

**LAWRENCE LIVERMORE NATIONAL LABORATORY YUCCA MOUNTAIN PROJECT
DECEMBER 1993 TECHNICAL HIGHLIGHTS AND STATUS REPORT
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**LAWRENCE LIVERMORE NATIONAL LABORATORY
(LLNL)
YUCCA MOUNTAIN PROJECT (YMP) STATUS REPORT**

December 1993

EXECUTIVE SUMMARY

(Items Proposed for Reporting in YMPO or OGD Reports)

1) WBS 1.2.1.5, Special Studies: In support of the thermal loading systems study, the impact of sub-repository-scale, buoyant, gas-phase convection on hydrothermal performance in the vicinity of emplacement drifts was studied. The most important observation concerns the substantial difference between thermal performance predicted by repository-scale models and that predicted by drift-scale models. For an areal mass loading (AML) of 24.2 MTU/acre, the repository-scale model predicts a peak temperature of 65°C, while the drift-scale model predicts peak temperatures of up to 172°C on the WP surface and 144°C in the rock adjacent the drift. While the repository-scale model predicts no boiling period, the drift-scale model predicts boiling for up to 350 yr on the WP surface. Another important observation about sub-repository-scale performance is that the peak temperature varies modestly for AMLs ranging from 24.2 to 55.3 MTU/acre. Because it occurs so early (generally the temperature peak occurs within 25 yr of emplacement), the peak temperature is relatively insensitive to whether the distance to the adjacent emplacement drift is 43.4 m or 99.0 m. For the high-AML cases, the drift spacing is small enough to cause the peak temperature to be sensitive to center-to-center drift spacing. Consequently, the peak temperature is significantly greater for the 110.5-MTU/acre case than for the 83.4-MTU/acre case. Another important observation is that the boiling duration is insensitive to sub-repository-scale, buoyant, gas-phase convection for the low- and high-AML cases (24.2, 35.9, and 110.5 MTU/acre) and modestly sensitive for intermediate-AML cases (55.3 and 83.4 MTU/acre). The spatial extent of moisture movement (i.e., dry-out and condensate buildup) is very dependent on the magnitude of sub-repository-scale, gas convection for the low-AML cases and insensitive for the high-AML cases.

2) WBS 1.2.2.2.1, Chemical and Mineralogical Properties of the Waste Package Environment: Study Plan 8.3.4.2.4.1, Characterization of Chemical and Mineralogical Changes in the Post Emplacement Environment, was submitted to YMPO, completing third level milestone MOL18.

3) WBS 1.2.2.2.2, Hydrologic Properties of the Waste Package Environment: For areal mass loadings (AMLs) of 27.1, 49.2, and 154.7 MTU/acre, we closely examined the net buildup in liquid water above the repository (ΔV) as a function of bulk permeability (k_b) between 10 millidarcy and 168 darcy. Because the model is an equivalent continuum formulation, non-equilibrium fracture flow (and hence much of the potential shedding) is not modeled; therefore, the predicted net water buildup is larger than that expected in the field. The dependence of ΔV vs k_b is

very nonlinear for the 27.1- and 49.2-MTU/acre cases. The water buildup increases abruptly at 1 darcy for the 49.2-MTU/acre case and at 10 darcy for the 27.1-MTU/acre case. Where the impact of mountain-scale, buoyant, gas-phase convection is greatest, the low- to intermediate-AML cases result in the largest ΔV . For intermediate- k_b (280 millidarcy to 1 darcy), where the impact of mountain-scale gas convection is relatively moderate, ΔV for the various AML cases generally varies by less than a factor of 2.

4) WBS1.2.2.2.4, Engineered Barrier System (EBS) Field Tests (Large Block Test): Drilling of vertical instrument holes in the large block is complete. The core had fewer minerals in the fractures than was anticipated. Preliminary indications are that the block will be suitable for planned tests of several thermal-hydrological hypotheses. A TV camera was used to log all of the holes and neutron logging was conducted in four holes to estimate the current moisture content in the block. The site is ready, and sawing is scheduled to begin in early January.

5) WBS 1.2.2.3.1.1, Waste Form Testing - Spent Fuel: Tests were initiated at ANL using non-YMP funds to evaluate the long-term performance of spent fuel in the potential repository under unsaturated conditions at 90°C. The tests include two with a saturated water vapor atmosphere; two tests with a drip rate of 0.075 ml/3.5 d which is representative of repository water flow conditions; and two tests with a drip rate of 0.75 ml/35.6 d to simulate the effect of a higher volume, less frequent water flow. A control test without fuel but with a 0.075 ml/3.5 d drip rate is also included. The EJ-13 water for the tests came from well J-13 and had been equilibrated with volcanic tuff for approximately 80 days at 90°C. The seven tests had ~450 days of testing at 90°C by the end of December. Similar tests on UO₂ have been ongoing for about eight years. LLNL-YMP has resumed funding of these experiments in FY94.

6) WBS 1.2.2.3.1.2, Waste Form Testing - Glass: The N2 tests (SRL actinide-doped glass) continued as scheduled with sampling occurring 12/22/93. This is the first sampling of these tests since 5/3/90. Aliquots were taken for pH, carbon anion, actinide, cation, and colloid analyses. The remaining liquid was stored for later analysis and use in potential tests. The glass samples from these tests were transferred to clean vessels with new gaskets and the tests were continued. These tests have now been in progress for 95 months.

7) WBS 1.2.2.3.2, Metal Barriers: For pitting corrosion, work continues on the sensitivity of the predicted median pit induction time, median number of pits, and median pit depth to the number of "cells" used in the stochastic simulations. At least several hundred cells are required to provide median values of pit quantity and depth that are independent of the number of cells used; the pit induction time appears to be less sensitive to the number of cells. The results of the numerical experiments performed this month using up to 10,000 cells show that the median number of pits and the median depth "saturate" at essentially constant values once the number of cells reaches approximately 400. The presence of this saturation

was not clear from the numerical experiments performed last month with fewer total cells.

8) WBS 1.2.3.10, Altered Zone Characterization and 1.2.3.12, Waste Package Environment Testing: WBS element 1.2.3.12 was created from WBS element 1.2.2.2. Transition of three of the five sub-elements to the new WBS has been approved by the YMPO CCB, and the other two will probably be approved in January. In addition, the two portions of WBS 1.2.2.3.4 have been moved to WBS 1.2.3.10 (subparts .3 and .4). A request has been made to transfer the FY94 funding between the old and new WBS elements. It is expected that the PACS system will require an additional month or two before it reports costs using the new WBS structure.

9) WBS 1.2.5.3.4, Geologic and Engineering Materials Bibliography of Chemical Species (GEMBOCHS): A reconnaissance and review of recently published thermodynamic data for Neptunium, Americium, Plutonium, and Technetium species continues. As needed and where appropriate, these data will be used to augment those already in GEMBOCHS until publication of the NEA-TDB critical reviews of the chemical thermodynamics of these species. During December, aqueous dissociation constants reported by Palmer, Silva, and Miller (1992) for approximately 300 aqueous Np, Pu, and Am complexes were incorporated.

10) WBS 1.2.5.4.2, Waste Package Performance Assessment: Participation in the Total System Performance Assessment 1993 (TSPA-2) continued. LLNL provided the SNL performance assessment team with time histories of spent fuel rod temperatures at the center of emplaced waste packages, for revised conservative boundary temperature histories. LLNL verified that the change in spent fuel and waste package effective thermal conductivity is small within the applicable temperature range, and hence a simple model could be used to adjust detailed calculations to the various cases. LLNL also completed text and graphics for six chapters of the SNL report on TSPA-2.

LLNL DELIVERABLES MET

(December 1993)

Milestone	WBS	Planned Date	Actual Date	Description	Comment
MOL08	1.2.2.3.4.1	11-30-93	12-08-93	Flow-through apparatus test phase completed.	Completes an FY93 action
MOL18	1.2.2.2.1	12-30-93	12-29-93	Submit study plan 8.3.4.2.4.1	Completes an FY93 action
MOL82	1.2.2.3.2	12-31-93	12-31-93	Progress report on corrosion modeling	
MOL88	1.2.5.4.2	12-31-93	12-28-93	Distribute YMIM collaborative code-in-development	
MOL92	1.2.5.4.2	01-25-94	12-28-93	Submit draft TSPA-2 text to SNL	
MOL95	1.2.2.3.4.2	12-17-93	12-07-93	Issue Activity Plan on Actinide Solubilities	Completes an FY93 action

LLNL DELIVERABLES NOT MET

(December 1993)

Milestone	WBS	Planned Date	Projected Date	Description	Comment
MOL19	1.2.2.2.4	12-30-93	01-14-94	Issue Activity Plan for the Large Block Test	will not affect critical path

Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 31-DEC-93

PARTICIPANT: LLNL PEM: SMITH WBS: 1.2.2.2.4
WBS TITLE: ENGINEERED BARRIER SYSTEM (EBS) FIELD TESTS
P&S ACCOUNT: 0L224

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	RAC	EAC	VAC	VACZ	TEAC	TCPI
754	831	560	59	7.8	107.8	253	31.1	145.2	2530	2265	265	10.5	1742	100.7

Analysis

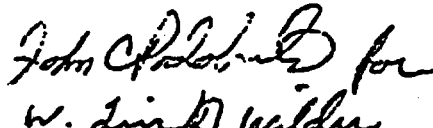
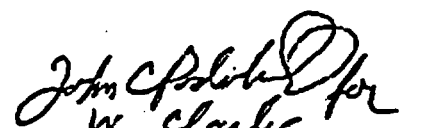
Cumulative Cost Variance:

The positive variance is caused primarily by the inclusion of FY93 carryover summary accounts for quarrying the large block and fabricating the loading frame. Carryover funds have been incorporated as BCWS for both accounts, but BCWP is still inaccurate. Original baseline finish dates were 9/30/93 and were changed to match the planned finish dates of 3/31/94 for the quarrying account and 7/14/94 for the frame account. LLNL feels this is an error and will be resolved during January.

Cumulative Schedule Variance:

Variance At Complete:

The variance at completion is an accurate summation of actuals in FY94. This will correct itself as effort increases in the Large Block area.

 <u>W. J. Walden</u> 1/20/94 P&S ACCOUNT MANAGER DATE	 <u>W. Charles</u> 1/20/94 TPO DATE
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Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 31-DEC-93

PARTICIPANT: LLNL PEM: SMITH

WBS: 1.2.2.3.1.1

WBS TITLE: WASTE FORM TESTING - SPENT FUEL

P&S ACCOUNT: QL2311

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCVS	BCVP	ACVP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
440	574	388	134	30.5	130.5	186	32.4	147.9	1785	1732	53	3.0	1207	90.1

Analysis

Cumulative Cost Variance:

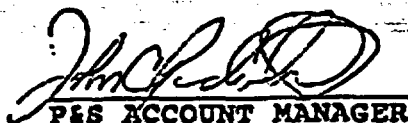
The cost variance in Spent Fuel is due to two FY93 summary accounts being carried over into FY94 awaiting completion of two milestones. Two reports from PNL arrived at LLNL and have been submitted to YMPO to complete the milestone requirements. No actual costs occurred but earned value was calculated upon closing of these summary accounts. The cost variance will remain in these accounts and will continue to appear in PACS until FY93 summary accounts are closed out by PACs.

Cumulative Schedule Variance:

The same situation as above applies for the schedule variance. FY94 activities are progressing as scheduled.

Variance At Complete:

The variance at completion is an accurate summation of actuals in FY94. This will correct itself as effort increases in dissolution tests and models.


P&S ACCOUNT MANAGER

11/14/94
DATE


TPO

11/14/94
DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

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	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
294	294	206	0	0.0	100.0	88.0	29.9	142.7	1250	1420	-170	-13.6	876	78.7

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

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

PARTICIPANT: SNL PEM: PERKINS WBS: 1.2.5.4.1

WBS TITLE: TOTAL SYSTEM PERFORMANCE ASSESSMENT

P&S ACCOUNT: 05541

FY 1994 Cumulative to Date									FY 1994 At Completion					
BCWS	BWP	ACWP	SV	SV%	SP1	CV	CV%	CP1	BAC	EAC	VAC	VAC%	TEAC	TCPI
317	417	560	100	31.5	131	-143	-34.3	74.5	1230	1243	-33	-2.7	1651	115.6

Analysis

Cumulative Cost Variance:

The majority of the cost overrun was caused by the effort to submit the TSPA-II report to DOE for programmatic review. This report would not have met the project schedule without the level-of-effort used during November and December. In addition to writing this report a Sandia Expert Panel Review Team, which was not budgeted for, also charged 264 hours.

Cumulative Schedule Variance:

The positive schedule variance is due to the completion of work in three FY 93 summary accounts. This work was scheduled to be completed in FY93, but resource constraints caused work to be delayed to the 1st quarter of FY94.

Variance At Complete:

NO VARIANCE AT THIS TIME

SNL will be monitoring cost for a potential cost overrun in this account.

W. George Perkins 1/12/94
P&S ACCOUNT MANAGER DATE
for H.A. Dockery, 6312

L. H. L. 1/14/94
TPO DATE

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

PARTICIPANT: SNL PEM: POTT- WBS: 1.2.4.2.1.1.1

WBS TITLE: IN SITU THERMOMECHANICAL PROPERTIES
DESIGN VERIFICATION 24 MAY 94

P&B ACCOUNT: 0842114

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	LV	CV%	CPI	BAC	EAC	VAC	VAC%	IRAC	ICPI
119	112	219	-7	-5.9	94.1	-101	-95.3	91.2	402	433	-33	-8.2	783	129.8

Analysis

Cumulative Cost Variance:

The cost overrun was due to increase efforts at the site to install geotechnical instrumentation for design verification methodology. The accelerated installation and reading of instrumentation at the Starter Tunnel and Alcove - NRST was a result of interactions with the Constructor so that SNL could use any down time to install all scheduled instrumentation.


The amount of resources allocated to this account was not properly funded by the Project Office. If additional budget is not allocated to this account work will stop. All instruments that will be used for reading in FY94 have been installed. Additional costs will predominantly incur for the reading of these instruments.

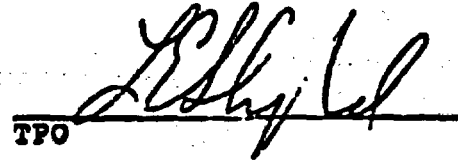
Cumulative Schedule Variance:

Variance At Complete:

None

Note: SNL will be monitoring cost for a potential cost overrun in this account.


P&B ACCOUNT MANAGER 1-13-94 DATE


TPO 1-14-94 DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: TYNAN

WBS: 1.2.3.2.2.1.2

WBS TITLE: Structural Features Within the Site Area

P&S ACCOUNT: OG32212

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SP1	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
416	416	367	0	0.0	100.0	49.0	11.8	113.4	1406	1537	-131	- 9.3	1240	84.6

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: SULLIVAN

WBS: 1.2.3.2.7.2.2

WBS TITLE: Site Ambient Thermal Conditions

P&S ACCOUNT: OG32722

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
7	0	0	-7	-100.0	0.0	0.0	0.0	0.0	80	0	80	100.0	0.0	0.0

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 a reduction in scope/budget due to reprogramming of funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: Sullivan WBS: 1.2.3.2.8.4.1

WBS TITLE: Historical and Current Seismicity

P&S ACCOUNT: OG32841

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
334	392	355	58	17.4	117.4	37	9.4	110.4	1693	1959	-266	-15.7	1534	81.1

Analysis

Cumulative Cost Variance:

Not applicable

Cumulative Schedule Variance:

Not applicable

Variance At Complete:

Cause:

The variance at completion is due to FY1993 carryover capital equipment of \$304,000. Because these are carryover funds, there is no BAC; however, the EAC remains at \$304,000.

Impact:

No impact

Corrective Action:

When approval is received to replan FY1993 capital equipment accounts into FY1994, the BAC will reflect the same as the EAC.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: SULLIVAN

WBS: 1.2.3.2.8.4.2

WBS TITLE: Location & Recency of Faulting Near Prospective Surface Facilities

P&S ACCOUNT: OG32842

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
71	12	0	-59	-83.1	16.9	12.0	100.0	0.0	110	175	-65	-59.1	0.0	56.0

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: SULLIVAN

WBS: 1.2.3.2.8.4.6

WBS TITLE: Quaternary Faulting Within The site Area

P&S ACCOUNT: OG32846

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
54	42	72	-12	-22.2	77.8	-30.0	-71.4	58.3	310	430	-120	-38.7	532.0	74.9

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: NEWBURY

WBS: 1.2.3.3.1.1.4

WBS TITLE: Regional Hydrologic System Synthesis & Modeling

P&S ACCOUNT: OG33114

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	TCPI
15	15	20	0	0.0	100.0	- 5.0	-33.3	75.0	100	175	- 75	-75.0	133.0	54.8

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.1

WBS TITLE: Unsaturated Zone Infiltration

P&S ACCOUNT: OG33121

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
102	102	193	0	0.0	100.0	-91.0	-89.2	52.8	675	968	-293	-43.4	1278.0	73.9

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: GANDI

WBS: 1.2.12.2.2

WBS TITLE: Local Records Center Operation (LRC)

P&S ACCOUNT: OGC22

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCMP	ACMP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VACX	IEAC	ICPI
100	100	101	0	0.0	100.0	-1.0	-1.0	99.0	400	350	50	12.5	404	120.5

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 a reduction in scope/budget due to reprogramming of funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval, and authorization to enter the BCWS for carryover capital equipment.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: SIMMONS

WBS: 1.2.5.3.5

WBS TITLE: Technical Data Base Input

P&S ACCOUNT: OG535

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
100	122	148	22	22.0	122.0	-26.0	- 21.3	82.4	400	527	-127	- 31.8	485.0	73.4

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: BJERSTEDT

WBS: 1.2.3.7.2.1

WBS TITLE: Natural Resource Assessment

P&S ACCOUNT: OG3721

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
19	13	18	-6	-31.6	68.4	- 5.0	- 38.5	72.2	60	225	-165	-275.0	83.0	22.7

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER	DATE	TPO	DATE
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**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: CRAWLEY

WBS: 1.2.3.6.2.2.1

WBS TITLE: Quaternary Regional Hydrology

P&S ACCOUNT: OG36221

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
60	60	125	0	0.0	100.0	-65.0	-108.3	48.0	200	577	-377	-188.5	417.0	31.0

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: PATTTERSON WBS: 1.2.3.3.1.3.2

WBS TITLE: Saturated Zone Hydrochemistry

P&S ACCOUNT: OG33132

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
18	18	29	0	0.0	100.0	-11	-61.1	62.1	120	172	- 52	-43.3	193	71.3

Analysis

Cumulative Cost Variance:

Not applicable

Cumulative Schedule Variance:

Not applicable

Variance At Complete:

Cause:

The variance at completion is due to FY1993 carryover capital equipment of \$41,000. Because these are carryover funds, there is no BAC; however, the EAC remains at \$41,000.

Impact:

No impact

Corrective Action:

When approval is received to replan FY1993 capital equipment accounts into FY1994, the BAC will reflect the same as the EAC.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

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	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
150	240	324	90	60.0	160.0	-84.0	-35.0	74.1	985	1253	-268	-27.2	1329	80.2

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending. Also, in this summary account, there is FY1993 carryover capital equipment. Because these are carryover funds, there is no BAC reflected at this time, only the EAC.

Impact:

None. BAC will equal EAC following official C/SCR approval, and authorization to enter the BCWS for carryover capital equipment.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.9

WBS TITLE: Site Unsaturated Zone Synthesis and Modeling

P&S ACCOUNT: OG33129

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCMP	ACMP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
0	0	0	0	0.0	0.0	0.0	0.0	0.0	0	200	-200	0.0	0.0	0.0

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.8

WBS TITLE: Fluid Flow in Unsaturated Zone Fractured Rock

P&S ACCOUNT: OG33128

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	0	134	-134	0.0	0.0	0.0

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.7

WBS TITLE: Unsaturated Zone Hydrochemistry

P&S ACCOUNT: OG33127

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPJ	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
51	51	76	0	0.0	100.0	-25.0	-49.0	67.1	425	602	-177	-41.6	633.0	71.1

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.4

WBS TITLE: Percolation in the Unsaturated Zone - ESF Study

P&S ACCOUNT: OG33124

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
405	390	238	-15	-3.7	96.3	152.0	39.0	163.9	2770	2295	475	17.1	1690	115.7

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 a reduction in scope/budget due to reprogramming of funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending.

Impact:

None. BAC will equal EAC following official C/SCR approval, and authorization to enter the BCWS for carryover capital equipment.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: December 31, 1993**

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					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
512	492	565	-20	-3.9	96.1	-73.0	-14.8	87.1	3890	4261	-371	- 9.5	4466	91.9

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 using underrun/reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCRs are pending. Also, in this summary account, there is FY1993 carryover capital equipment. Because these are carryover funds, there is no BAC reflected at this time, only the EAC.

Impact:

None. BAC will equal EAC following official C/SCR approval, and authorization to enter the BCWS for carryover capital equipment.

Corrective Action:

None required.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

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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	9	0	-4	15	15	12	0	3	62	59	3
1.2.3	SITE INVESTIGATIONS	1345	1403	1923	58	-520	3825	3841	3947	16	-106	20291	22845	-2554
1.2.5	REGULATORY	85	103	104	18	-1	252	274	271	22	3	1100	1198	-98
1.2.9	PROJECT MANAGEMENT	108	108	169	0	-61	324	324	258	0	66	1300	1224	76
1.2.11	QUALITY ASSURANCE	158	158	169	0	-11	472	472	484	0	-12	1900	1912	-12
1.2.12	INFORMATION MANAGEMENT	42	42	37	0	5	125	125	120	0	5	500	444	56
1.2.13	ENVIRONMENT, SAFETY, & HEA	31	31	33	0	-2	93	93	94	0	-1	543	544	-1
1.2.15	SUPPORT SERVICES	24	24	14	0	10	72	72	56	0	16	287	262	25
Total		1798	1874	2458	76	-584	5178	5216	5242	38	-26	25983	28488	-2505

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
LBRRRS	18526	19074	19882	21697	21177	21043	26078	26580	27199	25063	24064	24522	274905
LABOR	1095	1142	1174	1309	1273	1284	1645	1687	1728	1570	1511	1542	16960
SUBS	555	588	609	700	668	701	816	756	729	669	665	635	8091
CAPITAL	0	0	15	208	0	40	415	120	54	80	0	0	932
Total BCWS	1650	1730	1798	2217	1941	2025	2876	2563	2511	2319	2176	2177	25988

Actual Cost of Work Performed

[illegible]

Participant USGS

Yucca Mtn. Site Char. Project-Planning & Control System

01-Dec-93 to 31-Dec-93

PACS Participant Work Station (PPWS)

Page - 2

Prepared - 01/12/94:16:09:39

WBS Status Sheet (WBS02)

Inc. Dollars in Thousands

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	1650	1730	1798	2217	1941	2025	2876	2563	2511	2319	2176	2177	25983
BCWP	1630	1712	1874	0	0	0	0	0	0	0	0	0	5216
ACWP	1300	1484	2458	0	0	0	0	0	0	0	0	0	5242
ETC	0	0	0	2473	2043	2949	3110	2737	2925	2464	2288	2257	23246

	Fiscal Year Distribution												At
	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	Complete
BCWS	25852	25983	51462	48901	42359	29995	19018	9564	5128	97	0	0	258359
BCWP	23158	5216	0	0	0	0	0	0	0	0	0	0	
ACWP	23430	5242	0	0	0	0	0	0	0	0	0	0	
ETC	0	23246	51207	48802	42339	29806	18636	9654	5074	1047	0	0	258483

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey

MONTHLY COST/PTE REPORT

Fical Month/Year DECEMBER 1993Date Prepared 01/14/94 10:41Page 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	9	80	0		0		62		11
1.2.3	1751	9823	8053		1786		20291		3774
1.2.5	85	748	674		94		1100		248
1.2.9	169	796	428		277		1300		258
1.2.11	168	692	1430		769		1900		482
1.2.12	36	0	1108		352		500		119
1.2.13	33	0	0				543		94
1.2.15	14	0	309		184		287		56
<hr/>									
TOTALS	2265	12139	12002	0	3462		25983	0	5042



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

WBS 1.2.3
QA: N/A

NOV 04 1993

Larry R. Hayes
Technical Project Officer
for Yucca Mountain
Site Characterization Project
U.S. Geological Survey
101 Convention Center Drive
Suite 860
Las Vegas, NV 89109

FISCAL YEAR (FY) 1994 UNFUNDED AND UNDERFUNDED SITE SUITABILITY ACTIVITIES
(SCP: N/A)

Reference: Ltr, Hayes to Gertz, dtd 7/30/93

I appreciate your understanding of the difficult position that the Yucca Mountain Site Characterization Project (YMP) faces in this coming fiscal year due to underfunding. I share your concern about the apparent lack of funding for some of the critical U.S. Geological Survey (USGS) scientific investigation activities dealing with early site suitability determinations. I think that you correctly identified the weak points, namely the Tectonics, Climate, and Natural Resources Assessment programs and portions of the Hydrology and Rock Characteristics program.

I know that you have been actively working with the Regulatory & Site Evaluation Division work breakdown structure (WBS) managers and the Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) site integration staff to identify candidate areas for reprogramming of FY 1994 funds and resources to alleviate shortfalls based on an evolving understanding of the project needs in FY 1994. In addition, your presentation at the Technical Project Officers' budget concerns meeting of September 17, 1993, identified another potential source of resources, namely the reprogramming of FY 1993 USGS underruns of about \$1.2 million into the FY 1994 USGS technical program. I totally support this initiative.

On October 1, 1993, you suggested yet another source of resources, namely the reprogramming of a modest amount of FY 1994 USGS dollars from supporting WBS elements to the technical program. I agree to a shift of \$250K (WBS 1.2.3.1--\$125K, WBS 1.2.9.2.2--\$50K, WBS 1.2.12.2.2--\$50K, and WBS 1.2.15.3--\$25K) from infrastructure to the technical program with the understanding that these resources may need to be reinstated if support activities dip below an acceptable level. You also proposed reprogramming of \$570K funding within the technical program based on our evolving understanding of the needs of the program. I concur with your proposal to reprogram \$80K from WBS 1.2.3.2.7.2.2, \$135K from WBS 1.2.3.3.1.2.2, \$250K from WBS 1.2.3.3.1.2.3, and \$200K from WBS 1.2.3.3.1.2.4. I concur with your assessment that about \$250K in additional funds are needed for Lawrence Berkeley Laboratory in WBS Elements 1.2.3.3.1.2.6 and 1.2.3.3.1.2.9, and have instructed the PSED director to identify the source of this funding.

We reached an agreement on October 13, 1994, regarding the reallocation of all these funds, and you have agreed that a viable program could be developed using identified and reprogrammed funds which would ensure programmatic continuity.


NOV 04 1993

Larry R. Hayes

-2-

I realize that even with this reprogramming and shifting of funding, our program is still short about \$1 million of the funding you feel is necessary to support a minimal YMP/USGS "backbone" program. Although it may be a small consolation, rest assured that all elements within the project are feeling an exceptional squeeze this year due to the funding limitations. Regrettably at this time, these additional resources are simply not available. You have my assurance that programmatic status and priorities will be continually reevaluated during FY 1994, and we will move aggressively to reprogram resources to meet critical needs.

If you have any questions, please contact me at 794-7920.


J. Russell Dyer
Acting Project Manager

YMP:JRD-389

cc:
R. W. Craig, USGS, Las Vegas, NV
CCRU (2)



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

March 14, 1994

Vince Iorli
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, February 1994

Dear Vince:

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

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

Sincerely,

Raye E. Ritchey
for 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
C. Newbury, 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. Burke, TESS/Las Vegas
R. St. Clair, TESS/Las Vegas
D. Appel, USGS/Denver
M. Chornack, USGS/Denver
R. Craig, USGS/Las Vegas
L. Ducret, USGS/Denver
D. Gillies, USGS/Denver
R. Lucky, USGS/Denver
B. Parks, USGS/Denver
R. Ritchey, USGS/Denver
R. Spengler, USGS/Denver
J. Stuckless, USGS/Denver
J. Whitney, USGS/Denver

329 *Clair*
DIVISION
CC: *See Dist*
CC: *Just (12)*
CC: *ANSP / Wallace - cu 22*
CC: *Wright / Nelson, R - w/o*
CC: *Schiffcorrigot*
CC: *Wil*
CC: *Tynan*
CC: *Stacker*

REC'D IN YMP

3/21/94

I-354625

To

EXECUTIVE SUMMARY

February, 1994

WBS 1.2.3.1 - Coordination and Planning

United States Geological Survey-Yucca Mountain Project Branch (USGS_YMPB) is currently processing 70 hydrologic-related scientific publications, 62 geologic and climate-related scientific publications, 12 USGS-LBL hydrologic-related scientific publications, and 67 abstracts.

