples. Preliminary conclusions are that the plutonium, americium and curium are not being removed congruently with the uranium matrix. These conclusions, even if upheld for the two year tests, may not hold for longer

experiment durations; that was the case when UO_2 tests were extended from two years out to eight years.

4) **WBS 1.2.2.3.1.2, Waste Form Testing - Glass:** Samples taken from the high level waste dissolution tests have been analyzed. The dissolution rate of lithium from the glass has been fairly constant over a period of eight years. Silicon is being removed from the liquid, but the rate is leveling off. There appear to be two competing processes: addition of silicon to the liquid due to spallation of glass layers and removal of silicon as iron silicates which form on the metal sample holders.

5) **WBS 1.2.3.11.3, Geophysics - ESF Support, Subsurface Geophysical Testing:** The LLNL/LANL Geotechnical Engineering Group took delivery of the ENVIROLOG-4 Logging Winch manufactured by AUSLOG and purchased through Weber International on May 31st. The ENVIROLOG-4 includes a depth system, housing, 100 m 4-conductor cable, cable head, winch, 12 VDC motor drive, speed control, tripod, operational software, and downhole electronics. A preliminary performance test was conducted on the ENVIROLOG-4 winch unit on May 31st. A final performance test will be conducted after delivery of the color video tool, four arm caliper and neutron tool.

6) **WBS 1.2.3.12.2, Hydrologic Properties of the Waste Package Environment:** A primary concern for repository performance is how water contacts a waste package (WP), thereby affecting its integrity and, if containment is breached, radionuclide dissolution and transport. There are two primary modes of water contact: advective liquid flow, and condensation of water vapor on the WP surface. For the first water contact mode, *liquid-phase advective flow in fractures*, the primary sources are episodic infiltration of meteoric water and repository-heat-driven condensate drainage. Drainage can be due to boiling conditions; mountain-scale, buoyant vapor flow; sub-repository-scale, buoyant vapor flow, and focused vapor flow and condensate drainage due to heterogeneity. The last three sources of condensate can occur under either sub-boiling or boiling conditions. For the second water contact mode, *condensation on WP surfaces*, the critical concerns are the relative humidity and temperature on the WP surfaces. Ambient conditions are quite humid, with a relative humidity of 98-99%. Two ways to reduce the relative humidity on the WP surfaces are to drive a large fraction of the initial water content away from the repository, and to maintain a moderate temperature gradient in the vicinity of the WP. The primary means of reducing the water content near the repository are ventilation and repository-heat-generated boiling conditions. LLNL's thermal hydrological calculations are directed to evaluating the sensitivity of water contact to site characteristics and design parameters.

7) **WBS 1.2.3.12.4, Engineered Barrier System (EBS) Field Tests (Large Block Test):** The Large Block Test excavation work started at the beginning of May and continues. A wire saw was used to trim the top of the block. The entire sawing activity took two days. The original top of the block was successfully lifted off as a single piece and provided to RSN for use at the Colorado School of Mines. A

preliminary fracture mapping was conducted on the exposed top surface of the block.

8) **WBS 1.2.3.12.5, Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment:** The Diesel Exhaust study is underway. Sampling was conducted in N-tunnel, EQ 3/6 simulations have begun, and planning to add microbial effects to the study is underway. Results are required by August to support a Diesel vs. Electric decision for the ESF.

LLNL DELIVERABLES MET

Milestone	WBS	Planned Date	Actual Date	Description	Comment
MOL46	1.2.2.3.2	03-15-94	05-31-94	Submit degradation mode survey on iron-base materials to YMSCO	Draft received from subcontractor; in LLNL review
MOL75	1.2.3.12.3	03-31-94	05-31-94	Calibration of equip. for Scoping exp.	Delayed by procurement and requirements coordination with the LBT
MOL16	1.2.3.12.3	06-01-94	05-31-94	Approve Activity Plan	
MOL77	1.2.3.12.4	01-31-94	04-05-94	Submittal of SP comment responses	

LLNL DELIVERABLES NOT MET

Milestone	WBS	Planned Date	Projected Date	Description	Comment
MOL45	1.2.2.3.2	01-31-94	06-30-94	Submit updated Metal Barriers SIP	Delayed by TPR & NWTRB preparation
MOL03	1.2.3.10.3.1	03-31-94	07-29-94	Report on colloid characterization	Delayed by equip.malfunction related to MOL04 and delays in hiring new staff
MOL04	1.2.3.10.3.1	01-12-94	08-15-94	Document core flow experiment protocol	Delayed by equip.malfunction and delays in hiring new staff
MOL05	1.2.3.10.3.1	05-31-94	09-30-94	Report on Cs and Sr static diffusion test	Delayed by equip.malfunction and delays in hiring new staff
MOL26	1.2.3.12.1	03-31-94	07-01-94	Submit near-field geochemistry topical report	Delayed by TPR & NWTRB preparation
MOL15	1.2.3.12.4	03-31-94	07-29-94	LBT excavation and small block delivery	Construction delays have delayed test start to Dec. 94
MOL70	1.2.3.12.4	05-15-94	07-25-94	LBT frame delivery	Delay by fabricator
MOL73	1.2.3.12.5	05-31-94	06-22-94	Report on stability of organic compounds at elevated temperatures	Delayed by TPR & NWTRB preparation
MOL91	1.2.5.4.2	03-31-94	07-29-94	Submit plan for code qualification	Individual Software Plan is currently in technical review

Yucca Mountain Site Characterization Project
 Variance Analysis Report
 Status Thru: 31-MAY-94

PARTICIPANT: LLNL PEM: SIMMONS WBS: 1.2.3.12.5
 WBS TITLE: CHAR. OF EFFECTS OF MAN-MADE MAT. ON CHEM/MIN. CHGS.
 P&S ACCOUNT: 0L3C5

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCMP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
180	146	190	-34	-18.9	81.1	-44	-30.1	76.8	248	438	-190	-76.6	323	41.1

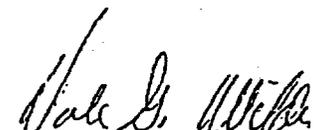
Analysis

Cumulative Cost Variance:

Cumulative Schedule Variance:

Variance At Complete:

Workscope was added for studies of diesel fuel impacts on the ESF. Additional funding has not been processed. LLNL cannot change BCWS until change has been worked through Change Control.




 P&S ACCOUNT MANAGER DATE TPO DATE

Yucca Mountain Site Characterization Project
 Variance Analysis Report
 Status Thru: 31-MAY-94

PARTICIPANT: LLNL PEM: GIL WBS: 1.2.5.2.2
 WBS TITLE: SITE CHARACTERIZATION PROGRAM
 P&S ACCOUNT: 0L522

FY 1994 Cumulative to Date									FY 1994 at Completion					
RCUS	BCUP	ACVP	SV	SVZ	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
160	160	241	0	0.0	100.0	-81	-50.6	66.4	240	322	-82	-34.2	361	98.8

Analysis

Cumulative Cost Variance:

Cumulative Schedule Variance:

Variance At Complete:

As of May 31, 1994, all funds budgeted for this element have been depleted, (\$240,000 budget; \$240,333 cost). Request for additional funding will be processed through Change Control, coordinated with Element PEM.

W. A. Latham 6/15/94
 P&S ACCOUNT MANAGER DATE

W. A. Latham 6/15/94
 TPO DATE

Yucca Mountain Site Characterization Project
 Variance Analysis Report
 Status Thru: 31-MAY-94

PARTICIPANT: LLNL PEM: IORII WBS: 1.2.9.2.2
 WBS TITLE: PARTICIPANT PROJECT CONTROL
 P&S ACCOUNT: 0L922

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCUP	ACUP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	LEAC	TCPI
401	401	461	0	0.0	100.0	-60	-15.0	87.0	601	661	-60	-10.0	691	100.0

Analysis

Cumulative Cost Variance:

Cumulative Schedule Variance:

Variance At Complete:

Increased staff by 2 full-time positions:

- 1.) Technical Coordinator - Interacts with Principal Investigators regarding project control activity.
- 2.) Assistant Resource Manager - Assists with Finance/Accounting/Reporting/Procurement functions.

Acceleration of LLNL activity in Large Block area and general ramping-up of testing activity has produced increase in project control functions. Anticipate future increases as LLNL role expands.


 P&S ACCOUNT MANAGER 6/14/94 DATE


 TPO 6/15/94 DATE

Participant LLNL

Yucca Mtn. Site Char. Project-Planning & Control System
 PACS Participant Work Station (PPWS)
 WBS Status sheet (WBS02)

01-May-94 to 31-May-94

Prepared - 06/14/94:11:04:24

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Inc. Dollars in Thousands

WBS No. - 1.2 WBS Manager -
 WBS Title - YUCCA MOUNTAIN PROJECT
 Parent WBS No. - Parent WBS Manager -
 Parent WBS Title -

Statement of Work

See the current WBS Dictionary

Cost/Schedule Performance

Id	Description	Current Period					FY1994 Cumulative to Date					FY1994 at Completion		
		BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	SAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	14	14	15	0	-1	107	107	93	0	14	160	160	0
1.2.2	WASTE PACKAGE	308	251	266	-57	-15	2256	2360	2203	104	155	3443	3507	-64
1.2.3	SITE INVESTIGATIONS	584	408	507	-176	-99	4426	4202	4182	-224	20	6348	7213	-865
1.2.5	REGULATORY	160	126	130	-34	-4	972	922	953	-50	-31	1462	1502	-40
1.2.9	PROJECT MANAGEMENT	103	103	106	0	-3	815	815	870	0	-55	1222	1271	-49
1.2.11	QUALITY ASSURANCE	54	54	31	0	23	433	433	347	0	86	650	650	0
1.2.12	INFORMATION MANAGEMENT	21	21	21	0	0	166	166	154	0	12	250	249	1
1.2.13	ENVIRONMENT, SAFETY, & HEA	2	2	5	0	-3	17	17	8	0	9	25	25	0
1.2.15	SUPPORT SERVICES	32	32	34	0	-2	254	254	200	0	54	382	375	7
Total		1278	1011	1115	-267	-104	9446	9276	9012	-170	264	13942	14952	-1010

Resource Distributions by Element of Cost

Fiscal Year 1994

Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LEAHRS	8281	7278	7559	7901	7764	7742	7988	7922	7912	7794	7746	7454	93341
LABOR	762	654	658	749	711	720	725	743	722	730	709	706	6589
SUES	109	258	264	233	315	269	218	206	226	200	142	169	2649
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	155	193	147	199	175	189	181	248	212	216	220	237	2372
CAPITAL	0	0	11	21	146	59	7	81	7	0	0	0	332
Total BCWS	1026	1145	1080	1202	1347	1237	1131	1278	1167	1146	1071	1112	13942

WBS No. 1.2 - YUCCA MOUNTAIN PROJECT

Resource Distributions by Element of Cost

Fiscal Year 1994

Actual Cost of Work Performed

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LABHRS	8301	6113	5630	6247	6390	7092	7097	7530	0	0	0	0	54400
LABOR	762	413	383	497	513	552	513	558	0	0	0	0	4191
SUBS	114	303	254	233	315	246	218	101	0	0	0	0	1784
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	152	385	243	355	388	452	388	456	0	0	0	0	2819
CAPITAL	0	0	11	21	138	33	15	0	0	0	0	0	218
Total ACWP	1028	1101	891	1136	1354	1283	1134	1115	0	0	0	0	9012

Resource Distributions

Fiscal Year 1994

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1026	1145	1080	1202	1347	1237	1131	1278	1167	1146	1071	1112	13942
BCWP	1188	1062	944	1068	1810	1177	1036	1011	0	0	0	0	9276
ACWP	1028	1101	891	1106	1354	1283	1134	1115	0	0	0	0	9012
ETC	0	0	0	0	0	0	0	0	1323	1534	1536	1547	5940

Fiscal Year Distribution

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCWS	11048	13942	43192	46455	35899	25532	17825	12021	8694	3594	823	705	219720
BCWP	10882	9276	0	0	0	0	0	0	0	0	0	0	
ACWP	10846	9012	0	0	0	0	0	0	0	0	0	0	
ETC	0	5940	42682	45613	34901	25892	18815	12262	9167	3624	823	705	220282

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

PARTICIPANT: LLNL
 DATE PREPARED 6/10/94

FISCAL MONTH/YEAR: MAY, 1994

WBS ELEMENT	CURRENT MONTH END								FISCAL YEAR		
	ACTUAL COSTS	PARTICIPANT FTES	HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS#	CAP EQPT ACCURAL	APPROVED BUDGET	CURRENT FY94 AFP	CUMULATIVE COSTS
1.2.1.5	22,600	0.80	120		0	0			160,000		92,200
SUBT 1.2.1	22,600	0.80	120	0	0	0	0	0	160,000	122,061	92,200
1.2.2.1	31,400	1.30	210		88	0	0		400,000		297,300
1.2.2.3.1.1	8,400	0.30	40	378	119	250,901	602,500		1,785,000		411,200
1.2.2.3.1.2	3,800	0.20	32		364	6,043	75,000		280,000		120,000
1.2.2.3.2	96,000	4.90	772		22,875	821	63,750		880,000		514,700
1.2.2.3.5	18,400	1.00	152		0	0	0		100,000		70,500
CAPITAL EQUIP.	1,689				10,477	0	0	0	****	91,000	133,823
SUBT 1.2.2	159,689	7.70	1,206	378	33,923	257,765	741,250	0	3,445,000	7664034*	1,547,523
1.2.3.12.1	37,400	1.60	250		6,804	176,000			610,000		413,000
1.2.3.12.2	68,300	3.30	630		2,850	0	0		861,000		524,100
1.2.3.12.3	14,400	0.50	132		4,300	0	1,800		230,000		124,600
1.2.3.12.4	207,300	6.70	1,164		12,185	495,856	34,795		2,530,000		1,147,700
1.2.3.12.5	20,300	0.40	63		50	0	10,774		248,000		177,400
1.2.3.10.3.1	18,200	0.90	138		1,344	0	0		392,000		174,400
1.2.3.10.3.2	14,900	0.20	162		2	0	0		301,000		112,400
1st SUBT 1.2.3*	380,800	13.60	2,538	0	27,535	671,856	47,369	0	5,172,000		2,673,600
1.2.3.1	44,000	2.10	337		0	0	0		245,000		183,800
1.2.3.4.2	28,100	1.10	254		103	0	0		381,000		220,000
1.2.3.5.2.2	10,600	0.70	112		0	0	0		25,000		57,000
1.2.3.10.1	0	0.00	0		0	0	0		75,000		91,300
1.2.3.10.2	14,100	0.90	134		0	0	0		175,000		161,600
1.2.3.11.3	2,400	0.10	20		36,525	0	0		180,000		22,600
CAPITAL EQUIP.	0	0.00	0		16,650	0	0		***	15,000	0
2nd SUBT 1.2.3	99,200	4.90	857	0	53,278	0	0	0	1,081,000	1,116,109	736,300
1.2.5.1	7,400	0.30	48		0	0	0		150,000		88,200
1.2.5.2.2	22,100	0.70	105		0	0	0		240,000		240,300
1.2.5.3.4	23,400	1.60	250		4,652	0	0		342,000		180,300
1.2.5.3.5	3,700	0.20	36		0	0	0		50,000		29,500
1.2.5.4.2	81,500	4.40	736		598	0	0		660,000		404,700
1.2.5.5.2	600	0.00	0		0	0	0		20,000		6,900
CAPITAL EQUIP.	0				0	0	0	0	**	34,000	0
SUBT 1.2.5	138,700	7.20	1,175	0	5,250	0	0	0	1,462,000	1,294,237	949,900

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

PARTICIPANT: LLNL
 DATE PREPARED: 6/10/94

FISCAL MONTH/YEAR: MAY, 1994

WBS ELEMENT	CURRENT MONTH END							FISCAL YEAR			
	ACTUAL COSTS	PARTICIPANT FTES	HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS#	CAP EQPT ACCURAL	APPROVED BUDGET	CURRENT FY94 AFP	CUMULATIVE COSTS
1.2.9.1.2	45,100	2.00	309		382	0	0		621,000		406,900
1.2.9.2.2	61,200	5.00	778		765	0	49		601,000		461,800
SUBT 1.2.9	106,300	7.00	1,087	0	1,147	0	49	0	1,222,000	1,057,812	868,700
1.2.11.1	31,100	1.60	200		0	0	0		650,000		346,300
SUBT 1.2.11	31,100	1.60	200	0	0	0	0	0	650,000	609,812	346,300
										(FUNDED UNDER 1.2.16)	
1.2.12.2.2	11,600	0.40	59		0	0	0		116,000		66,200
1.2.12.2.3	9,700	0.20	34		97	0	0		134,000		88,000
SUBT 1.2.12	21,300	0.60	93	0	97	0	0		250,000	215,606	154,200
										(FUNDED UNDER 1.2.17)	
1.2.13.2.5	5,400	0.30	60		0	0	0		25,000		8,400
SUBT 1.2.13	5,400	0.30	60	0	0	0	0	0	25,000	18,750	8,400
1.2.15.2	26,400	2.60	401		99	0	0		290,000		146,500
1.2.15.3	7,600	0.10	24		0	0	0		92,000		51,200
SUBT 1.2.15	34,000	2.70	425	0	99	0	0	0	382,000	300,010	197,700
TOTAL LLNL	999,089	46	7,761	378	121,329	929,621	788,668	0	13,849,000	4,734,397	7,574,823

* This work was moved to WBS 1.2.3; however, funding for this work remains in Budget and Report Category DB010202 in the AFP.

**** Capital equipment budgets are included in the individual WBS Elements.

Per instructions letter dated 4/27/93 V.F. Iorri to W. L. Clarke

Issues and Concerns

WBS 1.2.3.12.5: The CSCR to provide \$160k for DOE directed Man-Made Materials work in support of the August ESF Diesel vs. Electric decision was rejected by the Change Control Board Screening Group. An indication by YMSCO of how the funds will be provided to LLNL is needed.

TECHNICAL SUMMARY

1.2.1. SYSTEMS ENGINEERING

1.2.1.1 Systems Engineering Coordination and Planning

No significant activities.

1.2.1.5 Special Studies

Analysis of Thermo-Hydrological Conditions in the Repository

Degradation rates for aqueous corrosion of the WPs may be significantly enhanced if the WP environment is sufficiently hot and humid. A preliminary survey of aqueous corrosion indicates temperatures above 60°C and relative humidity (RH) above 70% may result in significantly enhanced degradation rates. It is important to recognize that with the use of large multiple purpose containers (MPCs), all thermal loading options are hot for some period of time. The critical question is whether the repository system can be managed such that repository conditions are hot and dry rather than hot and humid. For "hot and dry", issue is whether we can demonstrate (through *in situ* heater testing and bounding analyses) that hot and relatively dry conditions will prevail for some period of time in the vicinity of WPs. A related question is whether (with respect to WP corrosion) the WP environment becomes relatively cool before becoming relatively humid (or wet). The answer to this question must be addressed by both the near-field environment characterization studies and the WP material characterization studies which will determine the range of temperature and relative humidity conditions that result in significantly enhanced degradation rates for the WP materials under consideration. With the use of large MPCs, there are two boundary thermal strategies:

- 1) minimize how long a humid repository remains hot
- 2) maximize how long a hot repository remains relatively dry.

