UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 24, 1997

MEMORANDUM TO: Central File

FROM: Sandra L. Wastler
Performance Assessment & HLW
Integration Branch
Division of Waste Management, NMSS

SUBJECT: SUBMITTAL OF DOCUMENTS

The following documents have been received from the U.S. Department of Energy, either directly or through the U.S. Nuclear Regulatory Commission's On-Site Representatives and should be placed in the High-Level Waste, Yucca Mountain Subject file:

1. Yucca Mountain Site Characterization Office Weekly Highlights for the week ending January, 10 and 17, February 7, 14, and 28, March 7, 14, 21, and 28, April 4, 11, and 18, May 1, 8, 15, and 22 1997.

2. U.S. Department of Energy Field Test Coordination Report for the weeks ending February 5, 14, and 28, March 20 and 25, April 15, May 7 and 14 1997.

3 TRW Report, "Thermohydrology Abstraction/ Testing Workshop Results", March 18, 1997.

4. TRW Report,"Unsaturated Zone Flow Abstraction/Testing Workshop Results", February 27, 1997.

5. TRW Report, "Waste Package Degradation Abstraction/Testing Workshop Results", February 24, 1997.

6. TRW Report, "Unsaturated Zone Radionuclide Transport Abstraction/Testing Workshop Results", March 26, 1997.

7. TRW Report," Waste Package Filler Material Testing Report", October 3, 1996

8. U.S.Department of Energy, Director's Program Review Slides, March 6, 1996.

9. Letter to C. Glenn from T. Mayer, U.S. Department of the Interior, April 22, 1997 with attachment entitled "Spring Discharge and Water Monitoring at Ash Meadows National Wildlife Refuge".

10. Nye County, Nevada, report entitled "Water Supply Forecast for Southern Nye County Nevada.

NHXP

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Drawings Available in Central Files

11. Evernden, J. F., "Safety of Proposed Yucca Mountain Nuclear Repository as Regards Geological and Geophysical Factors: Evaluation of Minority Report by Archambeau and Price", U.S. Geological Survey, 1992.

12. Szymanski, J.S. and Archambeau, C. B., "TRAC-NA Final Report, Research Conducted During FY'92 Through FY'95, State of Nevada, May, 1996 (3 Attachments).

13. Yucca Mountain Project Summary Schedule, 3 Charts.

14. Yucca Mountain Ground Moution Data Package, Volume 1.

15. Nye County Technical Program Slides, N. Stellavato, dated January 29, 1997.

16. U.S. Department of Energy, "Engineered Barrier System Performance Requirements Systems Study Report", January 14, 1997.

17. U.S. Geological Survey, Monthly Progress Report for November, 1996, February, 1997, and March, 1997.

18. U.S. Department of Energy, Participant's Monthly Report, November and December, 1996.

Attachment(s): As stated

Contact: Sandra L. Wastler, NMSS
415-6724

all enclose on the shelf.

11. Evernden, J. F., "Safety of Proposed Yucca Mountain Nuclear Repository as Regards Geological and Geophysical Factors: Evaluation of Minority Report by Archambeau and Price", U.S. Geological Survey, 1992.

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

FEB 05 1997

D. R. Williams, DOE/YMSCO, Las Vegas, NV
J. M. White, DOE/YMSCO, Mercury, NV, M/S 717

FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING JANUARY 31, 1997

Enclosure 2 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. The concentration of DFBA tracer is continuing to tail off. No breakthrough of the pyridone tracer has been reported, but breakthrough is predicted to be soon. Data from tracer testing will help to model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Berkeley National Laboratory (LBNL) and Lawrence Livermore National Laboratory completed preparations for the Large Block Test and notified the project that the test was ready. After discussions with the participants, it was determined that additional baseline measurements of permeability would enhance the test results. LBNL personnel are continuing to conduct permeability tests in boreholes in the block. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 71+49.9 meters as of 8 a.m., Friday, January 31, 1997. TBM progress continues to be slowed by difficult excavation in fractured and faulted rock, although progress is increasing slightly. Geologists continue to report

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better excavation conditions at the cutterhead and progress is expected to continue to improve. Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 70+65.0 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
LBNL personnel are continuing the air permeability testing in the instrumentation holes in the AOD. The testing will help establish baseline conditions for the Heated Drift Test. Excavation of the heated drift using the Alpine Miner is complete at station 0+60.5 meters. Drill/blast excavation of the invert of the heated drift continues. The excavation is necessary for planned testing. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

Drilling of instrumentation holes in the Heated Drift continued this week. Drilling of borehole ESF-PL-PERM-2 in the Plate Load Test niche was completed to a final depth of 2.6 meters.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test started on schedule on August 26, 1996. The instruments are reported to be working properly and data are being collected. The Single Heater Test will heat approximately 25 cubic meters of rock to 100°C or greater. The purpose of this test is to understand heat related processes and measure parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). The results will be available for the viability assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Air permeability testing conducted by the USGS continues in the alcove. Testing is in support of pneumatic pathways and hydrochemistry testing in the ESF.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove progressed to station 0+95.2 meters this week using the Alpine Miner, AM-50. Design length for this phase of the Southern Ghost Dance Fault Alcove is 135 meters. Planned testing in the Southern Ghost Dance Alcove will investigate the hydrologic characteristics of the fault.

FEB 0 5 1997

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-0883

Enclosures:
1. Tunnel Stratigraphy
2. Site Characterization Field Activities in Progress

cc w/encls:
J. G. Jones, DOE/HQ (RW-40) FORS
C. J. Henkel, NEI, Washington, DC
R. W. Craig, USGS, Las Vegas, NV
C. J. Glenn, NRC, Las Vegas, NV
M. C. Brady, M&O/SNL, Las Vegas, NV
N. Z. Elkins, M&O/LANL, Las Vegas, NV
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J. T. Sullivan, DOE/YMSCO, Las Vegas, NV
M. C. Tynan, DOE/YMSCO, Las Vegas, NV
J. T. Gardiner, DOE/YMSCO, Las Vegas, NV
R. S. Waters, DOE/YMSCO, Las Vegas, NV
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ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ENCLOSURE 1

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+31?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+31 to face	Topopah Spring crystal poor upper lithophysal zone?

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

ENCLOSURE 2

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

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

FEB 1 4 1997

D. R. Williams, DOE/YMSCO, Las Vegas, NV
J. M. White, DOE/YMSCO, Mercury, NV, M/S 717

FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING FEBRUARY 7, 1997

Enclosure 2 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. The concentration of DFBA tracer is continuing to tail off. Breakthrough of the pyridone tracer still has not been seen in the pumped effluent from C#2. Data from tracer testing will help to model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Berkeley National Laboratory (LBNL) and Lawrence Livermore National Laboratory completed preparations for the Large Block Test and notified the project that the test was ready. After discussions with the participants, it was determined that additional baseline measurements of permeability would enhance the test results. LBNL personnel are continuing to conduct permeability tests in boreholes in the block. Current plans are to begin thermal testing the week of February 24, 1997. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 72+25.9 meters as of 8 a.m., Friday, February 7, 1997. TBM excavation progress increased to an average of about 20 meters per day beginning February 4, 1997, and has continued.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 71+45 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
LBNL personnel are continuing the air permeability testing in the instrumentation holes in the AOD. The testing will help establish baseline conditions for the Heated Drift Test. Rock excavation in Alcove 5 is complete. Currently, the heated drift and connecting drift are being cleaned up and prepared for mapping. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test started on schedule on August 26, 1996. The instruments, except some of the water chemistry probes, are reported to be working properly and data are being collected. The Single Heater Test (SHT) will heat approximately 25 cubic meters of rock to 100°C or greater. The purpose of this test is to understand heat related processes and measure parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in Alcove 5. The results will be available for the viability assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Air permeability testing conducted by the USGS continues in the alcove. Testing is in support of pneumatic pathways and hydrochemistry testing in the ESF.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove progressed to station 0+98.6 meters this week using the Alpine Miner, AM-50. Current plans are to remove the AM-50 and use the larger AM-75 Alpine Miner to complete the excavation. Design length for this phase of the Southern Ghost Dance Fault Alcove is 135 meters. Planned testing in the Southern Ghost Dance Alcove will investigate the hydrologic characteristics of the fault.

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If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-0970

Enclosures:
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2. Site Characterization Field Activities in Progress

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ESF TUNNEL STRATIGRAPHY*

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3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ENCLOSURE 1

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
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	Alcove #3 (centerline station intersection):7+54.
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8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
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ESF TUNNEL STRATIGRAPHY CONTINUED*

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65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+44?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+44 to face	Topopah Spring crystal poor upper lithophysal zone?

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

ENCLOSURE 2

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

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FEB 2 8 1997

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FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING FEBRUARY 21, 1997

Enclosure 2 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. The concentration of DFBA tracer is continuing to tail off. Breakthrough of the pyridone tracer is now predicted to occur in early March 1997. Data from tracer testing will help to model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory and Lawrence Berkeley National Laboratory (LBNL) are making final preparations for the Large Block Test (LBT). The thermal testing is scheduled to begin on February 28, 1997, at about 10 a.m. The LBT will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine continued this week to station 73+87.6 meters as of 8 a.m., Friday, February 21, 1997.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 73+04 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
LBNL personnel are continuing the air permeability testing in the instrumentation holes in the AOD. The testing will help establish baseline conditions for the Heated Drift Test (HDT). Currently, full periphery mapping is in progress in the heated drift. The HDT will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except some of the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater. The purpose of this test is to understand heat related processes and measure parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in Alcove 5. The results will be available for the viability assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Air permeability testing conducted by the USGS continues in the alcove, the air permeability testing should be completed next week. Following completion of the USGS testing, excavation will resume in Alcove #6. Testing is in support of pneumatic pathways and hydrochemistry testing in the ESF. Geologic mapping has progressed to Alcove station 0+38 meters.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove progressed to station 1+24.9 meters this week using the larger Alpine Miner, AM-75. The excavation should be completed next week. Design length for this phase of the Southern Ghost Dance Fault Alcove is 135 meters. Planned testing in the Southern Ghost Dance Alcove will investigate the hydrologic characteristics of the fault.

FEB 2 8 1997

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-1045

Enclosures:
1. Tunnel Stratigraphy
2. Site Characterization Field Activities in Progress

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ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ENCLOSURE

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+44?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+44 to ?	Topopah Spring crystal poor upper lithophysal zone?
? to ?	Topopah Spring crystal rich lithophysal zone
? To face	Topopah spring crystal rich nonlithophysal zone

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

ENCLOSURE 2

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

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MAR 20 1997

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FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING MARCH 14, 1997

Enclosure 1 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. The concentration of DFBA tracer is continuing to tail off. Breakthrough of the pyridone tracer injected in C#3 has not occurred yet. The USGS is developing testing strategies to address this issue. Currently, laboratory concentration of water samples from C#3 (the pumped well) is being performed to try to elevate the pyridone concentration. Consideration is being given to sampling water from C#1 (the injection well) to determine the pyridone concentration in the borehole. Data from tracer testing will help to model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory successfully started the thermal testing that began on schedule on February 28, 1997, at about 10 a.m. The heaters were turned on and began heating the rock. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 76+90 meters as of 8 a.m., Friday, March 14, 1997. There are approximately 187 meters remaining to TBM hole-through at the South Portal. The TBM is expected to hole-through on or about April 4, 1997.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 76+14 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 2.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
Placement of concrete in the invert of the heated drift is substantially complete up to station 0+48 meters. Next week, concrete forms will be erected in the lined portion of the drift. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater.

The following temperature readings have been reported from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. These measurements were made on March 13, 1997, and indicate that the rock is continuing to heat up.

Radial Distance from heater centerpoint (m)	Temperature in degrees Celsius
0.33 meters	155.0°
0.67 meters	120.2°
1.48 meters	75.8°

The purpose of this test is to understand heat related processes and measure parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in Alcove 5. The results will be available for the viability assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
There was no excavation in the alcove this week. Excavation using an Alpine Miner is expected to begin soon, possibly the week of March 31, 1997. The excavation will continue through the Ghost Dance Fault and provide a location for further testing of the fault.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove is complete at 1+34.4 meters (design length was 135 meters).

Drilling of a horizontal borehole, ESF-SAD-GTB1, across the Ghost Dance Fault from the end of Alcove 7 is in progress, but has encountered difficulty in drilling across the fault. The borehole had progressed to 33.0 meters as of March 10, 1997. Since then, drilling has been on hiatus while borehole videos were run, along with discussions of how best to proceed. Planned final depth is 60 meters. Testing of thermal and pneumatic properties of the Ghost Dance Fault will take place in the borehole following completion.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman

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Enclosures:
1. Site Characterization Field Activities in Progress
2. Tunnel Stratigraphy

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Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
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8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
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8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
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8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ENCLOSURE 2

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+46?	Topopah Spring crystal poor upper lithophysal zone
73+46 to ?	Topopah Spring crystal rich lithophysal zone
? to ?	Topopah spring crystal rich nonlithophysal zone
? to 74+30?	Topopah Spring vitric zone
74+30 to ?	pre -Pah Canyon bedded tuffs
?	Pah Canyon Tuff
?	pre-Yucca mountain bedded tuffs
?	Yucca Mountain Tuff
?	pre-Tiva Canyon bedded tuffs
?	Tiva Canyon crystal poor vitric zone
? to ?	Tiva Canyon crystal poor lower nonlithophysal zone
? to ?	Tiva Canyon crystal poor lower lithphysal zone
? to face	Tiva Canyon crystal poor middle nonlithophysal zone

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

QA: N/A

MAR 25 1997

D. R. Williams, DOE/YMSCO, Las Vegas, NV
J. M. White, DOE/YMSCO, Mercury, NV, M/S 717

FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING MARCH 21, 1997

Enclosure 1 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. The concentration of DFBA tracer is continuing to tail off. Breakthrough of the pyridone tracer injected in C#3 has not occurred yet. The USGS is continuing to develop testing strategies to address this issue. Currently, laboratory concentration of water samples from C#3 (the pumped well) is being performed to try to elevate the pyridone concentration. Consideration is being given to sampling water from C#1 (the injection well) to determine the pyridone concentration in the borehole. Data from tracer testing will help to model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory successfully started the thermal testing that began on schedule on February 28, 1997, at about 10 a.m. The heaters were turned on and began heating the rock. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 77+23.6 meters as of 8 a.m., Friday, March 21, 1997. Excavation was slowed this week by blocky rock in the Tiva Canyon middle nonlithopysal zone. There are approximately 154 meters remaining to TBM hole-through at the South Portal. The TBM is now expected to hole-through on or about April 11, 1997.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 76+46 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 2 (note: no USGS personnel have been available to pick contacts in the nonwelded tuffs or Tiva Canyon in the South Ramp so there are no recent contacts).

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
Placement of concrete in the invert of the heated drift is substantially complete up to station 0+48 meters. Chipping of rock to allow for the placement concrete forms is in progress in the lined portion of the drift. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater.

The following temperature readings have been reported from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. These measurements were made on March 19, 1997, and the decrease in the temperatures from last week is attributed to power outage at the ESF on March 16-17, 1997.

Radial Distance from heater centerpoint (m)	Temperature in degrees Celsius
0.33 meters	147.6°
0.67 meters	116.7°
1.48 meters	76.1°

The purpose of this test is to understand heat related processes and measure parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in

Alcove 5. The results will be available for the viability assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
There was no excavation in the alcove this week. Excavation using an Alpine Miner is expected to begin soon, possibly the week of March 31, 1997. The excavation will continue through the Ghost Dance Fault and provide a location for further testing of the fault.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove is complete at 1+34.4 meters (design length was 135 meters).

Drilling of a horizontal borehole, ESF-SAD-GTB1, across the Ghost Dance Fault from the end of Alcove 7 is in progress but has encountered difficulty in drilling across the fault. The borehole had progressed to 33.0 meters as of March 10, 1997. Currently, the hole is being reamed out to allow setting of drill casing. Reaming has progressed to 12.2 meters as of the date of this report. Planned final depth is 60 meters. Testing of thermal and pneumatic properties of the Ghost Dance Fault will take place in the borehole following completion.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-1255

Enclosures:
1. Site Characterization Field Activities in Progress
2. Tunnel Stratigraphy

cc w/encls:
J. G. Jones, DOE/HQ (RW-40) FORS
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R. W. Craig, USGS, Las Vegas, NV
C. J. Glenn, NRC, Las Vegas, NV
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R. S. Waters, DOE/YMSCO, Las Vegas, NV
Records Processing Center = "14"

Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ENCLOSURE 6

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+46?	Topopah Spring crystal poor upper lithophysal zone
73+46 to ?	Topopah Spring crystal rich lithophysal zone
? to ?	Topopah spring crystal rich nonlithophysal zone
? to 74+30?	Topopah Spring vitric zone
74+30 to ?	pre -Pah Canyon bedded tuffs
?	Pah Canyon Tuff
?	pre-Yucca mountain bedded tuffs
?	Yucca Mountain Tuff
?	pre-Tiva Canyon bedded tuffs
?	Tiva Canyon crystal poor vitric zone
? to ?	Tiva Canyon crystal poor lower nonlithophysal zone
? to ?	Tiva Canyon crystal poor lower lithphysal zone
? to face	Tiva Canyon crystal poor middle nonlithophysal zone

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

QA: N/A

APR 1 5 1997

Mary, please make copy for Chal file & return to me. Thanks Bill

Distribution

DAILY OPERATIONS SUMMARY REPORTS AND FIELD TEST COORDINATION REPORT

Enclosed for your information are copies of the Daily Operations Summary Reports for Yucca Mountain Site Characterization Project drilling activities (enclosure 1). These reports were prepared by the Civilian Radioactive Waste Management System Management and Operating Contractor, Drilling Management Organization, and cover March 31 and April 1-2, 1997.

A copy of the U.S. Department of Energy Field Test Coordinator's Report (enclosure 2) summarizing activities of that week and forecasting selected activities planned for the following week is also included for your information.

If you need additional information regarding these reports, please contact Drew H. Coleman at (702) 295-7825.

Drew H. Coleman
for Stephan J. Brocoum
Assistant Manager for Licensing

AML:DHC-1384

Enclosures:
1. Daily Operations Summary Reports
2. Ltr, 4/11/97, Coleman to Williams/White w/encls

YMP-5

Mark Esp
03/31/97 05:15 PM

To: Eddie Wright, Ezra Wasson, Ron Oliver, Alan Mitchell, Richard Kovach, Earl Spoeneman, Kenneth Skipper, Ray Wallace, Daniel Soeder, Debbie Edwards, John Martin, John Doyle, Ken McFall, Mike Harris, Tom Pysto, Crystal Olson, Beatrice Reilly, Brenda McGonigle, Ron E. Smith, Debbie Zesiger, Albert Williams, Patricia Smallwood, Glenn Milligan, Barbara Merritt, Greg Drew, Barry Stewart, Norman Bartley, Drew Coleman, Mike Mapa, Vickie Smith, Douglas Weaver, John Peck, Michael Taylor, Dan Neubauer, Ricky Joyce

cc:

Subject: Daily Drilling Operations Summary Report for 3/31/97

The daily drilling activities for the ESF Southern Ghost Dance Fault Access Drift (Alcove #7) are as follows:

Borehole Name:	ESF-SAD-GTB#1
Core Classification:	Allocated Core
Planned Total Depth:	246.06 Ft. (75 meters)
Drill Rig:	Longyear 38
Core Bit Size:	HQ-3 (3.937" O.D. x 2.4" I.D.)
Reaming Bit Size:	HW (4.75" O.D.)
Rig Shift:	17

Drilling/Coring Info:	Core Run Number(s):	#62 - #67
	Starting Cored Depth:	204.34 ft.
	Ending Cored Depth:	225.34 ft. (21.00 ft. cut)
	Shift Core Recovery:	81% (18.13' cut, 14.7' rec) (Does not include core run #67)
	Avg. Air Rate:	225 scfm
	Ream Cycle(s):	n/a
	Starting Reamed Depth:	n/a
	Ending Reamed Depth:	108.68 ft. (3/24/97, 4.75" O.D.)
	Avg. Air Rate:	n/a

Comments: Continued coring to a depth of 222.47 feet. Tripped tools from borehole to replace core bit due to slowing penetration rate. The Longyear PCD Syndex core bit had the carbide inserts broken off on outermost gauge row and approximately 50% of the inserts broken off on the inner gauge row. Picked up a different Longyear PCD Syndex core bit (rerun, 3.937" O.D. x 2.406" I.D.) and tripped back in borehole. Continued coring to a depth of 225.34 feet. Left core run #67 in the borehole, to be recovered in the morning.

ENCLOSURE 1

Mark Esp
04/01/97 05:08 PM

To: Eddie Wright, Ezra Wasson, Ron Oliver, Alan Mitchell, Richard Kovach, Earl Spoeneman, Kenneth Skipper, Ray Wallace, Daniel Soeder, Debbie Edwards, John Martin, John Doyle, Ken McFall, Mike Harris, Tom Pysto, Crystal Olson, Beatrice Reilly, Brenda McGonigle, Ron E. Smith, Debbie Zesiger, Albert Williams, Patricia Smallwood, Glenn Milligan, Barbara Merritt, Greg Drew, Barry Stewart, Norman Bartley, Drew Coleman, Mike Mapa, Vickie Smith, Douglas Weaver, John Peck, Michael Taylor, Dan Neubauer, Ricky Joyce

cc:

Subject: Daily Drilling Operations Summary Report for 4/1/97

The daily drilling activities for the ESF Southern Ghost Dance Fault Access Drift (Alcove #7) are as follows:

Borehole Name:	ESF-SAD-GTB#1
Core Classification:	Allocated Core
Planned Total Depth:	246.06 Ft. (75 meters)
Drill Rig:	Longyear 38
Core Bit Size:	HQ-3 (3.937" O.D. x 2.4" I.D.)
Reaming Bit Size:	HW (4.75" O.D.)
Rig Shift:	18

Drilling/Coring Info:	Core Run Number(s):	#68 - #75
	Starting Cored Depth:	225.34 ft.
	Ending Cored Depth:	248.08 ft. (22.74 ft. cut)
	Shift Core Recovery:	86% (25.61' cut, 22.1' rec) (Includes core run #67 from 3/31/97)
	Avg. Air Rate:	190 scfm
	Ream Cycle(s):	n/a
	Starting Reamed Depth:	n/a
	Ending Reamed Depth:	108.68 ft. (3/24/97, 4.75" O.D.)
	Avg. Air Rate:	n/a

Comments: Recovered core run #67 (cut 3/31/97) and continued coring to a depth of 248.08 feet. Recieved authorization from TCO to continue coring beyond 246.06 ft (75 meters). Shift core recovery information (above) includes core run #67, cut 3/31/97 and recovered 4/1/97.