WBS 1.2.3.2 - Geology

Synthesis of new and existing borehole data continued with the selection of lithologic contacts in boreholes USW UZ-N11, USW UZ-N34, USW UZ-N57, USW UZ-N58, USW UZ-N59, and USW UZ-N61. Tables of contacts for them, along with those for boreholes USW UZ-N27 and USW UZ-N35 were prepared and forwarded for review; data from these boreholes also were sent to the 3-D modelers for incorporation into their site scale model.

For use in the 3-D site scale mode, construction of lithostratigraphic unit surfaces within LYNX was continued. The structure contour of the base of the Tiva Canyon Ash Flow Tuff was used as the base-line surface with contact altitudes at borehole locations, and structure contour maps for the unit were calculated. Draft surfaces, modeled one-foot thick, were used to review the model for consistency and accuracy with the drill-hole data and geology down to the top of the Topopah Tuff.

Measurement and completion of the stratigraphic section SC#2, from the west slope of Yucca Mountain across Yucca Crest from Antler Ridge, was completed and the preliminary data forwarded for inclusion in the site-scale model.

An isopach map for the nonwelded to partly welded top of the crystal-rich caprock of the Topopah Spring tuff was developed; this new subdivision within the caprock represents a major contact within the thermo-mechanical stratigraphy and the hydrogeologic stratigraphy. Model surfaces in the 3-D litho stratigraphic model above the Topopah Spring Tuff were checked for accuracy.

In the lithologic logging of selected new boreholes, collaboration was begun on identification of tuff unit "x" in boreholes UE-25 NRG#2B, UE-25 NRG#UE-2C, and UE-25 NRG#2D. Lithology of core from UE-25 NRG-7/7A was observed; preliminary examination indicates that the base of the Topopah Spring Tuff in that area is about 1,493 feet below land surface.

Surface-based geophysics staff completed terrain corrections for gravity data from all 28 stations in preparation for future geophysical models; preliminary magnetic model figures representing a general idea of magnetic profiles were prepared.

Further processing of the Vertical Seismic Profiling (VSP) and reflection data by LBL/USGS staff showed a systematic change in velocity structure between the results at USW WT-2 and UE-25 NRG-6 and also a difference in the reflection data from Line 1 to Line 2. A depth section along Line 1 was produced using the velocity obtained from the VSP in USW WT-2; this depth section was consistent with reflections identified in the VSP at USW WT-2.

In support of surface and subsurface stratigraphic studies, about 124, 1/2-in. plugs were obtained from core samples from UE25 NRG-2A, UE25 NRG-3, and USW GU-3. These samples were taken as part of a detailed geochemical and petrographic study of the upper cliff and cap-rock units of the Tiva Canyon Tuff.

Variations in Sr isotopic composition from pumped and bailed ground-water samples were examined in support of the evaluation of past discharge areas. It was noted that isotopic ratios of water representative of the perched-water reservoir are identical in samples obtained by pumping and by bailing and are distinct from those in J-13 water used to drill previous nearby holes and to prime the pump used in USW UZ-14. Instead, strontium isotope compositions are within the range of pedogenic carbonate and unsaturated zone calcite fracture fills and are compatible with an infiltration source. In addition, concentrations of uranium in the samples, like those of the strontium isotopes, preclude J-13 water as unadulterated source of perched water.

Filtered particulates obtained from USW UZ-14 pump test 1 were analyzed by XRF and show non-detectable or insignificant amounts of Ba, Rb, and Sr, which would reflect a wall-rock contaminant, but showed high concentrations of Pb and Zn as well as elevated levels of Cu, Cr, and S. These latter elements are only present in trace amounts (<10 ppm) in the felsic tuffs of the Paintbrush Group and therefore must be of anthropogenic origin, presumably through contamination from drilling or pump emplacement.

Cleaning, mapping, and flagging stratigraphy and structures was completed on walls 1 and 2 as part of the study to evaluate the age and movement of faults within the Site area. The flagged contacts were photographed in preparation for compiling preliminary logs of walls 1 and 2.

Seven topographic profiles across fault scarps at Solitario Canyon and north Windy Wash sites were measured as part of the scarp-degradation study, North Windy Wash. Age-dating samples for the faults have been prepared and are ready for analyses at the University of Tucson.

WBS 2.3.3 - Hydrology

Minor precipitation was recorded for the monitoring network on February 3-7, 11, and 17-19. Average cumulative precipitation for the month measured at all network sites was about 0.9 inches. Total precipitation measured at the Nevada Test Site ranged from 0.4 to 1.5 inches; precipitation at other regional sites ranged from 0.2 to 0.9 inches. There was no runoff recorded or reported at any of the Yucca Mountain streamflow-monitoring sites; base flow at the Amargosa River at Tecopa, California was about 0.8 cfs for the month.

Neutron access hole 85 was logged with the gamma-gamma, neutron-neutron tools to determine the location of a number of washout zones known to exist behind the casing; location of the zones is important for interpretation of the hand-held neutron probe measurements used in unsaturated zone infiltration studies. Neutron access holes N 5, 6, 7, 8, 63, and USW UZ-4 were logged with the gamma-gamma, neutron-neutron tools; USW UZ-4 was also logged with the 3-arm caliper and single-point resistivity tools. These data will be used to determine wet and dry density, porosity, and moisture content, and depth to bedrock.

Surface-based air-permeability testing in USW UZ-16 continued with air injection testing conducted in the Topopah Spring lower lithophysal zone and in the lower non-lithophysal zone. It is estimated

that the more than 200 tests conducted in USW UZ-16 will require about 500 man hours to complete the preliminary analysis for permeability values.

Three USW UZ-14 core samples from the Pah Canyon and three from the Topopah Spring formations were compressed by high-pressure, one-dimensional compression. Water yields ranged from 0 ml from two densely-welded Topopah Spring cores with moisture contents <3 percent, up to 26 ml. Four of the tests produced sufficient quantities of water for the required analyses. Six other core samples from USW UZ-14 were distilled to obtain pore-water samples for analysis for tritium, $^{16}\text{O}/^{18}\text{O}$, and D/H.

Percolation testing in the ESF continued with a restart of the large-block experiment. Currently, water is continuously flowing through the block fractures at about 8 cm³/hr; the average water pressure along the block top is between -9 and -10 cm of water. Measurements of water pressure in the block matrix and fracture are being made with tensiometers.

With the starter tunnel blasted and drilled to 200 ft in the ESF, Alcove #1 excavated to final depth, and the first borehole completed, no natural water flows have been encountered. Hydrochemistry testing in the ESF to determine the possible effects of shotcreting were begun. Initial results from laboratory tests of two samples indicate that the shotcrete can consume as much carbon dioxide as it is exposed to; limitation of the use of shotcrete appears to be warranted. Core samples from the completed borehole were collected and sealed, and a pressure transducer and thermocouple were connected to the face of the borehole to monitor changes during drilling of the next two boreholes.

A 2-D numerical model of the unsaturated zone beneath Pagany Wash was created and run with the TOUGH code to examine the tendency for localized sources of infiltration to spread laterally with depth as a result of stratigraphic heterogeneity. In this case, infiltration at a rate of 20 mm/yr was assumed to be focused within Pagany Wash, against a background infiltration rate of 0.1 mm/yr. Preliminary results indicate that a substantial spreading will occur, with vertical flux entering the repository unit uniformly and in the sub-mm/yr range.

In support of the evaluation of site potentiometric levels, 18 water-level zones were monitored in 17 wells on a monthly basis (manually) and 17 zones in 11 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 11 wells using Data Collection Platforms (DCP's).

Packer installation in all three holes at the C-Hole Complex was completed in late January and electric signal values from the transducers and thermistors in all three holes are being collected by the data acquisition system and stored on a 1- gigabyte hard disk. The first diskette containing data from the experiment covering data obtained through 2/16/94 was transmitted to the LRC.

WBS 1.2.3.6 - Climate

From cores of lake/playa/marshes acquired from Desert Research Institute (DRI), ostracode counts were initiated of Late Holocene sediments in the southern Pahrangat Marshes; 29 samples were processed from cores taken in various playas in southern Nevada; 196 samples were prepared for $\delta^{18}\text{O}$ analyses from late glacial marsh deposits and from various springs; calcareous microfossils from modern lake samples were extracted for addition to the modern database; and ostracodes were extracted from late Pleistocene and early Holocene sediments in the Sevier Basin.

Studies of calcite and opaline silica deposits continued with the monitoring of soil gas CO₂ concentrations and collection of soil gas and soil moisture samples for isotopic analysis. Permanent soil temperature probes were installed at the Fortymile Wash, Fran Ridge, Pagany Wash, and Beatty sites; lateral soil gas sampling arrays were installed at Beatty and Pagany Wash.

WBS 1.2.3.7 - Resource Potential

In support of geochemical assessment studies of Yucca Mountain, oxygen isotope data obtained from 18 samples from a vertical section of Tiva Canyon Tuff at Antler Ridge were examined. These data will serve as baseline information for assessing the regional variation in $\delta^{18}\text{O}$. Values for $\delta^{18}\text{O}$ from this section range from +8.4 to +10.1 per mil. The boundary between the upper lithophysal and upper cliff zones may be marked by a one per mil enrichment in $\delta^{18}\text{O}$. Typically, the effects of wall-rock interaction with hydrothermal fluids results in a marked depletion of $\delta^{18}\text{O}$, producing values near zero or less.

WBS 1.2.12 - Information Management

All records were received into the LRC within the 15-day submittal requirement with 100 percent accuracy. All records were transmitted to the CRF within procedure required time. The LRC received 247 individual records, 30 non-data criteria packages, 15 data packages, no publication packages, and 1 cited reference list.

WBS 1.2.13 - Environment, Safety, and Health

In support of water-resources monitoring, ground-water levels were measured at 28 sites; discharge was measured at five springs. Ground-water data collected during January were checked and filed. Site location and construction data for two new wells, CF-3 and AD-3a, were entered into the data base and permanent elevation reference marks installed.

USGS LEVEL 3 MILESTONE REPORT
OCTOBER 1, 1993 - FEBRUARY 28, 1994
 Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
RPT/TDIF: EXCAVATED TRENCHES SOLITARIO CNYN FLT Milestone Number: 3GPF20M	01/28/93	04/29/94		
PUB: METEOROLOGICAL DATA FY92-94, ARID-ZONE INFL Milestone Number: 3GQH001M	02/26/93	08/31/94		
REPORT/TDIF: 14 C/D TRENCH STUDIES Milestone Number: 3GPF036M	03/31/93	05/31/94		
PUB: STRUCTURAL FLOW-PATH ANALYS W/TRANSPT & CHEM Milestone Number: 3GFH009M	03/31/93	05/31/94		
G300: FINAL RPT, CROSS-HOLE PROTOTYPE TESTING Milestone Number: 3GUT004M	03/31/93	05/31/94		
RPT/TDIF: RESULTS OF LOGGING FROM TRENCH 17 Milestone Number: 3GFP021M	04/05/93	03/31/94		
PRELIM RPT: TRENCH ACROSS FAULT S. WINDY WASH Milestone Number: 3GPF035M	04/30/93	05/31/94		
PUB: DETAILED MOIRE METHOD - FRACTURE-SURF CHAR Milestone Number: 3GUS015M	04/30/93	05/31/94		
PUBLICATION: WATER-LEVEL DATA (1990 AND 1991) Milestone Number: 3GWF064M	04/30/93	03/14/94		
PUB: INTRABOREHOLE FLOW AND STRESS TEST (P891) Milestone Number: 3GWF010M	04/30/93	04/29/94		
PUBLICATION: FY92 DATA FROM ANALOG RECHARGE SITE Milestone Number: 3GQH12CM	04/30/93	03/31/94		
FINAL REPORT/TDIF: MAP CALICO HILLS Milestone Number: 3GTD018M	06/30/93	06/30/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUBLICATION: FY92 SYNOPTIC/REG/SITE MET DATA Milestone Number: 3GMM038M	06/30/93	07/29/94		
PUB: STREAMFLOW & PRECIPITATION DATA FY86-90 Milestone Number: 3GRS031M	06/30/93	02/21/94	02/21/94	
PUBLICATION: CRATER FLAT TUFF FRACTURE MAPPING Milestone Number: 3GWM013M	06/30/93	07/29/94		
ANALYSIS PAPER: SEISMIC REFLECTION PROFILE EVAL Milestone Number: 3GGU256M	07/02/93	10/28/94		
RPT/TDIF: TRENCHES STAGECOACH ROAD FAULT Milestone Number: 3GPF21M	07/02/93	03/30/94		
ANLYS PAPER: LAB MEASUREMENT OF UNSATURATED FLOW Milestone Number: 3GUS034M	07/30/93	04/29/94		
RPT/TDIF: GEOPHYSICAL STUDY/WINDY WASH FAULT Milestone Number: 3GPF039M	08/27/93	04/15/94		
REPORT/TDIF: ASSESS LITTLE SKULL MTN EQ Milestone Number: 3GSM149M	09/15/93	03/31/94		
REPORT: EVAL FAULTS SW OF YUCCA MTN Milestone Number: 3GTQ009M	09/30/93	02/28/94	02/28/94	
ANLYS PPR: SCARP DEGRADATION/EVOL N. WINDY WASH Milestone Number: 3GPF034M	09/30/93	08/15/94		
PUBLICATION: FORTY MILE WASH RECHARGE DATA FY92 Milestone Number: 3GRG021M	09/30/93	04/29/94		
PUBLICATION: STREAMFLOW CHAOS JOURNAL ARTICLE Milestone Number: 3GRG023M	09/30/93	06/30/94		
PUBLICATION: HISTORICAL NEUTRON HOLE DATA Milestone Number: 3GUI050M	09/30/93	06/30/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUBLICATION: INFILT STUDY; DEVELOPMENT/TESTING Milestone Number: 3GUI636M	09/30/93	04/29/94		
PUB: PROJECTION MOIRE METHOD - FRACT-SURF CHAR Milestone Number: 3GUS024M	09/30/93	06/30/94		
ANLYS PPR: OBSERV OF WATER MOVEMENT IN WLD TUFF Milestone Number: 3GUS033M	09/30/93	02/04/94	02/04/94	
PUB: ASSESSMENT OF SITE SZ HYDROCHEM DATA (Z255) Milestone Number: 3GWH001M	09/30/93	04/29/94		
REPORT ON ORIGIN OF SURFACE DEPOSITS Milestone Number: 3GQH019M	09/30/93	07/29/94		
PUBLICATION: CL-36 AGES OF SOIL, ARID-ZONE INFIL Milestone Number: 3GQH007M	09/30/93	03/31/94		
PUBLICATION: 1-D AND 2-D MATRIX MODELS Milestone Number: 3GPA006M	09/30/93	04/29/94		
ANALYSIS PPR: FULL PERIPHERY MAP/STARTER TUNNEL Milestone Number: 3GGF003M	12/31/93	02/28/94	02/28/94	
PUBLICATION: FAULTS ON EAST SIDE YM Milestone Number: 3GPF114M	01/21/94	02/18/94	02/18/94	
PUBLICATION: ISOTPIC DATING IN QUAT FAULT SUDIES Milestone Number: 3GPF110M	01/31/94	02/18/94	02/18/94	
PUBLICATION: DEVELOPMENT OF 1-D COMPRESSION Milestone Number: 3GUH045M	01/31/94	04/29/94		
ANALYSIS PAPER: FLUID INCLUSION HISTORY Milestone Number: 3GQH14M	01/31/94	02/28/94		
ANALYSIS PAPER: STUDIES OF SOIL GAS GEOCHEMISTRY Milestone Number: 3GQH854M	01/31/94	03/18/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
ANALYSIS PAPER: PALEOCLIMATE IMP. SOIL CARBONATE Milestone Number: 3GQH856M	01/31/94	03/18/94		
ANALYSIS PAPER: SECONDARY CALCITE WITHIN YM Milestone Number: 3GQH858M	01/31/94	03/18/94		
ANLYS PPR: SR ISOTOPE GEOCHEM OF PLAYA DEPOSITS Milestone Number: 3GQH864M	01/31/94	03/18/94		
ANLYS PPR: Sr ISOTOPIC CHAR MINRL LMSTNS IN S NV Milestone Number: 3GNR010M	01/31/94	02/18/94	02/18/94	
ANALYSIS PAPER: UZ-16 COMPLETION REPORT (P013) Milestone Number: 3GUP066M	02/01/94	09/30/94		
ANALYSIS PAPER: LITHOLOGIC LOGGING - PHASE 1 Milestone Number: 3GGU131M	02/28/94	04/29/94		
PUBLICATION: SATURATION LEVELS AND TRENDS UZ Milestone Number: 3GGU397M	02/28/94	02/28/94	02/28/94	
ANALYSIS PPR: DATA-STARTER TUNNEL & NORTH PORTAL Milestone Number: 3GGF012M	02/28/94	05/02/94		
STUDY PLAN TO DOE: INTACT FRACTURE TESTS - ESF Milestone Number: 3GUS048M	02/28/94	03/31/94		
STUDY PLAN TO DOE: PERCOLATION TESTS IN ESF Milestone Number: 3GUS037M	02/28/94	03/31/94		
CRITERIA LETTER: TECH SUPPORT FOR X-HOLE TESTING Milestone Number: 3GWF086M	02/28/94	09/30/94		
ABSTRACT: ISOTOPE TRACERS GOLD MINERALZN-LIMESTN Milestone Number: 3GNR030M	02/28/94	02/23/94	02/23/94	
ANLYS PPR: MAG/GRAV INTERP YUC WASH/MDWAY VALLEY Milestone Number: 3GGU463M	03/31/94	06/29/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
ANLYS PPR: MAPS SOUTH-CNTRL GHOST DANCE FAULT Milestone Number: 3GGF122M	03/31/94	03/31/94		
STUDY PLAN TO DOE: GRND MOTION FROM EARTHQUAKES Milestone Number: 3GES008M	03/31/94	03/31/94		
PRELIMINARY DIGITAL GEOLOGIC MAP Milestone Number: 3GRM036M	03/31/94	04/29/94		
PUBLICATN: RESULTS - ZERO OFFSET & WALKAWAY DATA Milestone Number: 3GUP086M	03/31/94	03/31/94		
PUBLICATION: J-11 AND J-12 WATER LEVELS Milestone Number: 3GWF078M	03/31/94	03/31/94		
PUB: FINAL ANALOG RECHARGE: PRMS & CHLORIDE ION Milestone Number: 3GQH21CM	03/31/94	03/31/94		

USGS LEVEL 4 MILESTONE REPORT
OCTOBER 1, 1993 - FEBRUARY 28, 1994
 Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
SELECT SEISMIC CONTRACTOR(S) Milestone Number: 3GGU265M	02/01/93	07/29/94		
REPORT/TDIF: QUATERNARY FAULT MAP Milestone Number: 3GPF026M	03/31/93	03/31/94		
PUB: SECTION OF PERC & IMBIBITION TEST RESULTS Milestone Number: 3GUF022M	03/31/93	08/31/94		
REPORT/TDIF: EVALUATION OF BEATTY SCARP Milestone Number: 3GTQ034M	06/01/93	02/25/94	02/25/94	
REPORT: CENTRAL 1/3 YM Milestone Number: 3GCH055M	07/02/93	08/25/94		
REPORT/TDIF: RESULTS OF TRENCH LOGGING ESF TREN Milestone Number: 3GFP008M	08/31/93	03/31/94		
STATUS RPT/TDIF: ISOTOPE DATING/EOLIAN SANDS/SOIL Milestone Number: 3GCH161M	08/31/93	06/30/94		
PROV. RESULTS: QUAT ACT PNTBRSH CANYON & B BUTTE Milestone Number: 3GPF19M	09/15/93	03/31/94		
PRELIM SUMMARY REPORT/TDIF: MIDWAY VALLEY Milestone Number: 3GFP024M	09/30/93	04/11/94		
REPORT: ASSESS SURF CHANGES/LITTLE SKULL EQ Milestone Number: 3GTM07JM	09/30/93	03/31/94		
INTERIM REPORT/TDIF: DATA COLLECTED Milestone Number: 3GCR014M	09/30/93	03/29/94		
REPORT/TDIF: C14 ANALYSIS Milestone Number: 3GCL109M	09/30/93	03/31/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
FINAL RPT/TDIF:DIGITIZED MAP NORTHERN 1/3 YM Milestone Number: 3GCH036M	09/30/93	04/29/94		
PRELIMINARY SUMMARY PALEOFLOOD STUDIES Milestone Number: 3GQH010M	09/30/93	05/26/94		
REVIEW DRAFT: SUMMARY REPORT - MIDWAY VALLEY Milestone Number: 3GFP028M	01/20/94	03/31/94		
PROVISIONAL RESULTS: EVALUATION OF MEGABRECCIA Milestone Number: 3GTD040M	01/31/94	02/24/94	02/24/94	
DATA TO LRC: FY93 MOISTURE DATA Milestone Number: 3GRG002M	01/31/94	03/31/94		
PROVISIONAL RESULTS: ISOTOP COMP/FLUID INCLUSION Milestone Number: 3GQH850M	01/31/94	03/18/94		
SCIENT. NOTEBK: DETERMINE 180/160 RATIO OF H2O Milestone Number: 3GQH862M	01/31/94	03/29/94		
DATA TO LRC: 1993 TRANSDUCER DATA Milestone Number: 3GWF027M	02/11/94	02/11/94	02/11/94	
DATA TO LRC: TRENCH LOGS Milestone Number: 3GFP017M	02/21/94	03/31/94		
STREAM-GAGE DESIGN MEMO Milestone Number: 3GRS011M	02/28/94	02/25/94	02/25/94	
CRITERIA LET: REHABILITATING WELLS WT-7 & WT-11 Milestone Number: 3GWF073M	02/28/94	02/28/94	02/28/94	
DATA TO LRC: PRESSURE DATA FROM C-HOLES TESTING Milestone Number: 3GWF041M	02/28/94	02/24/94	02/24/94	
ABSTRACT: ORIGIN OF SECONDARY CALCITE IN UZ -YM Milestone Number: 3GQH868M	03/11/94	05/06/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
REVIEW DRAFT: TRENCHES STAGE COACH RD FLT Milestone Number: 3GPF117M	03/15/94	03/31/94		
REVIEW DRAFT: SUMMARY OF EXISTING HEAT FLOW INFO Milestone Number: 3GAT049M	03/31/94	02/14/94	02/14/94	
PROVISIONAL RESULTS: GROUND MOTION MODEL Milestone Number: 3GSG109M	03/31/94	03/31/94		
REVIEW DRAFT: CATALOG OF EVENTS CAL YEAR 1993 Milestone Number: 3GSM024M	03/31/94	06/20/94		
DATA TO LRC: SEISMIC DATA Milestone Number: 3GSM24AM	03/31/94	06/20/94		
PROV RESULTS: DEATH VALLEY-FURNACE CREEK FLT SYS Milestone Number: 3GTQ011M	03/31/94	03/31/94		
DATA TO LRC: PRE FY94 WATER-LEVEL DATA Milestone Number: 3GRG078M	03/31/94	03/31/94		
DATA TO LRC:FY93 CONSOLIDATED/UNCONSOLIDATED MTL Milestone Number: 3GUI105M	03/31/94	03/31/94		
MEMO TO TPO: DISATEST PROGRAM COMPLETION REPORT Milestone Number: 3GUP101M	03/31/94	03/31/94		
DATA TO LRC: UE-25 UZ#16 AIR-K DATA Milestone Number: 3GUP039M	03/31/94	05/31/94		
DATA TO LRC: FRACTURE LOGS DATA Milestone Number: 3GUP305M	03/31/94	03/31/94		
MEMO TO TPO: EXCAVATION EFFECTS DESIGN EVAL COMP Milestone Number: 3GUS007M	03/31/94	03/31/94		
DATA TO LRC: GAS/H2O VAPOR DATA-UZ#16/NRG-6/UZ-1 Milestone Number: 3GUH022M	03/31/94	03/31/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
STAT RPT: CONSTRUCTION OF FRACTURE NETWORK MODEL Milestone Number: 3GUF028M	03/31/94	03/31/94		
DATA TO LRC: 1993 PERIODIC WATER-LEVEL DATA Milestone Number: 3GWF026M	03/31/94	03/31/94		
DATA TO LRC: OUTCROP DATA Milestone Number: 3GWM11M	03/31/94	03/31/94		
PROVISIONAL RESULTS: PALEONTOLOGIC/ISOTOPE DATA Milestone Number: 3GCL117M	03/31/94	03/31/94		
MEMO TO TPO: STATUS OF SITE DECOMMISSIONING Milestone Number: 3GQH041M	03/31/94	02/28/94	02/28/94	
SCIENTIFIC NTBK: DETERMINE H/D RATIO OF H2O Milestone Number: 3GQH860M	03/31/94	02/28/94		

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: Williams WBS: 1.2.3.1

WBS TITLE: Site Investigations Coordination & Planning

P&S ACCOUNT: OG31

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
1334	1333	1200	0	0.0	100.0	133	10.0	111.1	3208	3127	81	2.5	2887	97.3

Analysis

Cumulative Cost Variance:

Cause:

The P&S level cost variance results from variances in several summary accounts. This variance is due, in part, to an unplanned vacancy in the reports section. The spending curve has not been adjusted to reflect this vacancy. Most of the underrun in the administrative account is due to an accounting error found after the PACS upload. This will be corrected in the March report. Much of the reflected underrun in the hydrology management account is due to capital equipment overhead charges being planned in this account. These assessments are not costed until the purchase orders are cut, so delays in procurement of capital result in cost variances in this account. Further, spending curves have not been adjusted to reflect the reprogramming of \$80K to technical activities (letter from Dyer to Hayes dated November 7, 1993).

Impact:

There is no impact to this level of effort account.

Corrective Action:

No corrective action is required at this time. All accounts will be reviewed on at least a quarterly basis, and adjustments made to the spending plan and ETC, as required.

Cumulative Schedule Variance:

Not applicable

Variance At Complete:

Not applicable

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: Sullivan WBS: 1.2.3.2.8.4.1

WBS TITLE: Historical and Current Seismicity

P&S ACCOUNT: OG32841

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
719	550	612	-169	-23.5	76.5	-62	-11.3	89.9	1997	1997	0	0	2221	104.5

Analysis

Cumulative Cost Variance:

Not applicable

Cumulative Schedule Variance:

Cause:

The schedule variance results from delays in completing the assessment of the Little Skull Mountain earthquake (milestone 3GSM149M). The data review needed to complete this milestone consists of several thousand seismograms of aftershocks, but is expected to be completed in mid-March. Following data reviews, the analysis report can be processed through the USGS publication approval system. The time required for data reviews diverted the limited resources available from other planned activities.

Impact:

Other activities under SCP 8.3.1.17.4.1.2 slipped about one month; however, a review of the schedule has allowed for workarounds so that no work planned for FY1994 is expected to slip into FY1995.

Corrective Action:

Additional staff have been hired to alleviate the current backlog of seismic data to be analyzed. The schedule has been reviewed and modified for workarounds, allowed by the addition of staff members to complete scheduled activities within the planned fiscal year.

Variance At Complete:

Not applicable

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: SULLIVAN

WBS: 1.2.3.2.7.2.2

WBS TITLE: Site Ambient Thermal Conditions

P&S ACCOUNT: OG32722

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
12	0	0	-12	-100.0	0.0	0.0	0.0	0.0	80	0	80	100.0	0.0	0.0

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 a reduction in scope/budget due to reprogramming of funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.1

WBS TITLE: Unsaturated Zone Infiltration

P&S ACCOUNT: OG33121

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPJ	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
237	237	295	0	0.0	100.0	-58.0	-24.5	80.3	675	889	-214	-31.7	841.0	73.7

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 using reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: NEWBURY WBS: 1.2.3.3.1.1.4
WBS TITLE: Regional Hydrologic System Synthesis & Modeling
P&S ACCOUNT: OG33114

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	TEAC	TCPI
28	28	38	0	0.0	100.0	-10.0	-35.7	73.7	100	175	- 75	-75.0	136.0	52.6

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 using reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ WBS: 1.2.3.3.1.2.4

WBS TITLE: Percolation in the Unsaturated Zone - ESF Study

P&S ACCOUNT: OG33124

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCMP	ACMP	SV	SVZ	SPJ	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	TCPJ
585	563	421	-22	-3.8	96.2	142.0	25.2	133.7	2925	2353	572	19.6	2188	122.3

Analysis

Cumulative Cost Variance:

Cause:

Two SCP activities are the main contributors to the cost variance in this P&S account. The radial boreholes testing activity has a cost variance of \$53K, due primarily to large amounts of non-capital materials and equipment (\$160K) planned for procurement, for which only \$11k in costs have been incurred to date. The major faults activity has a cost variance of \$60K, due primarily to the requested reprogramming of \$541K out of this account (due to the ESF schedule not planning to cross a major fault this FY) to other priority work within the USGS site characterization program. The BCWS to date reflects more than the total planned budget, and will be adjusted to more accurately reflect the current plan when the reprogramming request is approved. Changes in the ESF schedule have impacted a number of activities within this P&S account and planned spending has not been updated to sufficiently reflect these changes.

Impact:

There is no impact to this cost variance. Work is proceeding in accordance with the ESF tunnel boring schedule and the variances result primarily from a need to update the planning base consistent with the current schedule, which cannot be completed until the reprogramming is officially approved and the Implementation Directive is received.