The goal of the first strategy is to minimize the negative consequences of a humid repository. The goal of the second strategy is to maximize the fraction of WPs that will remain relatively dry until they have become relatively cool. Both strategies aim to minimize the likelihood and duration of hot and humid WP conditions. A primary motivation for both strategies is to avoid the most corrosive WP conditions.

T. Buscheck continued to support the thermal loading systems study by re-examining the repository-scale model calculations for AMLs of 55.3, 70, 83.4, 110.5, and 150 MTU/acre with an emphasis on the temperature and relative humidity conditions at various locations in the repository. We assume a Youngest Fuel First SNF receipt scenario with a 10 yr cut-off for the youngest fuel [referred to as YFF(10)] and account for the emplacement of BWR waste packages containing 40 assemblies per WP, and PWR WPs containing 21 assemblies per WP. The waste receipt schedule was supplied by John King of the M&O.

Table 1 summarizes the duration of the boiling period at various repository locations and the relative humidity attained at the end of the boiling period for a bulk permeability, k_b ,

of 280 millidarcy. These results are presented in order to improve the TSPA-93 analyses concerning the WP re-wetting time. For some of the TSPA-93 analyses, it was assumed that the WPs re-wet at the end of the boiling period. For point of comparison, the 55.3- and 110.5-MTU/acre cases (Table 1) are similar to the 57 and 114 kW/acre cases considered in TSPA-93. At the end of the boiling period for the 55.3-MTU/acre case, RH = 80.8% in the driest region of the repository (the inner half), while it never becomes drier than ambient conditions (98.4%) at the outer perimeter (outer 3%) of the repository. At the end of the boiling period, RH in the driest region of the repository (the inner half) is 81, 68, 57, 44, and 47%, for the five listed AMLs and 150 MTU/acre, respectively. For all repository locations, RH at the end of the boiling period decreases with increasing AML. For the inner half of the repository, this trend of decreasing temperature with increasing AML levels off at about 110.5 MTU/acre. For the outer edge of the repository, RH decreases with AML for the entire AML range considered. The importance of AML is illustrated by noting that the outer perimeter of the 150-MTU/acre repository is drier at the end of the boiling period than the driest region of the 55.3-MTU/acre repository.

Clearly, the end of the boiling period is not a consistent indication of how wet (or humid) WP conditions are. Some of the results and conclusions of TSPA-93 were undoubtedly affected by the assumption that WP conditions have become equally wet at the end of the boiling period. To further illustrate the shortcoming of assuming that re-wetting occurs at the end of the boiling period, it is useful to compare:

- 1) how long it takes the driest repository location to re-wet to RH = 81% (RH attained at the end of the boiling period in the 55.3-MTU/acre case) and
- 2) the temperature attained when RH = 81%.

For the five listed AMLs between 55.3 and 150 MTU/acre, re-wetting to RH = 81% requires 1760, 9820, 18,690, 29,000, and 36,150 yr, respectively. The corresponding temperatures for these cases is 96, 69, 57, 53, and 50°C, respectively. In comparing the two cases (55.3 and 110.5 MTU/acre) that roughly correspond to the 57 and 114 kW/acre cases in TSPA-93, we find that it requires 1760 and 29,000 yr for the inner half of the two repositories to re-wet to RH = 81%. Because the boiling period is 6130 yr for the 110.5-MTU/acre case, the assumption of equal "wetness" at the end of the boiling period is inconsistent with the observation that it requires an additional 22,870 yr (beyond the end of the boiling period) for the 110.5-MTU/acre case to attain the value of RH (80.8%) that was present in the 55.3-MTU/acre case at the end of its boiling period. Moreover, the 110.5-MTU/acre repository has a temperature of only 53°C when RH = 81% is attained (at 29,000 yr) as compared to 96°C for the 55.3-MTU/acre case (at 1760 yr). Therefore, the 110.5-MTU/acre case re-wets to relatively humid conditions at much lower temperatures (and much later times) than the 55.3-MTU/acre case.

For further illustration, the driest region (inner 50%) of the 110.5-MTU/acre repository has cooled to 68°C when RH = 70% is attained (at 15,960 yr). By the time the driest region (inner 50%) of the 55.3-MTU/acre repository has cooled to 68°C, (at 6180 yr) it has already re-wetted to RH = 97.8%. As far as aqueous corrosive processes are concerned, the 110.5-MTU/acre case is subjected to *far less* corrosive conditions than the 55.3-MTU/acre repository.

A "surprising" conclusion of TSPA-93 was "the insensitivity of total systems performance to AML," due to "advantages of high APD in delaying WP corrosion being offset by higher corrosion rates". Artificially assuming that equally humid (wet) conditions can be imposed onto the respective AML cases at the end of the boiling period has the effect of imposing very corrosive conditions onto the high-AML case which, as noted above, does not correspond to the repository-scale thermo-hydrological calculations.

An alternative TSPA-93 assumption for when WP conditions are "wet" is when the liquid saturation, S_l , exceeds 8%. For the 110.5-MTU/acre case, this corresponds to a RH of approximately 41%, while RH for the 55.3-MTU/acre case never becomes drier than 66%. For the 24.2-MTU/acre case, which roughly corresponds to the low-AML case in the TSPA-93 study, RH is never less than 98.4%. This alternative TSPA-93 re-wetting assumption is effectively equivalent to saying that, for WP corrosion, there is no difference between 41 and 98% relative humidity.

Table 1 is based on the smeared-heat-source, repository-scale model. Consequently, the listed value of RH is applicable to average liquid saturation conditions. Because RH = 70% approximately corresponds to a liquid saturation 13%, it does not require very much re-wetting to attain this value of RH. Had a discrete representation of WPs been done, we would find that the local liquid saturation conditions surrounding the emplacement drift are generally drier than the average saturation conditions. In that regard, the repository-scale model indicates a RH that is wetter than the local value of RH in the emplacement drift. Thermo-hydrological heterogeneity and variability in the heat output among the WPs will also cause local behavior to deviate from average behavior.

Table 1 Duration of the boiling period at various repository locations and the relative humidity attained at the end of the boiling period for 22.5-yr-old Spent Nuclear Fuel, various Areal Mass Loadings and a bulk permeability of 280 millidarcy. The locations are identified as the percentage of the repository area enclosed, with 0 percent corresponding to the repository center and 100 percent corresponding to the outer perimeter.										
Percentage of repository area enclosed (%)	Duration of the boiling period and relative humidity at the end of the boiling period for indicated AMLs									
	55.3 MTU/acre		70 MTU/acre		83.4 MTU/acre		110.5 MTU/acre		150 MTU/acre	
50	1760 yr	80.8%	2830 yr	68.1%	3870 yr	57.2%	6130 yr	44.3%	9590 yr	46.8%
75	1160 yr	83.7%	2000 yr	70.5%	2740 yr	65.2%	4290 yr	51.4%	7210 yr	45.1%
90	440 yr	92.7%	1090 yr	81.0%	1700 yr	76.6%	2870 yr	67.6%	5010 yr	54.1%
97	80 yr	98.5%	410 yr	95.5%	990 yr	92.5%	2150 yr	86.6%	3960 yr	66.8%

1.2.1.6 Configuration Management

No significant activity.

1.2.2. WASTE PACKAGE

1.2.2.1 Waste Package Coordination and Planning

An FY95 LLNL Metal Barriers Planning Meeting was held in Livermore on May 10, 11, and 12. W. Clarke chaired the meeting. Other LLNL staff members in attendance were J. Blink, T. Buscheck, D. Chesnut, E. Dalder, J. Farmer, J. Gansemer, B. Glass, W. Glassley, G. Gdowski, W. Halsey, R. Hamati, G. Henshall, D. Jones, G. Kaiper, A. Lamont, D. McCright, R. Monks, B. O'Connell, J. Podobnik, M. Revelli, R. Stout, R. Van Konynenburg, D. Wilder, K. Wilfinger, M. Whitbeck, B. Bryan, and M. Lewis. Other participants in the meeting were A. Simmons, D. Stucker (DOE); H. Benton, W. Cowles, L. Ramspott, R. Fish, K. McCoy, A. Roy, D. Stahl (M&O); D. Bullen (Iowa State); H. Cleary (Weston); D. Diercks, J. Park (ANL); and C. DiBella (NWTRB).

J. Blink presented "On the Benefits of an Integrated Nuclear Complex for Nevada" at the International High-Level Radioactive Waste Management Conference on May 23 in Las Vegas. Over 100 people were in the audience, and a lively discussion followed the presentation. The paper was highlighted in both Las Vegas newspapers, and several Nevada political figures and candidates have asked for a copy.

1.2.2.2 Waste Package Environment

This work is now being reported in WBS 1.2.3.12.

1.2.2.3 Waste Form and Materials Testing

1.2.2.3.1 Waste Form

1.2.2.3.1.1 Waste Form Testing - Spent Fuel

There has been a suspension of radiological work in Pacific Northwest Laboratories (PNL) Bldg. 325. Work conducted by the YMP was not a contributory element in the closure of this facility; however, this action has had a major impact on our work schedule. Formal documentation of the justification for closure of the building has been requested; it will be provided to LLNL and placed in the YMP records. At this time, there is no projected date for re-opening the facility, therefore, overall impact on the YMP cannot be determined. More information should become available in June.

Spent Fuel Dissolution

There are no activities to report for the month of May due to the total shutdown of all radiological work in Pacific Northwest Laboratories (PNL) Bldg. 325 for a safety assessment. This shutdown will further delay installation of the new liquid

radioactive waste disposal holding tank for the analytical hot cells that has been discussed in previous reports.

W. Gray (PNL) presented a paper entitled "Interlaboratory Comparison of UO_2 Dissolution Rates" at the Fifth Annual International High-Level Radioactive Waste Management Conference in Las Vegas.

D-20-43, Unsaturated Dissolution Tests with Spent Fuel and UO_2

Spent Fuel

Tests are in progress at ANL to evaluate the long-term performance of spent fuel under unsaturated conditions at $90^\circ C$ in a potential repository. These tests examine the leach and/or dissolution behavior of two types of well-characterized irradiated fuels, ATM-103 and ATM-106 (both PWR) in three types of tests: two with saturated water vapor atmospheres; two with a drip rate of $0.075 \text{ mL}/3.5 \text{ d}$; and two with a ten times higher drip rate of $0.75 \text{ mL}/3.5 \text{ d}$. A control test without fuel but with a $0.075 \text{ mL}/3.5 \text{ d}$ drip rate is also included. EJ-13 water for the tests came from well J-13 and was initially equilibrated with volcanic tuff for approximately 80 days at $90^\circ C$. The seven tests have undergone ~20 months of testing at $90^\circ C$.

Aliquots of the leachate removed in April from the high drip rate tests were filtered sequentially through several filters (1, 0.1, and $0.05 \mu\text{m}$) to determine the distribution of the colloidal material. The filters were submitted for alpha analyses. The sequential filtered samples were submitted for alpha, gamma, and cation analysis.

The data for cesium and the actinides for the first two test periods (four and five months) for the high drip-rate tests are compared to the results reported by C. Wilson for saturated tests in Tables 2 and 3, for unprecipitated fraction and maximum fraction, respectively. The unprecipitated fraction is defined for each isotope as the sum of ionic and colloidal species in the leachate. The maximum fraction is defined for each isotope as the fraction that the total amount released is of the original amount in the fuel. The total test time for Wilson was 18 months, versus 9 months for the unsaturated tests. The temperatures are comparable. The ratio of fuel weight to total volume of fluid in contact with the fuel is slightly greater for the unsaturated tests.

The major differences in the two sets of tests are these: First, a much larger fraction of the material was unprecipitated in the unsaturated tests. The one exception is cesium in the ATM-106 test. The low cesium solubility may indicate formation of a cesium uranate phase since formation of an insoluble cesium uranate phase has been noted previously.¹ Second, the maximum fraction of material released for the unsaturated tests is approximately an order of magnitude less for uranium, plutonium, and cesium than that released in the saturated tests. However, the maximum fraction of americium and curium released in the unsaturated tests is

about an order of magnitude greater than that in the saturated tests. The reason for these differences in release behavior appears to be linked to the higher unprecipitated fraction in the unsaturated tests. For longer test periods, these differences may not be observed.

UO₂

The objective of the tests at ANL is to evaluate the reaction of UO₂ pellets after exposure to dripping EJ-13 water at 90°C using the unsaturated test method. More specifically, these tests are designed to examine the dissolution behavior of UO₂, formation of alteration phases, release rates, and mechanisms of uranium release, and to serve as a pilot study for similar tests with spent nuclear fuel.

A Preparedness Review was held on May 12 in order to convert the experiments to Quality Affecting Activity Status. As a result of that meeting, the scientific notebook and sampling procedures used for the UO₂ tests were revised, and the final Preparedness Review was completed May 31.

Solution analytical results were received from the nine-year UO₂ drip test samples supported by Teflon stands. Uranium release rates were comparable to previous runs, with the samples releasing relatively low amounts of uranium over the last seven years, this following the rapid uranium release period that characterized the release patterns between one and two years. Fractional uranium release trends have also been examined for a limited number of samples. Uranium release was measured from three solution aliquots, including a <50A, an unfiltered suspended solution, and an acid strip fraction. The acid strip component was derived from a 10-minute HNO₃ soak of the test vessel and Teflon stand, and represents the largest recovered uranium fraction from the test (80 to 98%). The <50A component is typically the smallest fraction, representing from 1 to 6% of the total release. The suspended fraction represents all uranium suspended in solution, less the fraction passing through the 50A filter. The suspended fraction represents from 1 to 15% of the total release, with the relatively high variability probably resulting from the resuspension of particulate material during the vessel opening and sampling processes.

Cation analyses indicate continued depletion of alkali, alkaline earths, and silicon from the EJ-13 solution after contacting the UO₂ pellets. Previous scanning electron microscope/energy dispersive spectroscopy (SEM/EDS) investigations have revealed that these elements are being incorporated into secondary uranyl phases on the sample surfaces, with the uranium being derived from the dissolution of the UO₂.

¹ S. Stroes-Gascoyne, L.H. Johnson, P.A. Beeley, and D.M. Sellinger, "Dissolution of Used CANDU Fuel at Various Temperatures and Redox Conditions", Mater. Res. Soc. Symp. Proc. 50, 317-326 (1986).

pellets. Magnesium is generally depleted to the greatest extent, with leachate concentrations typically reduced to ~10% of the initial EJ-13 value. Calcium and potassium are generally depleted to ~30% of the original EJ-13 values, while Si is depleted to a level that is within 50 to 60% of the original EJ-13 value. Sodium concentrations are similar to those of the starting EJ-13 solution, a finding consistent with that of the absence of any discrete sodium uranyl phases on the UO₂ pellet surfaces.

Table 2. Unsaturated (High Drip Rate, 9 months, 90°C) versus Saturated (18 months, 85°C) Test Results
Average Unprecipitated Fraction (%), the sum of the ionic and colloidal species in the leachate

	U	Pu	Am	Cm	Cs
ATM-103 ^a	50	40	50	70	98
ATM-106 ^a	20	50	10	30	60
Wilson ^b	10	5	3	3	85

^a This is the total for the first two test periods

^b C.N. Wilson, PNL-7170 (1990), using bare fuel for three test periods at 85°C.

Table 3. Unsaturated (High Drip Rate, 9 months, 90°C) versus Saturated (18 months, 85°C) Test Results
Maximum Fraction (ppm), the fraction released from the original fuel inventory

	U	Pu	Am	Cm	Cs
ATM-103 (total) ^a	10	1	600	7000	600
ATM-106 (total) ^a	50	30	90	200	1000
Wilson ^b	100	100	200	40	10,000

^a This is the total for the first two test periods

^b C.N. Wilson, PNL-7170 (1990) 1 using bare fuel for three test periods at 85°C.

D-20-53(a), Dissolution Tests with UO₂

Approximately 20 grams of Schoepite (UO₃•H₂O) were prepared at LLNL via an aqueous hydrolysis of uranyl acetate, UO₂(C₂H₃O₂)₂, a procedure that took place over several days. This material is being analyzed and will be used in the studies just begun on the dissolution of the higher uranium oxides, UO₃ and UO₈. The initial four Schoepite dissolution experiments in the current test matrix that were begun last month are continuing. All four experiments are at room temperature and 20% oxygen. They consist of the four combinations of pH 8 and 10 as well as total carbonate concentrations of 2x10⁻⁴ and 2x10⁻² mol/L. These same

experiments will later be run at 75°C. Some flow problems were experienced and corrected. Very preliminary measurements that indicate uranium dissolution rates of the Schoepite at room temperature are similar to UO₂.

Spent Fuel Oxidation

Dry Bath Testing

The drybaths continue to operate without incident. An interim examination will be conducted for the 195°C and 255°C tests early in June. Work on the phase determinations has slowed considerably as the X-ray diffraction lab was closed with the general shutdown of Bldg. 325.

Thermogravimetric Apparatus (TGA)

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

Materials Characterization Center (MCC) Hot Cell Activities

S. Marschman (PNL) presented a paper entitled "Rationale for Determining Spent Fuel Acquisitions for Repository Testing" at the International High-Level Radioactive Waste Management Conference in Las Vegas.

1.2.2.3.1.2 Waste Form Testing - Glass

The preparedness review was completed at ANL for the Unsaturated Testing of UO₂, and the QA grading and supporting documentation were sent to LLNL. J. Bates and P. Finn (ANL) attended the International High-Level Radioactive Waste Management Conference and presented papers on spent fuel and glass performance under unsaturated conditions.

D-20-27, Unsaturated Testing of WVDP and DWPF Glass

The N₂ dissolution tests (DWPF actinide-doped glass previously described as SRL glass) continue at ANL as scheduled. The tests have been ongoing for 100 months. Data from the December sampling have been compiled and were presented in part at the IHLRWM conference. Preliminary release data for Li and Si can be used to project the rate of glass reaction and the mode by which radionuclides are released from the glass. The last solution sampling period (411.5 weeks total) shows a fairly steady Li release rate increase if the data are averaged. The normalized release rate over the 411.5 week period for Li is -2.6 mg/m²·day, while over the last sampling period the rate was 3.6 mg/m²·day.