Mark Esp
04/02/97 04:28 PM

To: Eddie Wright, Ezra Wasson, Ron Oliver, Alan Mitchell, Richard Kovach, Earl Spoeneman, Kenneth Skipper, Ray Wallace, Daniel Soeder, Debbie Edwards, John Martin, John Doyle, Ken McFall, Mike Harris, Tom Pysto, Crystal Olson, Beatrice Reilly, Brenda McGonigle, Ron E. Smith, Debbie Zesiger, Albert Williams, Patricia Smallwood, Glenn Milligan, Barbara Merritt, Greg Drew, Barry Stewart, Norman Bartley, Drew Coleman, Mike Mapa, Vickie Smith, Douglas Weaver, John Peck, Michael Taylor, Dan Neubauer, Ricky Joyce

cc:

Subject: Daily Drilling Operations Summary Report for 4/2/97

The daily drilling activities for the ESF Southern Ghost Dance Fault Access Drift (Alcove #7) are as follows:

Borehole Name:	ESF-SAD-GTB#1
Core Classification:	Allocated Core
Planned Total Depth:	246.06 Ft. (75 meters)
Drill Rig:	Longyear 38
Core Bit Size:	HQ-3 (3.937" O.D. x 2.4" I.D.)
Reaming Bit Size:	HW (4.75" O.D.)
Rig Shift:	19

Drilling/Coring Info:	Core Run Number(s):	#76 - #78
	Starting Cored Depth:	248.08 ft.
	Ending Cored Depth:	254.96 ft. (Total Depth)
	Shift Core Recovery:	97% (6.88' cut, 6.7' rec)
	Avg. Air Rate:	177 scfm
	Ream Cycle(s):	n/a
	Starting Reamed Depth:	n/a
	Ending Reamed Depth:	108.68 ft. (3/24/97, 4.75" O.D.)
	Avg. Air Rate:	n/a

Comments: Continued coring to a Total Depth of 254.96 feet. Decision was made and concurred with by the TCO, FDE, and K/PB driller to terminate the hole at a Total Depth of 254.96 feet due to no return cuttings for the last two core runs and "sticky" hole conditions for approximately the last 20 feet of the borehole. Tenative geologic pick on the western contact of the Ghost Dance Fault is at 208 feet. Tripped coring tools from the borehole and laid down the core barrel. Capped the bottom end of the core rods and tripped the core rod string back in borehole to a depth of 254.44 feet (0.52 feet off bottom). Capped the top end of the string and sealed the annulus with the diverter head rubber. Borehole is ready for USGS temperature survey and testing. Final Report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

QA: N/A

APR 1 1 1997

D. R. Williams, DOE/YMSCO, Las Vegas, NV
J. M. White, DOE/YMSCO, Mercury, NV, M/S 717

FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING APRIL 4, 1997

Enclosure 1 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. Breakthrough of the pyridone tracer injected in C#3 has not occurred yet.

The pump is operating normally at this time and sampling for pyridone tracer is continuing. There are also plans to pull the injection tubing from borehole C#2 next week in order to obtain water samples from #2 and test them for pyridone tracer.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory successfully started the thermal testing that began on schedule on February 28, 1997, at about 10 a.m. The heaters were turned on and began heating the rock. As of April 3, 1997, the temperatures measured at two places closest to the plane of the heaters were 96.10°C and 86.6°C. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 77+75.1 meters as of 8 a.m., Friday, April 4, 1997. The excavation rate is currently averaging about 12 to 15 meters per day in the Tiva Canyon middle nonlithopysal zone. There are approximately 102 meters remaining to TBM hole-through at the South Portal. The TBM is now expected to hole-through sometime the week of April 14, 1997.

ENCLOSURE 2

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 76+60 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 2.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
Placement of concrete in the invert of the heated drift is substantially complete up to station 0+48 meters. The forms have been set in place and preparations are underway to pour concrete in the lined portion of the drift. Drilling of instrumentation holes may resume next week. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater.

The following temperature readings have been reported from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. These measurements were made on April 7, 1997, and continue to show an increase in temperature.

Radial Distance from heater centerpoint (m)	Temperature in degrees Celsius
0.33 meters	157.3°
0.67 meters	121.7°
1.48 meters	76.5°

The purpose of this test is to understand heat related processes and measure physical parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in

Alcove 5. The results will be available for the Viability Assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Excavation using an Alpine Miner AM-50 resumed on March 27, 1997. Currently, the excavation is on hiatus, but plans are to resume excavation using the AM-75 next week. The excavation has progressed to Alcove station 1+50.2 meters. The excavation will continue through the Ghost Dance Fault and provide a location for further testing of the fault.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove is complete at 1+34.4 meters (design length was 135 meters).

Drilling of a horizontal borehole, ESF-SAD-GTB1, across the Ghost Dance Fault from the end of Alcove 7 is in progress but encountered difficulty in drilling across the fault. The borehole had progressed to 33.0 meters as of March 10, 1997. Reaming of the hole to a depth of 33 meters was completed on March 24, 1997, and casing was set. Coring resumed on March 25, 1997, and was completed to a final depth of 77.7 meters on April 2, 1997. A splay of the Ghost Dance Fault has been tentatively picked at 30.5 to 33.0 meters and the main Ghost Dance Fault at 62.8 to 64.6 meters. Testing of thermal and pneumatic properties of the Ghost Dance Fault will take place in the borehole next and will constitute one of the important project milestones for fiscal year 1997.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-1371

Enclosures:
1. Site Characterization Field Activities in Progress
2. Tunnel Stratigraphy

APR 1 1 1997

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Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone

ENCLOSURE

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone
69+84 to 69+96?	Topopah Spring crystal rich vitric zone
69+96 to 70+58?	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+00?	Topopah Spring crystal poor upper lithophysal zone
73+00 to 73+41?	Topopah Spring crystal rich lithophysal zone
73+41? to 74+36?	Topopah spring crystal rich nonlithophysal zone
74+36 to 74+63?	Topopah Spring vitric zone
74+63 to 74+99?	pre -Pah Canyon bedded tuffs
?	Pah Canyon Tuff
?	pre-Yucca mountain bedded tuffs
?	Yucca Mountain Tuff
? to 74+99?	pre-Tiva Canyon bedded tuffs
74+99? to 75+16?	Tiva Canyon crystal poor vitric zone
75+16? to 76+03?	Tiva Canyon crystal poor lower nonlithophysal zone
76+03? to face	Tiva Canyon crystal poor middle nonlithophysal zone
76+32	Fault - offset estimated to be 0.2 meters

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

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QA: N/A

MAY 14 1997

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FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING MAY 9, 1997

Enclosure 1 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1. The tracer was injected on January 9, 1997. Sampling and analysis of the water pumped from C#3 continues. Concentrations are reported to continue about the same as those reported last week. Tracer testing helps to understand flow in the saturated zone and yields data to help model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory continues the thermal testing at the Large Block. The temperature at the top of the block is nominally at the steady-state boundary condition of 60°C. Temperature readings taken on May 7, 1997, from the two probes closest to the heater plane remained at 103.2°C and 96.0°C. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) is being dismantled at the South Portal.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continues intermittently as the TBM is moved out of the ESF. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 2.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
The concrete inverts were placed in the lined portion of the Heated Drift Test, which completes the planned concrete placement for the test. Drilling of instrumentation holes for the Heated Drift Test resumed on April 9, 1997, and has continued around-the-clock, five or six days per week, in order to meet upcoming testing objectives and milestones. The following holes were completed or are in progress this week:

Area	Hole name	Start	Finish	Depth (meters)	Purpose
HD	ESF-HD-ERT-8	5/5/97	5/5/97	16.4 m	Resistivity Log
HD	ESF-HD-WH-41	5/5/97	5/5/97	11.6 m	Wing Heater
HD	ESF-HD-WH-42	5/5/97	5/5/97	11.8 m	Wing Heater
HD	ESF-HD-ERT-7	5/6/97	5/7/97	20.1 m	Resistivity Log
HD	ESF-HD-WH-10	5/6/97	5/6/97	11.6 m	Wing Heater
HD	ESF-HD-TEMP-5	5/7/97	5/8/97	11.6 m	Temperature
HD	ESF-HD-WH-11	5/7/97	5/7/97	11.6 m	Wing Heater
HD	ESF-HD-WH-40	5/7/97	5/8/97	11.6 m	Wing Heater
HD	ESF-HD-TEMP-9	5/8/97	5/9/97	21.3 m	Temperature
HD	ESF-HD-WH-38	5/8/97	5/9/97	11.5 m	Wing Heater
AOD	ESF-HD-ERT-4	5/8/97	5/9/97	39.9 m	Resistivity Log
HD	ESF-HD-WH-13	5/9/97	5/9/97	11.6 m	Wing Heater
HD	ESF-HD-WH-39	5/9/97	In progress	(4.7 m)	Wing Heater

The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater.

The following temperature readings have been reported from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. These measurements were made on May 7, 1997, and continue to generally show an increase in temperature:

Radial Distance from Heater Centerpoint (m)	Temperature in Degrees Celsius
0.33 m	159.2°C
0.67 m	123.9°C
1.48 m	78.1°C

The purpose of this test is to understand heat related processes and measure physical parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in Alcove 5. The results will be available for the Viability Assessment (VA) design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

Niche Drift Study:
Drilling of three boreholes was completed for the first niche at station 35+66. When the niche area is excavated at a later date, dye will be injected to help trace the fracturing. The Drift Niche Studies are part of the Risk Reduction Strategy for VA and focus on unsaturated zone hydrochemistry testing.

Area	Hole number	Start	Finish	Depth (meters)	Purpose
Niche	ESF-MD-NICHE#3a	5/2/97	5/3/97	10.0 m	Dye Injection
Niche	ESF-MD-NICHE#2	5/5/97	5/6/97	10.0 m	Dye Injection
Niche	ESF-MD-NICHE#1	5/7/97	5/7/97	10.0 m	Dye Injection

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Excavation across the Ghost Dance Fault and of the drilling alcove was completed this week. The final length of the alcove is 174.9 meters and the drilling alcove is 24.5 meters, as measured from Alcove 6 centerline. Drilling equipment was mobilized into the drilling alcove this week and drilling is expected to begin early next week. Drilling and testing will be in support of pneumatic and hydrochemistry testing.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove is continuing using an Alpine Miner AM-75 and progressed to station 1+51.6 meters this week. This completes the excavation far enough to allow the USGS to begin planned pneumatic and hydrochemistry testing across the Ghost Dance Fault and splays from the fault. Logging and pneumatic and hydrochemistry testing is expected to start early next week.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

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Enclosures:
1. Site Characterization Field Activities in Progress
2. Tunnel Stratigraphy

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Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
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8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
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8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone

ENCLOSURE 2

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+55	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+55 to 65+07	Topopah Spring crystal rich lithophysal zone
65+07 to 65+25	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+25 to 65+27	Topopah Spring crystal rich lithophysal zone
65+27 to 66+33	Topopah crystal rich nonlithophysal zone
66+33 to 66+49	Topopah Spring vitric zone
66+49 to 66+80.5	bedded tuffs
66+80.5 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+90.5	Topopah Spring crystal rich nonlithophysal zone
69+90.5 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+02	Topopah Spring crystal poor upper lithophysal zone
73+02 to 73+41	Topopah Spring crystal rich lithophysal zone
73+41? to 74+40	Topopah spring crystal rich nonlithophysal zone
74+40 to 74+50.5	Topopah Spring vitric zone
74+50.5 to 74+96	bedded tuffs
74+96 to 75+15	Tiva Canyon crystal poor vitric zone
75+15 to 76+03	Tiva Canyon crystal poor lower nonlithophysal zone
76+03 to 78+40	Tiva Canyon crystal poor middle nonlithophysal zone
76+32	Fault - offset estimated to be 0.2 meters
78+40 to 78+77	Tiva Canyon crystal poor upper lithophysal zone

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

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Yucca Mountain Site Characterization Office
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QA: N/A

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J. M. White, DOE/YMSCO, Mercury, NV, M/S 717

FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING MAY 2, 1997

Enclosure 1 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1. The tracer was injected on January 9, 1997. Sampling and analysis of the water pumped from C#3 continues.

Note that the concentrations of pyridone were incorrectly reported last week. The concentration of pyridone tracer observed in water samples collected from C#3 is now reported as 0.116 parts per billion (ppb).

The injection tubing was removed from well C#2 and water sampling is continuing. In the most recent samples from C#2, the concentration is reported to be 2 ppb of pyridone. The preliminary interpretation is that tracer travels from C#1 to C#2 and then to C#3 which results in additional dilution of the concentration in C#3.

Tracer testing helps to understand flow in the saturated zone and yields data to help model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory continues the thermal testing at the Large Block. The temperature at the top of the block is nominally at the steady-state boundary condition of 60°C. Temperature readings from the two probes closest to the heater plane are at 103.2°C and 96.0°C. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) is being dismantled at the South Portal.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continues intermittently as the TBM is moved out of the ESF. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 2.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
The concrete forms were stripped from the lined portion of the Heated Drift Test. Currently, slight flaws in the lining are being repaired. Drilling of instrumentation holes for the Heated Drift Test resumed on April 9, 1997, on a round-the-clock, five or six days per week schedule, in order to meet upcoming testing objectives and milestones. The following holes were completed or are in progress this week:

Hole Number	Start Date	Completion Date	Depth (meters)	Purpose	Drilling Rig
ESF-HD-NEU-9	4/24/97	4/25/97	39.5m	Neutron Log	Longyear 38
ESF-HD-ERT-6	4/25/97	4/25/97	16.2m	Resistivity Log	Diamec 262
ESF-HD-WH-7	4/28/97	4/29/97	11.4m	Wing Heater	Diamec 262
ESF-HD-NEU-10	4/25/97	4/28/97	39.7m	Neutron Log	Longyear 38
ESF-HD-ERT-5	4/28/97	4/26/97	20.1m	Resistivity Log	Diamec 262
ESF-HD-WH-6	4/28/97	4/26	11.6m	Wing Heater	Diamec 262
ESF-HD-WH-44	4/29	4/30	11.6m	Wing Heater	Diamec 262
ESF-HD-TEMP-4	4/29	4/30	21.3m	Temperature	Longyear 38
ESF-HD-WH-45	4/30/97	4/30/97	11.6m	Wing Heater	Diamec 262
WH-43	4/30	5/1/97	11.6m	Wing Heater	Diamec 262
TEMP-3	4/30	5/2/97	20.1m	Temperature	Longyear 38
ESF-HD-ERT-3	5/1/97	In progress	(24.4m)	Resistivity	Longyear 38
WH-8	5/1	5/2/97	11.6m	Wing Heater	Diamec 262
WH-9	5/2	5/2/97	11.7m	Wing Heater	Diamec 262

The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater.

The following temperature readings have been reported from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. These measurements were made on May 1, 1997, and continue to generally show an increase in temperature:

Radial Distance from Heater Centerpoint (m)	Temperature in Degrees Celsius
0.33 m	159.0°C
0.67 m	123.4°C
1.48 m	77.8°C

The purpose of this test is to understand heat related processes and measure physical parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in Alcove 5. The results will be available for the Viability Assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Excavation using a rented Alpine Miner continued this week to approximate station 1+74.9 meters. The Alpine Miner is currently excavating a Drill Alcove at right angles to Alcove 6 and progressed to station 0+11.5 meters as measured from Alcove 6 centerline. There are about 14 more meters of excavation planned. Drilling across the Ghost Dance Fault in the vicinity of Alcove 6 will begin upon completion of the Drill Alcove.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove is continuing using an Alpine Miner AM-75 and progressed to station 1+51.6 meters this week. This completes the excavation far enough to allow the USGS to begin planned pneumatic and hydrochemistry testing across the Ghost Dance Fault and splays from the fault.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-1504

Enclosures:
1. Site Characterization Field Activities in Progress
2. Tunnel Stratigraphy

cc w/encls:
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Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

ENCLOSURE 1

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone

ENCLOSURE 2

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+55	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+55 to 65+07	Topopah Spring crystal rich lithophysal zone
65+07 to 65+25	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+25 to 65+27	Topopah Spring crystal rich lithophysal zone
65+27 to 66+33	Topopah crystal rich nonlithophysal zone
66+33 to 66+49	Topopah Spring vitric zone
66+49 to 66+80.5	bedded tuffs
66+80.5 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+90.5	Topopah Spring crystal rich nonlithophysal zone
69+90.5 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+02	Topopah Spring crystal poor upper lithophysal zone
73+02 to 73+41	Topopah Spring crystal rich lithophysal zone
73+41? to 74+40	Topopah spring crystal rich nonlithophysal zone
74+40 to 74+50.5	Topopah Spring vitric zone
74+50.5 to 74+96	bedded tuffs
74+96 to 75+15	Tiva Canyon crystal poor vitric zone
75+15 to 76+03	Tiva Canyon crystal poor lower nonlithophysal zone
76+03 to 78+40	Tiva Canyon crystal poor middle nonlithophysal zone
76+32	Fault - offset estimated to be 0.2 meters
78+40 to 78+77	Tiva Canyon crystal poor upper lithophysal zone

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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January 10, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Daniel A. Dreyfus, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO Wesley E. Barnes

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

A Waste Package Degradation Abstraction/Testing workshop was conducted on January 8-10, 1997. The goals of the workship were to: 1) identify issues; 2) prioritize the issues; 3) review previous TSPA issues and associated uncertainties; 4) decide on a method of addressing and qualifying uncertainty; 5) create a plan for developing and testing model abstractions; 6) discuss the interfacing of these abstractions with other abstraction/testing topics associated with TSPA; and 7) develop a tentative schedule for abstraction/testing activities to meet the needs of site, design, PA, and completion and delivery of post-workshop products.

Staff participated in the Probabilistic Seismic Hazard Assessment workshop being held in Salt Lake City, Utah, January 6-10, 1997. The workshop includes discussions of issues related to the seismic source and hazards for the site area.

II. KEY ACCOMPLISHMENTS

The TBM is at station 71+33 meters/23,404 feet as of 0800 hours on 1/09/97. The ground classification is category 4 support [8-inch steel sets]. Shotcrete and timber blocking are being used as special support to consolidate some broken rock areas. Progress is slow due to broken rock in a fault zone that is resulting in large cavities outside the tunnel boundaries. Excavation of the Thermal Test Alcove continued during this period. The cross drift Bottom Heading has been completed to station 00+35 meters/113 feet. The Connection Drift Extension has been completed to station 00+13 meters/43 feet using drill and shoot excavation, and the total advance for the heated drift room is now at 51+00 meters/167 feet using the roadheader. The plate loading test excavation has been completed.

Excavation of the Northern Ghost Dance Fault Alcove has advanced to station 1+34 meters/442 feet, completing phase 1 and the alcove is now in a testing phase. The Southern Ghost Dance Fault Alcove has been excavated to a staion 00+51/166 feet and excavation of a side turnaround is now in progress.

The Assistant Manager for Administration and Asset Management reported that the plan for transitioning responsibility of ESF management following completion of the main tunnel is being prepared. A Type B Accident Report - Drilling Injury Yucca Mountain Exploratory Studies Facility - response is being prepared.

The Office of Institutional Affairs is continuing preparations for the January 23, 1997, public hearing for the proposed amendment to the Department of Energy's repository siting guidelines. Announcement of the public hearing appeared in the Federal Register on December 16, 1996. The hearing will be held at the University of Nevada, Las Vegas at the Moyer Student Union. The Notice of Proposed Rulemaking for 10 CFR Part 960 and a stakeholder letter were mailed out on January 3, 1997.

The Office of Institutional Affairs coordinated and conducted two tours of Yucca Mountain for four guests. Of special interest was a tour on January 9, 1997, for Nevada State Senator Ray Shaffer.

The Director of the Office of Institutional Affairs gave a general Yucca Mountain Project update presentation to the Lincoln County Commission, in Pioche, Nevada, on January 7, 1997. The Commission requested the presentation to provide information to the four newly elected County Commissioners.

The Director of the Office of Institutional Affairs met with Dr. Klaus Stetzenbach, newly appointed Director of the Harry Reid Center, and Dr. Donald Baepler, the previous Director, to discuss potential categories of work for the Center. An additional meeting with the appropriate project technical staff will be scheduled.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
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January 17, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Daniel A. Dreyfus, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Assistant Manager for Licensing reported that the USGS has received permission from the State of Nevada to inject up to 2 kilograms of pyridone and up to 10 kilograms of 2,6 difluorobenzoic acid into boreholes at the c-well complex. Injection has begun. These tracer tests will better define the permeability tensor of the anisotropic flow field in the saturated zone which is needed for flow and transport modeling.

On January 9, 1997, the M&O engineering staff held a kick-off meeting for the review of the Waste Handling Systems Configuration Analysis. This analysis is for the Repository Waste Handling Building and some related interfaces with other repository systems.

The precipitation gauge network that was previously monitored by the USGS is back in operation. The network was intentionally shut down so that it could be reconfigured and transferred over to the environmental group for monitoring by the PMO. The network is essential for both characterzation of the hydrologic setting and for environmental monitoring.

II. KEY ACCOMPLISHMENTS

The TBM is at station 71+37 meters/23,417 feet as of 0800 hours on 1/16/97. The ground classification is category 4 support [8-inch steel sets]. Shotcrete and timber blocking are being used as special support to consolidate some broken rock areas. Progress is slow due to broken rock in a fault zone that is resulting in large cavities outside the tunnel boundaries. It appears that more competent rock is in sight and progress should improve.

Excavation of the Thermal Test Alcove continued during this period. The cross drift Bottom Heading has been completed to station 00+35 meters/113 feet. The Connection Drift Extension has been completed to station 00+13 meters/43 feet using drill and shoot excavation, and the total advance for the heated drift room is now at 59+00 meters/194 feet using the roadheader. The plate loading test excavation has been completed.

Excavation of the Northern Ghost Dance Fault Alcove has advanced to station 1+34 meters/442 feet, completing phase 1. The alcove is now in a testing phase. The Southern Ghost Dance Fault Alcove has been excavated to a station 00+63 meters/207 feet.