Corrective Action:

Review all spending plans for this P&S account, and update the BCWS and the ETC to reflect the current schedule. This will be completed when the C/SCR requesting reprogramming of funds is approved, and the Implementation Directive is received.

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

The variance is due to the estimate to complete being modified to reflect a reduction in scope/budget due to reprogramming of funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ

WBS: 1.2.3.3.1.2.7

WBS TITLE: Unsaturated Zone Hydrochemistry

P&S ACCOUNT: OG33127

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
115	95	133	-20	-17.4	82.6	-38.0	-40.0	71.4	425	602	-177	-41.6	595.0	70.4

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 using reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ WBS: 1.2.3.3.1.2.8

WBS TITLE: Fluid Flow in Unsaturated Zone Fractured Rock

P&S ACCOUNT: OG33128

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	27	0	0.0	0.0	-27.0	0.0	0.0	0	134	-134	0.0	0.0	0.0

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 using reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER	DATE	TPO	DATE
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**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ WBS: 1.2.3.3.1.2.9
WBS TITLE: Site Unsaturated Zone Synthesis and Modeling
P&S ACCOUNT: OG33129

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VACX	IEAC	ICPI
0	0	30	0	0.0	0.0	-30.0	0.0	0.0	0	200	-200	0.0	0.0	0.0

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 using reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER	DATE	TPO	DATE
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**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 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	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
426	396	493	-30	- 7.0	93.0	-97.0	-24.5	80.3	1086	1203	-117	-10.8	1352	97.2

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 using reprogrammed funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted the week of March 14, 1994.

P&S ACCOUNT MANAGER	DATE	TPO	DATE
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**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: February 28, 1994**

PARTICIPANT: USGS PEM: GANDI

WBS: 1.2.12.2.2

WBS TITLE: Local Records Center Operation (LRC)

P&S ACCOUNT: OGC22

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SP1	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
166	166	164	0	0.0	100.0	-2.0	-1.2	101.2	400	350	50	12.5	395	125.8

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 a reduction in scope/budget due to reprogramming of funds approved in R. Dyer's November 4, 1993 letter (attached). Appropriate schedule/scope changes are reflected in affected summary accounts, and C/SCR is pending.

Impact:

None. BAC will equal EAC following official C/SCR approval.

Corrective Action:

Complete C/SCR and submit for approval. First draft has been approved by WBS managers, and formal C/SCR will be submitted by the week of March 14, 1994.

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

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	7	0	-2	25	25	20	0	5	62	63	-1
1.2.3	SITE INVESTIGATIONS	1577	1324	1389	-253	-65	7354	6911	7062	-443	-151	22087	22217	-130
1.2.5	REGULATORY	94	94	67	0	27	485	488	402	3	86	1219	1222	-3
1.2.9	PROJECT MANAGEMENT	108	108	77	0	31	540	540	392	0	148	1300	1250	50
1.2.11	QUALITY ASSURANCE	157	157	161	0	-4	788	788	786	0	2	1900	1900	0
1.2.12	INFORMATION MANAGEMENT	41	41	35	0	6	208	208	198	0	10	500	450	50
1.2.13	ENVIRONMENT, SAFETY, & HEA	41	0	32	-41	-32	163	122	156	-41	-34	543	543	0
1.2.15	SUPPORT SERVICES	24	24	21	0	3	120	120	98	0	22	287	262	25
Total		2047	1753	1789	-294	-36	9683	9202	9114	-481	88	27898	27907	-9

Resource Distributions by Element of Cost

Fiscal Year 1994

Budgeted Cost of Work Scheduled	
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	74
75	76
77	78
79	80
81	82
83	84
85	86
87	88
89	90
91	92
93	94
95	96
97	98
99	100

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	18285	18867	19669	21998	21681	22016	28069	28615	28751	26575	25130	24892	284548
LABOR	1086	1135	1171	1306	1298	1295	1555	1631	1800	1529	1473	2380	17659
SUBS	581	606	674	819	749	761	822	769	719	684	691	717	8592
CAPITAL	0	0	197	61	0	473	415	120	54	80	247	0	1647
Total BCWS	1667	1741	2042	2186	2047	2529	2792	2520	2573	2293	2411	3097	27898

Actual Cost of Work Performed

LBRHRS	11856	12411	12139	14734	18465	0	0	0	0	0	0	0	69605
LABOR	713	832	1588	1272	1102	0	0	0	0	0	0	0	5507
SUBS	583	652	685	782	664	0	0	0	0	0	0	0	3366
CAPITAL	4	0	185	29	23	0	0	0	0	0	0	0	241
Total ACWP	1300	1484	2458	2083	1789	0	0	0	0	0	0	0	9214

Participant USGS

Yucca Mtn. Site Char. Project-Planning & Control System

01-Feb-94 to 28-Feb-94

PACS Participant Work Station (PPWS)

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WBS Status Sheet (WBS02)

Inc. Dollars in Thousands

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	1667	1741	2042	2186	2047	2529	2792	2520	2573	2293	2411	3097	27898
BCWP	1645	1741	1882	2181	1753	0	0	0	0	0	0	0	9202
ACWP	1300	1484	2458	2083	1789	0	0	0	0	0	0	0	9114
ETC	0	0	0	0	0	2605	3014	2706	2820	2520	2647	2481	18793

	Fiscal Year Distribution											At	
Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	Complete	
BCWS	24644	27898	51462	48901	42359	29995	19018	9564	5128	97	0	0	259066
BCWP	23158	9202	0	0	0	0	0	0	0	0	0	0	
ACWP	23430	9114	0	0	0	0	0	0	0	0	0	0	
ETC	0	18793	51479	48693	42249	29748	18628	9669	5055	1477	0	0	258335

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey

MONTHLY COST/FTS REPORT

Fiscal Month/Year FEBRUARY 1994Date Prepared 03/11/94 14:44Page 1 of 1

	<u>CURRENT MONTH END</u>				<u>FISCAL YEAR</u>				
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON HOURS	PURCHASE COMMITMENTS	SUBCON COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMULATIVE COSTS
1.2.1.	7	88	0				62		20
1.2.3.	1384	15722	8794		2785		21516		6848
1.2.5.	67	1100	554		167		1200		380
1.2.9.	76	728	444		205		1250		391
1.2.11	160	827	1803		739		1900		783
1.2.12	35	0	1078		226		450		197
1.2.13	32	0	0				543		156
1.2.15	21	0	358		117		262		98
TOTALS	1782	18465	13031	0	4239		27183	0	8873

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR 10/1/93 - 02/28/94

	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	0.6	1.5	9.2	1.3	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.6
1.2.1.10	0.6	1.5	9.2	1.3	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.6
*1.2.1.1	0.6	1.5	9.2	1.3	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.6
**1.2.1	0.6	1.5	9.2	1.3	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.6
OG3194B1 Branch Coordination and Planning	31.0	41.7	59.2	29.3	44.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	205.2
OG3194B2 M&I - Branch Administrative Services	28.7	14.7	81.4	12.5	18.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	156.1
OG3194G1 Geologic Studies Program Management	22.9	27.8	38.5	58.0	58.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	205.5
OG3194G2 QA Implementation GSP	20.5	21.3	16.2	20.9	16.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.0
OG3194H1 Hydrology Program Management	35.2	33.3	88.0	40.2	36.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	233.0
OG3194H2 QA Implementation, Hydrology	13.0	13.5	20.5	8.6	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.4
OG3194H3 Computer Operation & Data Mgmt Hydrology	26.3	28.0	53.7	31.8	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	168.6
OG3194H4 Scientific Rpts/Proj Documents Hydrology	7.1	8.4	11.6	6.1	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.3
1.2.3.1	184.7	188.7	369.1	207.4	220.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1170.1
*1.2.3.1	184.7	188.7	369.1	207.4	220.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1170.1
OG32211A94 Surface/Subsurface Stratigraphic Studies	52.3	61.2	82.3	77.7	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	348.5
OG32211B94 Surface-Based Geophysical Surveys	0.0	0.9	1.5	53.9	26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.9
OG32211C94 Borehole Geophysical Surveys	0.0	0.0	6.4	58.9	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.7
1.2.3.2.2.1.1	52.3	62.1	90.2	190.5	123.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	518.1
OG32212A94 Geologic Mapping of Zonal Features	61.7	83.1	80.1	77.8	64.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	367.0
OG32212B94	0.0	0.0	13.9	0.6	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.2
OG32212D94 Geologic Mapping of the ES and Drifts	31.5	30.6	65.4	44.9	49.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	222.1
1.2.3.2.2.1.2	93.2	113.7	159.4	123.3	135.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	625.3
OG32531A94 Tectonic Effects	4.0	2.0	7.4	-3.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7
1.2.3.2.5.3.1	4.0	2.0	7.4	-3.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.7
OG32552C94 Heat Flow at Yucca Mountain	0.0	0.0	0.0	21.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9
1.2.3.2.5.5.2	0.0	0.0	0.0	21.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.9
OG32722A94 Surface-based Site Ambient Conditions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.2.7.2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OG32831A94 Identify Relevant Earthquake Sources	4.6	9.0	10.4	-5.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.1
OG32831B94 Characterize 10,000-yr Slip Earthquakes	0.0	0.0	0.0	32.7	-3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.2
1.2.3.2.8.3.1	4.6	9.0	10.4	27.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.3
OG32833A94 Empirical Earthquake Model	0.6	0.2	-0.8	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
1.2.3.2.8.3.3	0.6	0.2	-0.8	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
OG32834A94 Site Effects from Ground-Motion	0.0	0.0	14.5	6.2	-18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
1.2.3.2.8.3.4	0.0	0.0	14.5	6.2	-18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
OG32841A94 Compile Historical Earthquake Record	0.8	0.0	1.0	2.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
OG32841B94 Monitor Current Seismicity	80.0	109.8	102.8	115.5	141.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	549.9

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR 10/1/93 - 02/28/94

	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	
1.2.3.2.6.4.1	80.8	109.8	103.8	118.1	142.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	554.8
QG32842B94 Conduct Expl. Trenching in Midway Valley	0.0	0.0	0.0	105.0	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.9
1.2.3.2.6.4.2	0.0	0.0	0.0	105.0	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.9
QG32843B94 Eval Quaternary faults w/i 100 km of YM	13.2	26.4	14.6	6.0	37.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.9
QG32843D94 Evaluate Bare Mountain Fault Zone	21.6	26.3	25.5	13.1	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.2
1.2.3.2.6.4.3	34.8	52.7	40.1	19.1	46.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	193.1
QG32844A94 Evaluate the Rock Valley Fault System	6.9	19.4	9.8	17.5	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.2
QG32844B94 Evaluate the Mine Mountain Fault System	0.0	6.8	-6.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
1.2.3.2.6.4.4	6.9	26.2	3.0	18.5	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2
QG32845B94 Evaluate Postulated Detachment Faults	3.4	2.2	13.1	30.9	-12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8
QG32845C94 Evaluate Potential Relationship of Brecc	0.0	0.0	2.6	0.8	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1
QG32845D94 Evaluate Postulated Detachment Faults	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QG32845E94 Eval Age of Detachment Faults - Radiomet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.2.6.4.5	3.4	2.2	15.7	31.7	-7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.9
QG32846B94 Evaluate Age and Recurrence of Movement	21.1	3.2	47.9	26.9	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	148.6
1.2.3.2.6.4.6	21.1	3.2	47.9	26.9	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	148.6
QG3284AA94 Relevel Base-Station Network, YM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.3.2.6.4.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
QG3284CA94 Eval Tectonic Process/Stability at Site	0.0	0.0	2.2	10.1	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.9
QG3284CB94 Evaluate Tectonic Models	0.0	0.6	1.7	-1.3	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8
1.2.3.2.6.4.12	0.0	0.6	3.9	8.8	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.7
*1.2.3.2	301.7	381.7	495.5	714.4	509.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2402.8
QG33111A94 Precipitation/Meteorological Monitoring	10.7	12.7	24.7	12.7	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.8
1.2.3.3.1.1.1	10.7	12.7	24.7	12.7	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	67.8
QG33112A94 Surface-Water Runoff Monitoring	25.3	33.2	37.2	33.8	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	161.5
1.2.3.3.1.1.2	25.3	33.2	37.2	33.8	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	161.5
QG33113B94 Regional Potentiometric Level Distributi	5.4	6.7	4.1	7.9	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.1
QG33113C94 Forty-mile Wash Recharge Study	5.6	5.2	8.7	3.4	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6
1.2.3.3.1.1.3	11.0	11.9	12.8	11.3	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.7
QG33114B94	0.0	0.0	0.0	1.8	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3
QG33114D94 Regional 3-D Hydrology Modeling	3.9	5.3	10.6	7.3	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.6
1.2.3.3.1.1.4	3.9	5.3	10.6	9.1	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.9
QG33121A94 Char Hydr prop of Surficial Material	25.7	28.0	20.0	20.5	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103.9
QG33121B94 Evaluation of Natural Infiltration	5.1	49.7	52.5	19.2	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	152.8
QG33121C94	0.0	0.0	12.0	13.3	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.2
1.2.3.3.1.2.1	30.8	77.7	84.5	53.0	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	294.9
QG33123A94 Matrix Hydrologic-Properties Testing	13.1	29.9	38.7	59.0	-29.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.4

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/93 - 02/28/94

	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.1
OGB294Q QA-Program Development	33.4	31.3	46.5	29.9	52.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	193.9
1.2.11.2	33.4	31.3	46.5	29.9	52.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	193.9
*1.2.11.2	33.4	31.3	46.5	29.9	52.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	193.9
OGB3194Q QA Verification-Audits	60.3	50.9	60.7	48.3	48.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	268.3
1.2.11.3.1	60.3	50.9	60.7	48.3	48.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	268.3
OGB3294Q Quality Assurance Verification - Surveil	9.1	28.9	15.2	21.5	23.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.4
1.2.11.3.2	9.1	28.9	15.2	21.5	23.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.4
*1.2.11.3	69.4	79.8	75.9	69.8	71.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	366.7
OGB594B QA-Quality Engineering	22.2	29.5	14.8	22.2	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.2
1.2.11.5	22.2	29.5	14.8	22.2	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.2
*1.2.11.5	22.2	29.5	14.8	22.2	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.2
**1.2.11	148.4	165.9	168.1	140.8	159.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	782.9
OGC2294B Local Records Center Operations	32.8	38.3	29.5	35.5	26.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.8
1.2.12.2.2	32.8	38.3	29.5	35.5	26.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.8
OGC2394B Participant Records Management	3.6	8.7	6.6	7.2	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.2
1.2.12.2.3	3.6	8.7	6.6	7.2	8.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.2
*1.2.12.2	36.4	47.0	36.1	42.7	34.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.0
**1.2.12	36.4	47.0	36.1	42.7	34.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.0
OGD2594B Occupational Safety and Health	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.2.13.2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
*1.2.13.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OGD4794H Water Resources	32.9	27.8	32.9	29.7	32.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.7
1.2.13.4.7	32.9	27.8	32.9	29.7	32.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.7
*1.2.13.4	32.9	27.8	32.9	29.7	32.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.7
**1.2.13	32.9	27.8	32.9	29.7	32.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.7
OGF394B Training	19.6	22.3	13.9	20.9	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.9
1.2.15.3	19.6	22.3	13.9	20.9	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.9
*1.2.15.3	19.6	22.3	13.9	20.9	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.9
**1.2.15	19.6	22.3	13.9	20.9	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.9
1.2	1293.4	1482.3	2266.0	2048.4	1782.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8872.5
FTEs													
FEDERAL	87.2	91.5	89.4	108.4	135.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT	55.4	89.0	82.4	97.7	89.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL	142.6	180.5	171.8	206.1	224.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

* Fourth level WBS roll-up

.. Third level WBS roll-up

Sandia National Laboratories

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for the U.S. Department of Energy

L. E. Shephard
Manager, YMP Management Department, MS1333

MAR 17 1994

WBS: 1.2.9.2
QA: NA

BAA
I-354920

Mr. Robert M. Nelson, Acting Project Manager
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
Nevada Operations Office
Las Vegas, NV 89193-8608

Subject: Monthly Progress Report - February 1994

Dear Robert:

Enclosed is the input from Sandia National Laboratories for the February 1994 Monthly Progress Report. The sections on progress, issues, and deliverables/milestones were telecommunicated to Terri Rodriguez on March 15, 1994. The Variance, cost, performance, and FTE reports were FAXed to Ms. Rodriguez also on March 15, 1994.

You may contact Joe Schelling at (702) 794-7575 or Leigh Lechel at (505) 848-0844 if there are any questions.

Sincerely,



Les E. Shephard, Manager
YMP Management Department, 6302

LES:6302:ll
Attachment: As stated.

327
DIVISION
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CC: *Boak/Delany, S. TESS*
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CC: *Brooks*
CC: *Yel*
CC: *Spate, J.*
CC: *Stuckel*

Exceptional Service in the National Interest

ENCLOSURE 22
REC'D IN YMP
3/28/94
See Dist Let (6)

MAR 17 1994

Robert M. Nelson

-2-

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YMP CRF	

SANDIA NATIONAL LABORATORIES

YUCCA MOUNTAIN PROJECT

MONTHLY HIGHLIGHTS AND STATUS REPORT

FEBRUARY 1994

DISCLAIMER

Quality assurance checks on data contained or referenced in this report have been performed only to determine that the data have been obtained and documented properly. The SNL Project Department 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. Milestones have been baselined and are included to show status.

1.2.2 Waste Package

Progress During Report Period

SNL continued developing the data acquisition system for the backfill thermal conductivity test. Test results for abrasivity and moisture content were received and will be incorporated into the final report.

1.2.3 Site Investigations

Progress During Report Period

The SNL technical procedure TP-0217, "Determination of water content and physical properties of laboratory rock samples," was issued as a controlled document. This procedure is required to support laboratory testing of core from the Systematic Drilling Program in an overflow situation if the USGS Hydrologic Research Facility laboratory cannot keep up with samples from both the unsaturated zone (UZ) matrix properties and systematic drilling programs.

SNL began developing a new material properties model using the LYNX GMS system focused on thermal properties. Entry of available, but limited, thermal expansion data from samples taken from various North ESF Ramp drill holes was completed, and the data can be displayed in relationship to the preliminary geologic-unit modeling completed as part of the USGS Stratigraphic Studies program. Preliminary evaluation of thermal-expansion coefficients at 200°C indicates a strong correlation with a tentative rank-classification of intensity of vapor-phase alteration. A draft technical procedure for producing quality-affecting geologic "logs" using this rank-classification coding scheme was begun. Assuming that the correlation is validated by subsequent work and additional measurements, the process will allow much more detailed models of thermal-expansion behavior to be generated at a higher level of confidence.

Testing began for the study to examine the effects of sample saturation on thermal conductivity. Three samples of welded devitrified tuff and three samples of nonwelded zeolitic tuff are being used for the saturation effects study. The thermal conductivity of each sample is being measured at three nominal temperatures, and at five different saturation states (fully saturated, oven-dry, air-dry, and two other intermediate states).

Testing was completed on air-dry samples, vacuum saturated samples, and samples that were in two intermediate states (approximately 2/3 and 1/3 saturated). Significant delays in testing were experienced in February (see section on Issues and Concerns). Testing of two samples remains in order to complete the data acquisition for this study. These samples have not yet passed the oven drying criteria.

Six samples taken from below 416.0 feet were air-dried and tested at three nominal temperatures. Four of these measurements were reruns because the guard temperature of the low temperature (LT) test instrument was found to be out of specification during the calibration check. Testing of air dry samples

is continuing and saturated samples are ready for testing.

Testing was completed on 14 out of 40 samples selected for the study to examine the effects of sample size on thermal-expansion behavior. For this study, five samples of each of four different lithologies (welded devitrified, welded vitric, nonwelded vitric, and nonwelded zeolitic) are being tested. Pre- and post-test velocity measurements were completed on six samples. The post-test measurements indicated that velocity was up to 25 percent slower relative to the pre-test measurements for some samples, which indicates that the samples were significantly altered during thermal cycling.

The results of mechanical testing on samples from USW NRG-6 are included in a data report, "Bulk and Mechanical Properties of the Paintbrush Tuff Recovered from Borehole USW NRG-6: Data Report" (SAND93-4020) submitted to the Project Office for review on February 28, 1994 (Level 3 Milestone 103).

A lifecycle plan mandated by software quality assurance requirements was prepared and approved for qualifying the regional climate modeling code, RegCM2. SNL began installing the code on a computer workstation and developing the input needed for a software validation control run. The software validation will compare code output for current climate conditions against the output generated by earlier Cray runs.

SNL repeated benchmarking calculations that originally involved advection and diffusion, performed previously with the HYDROGEOCHEM and LEHGC0.0 codes, with LEHGC1.0, the most current version of LEHGC in support of a report on software verification/validation of LEHGC (Level 3 Milestone OS116).

Issues and Concerns

Several events have occurred during testing activities associated with thermal laboratory properties and thermal expansion testing studies that affected the progress of the testing and resulted in delays to the schedule. The Mettler balance used for weighing samples did not pass the calibration check and it was necessary for Mettler to repair and calibrate the balance; recently fabricated thermocouples would not pass the calibration using the NIST certified thermocouple, which limited the number of thermocouples available for calibrating the electronic ice reference, and consequently the thermal conductivity test equipment and sample drying oven; and one of the low temperature (LT) thermal conductivity testing instruments failed calibration. Further, preparation for and participation in the Technical Project Review delayed each of the activities in the site investigations work.

WBS 1.2.4 Repository

Progress During Report Period

SNL staff finished incorporating changes to Study Plan 8.3.1.15.1.5 responding to comments received from the Project Office reviewers. The revised Study Plan, and completed Study Plan Comment Resolution Forms were transmitted to the Project Office.

SNL met with the M&O designers and the tunnel boring machining (TBM) contractor to obtain details of the North Ramp design and TBM operation. These meetings were called to obtain information to support detailed experiment design for the access convergence test, and to learn what data is needed by the M&O design team to verify their design methodology being used in the construction of the ESF. Meetings were also held with the ESF ventilation designers, environmental monitors, ESF constructors and the potential repository ventilation designers to begin a process that would assure that air quality and ventilation measurements needed for repository ventilation design and for performance assessment calculations would be acquired.

SNL began preparing a report outlining the strategy for sealing and backfilling the ESF/Repository openings. The strategy for sealing emphasizes directing or isolating water from all sources entering shafts/ramps or the underground from the waste packages through the use of infiltration and diversion techniques. The report also provides general sealing concepts based on the current proposed designs.

SNL began planning a study plan for seal testing. This study plan will outline the rationale, concepts, and basic test concepts for in-situ sealing tests. The completion of this document will allow early FY 1995 field evaluations of borehole seal tests along with other critical seal evaluations such as the fracture grouting tests.

SNL met with the M&O to clarify specific design needs for package 2C and to identify appropriate revisions to original calculations. Extensions to the site-scale mechanical model were completed and the 100 kW/acre case rerun. SNL also began a rerun of cross-sectional analyses for the 100 kW/acre case according to agreed upon specifications. In addition, site-scale thermal analyses at 80 kW/acre were completed.

SNL and the Idaho National Engineering Laboratory (INEL), worked on a collaborative effort to begin a series of laboratory scale tests of small, layered polycarbonate models. These tests will be extremely useful for validating numerical analysis tools relative to defining rock mass behavior. During the month SNL and INEL reached an understanding of the scope of the project and a contract was initiated.

SNL prepared a draft work agreement that prescribes the activities for investigating the effects of silica phase transformations on the stresses in the proposed repository.

WBS 1.2.5 Regulatory

Progress During Report Period

SNL Technical Data Base staff had meetings with Task Leaders and Principal Investigators to determine the status of their respective data sets. This effort was part of an activity to create a comprehensive overview of the status of all WBS elements which are involved in the acquisition or development of data. The purpose of this overview is to ensure that all data is properly reported to the data bases.

SNL continued to use the TOUGH2 code to investigate possible dryout in the vicinity of a potential nuclear waste repository and the perching of water above the repository as a function of time after waste emplacement. A study was completed using a systematic variation of the fracture apertures. Calculations were extended to include a fracture-apertures range from 1 micrometer to 1 millimeter. The new results were incorporated into TSPA-1993.

The detailed lithologic logs defining the hydrogeologic units for the groundwater travel time (GWTT) effort were reworked. The twenty-three logs used in TSPA-1993 were converted from feet to meters and checked for accuracy and content. Four additional quality-affecting logs (NRG-2b, NRG-4, NRG-6, and UZ-14) were added to the data set, which brings the total to twenty-seven for the GWTT geostatistical simulations of Yucca Mountain. These additional data will assist in resolving the contacts in the Paintbrush Tuff members in the simulations.

The report, "Detailed Characterization and Preliminary Adsorption Model for Materials for an Intermediate-Scale Transport Experiment" (SAND94-0323C) was completed and submitted to the Project Office for review on February 28, 1994 (Level 3 Milestone OS143). The report summarizes the geochemical modeling conducted by SNL and LANL at the Experimental Engineered Test Facility, and describes the experimental and theoretical work predicting the migration of tracers through quartz sand in a caisson.

In collaboration with the USGS, SNL completed the comparison of physical experimentation and numerical simulation of matrix imbibition from a flowing fracture into Topopah Springs Tuff. Results are documented in the report, "Fracture-Matrix Interaction in Topopah Spring Tuff: Experiment and Numerical Analysis" (SAND94-0443C) which was submitted to the Project Office for review on February 11, 1994 (Level 3 Milestone OS140).

SNL completed documentation of the initial experimental investigations into scaling behavior of gas permeability measurements in Yucca Mountain tuffs. The report was submitted to the Project Office for review on February 11, 1994 (Level 3 Milestone OS146).

WBS 1.2.9 Project Management

Progress During Report Period

Several project management activities were completed in February. Fourteen Basis of Estimates were transmitted to the Project Office on February 11, 1994. The Monthly Cost, Cost/FTE, Variance, CPR, and Executive Summary reports were transmitted to the Project Office on February 15, 1994. The monthly Task Leader Program Review Meetings were held on February 8-9, 1994. In addition to assessing activity progress, discussions of schedule and cost resulted in SNL submitting two C/SCRs. The Project Control staff also identified approximately 14 changes or clarifications needed to Level 3 milestones, so a process was implemented for tracking changes to Level 3 Milestones. Several letters documenting schedule slips or changes to

milestone criteria were drafted for Task Leaders to communicate to the respective YMP WBS Element Managers.

Changes to the SNL Contractor Work Breakdown Structure Dictionary were transmitted to the Project Office on February 8, 1994.

WBS 1.2.11 Quality Assurance

Progress During Report Period

SNL conducted an audit at the Geology Department of the University of New Mexico on February 26 and 27.

A Data Quality Evaluation Team from DOE EM-342 met with SNL staff during the weeks February 21 and February 28. The team conducted an assessment of the quality, traceability, and useability of data collected for the Waste Isolation Pilot Plant (WIPP) Project and requested that SNL provide a team member knowledgeable in QA. Representatives from the EPA observed the assessment. Although this activity was primarily supporting WIPP, it was an opportunity to gain insights into EPA approaches to data quality, which may be applicable to the Yucca Mountain Site Characterization Project in the future.

WBS 1.2.12 Information Management

Progress During Report Period

Four documents were added to the Controlled Document database and three controlled documents were recalled.

A total of 4,000 microfilm records were verified, 10 individual records and 33 record packages were submitted to the CRF.

WBS 1.2.15 Support Services

Progress During Report Period

SNL telecommunicated the Payments-Equal-To-Taxes Report to the Project Office during the week of February 21st.

SNL completed an internal SNL-mandated property inventory. The radiation scan of the first shipment of surplus inventory was completed and the property was transported to shipping and receiving for return to YMP.

SNL added a new Safety and Health section to its YMP Orientation Manual. The section includes a guidance letter from Winn Wilson, a chart of training requirements for visits to the site or for staff working full-time at the site, a schedule of the site-related training, and a list of and training schedule for Environmental Safety and Health (ES&H) in accordance with SNL's requirements.

A system was developed and implemented that will aid in verifying that matrixed, site-based personnel is in compliance with all mandated SNL training.

The first session of the "Geology for Non-Geologists" course was held on February 23 with 20 attendees. Videotapes of the classes conducted in FY 1993 will be available for self-study in late spring and will be shared with the Project Office's Training organization in keeping with Training's commitment to maximizing the utilization of our collective resources.

A total of 110 training assignments were distributed.