Silicon release is negative (Si was being removed from the solution) for the first 210 weeks. While there is divergence in the replicate tests, the overall trend is a slowing of the rate at which Si is being depleted from the solution. Based on the analysis of material in solution, this is due to an increase in Si going into solution due to spallation from the glass.

In Test N2#10, the Np release rate was quite constant for the first 160 weeks at 0.8 mg/m²·day and then increased to ~5 mg/m²·day between 160 and 411 weeks. The analogous Pu releases are 8 and 30 µg/m² day. The increase in actinide release rate is consistent with the Si release trend and spallation of reacted layer from the glass. These rates provide a lower limit for release from SRL-based glasses since the SRL 165 glass used in the N2 tests is the most durable glass SRL has developed, and is more durable than the current reference glass.

Preparation for the next 6 month sampling period for these tests has been initiated, and the sampling is scheduled for June. The solution saved from the last sampling period, which contains colloidal material, will be saved in the event that the investigation of colloids is pursued.

The N3 (West Valley ATM-10 glass) tests continue at ANL as scheduled, having completed about 77 months of testing. We are proceeding with the analysis of the cation and actinide solution data from the N3 tests. These data have been collected periodically since testing began in 1987 and stored in the records file, but have not been fully analyzed or comprehensively presented.

Results for the actinides (Np, Pu, and Am) through 345 weeks have been analyzed. These data have been obtained by alpha spectroscopy. Cation results (ICP-MS or CP-AES) for Li and Si have been analyzed and corrected for the contribution from the EJ-13 water, and thus represent release from the sample. In the case of Si, an uptake of Si from the water to be incorporated into secondary phases is observed. Release rate data will be calculated and reported next month.

D-20-70, Parametric Studies of WVDP and DWPF Glass

Sixteen parametric dissolution tests of DWPF and WVDP glass continue at ANL. Some have been in progress for up to 8 years. No sampling has been done in several years, and the solution injections continue. Based on calculations of the free volume in the test vessel, it appears that sampling of these tests will be required shortly or the water will directly contact the glass as it collects in the test vessel. The samplings will be done in June.

Tests on a variety of glasses exposed to 60 and 95% relative humidity at 70°C continue at ANL. No test terminations have been done for several years and none are planned for this year.

1.2.2.3.2 Metal Barriers

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission. A three day planning meeting for this WBS element is discussed in Section 1.2.2.1.

The report entitled "Survey of the Degradation Modes of Candidate Materials for High-Level Radioactive Waste Disposal Containers - Iron Base, Corrosion-Allowance Materials" is undergoing concurrent reviews at LLNL and YMSCO. This report is a collaborative activity between the LLNL Engineered Barrier System Staff and the Nuclear Engineering Staff at Iowa State University and represents completion of milestone MOL46.

1.2.2.3.3 Other Materials

This WBS element has not been funded in FY94.

1.2.2.3.4 Integrated Testing

This WBS element has been moved to WBS element 1.2.3.10.3; progress is reported in that element.

WBS 1.2.2.3.5 Non-Metallic Barrier Concepts

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission. A three day planning meeting for this WBS element is discussed in Section 1.2.2.1.

1.2.2.4 Design, Fabrication, and Prototype Testing

1.2.2.4.3 Container/Waste Package Interface Analysis

This WBS element has not been funded in FY94.

1.2.3 SITE INVESTIGATIONS

1.2.3.1 Site Investigations Coordination and Planning

LLNL staff participated in planning for the Planned Program Approach re-baseline.

D. Wilder and D. Chesnut attended a YMSCO International Program Meeting held in Las Vegas on May 9.

J. Blink met with C. Johnson of the M&O on May 3 in Las Vegas to discuss LLNL's efforts on another program to develop software that couples geologic databases to simulation codes. It may be possible to share the cost of developing the software

with the LLNL environmental remediation program and to customize the software for YMP needs.

1.2.3.2 Geology

1.2.3.2.1.2.1 Natural Analogue of Hydrothermal Systems in Tuff

This WBS element has not been funded in FY94. Funding has been requested from the YMSCO WBS manager in order to write the Study Plan.

1.2.3.4 Geochemistry

1.2.3.4.2 Geochemical Modeling

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.3.5 Drilling

1.2.3.5.2.2 Engineering, Design, and Drilling Support

Eight logging sessions to monitor water level were conducted at UZ14 during the month of May. The runs were conducted on May 2, 4, 5, 6, 10, 11, 12, and 23.

On May 25, the 100' reference marks were re-established on truck #83361, SELSYN #SSN-1, per LLNL-YMP Technical Implementation Procedure (TIP-NV-01).

1.2.3.10 Altered Zone Characterization

1.2.3.10.1 Characterization Techniques for the Altered Zone

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.3.10.2 Characterization of Thermal Effects on the Altered Zone Performance

The study plan for this WBS is being written.

1.2.3.10.3 Integrated Testing

1.2.3.10.3.1 Integrated Radionuclide Release: Tests and Models

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.3.10.3.2 Thermodynamic Data Determination

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.3.11 Integrated Geophysical Testing for Site Characterization

1.2.3.11.3 Geophysics - ESF Support, Subsurface Geophysical Testing

The LLNL/LANL Geotechnical Engineering Group took delivery of the ENVIROLOG-4 Logging Winch manufactured by AUSLOG and purchased through Weber International on May 31. The ENVIROLOG-4 includes a depth system, housing, 100 m 4-conductor cable, cable head, winch, 12 VDC motor drive, speed control, tripod, operational software, and downhole electronics. A preliminary performance test was conducted on the winch unit on May 31. A final performance test will be conducted after delivery of the color video tool, four arm caliper and neutron tool.

1.2.3.12 Waste Package Environment Testing

This WBS element was created from WBS element 1.2.2.2. Management, reporting and PACS are using the new WBS structure, but funding will apparently remain within the old WBS structure for the remainder of FY94.

1.2.3.12.1 Chemical and Mineralogical Properties of the Waste Package Environment

The revised Study Plan 8.3.4.3.4.1 for Waste Package Geochemistry and Mineralogy that was sent to YMSCO is being reformatted to meet current format guidelines specified in the NRC-DOE Agreement. Other May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.3.12.2 Hydrologic Properties of the Waste Package Environment

Analysis of Temperature and Relative Humidity Conditions in the Repository

A primary concern for the Near-Field/Altered Zone Hydrology Tasks is how water contacts a waste package (WP), thereby affecting its integrity and, if containment is breached, radionuclide dissolution and transport. There are two primary modes of water contact:

- 1) advective liquid flow, particularly as it occurs in fractures, and
- 2) condensation of water vapor on the WP surface.

For the first water contact mode, *liquid-phase advective flow in fractures*, the primary sources are:

- 1) episodic infiltration of meteoric water and
- 2) repository-heat-driven condensate drainage due to:
 - a) boiling conditions,
 - b) mountain-scale, buoyant vapor flow,
 - c) sub-repository-scale, buoyant vapor flow, and
 - d) focused vapor flow and condensate drainage due to heterogeneity.

The last three sources of condensate can occur under either sub-boiling or boiling conditions.

For the second water contact mode, condensation on WP surfaces, the critical concerns are the relative humidity and temperature on the WP surfaces. Ambient conditions are quite humid, with a relative humidity of 98-99%. There are two ways to reduce the relative humidity on the WP surfaces:

- 1) driving a large fraction of the initial water content from the vicinity of the repository, and
- 2) maintaining a moderate temperature gradient in the vicinity of the WP.

The primary means of reducing the water content near the repository are:

- 1) repository-heat-generated boiling conditions, and
- 2) ventilation.

As reported last month, a large reduction in the initial water content is required to significantly reduce the relative humidity, RH. For example, an 80% reduction in liquid saturation is required to reduce RH to less than 70%. An Areal Mass Load (AML, expressed in MTU/acre) that does not drive repository temperatures well above the boiling point will result in only a small reduction in RH (see Table 4).

AML (MTU/acre)	T _{peak} (°C)	RH min(%)
55	109	66
70	128	36
83	146	22
110.5	187	8
150	250	2.5

The relative humidity calculations are based on the smeared-heat-source, disk-shaped model of the repository. Therefore, the relative humidity is based on averaged liquid saturation. Because it is more likely that saturation conditions will be drier in the immediate vicinity of WPs than at more distant locations (such as the centerline of the pillars separating emplacement drifts), relative humidity values based on average liquid saturation conditions will tend to indicate values that are wetter than conditions in the emplacement drifts. As reported last month, when the WP is hotter than the emplacement drift wall, the relative humidity on the WP

surface will be lower than on the drift wall. Because of its relatively low thermal conductivity, a granular backfill in the drift could result in a substantial, persistent temperature drop between the WP and drift wall.

See Section 1.2.1.5 for further discussion of thermal loading strategies and their implications.

Laboratory Experiments

LLNL continues to measure electrical impedance as a function of moisture content of Topopah Spring tuff samples from the G-4 and GU-3 holes at elevated temperatures using J-13 water as pore fluid. The wetting phase measurements at 95°C using the original set of samples were completed, and the data are being analyzed. Many samples broke during the measuring process. Additional samples are being prepared to complete the measurements at 95°C. Analysis of the existing data indicates that the frequency dependent measurements may be useful in describing the manner in which water wets rock. Several conduction mechanisms are observed that change in importance with changing saturation levels. Additional study is underway to determine the nature of each conduction mechanism. A paper describing this work, entitled "Electrical Properties of Topopah Spring Tuff as a Function of Saturation", by J.J. Roberts and W. Lin, was presented in a poster session during the High Level Radioactive Waste Management Conference. Successful completion of this work will simplify the task of measuring water distribution in thermal hydrological experiments at laboratory and field scales.

For the experiment of determining the moisture retention curve and one-dimensional imbibition using G-4 core, we continued the moisture retention experiments at high temperatures. Measurements at 95°C and about 95% relative humidity continued. There are still problems associate with the humidity sensor, and we are looking into potential solutions.

LLNL continued the experiment to determine the effect of confining pressure on fracture healing, as observed previously by Lin and Daily. A fractured Topopah Spring tuff sample from G-4 hole is being used. The sample is kept at a confining pressure of 1 MPa and a pore pressure of 0.5 MPa. Permeability as a function of effective pressure (confining pressure - pore pressure) at room temperature has been determined. Permeability as a function of temperature, at a confining pressure of 1 MPa and pore pressure of 0.5 MPa, is being determined. We have completed the measurements at temperatures to 150°C and back down to 125°C. The water permeability at 125°C after been heated to 150°C is about 30% lower than that measured at the initial 125°C. So far, the total decrease in permeability is about 40%. No drastic fracture healing has been observed. We will test the effect of flowing steam through the sample at 125°C on the permeability. Then the temperature will be decreased to the room temperature.

The calibration of a resonant cavity for measuring suction potential as a function of moisture content in rock samples and in the field continues. A LabView driver for the network analyzer has been installed and tested. This allows the computerized collection

of resonant spectra. Five cavities have been tested at room temperature and humidity conditions.

The evaluation of x-ray scan as a technique of monitoring moisture content distribution in a rock sample continues. Analysis of the preliminary x-ray scans indicates that using KI doped J-13 water as the saturating fluid can improve the resolution in the water saturation level to about 2.2%. Without doped water, the resolution decreases to about 4.4%.

Meetings and Publications

J. Blink and T. Buscheck had discussions with UNLV Prof. J. Cardle. Collaboration between LLNL and UNLV was discussed. UNLV will provide a student to assist LLNL in applications of the V-TOUGH code family for YMP studies. A contract for the remainder of FY94 is being initiated. It is anticipated that the student will be supported for several years, including a YMP-related thesis. Prof. Cardle will also provide support.

T. Buscheck presented a paper entitled "The Impact of Repository Heat on Thermo-Hydrological Performance at Yucca Mountain" on May 3 at the Thermal Loading Studies Meeting held at YMSCO and attended the Scenario A Focused ACD Assumptions Meeting held on May 4. The paper provides insight for identification of critically needed site characterization data for long term thermo-hydrological performance calculations.

T. Buscheck presented two papers at the Fifth Annual International High-Level Radioactive Waste Management Conference in Las Vegas, May 22-26, "Evaluation of Thermo-Hydrological Performance in Support of the Thermal Loading Systems Study" and "The Impact of Buoyant Gas-Phase Flow and Heterogeneity on Thermo-Hydrological Behavior at Yucca Mountain". The first report meets a milestone requirement for the thermal loading systems study and both reports provide input for the FY93 Thermal Loading Systems Study final report which has been submitted to YMSCO and is currently in review.

Several LLNL staff members attended the Peer Review Planning meeting in Las Vegas on May 27. The peer review of unsaturated zone thermal hydrology calculations requested by LLNL was delayed until after an internal YMSCO group meets to define the scope of the review. D. Chesnut was appointed as the LLNL member of the group.

1.2.3.12.3 Mechanical Attributes of the Waste Package Environment

The Activity Plan AP-GM-01, GM-03, GM-05 (8.3.4.2.4.3 - Mechanical Attributes of the Waste Package Environment) has been issued. This represents completion of milestone MOL16.

1.2.3.12.4 Engineered Barrier System (EBS) Field Tests

Revision of the draft Engineered Barrier System Field Tests (EBSFT) Study Plan was started, as a result of the comment resolution meeting (see Section 1.2.5.2.2).

J. Blink, T. Buscheck, W. Clarke, W. Halsey, W. Lin, And D. Wilder met with N. Elkins (LANL) and L. Costin (SNL) on May 25, 1994 to discuss the Phase 1 EBSFT at the North Ramp Extension.

Large Block Test (LBT)

Sample preparation for electrical impedance measurements, Hg porosimetry, and wet-dry porosity measurements using the core sections from the LBT vertical instrument holes was started. Some preliminary Hg porosimetry results indicate that the porosity in the matrix increases from about 9% near the top of the block to about 13% at about 4 m depth.

J. Blink met with senior management of the LLNL Mechanical Engineering Department on May 11 to discuss the LBT load frame design. The meeting concluded with a plan to perform 3-D structural mechanics analyses to determine in more detail the stresses in the frame due to the loads being applied to the block. Following the calculations, which are expected to be completed by mid-June, LLNL will determine and document the appropriate safety factor to be used in operating the system. Because the frame fabrication is nearly complete (delivery is scheduled for late July), modifications to increase the allowable load are expected to be made at NTS or at the DOE-Atlas Facility in North Las Vegas.

The Large Block Test excavation work started at the beginning of May and continues. A wire saw was used to trim the top of the block. The entire sawing activity took two days. The original top of the block was successfully lifted off as a single piece and provided to RSN for use at the Colorado School of Mines. A preliminary fracture mapping was conducted on the exposed top surface of the block. SNL completed two more (total) fracture flow visualization tests.

Laboratory tests on the performance of the Kapton heaters (to be used as guard heaters for the large block and as heaters for the small block experiments) and the potential insulation materials under a 5 MPa stress continues. Copper plates may be used to distribute heat from the guard heaters. Tests to evaluate the lateral temperature distribution on the surface of a copper plate opposite to the heater, was continued. Thermal conduction model calculations continue to be used in designing the guard heaters.

Procurement of instruments has started. A potential manufacturer for the bladders has been selected. A meeting will be scheduled with the representative of the manufacturer to discuss detailed design criteria for the bladders. The engineering design of the bladder support/housing devices continues.

Preparation of small blocks, obtained from Fran Ridge, for scoping experiments was continued. A block assembly is ready for x-ray background measurements.

A paper entitled "The Testing of Thermal-Mechanical-Hydrological-Chemical Processes Using a Large Block", by W. Lin, D. G. Wilder, J. A. Blink, S. C. Blair, T. A. Buscheck, D. A. Chesnut, W. E. Glassley, K. Lee, And J. J. Roberts, was presented at the High Level Radioactive Waste Management Conference. This paper describes plans for the LBT and construction through December 1993.

1.2.3.12.5 Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment

New Zealand

The contract with Dr. R. Rogers, (Biodegradation Systems, Inc.) for sampling and preliminary analyses of cores obtained from cement exposed to geothermal conditions, which is essential to our determination of pH values of water in contact with cementitious materials, has now been finalized by LLNL procurement. However, because the contract involves two sampling trips to New Zealand, foreign travel approval must be obtained through DOE. We are presently completing the paper work for that approval.

Seven months of temperature data have been logged at three locations within the cooling tower near the locations of the emplaced concrete samples. The data are being transmitted every three months to LLNL.

Diesel Fuel Stability Experiments

The 200°C H₂O-fibercrete™ control experiment has been completed and the experiment disassembled. The 200°C H₂O-diesel fuel-fibercrete™ experiments are presently being conducted. In June, the 200°C H₂O-diesel fuel-fibercrete™-tuff experiment will be set up, tested and initiated. The results of the experiments to date are presently being prepared to be released as a report at the end of June.

Diesel Exhaust Historical Analog Study

This study has been initiated at the request of the M&O and YMSCO. A CSCR to provide 160K for this work was initiated by the M&O-ESF, but rejected by the M&O CCB group. Until that money is received at LLNL, the Man-Made Materials spending will appear to be in variance. The Man-Made materials Task is conducting this study now in order to support an ESF decision that must be made in August. Additional guidance is needed from YMSCO as to the status of the fund transfer.

Sample locations in N-tunnel were selected for their potential to show the greatest accumulated diesel deposits. The sites were selected as a result of an earlier reconnaissance survey and from discussions with miners regarding diesel powered haulage systems and the timing of tunnel modifications. The rock wall near the floor and from the floor adjacent to the left rib at 1900 ft. into N-tunnel displays a clay-rich deposit

that appears to have a component of soot. A number of factors lead us to believe that this deposit may contain accumulations from diesel exhaust. First, this location is well into the tunnel and therefore had less chance to ventilate than areas closer to the tunnel entrance. Second, the engines supposedly stopped at this point for loading and unloading. Third, the early hauling systems were not scrubbed and were exhausted low and to the left. Later mucking operations have removed the contaminated ground from the middle of the tunnel floor and replaced it with a thick layer of gravel. Near the wall, however, we hope to have obtained floor samples from the original 1963 tunnel that were later contaminated by the exhaust scrubbing solution (Tide™).

The pipes and cables on the left side of the tunnel, and the lack of electricity and ventilation made the collection activity a challenge. Because of the limitations of the drill, we were only able to obtain two core samples. Due to the scarcity of core samples we have very limited expectations for our ability to provide what we consider to be a key piece of information: the mobility of the various diesel exhaust constituents from the surface of the tunnel into the tuff. Data regarding the mobility of diesel fuel in soils (see Table 5) suggests that the diesel constituents will move at different rates. However, we may not be able to quantify or verify this, given the few samples. Additional sampling and testing will be done at a later date in support of Study 8.3.4.2.4.5.

Table 5. Mobility of Distillate Oil Constituents. (From Hydrocarbon Contaminated Soils. Volume 1. E. J. Calabrese P. T. Kostecki eds. (1991) p.171).