The Office of Institutional Affairs is continuing preparations for the January 23, 1997, public hearing for the proposed amendment to the Department of Energy's repository siting guidelines. Announcement of the public hearing appeared in the Federal Register on December 16, 1996. The hearing will be held at the University of Nevada, Las Vegas at the Moyer Student Union. The Notice of Proposed Rulemaking for 10 CFR Part 960 and a stakeholder letter were mailed out on January 3, 1997, to approximately 1,080 stakeholders.

The Office of Institutional Affairs coordinated and conducted four tours of Yucca Mountain for 63 guests. Of special interest were tours on January 15, 1997, for Senator Rod Grams (R-MN) and 30 guests from the Massachusetts Institute of Technology.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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February 7, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Assistant Manager for Licensing reported that Project scientists from DOE and LANL recently collaborated with scientists from the Nevada Test Site's Environmental Restoration group on the planning of a forced gradient, multi-borehole, multi-tracer experiment that will be conducted on Pahute Mesa, approximately 20 miles North of the proposed repository area at Yucca Mountain. Results from this suite of testing will be available to YMSCO in support of flow and transport modeling. In addition to tracers similar to those used at the c-wells complex, the Test Site's forced gradient experiment also has actual radionuclide contaminants that resulted from underground testing. Data regarding the transport of these radionuclides may be of great value to the project.

The Unsaturated Zone Flow Model Expert Elicitation Project Workshop #3 and site visit were held the week of February 3, 1997. The site visit included a visit to the ESF and briefings by principal investigators associated with hydrologic investigations underground. The elicitation interviews of the individual experts will be conducted February 11-21, 1997. The final results of the project will be available by March 21, 1997, for input into the UZ flow model.

On February 5, 1997, YMSCO participated in an NRC Appendix 7 meeting, "Disposal Criticality," in Washington, D.C. This meeting provided an opportunity for NRC staff to raise questions and provide comments on the technical report that contains a preliminary description of the methodology that DOE plans to use in the 1998 Topical Report on Disposal Criticality Analysis Methodology. Also, any concerns and issues were identified and resolution for such issues were proposed.

On February 6, 1997, YMSCO participated in an NRC Appendix 7 meeting, "Level of Design Detail," in Rockville, Maryland. The focus of the meeting was to discuss the ESF and the proposed repository level of design detail that will be necessary in the 2002 License Application.

Preparation of the Large Block for thermal testing was completed. At the recommendation of project scientists, DOE has agreed to allow additional time for the collection of additional baseline data. The additional information is expected to enhance the collection of data from the thermal testing. Large Block testing is currently scheduled to commence on the week of February 24, 1997.

The Office of Institutional Affairs coordinated and conducted three tours of Yucca Mountain for 13 guests including the Nuclear Waste Technical Review Board.

At the request of interested members of the public, the Department of Energy has extended until March 17, 1997, the public comment period on its proposal to amend the siting guidelines that will be used to determine the suitability of the Yucca Mountain site for development as a repository.

II. KEY ACCOMPLISHMENTS

The current TBM stationing is at station 72+03 meters or 23,636 feet as of 0800 hours on February 5, 1997. The ground classification is category 1 support. The TBM has broken out of the fault area and has increased advance to 16 meters and 26 meters in the last 2 days. Present forecasts indicate that progress is 34 days behind the end of March schedule.

Excavation of the Thermal Test Alcove has continued during this period. The cross-drift Bottom Heading has been completed to station 00+35 meters or 113 feet. The Connection Drift Extension has been completed to station 00+13 meters or 43 feet, using drill and shoot excavation and the heated drift room is now completed on the top heading at 60.5 meters or 198 feet, using a road header. Excavation of the invert section of the heated drift room has also been completed to 60.5 meters or 198 feet. The plate loading test excavation has been completed.

Excavation of the Northern Ghost Dance Fault Alcove has advanced to station 1+34 completing phase I and the alcove is now in a testing phase. The Southern Ghost Dance Fault Alcove has been excavated to station 00+99 meters or 324 feet.

The box cut for the South Portal is progressing on schedule.

III. ISSUES

None to report.

IV. COST SUMMARY

None to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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FEBRUARY 14, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO Wesley E. Barnes

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

On February 6, 1997, an Appendix 7 Meeting was held at the NRC Headquarters in Rockville, Maryland to discuss the DOE Design Detail for License Application. The focus of the meeting was to discuss the repository design development strategy which is based upon SSC categorization (Binning) and the level of design detail that will be developed for various classification of SSCs at time of LA submittal.

AML is currently completing planning for AECL review of 3-D geologic framework and rock properties models and use in derivative process and design models. AECL may be requested to review up to fourteen 3-D model deliverable products during the next 8 months. AECL will conduct location visits and initiate review of geologic and unsaturated zone hydrologic flow models next week. The AECL review of the framework and rock properties models and their derivative model products will assist DOE in product acceptance review and in preparation for VA and LA as part of an overall model evaluation and assessment process. The process will assist DOE in documenting the development, use, modification, and application of framework and static rock properties model data within the broader YMP project.

The Unsaturated Zone Transport Abstraction and Testing Workshop was conducted on February 5-7, 1997, in Albuquerque, New Mexico. The workshop was held to develop plans for studies that should be completed prior to the TSPA for the Viability Assessment. Participants produced detailed plans for the work that included sensitivity analyses, model development, and model abstraction that will be necessary prior to the analysis of ground-water transport in the unsaturated zone for the Viability Assessment.

An NRC/DOE Appendix 7 Meeting on the Criticality Control Analysis Methodology was held on February 5, 1997, in the Forrestal building in Washington, D.C. Approximately 35 were in attendance representing YMSCO, NRC, OCRWM-HQ, M&O, DOE-NE, Nevada, and other subcontractors. The meeting provided valuable insights into specific areas that need to be emphasized in revising the Technical Report and in the Topical Report planned for FY 1998. As an example of this emphasis, the NRC wants to see a well-developed logic and justification of the integrated approach to validation of the isotopic and criticality codes used for taking credit for burnup in the criticality calculations.

II. KEY ACCOMPLISHMENTS

Current TBM stationing is at station 72+88 meters (23,912 ft) as of 0800 hours February 13, 1997. The ground classification has reverted to category 3A (6-inch steel sets) from category 1 support (bolts and mesh) due to broken ground conditions. At this time, the projection is that progress is 34 days behind the end of March schedule.

Excavation of the Thermal Test Alcove has been completed as of February 7, 1997. The cross-drift Bottom Heading has been completed to station 00+35 meters (113 ft). The Connection Drift Extension has been completed to station 00+13 meters (43 ft), using drill and shoot excavation, and the heated drift room is now completed on the top heading at 60.5 meters (198 ft) using a roadheader. Excavation of the invert section of the heated drift room has also been completed to 60.5 meters (198 ft). The plate loading test excavation has been completed.

Excavation of the Northern Ghost Dance Fault Alcove (NGDFA) has advanced to station 1+34 completing phase I and the alcove is now in a testing phase. The Southern Ghost Dance Fault Alcove (SGDFA) has been excavated to station 01+02 meters (335 ft).

The Office of Institutional Affairs' staff coordinated and conducted various tours of Yucca Mountain for 10 guests. Included were tours for guests from the Performance Assessment Peer Review Panel and the *Liberation Newspaper* (a French daily newspaper).

The Office of Institutional Affairs' staff completed a General Accounting Office questionnaire/audit inquiring about all DOE publications and information clipping service, and affiliated costs.

The Assistant Manager for Environment, Safety, and Health submitted the Quarterly Ground-Water Monitoring Report to the Nevada State Engineer. This Yucca Mountain water appropriation permit requirement reports ground-water levels and spring flows at approximately 40 monitoring locations in the Yucca Mountain region.

On February 4, 1997, the Yucca Mountain Project Repository Design Consulting Board submitted a draft copy of their Report No. 3 for review and comment. This report includes briefings and consultations held in Las Vegas, Nevada, December 5-6, 1996.

III. ISSUES

None to report.

IV. COST SUMMARY

None to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

Please make copies for Chad, Bill, Sandi (FYI) File

February 28, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO for

SUBJECT: **WEEKLY REPORT**

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Waste Form Degradation/Mobilization Abstraction and Testing Workshop was conducted on February 19-21, 1997 at LLNL. The workshop brought together experimentalists, process modelers, subsystems performance analysts and total system performance annalysts in order to jointly develop simplified representation of important processes to be used in TSPA-VA. The goals of the workshop were to produce a comprehensive list of issues important to waste form degradation and radionuclide mobilization, prioritize these issues against performance- related criteria, develop plans for abstracting and testing, and build consensus on the resulting priorities and plans. Smaller groups of analysts have been selected to coordinate these studies through the production of TSPA-VA.

The thermal effects part of the Large Block Test at Fran Ridge began on Friday, February 28, 1997. The heaters were turned on at 10:00 a.m.

The TBM advanced approximately 162 meters since 2/7/97. The heading lithology is the uppermost Topopah Spring. At station 72+56 the contractor changed from channels and wire with rock bolts (category 1) to steel sets (category 3). This is due to a fault at or around station 72+75. The ground improved again at station 72+99, where the contractor changed support from steel sets to channels and wire with rock bolts. The ground support at the heading is category 1. Overall, tunnel production is expected to be good, with minimal ground support.

Mr. John Gandi (AMAAM) has been temporarily detailed to the YMSCO Telecommunications Services Review. Ms. Jill Schrecongost will be acting Information Management Lead during the 120 days of Mr. Gandi's detail.

II. KEY ACCOMPLISHMENTS

The quarterly Ambient Air Monitoring Report for air quality operating permit compliance was delivered to the State of Nevada Bureau of Air Quality. Compliance with this permit requirement allows uninterrupted surface disturbing activies to continue.

The Office of Environment, Safety & Health hosted a meeting with Native Americans on February 23-28, 1997, at the Desert Research Institute's artifact curation facility to identify artifacts collected from the Yucca Mountain Project that may be related to the Native American Graves Protection and Repatriation Act.

Four tours of Yucca Mountain were conducted for 101 guests. These included Spanish Waste Management Company, the National Drilling and Excavation Technologies Institute, the Utility Concerns Program, and the Japan Atomic Industrial Forum.

The Mined Geologic Disposal System Requirements Document is in a QAP-3-5 formal review by the Management & Operating Contractor. The current schedule for completion of this review is Friday, February 28, 1997. This schedule is to meet the Level III deliverable (SE422M3) due date of March 3, 1997. A request to delay this due date was approved by the Department of Energy. This delay allows the document to be delivered by April 28, 1997. Responses to all review comments have been developed and will be presented to the respective reviewers this week. A comment resolution meeting is scheduled for Wednesday, February 26, 1997. It appears that there is a reasonable chance that all comments can be resolved by Friday. The goal is to deliver the document by the original due date.

The Exploratory Studies Facility construction completion evaluation is continuing as scheduled. An update to the technical document preparation plan controlling the documentation of the evaluation reports was reviewed for the Exploratory Studies Facility design organization. This change was primarily to clean up errors identified while trying to utilize the technical document preparation plan. All previously identified corrections were properly incorporated and therefore no additional comments were necessary.

The preliminary draft requirements attributes for the first Bin 3A System Description Documents were developed and working group meetings with the Integrated Product Team members were initiated. Coordination with the Design Organization Integrated Product Team members will facilitate the development of these requirements into quantifiable and measurable parameters. Follow-on work has also been initiated to develop the requirement traceability to the program requirement documents as well as development of the supporting requirement bases. Additionally, sixty percent of the functions for the next 6 Bin 3B System Description Documents have been developed and these draft functions will be reviewed within the next week.

A matrix summarizing the updates identified for Controlled Design Assumptions Document, to support Viability Assessment issues, was developed. It will be reviewed by both the responsible individual of each Viability Assessment issue as well as Engineering and Integration management prior to the incorporation of the associated assumptions or assumption updates into the Controlled Design Assumptions Document. The purpose of this matrix is to assure all affected parties that the reference design concept and the alternative design concepts are integrated with each other and consistent with what Engineering and Integration management requests.

NLP-3-32, Development of the Controlled Design Assumptions Document was approved on 2/17/97 with an effective date of 2/21/97. Thus, the procedure is now available for use and will be used soon for an interim change to the Controlled Design Assumptions Document. The document has been submitted to the Document Control Center and should be available on the Lotus Notes electronically controlled Management & Operating Contractor procedures database within the next week. The records package for the development and approval of the procedure has also been sent to and received by the Records Center.

Reviewed Emplacement Drift Invert Structural Design Analysis in accordance with QAP-3-9. Comments were submitted against the analysis where the appropriate requirements and assumptions from the Engineered Barrier Design Requirements Document and Controlled Design Assumptions Document were not incorporated.

Developed System Description Document Integrated Development schedule with Project Integrated Safety Assessment activities and milestones. The schedule has been distributed to Engineering and Integration management for review and comments.

Redrafted the Project Integrated Safety Assessment Content Guide for Chapter 11 as a result of comments from the Licensing organization regarding the Project Integrated Safety Assessment Chapter 11, Conduct of Operations. The redraft is based primarily on Engineering and Integration management direction to formulate the Project Integrated Safety Assessment Chapter 11 along the line of Draft Regulatory Guide 3003, as well as the data that will exist at the time the Project Integrated Safety Assessment is due.

Briefed Engineering and Integration management on 2/17/97 on the technical approach for the development of the Engineering Compliance Plan. An Integrated Product Team kickoff meeting was held on 2/21/97 in which the expanded FY97 workscope associated with the Engineering Compliance Plan was discussed and issues/activities were identified that need to be resolved/conducted.

Initiated an informal Management & Operating Contractor review of an unsolicited pre-proposal that addresses the possibility of substantially reducing the potential advective flow about an emplaced waste package by installing a "Richard's Grout Barrier." The intent of the informal review is to determine whether this concept should be seriously pursued as an element of the Engineered Barrier System Enhancements Key Viability Assessment Design Issue.

Prepared an evaluation of shipping cask availability for the Department of Energy. The shipping casks are those which have already been certified for transportation.

Completed Technical Publications changes to the Fifth Corridor Rail Report and the Fourth Heavy-Haul Route Report and prepared the document for Management and Operating Contractor review.

The current repository underground design has emplacement drifts and main shafts slanted, so that any potential liquid that might enter would be expected to drain to a low point at the north end of the repository block and away from the emplacements. This could possibly result in a localized concentration of radionuclides. As a part of the Seals Study being conducted drainage issues or water control issues are being addressed. To evaluate the performance of such a design solution, Performance Assessment was asked to perform bounding calculations to determine the effect of such a point term source on radionuclide release from the repository.

Completed and published the Technical Document Preparation Plan for the Waste Quantity, Mix and Throughput Study.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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North Las Vegas, NV 89036-0307

Please make copies for Bill, CHMO, File, Steve

March 7, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO LJB for

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Large Block Test (LBT) started February 28, 1997, at 10:00 a.m.

Drilling of vertical upwards borehole started this week in Alcove 7 (Southern Ghost Dance fault alcove). The planned total depth of the borehole is 60 meters, and the current depth is 1.1 meters. Core samples and video of the borehole will be used to determine the contact between the Topopah Spring crystal poor middle nonlithophysal zone (repository horizon) and the overlying Topopah Spring crystal poor upper lithophysal zone. This information will be used to determine the orientation of the subsequent borehole across the Ghost Dance fault.

On February 25-26, 1997, a Technical Exchange on Igneous Activity was held with the NRC in Rockville, Maryland. NRC presented new information related to Igneous Activity, a hazard model developed by the Center to estimate the repository disruption probability, and a preliminary consequence analysis that estimated doses from a tephra eruption through the repository. DOE presented the results of the Probabilistic Volcanic Hazard Analysis expert elicitation and plans for addressing this disruptive event in TSPA--VA. The main outcome of the meeting was a list of points of agreement and a proposed path to resolution of the probability of disruption subissue. The next step is for DOE to provide a letter to the NRC describing how the results of the PVHA will be used in TSPA-VA and how sensitivity studies will be conducted using single-point probability estimates. NRC is planning an Issue Resolution report on Igneous Activity in FY 1997.

On February 27, 1997, an Appendix 7 meeting on Seismic Topical Report #2 (Seismic Design Methodology) was held with the NRC in Rockville, Maryland. NRC comments on Rev. 1 of TR #2 were discussed, and the changes DOE will make to the text and provide in Rev. 2 were agreed with the NRC. NRC will follow with a letter documenting the

comments and reaffirming the commitment to prepare an SER following completion of Seismic Topical #3 in FY 98.

10 CFR 960 Rulemaking: To date, approximately 30 comments have been received on the 10 CFR 960 rulemaking. The comment period ends March 17, 1997.

Concurrence comments on Progress Report 15 from OGC were received and resolved on March 5, 1997, and change pages were sent to HQ via Federal Express on March 6, 1997. OGC concurrence had been expected by February 7, 1997. Issuance of Progress Report 15 is approximately one month behind, with release to the NRC now expected in April 1997.

II. KEY ACCOMPLISHMENTS

The TBM was at Station 75+88 meters/24,896.6 feet as of 0800 hours on March 6, 1997. Until March 4, 1997, the ground support category had been 3a and 10 steel sets were used. Since then, the ground classification has improved to support class category 1. Layout for test holes continued in Alcove #5, along with assembly and installation of concrete forms for heated drift. The scrubber unit was moved from Alcove #7 to Alcove #6 and installed. The muck conveyor was also installed in Alcove #6. Horizontal and vertical drilling commenced in Alcove #7 using LY 38 drill on fault probe and the Casagrande drill on the contact probe hole. Backfilling continued along the TBM runway pad at the ESF South Portal.

The M&O Performance Assessment team finished a mini-TSPA, which involved combining some of the TSPA-1995 models with the latest UZ flux model from LBNL (including the impact on drift-scale thermohydrology and package corrosion). Changes in the SZ flow model were also made to assure consistency with the new regional flow model. Results are being used internal to the DOE and M&O for discussion of issues and options, and for understanding new developments in the assessment of Yucca Mountain.

An M&O Performance Assessment team representative attended a workshop on In-Package Criticality held at INEL on February 24-26, 1997. Participants were primarily from DOE-EM. Discussions were held on the appropriate scenarios to consider for in-package criticality, the current state of the regulations, and the DOE-RW approach to risk-based analysis of criticality.

Staff developed Systems Integration inputs and estimates associated with addressing additional Department of Energy-owned Spent Nuclear Fuel. Three options were assessed involving the level of integration of Department of Energy-owned Spent Nuclear Fuel into the design by the Viability Assessment and LA dates.

An informal review draft copy of the Performance Confirmation Plan has been developed and provided to various Management & Operating Contractor organizations for their review.

Seal background data, design information, and seal/repository parameters have been reviewed and collected. A meeting has been set for April 4-5, 1997, with a seal design expert to review this information and determine what additional information (if any) is needed to establish the seal requirements for VA and LA.

The Mined Geologic Disposal System Requirements Document, Revision 3, is nearly completed. This Level III deliverable due date has been approved to be delayed until April 28, 1997.

Three tours of Yucca Mountain for 64 guests were conducted, including the Federal Railroad Administration, the Inyo County Planning Department, and Waste Management '97. The tour for the Inyo County Planning Department was requested by the Inyo County Yucca Mountain Repository Assessment Office Director to introduce two newly elected supervisors to the Yucca Mountain Site Characterization Project.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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Please make copies for Chuck Bill File Sparks

March 14, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO W. E. Barnes

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

Drilling of the borehole from Alcove #7, Southern Ghost Dance Fault Alcove, is currently in progress. The horizontal borehole will cross the Ghost Dance Fault. Planned total depth is approximately 60 meters/198 feet.

II. KEY ACCOMPLISHMENTS

The TBM is at Station 76+88.1 meters/25,225 feet as of March 13, 1997. The ground support was Category 1 until swing shift operations began on March 10, 1997, when it changed to 3a. Nine steel sets have been used. Total progress within the period in question has been 102.78 meters/339.2 feet. Distance remaining to hole out is 189.8 meters/622.7 feet.

Fourteen feet of heated drift invert has been poured in Alcove #5, Thermal Test Facility. A laser has been set up in Alcove #6, Northern Ghost Dance Fault Alcove, following the installation of ventilation and survey equipment. Phase II excavation has commenced in Alcove #6 and the present Station is 1+39.2 meters/459.4 feet. This represents 70% of the total excavation of 1+99.2 meters/ 657.4 feet. The probe hole to contact zone was completed in Alcove #7, Southern Ghost Dance Fault Alcove, while drilling of the probe hole to the fault continued. Present Station of Alcove #7 is 1+34 meters/442 feet. Total projected Station completion for Alcove #7 is 2+25 meters/743 feet.

Concrete curb was poured on the TBM Storage Pad at the ESF South Portal. Backfilling continued along the TBM Runway Slab. Rock bolts and wire mesh installation continued along the South wall of the box cut.

The Near-Field Environmental Model Testing and Abstraction Workshop was completed on March 3-5, 1997, in Berkeley, CA. Uncertainties and issues were ranked and work was planned to address issues of higher priority. Workshop documentation will describe the decision-making process and its outcome.

A review was completed of the Subsurface Repository Performance Confirmation Facilities' design analysis. This lengthy design analysis explicitly traced each and every parameter, design criteria, and

assumption stated in Section 4 to specific paragraphs in the design analysis where they were used. Tracking of Section 4 statements enables easier verification that design requirements are addressed in the analysis.

Staff participated in the Web-Based Information System brainstorming session and submitted comments on the associated document development processes. This system is testing the use of Internet browser-based software for the development and submittal of Yucca Mountain Site Characterization Project documents that support the License Application. The brainstorming session attempted to identify issues that would affect the way a document would be developed and viewed when using the Web-Based Information System.

Performance Assessment work for the Waste Isolation Requirements Study was completed. The results indicated that, under potentially higher fluxes that exist in the mountain, backfill will not alter the waste package environment to any appreciable extent that it would make a performance difference on releases to the accessible environment. Some additional work may be needed to develop improved process models for backfill to consider some of the aspects that were not included in the calculations.

A comprehensive listing of candidate external interfaces for Systems Engineering/Integration activities identified in the Project schedule was developed and provided to the Mined Geologic Disposal System Project Engineering Office.