DELIVERABLES COMPLETED THIS MONTH

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
N/A	1.2.3	N/A	N/A	FEB-94		TDIF 302417, Data Transmittal Package for Mechanical Properties Data (Grain Density, Porosity, Unconfined Strength, Elastic Properties, and Indirect Tensile Strength) for Drill Hole UE25 NRG-4: Samples from depth 378.1 ft. to 695.8 ft.	
N/A	1.2.3	N/A	N/A	FEB-94		TDIF 303003, Data Transmittal Package for Mechanical Properties Data (Ultrasonic Velocities, Static Elastic Properties, Triaxial Strength, Dry Bulk Density, and Porosity) for Drill Hole UE25 NRG-4 Samples from Depth 527.0 ft.	
OS103	1.2.3.2.7.1.3	19-JAN-94	14-FEB-94	28-FEB094	28	SAND-Experiments on Samples from NRG-6	Delays in drilling resulted in delays to test program
N/A	1.2.3.2.7.1.3	N/A	N/A	1-FEB-94	N/A	SAND94-0305C, "Mechanical and Bulk Properties in Support of ESF Design Issues"	To be presented at the 1994 IHLRWM Conference
N/A	1.2.3.2.7.1.3	N/A	N/A	1-FEB-94	N/A	SAND94-0306C, "Relation Between Static and Dynamic Rock Properties in Welded and Nonwelded Tuff"	To be presented at the 1994 North American Rock Mechanics Symposium
N/A	1.2.3.6.2.1.6	N/A	N/A	8-FEB-94	N/A	SAND94-4002C, "Paleoclimate Validation of a Numerical Climate Model"	To be presented at the 1994 IHLRWM Conference
N/A	1.2.4	N/A	N/A	FEB-94		TDIF 302418, Data Transmittal Package for North Ramp Starter Tunnel Rock-Mass Monitoring Data: Plots of Drift Convergence and Convergence Rate for ESF Starter Tunnel; and Plots of Rock Bolt Load Cells. Quarterly Transmittal of Data Covering Dates 6/1/93-12/14/93	
N/A	1.2.4.2.3.2	N/A	N/A	17-FEB-94	N/A	SAND94-0343C, "Thermal and Seismic Impacts on the North Ramp at Yucca Mountain"	To be presented at the 1994 IHLRWM Conference
N/A	1.2.4.2.1.1.4	N/A	N/A	8-FEB-94	N/A	SAND94-0348C, "Construction Monitoring Activities in the ESF Starter Tunnel" Mountain"	To be presented at the 1994 IHLRWM Conference

DELIVERABLES COMPLETED THIS MONTH (continued)

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
N/A	1.2.5.4.1	N/A	N/A	9-FEB-94	N/A	SAND94-0207C, "Constraining Local 3-D Models of the Saturated-Zone, Yucca Mountain, Nevada"	To be presented at the 1994 IHLRW Conference
N/A	1.2.5.4.1	N/A	N/A	3-FEB-94	N/A	SAND94-0087C, "Effect of Fractures on Repository Dryout"	To be presented at the 1994 IHLRW Conference
N/A	1.2.5.4.4	N/A	N/A	1-FEB-94	N/A	SAND94-0185C, "Modeling Heterogeneous Unsaturated Porous Media Flow at Yucca Mountain"	To be presented at the 1994 IHLRW Conference
OS140	1.2.5.4.6	28-JAN-94	9-FEB-94	9-FEB-94	7	Report-Details on Fracture Matrix Studies (SAND94-0443C)	
OS146	1.2.5.4.6	17-JAN-94	14-FEB-94	11-FEB-94	18	Report-Scaling Studies (SAND94-0326C)	
OS143	1.2.5.4.6	1-FEB-94	14-FEB-94	28-FEB-94	18	Rpt. on Geochemical Models for Caisson Experiment (SAND94-0323C)	
N/A	1.2.9.2.2	15-FEB-94		15-FEB-94	N/A	Monthly Progress Report, Cost/FTE Report, Variance Reports, etc. - January	
N/A	1.2.9.2.2	N/A	N/A	8-FEB-94	N/A	Revisions to SNL Contractor WBS Index and Dictionary	

DELIVERABLES PAST DUE

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
OS147	1.2.3.2.2.2.2	28-JAN-94	31-MAR-94		44	Submit Draft SP to YMP for Acceptance in the SP Review Process	
OS155	1.2.3.2.6.2.1	18-JAN-94	14-APR-94		61	Ltr Rpt Summary of Available Drillhole 2C Data	T. Sullivan (WBS element mgr) requested that data for more than drill hole 2C be included in report
OS17	1.2.4.2.1.2	15-NOV-93	1-APR-94		91	SAND-Test Interference Calculations	
OS23	1.2.4.2.3.2	23-DEC-93	29-APR-94		85	Ltr. Rpt. Seismic Analysis	
OS72	1.2.4.2.3.2	31-JAN-94	31-MAR-94		42	Rpt on Mech. Behavior of Accesses for Package 2C	Milestone was partially met with submittal of the report, "Design Support Analysis: North Ramp Design Package 2C" (SAND93-4021) 12/20/93
P654	1.2.5.4.1	23-DEC-93	29-APR-94		85	Nominal Case Scenario Description	
OS05	1.2.5.4.3	23-DEC-93	31-MAR-94		64	Thermal Loading Studies	
OS27	1.2.5.4.6	30-SEP-93	30-MAR-94		120	Paper-Fracture Wetted Region Structural Function	
OS29	1.2.5.4.6	30-SEP-93	31-AUG-94		228	SAND-Prel. Analysis Gravity Driven Fingering	Milestone deleted - information contained in this report will now be included in the integrated PA report to be submitted as L3 milestone OS134
OS38	1.2.5.4.6	30-SEP-93	30-MAR-94		120	SAND-Detail Charac. Mat. Tracers Caisson Exp.	
OS39	1.2.5.4.6	30-SEP-93	30-JUN-94		185	SAND-Scoping Studies Large Scale Saturated Pathway	

DELIVERABLES EXPECTED TO COMPLETE NEXT MONTH

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
OS78	1.2.3.2.2.2.2	30-MAR-94	30-MAR-94			Progress Report on Development of Linked Strat-Geo Software	
OS147	1.2.3.2.2.2.2	28-JAN-94	31-MAR-94		44	Submit Draft SP to YMP for Acceptance in the SP Review Process	
OS70	1.2.4.2.1.1.1	30-MAR-94	30-MAR-94			Submit Access Convergence Test Plan	
OS74	1.2.4.2.1.1.4	30-MAR-94	30-MAR-94			Submit Construction Monitoring Experiment Plan for North Ramp	
OS72	1.2.4.2.3.2	31-JAN-94	31-MAR-94		42	Rpt on Mech. Behavior of Accesses for Package 2C	Milestone was partially met with submittal of the report, "Design Support Analysis: North Ramp Design Package 2C" (SAND93-4021) 12/20/93
OS05	1.2.5.4.3	23-DEC-93	31-MAR-94		64	Thermal Loading Studies	
OS10	1.2.5.4.4	31-MAR-94	31-MAR-94			SAND Report on INTRAVAL	
OS142	1.2.5.4.6	1-MAR-94	1-MAR-94			Publish User's Manual for LEHGC1.0	
OS27	1.2.5.4.6	30-SEP-93	30-MAR-94		120	Paper-Fracture Wetted Region Structural Function	
OS38	1.2.5.4.6	30-SEP-93	30-MAR-94		120	SAND-Detail Charac. Mat. Tracers Caisson Exp.	

YMP PLANNING AND CONTROL SYSTEM(PACS)
MONTHLY COST/FTE REPORT
Participant: SNL PERIOD: FEB 94

WBS ELEMENT (3rd)	ACTUAL COSTS	PARTICIPANT** HOURS	SUBCON. HOURS	PURCHASE COMMITMENTS	SUBCON. COMMITMENTS	ACCRUED* COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMULATIVE COSTS
1.2.1	12000	-149	112.00	200.00	5790.09	N/A	182000	164131	24000
1.2.2	30000	-473	352.00	0.00	5263.08	N/A	50000	49088	58000
1.2.3	359000	-6908	4016.00	125616.00	759181.39	N/A	4985000	3775730	1407000
1.2.4	259000	-6193	1600.00	8993.00	413585.41	N/A	2864000	2191197	1282000
1.2.5	425000	-12490	2960.00	104739.47	591044.47	N/A	4374000	4030696	2213000
1.2.6	13000	-184	64.00	0.00	18048.18	N/A	130000	66939	18000
1.2.9	39000	-3686	-416.00	189.00	151716.47	N/A	1400000	1185432	557000
1.2.11	83000	-1483	1024.00	2096.00	1156134.61	N/A	1000000	798110	430000
1.2.12	19000	-370	1040.00	5711.00	143921.36	N/A	500000	125000	200000
1.2.15	80000	-1687	1024.00	4711.30	62017.11	N/A	495000	447778	186000
*** Total ***	1319000	-33623	11776.00	252255.77	3306702.17		15980000	12834101	6375000

** Participant hours negative due to one-time balance of hours reported with actual SNL Financial System Hours expended

SNL FTEs: 51.4
Contractor FTEs: 73.6

DISCLAIMER:

The Commitment Amounts displayed on this report represent estimates based upon the best available data and should be treated as approximations.

* Note: The SNL Financial system reports Accruals as Actual Costs.

Participant SNL

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

01-Feb-94 to 28-Feb-94

Prepared - 03/10/94:18:26:27

Page - 1

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	BAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	15	15	12	0	3	81	81	24	0	57	182	155	27
1.2.2	WASTE PACKAGE	7	7	30	0	-23	44	22	58	-22	-36	50	78	-28
1.2.3	SITE INVESTIGATIONS	410	264	359	-146	-95	1954	1745	1407	-209	338	4995	4885	110
1.2.4	REPOSITORY	281	206	259	-75	-53	1254	1231	1282	-23	-51	2864	2865	-1
1.2.5	REGULATORY	386	356	425	-30	-69	1905	1947	2213	42	-266	4374	4472	-98
1.2.6	EXPLORATORY STUDIES FACILI	11	11	13	0	-2	56	56	18	0	38	130	122	8
1.2.9	PROJECT MANAGEMENT	117	117	39	0	78	589	589	557	0	32	1400	1364	36
1.2.11	QUALITY ASSURANCE	84	84	83	0	1	431	431	430	0	1	1000	1056	-56
1.2.12	INFORMATION MANAGEMENT	43	43	19	0	24	215	215	200	0	15	500	506	-6
1.2.15	SUPPORT SERVICES	43	43	80	0	-37	220	220	186	0	34	495	498	-3
Total		1397	1146	1319	-251	-173	6749	6537	6375	-212	162	15990	16001	-11

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	7708	7866	7946	8139	8233	8528	8601	7973	7933	7774	7752	7653	96106
LABOR	640	639	639	644	647	677	679	616	608	590	574	560	7513
SUBS	485	543	588	565	607	608	614	579	573	568	554	533	6817
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	155	156	146	142	143	140	137	137	134	130	122	108	1650
CAPITAL	0	0	10	0	0	0	0	0	0	0	0	0	10
Total BCWS	1280	1338	1383	1351	1397	1425	1430	1332	1315	1288	1250	1201	15990

Participant SNL

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

01-Feb-94 to 28-Feb-94

Prepared - 03/10/94:18:26:27

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	6341	15060	21603	31781	-33623	0	0	0	0	0	0	0	41162
LABOR	547	689	754	647	665	0	0	0	0	0	0	0	3302
SUBS	316	272	551	609	736	0	0	0	0	0	0	0	2484
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	101	180	169	221	-82	0	0	0	0	0	0	0	589
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0	0
Total ACWP	964	1141	1474	1477	1319	0	0	0	0	0	0	0	6375

Resource Distributions

Fiscal Year 1994	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1280	1338	1383	1351	1397	1425	1430	1332	1315	1288	1250	1201	15990
BCWP	1313	1418	1281	1379	1146	0	0	0	0	0	0	0	6537
ACWP	964	1141	1474	1477	1319	0	0	0	0	0	0	0	6375
ETC	0	0	0	0	0	1328	1412	1398	1354	1398	1409	1327	9626

Fiscal Year Distribution

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCWS	15134	15990	29631	42435	48185	50224	54404	46938	35109	0	0	0	338050
BCWP	14647	6537	0	0	0	0	0	0	0	0	0	0	
ACWP	13393	6375	0	0	0	0	0	0	0	0	0	0	
ETC	0	9626	29938	41163	48554	55560	55161	47840	25378	1595	0	0	334583

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

PARTICIPANT: SNL PEM: SMISTAD WBS: 1.2.5.4.1

WBS TITLE: TOTAL SYSTEM PERFORMANCE ASSESSMENT

P&S ACCOUNT: 08541

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
542	576	799	34	6.3	106.3	-223	-38.7	72.1	1230	1305	-75	-6.1	1706	129.2

Analysis

Cumulative Cost Variance:

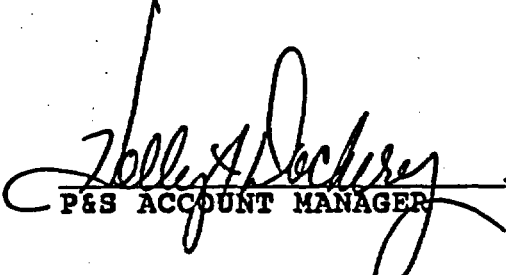
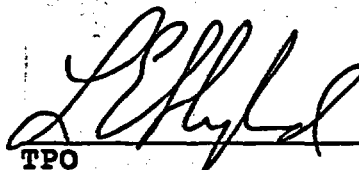
The majority of the cost overrun was caused by the effort to submit the TSPA-II report to DOE for programmatic review. This report would not have met the project schedule without the level-of-effort used during November and December. In addition to writing this report, a Sandia Expert Panel Review Team, which was not budgeted for, also charged 264 hours.

At this time there is no impact to any level II milestones or successor activities.

A CSCR has been initiated by the project office to transfer 75K into this P&S account from CRWMS M&O PA under 12541 to SNL. This additional funding will be used to fund an existing contract, thus supporting the cost overrun.

Cumulative Schedule Variance:

Variance At Complete:

	<u>3/11/94</u>		<u>3/11/94</u>
P&S ACCOUNT MANAGER	DATE	TPO	DATE

Sandia National Laboratories

P. O. Box 5800
Albuquerque, New Mexico 87185-1333

Managed by Martin Marietta Corporation
for the U.S. Department of Energy

L. E. Shephard
Manager, YMP Management Department, MS1333

FEB 17 1994

WBS: 1.2.9.2
QA: NA

Mr. Robert M. Nelson, Acting Project Manager
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
Nevada Operations Office
Las Vegas, NV 89193-8608

Subject: Monthly Progress Report - January 1994
Attn: Melinda M. Martin, (M&O/TRW)

Dear Robert:

Enclosed is the input from Sandia National Laboratories for the January 1994 Monthly Progress Report. The sections on progress, issues, and deliverables/milestones were telecommunicated to Melinda Martin on February 15, 1994. The Variance, cost, performance, and FTE reports were FAXed to Ms. Martin also on February 15, 1994.

You may contact Joe Schelling at (702) 794-7575 or Leigh Lechel at (505) 848-0844 if there are any questions.

Sincerely,



Les E. Shephard, Manager
YMP Management Department, 6302

LES:6302:ll

Attachments: As stated.

Exceptional Service in the National Interest

327
DIVISION
CC: Ameka
CC: BS&D-DD
CC: Coak
CC: Lorin
CC: Grassley
CC: Chell/Williams, C
CC: White, J/Peter
CC: Steve Kell
CC: Nelson, R-w/b
REC'D IN YMP
3/1/94

ENCLOSURE 21

I-354269
BAY

FEB 17 1994

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6351 R. E. Thompson
6352 S. E. Sharpton
6302 F. J. Schelling
6319 J. V. Volgt
6352 D. Armijo
6352 A. P. Hotchkiss
6352 L. Lechel
6302 31/1292/MGMT/1.3/NQ
YMP CRF

SANDIA NATIONAL LABORATORIES

YUCCA MOUNTAIN PROJECT

MONTHLY HIGHLIGHTS AND STATUS REPORT

JANUARY 1994

1. The Yucca Mountain Project is a multi-phased effort to develop a safe and secure repository for high-level radioactive waste. The project is managed by the U.S. Department of Energy, Office of Environmental Management, and is a joint effort with the U.S. Environmental Protection Agency, the U.S. Geological Survey, and the U.S. Nuclear Regulatory Commission. The project is currently in the design and construction phase, and is expected to be completed by the year 2000.

2. The project is a complex and challenging task, requiring the development of new technologies and the coordination of a large number of organizations. The project is currently in the design and construction phase, and is expected to be completed by the year 2000.

3. The project is a complex and challenging task, requiring the development of new technologies and the coordination of a large number of organizations. The project is currently in the design and construction phase, and is expected to be completed by the year 2000.

DISCLAIMER

Quality assurance checks on data contained in this report have been performed only to determine that the data have been obtained and documented properly. The SNL Project Department 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. Milestones have been baselined and are included to show status.

WBS 1.2.1 Systems Engineering

Progress During Report Period

Staff attended several Assessment Team (AT) meetings called to develop a response to a Corrective Action Report (CAR) associated with AP-6.17Q. Even though AP-6.17Q requires execution of a probabilistic risk assessment methodology for identifying items important to radiological safety on the Q-List, alternative methods have been used recently. The corrective action the AT is considering is to modify the procedure to allow the use of such alternative methods, although the AT intends to define detailed acceptance criteria for evaluating analyses.

1.2.3 Site Investigations

Progress During Report Period

The first set of samples that are no longer needed by SNL were successfully shipped to the YMP Sample Management Facility (SMF). The remaining 1,181 samples were then processed, packaged, and shipped to the SMF.

Drilling of hole USW SD-12 commenced on January 28, 1994. Information gathered from core testing and during drilling will support design of the ESF and in-situ monitoring of the unsaturated zone.

Core samples from the NRG-series drill holes were measured for "framework" hydrologic properties. This activity is being conducted under Study 8.3.1.2.2.3, "Matrix Hydrologic Properties."

The drafting of a technical procedure for coding core information in a format suitable for direct data input into the Lynx modeling package was initiated.

A paper entitled, "Development of Stochastic Indicator Models of Lithology, Yucca Mountain, Nevada," was sent to the Project Office for review on January 31, 1994. The results presented in the paper include the first known, rigorously quantitative evaluation of characterization uncertainty in stratigraphic models used by the Yucca Mountain Project.

In corroboration with staff from EG&G, an effort was initiated to determine the best way to directly import data from existing technical data bases into the Lynx GMS system. A method is being developed to handle multiple and/or replicated rock property values for the same core interval while still maintaining traceability of the original data.

Geologic and rock structure logs were completed for NRG-7 and NRG-2C.

The results from 28 unconfined compression experiments and 29 brazil experiments conducted on samples from UE25 NRG-4 were submitted under TDIF 302417, making reviewed and approved data available for the ESF design process. In addition, samples from UE25 NRG-4 were tested in triaxial compression and samples from UE25 NRG-7/7A were machined in preparation for testing.

Preliminary examination of whole rock chemical data from the nonwelded interval between the welded Tiva Canyon and Topopah Springs members indicates secondary mineralization involving more than just simple hydration of volcanic glass. Total H₂O is typically between 5 and 10%. This is considerably more than the upper limit of about 3% permissible for perlitization of glass and less than typical for highly zeolitized rocks at deeper levels at Yucca Mountain. Examination of thin sections indicates that clay probably dominates the hydrated phases, but some sections appear to contain some zeolites as well. X-ray diffraction (XRD) should conclusively establish the presence or absence of zeolites and hopefully the presence of clay materials.

ASCII files were developed of thermal conductivity data (TDIF 302217) and thermal expansion data (TDIF 302218) from NRG-6. The data from these files will be entered into the INGRES tables and used to generate plots. A process was developed to automate the of graphs are being prepared for the session.

Carryover funding was allocated from FY93 to continue the investigation of the time-dependent properties of intact tuff. Preparation began on a sample to be used in the creep (constant stress) experiments funded by the carryover.

Mechanical testing on fractures began on the first sample of a natural fracture from USW NRG-6. The sample was tested in a normal compression experiment and then tested in rotary shear.

The journal article on the simple model of rough fractures entitled, "Simple Mathematical Model of a Rough Fracture," (SAND92-2216J), which documents fracture profiles, was transmitted to the Project Office on January 27, 1994, fulfilling the criteria of Level 3 Milestone OS102.

The recently submitted Study Plan for SCP Study 8.3.1.5.1.6 ("Characterization of Future Regional Climate and Environment") contained organizational and workscope changes which may be in conflict with other Project requirements documents. A Document Action Request (DAR) was submitted to identify any potential changes to requirements documents.

The proposed revisions to the Study Plan 8.3.1.3.7 were transmitted to the Project Office for review on January 25, 1994 (Level 3 Milestone OS139). The recommended revisions describe the work to be conducted by SNL.

Benchmarking of KEMOD, a mixed kinetics/equilibrium chemical speciation code was conducted. This work will support efforts to imbed KEMOD within the LEHGC code in support of sensitivity analyses of systems in which rate-limited processes, such as mineral dissolution/precipitation, are important.

WBS 1.2.4 Repository

Progress During Report Period

The first laboratory-scale backfill conductivity test was assembled and all instrumentation was installed. This test consists of heating a large barrel of crushed welded tuff with a central heater and measuring the thermal

conductivity of the backfill. The conductivity of the backfill is a key parameter that needs to be determined before the thermal consequences of in-drift emplacement with back filling can be evaluated. This test is a joint effort of the sealing program (WBS 1.2.4.6.2) and the waste package program (WBS 1.2.2.4.3).

Planning began for the access convergence experiment, starting with meetings held with representatives of SNL, the M&O designers and the tunnel boring machine (TBM) subcontractors (Kiewit/PB). The purposes of these meetings were for SNL to obtain details of the North Ramp design and TBM operation in order to perform detailed experiment design for the access convergence test, and to ascertain the data needed by the M&O design team to verify their design methodology being used in the construction of the ESF. Although the excavation investigation experiments will be used for repository design, the experiments will also be designed to support verification of the ESF design methodology.

The analyses were identified that are needed to support the production of the Study Plan and that will be conducted this fiscal year. They will be summarized in a SAND report to be finished at the end of FY94.

Rock mass classification results for the North Ramp Starter Tunnel Alcove were submitted to the Project Office. The data for this report will be used in combination with the other data being collected under this study to verify the design methodology being used.

Two additional convergence stations were installed in the starter tunnel alcove. Convergence measurements were made at each of the five locations in the starter tunnel and at the two locations in the alcove.

A report entitled, "Effect of Boundary Conditions on the Strength and Deformability of Replicas of Natural Fractures in Welded Tuff: Data Analysis," (SAND93-7079) was submitted to the Project Office. The report is the last of several reports that describe a series of experiments designed to study the effects of a non-standard loading condition on frictional properties.

SNL has been planning a study of the effects of silica phase transformations on the stresses in the repository. Addressed in the study are (1) how the spatial variability of the materials may be incorporated in the study in a meaningful way and (2) what waste streams should be considered for use in the study.

SNL began translating the latest NRG borehole data into a usable form for submittal to the Reference Information Base (RIB).

Two reports related to laboratory testing of small, layered polycarbonate models, were completed in December. The first report entitled, "Geometrical Moire of Strain Analysis with Displacement Discontinuities," (SAND93-1157) documents the experimental method used in the testing. The second report entitled, "Laboratory Measurements of Frictional Slip on Interfaces in a Polycarbonate Rock Mass Model," (SAND93-2365), documents the experimental results. Both of these reports were transmitted to the Project Office on

January 19, 1994 and fulfill the requirements of Level 3 Milestone OS18.

Development of new reformulated generalized models in an effort to improve SNL's continuum joint model continued. The goals are to increase numerical robustness, have more joint sets at arbitrary angles, and have modifiable joint-slip curves. The capability to treat the intact rock as a Drucker-Prager material was employed with limited success. Only one element test problem was successfully performed.

Evaluations of sealing concepts with specific attention paid to their applications for the current ESF/Repository layouts and concepts were published in the report, "A Review of the Available Technologies for Sealing a Potential Underground Nuclear Waste Repository at Yucca Mountain, Nevada," (SAND93-3997) and fulfills the requirements of Level 3 Milestone OS25.

WBS 1.2.5 Regulatory

The Nuclear Energy Agency (NEA) requested that SNL participate in a working group chartered to oversee development of an international database of features, events, and processes (FEPs). As a member of the group, SNL was given the responsibility to develop and maintain the FEP database. Therefore, another summary account that identifies this effort was added to the SNL scope of work in WBS element 1.2.5.4.1. To date, about 25 new FEPs were entered into the Microsoft Access software.

Staff performed calculations to investigate differences in flow predicted by the weeps model used in the first TSPA iteration (TSPA-1991) and the weeps model used in TSPA-1993.

The weeps calculations were performed for a repository design assuming 57 kW/acre thermal loading with vertically emplaced, SCP-type containers. The major input difference between the TSPA-1991 and the TSPA-1993 weeps models is the inclusion of varied weep sizes in the newer model, but the TSPA-1993 model also included simplified thermal effects and climate changes. When thermal effects and climate changes are removed from the TSPA-1993 model, the model predicts that very few containers are ever contacted by weeps. Inclusion of either thermal effects or climate changes greatly increases the number of contacts. Climate changes result in slightly more weeps contacts than do thermal effects. However, as noted in the TSPA-1993 report, the vast majority of container failures occur when the container temperatures are elevated. Therefore, contacts caused by thermal effects are probably most significant.

A comment-resolution meeting was conducted on the report, "Scenarios Constructed for Nominal Flow in the Presence of a Repository at Yucca Mountain and Vicinity," (SAND92-2186) (Level 2 Milestone P654) and resolution was reached on 66 comments.

SNL Staff gave a presentation on TSPA-1993 to YMP WBS managers in Las Vegas on January 18, 1994.

Staff continued to adapt and improve program CAT2POR, which converts output from the indicator geostatistic simulations into hydrogeologic units and then samples the appropriate porosity probability distribution function to obtain simulated porosities for each node on the fine geostatistical grid.

SNL developed plotting procedures to support of Laboratory Thermal Expansion Testing activities.

Training was provided for existing and new users on the use of AVS for visualizing environmental data. The visualization server is presently configured only for use at the server.

The report entitled, "Wetting Phase Permeability in a Partially Saturated Horizontal Fracture," (SAND93-2774C) was submitted to the Project Office for review in fulfillment of Level 3 Milestone OS28 on January 24, 1994. The report documents the results of the fracture relative permeability experiments.

Air permeameter measurements were collected from a single face for each of two tuff blocks. Over 500 measurements per block face were collected at five different measurement scales (spanning four orders of magnitude on a per volume basis). The results will be included in a report on scaling studies (Level 3 Milestone OS146) to be presented at the 1994 IHLRWM Conference.

Efforts to develop methods to measure sorption under unsaturated conditions continued. Began designing a fiber-optic probe for use in measurements of pH and uranium in unsaturated sand in flow and batch systems.

A report entitled, "Detailed Characterization and Preliminary Adsorption Model for Materials for Intermediate-Scale Transport Experiments," was completed (Level 3 Milestone OS143).

Work began on three activities: the submittal of the hydrological code FEHM to the SNL Software QA System; the formulation of the fracture-matrix simulations; and the calculations to produce realizations of heterogeneous geohydrological properties.

WBS 1.2.9 Project Management

Progress During Report Period

FY94 Milestone Criteria Sheets for 73 SNL milestones were completed and submitted to YMP.

SNL YMP Project Control staff met with YMP integrators and WBS managers on January 10, 1994 to discuss YMP reorganization, the Technical Program Review, and other miscellaneous issues.

Transmitted Monthly Cost, Cost/FTE, Variance, CPR, and Executive Summary reports to the Project Office.

Prepared for and conducted the monthly Task Leader Program Review Meetings on January 10 and 11. Action items stemming from this meeting included reclassifying contracts to collect costs accurately, reallocating resources within various summary accounts, and adjusting due dates, as appropriate, on selected Level 3 Milestones.

Began documenting all of SNL YMP Project Control processes. Documentation of the Cost Report process was completed.

Developed an Integrated Cost Report that provides monthly detail from the SNL Financial System at the summary account level. This report will be used by SNL Task Leaders to monitor account expenditures and contract performance.

Consulted with Project Office on FY93 carryover issues. Replanned 5 FY93 summary accounts that had been closed, and distributed carryover budgets for activities in summary accounts that extended into FY94. Modified BCWS in the workstation to include carryover amounts and discussed the resulting distribution of BCWS with affected Task Leaders.

Loaded updated versions of workstation software.

Issues and Concerns

Changing the due dates of Level 3 Milestones is complicated by the absence of a Project-wide change control mechanism that allows for rebaselining of Level 3 Milestone status. SNL Project Control staff began developing a process for formally tracking requests for changes to Level 3 Milestones and obtaining concurrence from the responsible staff member at the Project Office.

WBS 1.2.11 Quality Assurance

Progress During Report Period

SNL QA Audit Schedule for 1994 was issued.

SNL QA review of J. F. T. Agapito Quality Assurance Program Plan (QAPP), Revision 9 resulted in "Conditional Acceptance" for current work activities to contracts AB-9836 and AE-6737. Full Acceptance is pending the resolution of 14 review comments documented on DRCs.

The SNL QA department has developed a refined procurement review checklist in accordance with SNL's response to the YMP CAR YM-93-097 corrective action commitment. Subsequent training for the QA staff was completed on 1/14/94.