<i>Chemical</i>	<i>Solubility(mg/L)</i>	<i>Retardation (R_d)^a Coefficient</i>
<i>Low Mobility ($R_d > 100$)</i>		
Fluorene	1.9	-
Phenanthrene	1.6	1,097
Pyrene	0.16	-
Benzanthracene	0.0057	24,601
Benzo(a)pyrene	0.0030	67,801
Fluoranthene	0.265	-
<i>Medium Mobility ($10 < R_d < 100$)</i>		
Napthalene	31	87.94
Dimethylbenzene, 1,3-(m-xylene)	160	60.91
Dimethylbenzene, 1,4-(p-xylene)	200	54.39
Dimethylbenzene, 1,2-(o-xylene)	180	23.26
Ethylbenzene	150	53.92
Toluene	520	30.40
<i>High Mobility ($R_d < 10$)</i>		
Benzene	1,800	8.80
Quinoline	60,000	5.16
Cresol (m-)	26,000	4.78
Cresol (p-)	25,000	4.21
Cresol (o-)	26,000	2.32
Phenol	67,000	2.09

^aThe retardation coefficient represents the rate of migration of the chemical constituent in comparison to that of ground water (e.g. $R_d = 100$ indicates that the constituent moves 100 times slower than water. The following values were used to determine R_d : $f_{oc} = 0.01$, porosity = 0.35, bulk density = 0.2 g/cm³).

Our expectations for the samples of the surface coatings are much higher. An excellent suite of samples were collected using a range of substrates that will allow us to use the variety of analytical tools required to identify and quantify the organic and inorganic compounds that are expected to be present. The samples have arrived at Livermore and are presently being prepared for analysis. We would like to thank Alan Mitchell and Kevin Kinter of LANL, and Mark Owens of LLNL for their assistance during this sampling operation.

Diesel Exhaust EQ3/6 Modeling Exercise

EQ3/6 simulations are presently in preparation for the diesel exhaust work. The first modeling simulations are being prepared using simple organic-H₂O systems that will ultimately be used to evaluate the exhaust component modeling exercise.

Diesel Exhaust Microbial Study

This study was initiated independently by the Man-Made Materials Task to add value to the Diesel Exhaust Studies described above. The intention is to provide a more complete answer to the long term impact of diesel exhaust than the non-biological chemical study that was requested by the M&O.

1.2.5 REGULATORY

1.2.5.1 Regulatory Coordination and Planning

LLNL staff participated in planning for the Planned Program Approach re-baseline.

1.2.5.2 Licensing

1.2.5.2.2 Site Characterization Program

W. Lin briefed an NRC tour at the Large Block Test site on May 3.

W. Lin, J. Blink and C. Passos attended a comment resolution meeting on Study Plan 8.3.4.2.4.4 in Las Vegas on May 5. Other LLNL technical staff participated by conference call.

J. Blink and C. Passos began the process of re-working LLNL's input to Progress Report #10 based on criteria changes initiated by YMSCO and the M&O.

1.2.5.3 Technical Data Management

1.2.5.3.4 Geologic and Engineering Materials Bibliography of Chemical Species (GEMBOCHS)

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.5.3.5 Technical Data Base Input

B. Bryan attended the Technical Data Working Group meeting in Las Vegas on March 23.

1.2.5.4 Performance Assessment

1.2.5.4.2 Waste Package Performance Assessment

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.5.5. Special Projects

1.2.5.5.1 Integrated Test Evaluation (ITE)

This activity has not been funded in FY94.

1.2.5.5.2 Energy Policy Act Support

May activities will be reported in a later monthly progress report. The LLNL staff has been occupied with participation in the Planned Program Approach and in preparing input for the FY95-01 PACS submission.

1.2.9 PROJECT MANAGEMENT

1.2.9.1 Management and Coordination

1.2.9.1.2 Technical Project Office Management

D. Wilder, T. Buscheck, D. McCright, B. Halsey, and W. Clarke attended a Thermal Workshop and Key Assumptions meeting held by D. Stucker on May 3 and 4. J. Blink attended the M&O Thermal Loading Workshop on May 5.

An "All Hands" meeting for LLNL-YMP staff members was held by W. Clarke to discuss new direction brought about by the "Planned Program Approach".

J. Blink trained new LESSON Chemistry Instructors on May 2. J. Blink and C. Passos attended the LESSON-Nevada Committee meeting on May 13 in Las Vegas. J. Blink served as tour guide for the LESSON teacher workshop tour of the Weapons and YMP portions of the Nevada Test Site on Saturday, May 21. J. Blink (LLNL) and J. Calovini (RSN) taught the first day of Physics for the 1994 Nye/Esmeralda County LESSON workshop at NTS on May 31. J. Blink conducted a four hour teacher workshop at the Yucca Mountain Science Center on Saturday, May 7; seven teachers (grades 2-6) attended. J. Blink made an educational presentation at the UNR Math Institute on May 19 in Reno, Nevada. He also met with UNR faculty members interested in the LESSON teacher workshop. J. Blink and the two Tonopah winners of the YMP Egg Drop Contest participated in the Jim Butler Days Parade in Tonopah, Nevada on Saturday, May 28.

J. Blink visited the labs of Prof. R. Boehm at UNLV where bench scale thermal hydrological experiments are being conducted. Future collaboration between LLNL and UNLV was discussed.

1.2.9.2 Project Control

1.2.9.2.2 Participant Project Control

Actual schedule progress and costs were submitted to the PACS reporting system via the PACS workstation. Variance analysis explanations were developed.

1.2.11 QUALITY ASSURANCE

Quality Assurance Coordination and Planning

The YMP-QA Quality Procedures (QP) are being reviewed and edited to incorporate text and procedural changes required by QARD review. Royce Monks will travel to Las Vegas during the week of June 6 to discuss changes made thus far with YMSCO personnel.

Quality Assurance Program Development

The following change notices were distributed:

- Activity Plan E-20-18(f), Rev. 1 (D. McCright) has been completed and distributed.
- Activity Plan AP-GM-01, GM-03, GM-05 (S. Blair) has been completed and distributed.
- Addendum A to Activity Plan AP-LBT-01 (W. Lin) was issued as Change Notice AP-LBT-01-0-2.

Quality Assurance Verification

Quality Assurance Verification - Audits

Audit report 94-04 was completed and distributed on May 5, 1994.

Notification of Audit 94-05 was distributed on April 26, and an entrance meeting was conducted on May 2. This audit concentrated on LLNL-YMP Near Field Environment Characterization and included the following procedures/requirements:

- 033-YMP-QP 2.6, Readiness Reviews
- 033-YMP-QP 2.8, Quality Assurance Grading
- 033-YMP-QP 2.10, Qualification of Personnel
- 033-YMP-QP 2.4, Technical Reviews
- 033-YMP-QP 3.0, Scientific Investigation Control
- 033-YMP-QP 3.2, Software Quality Assurance
- 033-YMP-QP 3.4, Scientific Notebooks

- 033-YMP-QP 5.0, Technical Implementing Procedures
- 033-YMP-QP 8.0, Identification & Control of Items, Samples & Data
- 033-YMP-QP 9.0, Control of Processes
- 033-YMP-QP 13.0, Handling, Storage and Shipping

CAR LLNL-033 was issued as a result of this audit.

Corrective action for CAR LLNL-028 was completed and verified, and the CAR was closed on May 10.

Quality Assurance Verification - Surveillance

No significant activities.

Field Quality Assurance/Quality Control

No significant activities.

Quality Assurance - Quality Engineering

No significant activities.

1.2.12 INFORMATION MANAGEMENT

1.2.12.2 Records Management

1.2.12.2.2 Local Records Center Operations (LRC)

LLNL-YMP Document Control issued three revisions and no change notices. Follow up continues on previously distributed documents.

1.2.12.2.3 Participant Records Management

A total of 131 items were logged into the LLNL-YMP tracking system. This includes nineteen records packages that were processed through to the CRF. Six action items were closed.

1.2.12.2.5 Document Control

LLNL received no funding under this WBS element for FY94. Work performed to complete LLNL's obligation in this WBS element is funded under WBS 1.2.12.2.2.

1.2.13 ENVIRONMENT, SAFETY AND HEALTH

1.2.13.2 Safety and Occupational Health

1.2.13.2.5 Occupational Safety and Health

J. Blink attended the YMP Safety Committee meeting in Las Vegas on May 5. Several ES&H surveillance reports were submitted to the FOC.

1.2.15 SUPPORT SERVICES

1.2.15.2 Administrative Support

No significant activities.

1.2.15.3 Yucca Mountain Site Characterization Project (YMP) Support for the Training Mission

Currently there are 100 participants on the project who are to be trained and/or tracked. Six new participants added during the month of May and one participant left the program.

A new training database program has been written utilizing "user friendly" software compatible with the Macintosh computer. Testing and implementation of this program will begin in late June.

R. Dalson, J. Haeberlin, and A. Russell received indoctrination from J. Blink via the revised indoctrination process.

LLNL PROJECT STATUS REPORT DISTRIBUTION

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YMP:356:94

June 15, 1994

438P

Robert M. Nelson, Jr.
Acting Project Manager
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Characterization Office
U. S. Department of Energy
P. O. Box 98608
Las Vegas, Nevada 89193-8608

Attention: V. F. Iorii

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP) EXECUTIVE STATUS REPORT (ESR)

Attached is the input to the above subject report for the month of May, 1994, from Raytheon Services Nevada (RSN).

If there are any questions, please contact me at 794-7014.


William C. Kopatich
Technical Project Officer

WCK:jmf
Attachment:
As Stated

- cc: J. R. Dyer, YMSCO, M/S 523
- J. M. Replogle, YMSCO, M/S 523
- W. B. Simecka, YMSCO, M/S 523
- R. E. Spence, YMSCO, M/S 523
- T. M. Rodriguez, TRW, M/S 423
- Executive Office, RSN, M/S 580
- J. M. Fleetwood, RSN, M/S 403
- R. G. Musick, Jr., RSN, M/S 403
- R. L. Schreiner, RSN, M/S 403
- L. E. Shaw, RSN, M/S 403
- D. J. Tunney, RSN, M/S 403
- L. E. Watson, RSN, M/S 726
- E. L. Wright, RSN, M/S 403
- YMP File
- RMC

319
Assistant Mgr (6)
Hart
Dyer
Replogle
Spence

6/17/94

8100 012-7

ENCLOSURE 4

Raytheon Services Nevada
May 1994 Monthly Input
Yucca Mountain Site Characterization Project (YMP)
Executive Status Report (ESR)

EXECUTIVE SUMMARY

Facilities Engineering:

Submitted as-built drawings for NRG-7/7A Borehole, Job Package 93-14, and Ghost Dance Faults, Job Package 94-12.

Prepared sketches for SD-7, SRG-4, and Borehole Drill Pads and Access Roads.

Systems Engineering:

Reviewed and commented on 16 Plans and Procedures for the Project Office.

The as-built Drawings and records submittal process is well underway. RSN has submitted the records for all the Job Packages currently in process. The As-built drawings are in various stages of Project review/acceptance/submittal. Two Job Packages are remaining at this time that require as-built drawings, these are scheduled to be completed during June.

Surface-Based Testing

Worked closely to update YMP SBT FY94-FY95 Schedule for Dennis Williams, SIB Branch Chief, and prepared status report to activities versus baseline schedule.

Completed Work Programs for USW SD-12, Rev. 1; USW UZ-14, Rev. 2A; and USW SR-1/USW SR-2, Rev. 0A. Prepared Summary Cost Estimates for capping unsecured boreholes; geophysical logging at UE-25 NRG-2a, UE-25 NRG-2b, UE-25 NRG-2c, UE-25 NRG-2d, USW NRG-6, UE-25 UZ-16; and USW NRG-7/7a, Rev. 2.

Submitted Procurement documents for Geophysical Logging Program at USW UZ-14, USW SD-9, and USW SD-12 boreholes.

Supported field operations for (1) drilling at USW SD-12, USW SD-9, and USW UZ-14; (2) workovers at UE-25 NRG-7/7a and UE-25 UZN #85 to support USGS follow-up testing; and (3) geophysical logging at UE-25 NRG-2a, UE-25 NRG-2b, UE-25 NRG-2c, UE-25 NRG-2d, and USW NRG-7/7a.

Field Operations

Established and monitored the survey control points to be used by Kiewit/PB for new construction activities in the Exploratory Studies Facilities (ESF).

Staked the environmental clearance zone and borehole location for USW SD-7 Borehole. In addition, staked an environmental corridor for the ESF subsurface waste water system and waste water pond.

Measured the dimensions of the boxcut at the North Portal and located the tunnel in respect to the boxcut. Performed a topographic survey including break lines and spot elevations from the west side of the drainage channel to the beginning of the boxcut.

Laid out the gripper pads for construction at the North Portal. Additionally, located seventeen (17) geologic sample points and two (2) points on a fault line at the ESF Drainage Channel.

Materials Testing Laboratory performed an infiltrometer test in accordance with ASTM D 3385-86 at the bottom of Trench NRT-1. The test was taken on the east end of the trench on undisturbed soil under the direction of the Principal Investigator.

Quality Assurance

Reviewed Surveyors Service Company's revised QA manual that had been revised to address comments identified during the RSN survey of their Corona, California facility. Based on this review and the survey, this supplier was qualified calibrate survey equipment.

Provided support to the M&O in the resolution of comments to ESF Package 2C Drawings, Specifications and Analyses.

Verified drilling (1) activities at SD-12 and UZ-14, (2) activities at C-well Complex, and (3) geophysical logging at NRG-7/7a, NRG-2c & NRG-7d.

Reviewed/approved/commented on seven procurement documents, one work program, and two drawings. Prepared one field verification plan.

DELIVERABLES

Letters and memorandums regarding Surface Based Testing Operations for the month of May	Continuous
Submitted the first and second portions of the construction monitoring survey data of the box cut around the North Portal to the M&O.	5/5/94 5/12/94
Submitted a list of points of the gripper pad survey to M&O.	5/26/94

ISSUES AND CONCERNS

Three Non-conformance Reports are open: (1) RSN-94-001, incorrect method of sampling cement slurry for borehole SD-12. The work program for SD-12 was revised to show the use-as-is condition and this NCR will be closed. (2) YMP-94-03, boreholes not secured in accordance with the borehole security program. Awaiting completion of disposition by REECO. (3) YMP-94-0040 was issued due to cave-in during surface drilling at Borehole SD-9. A disposition of repair has been specified by RSN Surface Based Testing and the NCR has been transmitted to REECO for disposition action.

Two RSN deficiency reports are open: (1) DR-94-O-001, gauges at SD-12 not calibrated. Corrective Action is due on July 15, 1994. (2) DR-93-O-009, job package records not submitted in required time frame. The corrective action completion date for this has been extended from May 31, 1994 to June 29, 1994.

Evaluated and accepted the Colorado School of Mines (CSM) amended response to Deficiency Report No. DR-94-O-006. Deficiency Report Nos. DR-94-O-002 through DR-94-O-006 are currently assigned to CSM and require verification prior to closure.

Currently, there are no open DOE OCRWM Corrective Action Requests assigned to RSN.

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT										
PARTICIPANT	RSN						FISCAL MONTH/YEAR		May-94	
DATE PREPARED	16, May, 1994						PAGE		1 of 1	
	CURRENT MONTH END						FISCAL YEAR			
	ACTUAL COSTS (K)	PARTICIPANT HOURS	SUBCON. HOURS	PURCHASE COMMITMENTS	SUBCON. COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET (K)	APPROVED FUNDS (K)	CUMULATIVE COSTS (K)	
1.2.1	\$9	85.0					\$80	\$80	\$70	
1.2.2	\$0	0.0					\$0	\$0	\$0	
1.2.3	\$324	3982.0			\$580,000.00	\$143,000	\$3,466	\$3,466	\$2,064	
1.2.5	\$9	83.0					\$50	\$50	\$28	
1.2.6	\$154	1801.0					\$1,289	\$1,289	\$782	
1.2.7	\$125	1637.0					\$1,422	\$1,422	\$1,098	
1.2.9	\$74	729.0					\$550	\$550	\$364	
1.2.11	\$77	845.0					\$650	\$650	\$405	
1.2.12	\$4	40.0					\$100	\$100	\$55	
1.2.14	\$2	28.0					\$33	\$33	\$19	
1.2.15	\$27	732.0					\$457	\$457	\$247	
TOTALS	\$805	9962			\$580,000	\$143,000	\$8,097	\$8,097	\$5,132	

Note: 1.2.2 budget and actuals transferred to 1.2.3

Attachment to YMP:356:94
Page 3 of 7

WBS No.	- 1.2	WBS Manager	-
WBS Title	- YUCCA MOUNTAIN PROJECT		
Parent WBS No.	-	Parent WBS Manager	-
Parent WBS Title	-		

Statement of Work
 See the current WBS Dictionary

Id	Description	Current Period					FY1994 Cumulative to Date					FY1994 at Completion		
		BCWS	BCMP	ACWP	SV	CV	BCWS	BCMP	ACWP	SV	CV	BAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	7	7	9	0	-2	56	56	70	0	-14	80	80	0
1.2.3	SITE INVESTIGATIONS	295	424	323	129	101	2089	2324	2064	235	260	3401	3412	-11
1.2.5	REGULATORY	4	4	9	0	-5	34	34	28	0	6	50	50	0
1.2.6	EXPLORATORY STUDIES FACILI	31	31	152	0	-121	518	518	784	0	-266	1089	1397	-308
1.2.7	TEST FACILITIES	142	115	124	-27	-9	1013	961	1098	-52	-137	1422	1422	0
1.2.9	PROJECT MANAGEMENT	46	46	74	0	-28	367	367	364	0	3	550	550	0
1.2.11	QUALITY ASSURANCE	54	54	77	0	-23	434	434	405	0	29	650	650	0
1.2.12	INFORMATION MANAGEMENT	8	8	3	0	5	67	67	55	0	12	100	100	0
1.2.15	SUPPORT SERVICES	38	38	20	0	18	305	305	266	0	39	459	459	0
Total		625	727	791	102	-64	4883	5066	5134	183	-68	7801	8120	-319

Resource Distributions by Element of Cost													
Fiscal Year 1994													
Budgeted Cost of Work Scheduled													
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	5564	7633	7051	7767	7228	8555	6368	9695	7889	7824	7040	6833	89447
LABOR	408	580	533	585	529	696	533	623	620	593	512	502	6714
SUBS	5	53	0	45	120	157	0	0	120	0	0	562	1062
OTHER	2	2	2	2	2	2	2	2	2	2	2	3	25
Total BCWS	415	635	535	632	651	855	535	625	742	595	514	1067	7801

Participant RSN

Yucca Mtn. Site Char. Project-Planning & Control System
PACS Participant Work Station (PPWS)
WBS Status Sheet (WBS02)

01-May-94 to 31-May-94

Prepared - 06/14/94:11:21:21

Page - 2

Inc. Dollars in Thousands

WBS No. - 1.2 -YUCCA MOUNTAIN PROJECT

Resource Distributions by Element of Cost

Fiscal Year 1994

Actual Cost of Work Performed

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	6283	8714	7162	7235	8049	9640	7926	10840	0	0	0	0	65849
LABOR	435	627	505	545	588	791	712	755	0	0	0	0	4958
SUBS	0	53	0	48	29	0	1	26	0	0	0	0	157
OTHER	2	1	5	1	0	0	0	10	0	0	0	0	19
Total ACMP	437	681	510	594	617	791	713	791	0	0	0	0	5134

Resource Distributions

Fiscal Year 1994	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	415	635	535	632	651	855	535	625	742	595	514	1067	7801
BCMP	468	610	556	633	763	765	544	727	0	0	0	0	5066
ACMP	437	681	510	594	617	791	713	791	0	0	0	0	5134
ETC	0	0	0	0	0	0	0	0	826	613	563	984	2986

Fiscal Year Distribution

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCWS	10852	7801	15056	13909	11406	8584	6341	6077	4958	5	0	0	84989
BCMP	10852	5066	0	0	0	0	0	0	0	0	0	0	
ACMP	11324	5134	0	0	0	0	0	0	0	0	0	0	
ETC	0	2986	16275	13265	11291	8469	6226	5962	4843	5	0	0	85780

**Yucca Mountain Site Characterization Project
 Variance Analysis Report
 Status Thru: May 1994**

PARTICIPANT: RSN **PEM:** Long **WBS:** 1.2.3.11
WBS TITLE: System Acquisition SBT Borehole, Geophysical Logging
P&S ACCOUNT: RS3B1

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
368	368	154	0	0.0	100	214	58.2	239.	580	580	0	0.0	243	49.8

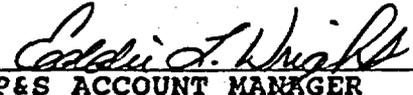
Analysis

Cumulative Cost Variance:

The Geophysical Logging Subcontract account will be expended or committed during FY94. Current commitments are 87% of budget.