A draft description of the Mined Geologic Disposal System Design was developed to accompany the Viability Assessment. The description was generated on short notice to support a Yucca Mountain Site Characterization Office request in which the structure and content of the four Viability Assessment products are to be solidified. The one-page writeup focuses on the distinction between the chapters which will be written to support the Project Integrated Safety Assessment with the structure and organization consistent with a safety case and the need for a design focused product dedicated to the cohesive, integrated presentation of the design.

Four tours of Yucca Mountain for 67 guests were conducted. Of special interest were tours for 20 guests from the University of Nevada, Las Vegas Minority Engineering Program and 10 guests from the Amargosa Nuclear Waste Steering Committee.

Plans are underway for celebrating the Tunnel Boring Machine daylighting activities.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

Mary, please make copies for Chad Bill Jake Thanks Bill

March 21, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO Wesley E. Barnes

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The public comment period for the proposal to amend siting guidelines, 10 CFR Part 960, has been extended an additional 30 days, thus providing a combined comment period of 121 days. A Federal Register notice announcing the extension was published March 20, 1997. The public comment period has been extended until April 16, 1997.

Approximately 30 representatives from the National Academy of Sciences will be in Las Vegas for meetings and a tour of Yucca Mountain, March 24-25, 1997. The tour will be conducted on Tuesday, March 25, and will include visits to the crest of Yucca Mountain and the Exploratory Studies Facility (ESF) tunnel.

Completion of the ESF tunnel is scheduled to occur on April 11, 1997. To recognize the achievement of this significant milestone, the Project is planning an internal employee event on the day excavation is completed.

II. KEY ACCOMPLISHMENTS

The TBM was at Station 77+18.58 meters/25,324.6 feet as of 08:00 a.m., March 19, 1997. Ground support has remained at 3a, and 35 steel sets have been used during this period. Total progress made by the TBM during this period is 41.29 meters/135.39 feet. Distance remaining to hole out (completion of the ESF tunnel) is 159.4 meters/523 feet. The slower rate of progress is attributed primarily to the need for hand mucking of large amounts of fallout material and cribbing instillation.

The heated drift invert pour was completed and heated drift invert forms were stripped in Alcove #5 (Thermal Test Alcove). Rock bolts and wire mesh were installed for ground support in exclusion zones. Permeability instrumentation in the boreholes -- located in the access observation drift -- was removed. Single Heater Test monitoring is in progress.

Permeability testing was completed and equipment removed from Alcove #6 (Northern Ghost Dance Fault Alcove). Workers are waiting for the arrival of the Alpine Miner. Coring of the fault probe hole was halted at 33.04 meters/108.40 feet in Alcove #7 (Southern Ghost Dance Fault Alcove) when rock caved into and plugged the borehole. Drilling will resume when casing for the fault probe hole arrives.

Backfilling along the south side of the TBM runway pad continued and installation of rock bolts in the box cut was completed at the ESF South Portal.

On Wednesday, March 12, 1997, Progress Report 15 was forwarded to the Secretary's Office for a 1-week courtesy review, per the letter delegating signature of Progress Reports to RW-1. The 1-week review period ended Wednesday, March 19. Following RW-1 concurrence and signature of Progress Report 15, the Yucca Mountain Site Characterization Progress Office is prepared to print the report, enabling distribution of the document to the Nuclear Regulatory Commission by the end of March.

A Purchase Requisition was completed for the technical services of a regulatory consultant. This consultant is scheduled to be at the Yucca Mountain Site Characterization Office the week of March 24, 1997, to develop a structure/architecture for documentation to support a license application. The task will focus on engineering and requirements documentation, and particularly on the role and scope of the Engineering Compliance Plan and its relationship to the System Description Documents.

Coordination has begun of an annotated outline which describes the Viability Assessment Design. The concept for the design is essentially a reorganization of the information already planned for inclusion in the Project Integrated Safety Assessment chapters to provide a more logically flowing presentation of the design rather than a document focused on the safety case (Project Integrated Safety Assessment).

Five tours of Yucca Mountain were coordinated and conducted for 67 guests during this period. Of special interest were tours for Nye County, Nevada Commissioner Dick Carver, and members of the Round Mountain Town Advisory Board; four guests from the University of Nevada's Research Affairs Council; and for the U.S. Navy, Admiral Frank L. Bowman, Navy General Counsel, Steven S. Honigman, and 10 staff

members from the Department of Energy's Naval Reactors program (NE-60). The Admiral is the Director of the Naval Nuclear Propulsion Program for the Department of the Navy/Department of Energy.

On March 15, 1997, a public open house tour of Yucca Mountain was conducted for 168 guests. This was the first Yucca Mountain public open house to have 100% attendance from registered guests. Tour participants included teachers participating in a "Science, Society, and America's Nuclear Waste" teacher workshop and hearing impaired members of the public from Las Vegas, Nevada.

On March 18, 1997, staff from the Office of Institutional Affairs coordinated and delivered Yucca Mountain Site Characterization Project update presentations to Esmeralda County, Nevada and Nye Counties, and the Nevada Boards of Commissioners.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

QA: N/A

March 28, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

Three panel members and staff from the NWTRB visited the site March 21, 1997, to discuss design matters. The discussions focused on the options under consideration for repository design, factors driving those options, and plans for reaching closure on the options. Of particular interest was the discussion about the repository design model and its use in the thermal management issue.

Project staff met with staff from the Department's Naval Reactors' program to resolve concern over waste canister size. That meeting was preceded by a telephone discussion with Bettis Atomic Power Laboratory, wherein the Project agreed to assess the specific impacts to both the Project over the use of larger canisters and to the Navy through the use of smaller canisters. The meeting with Naval Reactors' staff confirmed the earlier agreement and provided clearer understanding of each organization's issues. Much of the Navy's projected fiscal impact is due to an earlier DOE position which based disposal fee assessments on the number of canisters accepted at the repository.

Approximately 30 representatives from the National Academy of Sciences/National Research Council's Board on Radioactive Waste Management met in Nevada for meetings and a tour of Yucca Mountain on March 24-25, 1997. Meeting presentations addressed the Yucca Mountain Site Characterization Project status and Performance Assessment. The tour included a visit to the ESF and travel to test Alcove #5, the Heater Test Facility.

The DOE/NRC Management Meeting originally scheduled for April 9, 1997, has been rescheduled to April 30, 1997, to allow a productive prebriefing prior to the May 15, 1997, NRC briefing by the OCRWM Acting Director. The agenda setting teleconference for this meeting will be April 9, 1997. On March 20, 1997, NRC staff also presented their proposal for review of the proposed revision to 10 CFR 960 at the ACNW meeting. The review proposed by NRC staff included the following four options: 1) take no action; 2) defer concurrence; 3) provide conditional concurrence; and 4) issue a "no objection."

A PISA Content Guide briefing was given to DOE March 27, 1997. The document will be provided to DOE reviewers April 3, 1997.

The Viability Assessment Risk Mitigation Change Request was received from the M&O and is in review. Comment resolution meetings were held and comments were provided to the M&O the week of March 24, 1997. The CR was generally in accordance with DOE guidance with two major contributors to the cost delta. Those were related to development of the design basis model, which is more complex than originally theorized, and design control process improvements, which are more extensive than DOE believes necessary. These issues will be addressed in the resolution process.

DOE provided preliminary guidance to the M&O to scope the fiscal year (FY) 1998 deliverable, Disposal Criticality Analysis Methodology Topical Report, to include commercial PWR and BWR Spent Nuclear Fuel as well as the Savannah River Aluminum-Clad fuels currently under analysis by the Project. Pending negotiation and acceptance from DOE/EM, the remainder of the DOE-owned Spent Nuclear Fuel inventory will be addressed by schedule addendums to the Topical Report.

II. KEY ACCOMPLISHMENTS

The TBM was at Station 77+36.92 meters/25,384.7 feet as of 08:00 a.m. on March 26, 1997. Ground support class has varied between 3a and 4. Fourteen steel sets have been used. Total progress made by the TBM is 18.34 meters/60.1 feet, reflecting the poor rock conditions. Required hand mucking, void shotcreting, and cribbing instillation have slowed excavation progress. Distance remaining to hole out is 146.2 meters/479.7 feet.

Installation of the monorail (to transport tunnel forms) continued in Alcove #5, Heater Test Facility. The AM-50 Alpine Miner is in place and preparations are being made to commence excavation in Alcove #6, Northern Ghost Dance Fault Alcove. The fault probe hole was reamed to 31.40 meters/ 103 feet and casing was installed in the hole in Alcove #7, Southern Ghost Dance Fault Alcove. Hauling and spreading of fine material over coarse rock subgrade on the pad was completed at the ESF South Portal. Installation of ground cable and ground rods for the lightning pole and select backfill on the access road continued at the South Portal.

The Yucca Mountain Site Characterization Project Manager approved six change requests on March 14, 1997. These requests were initiated and achieved for the following purposes:

CR 97/013: Delete Level 3, Deliverable 3, GUF604M from the FY 1996 Cost and Schedule Baseline.

CR 97/014: Add Level 3 Deliverables to FY 1997 Cost and Schedule Baseline for WBS 1.2.3 to ensure that summary accounts remain open and accountable until the final acceptance of the deliverables.

CR 97/015: Additional Regulatory Consulting Team Support for additional support for review of DOE and M&O program and project documents. This will also support the development and interpretation of laws and regulations.

CR 97/016: Revised Budget Plan for NTS G&A and Common Site Support will accurately apply revised NTS rates and burdens not available at the start of the fiscal year.

CR 97/017: Web-Based Information System Prototype will ensure that links have been established between documentation locations on the web.

CR 97/018: YMP Tenant Relocation was required to move USGS and UNR to different locations.

The YMP Socioeconomic Monitoring Program Quarterly Employment Data Report for October through December 1996 was delivered to representatives of the State of Nevada and Affected Units of Local Government. This report describes the characteristics of workers associated with the Project, including residential distribution, inmigration, occupation, etc. This action is in compliance with Section 113 of the Nuclear Waste Policy Act, as amended.

Six tours of Yucca Mountain were coordinated and conducted for 84 guests. Of special interest were tours for the Minority clerk of the Senate Energy and Water Development Appropriations Subcommittee; a staff member for Nevada Senator Harry Reid; two Nuclear Energy Institute tours; and the National Academy of Sciences.

A press release on the extension of the comment period to April 17, 1997, for the proposal to amend siting guidelines 10 CFR 960 was released March 20, 1997. The total comment period for the proposal is now 121 days.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
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Yucca Mountain Site Characterization Office
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Nancy please make copies for K, II CRD File

TKS

VBM

April 4, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Integrated Planning Committee for the Enhanced Characterization of Repository Block is in the process of developing the criteria to determine the attributes for obtaining additional data needed to support the Viability Assessment.

Approximately 60 contractor employees were recognized with "Doer of Deeds" certificates for their efforts in relocating 550 Project personnel from the Bank of America building to Summerlin in a 10-week period. The move was completed without interruption to phone and data connectivity.

II. KEY ACCOMPLISHMENTS

The TBM was at Station 77+46.80 meters/25,417.2 feet as of 8:00 a.m. on April 2, 1997. Ground support class remained at Category 4 and seven steel sets were used. Total progress (for period March 26 to April 2) made by the TBM was 9.88 meters/32.4 feet, reflecting the currently poor ground conditions. Need for hand mucking, void filling with shotecrete, and cribbing installation have slowed the rate of progress. No weekend excavation was performed and 1.5 hours of scheduled maintenance was completed on Monday, March 31, 1997. Distance remaining to hole out (at the time of this report) is 130.2 meters/427.2 feet. The scheduled hole-out date at the South Portal has not yet been determined.

All excavation was completed in Alcove #5, the Thermal Test Facility. Work continued on installation of the heated drift tunnel forms and hole drilling for electrical cable trays in the access drift. Total excavation progress made by the Alpine Miner in Alcove #6,

Northern Ghost Dance Fault Alcove, was 15.8 meters/51.8 feet. Several shifts were devoted to repairs on the Alpine Miner, including hydraulic problems, the right-hand rear track gear, a snapped cutter blade, and the wet scrubber. Drilling of the fault probe hole and installation of the casing continued during day shift in Alcove #7, Southern Ghost Dance Fault Alcove.

Installation of select backfill on the access road continued at the ESF South Portal. Installation of three lightning poles was completed.

Two tours of Yucca Mountain were coordinated and conducted for 18 guests. These tours were sponsored by the Nuclear Energy Institute and were conducted for national union representatives and a minority coalition group.

An update on Project status and activities was given to the Nevada Test Site Community Advisory Board and other meeting attendees, April 2, 1997, in Las Vegas, Nevada. Update presentations were provided to the Churchill and Mineral Counties, and to Nevada Boards of Commissioners, April 3, 1997.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

copie to chad file

April 11, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO Wesley E. Barnes

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

An Appendix 7 meeting with the Nuclear Regulatory Commission is planned for May 7-8, 1997, in Lynchburg, Virginia. The meeting will be a follow-up on discussion of criticality model validation and defense in-depth. The meeting will include a tour of the Lynchburg fuel manufacturing facility.

II. KEY ACCOMPLISHMENTS

The TBM was at Station 78+18.92 meters/25,653.8 feet as of 08:00 a.m. on April 9, 1997. Ground support category was 3a and 25 steel sets were used. Total progress made by the TBM during this period was 57.6 meters/188.71 feet. Hand mucking, void shotcreting, and cribbing installation needs temporarily delayed progress. Progress has subsequently improved and the distance remaining to hole out is 58.1 meters/190.6 feet. The scheduled hole-out date at the ESF South Portal has not yet been determined.

Excavation of test Alcove #5, Thermal Test Facility, was completed during this period. The first pour of the full round tunnel section was made in the heated drift and the monorail was installed for the next set of forms. No excavation was conducted in Alcove #6, Northern Ghost Dance Fault Alcove. Several shifts were devoted to installing track pads on the AM-75 (excavation equipment) and the vent fan was removed for repairs. Characterization of Alcove #7, Southern Ghost Dance Fault Alcove, began. The Casagrande drill was moved from the Alcove face back to the portal in preparation for removal from the tunnel.

Installation of select backfill on the access road continued at the ESF South Portal. Placement of select backfill on the road between the South Portal access road and H road began.

Two tours of Yucca Mountain for 13 guests were coordinated and conducted during this period. Tour attendees included the Director of the U.S. Air Force/DOE Liaison Office, as well as 11 guests from the University of Colorado.

Yucca Mountain Project Manager, Wesley E. Barnes, provided a Project overview and update to Hubert T. Bell, Nuclear Regulatory Commission Inspector General on April 9, 1997, in Las Vegas, Nevada.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

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APRIL 18, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: (for) Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Office of the Assistant Manager for Environment, Safety, and Health (AMESH) successfully negotiated modifications to the Air Quality Operating Permit with the Nevada Division of Environmental Protection improving air pollutant emission limits and hourly operating specifications.

The agenda for the April 30, 1997, DOE/NRC Management Meeting has been finalized and will be distributed to interested parties by the NRC. Topics for discussion include DOE reaction to the NRC's annual issue resolution report, the status of the Project Integrated Safety Assessment, an update on the OCRWM briefing to the Commission (currently scheduled for May 15, 1997), enhanced site characterization planning, and DOE's reaction to NRC's Annual Report.

Progress Report 15 (PR 15) was approved for issuance by the Secretary's office on Monday, April 14, 1997. Camera-ready copy will be forwarded to DOE/HQ for printing by the end of week, April 18, 1997. PR 15 should be printed and distributed by May 5, 1997. Progress Report 16 (PR 16), Preliminary Draft, has been completed and distributed to the M&O for review. It is on schedule to be completed and provided to DOE/HQ for concurrence on July 21, 1997.

Assistant Manager for Administration and Asset Management (AMAAM) was appointed as the DOE lead for the Integrated Planning Committee for the Enhanced characterization of the Repository Block. Planning is progressing on schedule.

II. KEY ACCOMPLISHMENTS

The Office of Institutional Affairs' staff coordinated and conducted three tours of Yucca Mountain. Guests included a writer from "Spectrum Magazine"; former Nuclear Regulatory Commission member Robert Bernero; and two guests from KTNV-TV in Las Vegas, Nevada.

The Director of the Office of Institutional Affairs participated in the locally produced show, "Public Report," on the regional PBS television network, April 11, 1997. Also participating in this 30-minute program was a representative from "Citizen's Alert," a local environmental organization. The show will be televised locally on April 20, 1997.

The Office of Institutional Affairs' staff attended the Clark County Nuclear Waste Division Steering Committee meeting on April 15, 1997, in Las Vegas, Nevada. Items that were discussed included: nuclear waste repository program update; proposed DOE Valley Siding intermodal transfer demonstration; the future of Clark County's Yucca Mountain program; and a Remote Sensing Laboratory tour.

Current TBM stationing is at 78+73.03 meters or 25,844.4 feet. Ground support class remained at 3A, and 45 steel sets have been used. Total progress made by the TBM for the week was 54.1 meters or 177.5 feet. A ventilation bulkhead and fan were installed. The distance remaining to hole out is 3.9 meters or 12.8 feet. The scheduled hole-out date has not been determined.

In Alcove #5, the Thermal Test Facility, all excavation was completed by April 4, 1997. Test holes #181, 185, 76, 87, and 74 were completed. Difficulties were encountered with the main pump and backup with pumping fibre crete.

In Alcove #6, the North Ghost Dance Fault, total excavation progress made by the Alpine Miner was 32.5 meters or 24.9 feet. It took several days to return the AM-75 to the Alcove, including three derailments. The Alpine was also down for a period of time to replace bearings in the conveyer. In Alcove #7, the South Ghost Dance Fault, a transformer was installed.

As of April 9, 1997, the following temperatures were measured from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. The measurements continue to show an increase in temperature: at 0.33 meters = 157.3°C, at 0.67 meters = 122.3°C, and at 1.48 meters = 77.1°C.

No update was available for the two temperature measurements in the Large Block Test nearest the plane of the heaters. As of April 3, 1997, the temperatures were 96.1°C and 86.6°C.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

May 1, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

On April 25, 1997, excavation of the Exploratory Studies Facility tunnel at the Yucca Mountain site was completed. The Tunnel Boring Machine used to excavate the tunnel "daylighted" at the Exploratory Studies Facility South Portal at 11:40 a.m. PDT.

The CR regarding detailed planning for the Viability Assessment Risk Mitigation is under review. The CR includes planned work required to implement 36 Yucca Mountain Site Characterization Office identified tasks needed to mitigate risks associated with preparation of the project Viability Assessment. The Viability Assessment is scheduled for completion by the end of fiscal year 1998.

II. KEY ACCOMPLISHMENTS

In Alcove #5, Thermal Test Facility, all excavation was completed in the week ending April 2, 1997. Completed test holes #64, 67, 68, 88, 89, 132, 135, 138, and started holes #131 and 134.

In Alcove #6, Northern Ghost Dance Fault Alcove, advanced 6.3 meters/20.7 feet to complete the Access Drift and turned the corner into the Drift Alcove. Advanced 14.1 meters/46.3 feet in the Drift Alcove. Trimmed ribs in curve and installed vent line around the curve.

In Alcove #7, Southern Ghost Dance Fault Alcove, advanced 10.7 meters/35.1 feet. Trimmed inverts and repaired the hydraulic stabilizer on the Alpine Miner.

The *Annual Report on Compliance With the Programmatic Agreement on Historical Preservation* was transmitted to the Advisory Council on Historic Preservation, Bureau of Land Management, and Nevada Historic Preservation Offices. This progress report implements stipulations of the Programmatic Agreement for treatment of historical properties subject to effect by Project activities.

The *Quarterly Underground Injection Control (UIC) Permit Report* was submitted to the Nevada Division of Environmental Protection, in accordance with Yucca Mountain Site Characterization Project UIC Permit requirements for Safe Drinking Water Act compliance.

Three tours of Yucca Mountain were coordinated and conducted for 68 guests. These included a tour for 25 guests from Leadership Las Vegas, 26 guests from the Naval Reserve, and a tour for 17 members and guests from the Michigan State Legislature.

Yucca Mountain Site Characterization Project staff coordinated and assisted with the JASON VIII project at the Community College of Southern Nevada, April 28-May 9, 1997. The JASON project is made possible in Las Vegas through a unique partnership among governmental agencies, private industry, and the Clark County, Nevada School District. The JASON project uses state-of-the-art technology to allow students around the world to experience scientific discovery as it happens. For this year's project, students are transported live via interactive technologies to two of the Earth's geologically unique locations: Iceland and Yellowstone Park. Scientific activities at these sites focused on geology, biology, environmental science, and social science.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

May 8, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

No items to report.

II. KEY ACCOMPLISHMENTS

In Alcove #5, Thermal Test Facility, completed Heated Drift (HD) Test Holes #89, 90, 91, 92, 123, 124, 125, 126, 127, 133, 135, and 146. Completed Access Observation Drift (AOD) Test Hole #62. Completed concrete repair preparations.

In Alcove #6, Northern Ghost Dance Fault Alcove, no excavation advance in the Access Drift. The Drill Alcove was advanced to Station 22.2 meters/72.8 feet, for an advance of 15.7 meters/51.5 feet. Installed a booster fan in the Drill Alcove.

In Alcove #7, Southern Ghost Dance Fault Alcove, the Access Drift was advanced to Station 1+50.9 meters/495.1 feet, for an advance of 3.6 meters/11.9 feet. Test Hole #1 was completed and the sample niche was cut. In Niche #1, Test Holes #1 and 2 were completed. No work reported in Niche #2.

Four tours of Yucca Mountain were coordinated and conducted for eight guests. These included tours for guests from the Toronto Star Newspaper, Mackay School of Mines, Columbia University, and the Institute of Nuclear Energy Research.

Yucca Mountain Site Characterization Project update presentations were given to the Eureka and White Pine Counties, Nevada Boards of Commissioners. Staff also met with the Eureka and White Pine County School Districts to discuss possible participation in the DOE's Math and Science Gift Program.

The status of the planning activities for the Enhanced Characterization of the Repository Block was briefed at the Director's Program Review. Activities are on schedule and will be completed in the June 1997 time frame for the initial planning and change request submittal.