QA coordination resulted in completion of procurement contract revisions to reflect appropriate QA requirements, in accordance with SNL's response to YMP CAR YM-93-098 for contract AG-4079.

Training was provided to the SNL Product Assurance Department on the conduct of surveillance. That organization will conduct internal YMP surveillances.

WBS 1.2.12 Information Management

Progress During Report Period

Fifteen documents were added to the Controlled Document database and twenty-one controlled documents were recalled.

A uniform filing code system was developed for SNL use, and comments are being addressed. The new system will simplify the coding and submittal of records for all personnel.

A total of 2,045 microfilm records were verified and 34 individual records were submitted to the Central Records Facility.

Records Training was started for all Project Personnel. The first class was for secretaries and other support personnel.

March has been designated as "Records Awareness Month" and activities are being planned throughout the month to highlight the importance of records to the YMP project at SNL.

WBS 1.2.15 Support Services

Progress During Report Period

The Quarterly Worker Data Report for the period October through December 1993 was compiled and submitted.

Completed and submitted a report of FY94 subcontractor information requested by the Project Office as well a contractor procurement report requested by the GAO.

Began documenting all of SNL YMP procurement and property processes.

Defined a process to ensure that all procurement records are submitted to the records management system.

Initiated procurement for document production for all Nuclear Waste Management Center projects.

Prepared for SNL internal property inventory, to be conducted during the first week of February. Made arrangements to return surplus inventory to YMP after a radiation scan has been performed. Consulted with YMP property personnel regarding a WIPP and YMP agreement to share computing resources between the two projects.

The training organization arranged for a Procurement Survival course for SNL YMP staff on January 25, 1994. A team from SNL's purchasing organization conducted the all-day session and provided thorough training on procurements from SNL's viewpoint. This training was conducted as supplemental training to QAIP 4-11, Procurement.

SNL revised its orientation program.

Discussed with the Project Office's Training manager and staff how best to ensure that all persons who have access to the site have had orientation and appropriate training. The best solution is to exchange and compare training records.

A total of 90 training assignments were distributed.

DELIVERABLES COMPLETED THIS MONTH

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
N/A	1.2.1	N/A	N/A	24-JAN-94	N/A	SNL Interface Control Working Group (ICWG) Designate	
N/A	1.2.3.2.2.2.2	N/A	N/A	31-JAN-94	N/A	SAND94-0155C, "Development of Stochastic Indicator Model of Lithology, Yucca Mountain, Nevada	To be presented at the 1994 INLRMM Conference
OS58	1.2.3.2.6.2.2	30-AUG-93	14-JAN-94	31-JAN-94	57	Submit Results of Mech Prop Tests on NRG-4	Completes a FY93 milestone.
OS102	1.2.3.2.7.1.4	12-DEC-93	20-JAN-94	25-JAN-94	17	Submit Journal Article on Simple Model of Rough Fracture	
OS139	1.2.3.4.1.5.1	17-JAN-94	17-JAN-94	25-JAN-94	6	Submit Proposed Changes to SP 8.3.1.3.7	
N/A	1.2.4	N/A	N/A	JAN-94	N/A	TDIF 302344, Data Transmittal Package for SAND92-0450, "Rock Mass Mechanical Property Estimations for the Yucca Mountain Site Characterization Project"	
N/A	1.2.4	N/A	N/A	JAN-94	N/A	TDIF 302347, Data Transmittal Package for Rock Mass Classification Data for the Alcove/North Ramp Starter Tunnel	
N/A	1.2.4	N/A	N/A	JAN-94	N/A	TDIF 302348, Data Transmittal Package for Rock Mass Classification Results for the Alcove/North Ramp Starter Tunnel	
N/A	1.2.4	N/A	N/A	JAN-94	N/A	TDIF 302408, Data Transmittal Package for ESF North Ramp Yucca Mountain Project Site Characterization Cross Section Through Exile Hill North Ramp 0+00 to 6+00m	
OS18	1.2.4.2.1.2	30-SEP-93	3-FEB-94	19-JAN-94	75	SAND-Exper Involving Polycarbonate Models (2 reports)	Completes a FY93 milestone.
N/A	1.2.4.2.1.2	N/A	N/A	27-JAN-94	N/A	SAND94-0088C, "Modeling Fracturing of Rock Masses with the DDA Method"	To be presented at the North American Rock Mechanics Symposium
N/A	1.2.4.2.1.2	N/A	N/A	27-JAN-94	N/A	SAND93-7079, "Effect of Boundary Conditions on the Strength and Deformability of Replicas of Natural Fractures in Welded Tuff: Data Analysis"	

DELIVERABLES COMPLETED THIS MONTH (continued)

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
N/A	1.2.4.2.3.1	N/A	N/A	7-JAN-94	N/A	SAND92-2625, "Computational Model for Three-Dimensional Jointed Media with a Single Joint Set"	
OS25	1.2.4.6.1	30-SEP-93	28-JAN-94	31-JAN-94	80	Draft Rpt. Documenting Av. Tech. to Seal U/G Openings	Completes a FY93 milestone.
N/A	1.2.5.4.1	N/A	N/A	24-JAN-94	N/A	SAND93-4097C, "Appropriateness of One-Dimensional Calculations for Repository Repository Analysis"	To be presented at the 1994 IHLRM Conference
N/A	1.2.5.4.1	N/A	N/A	31-JAN-94	N/A	SAND94-0261C, "Analyses of Releases Due to Drilling at the Potential Yucca Mountain Repository"	To be presented at the 1994 IHLRM Conference
OS28	1.2.5.4.6	30-SEP-93	27-JAN-94	22-JAN-94	72	Paper-Effect Entrap Air/Variable Contact Area on Fracture Permeability	Completes a FY93 milestone.
OS148	1.2.5.4.6	28-JAN-94	28-JAN-94	27-JAN-94	-1	Report-Non Isothermal Exp.	
N/A	1.2.5.4.6	N/A	N/A	31-JAN-94	N/A	SAND93-3903C, "Modeling Infiltration into a Tuff Matrix From a Saturated Vertical Fracture"	To be presented at the 1994 IHLRM Conference
N/A	1.2.9.1.2	14-JAN-94	14-JAN-94	19-JAN-94	5	Document Review - "Project Glossary"	
N/A	1.2.9.2.2	14-JAN-94	14-JAN-94	14-JAN-94	N/A	Monthly Progress Report, Cost/FTE Report, Variance Reports, etc. - December	By FAX
N/A	1.2.9.2.2	N/A	N/A	19-JAN-94	N/A	Transmittal of SNL FY94 Approved Level 3 Milestone Criteria Sheets	
N/A	1.2.15.2	N/A	N/A	4-JAN-94	N/A	Subcontractor Information for FY94	
N/A	1.2.15.2	10-JAN-94	10-JAN-94	6-JAN-94	-2	U.S. GAO Request for Information	
N/A	1.2.15.2	25-JAN-94	25-JAN-94	11-JAN-94	-10	Yucca Mountain Project Worker Data Reports - Q4-Calendar Year 1993	

DELIVERABLES PAST DUE

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
OS147	1.2.3.2.2.2.2	28-JAN-94	31-MAR-94		44	Submit Draft SP to YMP for Acceptance in the SP Review Process	
OS155	1.2.3.2.6.2.1	18-JAN-94	1-APR-94		48	Ltr Rpt Summary of Available Drillhole 2C Data	T. Sullivan requested that data for more than drill hole 2C be included in report
OS103	1.2.3.2.7.1.3	19-JAN-94	14-FEB-94		18	SAND-Experiments on Samples from NRG-6	
OS17	1.2.4.2.1.2	30-SEP-93	1-APR-94		121	SAND-Test Interference Calculations	
OS23	1.2.4.2.3.2	30-SEP-93	14-FEB-94		61	Ltr. Rpt. Seismic Analysis	
OS72	1.2.4.2.3.2	31-JAN-94	31-MAR-94		43	Rpt on Mech. Behavior of Accesses for Package 2C	Milestone was partially met with submittal of the report, "Design Support Analysis: North Ramp Design Package 2C" (SAND93-4021) 12/20/93
P654	1.2.5.4.1	23-DEC-93	29-APR-94		85	Nominal Case Scenario Description	
OS05	1.2.5.4.3	23-DEC-93	31-MAR-94		64	Thermal Loading Studies	
OS27	1.2.5.4.6	30-SEP-93	30-MAR-94		120	Paper-Fracture Wetted Region Structural Function	
OS29	1.2.5.4.6	30-SEP-93	31-AUG-94		228	SAND-Prel. Analysis Gravity Driven Fingering	
OS38	1.2.5.4.6	30-SEP-93	30-MAR-94		120	SAND-Detail Charac. Mat. Tracers Caisson Exp.	
OS39	1.2.5.4.6	30-SEP-93	30-JUN-94		185	SAND-Scoping Studies Large Scale Saturated Pathway	
OS140	1.2.5.4.6	28-JAN-94	9-FEB-94		8	Report-Details on Fracture Matrix Studies	
OS146	1.2.5.4.6	17-JAN-94	14-FEB-94		20	Report-Scaling Studies	

DELIVERABLES EXPECTED TO COMPLETE NEXT MONTH

<u>EVENT</u>	<u>WBS NUMBER</u>	<u>DUE DATE</u>	<u>EXPECTED DATE</u>	<u>COMPLETED DATE</u>	<u>SLIP</u>	<u>DESCRIPTION</u>	<u>COMMENTS</u>
OS103	1.2.3.2.7.1.3	19-JAN-94	14-FEB-94		18	SAND-Experiments on Samples from NRG-6	
OS23	1.2.4.2.3.2	30-SEP-93	14-FEB-94		61	Ltr. Rpt. Seismic Analysis	
OS140	1.2.5.4.6	28-JAN-94	9-FEB-94		8	Report-Details on Fracture Matrix Studies	
OS146	1.2.5.4.6	17-JAN-94	14-FEB-94		20	Report-Scaling Studies	
OS143	1.2.5.4.6	1-FEB-94	14-FEB-94		8	Rpt. on Geochemical Models for Caisson Experiment	

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

PARTICIPANT: SNL PEM: SMISTAD WBS: 1.2.5.4.1

WBS TITLE: TOTAL SYSTEM PERFORMANCE ASSESSMENT

P&S ACCOUNT: 08541

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VACX	IEAC	ICPI
430	489	680	59	13.7	113.7	-191	-39.1	71.9	1230	1258	-28	-2.3	1711	128.2

Analysis

Cumulative Cost Variance:

The majority of the cost overrun was caused by the effort to submit the TSPA-II report to DOE for programmatic review. This report would not have met the project schedule without the level-of-effort used during November and December. In addition to writing this report a Sandia Expert Panel Review Team, which was not budgeted for, also charged 264 hours.

At this time there is no impact to any level II milestones or successor activities.

A CSCR has been initiated by the project office to transfer 75K into this P&S account from CRWMS M&O PA under 12541 to SNL. This additional funding will be used to fund an existing contract, thus supporting the cost overrun.

Cumulative Schedule Variance:

Variance At Complete:

W. George Perkins 2/11/94
P&S ACCOUNT MANAGER DATE

J. Chy L 2/11/94
TPO DATE

YMP PLANNING AND CONTROL SYSTEM(PACS)
MONTHLY COST/FTE REPORT
Participant: SNL PERIOD: JAN 94

WBS ELEMENT (3rd level)	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON. HOURS	PURCHASE COMMITMENTS	SUBCON. COMMITMENTS	ACCRUED* COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMULATIVE COSTS
1.2.1	15000	74	160.00	200.00	0.00	N/A	182000	118631	12000
1.2.2	16000	795	-80.00	0.00	2996.74	N/A	50000	36588	28000
1.2.3	358000	6480	2960.00	122277.00	734984.37	N/A	4985000	2439480	1048000
1.2.4	227000	5470	1408.00	6294.00	443596.48	N/A	2864000	1557947	1023000
1.2.5	495000	11232	1616.00	105346.17	434690.01	N/A	4374000	2646946	1788000
1.2.6	-8000	265	-224.00	0.00	22640.02	N/A	130000	34439	5000
1.2.9	121000	3936	576.00	321.00	17034.48	N/A	1400000	835432	518000
1.2.11	136000	1158	1712.00	2096.00	1103241.10	N/A	1000000	548110	347000
1.2.12	99000	375	1888.00	5711.00	75287.09	N/A	500000	288812	181000
1.2.15	18000	1996	-272.00	4711.30	2835.97	N/A	495000	324028	106000
*** Total ***	1477000	31781	9744.00	246956.47	2837306.26		15980000	8830413	5056000

SNL FTEs: 52.3
Contractor FTEs: 60.9

DISCLAIMER:
The Commitment Amounts displayed on this report represent estimates based upon the best available data and should be treated as approximations.

* Note: The SNL Financial system reports Accruals as Actual Costs.

Participant SWL

Yucca Mtn. Site Char. Project-Planning & Control System

01-Jan-94 to 31-Jan-94

Prepared - 02/11/94:09:44:24

PACS Participant Work Station (PPWS)

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WBS Status Sheet (WBS02)

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										FY1994 at Completion		
Id	Description	Current Period					FY1994 Cumulative to Date							
		BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	15	15	15	0	0	66	66	12	0	54	182	164	18
1.2.2	WASTE PACKAGE	8	5	16	-3	-11	37	15	28	-22	-13	50	52	-2
1.2.3	SITE INVESTIGATIONS	365	350	358	-15	-8	1544	1481	1048	-63	433	4995	4912	83
1.2.4	REPOSITORY	279	281	227	2	54	973	1025	1023	52	2	2864	2868	-4
1.2.5	REGULATORY	386	430	495	44	-65	1519	1591	1788	72	-197	4374	4402	-28
1.2.6	EXPLORATORY STUDIES FACIL	11	11	-8	0	19	45	45	5	0	40	130	124	6
1.2.9	PROJECT MANAGEMENT	117	117	121	0	-4	472	472	518	0	-46	1400	1384	16
1.2.11	QUALITY ASSURANCE	84	84	136	0	-52	347	347	347	0	0	1000	1028	-28
1.2.12	INFORMATION MANAGEMENT	43	43	99	0	-56	172	172	181	0	-9	500	497	3
1.2.15	SUPPORT SERVICES	43	43	18	0	25	177	177	106	0	71	495	466	29
Total		1351	1379	1477	28	-98	5352	5391	5056	39	335	15990	15897	93

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
LDRHRS	7708	7866	7946	8139	8233	8528	8601	7973	7933	7774	7752	7653	96106
LABOR	640	639	639	644	647	677	679	616	608	590	574	560	7513
SUBS	485	543	588	565	607	608	614	579	573	568	554	533	6817
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	155	156	146	142	143	140	137	137	134	130	122	108	1650
CAPITAL	0	0	10	0	0	0	0	0	0	0	0	0	10
Total BCWS	1280	1338	1383	1351	1397	1425	1430	1332	1315	1288	1250	1201	15990

Participant SNL

Yucca Mtn. Site Char. Project-Planning & Control System

01-Jan-94 to 31-Jan-94

Prepared - 02/11/94:09:44:24

PACS Participant Work Station (PPWS)

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WBS Status Sheet (WBS02)

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
LABHRS	6341	15060	21603	31781	0	0	0	0	0	0	0	0	74785
LABOR	547	689	754	647	0	0	0	0	0	0	0	0	2637
SUBS	316	272	551	609	0	0	0	0	0	0	0	0	1748
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PMLE	0	0	0	0	0	0	0	0	0	0	0	0	0
OTNER	101	180	169	221	0	0	0	0	0	0	0	0	671
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0	0
Total ACWP	964	1141	1474	1477	0	0	0	0	0	0	0	0	5056

Resource Distributions

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1280	1338	1383	1351	1397	1425	1430	1332	1315	1288	1250	1201	15990
BCWP	1313	1418	1281	1379	0	0	0	0	0	0	0	0	5391
ACWP	964	1141	1474	1477	0	0	0	0	0	0	0	0	5056
ETC	0	0	0	0	1302	1408	1378	1394	1321	1374	1382	1282	10841

Fiscal Year Distribution

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCWS	15134	15990	29631	42435	48185	50224	54404	46938	35109	0	0	0	338050
BCWP	14647	5391	0	0	0	0	0	0	0	0	0	0	
ACWP	13393	5056	0	0	0	0	0	0	0	0	0	0	
ETC	0	10841	30142	41145	48627	55490	55020	47670	25307	1570	0	0	334261

Sandia National Laboratories

P. O. Box 5800
Albuquerque, New Mexico 87185-1333

Managed by Martin Marietta Corporation
for the U.S. Department of Energy

L. E. Shephard
Manager, YMP Management Department, MS1333

WBS: 1.2.9.2
QA: NA

JAN 18 1994

Mr. Robert M. Nelson, Acting Project Manager
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
Nevada Operations Office
Las Vegas, NV 89193-8608

Subject: Monthly Progress Report - December 1993
Attn: Melinda M. Martin, (M&O/TRW)

Dear Robert:

Enclosed is the input from Sandia National Laboratories for the December 1993 Monthly Progress Report. The sections on progress, issues, deliverables/milestones, and TDIFs were telecommunicated to Melinda Martin on January 17, 1994. The Variance, cost, performance, and FTE reports were FAXed to Ms. Martin on January 14, 1994.

You may contact Joe Schelling at (702) 794-7575 or Leigh Lechel at (505) 848-0844 if there are any questions.

Sincerely,


for Les E. Shephard, Manager
YMP Management Department, 6302

LES:6302:II

Attachments: As stated.

Copy (w/attachments) to:

6300 D. E. Ellis
6302 L. E. Shephard
6115 P. B. Davies
6312 H. A. Dockery
6313 L. S. Costin
6318 R. R. Richards
6351 R. E. Thompson
6352 S. E. Sharpton
6302 F. J. Schelling
6352 D. Armijo
6352 A. P. Hotchkiss
6352 L. Lechel
6302 35/1292/CONT/1.4/NQ
YMP CRF

327
DIVISION
cc: Srinivasan - w/b
cc: Dyer/Nelson - w/b
cc: Bark
cc: Basu - w/b
cc: Bradsky
cc: BIB-BC
cc: White, J.
cc: Stueker

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BMH

SANDIA NATIONAL LABORATORIES

YUCCA MOUNTAIN PROJECT

MONTHLY HIGHLIGHTS AND STATUS REPORT

December 1993

**Sandia
National
Laboratories**

WBS 1.2.2 Waste Package

Progress During Report Period

SNL staff began to evaluate the environmental, safety, and health (ES&H) requirements necessary for the conduct of the backfill thermal conductivity experiment. The design and fabrication of the containment vessel for use in the experiment, and the development of a process to obtain and crush the rock necessary for the experiment continued.

1.2.3 Site Investigations

Progress During Report Period

Preparation of the draft Study Plan 8.3.1.4.3.1.2, "Three-Dimensional Rock Characteristics Models," (Level 3 Milestone OS147) continued. The study is intended to develop custom models specifically to support a particular design analysis or performance assessment exercise; therefore, the study plan will primarily describe the various methods and techniques that may be employed.

A joint (SNL, USGS, and M&O) training session was conducted by Lynx Geosystems in Albuquerque. The session focused on the existing Lynx GMS surface-modeling and geostatistical modules (most Lynx work to-date by both SNL and the USGS has utilized the "3-D component modeling" approach). In addition, a tape containing the current ESF underground workings that can be merged into the developing rock properties models for reference purposes was successfully installed on the SNL Lynx system.

A letter report entitled, "Development of Integrated Geostatistical Modeling Software: An Interim Status Report and Plan," (SLTR93-0003) was transmitted to the Project Office on December 22, 1993 (Level 3 Milestone OS76). The report summarizes SNL's experiences over the past several years using geostatistical algorithms (partially) developed under YMP contracts with the Stanford (University) Center for Reservoir Forecasting and applied to various Yucca Mountain modeling problems. The report also describes software development efforts to be conducted over the next year or so to integrate and automate a number of currently separate computer codes, and the benefits anticipated as a result of this effort.

Investigation of the nonlithified units on the west side of Exile Hill began. High-resolution seismic surveys were completed and data are being analyzed. Trench NRT-1 was excavated to a depth of 5 meters and will be deepened to 10 meters, at which time field tests and laboratory testing of rock samples will be performed.

Final Geologic and Rock Structural Logs were prepared for all the completed NRG boreholes. The initial phase of drilling was completed on NRG-7A at 880 feet, and structural and geologic logging of core is underway. Core samples from the first 500 feet of NRG-7A were submitted for mechanical laboratory testing.

To date, 12 Technical Data Information Forms (TDIFs) have been submitted for samples from 7 NRG holes at varying depths. The TDIFs are for average grain densities, dry bulk densities, and matrix porosities. The data contained in

these TDIFs will support interpretation of thermal and mechanical properties data being collected.

Thermal conductivity measurements are progressing on three samples of welded devitrified tuff and three samples of nonwelded zeolitic tuff are being used for the saturation effects study. The thermal conductivity of each sample is being measured at nominal temperatures of 30°C, 50°C, and 70°C, at five different saturation states (fully saturated, oven-dry, air-dry, and two other intermediate states). Testing on the air-dry, vacuum saturated, and one intermediate state (approximately 2/3 saturated) has been completed. Approximately half of the testing is completed on samples at the other intermediate saturation state. Testing for this study is anticipated to be completed by the end of January 1994. Results will be included in the report on the effects of saturation on thermal conductivity (Level 3 Milestone OS110).

Plots of thermal conductivity data transmitted under TDIF 302217 and of thermal expansion data transmitted under TDIF 302218 are being generated to support data analyses of thermal properties and geostatistical modeling activities.

The whole rock chemical analyses for samples from NRG-6 (below 416.0 feet) were completed and the data are being reviewed. Samples from depths 152.9 to 241.5 had a high water content (from approximately 4% to over 6%) compared to samples from other depths (generally less than 0.5%). Petrographic examination of these samples show the presence of clays and, possibly, some zeolites. Final results will be included in the report on mineralogoc, petrologic, and chemical data (Level 3 Milestone OS108).

The study to examine the effects of sample size on thermal-expansion behavior was initiated. For this study, five samples of each of four different lithologies (welded devitrified, welded vitric, nonwelded vitric, and nonwelded zeolitic) are being tested using nominal sample sizes of 1.0 inch diameter by 4.0 inches long and 0.25 inch diameter by 1.0 inch long. Results of the study will be included in a report on the effect of sample size on thermal-expansion behavior (Level 3 Milestone OS89).

In the study of the mechanical properties of NRG drill hole samples, two TDIFs (302231 and 302232) were submitted that provide results from 13 unconfined compression and 3 Brazil experiments, with corresponding bulk property and velocity measurements on samples from UE25 NRG-2B and UE25 NRG-5. As data are collected, analysis continues including comparison with previous data from smaller samples.

A report on the results of testing samples from USW NRG-6 entitled, "Bulk and Mechanical Properties of the Paintbrush Tuff Recovered from Borehole USW NRG-6: Data Report," (SAND93-4020) is in SNL technical review (Level 3 Milestone OS103).

A journal article on the simple model of rough fractures entitled, "Simple Mathematical Model of a Rough Fracture," (SAND92-2216J) which documents fracture profiles is in management review at SNL (Level 3 Milestone OS102).

The Study Plan 8.3.1.5.1.6, "Characterization of Future Regional Climate and

Environment," was submitted to the Project Office for approval on December 23, 1993 (Level 3 Milestone OS51). SNL and the National Center for Atmospheric Research (NCAR) completed all prerequisite actions necessary for the resumption of quality-affecting work in support of efforts in WBS element 1.2.3.6.2.1.6. NCAR staff began preparing software quality assurance documentation for the regional climate modeling code, RegCM2. Joe Schelling (SNL) met several times with Dick Maudlin (YMP-QA) and his team to discuss a performance-based audit of activities performed within this WBS element that the team intends to conduct in FY94.

In an attempt to adapt a coupled reaction/transport simulator (LEHGC) to a massively parallel computing architecture, the new version of the LEHGC code successfully ran a sample problem on multiple nodes of the nCUBE. Timing studies to evaluate the code's performance are being conducted using different numbers of dedicated nodes.

Issues and Concerns

Delivery of the Study Plan, "Three-Dimensional Rock Characteristics Models," may be delayed because the staff who are assigned to support this effort were needed to support the final review and revision of "Total-System Performance Assessment for Yucca Mountain - SNL Second Iteration (TSPA-93)," (SAND93-2675) (Level 3 Milestone OS133). Several major subsections were rewritten to provide needed integration of Chapter 6 into the overall report.

The role of the LEHGC code in support of the retardation sensitivity analyses and its use in the minimum K_d strategy is the subject of ongoing discussions. Resolution of this issue may require additional work by the principal investigator that was not originally included in this summary account.

WBS 1.2.4 Repository

Progress During Report Period

SNL hosted the monthly Repository Design Integration Workshop held on December 15, 1993. The principal purpose of the meeting was to present and discuss a new concept for integrated repository/waste package design and to review the status of revising the WBS structure for elements 1.2.2 and 1.2.4.

Work began on development of a draft of Study Plan 8.3.1.15.1.6, "In Situ Thermomechanical Properties," (Level 3 Milestone OS71), and identification of the analyses needed to support the Study Plan.

Planning for the access convergence test continued and will be documented in a report (Level 3 Milestone OS70).

Seismic monitoring of blasting in the starter tunnel alcove was conducted. The data taken, combined with seismic data taken during the construction of the rest of the starter tunnel will be used to construct a site-specific curve of peak particle velocity versus blast charge. This curve will be made available to the constructor for use in design, to replace the general (non-site specific) curve currently being used. Additionally, because peak particle velocity has been correlated with extent of blast damage into other studies, this data will be available for use in blast damage assessments. All

of the data obtained will be included in an initial data report for the starter tunnel (Level 3 Milestone OS75).

There are fifteen rock bolt load cells installed on selected rock bolts that form part of the permanent support of the starter tunnel. The cells were installed in five different cross sections in the tunnel, in groups of three. These rock bolt load cells were monitored and the records will be used to validate the design of the ground support, and enhance the safety of the tunnel. This information will also be included in the initial data report for the starter tunnel.

Two reports related to laboratory testing of small, layered polycarbonate models, were completed in December. The first report entitled, "Geometrical Moire of Strain Analysis with Displacement Discontinuities," (SAND93-1157) documents the experimental method used in the testing. The second report entitled, "Laboratory Measurements of Frictional Slip on Interfaces in a Polycarbonate Rock Mass Model," (SAND93-2365), documents the experimental results. Once both of these reports are transmitted to the Project Office, the requirements for completion of Level 3 Milestone OS18 will be met.

SNL began the initial planning efforts for studying the effects of silica phase transformations on the stresses in the repository. These phase transformations dramatically increase the thermal expansion coefficients of the rock and have the potential of significantly increasing the stresses. Preliminary analyses showed that increases of the stresses on the order of a factor of two could be expected. The results will be studied and new plans will be formulated. Final results will be included in a report on effects of silica phase transformations on stresses (Level 3 Milestone OS121).

The sub-blocking approach to discrete element analyses using an Augmented Lagrangian Method and rock block fracturing work continued and these capabilities are presented a conference paper entitled, "Using an Augmented Lagrangian Method and Block Fracturing in the DDA Method," (SAND93-0817C). Results of adding more general joint constitutive modeling capabilities will be presented in a report describing discrete element work (Level 3 Milestone OS123).

Thermal-mechanical analyses conducted in support of north ramp design package 2C were completed. Cross sections along the north ramp subject to combinations of in situ, seismic, and thermal loads were evaluated. Thermal stresses were computed along the north ramp using the output from the repository scale thermal model as input into a layered three-dimensional elastic model. The latest available site data were used in the mechanical model. Seismic loads were estimated primarily using a quasi-static approach based on a 0.4g earthquake. A limited set of dynamic seismic analyses using scaled downhole earthquake logs were also completed. Documentation of this work is incorporated into SAND93-4021, "Design Support Analysis: North Ramp Design Package 2C," and was submitted to the Project Office for approval on December 20, 1993. This deliverable partially fulfills the requirements of Level 3 Milestone OS72.

These analyses are required to support the selection of ground support for the ESF excavations as well as to provide the basis for demonstrating compliance with repository design requirements for those excavations that may become part

of a future repository. To perform these analyses and supply the results to the ESF design team on schedule required close coordination with the site characterization activities (material properties testing), code development and validation, design analysis, and the ESF design team.

Sealing concepts described in existing SAND reports were evaluated, with specific attention to their application for the current ESF/Repository layouts and concepts. A summary of the results of these evaluations will be included in the draft report entitled, "A Review of the Available Technologies for Seal Emplacement in an Underground Nuclear Waste Repository in the Unsaturated Zone," (SAND93-3997), (Level 3 Milestone OS25). An evaluation of repository design/performance constraints for seal systems is underway as related to the current facility design.

A limited laboratory evaluation was completed on the Y-7 grout mix intended for use in the USW UZ-16 instrumentation emplacement and characterization activities (memorandum Finley to Tynan, 12/8/93). The evaluation was limited to the grout supplied by the USGS, along with an assessment of mechanical property data. The mechanical properties of the Y-7 mix suggest that it could be removed from boreholes after emplacement, however, it is uncertain how this material will perform as a plugging and sealing material over longer time periods. It is suggested that tests be initiated to evaluate this material's long-term performance in rock from Yucca Mountain.