Cumulative Schedule Variance:

Variance At Complete:



 P&S ACCOUNT MANAGER DATE TPO DATE
 E. L. Wright 6/15/94 W. C. Kopatich 6/15/94

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 1994**

PARTICIPANT: RSN **PEM:** Replogle **WBS:** 1.2.6.11
WBS TITLE: ESF Management Engineering
P&S ACCOUNT: RS611

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACX	IEAC	TCPI
236	236	355	0	0.0	100.0	-119	-50.4	66.5	240	463	-223	-92.9	361	3.7

Analysis

Cumulative Cost Variance:

Additional funding was authorized in FIN Plan #9. The C/SCRs were not approved prior to PACS report closing date. C/SCRs have been approved and will be reflected in June Month End Reports.

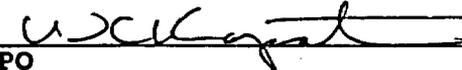
Cumulative Schedule Variance:

Variance At Complete:

Additional funding was authorized in FIN Plan #9. The C/SCRs were not approved prior to PACS report closing date. C/SCRs have been approved and will be reflected in June Month End Reports.


 P&S ACCOUNT MANAGER
 R. G. Musick, Jr.

6-15-94
 DATE

 6/15/94
 TPO
 W. C. Kopatich
 DATE



United States Department of the Interior



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

IN REPLY REFER TO:

INFORMATION ONLY

June 14, 1994

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

SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS)
Progress Report, May 1994

Dear Vince:

Attached is the USGS progress report in the required format for the month of May, 1994.

If you have any questions or need further information, please call me or Raye Ritchey at (303)236-0516.

Sincerely,

Raye E. Ritchey

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

Enclosure:

- cc: R. Crawley, DOE/Las Vegas
- J. Dlugosz, DOE/Las Vegas
- R. Dyer, DOE/Las Vegas
- S. Jones, DOE/Las Vegas
- W. Kozai, DOE/Las Vegas
- R. Patterson, DOE/Las Vegas
- A. Simmons, DOE/Las Vegas
- R. Spence, DOE/Las Vegas
- T. Sullivan, DOE/Las Vegas
- M. Tynan, DOE/Las Vegas
- D. Williams, DOE/Las Vegas
- P. Justus, NRC/Las Vegas (2 copies)
- P. Burke, M&O/Las Vegas
- R. St. Clair, M&O/Las Vegas
- D. Appel, USGS/Denver
- M. Chornack, USGS/Denver
- R. Craig, USGS/Las Vegas
- L. Ducret, USGS/Denver
- D. Gillies, USGS/Denver
- R. Luckey, USGS/Denver
- B. Parks, USGS/Denver
- R. Ritchey, USGS/Denver
- R. Spengler, USGS/Denver
- J. Stuckless, USGS/Denver
- R. Spengler, USGS/Denver

I-358481
BRH

329

*Assistant
Manager (6)*

*Hayes
Hays*

See cc list (9)

6/21/94

JUN 21 1994

ENCLOSURE 10

U.S. Geological Survey
EXECUTIVE SUMMARY
May 1994

WBS 1.2.3.1 - Coordination and Planning

United States Geological Survey-Yucca Mountain Project Branch (USGS-YMPB) is currently processing 91 hydrologic-related scientific publications, 65 geologic and climate-related scientific publications, 17 USGS-LBL hydrologic-related scientific publications, and 73 abstracts.

WBS 1.2.3.2 - Geology

In support of surface and subsurface stratigraphic studies, the Calico Hills Formation and Prow Pass Tuff were examined in the c-well complex in outcrops at Prow Pass and Raven Canyon and the Calico Hills Formation in outcrop at Busted Butte; lithostratigraphic data continue to be synthesized, unit descriptions prepared, criteria defined to identify contacts, and lithostratigraphic divisions compared to geochemical, mineralogical, and geophysical data collected from the literature. Thin sections are being prepared from 54 rock samples.

Mass spectrometric analysis of Sr isotopes were completed on 15 whole-rock samples obtained from UE-25 NRG#3 drill core.

Surface-based geophysics staff completed interpretations of magnetic-potential and gravity-potential field lines obtained during FY93 traverses across Midway Valley and Yucca Wash.

Geologic mapping of zonal features studies continued with the completion of chemical purification of and mass spectrometry analyses of 15 samples of the Tiva Canyon Tuff obtained from a faulted area at the eastern end of Antler Ridge. The lithostratigraphy of the Calico Hills Formation and Prow Pass Tuff was examined using previously measured sections in the Prow Pass, Busted Butte, and Raven Canyon areas as a guide.

At the Exploratory Studies Facility (ESF), editing of the drainage channel and portal map and cross-section through the starter tunnel was continued. Additional fracture data from the portal was entered into a DIPS format for detailed analysis. Field checks were performed on the drainage channel and portal map and photogrammetric mapping of the starter tunnel was completed.

In seismic surface-reflection profiling studies, additional processing on lines 1 and 2 was completed. An improved depth section using a refined velocity model was obtained along Line 1. Also, an F-X deconvolution improved the images along Lines 1 and 2. Further processing and display of the full one second of data showed deeper reflections beneath the Calico Hills formation.

In vertical seismic profiling (VSP) studies, further processing of the VSP data from USW WT-2 indicated several smaller faults between the borehole and the mapped trace of the Ghost Dance fault.

Trenches across the northern Solitario Canyon and Pagany Wash faults were examined as part of relevant earthquake sources, in order to document the Quaternary activities and slip histories. The trenches were cleaned and important contacts flagged and surveyed, and the exposures photographed.

For the compilation of the historical earthquake record, six catalogues relevant to the earthquake record in the southern Great Basin were merged and duplicated culled; recently announced nuclear explosions were eliminated from the catalogue of earthquakes. Develocorder film and digital data from PING tapes were checked for more than 20 events reported within a 10-km radius of Yucca Mountain during 1978-92. The preliminary earthquake intensity map for the Little Skull Mountain earthquake was completed.

Current seismicity data were recorded by CUSP for all sites in May, with no downtime. Seismic calibrations were performed at 15 sites of the SGBSN. All of the May seismic events, 208 in the southern Great Basin, were picked. The 44D network recorder was restored to operation and data are again being received from the 6-station digital upgrade network.

Studies to evaluate age and recurrence of movement on Quaternary faults continued. Field work was completed at North Windy Wash and preliminary results obtained of remaining cosmogenic dating analyses. Trench logs were completed and digitized for South Windy Wash. Three topographic profiles were surveyed across bedrock escarpment of the Ghost Dance Fault on Whaleback and Antler ridges and rock samples collected for cosmogenic dating. A preliminary photogrammetric log of Trench CF1 was compiled and stratigraphic units and soils described; sites for age-dating sampling were selected. Walls of the trench across the Paintbrush Canyon fault at Alice Ridge were cleaned; initial mapping and flagging of contacts of structures is in progress near the fault zone.

In geodetic leveling studies to assess surficial changes, Little Skull Mountain earthquake, analysis of pre- and post-earthquake geodetic leveling data reveals a region of surface elevation change that approximately corresponds to the area between the projection of the Mine Mountain fault in Jackass Flats and the Rock Valley fault in Rock Valley. Pre-earthquake elevations in this region were higher than post-earthquake elevations; the maximum change was about 22 mm.

WBS 1.2.3.3 - Hydrology

Collection of synoptic weather data continued in the form of weather charts and weather satellite images. Lightning data also are being collected during storms. Three periods of precipitation were recorded at Yucca Mountain in May. From the 6th through the 10th, a series of widely scattered showers moved slowly though the southwest; effects were negligible at Yucca Mountain with the non-recording raingage network recording an areal average of 0.76 mm. On May 12, scattered thunderstorms accompanied by lightning were noted throughout southern Nevada; numerous lightning strikes were recorded at Yucca Mountain. The non-recording rain-gage network measured an average of 3.6 mm with a maximum of 9.7 mm recorded at three locations. On the 31st, scattered showers with a few lightning strikes in the Yucca Mountain area; left an areal average precipitation of about 2.5 mm.

Cumulative rainfall measured for network sites averaged about 9.1 mm. Precipitation totals for monitoring sites on the Nevada Test Site ranged from 2.3 mm at Stockade Pass above Area 12, to 19.1 mm at Yucca Wash near Mouth. There was no runoff recorded or reported at any of the Yucca Mountain streamflow-monitoring sites on the Nevada Test Site. The Amargosa River at Tecopa, California continued to maintain a base flow of about 0.006 m³/sec for the month. Levels were run for a slope conveyance determination of discharge in the Amargosa River at Highway 127 near the California/Nevada stateline for an April 28 storm.

Ponding and infiltration experiments continued in the Fortymile Wash recharge study. Additional data collected included: precipitation data from gages in Fortymile Canyon; neutron logs from UE-29 UZN#91 and

#92; water-level measurements in UE-29a #1, a #2, and UE-29 UZN #91.

In unsaturated zone infiltration studies, neutron access holes UE-25 USN #54 and 55, and NRG 6 were logged with the gamma-gamma and neutron-neutron tools; caliper and single point resistivity logs also were run on NRG 6. The data will be used to determine wet and dry density, porosity, moisture content, and borehole diameter as well as depth to bedrock

As part of the study to predict washout zones around well casing, the casing was pulled in UE-25 UZN 85. Earlier, washout zones were predicted from gamma-gamma and neutron-moisture meter logs during the ponded infiltration experiment. After pulling the casing, five caliper and single-point resistivity logs were run sequentially. Results from the logs agreed well with the washout-zone detection experiments and suggest that gamma-gamma logs may be effective in detecting washout zones in cased boreholes.

Regular monthly neutron logs were obtained in 97 holes in the natural infiltration monitoring network. Preliminary processing of the count data was completed, and the count data were entered into the historical neutron hole count database.

Moisture-characteristic curves were generated for samples from the large-block, prototype ESF percolation experiment. Data were also collected on samples to examine the effect of different temperatures on the determination of moisture-retention curves using the chilled-mirror psychrometer.

An initial analysis of the data from the air-permeability testing at UE-25 UZ#16 was completed. To obtain a first estimate of the permeability in the hole, the test intervals were analyzed by a steady-state method for elliptical flow. This initial analysis will provide an estimate of the range and variance between and among the formations tested.

In unsaturated zone surface-based studies, USW UZ-14 support, two core samples were compressed by one-dimensional compression; both yielded pore water. Six samples were distilled after compression; extracted pore water will be analyzed for tritium, $^{18}\text{O}/^{16}\text{O}$, and D/H. One water sample was collected from the bottom of the hole (641.3 m) using a metal bailer; this water likely drained from the bottom of the Calico Hills unit. The pH of the water is 9.4; major anion and cation analyses will be performed. During the drilling, between 669.7 and 672.6 m, water from the saturated zone flowed through a fracture and raised the water level in the borehole to 598.7 m. A sample of the water was obtained for carbon isotope analyses, C-12,13,14.

Periodic water-level measurements were made in USW UZ-14 following unloading of the water column in the borehole. Water levels recovered to about 279 m from the drawdown depth of about 678 m. After three weeks, the water level was still recovering. Flow appears to be coming from a single fracture in the Bullfrog member of the Crater Flat Tuff.

The large-block, prototype ESF percolation experiment was restarted in May. Currently, water is flowing continuously through the block fractures between about 1 - 2 cm³/hr. Average water pressure along the block top is between -21 and -18 cm of water. Measurements of water pressure in the block matrix and fracture are being made with tensiometers. Pressures along the top will be decreased until water flow stops, then increased until flow begins again to determine any hysteretic behavior that may affect water flow in fractures.

Monitoring of perched water in the ESF by other investigators was continued. To date, the starter tunnel has been drilled and blasted to about 61 m. Alcove #1 has been excavated to final depth. Drilling of the three radial

boreholes has been completed. No natural water flows have been encountered.

Gaseous-phase chemical investigations in the unsaturated zone continued. Retesting of the gas/sample sorption equilibration between gas and sample for concentrations of SF₆ < 0.1 ppm was completed. The test was run for 500 hours and indicates that for such a small volume of SF₆ after 40 hours of testing, only 85-90 percent of the sorption obtained by the final equilibrium is achieved. Gas samples of SF₆ were collected from USW UZ-1 to study the continuing effects of drilling at USW UZ-14.

In unsaturated zone hydrochemistry studies, six molecular sieve collection cylinders of unsaturated zone gas samples collected from boreholes USW UZ-6, N93, N94, and N95 were degassed. The CO₂ gas and H₂O vapor was collected in cold traps and the condensed CO₂ gas was vaporized and collected in storage cylinders. The CO₂ gas will be analyzed for 14C. Silicon tubing was lowered into borehole USW NRG 6 at specified levels for the collection of gas samples for analysis of CO₂, CH₄, SF₆, 14C, and 13C/12C. Gas samples also were collected at USW UZ-16 between packed-off intervals. Analyses of CO₂, CH₄, and SF₆ were completed at the test site with a gas chromatograph; the other samples were returned to Denver and are currently being analyzed.

As part of the aqueous-phase chemical investigations, two USW UZ-14, one UE-25 UZ#16, and one UE-25 NRG#7 cores were compressed and water samples obtained and sent for inorganic and 14C determinations. Distilled six core samples from USW UZ-14, one from UE-25 UZ#16, and one water sample from USW UZ-14; extracted pore water will be analyzed for tritium, D/H, and 18O/16O. Thirty-two pore-water samples extracted from cores using one-dimensional compression methods and one calcite crystal sample extracted from a core fracture were submitted for 14C analysis. Fifteen water-vapor samples from borehole USW UZ-1 were analyzed for tritium content.

As part of the evaluation of site potentiometric levels, 19 water level zones were monitored in 17 wells on a monthly basis (manually) and 17 zones in 12 wells on an hourly basis (transducers). Continuous water-level data were obtained in four zones in two wells in order to monitor water-level responses to seismic events. Real-time data were obtained from 17 zones in 12 wells using DCP's.

WBS 1.2.3.6 - Climatology

As part of Paleoclimate studies of lake, playa, and marsh deposits, continued sampling Black Rock long core from which paleontological and isotope data will be used to establish geological (million year) climate reference to establish the nature of the climate state under which fracture flow occurs within Yucca Mountain. Processes approximately 40 samples and selected and prepared specimens for scanning electron photomicrography.

In support of calcite and opaline silica deposit studies, soil and gas samples were collected from sites at Pagany Wash, Fortymile Wash, Fran Ridge, Rainier Mesa, Holmes Road, and Beatty. Eighteen silica (opal, quartz) samples were prepared for determination of $\delta^{18}O$ values.

WBS 1.2.3.7 - Resource Potential

Data from UE-25 NRG#2A were entered into a spreadsheet; spreadsheet data from UE-25 NRG#2A and Whaleback ridge were validated.

WBS 1.2.12 - Information Management

The LRC received 274 individual records, 26 non-data criteria packages, 37 data packages, 11 publication packages, and five cited reference lists. Current material transmitted to the CRF from the LRC included 16 individual records and six non-data criteria packages (924 pages), 14 publication packages, 23 data package (5,119 pages), and 28 cited references. Backlog material transmitted included no individual records, no data packages, 10 publication packages, and no backlog cited references (331 pages). The total pages transmitted for current and backlog material was 7,215 pages.

WBS 1.2.13 - Environment, Safety, and Health

In support of water-resources monitoring, ground-water levels were measured at 27 sites; discharge was measured at one flowing well. Ground-water data collected during May were checked and filed.