YMSCO and OCRWM staff toured the Calvert Cliffs Nuclear Power Plant to review the dry storage facility and records management applications at Calvert Cliffs. Discussions were focused on the regulatory requirements, records processes, and local stakeholder involvement.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

May 15, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

Reviewed and recommended conditional approval of the first of two proposed Change Requests (CR) for the Enhanced Characterization of the Repository Block (ECRB). The first CR is to provide authorization for early start activities for the period of May through August 1997. It is anticipated that the second CR, which will address the remainder of the ECBR, will be received on approximately June 3, 1997.

A detailed Electrical Safety Review of ESF surface and underground facilities by an outside independent expert is scheduled to begin on June 3, 1997. The Construction Management Office has identified a detailed list of electrical items that will be corrected over the next 8 weeks.

The Las Vegas phase of the Business Management Oversight Program of the M&O procurement system was conducted this week. DOE Procurement Operations RW contracts staff and local YMSCO procurement staff are reviewing the M&O procurement policies, procedures, and practices. The Business Management Review of Property will commence the following week.

II. KEY ACCOMPLISHMENTS

In Alcove #5, Thermal Test Facility, completed Heated Drift drill holes #93, 94, 95, 121, 122, 135, 139, 142, 143, 145. Completed Access Observation Drift test hole #63. Started Heated Drift test holes #107, 108, and 144, and continued Heated Drift test holes #94, 120, 137, 140, and Access Observation Drift test hole #68.

In Alcove #6, Northern Ghost Dance Fault Alcove, advanced 2.3 meters/7.55 feet in Drill Alcove. Finished installing ground support and mucking. Moved Alpine Miner out and brought in the LY-38 Core Drill. Began drilling the first test hole (ESF-NDR-MF-1).

In Alcove #7, Southern Ghost Dance Fault Alcove, continued drilling holes for wall samples. Continued with ongoing testing. Completed drilling of three test holes in Niche #1. Continued ongoing tests and the USGS began logging boreholes at the Niche. No work was done in Niche #2.

Three tours of Yucca Mountain were coordinated and conducted for 31 guests. These included tours for guests from the Japanese Power Reactor and Nuclear Fuel Development Corporation (PNC), Spanish Senate, and Minister Vladmir Shkolnik with staff from Kazakhstan. Guests from PNC were also provided project overview presentations the day prior to the tour.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

MAY 22, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Las Vegas, Nevada, phase of the Business Management Oversight Program review of the Civilian Radioactive Waste Management System Management and Operating Contractor Procurement system is complete and the Business Management Oversight Program review of Property is underway.

Planning and budgeting activities for fiscal years 1998 and 1999 are underway. Significant effort is being made in the planning and budgeting effort to assure that planned work is within the funding and requirements of the program.

II. KEY ACCOMPLISHMENTS

In Alcove #5, Thermal Test Facility, completed Heated Drift Test Holes #94, 104, 105, 106, 107, 108, 109, 110, 138, 140A, 142, 143, 144, 159, 160, 161, 164, and 165. Grouted Heated Drift Test Hole #140 and initiated drilling on Heated Drift Test Holes #148 and 163. Continued drilling on Access Observation Drift Test Hole #71.

In Alcove #6, Northern Ghost Dance Fault Alcove, completed drilling on ESF-NDR-MF #1 on May 15, 1997. Initiated drilling on ESF-NDR-MF #2.

Work continued on the Change House at the Exploratory Studies Facility North Portal Pad. Work included the installation of exterior lighting, painting of the visitor locker room, hydro testing of the fire sprinkler system, and installation of bathroom fixtures.

Eight tours of Yucca Mountain were coordinated and conducted for 137 guests. Of special interest were tours for guests from Swedish Nuclear Fuel, the American Nuclear Society, U.S. Air Force, and Environmental Protection Agency. A public open-house tour of Yucca Mountain was conducted May 17, 1997, for 177 guests.

A Memorandum of Understanding (MOU) was sent to County School Districts in Nevada. The MOU permits the Department of Energy to implement a Gift program authorizing individual gift agreements to Nevada School Districts as surplus equipment becomes available. The purpose of the MOU is to implement a cooperative effort between the DOE and Nevada School Districts directed at reaching national educational goals related to mathematics, science, engineering, and technical education.

III. ISSUES

No items to report.

IV. COST SUMMARY

No items to report.

Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

QA: L

APR 1 6 1997

OVERNIGHT MAIL

Sandra L. Wastler
High Level Waste & Uranium Recovery
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North
Rockville, MD 20852

SUBMITTAL OF PARTICIPANTS' MONTHLY SUMMARY REPORT

As you have requested, the U.S. Nuclear Regulatory Commission is on distribution to receive a copy of the Yucca Mountain Site Characterization Project participants' monthly status reports on a regular basis. Enclosed is the Civilian Radioactive Waste Management System Management & Operating Contractor's Monthly Summary Report for November and December, 1996, and January, 1997.

If you have any questions, please call April V. Gil at (702) 794-5578.

April V. Gil

for Stephan J. Brocoum
Assistant Manager for Licensing

AML:AVG-1360

Enclosures:
1. CRWMS M&O Monthly Summary Report for November, 1996
2. CRWMS M&O Monthly Summary Report for December, 1996
3. CRWMS M&O Monthly Summary Report for January, 1997

YMP-5

cc w/encls:
A. B. Brownstein, DOE/HQ (RW-52) FORS
C. J. Glenn, NRC, Las Vegas, NV
W. D. Barnard, NWTRB, Arlington, VA
R. I. Holden, National Congress of American Indians, Washington, DC
Tom Burton, Nevada Indian Environmental Coalition, Reno, NV
R. R. Loux State of Nevada, Carson City, NV
John Meder, State of Nevada, Carson City, NV
Jim Regan, Churchill County, Fallon, NV
D. A. Bechtel, Clark County, Las Vegas, NV
Susan Dudley, Esmeralda County, Goldfield, NV
Sandy Green, Eureka County, Eureka, NV
B. R. Mettam, Inyo County, Independence, CA
Tammy Manzini, Lander County, Austin, NV
Jason Pitts, Lincoln County, Pioche, NV
V. E. Poe, Mineral County, Hawthorne, NV
L. W. Bradshaw, Nye County, Tonopah, NV
Wayne Cameron, White Pine County, Ely, NV
P. A. Niedzielski-Eichner, Nye County, Chantilly, VA
C. L. Sisco, M&O, Washington, DC

cc w/o encls:
R. A. Milner DOE/HQ (RW-40) FORS
C. E. Einberg, DOE/HQ (RW-52) FORS
Samuel Rousso, DOE/HQ (RW-50) FORS
M. A. Lugo, M&O, Las Vegas, NV
AML Library
Records Processing Center = "4"
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Enclosure 1

WBS: 9.3.7
A: N/A

Civilian Radioactive Waste Management System
Management & Operating Contractor

Monthly Summary Report

November 1996

Prepared for:

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
1000 Independence Avenue SW.
Washington, DC 20585

Prepared by:

TRW Environmental Safety Systems Inc.
2650 Park Tower Drive
Suite 800
Vienna, Virginia 22180

Under Contract Number
DE-AC01-91RW00134

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3. WASTE MANAGEMENT AND INTEGRATION REPORT 5

4. PROGRAM QUALITY ASSURANCE REPORT 7

1. PROGRAM-LEVEL REPORT

November was a month of steady progress. Among the major highlights: the TBM moved forward rapidly until encountering Category 3A rock during the second half of the month. The highly fractured rock made the date of the TBM "hole-out" uncertain, most likely slipping it from late January until well into February. Both dates are still ahead of the baselined hole-out schedule.

In Washington and Vienna, the M&O redirected staff activities to adapt to its new role in support of OCRWM's WM&I activities. A streamlined CRWMS requirements document was adopted to reduce the previous 1200-page document to a 50 page document. An audit performed by OCRWM's OQA resulted in an "effective" rating for QA activities related to design activities for a non-site-specific interim storage facility which are being undertaken for TSAR development.

2. YUCCA MOUNTAIN PROJECT REPORT

November was another progressive month toward achieving project annual objectives for the M&O Contractor. The TBM made good excavation advancement encountering Category 1 ground for the first half of the month and Category 3A ground for the second half of the month. The TBM is expected to reach "hole-out" in late February 1997 but geologic uncertainties make that tentative. The Thermal Test Facility Connecting Drift Extension and Plate Loading Niche excavations were completed as anticipated. In addition, excavation of the Northern Ghost Dance Fault Access Drift extension was completed to accommodate bore hole testing of the fault. Excavation of the Thermal Test Facility continued as planned with completion expected in February 1997 following excavation of the Heater Drift. Finally, excavation of the Southern Ghost Dance Fault Alcove, initiated in October, is on schedule for completion by July 1997.

Important information continues to be collected in the site investigations area. Approximately 5.5 liters of water were collected from a borehole associated with the Single Heater Test. Preliminary tests indicate that the water contains only a trace of lithium bromide drilling-fluid tracer and thus it is believed to have been produced by the induced heating and subsequent condensation in the rock matrix. Additional chemical and isotopic tests are underway to provide input to the drift-scale thermohydrologic models calibration process. Air injection tests were carried out in 14 boreholes originating from the Access/Observation Drift in the Drift Scale Test Area. Slow buildup and recovery of the interference pressure data in these boreholes suggest large rock porosity.

The materials necessary for radionuclide transport experiments at Lawrence Livermore National Laboratory were identified. The experiments will use ferric oxides, geothite and hematite as proxies for the corrosion envelope expected to form resulting from corrosion allowance overpack alteration prior to the breaching of the waste container.

Regulatory and engineering progress were also favorable. The Interactive Review draft of Progress Report No. 15 was completed and submitted to the DOE for final review. The first expert elicitation workshop supporting the development of the Unsaturated Zone Flow and Transport Model for the Total System Performance Assessment was completed. Long-term criticality issues for immobilized plutonium waste forms were addressed in a study submitted for DOE review. Studies of waste package materials and corrosion testing continue to progress on schedule.

HIGHLIGHTS

- Test drilling encountered the Ghost Dance Fault on November 6. Temperature measurements, water potentials, and responses to surface barametric pressure changes are being used to indicate how the fault functions as a flow and transport pathway.

- The Tunnel Boring Machine progressed 268.5 meters (880.9 feet) to Construction Station 70+76.2 meters (23,217 feet or 4.4 miles). Based on current progress and ground conditions, completion of the main tunnel excavation is projected for late February 1997.

- Completed excavation of the upper portion of the Thermal Testing Facility Connecting Drift in October. Advanced the lower portion of the Connecting Drift excavation to Station 0+34.5

meters (113.2 feet). Total progress on the lower portion of the Connecting Drift for November was 6.9 meters (23 feet) using drill-and-blast techniques.

- Completed planned excavation of the Thermal Testing Facility Connecting Drift Extension and Plate Loading Niche using drill-and-blast techniques; total excavated length for November was 10.7 meters (35 feet) and 6.9 meters (23 feet) respectively.

- Completed extension of the Northern Ghost Dance Access Drift an additional 29.2 meters (95.8 feet) to Station 1+34.4 meters (441.0 feet) to accommodate planned testing activity.

- Submitted Degraded Mode Criticality Analysis of Immobilized Plutonium Waste Forms in a Geologic Repository for review. This analysis addresses long-term criticality issues and assists waste form producers in product specification development for safe final disposition of plutonium in a geologic repository.

- Completed the first Expert Elicitation Workshop quantifying uncertainties in the Unsaturated Zone Flow and Transport Model in support of the Total System Performance Assessment for the Viability Assessment.

- Hosted an update for Official Tribal Contact Representatives from Native American Tribes and organizations involved with the YMP. Presented a YMP update and discussed the Native American Graves Protection and Repatriation Act and ethnobotany studies.

3. WASTE MANAGEMENT AND INTEGRATION (WM&I) REPORT

November was devoted to adapting to the new role defined for OCRWM headquarters organizations under the recent reorganization and the required support to the program by the M&O organizations in Vienna, VA and Washington D.C. including addressing some of the needs remaining as the staffing level of the OCRWM support services contractor is being reduced

A streamlined version of the CRWMS requirements document was adopted by the Program Change Control Board which describes in 50 pages what previously required 1200 pages. It also formally incorporates the requirement that 1/3 of the allocation for defense wastes, in the statutorily limited capacity of the initial repository, be in the form of DOE-owned SNF. The incorporation of this requirement into the MGDS baseline is now the responsibility of the Yucca Mountain Project.

Good progress continues on design activities for a non-site-specific interim storage facility for the acceptance of canistered fuel. A technical exchange meeting took place with the NRC staff, and an audit performed by OCRWM's OQA provided a rating of "effective" for A activities related to this design.

WASTE ACCEPTANCE, STORAGE AND TRANSPORTATION (WAST) HIGHLIGHTS

- The second ISF Phase I TSAR technical interchange with the NRC was conducted on November 20, 1996. This meeting was to inform the NRC of the ISF TSAR project status; describe the design approach; and discuss design basis events, design criteria, and nuclear analysis.

- Provided resolution of all DOE comments on the ISF DRD DOE Acceptance Draft and obtained baseline approval.

- Delivered a draft Statement of Work for the Request for Proposal for Waste Acceptance and Transportation Services to RW-44 for assembly into a package for review by RW-1 and RW-2.

- Briefed Jason Associates, the contractor for preparation of the Environmental Impact Statement for the MGDS, on the Regional Servicing Agent concept and the National Transportation Program.

- Delivered the draft Spent Nuclear Fuel Verification Plan for DOE baselining. This version of the plan does not include DOE-owned SNF.

PROGRAM MANAGEMENT AND ADMINISTRATION HIGHLIGHTS

- Delivered Systems Requirements Documents (Rev. 2 CRD, MGDS SRD, WA SRD, and Transportation SRD) that implement BCP-00-96-0005 addressing DOE SNF for PBCCB verification.

- Developed an outline of a paper that will describe the advantages and disadvantages of on-site disposal of repository site-generated wastes.

- Continued developing justification for the data items necessary to accept DOE-owned SNF; began incorporating comments on an internal draft of a sample of justifications to determine the best format for the final deliverable.

- Draft sections of the repository input to the INEL Task Force report were submitted to RW for review. The criticality and performance assessment appendices are in M&O review.

- The Program Baseline Change Control Procedure, Rev. 2 was approved by RW-2 on November 25, 1996.

- Delivered the final copy of the fall '96 issue of the *OCRWM Enterprise* for Front Office review and approval.

REPOSITORY ANALYSIS FOR PLUTONIUM DISPOSITION HIGHLIGHTS

- Submitted the Degraded Mode Criticality of Immobilized Plutonium Waste Forms deliverable to YMSCO on November 15. The Office of Fissile Materials Disposition favorably received the findings when presented at their November Monthly Management Meeting.

4. PROGRAM QUALITY ASSURANCE REPORT

HIGHLIGHTS

- OQA submitted the draft A Consolidation Plan for review November 7. The plan was distributed to affected organizations for comments.

- An M&O A Lab Manager's Meeting was held November 21 to discuss comments on the draft A Consolidation Plan, development of the Engineering Assurance Organization, and other M&O A issues.

Enclosure 2

WBS: 9.3.7
A: N/A

Civilian Radioactive Waste Management System
Management & Operating Contractor

Monthly Summary Report

December 1996

Prepared for:

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
1000 Independence Avenue SW.
Washington, DC 20585

Prepared by:

TRW Environmental Safety Systems Inc.
2650 Park Tower Drive
Suite 800
Vienna, Virginia 22180

Under Contract Number
DE-AC01-91RW00134

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1. PROGRAM-LEVEL REPORT

December was another month of steady progress across the program with the exception of the TBM.

The TBM became the victim of natural phenomena as it entered an area of loosely constituted rock. Progress slowed as constructors struggled to provide the TBM with surfaces it could "grip" in order to thrust forward through the mountain. Operations were largely reduced to hand-mucking material that continually fell into the tunnel. Alternative ways to accelerate progress were being developed. Elsewhere in the ESF, work continued on schedule. Alcove and test facility tunneling moved forward and preparations continued on the Large Block Test for heat-up. All Yucca Mountain Project deliverables scheduled for the month were completed on time.

The East Coast-based M&O supported development of the RFP for the Regional Servicing Agents under the initiative for privatization of the spent fuel acceptance and transportation functions. DOE issued the draft RFP for industry comment during the month. Extensive work resulted in a successful transition to the multi-year baseline. Good progress continued on both the Topical Safety Analysis Report and responses to NRC questions concerning the Actinide Burnup Credit Topical Report.

2. YUCCA MOUNTAIN PROJECT REPORT

December was another progressive month with all deliverables scheduled for the period submitted on time. Expert Elicitation and Performance Abstraction workshops were held in support of unsaturated zone processes. Good progress was made in readying the Large Block Test for heat-up, and important testing at the C-Well complex was completed.

The rate of advance of the TBM was slower than for previous months due to an unexpectedly long section of poorly consolidated rock. Operations have been reduced to hand-mucking material that is falling into the tunnel. Common advance rates were 1 to 2-meters a day. According to geologic projections, this situation could continue for some time. Alternative measures to accelerate progress if the poor rock quality persists are under investigation. Alcove construction is proceeding as planned.

HIGHLIGHTS

- Advanced tunnel excavation to Construction Station 71+30.8 meters (23,369 feet or 4.4 miles). Progress using the TBM was 54.6 meters (179 feet).

- Advanced the Upper portion of the Heated Drift to Station 0+39.4 meters (129 feet). Progress was 26.4 meters (86.6 feet).

- Completed excavation of the Turn Around Bay and continued excavation of the Southern Ghost Dance Fault. Total progress for the month was 20.3 meters (66.6 feet).

- Completed tracer testing at the C-Hole Complex. Testing verified previous laboratory models, and provided confidence that YMP can construct a predictive transport model. Retardation of lithium substantiated earlier laboratory findings of retardation in YMP tuffaceous rock, and physical retardation of polystrene microspheres compared closely to earlier laboratory determinations.

- Completed installing the first and second layers of the Large-Block Test (LBT) which included installing rubber membranes, ultratemperature insulations, and electric resistance tomography probes (ERT). Three layers need to be completed before LBT is initiated; the third layer of the LBT was grooved for ERT electrodes.

- Completed phase 1 of the Geographic Nodal Information Study and Evaluation System (GENISES) database restructuring. Data incorporation time was reduced by 60%, and an on-line ready data retrieval capability was provided.

- Completed the 1st Performance Abstraction Workshop on the Unsaturated Zone process Model. The Performance Assessment and Scientific Programs staffs worked together to define the process model in Total System Performance Assessment (TSPA).

- Completed the second Expert Elicitation Workshop on Alternative Models and Interpretations to present alternative models affecting the Unsaturated Zone flow and transport model. The

workshops involve internal and external experts and are being used to strengthen the basis for treating unsaturated zone flow in the TSPA.

- Completed a proposal for a criticality analysis of Savannah River aluminum clad and aluminum based fuel. The analysis would determine packaging concepts that would enhance the probability of fuel being acceptable for disposal without re-canisterization. The proposal will be presented as a model for the analysis needed for all DOE-owned spent fuel.

- Delivered the Site Environmental Report to DOE Headquarters, State of Nevada, American Indian tribes, and public stakeholders. The annual report statuses YMP environmental programs, confirms environmental compliance, and highlights significant program efforts.

- Provided a tour of Yucca Mountain to the Nevada Legislatures Committee on High-Level Radioactive Waste. An update was also presented during their quarterly meeting in Pahrump, Nevada.

3. WASTE MANAGEMENT AND INTEGRATION (WM&I) REPORT

Activities in December continued to emphasize providing support to OCRWM Headquarters as Federal staff become more directly involved in the technical elements of the Program.

Two significant events in December stand out. DOE released a draft RFP for Regional Servicing Agents under the initiative for privatization of the spent fuel acceptance and transportation functions. Also, a Director's Program Review was conducted in which the status of Program activities was reviewed against a multi-year baseline for the first time.

The M&O provided critical support to the development of work scope for the draft RFP. M&O personnel also ensured copies of the RFP were reproduced on compact discs and as complete text on the OCRWM internet home-page between the Christmas and New Year holidays.

M&O personnel have been working closely with DOE counterparts over the last several months to affect the transition to the multi-year baseline. The prompt development and approval of FY 1997 work plans, earlier in the year than ever before, permitted conversion to the multi-year reporting mode. This achievement was noted by senior OCRWM management.

Good progress continues to be made in both the development of the Topical Safety Analysis Report (TSAR) for a canister-only ISF and in preparation of responses to NRC staff questions concerning the Actinide Burnup Credit Topical Report. A briefing was provided to YMSCO staff to communicate the design bases for the ISF being used in the TSAR and ensure a compatible approach with those under consideration for repository surface facilities. In the case of the burnup topical report, preliminary informal agreements have been made by commercial cask vendors to provide analyses specific to their cask designs in the report. We expect that DOE will receive formal confirmation of these commitments in the coming weeks. Including these analyses in the topical report provides evidence that the cask industry supports the topical report activity and recognizes its benefits. The inclusion will signal to the NRC the relevance of this analysis to the industry and, should the NRC approve it, the possible intent to apply the credit in future designs.

The most recent activity supporting DOE's consideration of SNF disposal in a repository was submission of a performance assessment for inclusion in an INEL report. Recognition of the continuing support that has been provided came in the form of a laudatory letter from EM to RW-40 praising the work of both DOE and M&O personnel.

WASTE ACCEPTANCE, STORAGE AND TRANSPORTATION (WAST) HIGHLIGHTS

- The timely development and approval of FY 1997 work plans permitted the conversion to the multi-year reporting mode. The Program activities status was reviewed against a multi-year baseline at the Director's Program Review. This was the first time this performance measurement could be made.

- Completed ISF site, transfer facility, and storage configuration item design criteria.

- Completed the ALARA evaluation of the ISF. Remote handling equipment will be required to limit occupational exposure.

- Completed a draft annotated outline for Section 180(c), Notice of Final Policy and Procedures.

- Developed highway and railroad maps illustrating interjurisdictional eligibility for Section 180(c) grants.

- Completed the Draft RFP for the Regional Servicing Agents procurement. Copies of the Draft RFP are available to the public via hard copy, CD-ROM, and the OCRWM Home Page.

- Assisted DOE in preparing and distributing a letter to Purchasers notifying them that the 1998 deadline for pickup of SNF would not be met; invited views from contract holders on how to accommodate the delay.

- Obtained preliminary/informal agreement from commercial vendors that they will perform a sample calculation using the Actinide-Only burnup credit methodology to produce a loading curve for their individual casks/canisters. The calculation will be included in an appendix to the revision of the Burnup Credit Topical Report to be submitted to the NRC.