WBS 1.2.5 Regulatory

Progress During Report Period

SNL staff throughout the project participated in an Expert Panel Review of the report entitled, "Total-System Performance Assessment for Yucca Mountain - SNL Second Iteration (TSPA-1993)," (SAND93-2675). The review panel generated a large number of mandatory comments that required significant modifications to the document. The TSPA report was transmitted to the Project Office on December 30, 1993 (Level 3 Milestone OS133).

Numerical modeling began to support investigation of the impacts of varying permeabilities on predicted non-isothermal flow fields in saturated homogeneous systems. Based on the results of this modeling exercise, an experiment was initiated using a material with a permeability that should result in significantly reduced convection in the system. Comparisons of experimental results and numerical simulations for this experiment will be included in a progress report on non-isothermal modeling and experiments (Level 3 Milestone OS127).

Work completed as part of the ongoing investigations of non-isothermal flow modeling and experimentation was incorporated into "Studies of Non-Isothermal Flow in Saturated and Partially Saturated Porous Media," (SAND93-4045C) (Level 3 Milestone OS145).

A paper entitled, "Development of Methods to Evaluate Uranium Distribution Coefficients in Unsaturated Media," (SAND93-7091C) was submitted to the Project Office for approval on December 8, 1993 (Level 3 Milestone OS35).

Progress was made on a collaborative MIT/SNL/UNM study to measure uranium

sorption by mineral mixtures under unsaturated conditions. Improved instrumentation was developed to measure concentrations of uranium in moist and solution samples; current detection limits are 1 ppm and 1 ppb in moist sand and solutions. Results of this work will be included in a report on measurement of sorption under unsaturated conditions (Level 3 Milestone OS142).

Technical review and revision of 12 chapters in the report describing characterization of materials for the caisson experiment were completed (Level 3 Milestone OS38).

Final results of the fracture-relative permeability experiments were prepared for inclusion in the report, "Wetting Phase Permeability in a Partially Saturated Horizontal Fracture," (SAND93-2774C) to be presented at the 1994 IHLRWM Conference (Level 3 Milestone OS28).

Analyses of X-ray images collected from the large format (0.6 by 0.6 m) fracture-matrix interaction test were completed. The investigation yielded porosity fields for both tuff slabs at a spatial resolution of 0.4 by 0.4 mm. Saturation fields, quantifying the transient imbibition of fluid into the tuff slabs from the saturated slot fracture, were also generated. In a joint effort with the USGS in Mercury, NV, characterization of the tuff hydraulic properties was accomplished as well as numerical simulations of the experiment. Results of the study will be documented in a report that will detail fracture-matrix studies (Level 3 Milestone OS140).

Eight tuff blocks sawn from boulders taken from Yucca Mountain, NV were received at SNL. These tuff blocks were selected because they exhibit varying types and degrees of heterogeneity and depositional history (i.e., welding, varying pumice/lithic/lithophysae content and size). By studying the different blocks, the effect of heterogeneity on scaling behavior will be investigated. Scaling investigations were initiated which involve making over 500 measurements per block face at five different measurement scales (spanning four orders of magnitude on a per volume basis). Results of these investigations will be included in a report on scaling studies (Level 3 Milestone OS146) to be presented at the 1994 IHLRWM Conference.

A non-isothermal flow experiment in a saturated homogeneous sand pack was performed this month. The experiment utilized a thin sand chamber in which the lower boundary was heated and the top cooled. Light transmission imaging was used to track the movement of a dye tracer and an array of thermocouples were used to monitor temperature. The experiment was then modeled using TOUGH2. Good agreement between the experiment and the simulated flow and temperature field was achieved. A sensitivity analysis was also performed to evaluate the influence of bulk permeability and boundary heat loss. The results of these analyses will be included in a report entitled, "Studies of Non-Isothermal Flow in Saturated and Partially Saturated Porous Media," (SAND93-4045C) to be presented at the 1994 IHLRWM Conference (Level 3 Milestone OS148).

Requirements were collected for supporting IGIS-related activities in the Laboratory Thermal Expansion Testing WBS element.

The HP visualization server is being configured for use and additional AVS

licenses ordered to support existing users on the old Stardent system and other temporary systems. Maintenance for the Stardent has become too costly and is being discontinued. Visualization will now be handled on the HP with the Stardent acting as a workstation.

WBS 1.2.11 Quality Assurance

Progress During Report Period

SNL submitted all documentation to the Yucca Mountain QA Division required for completion of the QARD transition. Concurrently, the QARD matrix was transmitted via the Requirements Tracking Network to YMQAD.

The initial schedule of SNL YMP QA surveillances for calendar year 1994 was issued.

The SNL Primary Standards Laboratory completed actions identified in a supplier evaluation conducted earlier this year; they can now be placed on the YMP Qualified Supplier List.

On-site quality engineering assistance for site data-gathering activities involving the ESF geotechnical measurements and the Soil and Rock Properties study was provided at the starter tunnel and the Field Operations Center (FOC).

QAIP 19-1 "Software QA Requirements" was issued, superseding QAIP 3-2, "Software QA Requirements."

TDIFs SUBMITTED IN DECEMBER

TDIF 302231 Data Transmittal Package for Mechanical Properties Data (Ultrasonic Velocities, Static Elastic Properties, and Unconfined Strength) for Drillhole UE25 NRG-5 Samples from Depth 847.2 ft to 896.5 ft

TDIF 302232 Data Transmittal Package for Mechanical Properties Data (Ultrasonic Velocities, Static Elastic Properties, Unconfined Strength, Tensile Strength, and Porosity) for Drillhole UE25 NRG-2B Samples from Depth 2.7 ft to 87.6 ft

TDIF 302238 Data Transmittal Package for YM Site Characterization Project Geology and Rock Structure Log for Drillhole UE25 NRG-5

TDIF 302239 Data Transmittal Package for YM Site Characterization Project Geology and Rock Structure Log for Drillhole UE25 NRG-4

TDIF 302241 Data Transmittal Package for YM Site Characterization Project Core Hole Rock Structural Data Summary for Holes UE25 NRG-1, UE25 NRG-2, UE25 NRG2A, UE25 NRG-3, UE25 NRG-4, UE25 NRG-5, USW NRG-6, and RF#8

TDIF 302270 Data Transmittal Package for Schmidt Hammer Test Data from NRG Drillholes Core

TDIF 302271 Data Transmittal Package for YM Site Characterization Project Estimated Rock Mass Quality Indices Based on Core Log Data Holes UE25 NRG-1, UE25 NRG-2, UE25 NRG2A, UE25 NRG-3, UE25 NRG-4, UE25 NRG-5, and USW NRG-6

TDIF 302272 Data Transmittal Package for YM Site Characterization Project Rock Mass Mechanical Properties Estimates Boreholes UE25 NRG-1, UE25 NRG-2, UE25 NRG2A, UE25 NRG-3, UE25 NRG-4, UE25 NRG-5, and USW NRG-6

TDIF 302273 Data Transmittal Package for Design Support Analyses: North Ramp Design Package 2C

DELIVERABLES/MILESTONE

WBS 1.2.3 Site Investigations

<u>Milestone #</u>	<u>Description</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
OS12 ('93)	SAND-Summary of Work Done in NRG Holes in FY93	11/30/93	5/2/94		
OS51 ('93)	Submit Draft SP 8.3.1.5.1.6	9/30/93	12/22/93	12/22/93	
OS58 ('93)	Submit Results of Mech Prop Tests on NRG-4	8/30/93	1/14/94		
OS76 ('94)	Submit Progress Report and Plan for Integration of GSLIB	12/22/93	12/22/93	12/22/93	
OS78 ('94)	Submit Progress Report on Development of Linked Strat- Geostatistical Software	3/30/94	3/30/94		
OS102('94)	Submit Journal Article on Simple Model of Rough Fracture	12/22/93	1/20/94		
OS103('94)	SAND-Experiments on Samples from NRG-6	1/18/94	1/18/94		
OS110('94)	Rpt. on Effects of Satur. on Thermal Conductivity	3/30/94	3/30/94		
OS139('94)	Submit Proposed Changes to SP 8.3.1.3.7	1/14/94	1/14/94		

WBS 1.2.3 Site Investigations (continued)

<u>Milestone #</u>	<u>Description</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
OS147('94)	Submit Draft SP to YMP for Acceptance in the SP Review Process	1/28/94	3/31/94		Resources were dedicated to supporting the TSPA-93 report in reviewing and having to make significant revisions to some chapters. No significant impact to other milestones will result from the delay.
OS155('94)	Ltr Rpt Summary of Available Drillhole 2C Data	1/18/94	1/18/94		

WBS 1.2.4 Repository

<u>Milestone #</u>	<u>Description</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
OS17 ('93)	SAND-Test Interference Calc.	9/30/93	4/1/94		
OS18 ('93)	SAND-Exper Involving Poly-carbonate Models	9/30/93	2/3/94		
OS23 ('93)	Ltr. Rpt. Seismic Analysis	9/30/93	2/14/93		
OS25 ('93)	Draft Rpt. Documenting Av. Tech. to Seal U/G Openings	9/30/93	1/28/94		
OS72 ('94)	Rpt on Mech. Behavior of Accesses for Package 2C	1/31/94	1/31/94		Milestone was partially met with submittal of the report, "Design Support Analysis: North Ramp Design Package 2C" (SAND93-4021) 12/20/93

WBS 1.2.5 Regulatory

<u>Milestone #</u>	<u>Description</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
P654 ('93)	Nominal Case Scenario Desc.	9/30/93	4/30/94		C/SCR submitted 12/20 to extend due date to 4/30/94 because of other priorities (support to TSPA-93, primarily)
OS05 ('93)	Thermal Loading Studies	12/22/93	3/31/94		Accounting for internal SNL review time, and the fact that resources have been dedicated to other priorities.
OS10 ('93)	SAND Report on INTRAVAL	9/30/93	3/30/94		C/SCR submitted 12/20 to extend due date to 3/30.
OS27 ('93)	Paper-Fracture Wetted Region Structural Function	9/30/93	3/30/94		
OS28 ('93)	Paper-Effect Entrap Air/ Variable contact Area on Fracture Permeability	9/30/93	1/27/94		
OS29 ('93)	SAND-Prel. Analysis Gravity Driven Fingering	9/30/93	8/31/94		
OS35 ('93)	Prel. Report on Unsaturated Sorption (KD) Measurements	9/30/93	12/22/93	12/8/93	
OS37 ('93)	Draft Users Manual LEHGC Code	9/30/93	N/A		C/SCR submitted 12/17 to replace with L3 milestone OS142

WBS 1.2.5 Regulatory (continued)

<u>Milestone #</u>	<u>Description</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
OS38 ('93)	SAND-Detail Charac. Mat. Tracers Caisson Exp.	9/30/93	2/15/93		C/SCR submitted 12/17 to extend due date to 2/15/94 due to support provided to other priorities
OS39 ('93)	SAND-Scoping Studies Large Scale Saturated Pathway	9/30/93	6/30/94		
OS133('94)	Report on TSPA-II	12/22/93	12/22/93	12/30/93	
OS140('94)	Report-Details on Fracture Matrix Studies	1/28/94	1/28/94		
OS142('94)	Publish Users Manual LEHGC Code	2/28/94	2/28/94		
OS143('94)	Rpt. on Geochemical Models for Caisson Experiment	2/1/94	2/1/94		
OS146('94)	Report-Scaling Studies	1/17/94	1/17/94		
OS148('94)	Report-Non Isothermal Exp.	1/28/94	1/28/94		

Participant SNL

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

01-Dec-93 to 31-Dec-93

Prepared - 01/13/94:09:09:15

Page - 1

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												
		Current Period					FY1994 Cumulative to Date					FY1994 at Completion		
Id	Description	BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	16	16	0	0	16	51	51	-3	0	54	182	157	25
1.2.2	WASTE PACKAGE	8	0	4	-8	-4	29	10	12	-19	-2	50	41	9
1.2.3	SITE INVESTIGATIONS	429	361	353	-68	8	1179	1131	690	-48	441	4995	4859	136
1.2.4	REPOSITORY	265	248	315	-17	-67	694	744	796	50	-52	2864	2856	8
1.2.5	REGULATORY	365	356	479	-9	-123	1133	1224	1293	91	-69	4374	4313	61
1.2.6	EXPLORATORY STUDIES FACILI	11	11	1	0	10	34	34	13	0	21	130	109	21
1.2.9	PROJECT MANAGEMENT	117	117	166	0	-49	355	355	397	0	-42	1400	1380	20
1.2.11	QUALITY ASSURANCE	85	85	109	0	-24	263	263	211	0	52	1000	1006	-6
1.2.12	INFORMATION MANAGEMENT	43	43	10	0	33	129	129	82	0	47	500	495	5
1.2.15	SUPPORT SERVICES	44	44	37	0	7	134	134	88	0	46	495	466	29
Total		1383	1281	1474	-102	-193	4001	4075	3579	74	496	15990	15682	308

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	7708	7866	7946	8179	8193	8528	8601	7973	7933	7774	7752	7653	96106
LABOR	640	639	639	648	643	677	679	616	608	590	574	560	7513
SUBS	485	543	588	608	612	606	612	568	556	551	542	523	6794
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	155	156	146	151	151	143	139	139	133	129	121	110	1673
CAPITAL	0	0	10	0	0	0	0	0	0	0	0	0	10
Total BCWS	1280	1338	1383	1407	1406	1426	1430	1323	1297	1270	1237	1193	15990

Participant SNL

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

01-Dec-93 to 31-Dec-93

Prepared - 01/13/94:09:09:15

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	6341	15060	21603	0	0	0	0	0	0	0	0	0	43004
LABOR	547	689	754	0	0	0	0	0	0	0	0	0	1990
SUBS	316	272	551	0	0	0	0	0	0	0	0	0	1139
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	101	180	169	0	0	0	0	0	0	0	0	0	450
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0	0
Total ACWP	964	1141	1474	0	0	0	0	0	0	0	0	0	3579

Resource Distributions

Fiscal Year 1994	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1280	1338	1383	1407	1406	1426	1430	1323	1297	1270	1237	1193	15990
BCWP	1369	1425	1281	0	0	0	0	0	0	0	0	0	4075
ACWP	964	1141	1474	0	0	0	0	0	0	0	0	0	3579
ETC	0	0	0	1389	1347	1406	1389	1360	1312	1302	1240	1358	12103

Fiscal Year Distribution

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCWS	15134	15990	29631	42435	48185	50224	54404	46938	35109	0	0	0	338050
BCWP	14598	4075	0	0	0	0	0	0	0	0	0	0	
ACWP	13393	3579	0	0	0	0	0	0	0	0	0	0	
ETC	0	12103	30555	41104	48855	55368	54896	47620	25287	1386	0	0	334146

YMP PLANNING AND CONTROL SYSTEM(PACS)
MONTHLY COST/FTE REPORT
Participant: SNL PERIOD: DEC 93

WBS ELEMENT (3rd level)	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON. HOURS	PURCHASE COMMITMENTS	SUBCON. COMMITMENTS	ACCRUED* COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMULATIVE COSTS
1.2.1	0	0	0.00	200.00	0.00	N/A	182000	57631	-3000
1.2.2	4000	60	-48.00	0.00	2996.74	N/A	50000	24088	12000
1.2.3	353000	4239	2912.00	15687.50	-10929.11	N/A	4985000	1507730	690000
1.2.4	315000	4437	1968.00	6284.00	-215814.08	N/A	2864000	1241447	796000
1.2.5	479000	8624	944.00	59173.57	1099890.61	N/A	4374000	1863196	1293000
1.2.6	1000	91	-32.00	0.00	-27986.97	N/A	130000	1939	13000
1.2.9	166000	2039	1600.00	6965.00	-78360.67	N/A	1400000	485432	397000
1.2.11	109000	913	1200.00	2096.00	1198481.45	N/A	1000000	298110	211000
1.2.12	10000	233	32.00	5711.00	38140.68	N/A	500000	163812	82000
1.2.15	37000	898	240.00	2148.80	286.91	N/A	495000	200278	88000
*** Total ***	1474000	21534	8816.00	98265.87	2006705.56		15980000	5843663	3579000

SNL FTEs: 58.1
Contractor FTEs: 55.1

DISCLAIMER:
The Commitment Amounts displayed on this report represent estimates based upon the best available data and should be treated as approximations.

* Note: The SNL Financial system reports Accruals as Actual Costs.

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

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
ANALYSIS PAPER: STUDIES OF SOIL GAS GEOCHEMISTRY Milestone Number: 3GQH854M		01/31/94		
ANALYSIS PAPER: PALIOCLIMATE IMP. SOIL CARBONATE Milestone Number: 3GQH856M		01/31/94		
ANALYSIS PAPER: PALIOCLIMATE IMP. SOIL CARBONATE Milestone Number: 3GQH858M		01/31/94		
TECHNICAL PROC: DETERMINE H/D RATIO OF H2O Milestone Number: 3GQH860M		01/31/94		
TECHNICAL PROC: DETERMINE H/D RATIO OF H2O Milestone Number: 3GQH862M		01/31/94		
ANLYS PPR: SR ISOTOPE GEOCHEM OF PLAYA DEPOSITS Milestone Number: 3GQH864M		01/31/94		
REPORT: PROTOTYPE TESTING, BERGEN PARK Milestone Number: 3GUP081M	12/31/92	09/30/94		
RPT/TDIF: EXCAVATED TRENCHES SOLITARIO CNYN FLT Milestone Number: 3GPF20M	01/28/93	04/29/94		
REPORT/TDIF: METEOROLOGICAL DATA FY91-92 Milestone Number: 3GQH001M	02/26/93	08/31/94		
REPORT/TDIF: 14 C/D TRENCH STUDIES Milestone Number: 3GPF036M	03/31/93	05/31/94		
PAPER ON STRUCTURAL FLOW-PATH W/TRANSPT & CHEM Milestone Number: 3GFH009M	03/31/93	03/31/94		
RPT/TDIF: RESULTS OF LOGGING FROM TRENCH 17 Milestone Number: 3GFP021M	04/05/93	01/31/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PRELIM RPT:TRENCH ACROSS FAULT S. WINDY WASH Milestone Number: 3GPF035M	04/30/93	05/31/94		
JOURNAL PAPER/TDIF: DETAILED MOIRE Milestone Number: 3GUS015M	04/30/93	05/31/94		
REPORT/TDIF: WATER-LEVEL DATA (1990 AND 1991) Milestone Number: 3GWF064M	04/30/93	03/14/94		
P891: INTRABOREHOLE FLOW AND STRESS TEST REPORT Milestone Number: 3GWF010M	04/30/93	01/31/94		
RPT/TDIF: FY92 DATA FROM ANALOG RECHARGE SITE Milestone Number: 3GQH12CM	04/30/93	01/31/94		
REPORT/TDIF: EVALUATION OF BEATTY SCARP Milestone Number: 3GTQ034M	06/01/93	02/25/94		
REPORT/TDIF: PRELIMINARY QUATERNARY FAULT MAP Milestone Number: 3GTQ035M	06/01/93	12/31/93	12/31/93	
REPORT/TDIF: FY92 SYNOPTIC/REG/SITE MET DATA Milestone Number: 3GMM038M	06/30/93	07/29/94		
RPT/TDIF:STREAMFLOW & PRECIPITATION DATA FY86-90 Milestone Number: 3GRS031M	06/30/93	01/17/94		
REPORT/TDIF: CRATER FLAT TUFF FRACTURE MAPPING Milestone Number: 3GWM013M	06/30/93	07/29/94		
ANALYSIS PAPER: SEISMIC REFLECTION PROFILE EVAL Milestone Number: 3GGU256M	07/02/93	07/29/94		
RPT/TDIF: TRENCHES STAGECOACH ROAD FAULT Milestone Number: 3GPF21M	07/02/93	03/30/94		
ANLYS PAPER: LAB MEASUREMENT OF UNSATURATED FLOW Milestone Number: 3GUS034M	07/30/93	02/04/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
REPORT/TDIF: TRENCH LOG ON A-3 Milestone Number: 3GFP011M	08/03/93	07/29/94		
RPT/TDIF: GEOPHYSICAL STUDY/WINDY WASH FAULT Milestone Number: 3GPF039M	08/27/93	02/25/94		
REPORT/TDIF: RESULTS OF TRENCH LOGGING ESF TREN Milestone Number: 3GFP008M	08/31/93	01/31/94		
REPORT/TDIF: ASSESS LITTLE SKULL MTN EQ Milestone Number: 3GSM149M	09/15/93	01/31/94		
RPT/TDIF: QUAT ACT PAINTBRUSH CANYON & B BUTTE Milestone Number: 3GPF19M	09/15/93	01/31/94		
REPORT: EVAL FAULTS SW OF YUCCA MTN Milestone Number: 3GTQ009M	09/30/93	02/28/94		
ANLYS PPR: SCARP DEGRADATION/EVOL N. WINDY WASH Milestone Number: 3GPF034M	09/30/93	10/14/94		
REPORT: FORTY MILE WASH RECHARGE DATA FY92 Milestone Number: 3GRG021M	09/30/93	03/31/94		
STREAMFLOW CHAOS JOURNAL ARTICLE Milestone Number: 3GRG023M	09/30/93	06/30/94		
REPORT: HISTORICAL NEUTRON HOLE DATA Milestone Number: 3GUI050M	09/30/93	06/30/94		
OFR/TDIF INFILT STUDY: DEVELOPMENT/TESTING Milestone Number: 3GUI636M	09/30/93	04/29/94		
OFR/TDIF: PROJECTION MOIRE Milestone Number: 3GUS024M	09/30/93	06/30/94		
ANLYS PPR: OBSERV OF WATER MOVEMENT IN WLD TUFF Milestone Number: 3GUS033M	09/30/93	03/10/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
WRIR/TDIF: MONITORING GAS TRACER Milestone Number: 3GUH016M	09/30/93	06/30/94		
Z255: RPT/TDIF: ASSESS OF SITE SZ HYDROCHEM DATA Milestone Number: 3GWH001M	09/30/93	02/28/94		
STATUS RPT: CONCEPTUAL MODEL FRACTURE NETWORK Milestone Number: 3GWM005M	09/30/93	12/28/93	12/28/93	
REPORT/TDIF: C14 ANALYSIS Milestone Number: 3GCL109M	09/30/93	01/31/94		
FINAL RPT/TDIF: DIGITIZED MAP NORTHERN 1/3 YM Milestone Number: 3GCH036M	09/30/93	01/31/94		
REPORT ON ORIGIN OF SURFACE DEPOSITS Milestone Number: 3GQH019M	09/30/93	03/31/94		
REPORT/TDIF: CL-36 AGES OF SOIL FY93 Milestone Number: 3GQH007M	09/30/93	01/31/94		
PROV RESULTS: DECISION - TRENCHES, ROCK VALLEY Milestone Number: 3GTN003M	12/09/93	12/07/93	12/07/93	
RFP(S): COMPLETE RFPs FOR SEISMIC CONTRACT Milestone Number: 3GGU465M	12/31/93	12/21/93	12/21/93	
ANALYSIS PPR: FULL PERIPHERY MAP/STARTER TUNNEL Milestone Number: 3GGF003M	12/31/93	01/17/94		
POSTER (AGU): HYDROCHEM SPREADSHEET Milestone Number: 3GRG075M	12/31/93	12/08/93	12/08/93	
CRITERIA LET: REHABILITATING WELLS WT#4/#14/#15 Milestone Number: 3GWF072M	12/31/93	12/13/93	12/13/93	
PROVISIONAL RESULTS: PHYS/MINERAL/PETRO DESCRIPT Milestone Number: 3GQH20M	12/31/93	12/31/93	12/31/93	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUBLICATION: FAULTS ON EAST SIDE YM Milestone Number: 3GPF114M	01/21/94	01/21/94		
PUBLICATION: ISOTPIC DATING IN QUAT FAULT SUDIES Milestone Number: 3GPF110M	01/31/94	01/19/94		
ANALYSIS PAPER: FLUID INCLUSION HISTORY Milestone Number: 3GQH14M	01/31/94	01/31/94		
ANLYS PPR: SR ISOTOPIC CHAR MINRL LMSTNS IN S NV Milestone Number: 3GNR010M	01/31/94	01/31/94		
GROUND-WATER REPORT/TDIF: FIRST QUARTER FY94 Milestone Number: 3GWR030M	01/31/94	01/31/94		

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

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PROVISIONAL RESULTS: ISOTOP COMP/FLUID INCLUSION Milestone Number: 3GQH850M		01/31/94		
SELECT SEISMIC CONTRACTOR(S) Milestone Number: 3GGU265M	02/01/93	04/29/94		
SECTION OF PERCOLATION TEST REPORT (FOR 8312242) Milestone Number: 3GUF022M	03/31/93	08/31/94		
REPORT/TDIF: PRELIMINARY QUATERNARY FAULT MAP Milestone Number: 3GTQ035M	06/01/93	12/31/93	12/31/93	
REPORT: CENTRAL 1/3 YM Milestone Number: 3GCH055M	07/02/93	07/29/94		
PRELIM SUMMARY REPORT/TDIF: MIDWAY VALLEY Milestone Number: 3GFP024M	09/30/93	02/28/94		
REPORT: ASSESS SURF CHANGES/LITTLE SKULL EQ Milestone Number: 3GTM07JM	09/30/93	01/28/94		
STATUS RPT: CONCEPTUAL MODEL FRACTURE NETWORK Milestone Number: 3GWM005M	09/30/93	12/28/93	12/28/93	
PROV RESULTS: DECISION - TRENCHES, ROCK VALLEY Milestone Number: 3GTN003M	12/09/93	12/07/93	12/07/93	
RFP(S): COMPLETE RFPs FOR SEISMIC CONTRACT Milestone Number: 3GGU465M	12/31/93	12/21/93	12/21/93	
POSTER (AGU): HYDROCHEM SPREADSHEET Milestone Number: 3GRG075M	12/31/93	12/08/93	12/08/93	
CRITERIA LET: REHABILITATING WELLS WT#4/#14/#15 Milestone Number: 3GWF072M	12/31/93	12/13/93	12/13/93	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PROVISIONAL RESULTS: PHYS/MINERAL/PETRO DESCRIPT Milestone Number: 3GQH20M	12/31/93	12/31/93	12/31/93	
REVIEW DRAFT: SUMMARY REPORT - MIDWAY VALLEY Milestone Number: 3GFP028M	01/20/94	01/20/94		
DATA TO LRC: TRENCH LOGS Milestone Number: 3GTQ062M	01/31/94	01/31/94		
PROVISIONAL RESULTS: EVALUATION OF MEGABRECCIA Milestone Number: 3GTD040M	01/31/94	01/31/94		
DATA TO LRC: FY93 MOISTURE DATA Milestone Number: 3GRG002M	01/31/94	01/31/94		
PROV RLTS: COMPLETION OF SECT - L2 MILESTNE P932 Milestone Number: 3GWM017M	01/31/94	01/31/94		
PROVISIONAL RESULTS: DUPLICATE ANALYSIS COMPARSN Milestone Number: 3GCL120M	01/31/94	07/29/94		
PROVISIONAL RESULTS: RADIOCARBON DATING RESULTS Milestone Number: 3GCL130M	01/31/94	01/31/94		
MEMORANDUM OF SITE RESTORATION Milestone Number: 3GQH22CM	01/31/94	01/31/94		

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 31-DEC-93**

PARTICIPANT: LLNL PEM: LONG

WBS: 1.2.3.5.2.2

WBS TITLE: ENGINEERING, DESIGN AND DRILLING SUPPORT

P&S ACCOUNT: 0L3522

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	EVZ	SPI	CV	EVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
6	6	27	0	0.0	100.0	-21	-350.0	22.2	25	46	-21	-84.0	113	100.0

Analysis

Cumulative Cost Variance:

The DOE WBS Manager decided to only fund this LOE account at the \$25k level for FY94, with a contingency to increase funding if demand warranted. In mid-November, the WBS Manager was informed that about 1/2 of the FY funding had been used in the first month; it was recommended that funding be increase to \$75k. In mid-December, the recommendation was reviewed and accepted, with action to be completed in time for the January YMPO AFP submission to DOE HQ. In the meantime, calls for support in this WBS will be met because the third level (1.2.3) WBS has enough funds to temporarily meet the overall 1.2.3 demand.

Cumulative Schedule Variance:

Variance At Complete:

This is an LOE account; its funding is determined by the demand for support services. Additional funding has been requested to meet requirements.

W. L. Lelanne 1/14/94
P&S ACCOUNT MANAGER DATE

W. L. Lelanne 1/14/94
TPO DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 31-DEC-93**

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					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	TEAC	TCPI
59	59	125	0	0.0	100.0	-66	-111.9	47.2	240	306	-66	-27.5	508	100.0

Analysis

Cumulative Cost Variance:

Cost variance was produced by unforeseen level of activity required to support NWTRB actions. LLNL does not control the frequency or requirements of activities covered by this WBS. Costs are incurred as a result of ad hoc support requirements requested by NRC, NWTRB, and DOE.