USGS LEVEL 3 MILESTONE REPORT
 OCTOBER 1, 1993 - MAY 31, 1994
 Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
G300: FINAL RPT, CROSS-HOLE PROTOTYPE TESTING Milestone Number: 3GUT004M	03/31/93	07/29/94		
PUBLICATION: DEVELOPMENT OF 1-D COMPRESSION Milestone Number: 3GUH045M	01/31/94	06/30/94		
PUBLICATION: FY92 DATA FROM ANALOG RECHARGE SITE Milestone Number: 3GQH12CM	01/31/94	06/10/94		
ANALYSIS PAPER: UZ-16 COMPLETION REPORT (P013) Milestone Number: 3GUP066M	02/01/94	09/30/94		
ANLYS PAPER: LAB MEASUREMENT OF UNSATURATED FLOW Milestone Number: 3GUS034M	02/04/94	06/30/94		
ANALYSIS PAPER: LITHOLOGIC LOGGING - PHASE 1 Milestone Number: 3GGU131M	02/28/94	05/31/94	05/31/94	
ANALYSIS PPR: DATA-STARTER TUNNEL & NORTH PORTAL Milestone Number: 3GGF012M	02/28/94	07/29/94		
CRITERIA LETTER: TECH SUPPORT FOR X-HOLE TESTING Milestone Number: 3GWF086M	02/28/94	09/30/94		
PUB: ASSESSMENT OF SITE SZ HYDROCHEM DATA (Z255) Milestone Number: 3GWH001M	02/28/94	05/19/94	05/19/94	
ANLYS PPR: MAG/GRAV INTERP YUC WASH/MDWAY VALLEY Milestone Number: 3GGU463M	03/31/94	07/29/94		
ANLYS PPR: MAPS SOUTH-CNTRL GHOST DANCE FAULT Milestone Number: 3GGF122M	03/31/94	07/29/94		
PUBLICATION: FORTYMILE WASH RECHARGE DATA FY92 Milestone Number: 3GRG021M	03/31/94	05/27/94	05/27/94	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUB: STRUCTURAL FLOW-PATH ANALYS W/TRANSPT & CHEM Milestone Number: 3GFH009M	03/31/94	08/31/94		
PRELIMINARY DIGITAL GEOLOGIC MAP Milestone Number: 3GRM036M	03/31/94	05/26/94	05/26/94	
PUBLICATN: RESULTS - ZERO OFFSET & WALKAWAY DATA Milestone Number: 3GUP086M	03/31/94	07/29/94		
PUB: INTRABOREHOLE FLOW AND STRESS TEST (P891) Milestone Number: 3GWF010M	03/31/94	06/30/94		
PUBLICATION: GEOPHYSICAL STUDY/WINDY WASH FAULT Milestone Number: 3GPF039M	04/15/94	06/30/94		
ANALYSIS PPR: MAG/GRAV ACROSS GHOST DANCE FAULT Milestone Number: 3GGU440M	04/29/94	07/29/94		
PUBLICATION: ASSESS LITTLE SKULL MTN EQ Milestone Number: 3GSM149M	04/29/94	06/30/94		
PUBLICATION: STREAMFLOW & PRECIP DATA FY91-93 Milestone Number: 3GRS033M	04/29/94	06/30/94		
PUBLICATION: INFILT STUDY; DEVELOPMENT/TESTING Milestone Number: 3GUI636M	04/29/94	06/30/94		
PUBLICATION: 1-D AND 2-D MATRIX MODELS Milestone Number: 3GPA006M	04/29/94	06/30/94		
PUBLICATION: MAP - CRATER FLAT Milestone Number: 3GTD012M	04/30/94	06/29/94		
ANLYS PPR: ISOTOPIC PARAMETERS- DRILLCORE SECTNS Milestone Number: 3GGU22BM	05/31/94	09/30/94		
ANLYS PPR: MAP-GHOST DANCE FAULT PAVEMENT Milestone Number: 3GGF202M	05/31/94	07/29/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUBLICATION: FINAL SUMMARY RPT - MIDWAY VALLEY Milestone Number: 3GFP029M	05/31/94	09/29/94		
PUBLICATION: MAP - CALICO HILLS Milestone Number: 3GTD018M	05/31/94	08/01/94		
PUBLICATION: MAP- EAST OF BEATTY QUADRANGLE Milestone Number: 3GTD028M	05/31/94	06/29/94		
ANLYS PPR: SCARP DEGRADATION/EVOL N. WINDY WASH Milestone Number: 3GPF034M	05/31/94	08/15/94		
PUBLICATION: STAGE COACH RD FAULT Milestone Number: 3GPF118M	05/31/94	08/31/94		
PUB: DETAILED MOIRE METHOD - FRACTURE-SURF CHAR Milestone Number: 3GUS015M	05/31/94	08/31/94		
ANALYSIS PPR: TRACE ELEMENT/RADIOGENIC-ISOTOPE Milestone Number: 3GGU122M	06/30/94	06/30/94		
PUBLICATION: STREAMFLOW CHAOS JOURNAL ARTICLE Milestone Number: 3GRG023M	06/30/94	09/30/94		
PUBLICATION: HISTORICAL NEUTRON HOLE DATA Milestone Number: 3GUI050M	06/30/94	06/30/94		
PUB: PROJECTION MOIRE METHOD - FRACT-SURF CHAR Milestone Number: 3GUS024M	06/30/94	08/31/94		
PUBLICATION: ORIGIN OF SURFACE DEPOSITS Milestone Number: 3GQH019M	06/30/94	06/29/94		
ANLYS PPR:ALTERATIONS IN CORE FROM UZ-14 & UZ-16 Milestone Number: 3GNR020M	06/30/94	06/30/94		

USGS LEVEL 4 MILESTONE REPORT
 OCTOBER 1, 1993 - MAY 31, 1994
 Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PROV. RESULTS: ISOTOPE DATING/EOLIAN SANDS/SOIL Milestone Number: 3GCH161M	08/31/93	08/01/94		
PRELIMINARY SUMMARY PALEOFLOOD STUDIES Milestone Number: 3GQH010M	09/30/93	09/30/94		
REVIEW DRAFT: SUMMARY REPORT - MIDWAY VALLEY Milestone Number: 3GFP028M	01/20/94	06/30/94		
DATA TO LRC: TRENCH LOGS Milestone Number: 3GFP017M	02/21/94	06/30/94		
PROV. RESULTS: EVAL. MODEL ON SECONDARY CALCITE Milestone Number: 3GQH868M	03/11/94	06/30/94		
REVIEW DRAFT: TRENCHES STAGE COACH RD FLT Milestone Number: 3GPF117M	03/15/94	06/15/94		
REVIEW DRAFT: CATALOG OF EVENTS CAL YEAR 1993 Milestone Number: 3GSM024M	03/31/94	06/30/94		
DATA TO LRC: SEISMIC DATA Milestone Number: 3GSM24AM	03/31/94	06/30/94		
PROVISIONAL RESULTS: LOGGING OF TRENCH 17 Milestone Number: 3GFP021M	03/31/94	06/30/94		
REPORT: ASSESS SURF CHANGES/LITTLE SKULL EQ Milestone Number: 3GTM07JM	03/31/94	05/13/94	05/13/94	
DATA TO LRC: UE-25 UZ#16 AIR-K DATA Milestone Number: 3GUP039M	03/31/94	06/29/94		
DATA TO LRC: FRACTURE LOGS DATA Milestone Number: 3GUP305M	03/31/94	11/30/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
DATA TO LRC: GAS/H2O VAPOR DATA-UZ#16/NRG-6/UZ-1 Milestone Number: 3GUH022M	03/31/94	09/30/94		
SELECT SEISMIC CONTRACTOR(S) Milestone Number: 3GGU265M	04/29/94	07/29/94		
PROV RESULTS: TRENCHES SOLITARIO CANYON FAULT Milestone Number: 3GPF20M	04/29/94	05/04/94	05/04/94	
DATA TO LRC:FY93 SYNOPTIC/REGIONAL/SITE MET DATA Milestone Number: 3GMM039M	04/29/94	06/30/94		
DATA TO LRC: FY93 MATRIX PROPERTIES DATA Milestone Number: 3GUP034M	04/29/94	06/29/94		
MEMO TO TPO: COMPL SINGLE-HOLE AIR-K TESTING SYS Milestone Number: 3GUS421M	04/29/94	05/05/94	05/05/94	
PROVISIONAL RESULTS: ESF TRENCH LOGGING Milestone Number: 3GFP008M	04/30/94	06/30/94		
TECHNICAL MEMO: APR-1 FRACTURE DATA Milestone Number: 3GGF120M	05/23/94	07/29/94		
TECH PROCEDURE: ESTABLISH MAXIMUM MAGNITUDE EQs Milestone Number: 3GSS108M	05/31/94	05/09/94	05/09/94	
REVIEW DRAFT: MAP- BIG DUNE QUADRANGLE Milestone Number: 3GTD029M	05/31/94	06/29/94		
PROVISIONAL RESULTS: 14 C/D TRENCH STUDIES Milestone Number: 3GPF036M	05/31/94	06/30/94		
DATA TO LRC: LOGS-TRENCHES- SOUTH WINDY WASH FLT Milestone Number: 3GPF106M	05/31/94	05/31/94	05/31/94	
DATA TO LRC: FIRST QUARTER WATER-LEVEL DATA Milestone Number: 3GWF050M	05/31/94	05/16/94	05/16/94	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
TECH PROCEDURE: COLLECT GEOLOGIC DATA (LEVEL 4) Milestone Number: 3GGF60BM	06/30/94	06/30/94		
REVIEW DRAFT: HISTORY OF BOW RIDGE FLT Milestone Number: 3GPF119M	06/30/94	06/30/94		
REVIEW DRAFT: BUSTED BUTTE EXPOSURES Milestone Number: 3GPF121M	06/30/94	06/30/94		
DATA TO LRC: QUADRILATERAL SURVEY Milestone Number: 3GTL009M	06/30/94	08/31/94		
REVIEW DRAFT: PRELIMINARY TECTONIC MODEL Milestone Number: 3GTE061M	06/30/94	06/30/94		
MEMO TO TPO: INSTRUMENTATION CERTIF FOR NRG-6 Milestone Number: 3GUP072M	06/30/94	12/15/94		
DATA TO LRC: AXIAL FRACTURE BLANK TEST RESULTS Milestone Number: 3GUS032M	06/30/94	06/30/94		
REVIEW DRAFT: GAS CHEMISTRY Milestone Number: 3GGP005M	06/30/94	06/30/94		
DATA TO LRC: 1ST & 2ND QTR FY94 GAS FLOW DATA Milestone Number: 3GGP03M	06/30/94	06/30/94		
DATA TO LRC: 1ST & 2ND QTR FY94 GAS SAMPLE DATA Milestone Number: 3GGP05M	06/30/94	06/30/94		
DATA TO LRC: 1ST & 2ND QTR FY94 TRACER TEST DATA Milestone Number: 3GGP07M	06/30/94	06/30/94		
CRITERIA LET: REHABILITATING WELLS WT-2 & WT#3 Milestone Number: 3GWF075M	06/30/94	05/20/94	05/20/94	
DATA TO LRC: HYDRAULIC DATA Milestone Number: 3GWF020M	06/30/94	06/30/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
DATA TO LRC: LIMITED SITE HYDROCHEMISTRY DATA Milestone Number: 3GWH008M	06/30/94	06/30/94		
PROVISIONAL RESULTS: STATUS OF CONCEPTUAL MODEL Milestone Number: 3GWM018M	06/30/94	06/30/94		
ABSTRACT: ORIGIN OF SECONDARY CALCITE IN UZ -YM Milestone Number: 3GQH866M	06/30/94	06/30/94		

**Yucca Mountain Site Characterization Project
 Variance Analysis Report
 Status Thru: May 31, 1994**

PARTICIPANT: USGS **PEM:** TYNAN **WBS:** 1.2.3.2.2.1.1
WBS TITLE: Vertical and Lateral Distribution of Stratigraphic
 Units in the Site Area
P&S ACCOUNT: OG32211

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
785	785	810	0	0.0	100.0	-25.0	-3.2	96.9	1420	2479	-1059	-74.6	1465	38.0

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

The variance is due to the estimate to complete being modified to reflect additional scope/budget associated with running the seismic line. This EAC represents the estimated funds required to complete the work related to the seismic line planned for this fiscal year. The original budget was not adequate to cover all scope addressed in PACS. If the decision is made not to award this contract this fiscal year, the EAC for this fiscal year will be modified, and the corresponding budget moved to fiscal year 1994. Further, a capital equipment summary account was added for procurement of a RAAX borehole image-processing system, which will provide a digital data set describing structural features and secondary features in support of the borehole geophysics program.

Impact:

None. Funds will be made available if a decision is made to proceed with award of the seismic line contract, or purchase of the RAAX system.

Corrective Action:

None required at this time.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: Sullivan WBS: 1.2.3.2.6.2.1

WBS TITLE: Surface Facilities Exploration Program

P&S ACCOUNT: OG32621

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
0	0	5	0	0.0	100.0	-5	0.0	0.0	0	50	-50	0.0	0	0.0

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

A C/SCR is pending to transfer funds in the amount of \$50,000 from SNL to the USGS to provide support as requested for the soil and rock studies. BAC cannot be entered until C/SCR is approved and implementation directive is received.

Impact:

There is not impact if C/SCR is approved.

Corrective Action:

Update PACS to reflect BAC equal to EAC as soon as C/SCR is approved and implementation directive is approved.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: Sullivan WBS: 1.2.3.2.8.2

WBS TITLE: Faulting Potential at the Repository

P&S ACCOUNT: OG3282

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	LEAC	TCPI
0	0	0	0	0.0	0.0	0	0.0	0.0	0	50	-50	0.0	0	0.0

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

A C/SCR was recently approved transferring funds in the amount of \$50,000 from the M&O contractor to the USGS to write a study plan for this study. BAC cannot be entered until implementation directive is received. (Implementation Directive was received just after the May status upload)

Impact:

None.

Corrective Action:

Update PACS to reflect BAC equal to EAC before June status upload.

P&S ACCOUNT MANAGER	DATE	TPO	DATE
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**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: Sullivan WBS: 1.2.3.2.8.3.6

WBS TITLE: Probabilistic Seismic Hazards Analysis

P&S ACCOUNT: OG32836

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
0	0	0	0	0.0	0.0	0	0.0	0.0	0	50	-50	0.0	0	0.0

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

A C/SCR was recently approved transferring funds in the amount of \$50,000 from the M&O contractor to the USGS to write a study plan for this study. BAC cannot be entered until implementation directive is received. (Implementation Directive was received just after the May status upload)

Impact:

None.

Corrective Action:

Update PACS to reflect BAC equal to EAC before June status upload.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: SULLIVAN WBS: 1.2.3.2.8.4.3
WBS TITLE: Quaternary Faulting Within 100 km of Yucca Mountain
P&S ACCOUNT: OG32843

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCVP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
221	221	284	0	0.0	100.0	-63	-28.5	77.8	350	454	-104	-29.7	450.0	75.9

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

Additional funds of \$100K are required because a new task is needed to study the Stuart Valley-Pahrump Valley Fault system. Work elements include an airphoto study to determine the number and length of fault segments, dating of appropriate rock and soil samples, and identification of possible trench sites for study in FY 1995. This is work that was planned for FY1994, but not funded in the baseline funding.

Impact:

There is no impact as work on this task will not begin until funds are made available.

Corrective Action:

None required at this time.

P&S ACCOUNT MANAGER DATE TPO DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: SULLIVAN WBS: 1.2.3.2.8.4.4
WBS TITLE: Quaternary Faulting in NE-Trending Fault Zones
P&S ACCOUNT: OG32844

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCVP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
102	67	71	-35	-34.3	65.7	-4	-6.0	94.4	150	195	-45	-30.0	159	66.9

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

Additional funds of \$50K are required because a new task is needed for the study of the Rock Valley Fault system to date offset soil and alluvial deposits this fiscal year. Data obtained a decade ago by the Uranium-trend method must be re-evaluated by the Uranium series method before the final analysis of the Rock Valley faulting history can be completed. This is work that was planned for FY1994, but not funded in the baseline funding.

Impact:

There is no impact as work on this task will not begin until funds are made available.

Corrective Action:

None required at this time.

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P&S ACCOUNT MANAGER	DATE	TPO	DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ WBS: 1.2.3.3.1.2.3

WBS TITLE: Percolation in the Unsaturated Zone - Surface-Based Study

P&S ACCOUNT: OG33123

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCVS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
1901	1459	2043	-442	-23.3	76.7	-584.0	-40.0	71.4	3615	3642	-27	-0.7	5063	134.8

Analysis

Cumulative Cost Variance:

Cause:

Most of the negative cost variance (indicating an overspent condition) is due to the behind-schedule condition. However, about \$140K of the cost variance is due to 1) ahead-of-schedule acquisition and calibration of equipment needed for instrumentation of UZ boreholes, 2) redirection of some resources within the UZ-14 account to analyze samples of the perched water encountered in UZ-14, and 3) redirection of some resources to support DOE's initiative to acquire pre-ESF construction pneumatic and hydrologic data.

Impact:

Overall, this P&S account will not be overspent at the end of the FY 94, despite the redirection of resources as indicated above. However, unless the UZ-14 summary account is replanned to reflect current delays in drilling and testing, this summary account will be significantly underspent by the end of the year. However, because the resources allocated to this summary account are primarily salaries of permanent full-time staff, other closely related summary accounts in WBS 1233123 and 1233127 may be overspent because of the redirection of staff to tasks within those summary accounts.

Corrective Action:

A C/SCR could be prepared for the UZ-14 summary account as described in the "schedule variance" section. A portion of the current funding could be reprogrammed to other affected summary accounts in WBS 1233123 and WBS 1233127 to avoid the predicted overspent condition in these accounts.

Cumulative Schedule Variance:

Cause:

Several tasks involving testing, hydrologic instrumentation, and monitoring in recently drilled boreholes have been delayed by two to five months. These delays are all related to unexpected conditions encountered in the boreholes and are beyond the control of the USGS as described below.

1) Both air-permeability testing and instrumentation of NRG-6 have been delayed because a 50-foot section of casing is still lodged in this borehole.

2) Geophone instrumentation of UZ-16 and the vertical seismic profiling production survey have been delayed about 2 months due to the unavailability of a drilling/support crew. Time required for RSN to award a VSP data-acquisition contract has the potential to delay the production survey by another 3 months.

3) Tasks scheduled for UZ-14 are behind schedule because of the delay in completion of drilling of USW UZ-14 because of the perched water encountered therein. UZ-14 tasks behind schedule include geophysical logging, gas sampling, preparation of data report, gas-phase testing, review of gas and water-vapor data, and air-permeability testing.

Impact:

1) The delay in instrumentation of NRG-6 will reduce the pre-TBM-excavation monitoring period for this borehole by about 5 months.

2) Delay of VSP survey of UZ-16 is acceptable because no near-term, high-priority YMP initiatives are impacted.

3) Although the overall YMP site-characterization schedule is impacted by delays at UZ-14, the delays are acceptable because no near-term, high-priority YMP initiatives are impacted.

Corrective Action:

1) USGS and DOE staff are working hard to maximize the scope and duration of pneumatic-pathways monitoring prior to excavation of the ESF north ramp by the TBM. To support this effort, USGS has agreed to change the priority order of borehole instrumentation so that two other boreholes can be instrumented in the near term in addition to NRG-6. Accordingly, NRG-7a will be instrumented instead of UZ-7, and SD-9 will be instrumented instead of SD-12. Individual task titles and work scopes are being revised in PACS immediately to reflect these critical shifts in borehole-instrumentation priorities. These PACS modifications do not require change-

control because no milestones are involved.

2) A fourth drilling crew is scheduled to come on board in June and will allow commencement of UZ-16 VSP instrumentation in July. USGS will continue to work closely with RSN staff to minimize the delay in award of the VSP data-acquisition contract.