PROGRAM MANAGEMENT AND ADMINISTRATION HIGHLIGHTS

- Posted the Notice of Proposed Rulemaking to amend 10 CFR 960, the Draft Regional Servicing Agency RFP, and the *OCRWM Enterprise* (December 1996) on the OCRWM Home Page.

- Completed and delivered the performance assessment appendix deliverable for the INEL SNF plan to DOE.

REPOSITORY ANALYSIS FOR PLUTONIUM DISPOSITION HIGHLIGHTS

- The *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* was released with the ROD decision scheduled for mid-January 1997.

4. PROGRAM QUALITY ASSURANCE REPORT

HIGHLIGHTS

- DOE Audit Results (MO-ARP-97-04) on the ISF TSAR work effort performed in Charlotte, NC and Vienna, VA resulted in an overall evaluation of "EFFECTIVE."

- Finalizing comments on draft 1 of the QA Consolidation Plan Phase A for submission to OQA. Continuing development of requirements for the Engineering Assurance Organization.

Enclosure 3

WBS: 9.3.7
A: N/A

Civilian Radioactive Waste Management System
Management & Operating Contractor

Monthly Summary Report

January 1997

Prepared for:

U.S. Department of Energy
Office of Civilian Radioactive Waste Management
1000 Independence Avenue SW.
Washington, DC 20585

Prepared by:

TRW Environmental Safety Systems Inc.
2650 Park Tower Drive
Suite 800
Vienna, Virginia 22180

105 pp.

Under Contract Number
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9704210139 7pp

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1. PROGRAM-LEVEL REPORT

January was a "mixed bag" for the program's most visible element, the ESF. The TBM continued to struggle through the worst rock conditions yet encountered. Progress was slow and the schedule continued to slip. The TBM advanced just over 70 feet. Conversely, test alcove construction proceeded well. The lower portion of the heated drift in the ESF was extended 99 feet and the upper portion was extended 69 feet. The Southern Ghost Dance Fault Alcove advanced almost 204 feet.

Other activities at Yucca Mountain moved forward. Among the most significant was our submittal of a letter to DOE requesting authorization to begin the Large Block Test. This will be a highly-visible and important part of the program's site characterization effort. Also, two highly successful Modeling Abstraction/Testing workshops, key steps leading to completion of the TSPA-VA, were held.

The M&O staff provided analyses and presentations of program-wide issues to support DOE/OCRWM during testimony and discussions with Congress. A revised program cost estimate for use during Congressional hearings was prepared.

The signing of a Record of Decision concerning a dual-track strategy including "irreversible disposal" in a repository by the Secretary of Energy or January 14, 1997 emphasized the continuing importance of technical work in support of both the Office of Materials Dispository (MD) and the Office of Environmental Restoration and Waste Management (EM). Additional funds for performance of a repository waste package analyses were provided to RW for EM this month.

2. YUCCA MOUNTAIN PROJECT REPORT

January was a month of continued success in developing testing alcoves and in continuing scientific testing in the ESF. ESF tunneling progress was extremely slow due to poor rock conditions. The project completed two highly successful Modeling Abstraction/Testing Workshops-key steps leading to the completion of TSPA-VA.

HIGHLIGHTS

- Advanced tunnel excavation to Construction Station 71+53.3 meters (23,459 feet or 4.4 miles). Progress using the TBM was 22.5 meters (73.8 feet).

- Advanced the upper portion of the Heated Drift to completion at Station 0+60.5 meters (198.5 feet) with total progress at 21.1 meters (69.2 feet). The lower portion of the Heated Drift was excavated to Station 0+42.0 meters (138 feet) with total progress at 30.2 meters (99.1 feet). Also completed excavation of an electrical niche on the right rib of the Connecting Drift.

- Excavated 62.1 meters (203.8 feet) of the Southern Ghost Dance Fault Alcove.

- Finalized the design of the galvanic coupled specimens for long-term testing and initiated procurement of the specimens. Also initiated the shorter term electrochemical galvanic effects tests.

- Submitted a letter (Level 3 deliverable) to DOE requesting authorization to start the Large Block Test. The test will provide small scale field measurements of thermal-hydrologic processes important to understanding expected potential repository behavior under thermal loading.

- Completed pneumatic monitoring and gas sampling; presently conducting air-permeability borehole testing in the North Ghost Dance Fault Alcove of the ESF. Results imply that the Ghost Dance fault may be a fast pathway in the tested area.

- Combined gas and liquid data in a coupled inverse model as part of calibrating the three-dimensional, unsaturated zone, site-scale flow model. This work represents a major step in the combined calibration of the UZ model to gas pressure, saturation, and water potential data and clarifies the relationship between the fracture and matrix flow.

- Conducted a Thermohydrology Modeling Abstraction/Testing Workshop to develop a strategy, plan, and schedule for incorporating major effects of thermohydrology into TSPA-VA analyses.

- Conducted a Waste Package Degradation Abstraction/Testing Workshop to develop a strategy, plan, and schedule for incorporating major effects of waste package degradation into TSPA-VA analyses.

- Completed software development of RDMS II, and production scanning is now being performed. An estimated cost avoidance of over $1,000,000 in providing records images at the desktop is expected.

3. WASTE MANAGEMENT AND INTEGRATION (WM&I) REPORT

The development of analyses and presentations of Program cross-cutting issues to support OCRWM management during a period of intense negotiations with Congressional committees continues to be emphasized. A revised program cost estimate was prepared for OCRWM management to use in Congressional hearings. It was briefed to RW-1 and RW-2 and a written report was completed by month's end.

Technical support to RW interactions with EM concerning potential disposal of DOE wastes and with MD concerning disposition plans for weapons-usable fissile materials continues to be a high priority. Additional funds for technical support work by the M&O were transferred from EM to RW during this month.

Work included interactive development with OCRWM OWAST managers of long range schedules and milestones to be incorporated into a baseline update for WAST. The baseline update will reflect the developing strategy for the market-driven approach to waste acceptance and transportation and preparation for interim storage activities should a site be authorized.

Work progressed well on both the TSAR for a Phase 1 ISF and preparation of responses to the NRC staff concerning the Actinide-Only Burnup Credit Topical Report. Five cask vendors have agreed to provide calculations specific to their designs to be included in an appendix to the revised topical report. Although some additional resources will be required to complete backup analyses for the TSAR submittal, schedules for completion of both reports will be met.

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION (WAST) HIGHLIGHTS

- Gave an update of the WAST multi-year baseline M&O briefing to RW-40 and staff. DOE's additional guidance was used to complete the baseline update and deliver it on January 31, well ahead of the March 31 scheduled date.

- The January focus for the ISF TSAR was completion of design activities; the focus for February will be on TSAR development. The Draft TSAR is on schedule for submittal for DOE review on March 19.

- Completed CI design criteria documentation and drafts of CI system descriptions.

- Completed drafts of engineering analysis, site boundary dose analysis, occupational ALARA dose analysis, and hazards analysis to define credible accidents, off-normal conditions, and accident consequence analysis.

- The M&O will support the RSA procurement.

- Participated in meetings with RW Front Office and senior management to discuss the annotated outline for the Final Policy and Procedures for implementing Section 180(c) of the NWPA. As a result, the next Federal Register Notice on 180(c) will be another proposed policy for public comment. The M&O will provide a draft Notice in May.

- Presented the background information issues associated with the current method for determining the fee due for disposal of DOE SNF/HLW.

- Made technical presentations on changes to the Actinide-Only Burnup Credit Topical Report and responses to the NRC's round one questions during a successful DOE/NRC Technical Exchange.

- Obtained preliminary/informal agreement from commercial vendors that they will perform a sample calculation using the Actinide-Only burnup credit methodology to produce a loading curve for their individual casks/canisters. The calculations will be included in an appendix to the revision of the Burnup Credit Topical Report to be submitted to the NRC. The vendors are: General Atomic, Holtec, NAC, Transnuclear, and Vectra.

PROGRAM MANAGEMENT AND ADMINISTRATION HIGHLIGHTS

- Completed a draft Rough-Order-of Magnitude program cost estimate and briefed to RW-1 and RW-2.

- Completed a top-level study of disposal options for repository site-generated wastes and delivered the final report to RW-51.

- Completed an initial evaluation of repository early receipt and storage schedule, costs, and key issues. A briefing was presented to RW-51.

- Completed and delivered the deliverable on the criticality analysis appendix for the INEL SNF plan to DOE.

- An additional $220K was transferred from EM to RW for TSPA and included in the M&O cost baseline.

- Submitted the paper work for an additional $515K, approved by EM, to RW. Work start is pending availability of data requested from Savannah River.

REPOSITORY ANALYSIS FOR PLUTONIUM DISPOSITION HIGHLIGHTS

- The Secretary of Energy signed the ROD on the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* on January 14. This finalizes a dual-track strategy to "irreversibly dispose" of excess Pu in a geologic repository.

- DOE MD met with the NRC commissioners to discuss the MD program and its future direction. NRC interaction with MD will increase due to new facilities coming under NRC jurisdiction, and the need for security is different for this material. These issues will be worked on in the coming months. Regular meetings with NRC are planned.

4. PROGRAM QUALITY ASSURANCE REPORT

HIGHLIGHTS

- OCRWM audited YMP M&O during the last week of the month. The overall conclusion was that the M&O is effectively implementing the QA program. The report is expected to note several areas where there was outstanding implementation and include one Corrective Action Report, one Deficiency Report, and several recommendations. Five items were Corrected During the Audit.

- Consolidation of OCRWM QA Functions Transition Phase A was approved allowing M&O QA Verification Functions to begin transitioning to OQA in February.

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

Pls / upis for Chad the file

January 31, 1997, WEEKLY HIGHLIGHTS REPORT

TO: Lake H. Barrett, DOE/HQ (RW-1)

FROM: Wesley E. Barnes, DOE/YMSCO

SUBJECT: WEEKLY REPORT

The following activities are provided as input from the Yucca Mountain Site Characterization Office for the Program Office Weekly Report.

I. MAJOR EVENTS

The Assistant Manager for Licensing reported that on January 28-29, 1997, YMP staff participated in the Nuclear Waste Technical Review Board meeting in Pahrump, Nevada. Topics included: program progress; technical issues associated with the need for an east-west crossing; national and local transportation issues; Nye County, Nevada, scientific issues; and making performance assessment "transparent" to scientific and lay communities.

On January 29, 1997, YMP staff participated in an agenda setting teleconference with the Nuclear Regulatory Commission in preparation for the Probabilistic *Volcanic Hazards Analysis (PVHA) Technical Exchange*. The PVHA meeting is scheduled for February 25-26, 1997.

The USGS continues convergent tracer testing in the C-Hole complex. Pyridone tracer has been injected into borehole C#1. 2,6 difluorobenzoic acid (DFBA) has been injected into borehole C#2. Breakthrough of DFBA occurred on 1/16/97 and the peak concentration occurred on 1/21/97. Currently, the concentration of DFBA is tailing off. Breakthrough of the pyridone tracer has not occurred as of 1/24/96, but is anticipated in the following week.

Work completed by the USBR included: full-periphery geologic mapping to station 70+64.98, and in Alcove #6 to station 0+55; detailed line surveys at the heading to station 70+64.98, and in cross-drift of Alcove #5 to 0+14.28; stereophotographic mapping at the heading to station 70+66.00; Q & RMR to station 70+25; and RQD to station 70+60. Preparation of the Main Drift Report from station 28+00 to 55+00 continues.

The engineering group has completed a presentation to the Office of Environmental Restoration and Waste Management (EM) concerning the preparation of an analysis on *Disposal Criticality for Aluminum Spent Fuel From Research Reactors*. The analysis will cover the criticality of intact Spent Nuclear Fuel degraded waste package configurations. EM has agreed to the analysis and will transfer $515,000 to RW to fund the work.

II. KEY ACCOMPLISHMENTS

The TBM is at station 71+47 meters/23,449 feet as of 0800 hours on 1/30/97. The ground classification is category 3A support [6-inch steel sets]. Blocking behind the grippers has been required, but better conditions are evidenced by the reduction from 8-inch steel sets to 6-inch steel sets. Overall progress for the week is about the same as the previous week.

Excavation of the Thermal Test Alcove continued during this period. The cross-drift Bottom Heading has been completed to station 00+35 meters/113 feet. The Connection Drift Extension has been completed to station 00+13 meters/43 feet using drill and shoot excavation, and the heated drift room is now completed on the top heading at 60.5 meters/198 feet using a roadheader. Excavation of the invert section of the heated drift room has now progressed to 00+42 meters/138 feet. The plate loading test excavation has been completed.

Excavation of the Northern Ghost Dance Fault Alcove has advanced to station 1+34 meters/442 feet, completing phase 1. The alcove is now in a testing phase. The Southern Ghost Dance Fault Alcove has been excavated to a station 00+92 meters/302 feet.

The Assistant Manager for Environmental, Safety, and Health (AMESH) submitted the *Underground Injection Control (UIC) Permit Annual Report* and the *UIC Permit Fourth Quarterly Report*, calendar year 1996, to the Nevada Division of Environmental Protection, in accordance with YMP UIC Permit requirements.

The YMP Socioeconomic *Monitoring Program Procurement Data Report* for period, April 1996 through September 1996, was delivered to representatives of the State of Nevada and affected units of local government. This report describes the characteristics of procurement associated with the Yucca Mountain Site Characterization Project.

The Office of Institutional Affairs staff coordinated and conducted four tours of Yucca Mountain for 23 guests. Of special interest were tours for guests from the Nuclear Energy Agency, the Canadian Broadcasting Corporation, and a Nuclear Energy Institute tour.

The Office of Institutional Affairs coordinated the review of testimony, sample Q&As, briefing packages, and other materials being prepared for upcoming Congressional interactions.

III. ISSUES

The March 1997, milestone for holeout continues to slip day-to-day as long as the TBM is delayed due to the present faulted condition of the tunnel face. Present forecasts indicate about 34 days behind the March schedule.

IV. COST SUMMARY

No items to report.

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

JAN 30 1997

D. R. Williams, DOE/YMSCO, Las Vegas, NV
J. C. de la Garza, DOE/YMSCO, Mercury, NV, M/S 717

FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING JANUARY 24, 1997

Enclosure 2 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. The concentration of DFBA tracer is now tailing off. No breakthrough of the pyridone tracer has been reported, but breakthrough is predicted for sometime next week. Data from tracer testing will help to model the travel of radionuclides in the saturated zone.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Berkeley National Laboratory (LBNL), Lawrence Livermore National Laboratory, and Sandia National Laboratories continue to set up equipment and instrumentation in preparation for the testing. Installation of the heaters is in progress this week. LBNL personnel are conducting air permeability tests in boreholes in the block.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 71+41.4 meters as of 8 a.m., Friday, January 24, 1997. TBM progress continues to be slowed by difficult excavation in fractured and faulted rock. Geologists have reported better excavation conditions at the cutterhead and progress is expected to improve soon. Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 70+65.0 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
LBNL personnel are continuing the air permeability testing in the instrumentation holes in the AOD. The testing will help establish baseline conditions for the Heated Drift Test. Excavation of the heated drift using the Alpine Miner is complete at station 0+60.5 meters. Drill/blast excavation of the invert of the heated drift continued to station 0+32 meters. The excavation is necessary for planned testing. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

Drilling of instrumentation holes in the connecting drift resumed this week. Drilling of borehole ESF-HD-PERM-2 started on January 15, 1997, and was completed to final depth of 20.0 meters on January 24, 1997. The borehole is being drilled dry (using compressed air rather than water as a circulating medium), and will be used for air permeability testing and other hydrochemistry tests.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test started on schedule on August 26, 1996. The instruments are reported to be working properly and data are being collected. The Single Heater Test will heat approximately 25 cubic meters of rock to 100°C or greater. The purpose of this test is to understand heat related processes and measure parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). The results will be available for the viability assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
The USGS continues to monitor the borehole in Alcove 6. Air permeability testing is in progress in the alcove. Testing is in support of pneumatic pathways and hydrochemistry testing in the ESF.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove progressed to station 0+79.9 meters this week using the Alpine Miner, AM-50. Design length for this phase of the Southern Ghost Dance Fault Alcove is 135 meters. Planned testing in the Southern Ghost Dance Alcove will investigate the hydrologic characteristics of the fault.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-0805

Enclosures:
1. Tunnel Stratigraphy
2. Site Characterization Field Activities in Progress

cc w/encls:
J. G. Jones, DOE/HQ (RW-40) FORS
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J. T. Sullivan, DOE/YMSCO, Las Vegas, NV
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J. T. Gardiner, DOE/YMSCO, Las Vegas, NV
R. S. Waters, DOE/YMSCO, Las Vegas, NV
Records Processing Center = "12"

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone

ENCLOSURE 1

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
69+84 to 69+96	Topopah Spring crystal rich vitric zone
69+96 to 70+58	Bedded tuffs
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+31?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+31 to face	Topopah Spring crystal poor upper lithophysal zone?

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

ENCLOSURE 2

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

United States Department of the Interior

U. S. GEOLOGICAL SURVEY
Box 25046 M.S. 425
Denver Federal Center
Denver, Colorado 80225

IN REPLY REFER TO:

INFORMATION ONLY

December 18, 1996

Wayne Kozai
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, November, 1996

Attached is the USGS progress report in the required format for the month of November, 1996.

If you have any questions or need further information, please call Raye Ritchey Arnold at (303)236-0516, ext. 282.

Sincerely,

Raye Ritchey Arnold
for Robert W. Craig
Technical Project Officer
Yucca Mountain Project Branch
U.S. Geological Survey

Enclosure:
cc: S. Hanauer, DOE/Forrestal
R. Dyer, DOE, Las Vegas
C. Fox, DOE, Las Vegas
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U. S. GEOLOGICAL SURVEY

EXECUTIVE SUMMARY
November, 1996

WBS 1.2.3.1 Coordination and Planning

U. S. Geological Survey - Yucca Mountain Project Branch is currently processing 207 scientific papers authored by USGS authors. Of these, 117 are related to hydrologic studies and 90 to geologic studies. In addition, 51 abstracts are being processed, as well as 17 reports from LBL.

WBS 1.2.3.2 Geology

Geologic Framework

Work continued on the review and revision of the ten lithostratigraphic contacts in the 4th (and last) group of boreholes being studied in support of the 3-D modeling effort. Many of the boreholes currently being examined have only drill cuttings as samples, but many of the contacts can be identified where the cuttings are not too contaminated with fragments from higher in the boreholes. Many of the contacts also correlate well with geophysical logs, but the signatures of several of the contacts can change slightly between boreholes. In further support of 3-D modeling, project staff supplied information on several lithostratigraphic contacts in addition to the usual ten contacts, and met with the M&O modeling staff to review the thickness and geometry of the various units being modeled.

As part of the investigations in the ESF, project staff: (1) examined the exposed bedrock and geologic structures in the North Ghost Dance Alcove, (2) reviewed the video tape of the subhorizontal borehole NAD-GTB#1A, and (3) examined cores and video of cores from the borehole. Based on these studies, the Ghost Dance fault was identified at a location beginning about 149 m from the center line of the ESF and marked by a 10 m-wide zone of more broken rock as compared to the adjacent rock.

Project staff also participated in the planning for the southern Ghost Dance fault alcove (Alcove #7), by providing data on the location and geometry of the fault based on the new geologic mapping in the central block of Yucca Mountain. As identified at the surface, there are two splays of the Ghost Dance fault, the eastern one of which dies out to the south and is considered to be the main trace. At the location of Alcove #7, this eastern splay contains the majority of the fault displacement and is the main target for the forthcoming hydrologic tests. Current plans for Alcove #7 are to drift due east off the main ESF for about 125 m and then drill horizontally to the projected location of the fault, which is expected to be an additional 60 m. The western splay of the Ghost Dance fault, which has been intersected in the ESF, has relatively minor offset (10-20 ft) and seems to connect with the Abandoned Wash fault to the southwest.

The central block geologic map is being converted from the AutoCad draft into ARC/INFO to produce a robust spatial geologic map digital. This conversion will enable a faster and more

efficient preparation of the final geologic map for formal publication as a USGS Miscellaneous Investigation Series map, as well as being made available for wider use throughout the Yucca Mountain site characterization program.

Geologic mapping of Fran Ridge, Bow Ridge, the southern part of Boundary Ridge, and parts of Dune Wash and Busted Butte has been completed, and the map data digitized for inclusion in the site area geologic map. Many modifications of previous mapping have been made, particularly in areas of complex structure. Accordingly, mapping efforts are concentrating on those areas to help construct a more accurate and internally consistent map at the 1:24,000 scale. A 1:6,000-scale digital version of the geologic map of the Paintbrush Canyon area, which is at the northeast corner of the site area geologic map, is being finalized.

Fracture data was provided as input to LBL's unsaturated zone flow model. The input consisted of the principal results of the collection and integration of surface and borehole fracture data for the zeolitically altered Calico Hills Formation and Prow Pass Tuff. Data on the Calico Hills Formation were collected from surface exposures in the vicinity of Prow Pass using both detailed line survey and areal set survey techniques. Television videos of QA'd boreholes USW SD-7, USW SD-12, and USW UZ-14 were observed to obtain fracture data for both formations. Assistance was given to LANL scientists collecting samples in the ESF by directing sample selection to potentially conductive features and providing descriptions of the structural relations at the sample locations. Comparisons between surface geologic mapping and full periphery mapping and detailed line survey data in the ESF, and evaluations of the structural controls of ^{36}Cl distribution continued.

Project staff prepared annotated outlines for the sections on site stratigraphy and site structure for the Site Description Report (part of PISA). They also participated in the PSHA workshop held at Pahrump, Nevada, and led field trips to study bedrock structures at Yucca Mountain.

Geologic mapping of south ramp of the ESF was accomplished as follows: (1) full periphery geologic mapping was completed to station 69+90, (2) detailed line survey was completed to station 69+95, and (3) stereophotography was completed to station Project staff conducted tours of the ESF for participants in the PSHA workshop that was held in Pahrump, Nevada.