Cumulative Schedule Variance:

Variance At Complete:

Variance at completion is a trend indication only. LLNL will continue to respond to requests by the above organizations until BAC has been expended.

John Charles for
W. Charles 11/18/94
P&S ACCOUNT MANAGER DATE

John Charles for
W. Charles 11/18/94
TPO DATE

Participant LLNL		Yucca Mtn. Site Char. Project-Planning & Control System								01-Dec-93 to 31-Dec-93					
Prepared - 01/10/94:11:40:20		PACS Participant Work Station (PPWS)								Page - 1					
		WBS Status Sheet (WBS02)								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															
Current Period															
FY1994 Cumulative to Date															
FY1994 at Completion															
Id Description BCWS BCWP ACWP SV CV BCWS BCWP ACWP SV CV BAC EAC VAC															
1.2.1 SYSTEMS ENGINEERING 13 13 11 0 2 39 39 24 0 15 160 145 15															
1.2.2 WASTE PACKAGE 774 884 553 110 331 2204 2256 1852 52 404 8772 8149 623															
1.2.3 SITE INVESTIGATIONS 106 80 56 -26 24 317 239 225 -58 34 1101 969 132															
1.2.5 REGULATORY 109 106 112 -3 -6 336 309 378 -27 -69 1482 1497 -15															
1.2.9 PROJECT MANAGEMENT 100 100 88 0 12 303 303 287 0 16 1222 1206 16															
1.2.11 QUALITY ASSURANCE 53 53 32 0 21 161 161 134 0 27 650 623 27															
1.2.12 INFORMATION MANAGEMENT 21 21 18 0 3 62 62 45 0 17 250 233 17															
1.2.13 ENVIRONMENT, SAFETY, & HEA 1 1 0 0 1 6 6 3 0 3 25 22 3															
1.2.15 SUPPORT SERVICES 31 31 21 0 10 94 94 72 0 22 382 360 22															
Total 1208 1289 891 81 398 3522 3489 3020 -33 469 14044 13204 840															
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															
LABHRS 8389 8320 8192 8384 8257 8104 8087 7808 8058 7906 7896 7564 96965															
LABOR 772 781 758 803 764 766 745 737 740 747 722 721 9056															
SUBS 202 205 264 233 315 269 195 173 257 167 109 200 2589															
TRAVEL 0 0 0 0 0 0 0 0 0 0 0 0 0															
PHSE 0 0 0 0 0 0 0 0 0 0 0 0 0															
OTHER 156 198 175 203 184 185 170 179 162 161 136 158 2067															
CAPITAL 0 0 11 21 258 21 7 7 7 0 0 0 332															
Total BCWS 1130 1184 1208 1260 1521 1241 1117 1096 1166 1075 967 1079 14044															

UBS 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
LABORS	8301	6113	5630	0	0	0	0	0	0	0	0	0	20044
LABOR	762	413	383	0	0	0	0	0	0	0	0	0	1558
SUBS	114	303	254	0	0	0	0	0	0	0	0	0	671
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PHSE	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	152	385	243	0	0	0	0	0	0	0	0	0	780
CAPITAL	0	0	11	0	0	0	0	0	0	0	0	0	11
Total ACWP	1028	1101	891	0	0	0	0	0	0	0	0	0	3020

Fiscal Year 1994	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCUS	1130	1184	1208	1260	1521	1241	1117	1096	1166	1075	967	1079	14044
BCWP	1289	911	1289	0	0	0	0	0	0	0	0	0	3489
ACWP	1028	1101	891	0	0	0	0	0	0	0	0	0	3020
ETC	0	0	0	1159	1486	1233	1073	1098	1108	1070	956	1001	10184

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCUS	10845	14044	42631	40634	35287	24735	16377	10420	6461	750	0	0	202184
BCWP	10466	3489	0	0	0	0	0	0	0	0	0	0	
ACWP	10846	3020	0	0	0	0	0	0	0	0	0	0	
ETC	0	10184	40817	39334	34883	25684	17844	10918	7189	823	0	0	201742

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

PARTICIPANT: LLNL
DATE PREPARED: Jan. 19, 1994

FISCAL MONTH/YEAR: DEC. 1993

WBS ELEMENT	CURRENT MONTH END								FISCAL YEAR		
	ACTUAL COSTS	PARTICIPANT FTEs	HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS#	CAP EOPT ACCURAL	APPROVED BUDGET	CURRENT FY94 AFP	CUMULATIVE COSTS
1.2.1.5	11,933	0.70	88		0				160,000		23,692
SUBT 1.2.1	11,933	0.70	88	0	0	0	0	0	160,000	80,000	23,692
1.2.2.1	18,859	1.60	120		58				400,000		134,924
1.2.2.2.1	44,875	2.90	344		3,483	176,000			550,000		128,482
1.2.2.2.2	56,665	1.60	330		2,059		2,024		850,000		154,158
1.2.2.2.3	13,377	0.60	120		15				230,000		26,258
1.2.2.2.4	183,011	5.10	861		591	622,259	44,900		1,650,000		308,609
1.2.2.2.5	14,635	0.80	115		20				248,000		57,892
1.2.2.3.1.1	139,481	0.90	114	721	0	365,319	245,000		1,785,000		100,681
1.2.2.3.1.2	14,147	0.60	72		122	61,731			280,000		11,781
1.2.2.3.2	137,720	3.40	430		1,084	30,000	23,250		880,000		145,174
1.2.2.3.4.1	23,747	1.50	192		2,897				390,000		73,644
1.2.2.3.4.2	6,331	0.40	56		2				300,000		36,673
1.2.2.3.5	6,031	0.50	64		0				100,000		8,373
CAPITAL EQUIP.									****		
SUBT 1.2.2	656,879	19.90	2,816	721	10,331	1,255,308	315,174	0	7,663,000	3,631,500	985,287
1.2.3.1	25,405	0.40	176		0				245,000		29,134
1.2.3.4.2	22,921	1.30	106		332				381,000		68,261
1.2.3.5.2.2	0	0.00	0		0				25,000		27,136
1.2.3.10.1	13,833	0.80	100		0				125,000		37,296
1.2.3.10.2	18,024	0.50	168		41,774		4,304		125,000		37,360
1.2.3.11.3	12,005	0.50	70		6				200,000		35,834
CAPITAL EQUIP.									***		
SUBT 1.2.3	92,188	3.50	620	0	42,112	0	4,304	0	1,101,000	450,500	235,021
1.2.5.1	7,803	0.50	68		0				150,000		7,803
1.2.5.2.2	31,132	1.70	212		0				240,000		123,604
1.2.5.3.4	27,805	1.50	271		6,983		1,820		350,000		65,650
1.2.5.3.5	6,024	0.20	56		6,024				50,000		9,919
1.2.5.4.2	41,350	3.60	460		811				660,000		134,225
1.2.5.5.2	2,943	0.20	24		0				20,000		4,943
CAPITAL EQUIP.									**		
SUBT 1.2.5	117,057	7.70	1,091	0	13,818	0	1,820	0	1,470,000	735,000	346,144

Issues and Concerns

The issue of ownership of the spent fuel samples maintained at the Materials Characterization Center at PNL (as a LLNL subcontract) needs resolution. The samples were obtained from the utilities by DOE (but not necessarily DOE-RW). Because of reduced OCRWM workscope (due to both reduced resources and to favorable results from early screening experiments), much of the inventory is no longer required by RW. Further, PNL has other sponsors (including EM) who have need for the hot-cells in which the inventory is maintained. Consequently, PNL is proceeding with a plan to downscope the inventory and move the unneeded material to lower-cost dry storage on site. However, it is not clear which DOE organization, RW or EM, will be responsible for the dry storage and ultimate disposal of these materials. In addition, the material remaining in the hot cells will be maintained with RW funding. But, this creates an issue of RW's responsibility for its ultimate disposal. Resolution of this issue will require coordination at DOE HQ and with DOE-RL. This issue was raised to the YMPO level by LLNL about a year ago; DOE-RL has also raised this issue at DOE HQ.

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

T. Buscheck continued to support the thermal loading systems study with a suite of repository-scale models of the unsaturated zone (UZ) and saturated zone (SZ) for repository areas of 570, 744, 1139, 1755, and 2598 acres. For 63,000 MTU of Spent Nuclear Fuel (SNF), these repository areas correspond to Areal Mass Loadings (AMLs) of 110.5, 83.4, 55.3, 35.9, and 24.4 MTU/acre. 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 (in yearly increments) the emplaced inventory of BWR Waste Packages (WPs) each containing 40 assemblies, and PWR WPs each containing 21 assemblies. The waste receipt schedule was supplied by John King of the M&O. This month, we focused on the impact of sub-repository-scale, buoyant, gas-phase convection on hydrothermal performance in the vicinity of emplacement drifts.

Using the drift-scale model, we conducted calculations for AMLs of 24.2, 35.9, 55.3, 83.4, and 110.5 MTU/acre. In order to analyze the impact of sub-repository-scale, buoyant, gas-phase convection, we considered values of k_b of 10 and 280 millidarcy, and 168 darcy. Table I summarizes the thermal performance of the waste package surface for all of the cases considered. Table II summarizes the thermal performance in the rock 0.75 m above the drift ceiling. These calculations apply to the 21-PWR and 40-BWR WP receipt scenario assumed in the repository-scale models with one important distinction. Rather than blending all of the WPs received over the 23-yr emplacement period, we assumed a WP receipt scenario which is more realistic in analyzing the local hydrothermal performance in the vicinity of an individual emplacement drift. We blended the heat output for the first 63 21-PWR WPs and 46 40-BWR WPs received during the first two years of repository operation. Our earlier drift-scale calculations, which blended 23 yr of WPs received by the repository, resulted in peak WP temperatures occurring at about 125 yr. Using the WP receipt schedule that more realistically accounts for local heating conditions, the drift-scale models predict temperature peaking between 12 and 60 yr. For the 21-PWR and 40-BWR WP receipt scenario, a center-to-center WP spacing of 12 m is assumed. Note that these calculations are also applicable to a 12-PWR and 21-BWR WP receipt scenario with a center-to-center WP spacing of 6.86 m.

<p align="center">Table I Thermal performance of the waste package (WP) surface for 21-PWR WPs and 40-BWR WPs with 12-m center-to-center spacing between WPs; also applicable to 12-PWR WPs and 21-BWR WPs with 6.86-m center-to-center WP spacing</p>							
AML (MTU/acre)	APD (kW/acre)	Drift spacing (m)	k _b (darcy)	T _{1000 yr} (°C)	T _{peak} (°C)	t _{peak} (yr)	t _{bp} (yr)
24.2	25	99.0	0.01	80.0	171.8	12.6	350
24.2	25	99.0	0.28	79.4	170.4	12.8	310
24.2	25	99.0	168	79.0	164.0	12.5	300
35.9	37	68.8	0.01	99.3	172.5	14.1	1155
35.9	37	68.8	0.28	99.2	170.7	12.4	1148
35.9	37	68.8	168	91.1	165.2	12.8	1111
55.3	57	43.4	0.01	125.3	184.6	25.1	2438
55.3	57	43.4	0.28	120.5	181.6	20.0	2394
55.3	57	43.4	168	120.1	169.0	14.3	2029
83.4	86	28.8	0.01	162.6	219.9	50.0	3964
83.4	86	28.8	0.28	157.2	202.0	40.1	3966
83.4	86	28.8	168	154.0	169.0	40.0	3415
110.5	114	21.7	0.01	203.3	269.9	60.0	5725
110.5	114	21.7	0.28	192.5	241.5	50.2	5574
110.5	114	21.7	168	188.1	242.2	60.0	5548

<p align="center">Table II Thermal performance in the rock 0.75 m above the drift ceiling for 21-PWR WPs and 40-BWR WI's with 12-m center-to-center spacing between WPs; also applicable to 12-PWR WPs and 21-BWR WPs with 6.86-m center-to-center WI' spacing</p>							
AML (MTU/acre)	APD (kW/acre)	Drift spacing (m)	k _b (darcy)	T _{1000 yr} (°C)	T _{peak} (°C)	t _{peak} (yr)	t _{bp} (yr)
24.2	25	99.0	0.01	78.2	144.1	14.4	202
24.2	25	99.0	0.28	75.8	142.2	17.6	195
24.2	25	99.0	168	75.4	133.0	14.5	183
35.9	37	68.8	0.01	98.3	146.1	19.3	1014
35.9	37	68.8	0.28	98.2	144.4	25.2	1010
35.9	37	68.8	168	94.9	135.4	19.0	955
55.3	57	43.4	0.01	123.0	165.5	35.3	2379
55.3	57	43.4	0.28	118.0	160.7	25.0	2316
55.3	57	43.4	168	117.7	136.8	18.1	1828
83.4	86	28.8	0.01	160.9	208.8	60.1	3885
83.4	86	28.8	0.28	155.4	188.0	45.8	3873
83.4	86	28.8	168	152.1	182.8	60.3	3338
110.5	114	21.7	0.01	201.9	262.7	60.0	5594
110.5	114	21.7	0.28	190.9	238.2	60.7	5430
110.5	114	21.7	168	186.4	233.6	70.4	5408

The most important observation about sub-repository-scale performance concerns the substantial difference between thermal performance predicted by repository-scale models and that predicted by drift-scale models. For an AML of 24.2

MTU/acre, the repository-scale models predict a peak temperature, T_{peak} of 65°C, while the drift-scale model predicts T_{peak} up to 172°C on the WP surface and 144°C in the rock adjacent the drift. While the repository-scale model predicts no boiling period, the drift-scale model predicts t_{bp} from 183 to 202 yr in the rock and from 300 to 350 yr on the WP surface. Similarly, the repository-scale model predicts no boiling period for an AML of 35.9 MTU/acre. However, the drift-scale model predicts t_{bp} of 955 to 1014 yr in the rock and 1111 to 1155 yr on the WP surface.

Another important observation about sub-repository-scale performance is that T_{peak} varies modestly for AMLs ranging from 24.2 to 55.3 MTU/acre. Because it occurs so early (generally, $t_{\text{peak}} < 25$ yr), T_{peak} is relatively insensitive to whether the distance to the adjacent emplacement drift is 43.4 m or 99.0 m. For the high-AML cases, the drift spacing is small enough to cause T_{peak} to be sensitive to center-to-center drift spacing. Consequently, T_{peak} is significantly greater for the 110.5-MTU/acre case than for the 83.4-MTU/acre case.

Another important observation is that t_{bp} is insensitive to sub-repository-scale, buoyant, gas-phase convection for the low- and high-AML cases (24.2, 35.9, and 110.5 MTU/acre). For intermediate-AML cases (55.3 and 83.4 MTU/acre), t_{bp} is modestly sensitive to sub-repository-scale, buoyant, gas-phase convection. For the low-AML cases, the spatial extent of moisture movement (i.e., dry-out and condensate buildup) is very dependent on the magnitude of sub-repository-scale, buoyant, gas-phase convection. For the high-AML cases, the spatial extent of dry-out and condensate buildup is insensitive to sub-repository-scale, buoyant, gas-phase convection.

1.2.1.6 Configuration Management

No significant activities.

1.2.2. WASTE PACKAGE

1.2.2.1 Waste Package Coordination and Planning

W. Clarke, J. Blink, R. Stout, W. Halsey, and D. McCright attended the Design Integration Group meeting in Albuquerque on December 15.

LLNL hosted representatives from Spain's radioactive waste program, ENRESA. Spain has completed a collaboration agreement with the DOE. Areas of possible collaboration discussed include container material performance, spent fuel and cladding performance, engineering backfill and the effects of man-made materials.

W. Lin attended a Sample Overview Committee meeting at NTS on December 8, 1993.

1.2.2.2 Waste Package Environment

The YMPO Change Control Board approved movement of portions of WBS 1.2.2.2 to WBS 1.2.3.12. A supplemental request has been submitted to move the remaining portions of the WBS so that the structure of the Waste Package Environment WBS remains unchanged. A request was also made to transfer the FY94 funding between the old and new WBS elements. If those requests are approved, we will begin reporting using the new WBS structure in the February report. It is expected that the PACS system will require an additional month or two before it reports costs using the new WBS structure.

1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment

Study Plan 8.3.4.2.4.1, Characterization of Chemical and Mineralogical Changes in the Post Emplacement Environment, was submitted to YMPO, completing third level milestone MOL18.

Work on the New Zealand natural process analog site concentrated on preparation, presentation, and final drafting of a paper for the Materials Research Society meeting in Boston. The paper was entitled "Field-based Tests of Geochemical Modeling Codes: New Zealand Hydrothermal Systems".

Data sets for use in the three-dimensional representation of mineralogical and chemical changes associated with various waste loading scenarios and repository geometries were obtained. These data sets will be imported into the graphics package in February.

1.2.2.2.2 Hydrologic Properties of the Waste Package Environment

Some calculations related to this WBS element are reported under WBS 1.2.1.5.

The Impact of Mountain-Scale, Buoyant Gas-Phase Convection on Bulk Moisture Movement

With the use of the repository-scale models that include the unsaturated zone (UZ) and saturated zone (SZ), we continued analyzing the sensitivity of mountain-scale, buoyant, gas-phase convection to bulk permeability, k_b . Calculations conducted this month include a 27.1-MTU/acre, 10-millidarcy case; 49.2-MTU/acre, 10-millidarcy and 168-darcy cases; and 154.7-MTU/acre, 84- and 168-darcy cases. All of these cases assume a uniform fracture permeability throughout the UZ, resulting in a nearly uniform k_b in the UZ. For areal mass loadings (AMLs) of 27.1, 49.2, and 154.7 MTU/acre, we closely examined the net buildup in liquid water above the repository, ΔV , as a function of k_b between 10 millidarcy and 168 darcy. Because the model is an equivalent continuum formulation, non-equilibrium fracture flow (and hence much of the potential shedding) is not modeled; therefore, the predicted net water buildup is larger than that expected in the field.

The shape of the ΔV vs k_b curve varies significantly among the various AML cases. For the 154.7 MTU/acre case, the slope of ΔV vs k_b is fairly uniform, increasing slightly with increasing k_b . The dependence of ΔV vs k_b is very nonlinear for the 27.1- and 49.2-MTU/acre cases. For small k_b , the slope is very shallow. The slope increases abruptly at $k_b = 1$ darcy for the 49.2-MTU/acre case and at $k_b = 10$ darcy for the 27.1-MTU/acre case.

Over the k_b range between 10 millidarcy and 168 darcy, we made the following observations about the effect of AML on ΔV . For $k_b < 20$ millidarcy, the 154.7-MTU/acre case has the smallest ΔV . The AML with the largest ΔV varies with k_b : 49 MTU/acre has the largest ΔV for 20 to 50 millidarcy and for 2.5 to 100 darcy; 154.7 MTU/acre has the largest ΔV for the intermediate k_b range of 50 millidarcy to 2.5 darcy; and 27.1 MTU/acre has the largest ΔV for high k_b (above 100 darcy). Where the impact of mountain-scale, buoyant, gas-phase convection is greatest, the low- to intermediate- AML cases result in the largest ΔV . For intermediate- k_b (280 millidarcy to 1 darcy), where the impact of mountain-scale, buoyant, gas-phase convection is relatively moderate, ΔV for the various AML cases generally varies by less than a factor of 2.

Impact of Enhanced Gas-Phase Diffusion

We examined the effect of enhanced gas-phase diffusion on repository-scale hydrothermal performance. It has been observed by soil scientists that in soils, the movement of water vapor in the gas-phase due to diffusive transport is enhanced under nonisothermal conditions as compared to when the soil is under isothermal conditions. The diffusive flux of water vapor, according to Fick's law applied to a porous medium under isothermal conditions, is equal to the negative of the gradient of the mass multiplied the tortuosity factor and the free diffusion coefficient. Roughly speaking, the tortuosity factor (the reciprocal of the tortuosity) is defined to be the mean ratio of the straight line path length divided by the actual path length between two points within the porous medium. Under nonisothermal conditions, the diffusive flux is affected by another factor called the diffusion enhancement factor, τ_e , which depends on the saturation and temperature. In soils, τ_e can be as large as 5. The diffusion enhancement effect is thought to arise from various mechanisms. One such mechanism is the simultaneous evaporation and condensation on opposite sides of liquid water bodies that constrict pore throats. The net mass transfer across these bodies is higher than gaseous diffusion, leading to enhanced mass transfer. The evaporation-condensation processes on the liquid phase bodies are also thought to be facilitated by larger temperature gradients across the gas-phase as compared to the gradient across the liquid-phase bodies.

For both the TOUGH and V-TOUGH hydrothermal codes, τ_e is treated as a constant. For the 154.7-MTU/acre, 280-millidarcy case, we considered three values of τ_e : 0.2, 1, and 2. Increasing τ_e from 0.2 to 1 (thereby increasing the diffusion enhancement effect) results in a minor cooling effect. This cooling effect reduces

the area-weighted boiling period duration, $t_{bp,avg}$, from 7984 to 7622 yr. Increasing τ_0 from 0.2 to 1 also has a minor drying effect, modestly reducing the net buildup of liquid water above the repository, ΔV , by 3.2%. Increasing τ_0 from 0.2 to 2 results in a more substantial cooling effect, reducing $t_{bp,avg}$ from 7984 to 7323 yr. The greatest cooling effect occurs at the repository center (where the highest temperatures occur) and decreases with increasing distance from the repository center. At the repository edge, the cooling effect is minor. Increasing τ_0 from 0.2 to 2 also has a minor drying effect, reducing the maximum value of ΔV by 9.7%.

Laboratory Experiments

Measurement of electrical resistivity as a function of moisture content of Topopah Spring tuff samples from the G-4 and GU-3 holes continues using J-13 water as pore fluid at elevated temperatures. The wetting phase measurements at 65°C are now complete, and the drying phase at 65°C is in progress. Several samples were broken during the continuous heating and cooling process.

The experiment to determine the moisture retention curve and one-dimensional imbibition using G-4 core continues. The data from this experiment will be used to calculate relative permeability as a function of water saturation. Moisture retention experiments at high temperatures have been initiated. Measurements at 95°C and up to 78% relative humidity are complete. Data analysis of the one-dimensional imbibition experiment is proceeding. Evaluation of the use of the four-electrode method on a rectangular sample continues.

The saturated water permeability measurement on an intact sample from G-4 is ongoing. The sample was under a confining pressure of about 5 MPa and a pore-water pressure of about 2.4 MPa. Permeability measurements were conducted at a series of pore pressure gradients ranging from 0.08 to 0.24 MPa/cm.

Meetings and Publications

T. Buscheck attended the fourth meeting held by the National Research Council's Committee on the Technical Bases for Yucca Mountain Standards in Washington, DC on December 16-17. At that meeting, he presented "The Impact of Repository Heat on Thermo-Hydrological Performance at Yucca Mountain" during the session on Thermal Effects and Radionuclide Transport.

In the December issue (Volume 104) of Nuclear Technology (A Journal of the American Nuclear Society), the following LLNL-YMP articles were published:

- 1) "Implications of Episodic Nonequilibrium Fracture-Matrix Flow on Repository Performance" by J. Nitao, T. Buscheck, and D. Chesnut
- 2) "Repository-Heat-Driven Hydrothermal Flow at Yucca Mountain, Part I: Modeling and Analysis" by T. Buscheck and J. Nitao

3) "Repository-Heat-Driven Hydrothermal Flow at Yucca Mountain, Part II: Large-Scale In Situ Heater Tests" by T. Buscheck, J. Nitao, and D. Wilder.

A paper on laboratory measurements has been drafted by J. Roberts and W. Lin for the High Level Radioactive Waste Management Conference.

1.2.2.2.3 Mechanical Attributes of the Waste Package Environment

A design has been developed for the initial laboratory block experiments in support of the large block test (LBT). The purpose of these experiments is to evaluate techniques and equipment to be used in the LBT and in the laboratory scale block tests. The following test geometry and boundary conditions are proposed. A cubic sample will be prepared from material excavated from the site. The cube will be loaded in uniaxial compression, with load applied to the top and bottom faces. A thermal gradient will be imposed between the bottom and top faces by heating the bottom face with a guard heater assembly. The sides of the cube will be insulated. The following parameters will be measured at several locations on or in the block; temperature, displacement, acoustic velocity, and internal stress. To expedite the design of guard heater assemblies and other instrumentation for the LBT the initial tests will be conducted on blocks of synthetic rock. This one dimensional thermal-mechanical test will allow evaluation of guard heater assemblies, and diagnostics for measurement of displacement, acoustic velocity, stress and temperature. In addition, the temperature control system for guard heaters will be evaluated.

Work on the numerical modeling sub-task includes initiation of efforts to simulate the geomechanical response of the LBT during the heat-up phase of the test. This simulation will be performed with the FLAC code and will be coupled to the hydrologic analysis of the LBT. Stress and temperature boundary conditions prescribed for the LBT will be incorporated along with isotherms for various times after the start of heating, up to and including the steady state temperature field computed for the LBT. These isotherms were obtained using the hydrologic codes V-TOUGH and NUFT. The rock block response will be evaluated using different constitutive models available in the FLAC code to estimate stress and displacement fields at different stages of the heat-up phase of the LBT.

Work also continued on the activity plan for this task; the plan is 70 percent complete.

1.2.2.2.4 Engineered Barrier System (EBS) Field Tests

The Task Leader attended a meeting at NTS to discuss the possibility of using existing NTS tunnels for thermal-hydrological field tests. Input was provided to H. Kalia, the YMPO feasibility study leader.

Study Plan 8.3.4.2.4.4, entitled "Engineered Barrier System Field Tests" has been reviewed by YMPO. Comment resolution by the PI continues.

Large Block Test (LBT)

Third level milestone MOL19, activity plan for the Large Block Test, was deferred to mid-January 1994. The critical path for the Large Block Test was not affected.

W. Lin, J. Blink, and M. Owens viewed core at the Sample Management Facility on December 8. The core, from the Large Block Test instrumentation holes, had fewer minerals in the fractures than was anticipated. Preliminary indications are that the block will be suitable for planned tests of several thermal-hydrological hypotheses.

The Activity Plan for the LBT has been reviewed, and revisions have been made in response to reviewer comments. Twenty-six drawings depicting various stages of the Large Block Test are nearing completion.

Preliminary designs for laboratory tests on smaller blocks have been completed. Preparation to support quarrying of the large block continues.

Drilling of vertical instrument holes in the large block is complete. A TV camera was used to log all of the holes and neutron logging was conducted in four of the small (EX) holes to estimate the current moisture content in the block. The site is ready, and sawing is scheduled to begin in early January.

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

Three papers were presented at the Materials Research Society Fall Meeting in Boston, Symposium V (Scientific Basis for Nuclear Waste Management):

- 1) "Chemical Implications For The Presence Of Introduced Materials In The Post-Emplacement Environment" by A. Meike
- 2) "Introduced Materials And Colloid Formation: A Report On The Current State Of Knowledge" by A. Meike and C. Wittwer
- 3) "Experimental Investigation Of Hydrous Pyrolysis Of Diesel Fuel And The Effect Of Pyrolysis Products On Performance Of The Candidate Nuclear Waste Repository At Yucca Mountain" by K. Jackson and S. Carroll

New Zealand

Meetings were held between R. Rogers, (Biodegradation Systems, Inc.) and A. Meike to discuss sampling and preliminary analyses of cores obtained from cement exposed to geothermal conditions. Groundwork for setting up a contract with Biodegradation Systems, Inc. to address long term biodegradation of cement during FY94 continues.

Diesel Fuel Stability Experiments

A three month experiment investigating diesel fuel stability in water at elevated temperature continues.

A. Meike has provided a draft response to the M&O reviewer's comments for the white paper "Chemical and Mineralogical Concerns for the Use of Man-Made Materials in the Post-Emplacement Environment" and is awaiting informal review before providing a formal response.

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

Spent Fuel Dissolution

Two repeat experiments of UO_2 dissolution rates at 20% oxygen and 75°C begun last month at LLNL are continuing. The original data seemed unusually high when compared to the other experiments in the test plan. Early results indicate that the dissolution rates remain high and are similar to the original data. Different samples were used to assure that unknown sample characteristics were not contributing to the high dissolution rates. This new data are being included in the paper being prepared for the International High Level Waste Management Conference to be held in Las Vegas in May 1994 that combines and compares the UO_2 dissolution data and the similar spent fuel dissolution data obtained at Pacific Northwest Laboratories (PNL).

Preparation of specimens of ATM-104 (PWR) and ATM-105 (BWR) spent fuel for use in dissolution tests with oxidized fuel has been completed. Part of the preparation involved exposing short sections (about 20 mm long) of the fuel and its associated cladding to deionized water for one week. These waters will be analyzed to determine the so-called gap inventories of Cs-137, I-129, and other radionuclides. Following the water exposure, portions of each fuel were oxidized to U_3O_8 for use in flow-through dissolution tests. Other portions were ground and screened to produce specimens consisting of individual grains. These were subjected to short-term dissolution tests designed to measure the grain-boundary inventories of Cs-137, I-129, and other radionuclides. The specimens will then be used in flow-through dissolution tests, and the results will be compared with test results from other specimens of ATM-104 and ATM-105 fuels that were oxidized to U_4O_9+x . Waste disposal and maintenance work in PNL building 325 hot cells has precluded transfer of the specimens to PNL until early January 1994.