3) Most remaining work in UZ-14 has been put on hold until FY 95 in order to support DOE's initiative to obtain pre-ESF-north-ramp-construction data from NRG and SD boreholes. Because UZ-14 tasks comprise a dedicated summary account, some consideration should be given to a C/SCR to reschedule this account when enough is known about the sequence and duration of tasks still to be completed. Alternatively, the variance in this summary account could be allowed to grow through the end of FY 94 and then the UZ-14 summary account could be rebaselined or eliminated for FY 95.

Several tasks associated with recently drilled boreholes have been delayed by one to four months. These delays are all related to unexpected conditions encountered in the boreholes and are beyond the control of the USGS. Specifically, both air-permeability testing and instrumentation of NRG-6 have been delayed because a 50-foot section of casing is still lodged in this borehole. Tasks scheduled for UZ-14 are behind schedule because of the delay in completion of drilling of USW UZ-14 because of the perched water encountered therein. UZ-14 tasks behind schedule include geophysical logging, gas sampling, preparation of data report, gas-phase testing, review of gas and water-vapor data, and air-permeability testing.

Variance At Complete:

Not Applicable

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: PATTERSON WBS: 1.2.3.3.1.3.1
WBS TITLE: Site Saturated Zone Ground Water Flow System
P&S ACCOUNT: OG33131

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
762	657	684	-105	-13.8	86.2	-27.0	-4.1	96.1	1201	1197	4	0.3	1250	106.0

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Cause:

Two tasks to be performed at the C-Hole complex have been delayed 5 and 7 months, respectively: conduct of cross-hole hydraulic tests and review of work program for tracer tests. These tasks have been delayed because of delays in implementing the necessary prerequisites at the C-Hole complex. These include the discharge pipeline, settling/infiltration pond, uninterruptable generator power, variable-speed controller for pump, and a work-over rig and crew. The USGS has no direct control over the fulfillment of these prerequisites.

Impact:

Although the C-Hole testing in the saturated zone has been delayed, no other near-term YMP initiative has been impacted.

Corrective Action:

All reasonable actions have been taken already to minimize the delay in C-Hole testing. USGS will continue to work closely with DOE and NTS contractors to expedite the C-Holes testing.

Variance At Complete:

Not Applicable

P&S ACCOUNT MANAGER DATE TPO DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: May 31, 1994**

PARTICIPANT: USGS PEM: Baumiester WBS: 1.2.13.2.5

WBS TITLE: Occupational Safety and Health

P&S ACCOUNT: OGD25

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
44	44	13	0	0.0	100.0	31	70.5	338.5	110	50	60	54.5	32	178.4

Analysis

Cumulative Cost Variance:

Not applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

This position was budgeted for one FTE for a full year. The position was only recently filled, allowing for a return of some of the budget to DOE. A C/SCR has been initiated to reflect this.

Impact:

There is no impact. This position has now been filled and funding is adequate to support the FTE for this level of effort account.

Corrective Action:

Update PACS to reflect the BAC equal to the EAC as soon as the C/SCR is approved and an implementation directive is received.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

WBS No. - 1.2 WBS Manager -
 WBS Title - YUCCA MOUNTAIN PROJECT
 Parent WBS No. - Parent WBS Manager -
 Parent WBS Title -

Statement of Work

See the current WBS Dictionary

Cost/Schedule Performance

Id	Description	Current Period					FY1994 Cumulative to Date					FY1994 at Completion		
		BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	5	5	6	0	-1	41	41	38	0	3	62	62	0
1.2.3	SITE INVESTIGATIONS	1972	1594	1594	-378	0	12745	11935	12100	-810	-165	21997	24165	-2168
1.2.5	REGULATORY	109	109	107	0	2	795	798	734	3	64	1194	1185	9
1.2.9	PROJECT MANAGEMENT	121	121	94	0	27	741	741	718	0	23	1225	1229	-4
1.2.11	QUALITY ASSURANCE	159	159	167	0	-8	1264	1264	1304	0	-40	1900	1913	-13
1.2.12	INFORMATION MANAGEMENT	41	41	36	0	5	333	333	308	0	25	530	520	10
1.2.13	ENVIRONMENT, SAFETY, & HRA	59	184	45	125	139	306	306	262	0	44	543	481	62
1.2.15	SUPPORT SERVICES	24	24	22	0	2	191	191	167	0	24	287	281	6
Total		2490	2237	2071	-253	166	16416	15609	15631	-807	-22	27738	29836	-2098

Resource Distributions by Element of Cost

Fiscal Year 1994

Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	17791	18184	18921	20781	20343	21355	25689	29651	29630	28008	26447	26339	283139
LABOR	980	1046	1216	1272	1273	1368	1634	1655	1644	1557	1613	1711	16969
SUBS	588	624	696	790	758	667	770	746	733	710	991	694	8767
CAPITAL	0	0	197	41	0	0	6	89	1002	90	0	577	2002
Total BCWS	1568	1670	2109	2103	2031	2035	2410	2490	3379	2357	2604	2982	27738

Actual Cost of Work Performed

LBRHRS	11856	12411	12139	14734	18465	18096	16085	15265	0	0	0	0	119051
LABOR	713	832	1588	1272	1102	1284	1597	1240	0	0	0	0	9628
SUBS	583	652	685	782	664	809	755	799	0	0	0	0	5729
CAPITAL	4	0	185	29	23	0	1	32	0	0	0	0	274
Total ACWP	1300	1484	2458	2083	1789	2093	2353	2071	0	0	0	0	15631

WBS No. - 1.2 -YUCCA MOUNTAIN PROJECT

Fiscal Year 1994	Resource Distributions												Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
BCWS	1568	1670	2109	2103	2031	2035	2410	2490	3379	2357	2604	2982	27738
BCWP	1541	1656	1952	2116	1764	2134	2209	2237	0	0	0	0	15609
ACWP	1300	1484	2458	2083	1789	2093	2353	2071	0	0	0	0	15631
ETC	0	0	0	0	0	0	0	0	3653	2740	3506	4306	14205

	Fiscal Year Distribution											At Complete	
	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003		Future
BCWS	24644	27738	51462	48901	42359	29995	19018	9564	5128	97	0	0	258906
BCWP	23158	15609	0	0	0	0	0	0	0	0	0	0	
ACWP	23430	15631	0	0	0	0	0	0	0	0	0	0	
ETC	0	14205	51112	48391	42120	29660	18703	9770	5048	2262	0	0	260332

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey
 Date Prepared 06/13/94 10:53

MONTHLY COST/FTE REPORT

Fiscal Month/Year MAY 1994
 Page 1 of 1

WBS ELEMENT	<u>CURRENT MONTH END</u>				<u>FISCAL YEAR</u>				
	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON HOURS	PURCHASE COMMITMENTS	SUBCON COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMULATIVE COSTS
1.2.1	6	40	0	0	0		62		38
1.2.3	1556	12753	11011	333	2607		20950		11838
1.2.5	107	1068	626	0	100		1175		711
1.2.9	94	638	606	0	131		1225		716
1.2.11	168	718	1814	0	347		1900		1300
1.2.12	36	48	1149	0	199		530		307
1.2.13	46	0	0	0	0		483		262
1.2.15	22	0	450	0	73		287		167
TOTALS	2035	15265	15656	333	3457		26612	0	15339

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/93 - 05/31/94

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
OG1194B Q-List Development and Maintenance	0.6	1.5	9.2	1.3	7.0	5.1	7.2	6.0	0.0	0.0	0.0	0.0	37.9
1.2.1.10	0.6	1.5	9.2	1.3	7.0	5.1	7.2	6.0	0.0	0.0	0.0	0.0	37.9
*1.2.1.1	0.6	1.5	9.2	1.3	7.0	5.1	7.2	6.0	0.0	0.0	0.0	0.0	37.9
**1.2.1	0.6	1.5	9.2	1.3	7.0	5.1	7.2	6.0	0.0	0.0	0.0	0.0	37.9
OG3194B1 Branch Coordination and Planning	31.0	41.7	59.2	29.3	44.0	36.5	85.4	-30.8	0.0	0.0	0.0	0.0	296.3
OG3194B2 M&I - Branch Administrative Services	28.7	14.7	81.4	13.5	18.8	56.2	48.1	36.2	0.0	0.0	0.0	0.0	296.6
OG3194G1 Geologic Studies Program Management	22.9	27.8	38.5	58.0	58.3	5.4	19.3	26.6	0.0	0.0	0.0	0.0	256.8
OG3194G2 QA Implementation GSP	20.5	21.3	16.2	20.9	16.1	23.1	20.4	22.5	0.0	0.0	0.0	0.0	161.0
OG3194H1 Hydrology Program Management	35.2	33.3	88.0	40.2	36.3	-4.5	54.3	103.5	0.0	0.0	0.0	0.0	386.3
OG3194H2 QA Implementation, Hydrology	13.0	13.5	20.5	8.6	10.8	17.4	15.2	9.6	0.0	0.0	0.0	0.0	108.6
OG3194H3 Computer Operation & Data Mgmt Hydrology	26.3	28.0	53.7	31.8	28.8	35.7	35.5	43.7	0.0	0.0	0.0	0.0	283.5
OG3194H4 Scientific Rpts/Proj Documents Hydrology	7.1	8.4	11.6	6.1	7.1	7.1	6.5	6.9	0.0	0.0	0.0	0.0	60.8
1.2.3.1	184.7	188.7	369.1	207.4	220.2	176.9	284.7	218.2	0.0	0.0	0.0	0.0	1849.9
*1.2.3.1	184.7	188.7	369.1	207.4	220.2	176.9	284.7	218.2	0.0	0.0	0.0	0.0	1849.9
OG32211A94 Surface/Subsurface Stratigraphic Studies	52.3	61.2	82.3	77.7	75.0	128.0	87.3	49.2	0.0	0.0	0.0	0.0	613.0
OG32211B94 Surface-Based Geophysical Surveys	0.0	0.9	1.5	53.9	26.6	23.4	15.9	0.6	0.0	0.0	0.0	0.0	122.8
OG32211C94 Borehole Geophysical Surveys	0.0	0.0	6.4	58.9	21.4	16.8	-29.4	-2.0	0.0	0.0	0.0	0.0	72.1
1.2.3.2.2.1.1	52.3	62.1	90.2	190.5	123.0	168.2	73.8	47.8	0.0	0.0	0.0	0.0	807.9
OG32212A94 Geologic Mapping of Zonal Features	61.7	83.1	80.1	77.8	64.3	79.5	54.3	87.2	0.0	0.0	0.0	0.0	588.0
OG32212B94 Surface-fracture Network Studies	0.0	0.0	13.9	0.6	21.7	1.1	6.5	6.3	0.0	0.0	0.0	0.0	50.1
OG32212D94 Geologic Mapping of the ES and Drifts	31.5	30.6	65.4	44.9	49.7	60.5	56.5	57.2	0.0	0.0	0.0	0.0	396.3
1.2.3.2.2.1.2	93.2	113.7	159.4	123.3	135.7	141.1	117.3	150.7	0.0	0.0	0.0	0.0	1034.4
OG32531A94 Tectonic Effects	4.0	2.0	7.4	-3.3	0.6	3.8	-0.2	0.3	0.0	0.0	0.0	0.0	14.6
1.2.3.2.5.3.1	4.0	2.0	7.4	-3.3	0.6	3.8	-0.2	0.3	0.0	0.0	0.0	0.0	14.6
OG32552C94 Heat Flow at Yucca Mountain	0.0	0.0	0.0	21.9	0.0	0.0	26.1	0.0	0.0	0.0	0.0	0.0	48.0
1.2.3.2.5.5.2	0.0	0.0	0.0	21.9	0.0	0.0	26.1	0.0	0.0	0.0	0.0	0.0	48.0
OG32621A94 Surface Facilities Exploration Program	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	4.6
1.2.3.2.6.2.1	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	4.6
OG32831A94 Identify Relevant Earthquake Sources	4.6	9.0	10.4	-5.0	4.1	14.6	6.5	15.8	0.0	0.0	0.0	0.0	60.0
OG32831B94 Characterize 10,000-yr Slip Earthquakes	0.0	0.0	0.0	32.7	-3.5	18.7	-14.5	1.0	0.0	0.0	0.0	0.0	34.4
1.2.3.2.8.3.1	4.6	9.0	10.4	27.7	0.6	33.3	-8.0	16.8	0.0	0.0	0.0	0.0	94.4
OG32833A94 Empirical Earthquake Model	0.6	0.2	-0.8	20.0	0.0	8.7	2.5	0.0	0.0	0.0	0.0	0.0	31.2
1.2.3.2.8.3.3	0.6	0.2	-0.8	20.0	0.0	8.7	2.5	0.0	0.0	0.0	0.0	0.0	31.2
OG32834A94 Site Effects from Ground-Motion	0.0	0.0	14.5	6.2	-18.4	17.7	5.0	1.5	0.0	0.0	0.0	0.0	26.5
1.2.3.2.8.3.4	0.0	0.0	14.5	6.2	-18.4	17.7	5.0	1.5	0.0	0.0	0.0	0.0	26.5
OG32841A94 Compile Historical Earthquake Record	0.8	0.0	1.0	2.6	1.0	28.6	15.0	2.4	0.0	0.0	0.0	0.0	51.4
OG32841B94 Monitor Current Seismicity	80.0	109.8	102.8	115.5	141.3	47.2	117.6	90.8	0.0	0.0	0.0	0.0	805.0

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	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
	EST	EST	EST	EST	EST								
1.2.3.2.8.4.1	80.8	109.8	103.8	118.1	142.3	75.8	132.6	93.2	0.0	0.0	0.0	0.0	856.4
OG32842B94 Conduct Expl. Trenching in Midway Valley	0.0	0.0	0.0	105.0	15.9	5.5	11.9	1.4	0.0	0.0	0.0	0.0	139.7
1.2.3.2.8.4.2	0.0	0.0	0.0	105.0	15.9	5.5	11.9	1.4	0.0	0.0	0.0	0.0	139.7
OG32843B94 Eval Quaternary faults w/i 100 km of YM	13.2	26.4	14.6	6.0	37.7	22.6	10.8	26.7	0.0	0.0	0.0	0.0	158.0
OG32843D94 Evaluate Bare Mountain Fault Zone	21.6	26.3	25.5	13.1	8.7	16.0	2.6	10.2	0.0	0.0	0.0	0.0	124.0
1.2.3.2.8.4.3	34.8	52.7	40.1	19.1	46.4	38.6	13.4	36.9	0.0	0.0	0.0	0.0	282.0
OG32844A94 Evaluate the Rock Valley Fault System	6.9	19.4	9.8	17.5	-0.4	-0.9	5.1	7.1	0.0	0.0	0.0	0.0	64.5
OG32844B94 Evaluate the Mine Mountain Fault System	0.0	6.8	-6.8	1.0	0.0	-1.0	4.3	1.9	0.0	0.0	0.0	0.0	6.2
1.2.3.2.8.4.4	6.9	26.2	3.0	18.5	-0.4	-1.9	9.4	9.0	0.0	0.0	0.0	0.0	70.7
OG32845B94 Evaluate Postulated Detachment Faults	3.4	2.2	13.1	30.9	-12.8	12.2	9.5	12.7	0.0	0.0	0.0	0.0	71.2
OG32845C94 Evaluate Potential Relationship of Brecc	0.0	0.0	2.6	0.8	5.7	1.3	0.8	0.1	0.0	0.0	0.0	0.0	11.3
OG32845D94 Evaluate Postulated Detachment Faults	0.0	0.0	0.0	0.0	0.0	0.2	0.3	1.1	0.0	0.0	0.0	0.0	1.6
OG32845E94 Eval Age of Detachment Faults - Radiomet	0.0	0.0	0.0	0.0	0.0	0.0	3.6	6.7	0.0	0.0	0.0	0.0	10.3
1.2.3.2.8.4.5	3.4	2.2	15.7	31.7	-7.1	13.7	14.2	20.6	0.0	0.0	0.0	0.0	94.4
OG32846B94 Evaluate Age and Recurrence of Movement	21.1	3.2	47.9	26.9	49.5	40.5	26.9	101.9	0.0	0.0	0.0	0.0	317.9
1.2.3.2.8.4.6	21.1	3.2	47.9	26.9	49.5	40.5	26.9	101.9	0.0	0.0	0.0	0.0	317.9
OG3284AA94 Relevel Base-Station Network, YM	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	0.0	0.0	0.0	0.0	5.0
1.2.3.2.8.4.10	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.0	0.0	0.0	0.0	0.0	5.0
OG3284CA94 Eval Tectonic Process/Stability at Site	0.0	0.0	2.2	10.1	15.6	6.4	-14.7	-7.7	0.0	0.0	0.0	0.0	11.9
OG3284CB94 Evaluate Tectonic Models	0.0	0.6	1.7	-1.3	5.8	29.2	24.2	26.3	0.0	0.0	0.0	0.0	86.5
1.2.3.2.8.4.12	0.0	0.6	3.9	8.8	21.4	35.6	9.5	18.6	0.0	0.0	0.0	0.0	98.4
*1.2.3.2	301.7	381.7	495.5	714.4	509.5	580.6	442.0	500.7	0.0	0.0	0.0	0.0	3926.1
OG33111A94 Precipitation/Meteorological Monitoring	10.7	12.7	24.7	12.7	7.0	18.7	23.5	36.5	0.0	0.0	0.0	0.0	146.5
1.2.3.3.1.1.1	10.7	12.7	24.7	12.7	7.0	18.7	23.5	36.5	0.0	0.0	0.0	0.0	146.5
OG33112A94 Surface-Water Runoff Monitoring	25.3	33.2	37.2	33.8	32.0	24.6	21.8	20.7	0.0	0.0	0.0	0.0	228.6
1.2.3.3.1.1.2	25.3	33.2	37.2	33.8	32.0	24.6	21.8	20.7	0.0	0.0	0.0	0.0	228.6
OG33113B94 Regional Potentiometric Level Distributi	5.4	6.7	4.1	7.9	4.0	3.0	3.9	4.2	0.0	0.0	0.0	0.0	39.2
OG33113C94 Forty-mile Wash Recharge Study	5.6	5.2	8.7	3.4	5.7	6.0	5.6	5.7	0.0	0.0	0.0	0.0	45.9
1.2.3.3.1.1.3	11.0	11.9	12.8	11.3	9.7	9.0	9.5	9.9	0.0	0.0	0.0	0.0	85.1
OG33114B94 Subregional Two-Dimensional Areal Hydrol	0.0	0.0	0.0	1.8	1.5	6.0	5.6	3.4	0.0	0.0	0.0	0.0	18.3
OG33114D94 Regional 3-D Hydrology Modeling	3.9	5.3	10.6	7.3	6.5	6.4	8.1	9.3	0.0	0.0	0.0	0.0	57.4
1.2.3.3.1.1.4	3.9	5.3	10.6	9.1	8.0	12.4	13.7	12.7	0.0	0.0	0.0	0.0	75.7
OG33121A94 Char Hydr Prop of Surficial Material	25.7	28.0	20.0	20.5	9.7	21.4	24.5	10.6	0.0	0.0	0.0	0.0	160.4
OG33121B94 Evaluation of Natural Infiltration	5.1	49.7	52.5	19.2	26.3	51.5	40.6	28.6	0.0	0.0	0.0	0.0	273.5
OG33121C94 Evaluation of Artificial Infiltration	0.0	0.0	12.0	13.3	12.9	10.0	42.7	17.7	0.0	0.0	0.0	0.0	108.6
1.2.3.3.1.2.1	30.8	77.7	84.5	53.0	48.9	82.9	107.8	56.9	0.0	0.0	0.0	0.0	542.5
OG33123A94 Matrix Hydrologic-Properties Testing	13.1	29.9	38.7	59.0	-29.3	41.3	43.4	23.0	0.0	0.0	0.0	0.0	219.1