Seismotectonic Studies

The Seismic Source Models and Proponents Workshop (Workshop #3) and the associated field trip for the Probabilistic Seismic Hazards Analysis (PSHA) project was held November 18-22, at Pahrump in the Amargosa Valley. This workshop accomplished two goals: (1) presentation and discussion of alternative models, hypotheses, and interpretations of data that could be used to characterize seismic sources for PSHA; and (2) a visit to the Yucca Mountain site, the ESF tunnel, and key exposures in the area so as to introduce participants in PSHA to the geology and tectonic setting of the region and to provide an in-the-field forum to debate alternatives. The workshop discussions centered upon five specific issues of importance to ground motion and fault displacement hazards: tectonic models, three-dimensional geometry of faults, definition and synchroneity of faulting events, characterization of faulting and fracturing in the potential

repository block, and maximum background earthquakes. During the two-and-one-half-day field trip, observations and discussions focused principally on fault characteristics.

Final versions of the annotated outlines for the sections on regional geology, seismology, Quaternary geology, and tectonic models were completed and submitted for review.

WBS 1.2.3.3 HYDROLOGY

Regional Hydrology

Work continued on the analysis and interpretation of regional precipitation data.

Closing calibrations of the tipping-bucket rain gages also continued during the reporting period. Sites for the location of the 14 precipitation gages are being identified.

Work continued on formatting the meteorological data from FY96 for the two weather stations that were active during that time. The data package is expected to be ready for technical review by middle December.

Staff completed computing and checking daily discharge data for the three recording streamgage sites on Fortymile Wash. Staff also continued to compute and check records for streamflow and precipitation data collected in FY95 which were not published in the USGS Nevada District annual data report for 1995.

Final hydraulic-conductivity arrays for the regional flow model were converted to ARC/INFO coverages for updating of the regional framework model.

Staff met on November 6 to discuss NCAR precipitation data for future-climate scenarios and possible alternatives for using those data, which are at far too gross a scale to be useful to estimating recharge for the regional flow model.

Modeling staff met with paleoclimate staff to discuss past-discharge areas and past climatic conditions. A map of past-discharge areas, which will be used as part of the "reality check" on future-climate simulations, was received from the USGS Climate Team.

The report documenting the construction and calibration of the regional flow model received USGS Director's approval as Water-Resources Investigations Report 96-4300 on November 26. Staff examined comments from USGS Headquarters and began revisions.

> Agnese, F.A., Faunt, C.C., Turner, A.K., and Hill, M.C., *Hydrogeologic evaluation and numerical simulation of the Death Valley regional ground-water flow system, Nevada and California*, U.S. Geological Survey Water-Resources Investigations Report 96-4300, *in press.*

A report documenting the construction of a regional potentiometric-surface map was returned from the USGS Central Region Office for additional work. Staff reviewed the comments, discussed possible changes, and began working on the changes.

Unsaturated-Zone Hydrology

Work continued on the numerical infiltration model with comparison of results of simulated precipitation obtained from the Global Climate Model to the results obtained using historical data from the regional precipitation gage network.

Development of an improved version of the bucket sub-model also continued, using a cascading bucket approach which would allow for an improved modeling of the root zone. Work also continued on improving the Richards-equation sub-model.

Staff prepared 10 additional figures for inclusion in the Main Drift Hydrology report. Additional efforts went to preparation and review of the basic data submittal due at the end of December.

A data package (reduced borehole data) was reviewed and submitted to the USGS data management group.

Pneumatic data from instrument station "B" located in the basal vitrophyre of the Topopah Spring Tuff at SD-12 indicate the presence of diurnal and synoptic signals in the pressure record. These signals have been present in the pressure record from this station since this borehole was first instrumented in November, 1995, but they have only recently been recognized. These signals appear to be superimposed on a seasonal pressure signal that is severely lagged and damped with respect to the surface barometric pressure signal. The phase of the synoptic and diurnal signals that are present in this record are, however, coincident with the phase of the surface synoptic and diurnal signals. These signals also lead the synoptic and diurnal pressure signals that are present in all of the overlying Topopah Spring stations. A preliminary analysis of these data suggests that the superimposed signals may be the result of atmospheric loading and/or Earth tide effects. These observations will be addressed in the Main Drift Hydrogeology report.

Approximately 80 man hours were spent in the preparation of overheads and handouts for the Expert Elicitation (3-D site-scale model) meeting held in Berkeley, CA, on November 14 and 15.

Preliminary analysis has been completed on the unsaturated conductivity measurements for two core samples. Using moisture retention data collected from subsamples of the core, various methods were used to fit curves to the moisture retention data and then to predict unsaturated conductivity. These curves were compared to the measured data. The comparisons indicate that the predicted conductivities are lower than the measured values suggesting that more water may travel through the matrix under unsaturated conditions than currently estimated in flow models. Additional issues brought forth with the analysis include the need to evaluate other methods to collect moisture retention data, such as pressure-plate and centrifuge methods, to see how sensitive the curve-fitting techniques and the curve shapes are to the prediction of unsaturated conductivities. Samples have been prepared for these measurements. A piece of the rotor apparatus on the centrifuge has broken and is currently being replaced.

Samples from boreholes ESF-AL#2-HPF#1, ESF-BRFA-HPF#2, ESF-AL#3-RBT#1, ESF-AL#3-RBT#4, and ESF-AL#4-RBT#1 were reprocessed for physical properties determined from

relative-humidity oven drying. Processing of samples from the Ghost Dance Fault Alcove #6 has been completed, and the data are being organized. Collection of systematic samples from the main drift will begin the second week of December. All core samples in cans and lexan, approximately 450 core boxes, with the exclusion of the Ghost Dance Fault samples, have been returned to the Sample Management Facility for long term storage.

Borehole data from NRG-7a, UZ#4, UZ#5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived to optical disk on a routine basis throughout the month. Daily EKES files were checked for any shelter activity. Sensor readings were checked daily as well for unusual occurrences, and any statistical outliers were flagged.

Several trips were made to field sites. Three trips were made for routine generator maintenance. Five trips were made to retrieve data manually when the radio communication link from the field sites to the HRF failed. These failures resulted from shutdowns of the Novell network at the HRF because of power failures or from malfunctioning of the field site radio modems.

Four trips were made to exercise the generator at UZ#4 and UZ#5. For several weeks, there have been periods of high noise levels from most or all sensors at UZ#4 and UZ#5 - periods lasting several hours or several days, then mysteriously ending. Although the generator was suspected as the source of the noise, the malfunction was not actually observed until October 16. After several days of steady output, the generator frequency and voltage would become unstable, varying 1% to 2% several times per minute, but not quite enough variation to trip the UPS alarms. Cause of the problem has been tentatively attributed to carbon loading on the generator engine, a result of running under light loads for extended periods of time. To circumvent this problem, routine trips are being made to UZ#4 and UZ#5 to exercise the generator using a load bank. Recurring problems with the generator at UZ#4 and UZ#5 persisted throughout the month of November.

Two glass thermometers were calibrated for the Regional Saturated Zone Hydrology Group.

Air-permeability and hydrochemical testing continued in the Ghost Dance fault (GDF) alcove. The GDF was identified in a 60-m borehole. USGS geologists have located the fault at 154-m distance from the ESF centerline. The 60-m borehole temperature log shows a 0.1-degree Celsius drop in temperature in the broken zone of the fault. The alcove has been excavated an additional 30 m, and hydrochemical and pneumatic testing is scheduled to begin on December 2.

Analysis of air-permeability data from the ESF produced interesting results. The GDF has a brecciated zone that extends from 143 to 155 meters from the ESF centerline. Most of the brecciated zone is clast-supported breccia. There are four subzones, however, of fine-grained matrix-supported breccia. Based on the location at ESF depth of the main trace of the Ghost Dance fault (154 m from ESF centerline) and its surface location, the GDF is nearly vertical. The geothermal temperature drop in the breccia zone may indicate downward transport of gas or water.

Collection of temperature and relativity humidity data continued at four sites in the ESF. Wind-speed data are currently being collected at two locations (near Alcove 3 and 4). One wind-speed

sensor (Alcove 4) was replaced on November 6 because the other unit experienced an electronic malfunction.

A project designed to preserve the in-situ water content of selected sites in the tunnel continued. Plastic sheets (1.5 m by 1.5 m) are being attached to the tunnel wall (below the spring line) using nails, silicon sealer, and grout. These selected locations may be the site of future sampling and/or instrumentation locations. The new selected sites contain the contact between the Bedded Tuff (PTn) and the Tiva Canyon (Tpcpv). To date, 13 pieces of plastic have been installed. As the TBM advances, additional plastic will be installed.

A tensiometer was installed in October in the PTn unit to measure the rate of dry-out from a bare rock surface. The tensiometer was installed 30 cm into the tunnel wall and is being read frequently to monitor the rate of dry-out. A second set of tensiometers were installed on November 14 at the contact between the Bedded Tuff (PTn) and the Tiva Canyon (Tpcpv). In addition, heat-dissipation probes were installed at each of these locations.

Standard data formats have been developed for the various types of moisture data being collected. These data are being assembled into a data package for submittal.

Results of hydrochemical analyses were compiled. Water collection by compression and distillation during November was recorded in the water collection database. Water samples analyzed for tritium during November were likewise recorded in the tritium database. Seven ESF water samples were prepared for tritium analysis and counted for tritium concentration. The data have been reduced.

Twenty-four molecular sieve cylinders were leak-tested and heat-evacuated to remove residual CO_2 gas and H_2O vapor. The evacuated cylinders were pressurized with nitrogen gas and prepared for shipment to the NTS for collection efforts from the SD-12 borehole. Staff training on heat evacuation of collection cylinders and preparation of cylinders for field use was conducted.

Hydrochemical analysis continued. Five core-compression water samples and one disguised USGS Standard Water Reference Sample were prepared and delivered to Huffman Laboratories for anion and cation analyses. Eight SD-12 cores, four SD-7 cores, two SD-9 cores, and four ESF core samples were distilled. The extracted pore water will be analyzed for tritium.

Twenty UZ water samples (seven from the ESF, three from SD-7, and 10 from SD-12) were prepared for tritium analysis and counted for tritium concentration. The data have been reduced.

Seven gas samples, collected from instrumented borehole SD-12 and sent to Desert Research Institute for $^{13}C/^{12}C$ and ^{14}C analyses, were received in early November.

One set of core-compression water samples was prepared and shipped to Beta Analytical Laboratory for ^{14}C analysis.

The LKB Liquid Scintillation Counter was calibrated.

Staff training covered the distillation method for extracting pore water from core samples, preparation of tritium samples for counting, operation and calibration of the LKB liquid scintillation counter, and reduction of counting data.

Several unscheduled activities were accomplished. UZ hydrochemical staff, along with PIs from the Environmental Science Team, attended a whole-day meeting with M&O/LLNL staff to update recent progress in hydrologic investigations at Yucca Mountain. The USGS safety officer inspected UZ Hydrochemistry Laboratory fume hoods for efficiency of operation.

A new distillation rack, designed to extract dissolved CO_2 and inorganic carbon from pore water in Topopah Spring Tuff core, was constructed. This was necessary because no water can be extracted from low-moisture-content core by the compression method. Staff training for the new method was conducted. Three tests have been conducted; all of the tests were successful in extracting enough CO_2 for ^{14}C dating by Tandem Accelerator Mass Spectrometer. The extracted CO_2 will be sent to Beta Analytical Laboratory in Miami, Florida, for analysis.

In unscheduled work, staff prepared and presented results of preliminary fracture modeling at the Expert Elicitation Workshop for unsaturated-zone studies in Berkeley, California.

Based solely on pneumatic testing of unsaturated zone boreholes, data concerning the degree to which fracturing has enhanced the permeability of the nonwelded tuffs in the lower part of the unsaturated zone must be considered sparse to nonexistent. To supplement the little that is known concerning secondary permeability in the Calico Hills, Prow Pass and Bullfrog Tuffs, permeabilities determined from in-situ hydraulic testing where these units are submerged beneath the water table were compared with permeabilities determined on core retrieved from the test boreholes or boreholes in close proximity. These comparisons showed that, despite the potential for sealing of secondary permeability by zeolites and other alteration products, considerable secondary permeability exists within these units at some borehole locations.

A presentation entitled *A conceptual model of unsaturated zone flow at Yucca Mountain, Nevada* was made to the UZ experts at the first Expert Elicitation workshop held in Berkeley on November 14 and 15. Staff also participated in a Management Team meeting held in Las Vegas on November 26 to help outline the agenda for the second workshop to be held in Berkeley December 18 to 20.

Saturated-Zone Hydrology

Preparation of a memorandum describing the planned USGS purely convergent tracer test in C-hole wells continued during November. Data are being analyzed to isolate the tail of the breakthrough curve from prior injections, to obtain antecedent iodide concentration curves. The data analysis will be used to predict results from the upcoming purely convergent tracer test using Pyridone.

In planning for the purely convergent test, interactions between the USGS and DOE's environmental permitting group continued with preparation (completed November 21) of a letter to the State of Nevada requesting injection of these Pyridone and 2,6 Difluoro-benzoic acid tracers into UE-25 c#1 and c#2, respectively.

The partial recirculation of water from the pumped well UE-25 c#3 into UE-25 c#2 performed by LANL as part of their lithium bromide-PFBA-microspheres reactive tracer test was halted on November 19 in response to a request from the USGS. The USGS sought discontinuation of recirculation so that the flow regime could return to the purely convergent flow field that would result from pumping of 150 gallon per minute from UE-25 c#3. This is the flow field over which the nearly simultaneous injection of Pyridone and 2,6 Difluoro-benzoic acid will be superposed.

A proposal to conduct hydraulic and tracer tests in the UE-25 a#1 and UE-25 b#1 borehole pair was submitted to DOE and the M&O on November 8. These tests would be conducted after March 14, 1997, in confirmatory testing to obtain hydraulic and transport parameters in a saturated-zone location other than the C-hole complex.

Several efforts in water-level measurements, equipment calibration, and data compilation continued. In support of the aquifer testing conducted at well USW G-2 and at the C-hole complex, 25 manual measurements were completed in November. Six zones in five wells were monitored hourly with transducer measurements and data recorders.

Water-level measurements were obtained in boreholes UE-25 WT#6 and UE-25 WT#16 on November 5; in USW WT-2, UE-25 WT#4, UE-25 WT#13, UE-25 WT#15, and UE-25 b#1 (upper interval) on November 6; in USW H-1 tubes 1, 2, 3, and 4 on November 7; in USW WT-1 on November 12; in USW VH-1, USW WT-7, USW WT-10, USW WT-11, and USW H-6 (upper and lower intervals) on November 13; in USW H-3 (upper and lower intervals) and USW H-5 (upper and lower intervals) on November 14; and in J-11, J-12, and J-13 on November 18. Data were downloaded from 21X recorders at wells USW G-2, H-4 (upper and lower zones), UE-25 WT #3, UE-25 WT #14, and UE-25 p#1. Editing was completed of hourly data from UE-25 p#1 through September 3, from USW H-5 (upper interval) through August 27, and USW H-5 (lower interval) through August 8. Review of all manual water-level data collected from July through November 1996 was completed. Field notes for the same time frame were also reviewed.

The first draft of report section "Well data and water levels" for the 1995 water-level data report was completed and reviewed. Staff began working on the remainder of the report which includes discussion of data collection systems.

Efforts to finalize SZ numerical flow model inputs and outputs continued. Work began on completion of a potentiometric-surface map for the site model area. Previous work by others is being compiled and checked. Screened or open intervals of wells are being matched with hydrogeologic units to be used for comparison with model output. Staff continued analysis of water-level fluctuations at Yucca Mountain to estimate hydraulic properties of the saturated zone rock units.

Development of the Site hydrogeologic framework model continued with discussion of refinement of the grid-spacing of the framework model for use in the construction of input data sets for a finite-difference flow model of the site area. A cell spacing of 250 m was determined to be adequate for that purpose.

In work to calibrate the Site flow model, staff continued efforts with C. Gable and G. Zvoloski (LANL) to solve problems with the finite-element mesh to be used with the FEHMN flow model. At the end of this reporting period, problems with the mesh remained.

Staff discussed construction of a finite-difference flow model of the site area, using MODFLOWP. This will be a parallel effort to the modeling using FEHMN and is intended to test alternate conceptual models of the large hydraulic gradient, as well as to obtain model results that can be used by PA should the FEHMN modeling efforts continue to be delayed by mesh problems. A finite-difference grid was designed, and a layering scheme for the model was developed.

In unscheduled work, a poster on hydraulic testing and conceptual models of flow at well USW G-2 was presented by SZ modeling staff at a USGS Workshop on Advanced Geophysical Techniques. Staff attended several of the sessions at the workshop. A staff hydrologist provided technical review of an SZ report.

Revisions were made to an approved report that documents results of aquifer tests conducted last fiscal year at three wells at Yucca Mountain, and the report was submitted for final publication preparation.

> O'Brien, Grady M., *Analysis of aquifer tests conducted in boreholes USW WT-10, UE-25 WT#12, and USW SD-7, 1995-96, Yucca Mountain, Nevada*, U.S. Geological Survey Water-Resources Investigations Report 96-4293, *in press.*

USGS staff met with B. Arnold, J. Gauthier, and M. Wilson (SNL) on November 21 in Albuquerque to discuss organization of a workshop that will address critical issues in SZ flow modeling and transfer of the information obtained in process modeling for use by PA modelers. Key participants were identified, as were key issues to be addressed by the participants during the workshop. The organization and format for the workshop were discussed. Current plans are to hold the workshop in Denver in early April. Background information (past TSPA reports and plans for other workshops) was provided by SNL staff.

<u>WBS 1.2.3.6 Climatology and Paleohydrology</u>

Staff continued to collect and compile diatom data from Owens Lake to establish a regional climate history for the past 500 ky. Staff also continued preparation of diatom samples from Owens Lake cores and from analog sites. Sample preparation has been impeded by partial shutdown of the lab in preparation for relocation to Bldg. 56.

Interpretive efforts for the Owens Lake region continued. Compilation of hydrologic and climatic data for the Owens Lake region to develop analog models to determine precipitation and temperature changes for the past 400 ky continued during the reporting period. Conversion was

begun of the multispecies ostracode dataset from Owens Lake into a single limnologic/climatic curve. Once properly calibrated, such a curve will provide a long (500 ky) regional climate history.

A proposal to acquire high-resolution climate data from cores taken by DRI from the Pahranagat Marshes was prepared. Collection of high-resolution data from the Pahranagats would provide a means to evaluate possible climate change during the next one or two millennia when a repository would be very hot.

Staff has initiated extraction of ostracodes from prepared sediment residues for inclusion in the baseline dataset, and other sample extraction efforts focused on ostracodes from prepared paleowetland sediments for stable isotopic analyses.

A preliminary map was prepared to show areas near Yucca Mountain where ground-water discharge from the regional and alluvial aquifers occurred about 21 ka. This activity fulfills a requisite data transfer from the Climate/Quaternary Hydrology group to the SZ group in support of the 3-D hydrologic model.

The time and agenda for a climate roundtable meeting involving USGS, DRI, and Dames and Moore participants are being arranged. The purpose of the initial meeting will be to discuss the methods used by the participants to reconstruct past climate from proxy datasets and to discuss potential strengths and weaknesses of those methods.

U and Th isotopic analyses were completed of nine subsamples of authigenic cements from three horizons within the Station 6 section at the Highway 95 white-bed deposit. Resulting ages tend to confirm previously reported U-series data that indicate a major age break between the overlying gray diatomite bed (basal materials with ages between 33 and 55 ka) and the underlying green-sand unit (upper portion ~130 ka; lower portion ~180 ka). The reason for discordance between TL and U-series ages for the green-sand unit is still unknown, although additional information bearing on the mineralogy of the fine silts from this unit used for TL age determination is currently being collected.

Staff mapped the distribution of discharge sites during the last full-glacial period (10 to 30 ka) on a regional scale in support of the three-dimensional saturated-zone hydrologic model. Sites were located on a 1:250,000 base map and briefly described in terms of the type of discharge system and the source of water. Data will be used to test the SZ model under pluvial conditions
An assessment was completed of isotopic (Sr, O, H, C) variations in ground water as a function of flow paths predicted by the regional hydrologic model constructed by the USGS. The objective was to determine if the isotope hydrology was consistent with modeled flow paths.

A field trip to the Amargosa Valley discharge sites was planned for geological description and sample collection. In addition to examination of sites in light of FY96 data, hand augering to a depth of about 6 meters is planned to determine the vertical extent of the deposits and to collect samples from the deepest portions of the deposits. In addition, samples will be collected to determine moisture profiles in order to assess the possibility of present-day water perching that

might be supporting the scattered population of *Distichlis* (salt grass) at one of the sites (the Crater Flat deposit).

Work continued on samples TL-77 and TL-78, but no ages are being released until a data review is completed.

Fifteen subsamples of outermost opal and calcite from six secondary mineral occurrences in the ESF between stations 57 and 64 were prepared. Chemical separation of U and Th for nine of these samples was completed, and isotopic measurements were completed on six subsamples. Resulting ages range from 69 to 380 ka with two ages of about 160 ka and two of 240 ka. Calculated initial $^{234}U/^{238}U$ ratios range from 5.4 to 1.5 and show a general negative correlation with subsample age. These results are consistent with previously reported data and indicate similar distributions of secondary materials and ages in the middle lithophysal unit of the Topopah Spring Tuff between the northern and southern bends in the ESF.

Staff met in Denver with M&O coordinator for climate and hydrology to discuss current status and future work of climate and UZ hydrology.

Modifications were completed to technical procedure GCP-13 that accommodate U-Pb analysis of very small samples of high-U opals from the ESF. Staff at the Jack Satterly Geochronology Lab, Royal Ontario Museum, will provide a limited number of analyses of opal and chalcedony from various microstratigraphic positions within secondary mineral coatings. The technique allows dating of high-U, low-Pb materials in the range of several hundreds of thousands of years to >13 million years (age of host tuffs) and will provide some indication of whether secondary mineral coatings were initiated shortly after emplacement of the tuffs, or whether deposition reflects a more-recent phenomenon related to the arid climate typical of the Quaternary period (the last 2 million years).

Staff discussed reconnaissance fluid-inclusion observations from secondary calcite occurrences in the ESF in light of at least two published abstracts by Dublyansky and coworkers that report observations from ESF occurrences. These abstracts conclude that early calcite may have formed during a comparatively mild hydrothermal event, which is consistent with earlier reported findings of Roedder and others (1994, IHLRWM Conference, ANS), but those abstracts are also mildly critical of some of the conclusions of that work. Four samples of ESF calcite were prepared for fluid-inclusion analysis.