D-20-49.1. Unsaturated Dissolution Tests with Spent Fuel and UO_2

Tests were initiated under unsaturated conditions at 90°C to evaluate the long-term performance of spent fuel in the potential repository. These tests examine the leach/dissolution behavior of two types of well-characterized irradiated PWR fuels, ATM-103 and ATM-106, in three types of tests. The tests include two with a

saturated water vapor atmosphere; two tests with a drip rate of 0.075 ml/3.5 d which is representative of repository water flow conditions; and two tests with a drip rate of 0.75 ml/35.6 d to simulate the effect of a higher volume, less frequent water flow. A control test without fuel but with a 0.075 ml/3.5 d drip rate is also included. The EJ-13 water for the tests came from well J-13 and had been equilibrated with volcanic tuff for approximately 80 days at 90°C. The seven tests had ~450 days of testing at 90°C by the end of December.

Tests on UO₂ using the drip test method at a drip rate of 0.075 mL/3.5 d of EJ-13 water are ongoing. Results of these tests have been published in the past, and the tests have been ongoing for about eight years. At present, no sampling of the tests is planned.

A paper entitled "Rationale for Determining Spent Fuel Acquisitions for Repository Testing" has been submitted for approval. This paper has been accepted for inclusion in the 1994 International High Level Radioactive Waste Management Conference.

A paper entitled "Elements Present in Leach Solutions from Unsaturated Spent Fuel Tests" written by ANL staff members P. Finn, J. Bates, J. Hoh, J. Emery, L. Hafenrichter, E. Buck and M. Gong, was presented at the Fall Material Research Society Meeting in Boston. The paper was reviewed internally, and has been accepted for publication in the meeting proceedings. The paper has been provided to LLNL for information. This work was conducted with non-YMP funding; LLNL-YMP has begun funding this work in FY94.

A paper entitled "Colloidal Products and Actinide Species in Leachage from Spent Nuclear Fuel" written by ANL staff members P. Finn, E. Buck, M. Gong, J. Hoh, J. Emery, L. Hafenrichter and J. Bates, was presented at the Fourth International Conference on the Chemistry and Migration of Actinides and Fission Products in the Geosphere. The paper is currently being reviewed for publication in Radiochimica Acta and has been provided to LLNL for information. This work was conducted with non-YMP funding; LLNL-YMP has begun funding this work in FY94.

An Activity Plan is currently being written to complete the planning for continuing these initially-scoping experiments under full QA Program control. When the planning documents are approved, this work will be reported under the appropriate quality-affecting activity number.

Spent Fuel Oxidation

Dry Bath Testing

A drybath interim examination was conducted in December. Delays were encountered due to the failure of the electronic balance used to measure the mass

of each sample. Another balance was borrowed, calibrated, and put into service to complete the examination. Purchase of a new balance will be necessary.

To date, none of the weight gain measurements appear to be unusual. An extensive set of samples, primarily from the 255°C drybath will be withdrawn for electro-optical examination. The oxygen to metal ratio for these samples ranges from 2.4 to 2.55. After these samples are removed, the drybaths will be restarted.

Thermogravimetric Apparatus (TGA)

The test in TGA#1 at 270°C using a 203 mg ATM-105 (BWR) spent fuel fragment continues. This test has run for 1450 hours and has reached a bulk oxygen to metal ratio of 2.47 (and is still increasing). The sample reached the first plateau at an oxygen to metal ratio of 2.39 in 140 hours and stayed at that ratio for 750 hours.

A 194 mg fragment of ATM-105 (BWR) spent fuel was oxidized in TGA#2 at 255°C for 525 hours. A plateau was reached at an oxygen to metal ratio of 2.41 within 250 hours. The oxygen to metal ratio remained at this level and did not increase. The test was then terminated. These data will be used for comparison with the drybath tests also running at 255°C. Initial comparisons of the data are favorable. This sample appears to have remained intact with only slight signs of powdering. It is awaiting subsectioning for x-ray diffraction and scanning electron microscope (SEM) analyses. TGA#2 was reloaded with a 214 mg fragment of ATM-105 spent fuel. A test at 283°C has been initiated.

A TGA Test Plan Addendum has been completed. Corrections and revisions are currently being incorporated.

Materials Characterization Center (MCC) Hot Cell Activities

Old and unusable spent fuel samples are in the process of being packaged and consolidated for storage. Consolidation will simplify accountability of special nuclear materials. These samples are unusable due to contamination in the hot cells and have presented inventory problems.

1.2.2.3.1.2 Waste Form Testing - Glass

Work is in progress on the Activity Plan for Glass Dissolution Modeling. Work is continuing on the collection and evaluation of borosilicate glass dissolution data obtained outside of the YMP for inclusion in the next version of the Waste Form Characteristics Report.

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

The N2 tests (SRL actinide-doped glass) continued as scheduled with sampling occurring 12/22/93. This is the first sampling of these tests since 5/3/90. Throughout the 3 1/2 year period, the test vessels have registered pressure which indicates that some water had been retained in the vessel; however, the test sampling in the past has been done on a much more frequent basis, and there was some question as to how the sealing gasket was retaining its integrity. Tests N2 #9, #10, and #12, which contained glass, were sampled and all had retained more than 10 mL of solution. Aliquots were taken for pH, carbon anion, actinide, cation, and colloid analyses. The remaining liquid was retained in the test vessels which were sealed and stored for later analysis and use in potential tests. The glass samples from these tests were transferred to clean vessels with new gaskets and the tests were continued. Test N2 #11 is a blank test which was sampled, the liquid removed from the vessel, and the test continued. Analyses from these samples have been requested, and it is hoped that these new data can be incorporated into the paper to be presented at the ANS meeting in Las Vegas. These tests have now been in progress for 95 months. A QAC surveillance on the N2 activities was performed on 12/21/93 as part of sampling process.

The N3 tests (ATM-10, a West Valley actinide-doped glass) continue and have been in progress for 73 months. Sampling of these tests was to be done in December as input to the Topical Report for N3 tests, but has been postponed to early January. It is believed that data from these tests will also be available for presentation at the ANS meeting. A QAC surveillance will be conducted during the sampling of the N3 tests in January.

D-20-28. Static Leach Testing of WVDP and DWPF Glass

No significant activities.

D-20-31. Studies of Glass Surface Layers and Precipitation

No significant activities.

D-20-34. Development of Licensing Database for Glass Waste Form Materials Interactions

No significant activities.

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

Sixteen tests are continuing. Some have been in progress for up to 8 years. No sampling has been done in several years and none is anticipated this year, although the solution injections will continue.

Several dozen tests on glasses exposed at 70°C at 60 and 95% relative humidity (RH) continue. No test terminations have been done for several years and none are planned for this year. The tests will continue to be ongoing.

An Activity Plan will be written to complete the planning for continuing these initially-scoping experiments under full QA Program control. When the planning documents are approved, this work will be reported under the appropriate quality-affecting activity number.

1.2.2.3.2 Metal Barriers

Task Management and Quality Assurance (PACS OL232JCD)

D. McCright participated in the Design Integration Workshop on December 15, in Albuquerque, NM. The purpose of the meeting was discussion of the advanced conceptual design phase of the project, and how the different project participants will focus their efforts. Organizations were discussed, and proposed modification of the present WBS nomenclature was presented. An on-going dialogue between organizations responsible for the repository design, the waste package design, and the performance of engineered barrier materials was established as the function of the workshop group. The next workshop is scheduled for February 1994.

A Quality Assurance internal audit of the Metal Barrier Task was conducted December 13-17. The Task Leader, Principal investigators and technical staff attended the opening meeting. The auditor visited the laboratories where the experimental work is being conducted. Informal discussions were held on the issue of calibration of newly purchased equipment that is presently being used on non-quality affecting work in anticipation that it will eventually be used on quality affecting work. The equipment in question has a number of operating components, so that calibration raises a number of complex issues.

R. Van Konynenburg completed all the reviews and other related matters needed to finish up the Materials Research Symposium (MRS) on the Scientific Basis for Nuclear Waste Management. His paper on "Science and Licensing: Let's Get Off the Collision Course" was approved for presentation by the YMPO. The paper continues to attract comment. During the symposium, he was interviewed by National Public Radio affiliate station WBUR on the subject of nuclear waste management, and the interview was aired nationally on "Morning Edition". He also participated in a news conference with several science editors. The symposium papers will be published by the MRS in the spring of 1994.

Prepare Planning Documents (PACS OL232LFF)

The Metal Barrier Scientific Investigation Plan (SIP) is being revised to incorporate changes on container material considerations corresponding to the advanced conceptual design (ACD). The revised SIP will contain fewer activities than the

existing SIP, but each of these activities will be divided into sub-activities corresponding to different ACD options.

Degradation Mode Surveys (PACS OL232LFF)

Metal Barrier SIP Activity E-20-13: A sub-contract has been prepared for Iowa State University to complete the degradation mode survey on carbon steel and related materials; D. Bullen, a professor in the Nuclear Engineering Department, is the principal investigator. The sub-contract is awaiting final procurement action.

Performance Tests and Model Development (PACS OL232LFB)

Metal Barrier SIP Activity E-20-16: G. Henshall is assessing the impact of fully implementing the Software Quality procedures on the stochastic pitting corrosion modeling effort. He has gone through the SQA documents in some detail and has had discussions with W. Halsey, R. Hamati, and L. Lewis.

Work continues, as described last month, on the sensitivity of the predicted median pit induction time, $\langle t_{ind} \rangle$; median number of pits, $\langle n_{pits} \rangle$; and median pit depth, $\langle d \rangle$; to the number of "cells" used in the stochastic simulations. This month, the computer code was altered to allow larger numbers of pits and cells. As many as 10,000 cells now may be simulated. The new version of the code, "PIGS2.V1.1C", was used to complete the numerical experiments begun last month. For a given number of cells, four separate numerical "experiments" were performed with identical input parameters. Each experiment consisted of 30 separate runs with the seed value used to generate random numbers varied for each of the experiments to provide the statistically varying results. At least several hundred cells are required to provide median values of $\langle n_{pits} \rangle$ and $\langle d \rangle$ that are independent of the number of cells used; $\langle t_{ind} \rangle$ appears to be less sensitive to the number of cells. The results of the experiments performed this month using up to 10,000 cells show that the median number of pits and the median depth "saturate" at essentially constant values once the number of cells reaches approximately 400. The presence of this saturation was not clear from the experiments performed last month with fewer total cells.

This section of the progress report constitutes completion of milestone MOL82.

Parameter Tests and Metal Degradation (PACS OL232LFC)

Metal Barrier SIP Activity E-20-17 (Advanced Technique Development): G. Gdowski and J. Estill are conducting several initial tests using the Cahn TG-131 thermogravimetric analyzer. A copper specimen was oxidized in dry air at 100, 175, 250, and 325°C for times up to 47 hours. The data show the expected increase in oxidation rate with increasing temperature. The oxidation data are being analyzed and will be compared to other data found in the literature.

The present data acquisition software is limited to a run time of 48 hours. Cahn has developed new software that allows an indefinite time for data acquisition. They have asked if we would be interested in serving as a "beta" site, and we have agreed. The beta version is expected to be ready in January. The longer data acquisition times will give us flexibility in the type of data that can be obtained. There is some concern with the noise level of the signal from the apparatus. We are in the process of changing some operating conditions in order to decrease the noise level. The water vapor system is ready for incorporation into the apparatus. However, our initial effort is to focus on the operation of the apparatus with as few changes in other parameters as possible.

J. Estill and S. Gordon are also readying the operation of the General Electric Reversing DC unit for conducting stress corrosion cracking studies on fracture mechanics test specimens. A few more bugs have been worked out with the program that operates the unit. The errors are cataloged as they occur. Plots of crack length versus time and vessel temperature versus time for the candidate alloys have been produced. A series of several short term tests with 1 to 6 samples in various vessel configurations were run and all major software problems have been resolved. Confidence in the ability to run long-term experiments is much improved.

Crack Growth Tests (PACS OL232LFD)

Metal Barrier SIP Activity E-20-18f: The Integrated Contractor Order (ICO) for sub-contract work in this area at Argonne National Laboratory was circulated through project management and the Procurement Department.

Engineered Materials Characterization Report (PACS OL232LFE)

No significant activities.

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 be a portion of WBS element 1.2.3.10; progress is reported in that element.

1.2.2.3.5 Non-metallic Barrier Concepts

(PACS OL235JGD and OL235KKA): Ceramic manufacturers were contacted to identify large scale products, and a search of ceramic literature was initiated. These activities seek to identify ceramic materials that could be used in a multiple barrier design, the state of technology in fabricating ceramic materials in dimensions

suitable for a waste package barrier, and possible degradation modes affecting ceramics for long-term disposal.

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

B. Viani participated in a GIT teleconference on December 20.

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 YMPO WBS manager in order to write the Study Plan required by the RSED Director in FY94.

1.2.3.4 Geochemistry

1.2.3.4.2 Geochemical Modeling

EQ3/6 Version 7.2a was completed on December 28. Principal improvements include:

- 1) The PC interface software operates correctly under straight DOS (previously it worked only in a DOS window under Windows 3.1)
- 2) The Chemval data base is now in the package. It is unique among the other data files in that it uses "e" as the redox species instead of $O_2(g)$. The new EQPT code can deal with this.
- 3) Convergence behavior in systems containing highly concentrated aqueous solutions is much improved. In EQ6, the run times for modeling such systems have been dramatically reduced, and convergence failures upon attempting to precipitate certain salt mineral assemblages have been eliminated.

Distribution to project participants is scheduled to begin in January. We are experiencing a problem in procuring floppy disks for this purpose and are working to resolve it.

The Independent Software Validation activity for EQ3/6 Version 7 is continuing. It is now focused on EQ6. This is the last part of EQ3/6 to be put through this process.

Work is continuing on EQ3/6 Version 8.0. In FY93, we completed a major re-write of the software, incorporating major changes in the data structure in order to accommodate improvements in numerical methods and the addition of new functional capabilities. This included modifying the EQ6 code to utilize the auxiliary basis concept, thus allowing it to make reaction path calculations incorporating specified redox disequilibria. This capability is important in treating the metastable persistence of dissolved components such as sulfate, nitrate, and organics in laboratory and field settings. In FY94, we are adding two additional capabilities to EQ3/6:

- 1) a generic ion-exchange model
- 2) correction of supporting data, mostly thermodynamic, to pressures off the 1.013 bar-steam saturation curve.

1.2.3.5 Drilling

1.2.3.5.2.2 Engineering, Design, and Drilling Support

A CAR was written by YMPO because TIP-NV-01 was not yet approved and distributed as a controlled document. To date, activities have been controlled by the scientific notebook procedure and by Weapons Program procedures. In response to the CAR, review of TIP-NV-01 was accelerated.

Funding for this WBS element has been exhausted. Additional funds have been requested from the DOE WBS Manager, these are expected in the YMPO February AFP submission to DOE-HQ.

1.2.3.10 Altered Zone Characterization

The YMPO Change Control Board approved movement of portions of WBS 1.2.2.3.4 to WBS 1.2.3.10 (1.2.2.3.4.1 has become 1.2.3.10.3.3 and 1.2.2.3.4.2 has become 1.2.3.10.4). A request has been made to transfer the FY94 funding between the old and new WBS elements. It is expected that the PACS system will require an additional month or two before it reports costs using the new WBS structure.

1.2.3.10.1 Characterization Techniques for the Altered Zone

Preliminary activities to begin experiments to evaluate the effect of relative humidity on reaction products and rates in vitric material continued. Sample characterization was initiated but was not completed. Unexpected changes in the schedule of technical support prevented completion of characterization projected for December and the start of experimental runs that were to begin in December. Characterization is now expected to be completed in mid-January, and the experimental runs started in late January. The reaction products will be provided to Los Alamos National Laboratory (LANL) for use in studies of dehydration/rehydration effects in single phases.

Plans for the first reaction precipitation studies have been developed. Existing equipment has been evaluated and deemed suitable. The first efforts will focus on silica precipitation kinetics and will begin in February.

Experiments to examine rock-water interaction in relevant lithologic units at different relative humidities are continuing.

Installation of existing codes that couple hydrological and geochemical processes is now in progress. It is expected that they will be in place by late January, with test cases also completed. Initial work will concentrate on the 1Dreact code written by Carl Steffel. At that time, general test cases for use in all of the codes, as well as design of experiments to test the codes, will begin.

1.2.3.10.2 Characterization of Thermal Effects on the Altered Zone Performance

The study plan for this WBS is now being written. Projected completion is May 1994.

1.2.3.10.3 Integrated Radionuclide Release: Tests and Models

G-20-2 Determination of Elemental Profiles in Rocks, Minerals, and Glasses using the Ion Microscope

Additional samples of clinoptilolite to be used for diffusion studies were selected.

Preparation of a status report on diffusion in clinoptilolite is in progress.

G-20-3 Interactions of Actinide-Bearing Solutions with Rock Core Samples

The test phase of the flow-through apparatus was completed and documented in a letter report to YMPO on December 6, completing third level milestone MOL06.

Analysis of the preliminary flow data indicate that constant flow conditions would not be able to be maintained with the present pump. A piston metering pump has been ordered.

The flow-through apparatus will be reassembled when the new pump and a fraction collector for sampling are received. The core flow-through apparatus will be rassembled in an adjacent laboratory due to space limitations at the current location.

1.2.3.10.4 Thermodynamic Data Determination

Activity Plan D-20-54, "Actinide Solubilities: Solubility Measurements and Thermodynamic Data Determinations" was issued on December 7, completing third level milestone MOL95.

C. Palmer attended the "Fourth International Conference on the Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere" in Charleston, South Carolina on December 12 - 17.

1.2.3.11 Integrated Geophysical Testing for Site Characterization

1.2.3.11.3 Geophysics - ESF Support, Subsurface Geophysical Testing

A summary of the plans for this activity was prepared for the YMPO WBS Manager in preparation for the February 1994 program review.

1.2.3.12 Waste Package Environment Testing

This WBS element is being created from WBS element 1.2.2.2. It is currently reported as a part of 1.2.2.2. Reporting in this WBS element will begin in the January report. Cost reporting in this WBS element may require an additional few months until the financial accounting system is reprogrammed.

1.2.5 REGULATORY

1.2.5.1 Regulatory Coordination and Planning

No significant activities.

1.2.5.2 Licensing

1.2.5.2.2 Site Characterization Program

J. Savy, T. Nelson, and Q. Hossain resolved comments on their portion of the M&O report on Seismic Issues.

D. McCright, R. Stout, D. Wilder, and W. Clarke participated in a teleconference with C. di Bella of the Nuclear Waste Technical Review Board (NWTRB) staff on December 9. The conference call was made to plan the agenda for an upcoming March 1994 NWTRB meeting.

1.2.5.3 Technical Data Management

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

A reconnaissance and review of recently published thermodynamic data for Neptunium, Americium, Plutonium, and Technetium species continues. As needed and where appropriate, these data will be used to augment those already in GEMBOCHS until publication of the NEA-TDB critical reviews of the chemical thermodynamics of these species. During December, aqueous dissociation

constants reported by Palmer, Silva, and Miller (1992) for approximately 300 aqueous Np, Pu, and Am complexes were incorporated.

Development of a Windows/4GL (mouse-driven) version of JEWEL is continuing. Numerous minor modifications were made to the format of thermodynamic datafiles generated by this program; each modification provides additional information and/or improved interpretive clarity. This program facilitates interactive point-and-click generation of customized thermodynamic data files for EQ3/6, GT, and other geochemical modeling packages.

Development of a Windows/4GL version of FACET has been initiated. This program facilitates interactive point-and-click review, revision, deletion, and addition of GEMBOCHS data. During December, most top-level routines (and many primitives) were completed.

Transfer of the GEMBOCHS database and software library from its dedicated Sun SPARCstation2 to a new dedicated SPARCstation-10/41 has begun. This hardware upgrade will result in dramatically improved performance for each database and software module of the GEMBOCHS system. INGRES-6.4/04, JEWEL, FACET and CNGBOCHS were all ported to this new platform.

1.2.5.3.5 Technical Data Base Input

LLNL reviewed its records and identified twelve data items that must be processed. These data items have already been published in reports. Projected submission date to the Automated Technical Data Tracking System is January.

1.2.5.4 Performance Assessment

1.2.5.4.2 Waste Package Performance Assessment

A working object code and draft user manual for YMIM were distributed to YMP collaborators on December 28, completing third level milestone MOL88.

Participation in the Total System Performance Assessment 1993 (TSPA-2) continued. LLNL provided the SNL performance assessment team with time histories of spent fuel rod temperatures at the center of emplaced waste packages, for revised conservative boundary temperature histories. LLNL verified that the change in spent fuel and waste package effective thermal conductivity is small within the applicable temperature range, and hence a simple model could be used to adjust detailed calculations to the various cases.

LLNL completed text and graphics for the SNL report on Total System Performance Assessment 1993 (TSPA-93). Portions of six chapters were submitted to SNL for inclusion in the draft report: Chapter 3 "Thermal/Emplacement Configurations", Chapter 10 "Thermal Effects", Chapter 13 "Source Term: Near-field Processes", Chapter 22 "Discussion", Chapter 23 "Conclusions/Recommendation" and Chapter

24 "Future TSPA Work". The text was submitted to SNL on December 28 for inclusion in the TSPA -2 report, completing third level milestone M0L92.

T.-S. Ueng and W. J. O'Connell submitted the final draft of "Near-Field Diffusion Through One and Two Finite Zones from a Nuclear Waste Package" to the American Nuclear Society journal Nuclear Technology. The paper was accepted for publication with minor changes.

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

No significant activities.

1.2.9 PROJECT MANAGEMENT

1.2.9.1 Management and Coordination

1.2.9.1.2 Technical Project Office Management

J. Blink attended the Edison Electric Institute (EEI) meeting on December 1, gave a presentation on the Infrastructure Reduction Assessment Team (IRAT) to EEI on December 2, and attended IRAT meetings in Las Vegas on December 10 and December 16. He attended a Cost Reduction Steering Committee meeting on December 3.

J. Blink attended First aid and CPR training on December 8. He is now trained as an escort for the ESF North Ramp.

W. Clarke and J. Blink attended a TPO meeting on December 16 and a TAG meeting on December 17.

J. Blink received an award of excellence from the YMPO Project Manager for his contributions to YMP public outreach in FY93. He presented his hands-on "gee-whiz" science activity at C.P. Squires Elementary School on December 6 and Pahrump 5/6 school on December 7.

1.2.9.2 Project Control

1.2.9.2.2 Participant Project Control

November actual schedule progress and costs were submitted to the PACS reporting system via PACS workstation. Variance analysis explanations were developed for five P&S accounts:

- 1) Waste Package Coordination & Planning, 1.2.2.1
- 2) EBS Field Tests, 1.2.2.2.4
- 3) Spent Fuel, 1.2.2.3.1.1
- 4) Engineering, Design & Drilling Support, 1.2.3.5.2.2
- 5) Site Characterization Program, 1.2.5.2.2

FY 94 PACS milestone worksheets were coordinated with the M&O and YMPO WBS managers.

The Project Control Coordinator position has been posted. Posting for the position is both internal and external. The interviewing and selection process should be complete and the position filled by the end of January.

J. Podobnik discussed LLNL internal procedures with the LLNL Finance Department required to expend two fund types that are included in LLNL's FY94 YMP funding. DOE has requested that fund type TH be depleted before WD withdrawals. Most B&R Codes have a single fund type and this has caused complications. In the case of double fund types, the major portion of funds are WD; therefore, only a small adjustment will be required during the latter part of the fiscal year.

J. Podobnik attended a YMPO Project Control meeting in Las Vegas on December 9. Procedures for treating carryover funds in PACS, the accuracy of FY93 carryover obligations, and the schedule for FY94 variance analyses were discussed.

A verification of LLNL Capital Equipment Plans for FY94 was prepared.

1.2.11 QUALITY ASSURANCE

Quality Assurance Coordination and Planning

No significant activities.

Quality Assurance Program Development

LLNL is continuing to work on revising procedures to comply with the new QARD and on matricing requirements against LLNL-YMP procedures. In that respect, the following procedures, cancellations or change notices to procedures were issued during December:

- 1) CN 1.0-4-2 to procedure 033-YMP-QP 1.0, "Organization"

- 2) CN 4.0-4-1 to procedure 033-YMP-QP 4.0, "Procurement Document Control".
- 3) CN 6.0-4-1 to procedure 033-YMP-QP 6.0, "Document Control".
- 4) CN 13.0-1-1 to procedure 033-YMP-QP 13.0, "Handling, Storage, & Shipping".
- 5) CN 18.1-5-1 to procedure 033-YMP-QP 18.0, "Audits".
- 6) 033-YMP-QP 2.4, Rev. 1, "Technical Review".
- 7) 033-YMP-QP 2.6, Rev. 2, "Readiness Reviews".
- 8) 033-YMP-QP 4.1, Rev. 3, "Preparation of QA Requirements Specifications & Approval of Subcontractor QA Programs".
- 9) 033-YMP-QP 3.0, Rev. 3, "Scientific Investigation Control".
- 10) 033-YMP-QP 3.5, Rev. 1, "Control of Internal Technical Interfaces".
- 11) 033-YMP-QP 2.11, Rev. 0, "Qualification and Certification" - Canceled.
- 12) 033-YMP-QP 3.1, Rev. 1, "Design Control" - Canceled.
- 13) 033-YMP-QP 9.0, Rev. 0, "Control of Processes" - Canceled.
- 14) 033-YMP-QP 10.0, Rev. 0, "Inspection" - Canceled.
- 15) 033-YMP-QP 11.0, Rev. 0, "Test Control" - Canceled.
- 16) 033-YMP-QP 14.0, Rev. 0, "Inspection, Test & Operating Status" - Canceled.

Quality Assurance Verification

Quality Assurance Verification - Audits

Internal audits QA 94-01 and 94-02 were performed on December 2-7, 1993 and December 1-17, 1993, respectively. Audit 94-01 concentrated on the areas of Instrument Calibration and Procurement, and included the following procedures/requirements:

- 1) 033-YMP-QP 4.0, Procurement Document Control
- 2) 033-YMP-QP 5.0, Technical Implementing Procedures
- 3) 033-YMP-QP 7.0, Control of Purchased Items
- 4) 033-YMP-QP 12.0, Control of Measuring and Test Equipment
- 5) TIPs associated with M&TE calibration

Audit 94-02 concentrated on the area of EBS Materials Characterization and included the following procedures/requirements:

- 1) 033-YMP-QP 2.4, Technical Review
- 2) 033-YMP-QP 2.6, Readiness Reviews
- 3) 033-YMP-QP 2.8, Quality Assurance Grading
- 4) 033-YMP-QP 3.0, Scientific Investigation Control
- 5) 033-YMP-QP 3.4, Scientific Notebooks
- 6) 033-YMP-QP 5.0, Technical Implementing Procedures
- 7) 033-YMP-QP 8.0, Identification and Control of Items, Samples, and Data
- 8) 033-YMP-QP 9.0, Control of Processes
- 9) 033-YMP-QP 13.0, Handling, Storage, and Shipping
- 10) TIP YM-3

Quality Assurance Verification - Surveillance

No significant activities.

Field Quality Assurance/Quality Control

No significant activities.

Quality Assurance - Quality Engineering

QA Review of TIP-NV-01 has been completed. A review of an Activity Plan in the Near Field Environment technical area is in progress.

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 the revisions, cancellations, and change notices reported in WBS 1.2.11.

1.2.12.2.3 Participant Records Management

A total of 171 items were logged into the LLNL-YMP tracking system. This includes 23 records/records packages that were processed through to the CRF. Six action items were closed.

LLNL-YMP Records will be represented at the January 1994 Records Meeting to be held in Washington, D.C..

1.2.12.2.5 Document Control

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

1.2.13.2 SAFETY AND OCCUPATIONAL HEALTH

1.2.13.2.5 Occupational Safety and Health

During neutron logging of the large block, the neutron source became stuck in the hole. In accordance with the LLNL-YMP plan for conducting the logging, operations were halted, and a modified plan was developed and approved for recovering the tool. Recovery was successful, with no damage to the source or additional exposure of personnel. It was determined that the centering ring for the source was trapping small rubble in the hole, causing jamming. Future operations will use mounting springs that are less likely to trap small rubble.

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 86 participants on the project who are to be trained and/or tracked.

LLNL-YMP added five new participants and re-activated one participant. The training office distributed 346 self study assignments; 86 participants were trained to 2 new revisions, 77 participants were trained to 2 change notices, 5 new participants and 1 re-activated participant were trained to a total of 183 self-study assignments.

LLNL PROJECT STATUS REPORT DISTRIBUTION

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LLYMP9401088
January 19, 1994

WBS 1.2.9
QA: N/A


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

Attached is the December 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.

ENCLOSURE 19

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