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	EST	EST	EST	EST	EST	EST							
OG33123B94 Surface-Based Borehole Studies	57.7	59.1	101.8	143.7	78.0	152.1	223.2	201.0	0.0	0.0	0.0	0.0	1016.6
OG33123C94 Vertical Seismic Profiling	5.7	12.9	38.6	-1.5	11.7	20.8	27.0	17.9	0.0	0.0	0.0	0.0	133.1
OG33123D94 Integrated Data Acquisition System	24.3	26.8	27.1	19.7	38.3	24.3	28.4	35.8	0.0	0.0	0.0	0.0	224.7
OG33123E94 Air-Permeability/Gaseous-Tracer Testing	16.8	19.7	22.4	28.9	60.0	27.1	52.0	9.8	0.0	0.0	0.0	0.0	236.7
OG33123F94 USW UZ-14 Support	33.8	12.6	20.7	4.6	13.3	27.2	37.1	37.7	0.0	0.0	0.0	0.0	187.0
1.2.3.3.1.2.3	151.4	161.0	249.3	254.4	172.0	292.8	411.1	325.2	0.0	0.0	0.0	0.0	2017.2
OG33124A94 Prototype Testing of Intact Fractures	22.0	32.4	36.7	37.3	27.8	37.8	45.5	40.5	0.0	0.0	0.0	0.0	280.0
OG33124B94 Prototype Infiltration Testing	9.3	14.6	19.8	12.2	8.7	10.1	12.4	7.1	0.0	0.0	0.0	0.0	94.2
OG33124D94 Radial Borehole Testing	0.0	0.0	8.6	32.0	40.6	23.0	114.1	46.6	0.0	0.0	0.0	0.0	264.9
OG33124E94 Prototype Excavation Effects Testing	7.8	10.4	13.3	3.9	4.0	13.0	24.9	23.3	0.0	0.0	0.0	0.0	100.6
OG33124G94 Prototype Perched-Water Testing	0.0	0.0	4.0	1.3	1.1	5.3	2.6	5.4	0.0	0.0	0.0	0.0	19.7
OG33124H94 Hydrochemistry tests in the ESP	6.0	7.7	8.7	5.7	0.5	16.5	9.9	14.4	0.0	0.0	0.0	0.0	69.4
OG33124J94 Major Faults in the ESP	9.8	7.4	17.7	-3.0	-1.6	4.7	-2.4	0.0	0.0	0.0	0.0	0.0	32.6
1.2.3.3.1.2.4	54.9	72.5	108.8	89.4	81.1	110.4	207.0	137.3	0.0	0.0	0.0	0.0	861.4
OG33126A94 Gaseous-Phase Circulation Study	7.8	10.5	32.4	40.7	7.1	25.5	57.0	-23.3	0.0	0.0	0.0	0.0	157.7
1.2.3.3.1.2.6	7.8	10.5	32.4	40.7	7.1	25.5	57.0	-23.3	0.0	0.0	0.0	0.0	157.7
OG33127A94 Gaseous-Phase Chemical Investigations	12.5	13.7	16.3	8.4	21.8	5.5	17.4	14.6	0.0	0.0	0.0	0.0	110.2
OG33127B94 Aqueous-Phase Chemical Investigations	9.8	7.3	16.0	15.9	11.4	27.9	12.2	20.3	0.0	0.0	0.0	0.0	120.8
1.2.3.3.1.2.7	22.3	21.0	32.3	24.3	33.2	33.4	29.6	34.9	0.0	0.0	0.0	0.0	231.0
OG33128A94 Development of Conceptual and Numerical	0.0	0.0	0.0	14.6	11.9	10.6	10.5	12.2	0.0	0.0	0.0	0.0	59.8
1.2.3.3.1.2.8	0.0	0.0	0.0	14.6	11.9	10.6	10.5	12.2	0.0	0.0	0.0	0.0	59.8
OG33129A94	0.0	0.0	0.0	14.3	15.5	29.4	21.3	17.4	0.0	0.0	0.0	0.0	97.9
1.2.3.3.1.2.9	0.0	0.0	0.0	14.3	15.5	29.4	21.3	17.4	0.0	0.0	0.0	0.0	97.9
OG33131B94 Site Potentiometric-Level Evaluation	30.9	31.1	56.4	46.5	33.9	38.4	72.9	42.6	0.0	0.0	0.0	0.0	352.7
OG33131C94 Anal Single/Mult-Well Hydraulic-Stress	5.2	2.8	6.3	1.5	2.1	4.7	-0.2	0.4	0.0	0.0	0.0	0.0	22.8
OG33131D94 Multiple-Well Interference Testing	11.7	26.2	38.1	38.1	20.5	1.1	11.7	-4.3	0.0	0.0	0.0	0.0	143.1
OG33131E94 Testing C-Hole Sites w/ Conserv Tracers	5.0	8.1	13.1	8.5	16.7	9.6	8.8	3.8	0.0	0.0	0.0	0.0	73.6
1.2.3.3.1.3.1	52.8	68.2	113.9	94.6	73.2	53.8	93.2	42.5	0.0	0.0	0.0	0.0	592.2
OG33132B94 Hydrochem Char of Water - Upper Part SZ	4.4	9.8	14.6	8.5	10.1	19.4	6.7	3.9	0.0	0.0	0.0	0.0	77.4
1.2.3.3.1.3.2	4.4	9.8	14.6	8.5	10.1	19.4	6.7	3.9	0.0	0.0	0.0	0.0	77.4
OG33133A94 Conceptualization of SZ Flow Models	3.8	3.9	15.3	4.8	6.1	8.3	4.1	2.9	0.0	0.0	0.0	0.0	49.2
OG33133B94 Development of Fracture-Network Model	5.3	5.8	-0.1	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6
1.2.3.3.1.3.3	9.1	9.7	15.2	4.4	6.1	8.3	4.1	2.9	0.0	0.0	0.0	0.0	59.8
*1.2.3.3	384.4	493.5	736.3	665.1	515.8	731.2	1016.8	689.7	0.0	0.0	0.0	0.0	5232.8
OG36212B94 Analysis of Stratigraphy - Sedimentology	11.3	12.3	21.9	13.4	15.2	16.5	13.0	26.6	0.0	0.0	0.0	0.0	130.2
1.2.3.6.2.1.2	11.3	12.3	21.9	13.4	15.2	16.5	13.0	26.6	0.0	0.0	0.0	0.0	130.2
OG36213A94 Analysis of Pack Rat Middens	0.0	0.0	36.3	1.4	4.5	-3.0	0.1	2.2	0.0	0.0	0.0	0.0	41.5

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	OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
1.2.3.6.2.1.3	0.0	0.0	36.3	1.4	4.5	-3.0	0.1	2.2	0.0	0.0	0.0	0.0	41.5
OG36214B94	0.0	0.0	14.9	6.7	3.3	6.4	8.7	8.4	0.0	0.0	0.0	0.0	48.4
1.2.3.6.2.1.4	0.0	0.0	14.9	6.7	3.3	6.4	8.7	8.4	0.0	0.0	0.0	0.0	48.4
OG36221C94 Evaluation of Past Discharge Areas	0.0	0.0	19.0	16.4	32.2	23.4	20.4	32.8	0.0	0.0	0.0	0.0	144.2
OG36221D94 Analog Recharge Sites	7.6	4.4	6.8	3.6	7.9	6.2	7.2	0.0	0.0	0.0	0.0	0.0	43.7
OG36221E94 Analog Recharge Sites	0.0	0.0	7.5	-0.2	6.4	1.1	1.6	4.9	0.0	0.0	0.0	0.0	21.3
OG36221F94 Calcite and Opaline Silica Vein Deposits	15.6	26.6	35.6	28.7	29.0	24.3	27.0	56.8	0.0	0.0	0.0	0.0	243.6
1.2.3.6.2.2.1	23.2	31.0	68.9	48.5	75.5	55.0	56.2	94.5	0.0	0.0	0.0	0.0	452.8
*1.2.3.6	34.5	43.3	142.0	70.0	98.5	74.9	78.0	131.7	0.0	0.0	0.0	0.0	672.9
OG3721A94 Geochemical Assessment of YM in Relation	2.3	7.7	8.1	33.6	40.3	26.3	23.3	15.0	0.0	0.0	0.0	0.0	156.6
1.2.3.7.2.1	2.3	7.7	8.1	33.6	40.3	26.3	23.3	15.0	0.0	0.0	0.0	0.0	156.6
*1.2.3.7	2.3	7.7	8.1	33.6	40.3	26.3	23.3	15.0	0.0	0.0	0.0	0.0	156.6
**1.2.3	907.6	1114.9	1751.0	1690.5	1384.3	1589.9	1844.8	1555.3	0.0	0.0	0.0	0.0	11838.3
OG52294B1 WRC Interaction Support	1.8	8.5	7.1	3.6	3.1	22.3	37.4	7.8	0.0	0.0	0.0	0.0	91.6
OG52294B2 Site Characterization Program	22.6	5.1	23.8	18.4	15.1	34.3	11.1	33.6	0.0	0.0	0.0	0.0	164.0
OG52294B3 Study Plan Coordination	1.0	19.7	-17.1	0.1	1.0	5.9	2.0	1.5	0.0	0.0	0.0	0.0	14.1
OG52294B4 Technical Status Report	2.7	0.0	0.0	0.0	0.0	9.7	1.6	-1.7	0.0	0.0	0.0	0.0	12.3
OG52294B5 Issue Resolution	0.0	0.0	0.0	0.0	1.7	0.0	-1.7	1.7	0.0	0.0	0.0	0.0	1.7
1.2.5.2.2	28.1	33.3	13.8	22.1	20.9	72.2	50.4	42.9	0.0	0.0	0.0	0.0	283.7
*1.2.5.2	28.1	33.3	13.8	22.1	20.9	72.2	50.4	42.9	0.0	0.0	0.0	0.0	283.7
OG53594B Technical Data Base Input	24.2	32.2	28.8	26.1	24.3	31.0	30.1	37.0	0.0	0.0	0.0	0.0	233.7
OG53594H Technical Data Base Control and Input	11.1	11.9	17.3	6.0	10.0	11.4	11.9	12.8	0.0	0.0	0.0	0.0	92.4
1.2.5.3.5	35.3	44.1	46.1	32.1	34.3	42.4	42.0	49.8	0.0	0.0	0.0	0.0	326.1
*1.2.5.3	35.3	44.1	46.1	32.1	34.3	42.4	42.0	49.8	0.0	0.0	0.0	0.0	326.1
OG54494H Site Performance Assessment	10.1	11.7	25.5	10.7	11.7	8.3	8.8	13.9	0.0	0.0	0.0	0.0	100.7
1.2.5.4.4	10.1	11.7	25.5	10.7	11.7	8.3	8.8	13.9	0.0	0.0	0.0	0.0	100.7
*1.2.5.4	10.1	11.7	25.5	10.7	11.7	8.3	8.8	13.9	0.0	0.0	0.0	0.0	100.7
**1.2.5	73.5	89.1	85.4	64.9	66.9	122.9	101.2	106.6	0.0	0.0	0.0	0.0	710.5
OG91294B Management and Integration (TPO)	21.5	21.2	55.3	20.1	30.7	43.1	101.6	29.7	0.0	0.0	0.0	0.0	323.2
1.2.9.1.2	21.5	21.2	55.3	20.1	30.7	43.1	101.6	29.7	0.0	0.0	0.0	0.0	323.2
*1.2.9.1	21.5	21.2	55.3	20.1	30.7	43.1	101.6	29.7	0.0	0.0	0.0	0.0	323.2
OG92294B Project Control	52.9	-7.4	114.1	37.5	45.4	45.0	41.3	64.1	0.0	0.0	0.0	0.0	392.9
1.2.9.2.2	52.9	-7.4	114.1	37.5	45.4	45.0	41.3	64.1	0.0	0.0	0.0	0.0	392.9
*1.2.9.2	52.9	-7.4	114.1	37.5	45.4	45.0	41.3	64.1	0.0	0.0	0.0	0.0	392.9
**1.2.9	74.4	13.8	169.4	57.6	76.1	88.1	142.9	93.8	0.0	0.0	0.0	0.0	716.1
OGB194Q QA-Coordination & Planning	23.4	25.3	30.9	18.9	24.6	29.0	18.9	32.1	0.0	0.0	0.0	0.0	203.1
1.2.11.1	23.4	25.3	30.9	18.9	24.6	29.0	18.9	32.1	0.0	0.0	0.0	0.0	203.1

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/93 - 05/31/94

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
*1.2.11.1	23.4	25.3	30.9	18.9	24.6	29.0	18.9	32.1	0.0	0.0	0.0	0.0	203.1
OGB294Q QA-Program Development	33.4	31.3	46.5	29.9	52.8	46.4	39.3	37.8	0.0	0.0	0.0	0.0	317.4
1.2.11.2	33.4	31.3	46.5	29.9	52.8	46.4	39.3	37.8	0.0	0.0	0.0	0.0	317.4
*1.2.11.2	33.4	31.3	46.5	29.9	52.8	46.4	39.3	37.8	0.0	0.0	0.0	0.0	317.4
OGB3194Q QA Verification-Audits	60.3	50.9	60.7	48.3	48.1	68.1	61.3	55.7	0.0	0.0	0.0	0.0	453.4
1.2.11.3.1	60.3	50.9	60.7	48.3	48.1	68.1	61.3	55.7	0.0	0.0	0.0	0.0	453.4
OGB3294Q Quality Assurance Verification - Surveill	9.1	28.9	15.2	21.5	23.7	22.1	18.7	17.7	0.0	0.0	0.0	0.0	156.9
1.2.11.3.2	9.1	28.9	15.2	21.5	23.7	22.1	18.7	17.7	0.0	0.0	0.0	0.0	156.9
*1.2.11.3	69.4	79.8	75.9	69.8	71.8	90.2	80.0	73.4	0.0	0.0	0.0	0.0	610.3
OGB594B QA-Quality Engineering	22.2	29.5	14.8	22.2	10.5	22.1	23.1	25.2	0.0	0.0	0.0	0.0	169.6
1.2.11.5	22.2	29.5	14.8	22.2	10.5	22.1	23.1	25.2	0.0	0.0	0.0	0.0	169.6
*1.2.11.5	22.2	29.5	14.8	22.2	10.5	22.1	23.1	25.2	0.0	0.0	0.0	0.0	169.6
**1.2.11	148.4	165.9	168.1	140.8	159.7	187.7	161.3	168.5	0.0	0.0	0.0	0.0	1300.4
OGC2294B Local Records Center Operations	32.8	38.3	29.5	35.5	26.7	29.3	29.9	29.3	0.0	0.0	0.0	0.0	251.3
1.2.12.2.2	32.8	38.3	29.5	35.5	26.7	29.3	29.9	29.3	0.0	0.0	0.0	0.0	251.3
OGC2394B Participant Records Management	3.6	8.7	6.6	7.2	8.1	7.3	7.1	6.7	0.0	0.0	0.0	0.0	55.3
1.2.12.2.3	3.6	8.7	6.6	7.2	8.1	7.3	7.1	6.7	0.0	0.0	0.0	0.0	55.3
*1.2.12.2	36.4	47.0	36.1	42.7	34.8	36.6	37.0	36.0	0.0	0.0	0.0	0.0	306.6
**1.2.12	36.4	47.0	36.1	42.7	34.8	36.6	37.0	36.0	0.0	0.0	0.0	0.0	306.6
OGD2594B Occupational Safety and Health	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.0	0.0	13.4
1.2.13.2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.0	0.0	13.4
*1.2.13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.4	0.0	0.0	0.0	0.0	13.4
OGD4794H Water Resources	32.9	27.8	32.9	29.7	32.4	32.7	27.8	32.1	0.0	0.0	0.0	0.0	248.3
1.2.13.4.7	32.9	27.8	32.9	29.7	32.4	32.7	27.8	32.1	0.0	0.0	0.0	0.0	248.3
*1.2.13.4	32.9	27.8	32.9	29.7	32.4	32.7	27.8	32.1	0.0	0.0	0.0	0.0	248.3
**1.2.13	32.9	27.8	32.9	29.7	32.4	32.7	27.8	45.5	0.0	0.0	0.0	0.0	261.7
OGP394B Training	19.6	22.3	13.9	20.9	21.2	23.5	23.4	22.2	0.0	0.0	0.0	0.0	167.0
1.2.15.3	19.6	22.3	13.9	20.9	21.2	23.5	23.4	22.2	0.0	0.0	0.0	0.0	167.0
*1.2.15.3	19.6	22.3	13.9	20.9	21.2	23.5	23.4	22.2	0.0	0.0	0.0	0.0	167.0
**1.2.15	19.6	22.3	13.9	20.9	21.2	23.5	23.4	22.2	0.0	0.0	0.0	0.0	167.0
1.2 OPERATING	1293.4	1482.3	2266.0	2048.4	1782.4	2086.5	2345.6	2033.9	0.0	0.0	0.0	0.0	15338.5
CAPITAL EQUIPMENT	0.0	0.0	0.0	31.7	22.6	0.0	0.5	32.2	0.0	0.0	0.0	0.0	87.0
GRAND TOTAL	1293.4	1482.3	2266.0	2080.1	1805.0	2086.5	2346.1	2066.1	0.0	0.0	0.0	0.0	15425.5
FTEs													
FEDERAL	87.2	91.5	89.4	108.4	135.5	134.3	118.2	111.5	0.0	0.0	0.0	0.0	
CONTRACT	55.4	89.0	82.4	97.7	89.3	101.1	100.6	107.0	0.0	0.0	0.0	0.0	
TOTAL	142.6	180.5	171.8	206.1	224.8	235.4	218.8	218.5	0.0	0.0	0.0	0.0	