Calcite from 11 secondary occurrences within the ESF (17 total samples) was sampled for determination of modern carbon contents by AMS at Beta Analytical Laboratory; two blind blanks were included.

Staff met for an afternoon with Mike Reddy, a WRD carbonate geochemist, for interchange of information concerning conditions of calcite precipitation and controls on calcite crystal morphology. Reddy, like all others so far, had never seen calcite crystal forms similar to those commonly found in the unsaturated zone of the ESF.

All of the Past Discharge stable isotope data from carbonate microfossils was compiled for incorporation into FY97 reports.

XRD traces from 13 samples of carbonate from ESF secondary mineral occurrences were collected to check for the presence of aragonite. This was prompted by the unusual calcite crystal morphologies that have been observed; calcite samples spanned a wide range of paragenetic positions and were mostly from bladed occurrences. No aragonite was observed, which confirms past mineralogic studies by LANL but does not provide any further clues to the origin of the unusual calcite forms.

XRD traces were also obtained from 10 TL separates of samples from the Lathrop Wells diatomite. TL and ^{230}Th/U ages of these samples do not agree well. The XRD patterns of these samples, in contrast to TL separates from other localities, show only a handful of sharp peaks (generally the most intense of peaks of the minerals quartz, feldspar, and mica) and broad humps between 2□ angles of 20° to 30°. These humps are characteristic of amorphous opal and probably indicate that the bulk of the material in the separates is diatomaceous.

Some 130 samples of calcite were extracted from ESF samples, largely from between stations 40 and 50, and mass-spectrometer analyses were performed. These occurrences contain early calcite with anomalously heavy □^{13}C values.

ESF samples of secondary mineralization from the past two collecting trips were examined, and 38 chips were cut and impregnated for preparation of polished thick sections. These sections are used for both petrographic analysis and microsampling of carbonate for Kiel automated stable isotope analysis. In addition, five roughly polished sections from G-2 drill core were prepared for carbonate microsampling.

Strontium isotopic analyses of pore water salts in a suite of 27 core samples from drill hole USW SD-7 were completed. □^{87}Sr values increase gradually through the intercepted portion of TCw, increase dramatically in the PTn, and remain nearly constant in TSw. The pore salts (which precipitated from pore water when the core dried) are extracted from coarsely crushed pieces of core using de-ionized water. □^{87}Sr for pore water in the TSw are similar to those of calcite fracture fillings. If the kinetics of water-rock interaction can be reasonably constrained on experimental and theoretical grounds, the observed systematic trends offer hope of estimating residence time of the pore fluids.

Several unplanned efforts were conducted. Technical review was completed of a data package (titled "Chemical and isotopic composition of pore water and pore gas, 1994-96, from boreholes UZ-1, UZ-14, UZ-16, NRG-6, NRG-7A, SD-7, SD-9, SD-12 and the ESF"). An inventory of all radioactive materials in YMP-Isotope Hydrology labs was completed as requested by the USGS Radiation Safety Officer. Technical review was performed of an FY96 milestone [Interpretations of Chemical and Isotopic Compositions Data and Geochemical Modeling (NETPATH) in the Unsaturated Zone, Yucca Mountain, Nevada]. Staff attended the Unsaturated Zone Expert Elicitation meeting in Berkeley on November 13 and 14 and presented an overview of age and isotopic results obtained in the ESF dating task. Considerable time was spent preparing data for

review for December TDIFs. These samples are to be included in the paleodischarge milestone due March 1997. Revisions to Technical Procedure GCP-29 were also prepared.

WBS 1.2.13.4.7 Water Resources Monitoring

Ground-water levels were measured at 29 sites. Discharge was measured at five springs and at one flowing well. Ground-water data collected during October were checked and filed.

Support was provided to the Environmental Program in several ways. Owner contacts and detailed information on site locations were provided, and sampling configurations at selected sites in the region were discussed with USGS-Nevada District personnel (in preparation for USGS participation in SAIC's radiological ground-water sampling program). In consultation with U.S. Fish and Wildlife Service (USFWS) personnel at Ash Meadows National Wildlife Refuge, discharge-monitoring locations at two springs in Ash Meadows selected and modified to improve data-collection activities. Potential methods for improved water-use monitoring in the Amargosa Desert were discussed with National Park Service (NPS) personnel. Checking of the NWIS database for consistency with previously stored and reported data following a merge of USGS-NV District and USGS-ESIP databases was initiated. Staff met with USGS-ESIP personnel on November 6 and 7 to complete final processing of the data-records package for 1995 data and submitted the package to the YMP Records Processing Center. Preparation of electronic data files for 1995 data to be submitted to the YMP Technical Data Base is also now underway. USDOE approval for the 1995 summary monitoring report was received on November 12 (completed milestone 3GWR622M). Camera-ready copy of the report was reviewed and delivered on November 20 to USGS-ESIP for publication.

WBS 1.2.3.9 Special Studies

The Principal Investigator and nine other staff members from the USGS attended a meeting with DOE and the M&O on November 5 to review draft outlines of chapter 2.3 (Geological Systems).

Revised outlines of subsections on site stratigraphy, site structure, regional geology and seismicity were submitted to the M&O in preparation for the December 2 meeting where an annotated outline for chapter 2.3 is expected to be finalized.

In conjunction with the disparity in interpretations of the geophysical data about the configuration of the Paleozoic-Tertiary contact, a proposal to deepen USW H-4 was developed.

The USGS lead for the Site Characterization Progress Report (SCPR) presented plans for compilation of SCPR input at the USGS monthly planning meetings held in Denver November 6. In addition to describing how routine "progress" information will be compiled, the presentation also described the current process for documenting the differences between the Site Characterization Plan (SCP) and the current program.

The USGS SCPR lead compiled input for Appendix A of SCPR #15 and transmitted it to the M&O staff to compile the complete text. This Appendix A is intended to describe, in summary

fashion, the changes that have occurred in the Site Characterization Program since the SCP was issued in December 1988 and to compare the content of the SCP to the current YMP Long-Range Plan. The summaries were written at the SCP Investigation level but capture the fundamental aspects of the characterization program at the SCP study and activity levels. Write-ups for Appendix A consist of two sections: "Overview of Testing Proposed in the SCP" and "Changes Through Time." Each section contains a series of numbered, paragraph-sized bullets that correspond to the SCP studies that comprise the Investigation. In the "Overview" section, an introductory paragraph summarizes the overall objectives for the SCP Investigation. Each bullet then summarizes the combined objectives of the SCP study and the activities that comprise the study. To ensure that the "overview" section accurately describes SCP objectives, word-processing files for chapter 8 of the SCP were obtained and abstracted. For the "changes" section, information was compiled by researching previous SCPRs, interviewing Principal Investigators (PI), and by soliciting written material from PIs and other members of the technical staff. Investigation-level write-ups were prepared for 11 SCP Investigations: three in Geohydrology, one in Rock Characteristics, two in Climate, one in Postclosure Tectonics, one in Thermal and Mechanical Rock Properties, and three in Preclosure Tectonics. This USGS input to Appendix A consisted of about 50 pages of text, which represented about 40 percent of the text of Appendix A for Site Programs. USGS input was well received by the M&O staff and generated very few comments during the initial management-level review.

First drafts were completed for the PISA Site Description sections on Surface Water and Regional Hydrogeology. Drafts for the Site Hydrogeology section, including both unsaturated-zone and saturated-zone hydrology, were in preparation. Unresolved staff-scheduling conflicts continue to hamper the development of this outline.

USGS Level 3 Milestone Report

October 1, 1996 - November 30, 1996

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
LETTER REPORT Milestone Number: SSH13BM3	11/1/96	10/30/96	10/30/96	

USGS Level 4 Milestone Report

October 1, 1996 - November 30, 1996

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: SS Hazards Methodologies Wrkshop **Milestone Number:** SPG28FM4	10/25/96	10/24/96	10/24/96	
Memo to TPO: Jan-Jun96 Perio Wtr Lvl Data to RPC **Milestone Number:** SPH21CM4	10/31/96	10/30/96	10/30/96	
Memo to TPO: SS Hazards Method. Wrkshop Summary **Milestone Number:** SPG28GM4	11/15/96	11/15/96	11/15/96	
Memo toTPO: Seis. Src. Mdls & Proponents Wrkshop **Milestone Number:** SPG28HM4	11/27/96	11/26/96	11/26/96	
Memo to TPO: Comp Frac Data Coll:Cal. Hills,Prow **Milestone Number:** SPG34M4	11/27/96	11/27/96	11/27/96	

Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 11:42 AM **Entered by:** Raye Arnold
WBS: 1.2.3.1.2
WBS Title: Participant Management and Integration
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($-120K / %)
Cause:
The negative cumulative cost variance is due largely to the FY 1996 budget and funding being at below the minimum level to manage the USGS site program. Initial budgets indicated that a potential overrun of $426K was possible. This account was not funded at a level adequate even for basic staffing requirements, leaving no funding for supplies & materials, office machine maintenance, secretarial support, publications, vehicle support, etc. Additional funding of $50K was received via an Approved Funding Change, but because there was no change in scope, no C/SCR was required and therefore, this amount is not reflected in the BCWS.

Impact:
There was an actual FY1996 cost overrun in this P&S account of $143K (less the additional funding of $50K, resulting in a cost overrun of funding of $93K). Cost underruns were identified elsewhere in WBS 1.2.3 offset this cost overrun. There is a small cost underrun in this account for October 1996 resulting in a net negative cumulative cost variance of $120K.

Corrective Action:
No corrective action possible. Account is closed with a cost overrun. Overruns were offset by compensating underruns within the third level WBS. This FY1996 cost overrun cannot be recovered in FY1997.

Cumulative Schedule Variance: ($0K / %)
Variance is within threshold.

Variance at Complete: ($-143K / %)
See "Cumulative Cost Variance"

Approved:
- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

INFORMAL INPUT

INFORMAL INPUT

Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 11:45 AM **Entered by:** Raye Arnold
WBS: 1.2.3.2.8.3.6
WBS Title: Probabilistic Seismic Hazards Analyses
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($-182K / %)
Cause:
$120K of the negative cumulative cost variance is due cost overruns in FY1996 resulting from the hiring of additional staff to complete the seismotectonic synthesis report level 3 milestone. $45K of the negative cumulative cost variance results from the costing of an FY1997 consulting agreement in the month of October. This was spread linearly in the budget plan rather than as a one time cost in October.

Impact:
There was an actual FY1996 cost overrun of $120K in this P&S account; however, there were adequate FY1997 cost underruns within the USGS 1.2.3 WBS element to offset these cost overruns. There was no FY1996 schedule variance; the milestone was completed by the due date of August 1, 1996. There is no impact from the FY1997 overrun. The budget plan did not reflect spending obligations.

Corrective Action:
No corrective action possible for FY1996. Account closed with a cost overrun. There were adequate cost underruns within the third level WBS to cover this cost overrun. No recovery of this FY1996 overrun is possible in FY1997. No corrective action is necessary for the FY1997 cost variance. There is no projected FY1997 variance at complete.

Cumulative Schedule Variance: ($0K / %)
Variance is within threshold.

Variance at Complete: ($-132K / %)
See "Cumulative Cost Variance"

Approved:
- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

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INFORMAL INPUT

Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 11:48 AM **Entered by:** Raye Arnold
WBS: 1.2.3.2.8.4.6
WBS Title: Quaternary Faulting within the Site Area
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($-80K / %)
Variance is within threshold.

Cumulative Schedule Variance: ($0K / %)
Variance is within threshold.

Variance at Complete: ($-80K / %)
Cause:
This negative variance at complete is due to significantly more field work being required in FY1996 than had been planned or funded for that fiscal year. Additionally, $15K from this account was transferred to USBR to complete an FY1995 milestone report, 3GTQ530M, which was submitted on July 22, 1996. This was not part of the planned FY1996 budget.

Impact:
There is an actual cost overrun of $80K in this P&S account in FY1996; however, there were adequate projected FY1996 cost underruns within the USGS 1.2.3 WBS element to offset these cost overruns.

Corrective Action:
No corrective action possible. Account is closed with a cost overrun. There were adequate FY1996 cost underruns within the third level WBS to cover this cost overrun. Cost overrun cannot be recovered in FY1997.

Approved:
- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

INFORMAL INPUT

Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 11:50 AM **Entered by:** Raye Arnold
WBS: 1.2.3.3.1.2.4
WBS Title: Percolation in the Unsaturated Zone - ESF Study
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($-169K / %)
Cause:
The negative cumulative cost variance results primarily from the negative cumulative schedule variance. Funds have been expended for staff costs at nearly the planned rate although planned work has been delayed.

Impact:
There is minimal impact resulting from the cost variance. There was a slight cost underrun ($21K) for this P&S account in FY1996, although it is estimated that it will cost an additional $35K to complete resulting in a cost overrun for the P&S account of $13K at the end of FY1997.

Recovery Plan:
None possible. The majority of the cost variance will be negated when scheduled work is completed or rescheduled eliminating the schedule variance. The actual cost overrun is expected to be $13K.

Cumulative Schedule Variance: ($-219K / %)
Cause:
A portion of this negative schedule variance is due to FY1996 delays in completion of level 3 milestone 3GUS619M as well as delays in Alcove 4 testing. The milestone was delayed due to delays in construction of alcove boreholes, drilling, cleaning, borehole logging, etc., along with restricted field support, access, electrical power, resulting in both delays and additional time requirements for field testing. Further schedule delays have occurred in FY1997 due to difficulties in locating the Ghostdance Fault and construction delays resulting in a projected delay of at least two months for milestone SP3500M3, "Initiate North GDF Testing".

Impact:
Collection of field data, analysis and report preparation were delayed. Milestone 3GUS619M currently is scheduled for completion on 12/31/96, and milestone SP3500M3 is scheduled for completion 5/13/97.

Recovery Plan:
Expedite completion and review of milestone report 3GUS619M. A Change Request is being prepared by the M&O to reschedule work relating to the North Ghost Dance Fault alcove.

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Variance at Complete: ($-11K / %)
Variance is within tolerance.

Approved:

- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

INFORMAL INPUT

Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 02:43 PM **Entered by:** Raye Arnold
WBS: 1.2.3.3.1.2.7
WBS Title: Unsaturated Zone Hydrochemistry
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($-119K / %)
Cause:
The primary cause of this negative cumulative cost variance is the negative cumulative schedule variance resulting from delays in completing milestone 3GUH607M in FY1996. Staff costs continued to be incurred for report preparation while waiting for gaseous-phase C-14 data.

Impact:
There is some impact from this cost variance. The P&S account had a slight underrun ($6K) in FY1996 and it is estimated that it will cost $30K to complete the milestone resulting in a cost overrun at the P&S level of $24K at the end of FY1997.

Recovery Plan:
None possible. The majority of the cost variance will be negated when the work is completed eliminating the schedule variance. The actual cost overrun is expected to be $24K.

Cumulative Schedule Variance: ($-94K / %)
Variances are within threshold.

Variance at Complete: ($-49K / %)
Variances are within threshold.

Approved:
- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

INFORMAL INPUT

Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 03:08 PM **Entered by:** Raye Arnold
WBS: 1.2.3.3.1.3.1
WBS Title: Site Saturated Zone Ground-Water Flow System
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($122K / %)
Cause:
This positive cost variance is due primarily to the cleanout of WT-12 requiring less time and resources than was budgeted for the effort in FY1996.

Impact:
There is no schedule impact to this cost variance. FY1996 work was completed with less time and resources than budgeted. There was an actual cost underrun in this P&S account of $114K. These funds were identified to help offset the FY1996 overrun in other 1.2.3 P&S accounts.

Corrective Action:
No corrective action required. Projected underrun will be used to help offset projected overrun. Funds were used to cover overruns in other accounts in FY1996. Cost recovery is not possible in FY1997.

Cumulative Schedule Variance: ($0K / %)
Variances are within threshold.

Variance at Complete: ($118K / %)
See "Cumulative Cost Variance".

Approved:
- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

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Yucca Mountain Project
Variance Analysis Report

Entered on: 12/17/96 03:14 PM **Entered by:** Raye Arnold
WBS: 1.2.3.6.2.2.1
WBS Title: Quaternary Regional Hydrology
AM: JONES S. **OM:** HAYES L.
Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS
Submitted by: Raye Arnold
Reporting Period: 11/96

Data:

Cumulative Cost Variance: ($116K / %)
Cause:
Positive cumulative cost variance results from the FY1996 positive cost variance of $28K, with the remaining $88K occurring in FY1997. The primary cause for the FY1997 cost variance is errors in time-phasing the budget for this account. The heaviest costs occur in the last quarter of the fiscal year due to laboratory costs, etc. This is not reflected in the time phasing.

Impact:
There is no impact resulting from this cost variance.

Recovery Plan:
Correct time-phasing of budget for remaining months to more accurately reflect planned spending.

Cumulative Schedule Variance: ($0K / %)
Variances are within threshold.

Variance at Complete: ($38K / %)
Variances are within threshold.

Approved:
- ● No
- ○ Tech. Mgr
- ○ TPO
- ○ Yes

INFORMAL REPORT

Participant USGS

Prepared - 12/12/96:07:23:25

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

01-Nov-96 to 30-Nov-96

Inc. Dollars in Thousands

WBS No. - 1.2

WBS Title - Yucca Mountain Project

Parent WBS No. - 1.0

Parent WBS Title - Mined Geologic Disposal System

Element ID - 12

Statement of Work:

See the current WBS Dictionary

Cost/Schedule Performance

		Current Period					FY1997 Cumulative to Date					FY1997 at Completion		
Id	Description	BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.3	Site Investigations	989	942	783	-47	159	1945	1840	1603	-105	237	11387	11491	-104
1.2.5	Regulatory	44	44	18	0	26	79	79	40	0	39	504	491	13
1.2.8	Environment, Safety, and H	49	49	37	0	12	99	99	76	0	23	612	605	7
1.2.9	Project Management	60	60	42	0	18	122	122	88	0	34	664	660	4
1.2.12	Information Management	5	5	3	0	2	13	13	7	0	6	80	78	2
1.2.15	Support Services	145	145	137	0	8	287	287	277	0	10	1722	1722	0
Total		1292	1245	1020	-47	225	2545	2440	2091	-105	349	14969	15047	-78

Resource Distributions by Element of Cost

Fiscal Year 1997

Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	19540	19599	19867	19764	19855	18584	19318	19353	19352	19325	18653	18082	231292
LABOR	885	899	908	913	907	893	872	874	865	872	851	842	10581
SUBS	139	143	145	140	137	137	128	133	131	133	133	123	1622
TRAVEL	25	43	42	45	43	47	35	34	37	34	35	31	451
PM&E	7	6	8	5	9	6	7	5	9	7	5	4	78
OTHER	197	201	202	206	197	184	178	180	175	177	169	171	2237
Total BCWS	1253	1292	1305	1309	1293	1267	1220	1226	1217	1223	1193	1171	14969

Actual Cost of Work Performed

LBRHRS	19283	18578	0	0	0	0	0	0	0	0	0	0	37861
LABOR	771	712	0	0	0	0	0	0	0	0	0	0	1483
SUBS	127	139	0	0	0	0	0	0	0	0	0	0	266
TRAVEL	11	24	0	0	0	0	0	0	0	0	0	0	35
PM&E	43	16	0	0	0	0	0	0	0	0	0	0	59
OTHER	119	129	0	0	0	0	0	0	0	0	0	0	248
Total ACWP	1071	1020	0	0	0	0	0	0	0	0	0	0	2091

Participant USGS

Prepared - 12/12/96:07:23:25

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

01-Nov-96 to 30-Nov-96

Inc. Dollars in Thousands

WBS No. - 1.2 -Yucca Mountain Project

Resource Distributions by Element of Cost

Fiscal Year 1997
Estimate to Complete

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	0	0	20037	19771	19862	18601	19318	19353	19352	19325	18653	18082	192354
LABOR	0	0	931	910	888	931	894	876	882	885	878	869	8944
SUBS	0	0	145	153	148	151	144	144	149	151	155	138	1478
TRAVEL	0	0	44	48	44	48	36	35	39	37	39	32	402
PM&E	0	0	9	5	8	6	9	5	9	7	2	1	61
OTHER	0	0	204	229	258	225	179	182	192	192	188	222	2071
Total ETC	0	0	1333	1345	1346	1361	1262	1242	1271	1272	1262	1262	12956

Resource Distributions

Fiscal Year 1997	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1253	1292	1305	1309	1293	1267	1220	1226	1217	1223	1193	1171	14969
BCWP	1195	1245	0	0	0	0	0	0	0	0	0	0	2440
ACWP	1071	1020	0	0	0	0	0	0	0	0	0	0	2091
ETC	0	0	1333	1345	1346	1361	1262	1242	1271	1272	1262	1262	12956

Fiscal Year Distribution

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
BCWS	15914	14969	9432	980	0	0	0	0	0	0	0	0	41295
BCWP	15609	2440	0	0	0	0	0	0	0	0	0	0	
ACWP	15908	2091	0	0	0	0	0	0	0	0	0	0	
ETC	0	12956	9432	980	0	0	0	0	0	0	0	0	41367

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey
Date Prepared 12/11/96 15:48

MONTHLY COST/FTE REPORT

Fiscal Month/Year NOVEMBER 1996

	CURRENT MONTH END						FISCAL YEAR		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON HOURS	PURCHASE COMMITMENTS	SUBCON COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.3	787	15581	2264	0	1207	32	11838	4176	1604
1.2.5	18	168	336	0	242	0	53	200	39
1.2.8	37	619	0	0	0	0	612	400	76
1.2.9	42	840	168	0	73	4	664	300	88
1.2.12	3	168	0	0	0	7	80	20	7
1.2.15	135	1201	336	0	93	25	1722	700	273
TOTALS	1022	18577	3104	0	1615	68	14969	5796	2087

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/96 - 11/30/96

		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
0G39BFB1E	Provide Input to SC Progress Report 16	9.9	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9
0G39BFB2	Develop PISA Chapter 2.4 (Hydrology)	11.6	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.1
0G39BFB2E	Provide Input to SC Progress Report 17	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
0G39BFB4	Dev Climate/Meteorologic Sys Desc (PISA	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
1.2.3.9.11		66.2	66.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	132.4
*1.2.3.9		66.2	66.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	132.4
**1.2.3		817.4	786.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1603.7
0G535FA1	Provide FY97 Technical Data Base Input	21.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.3
1.2.5.3.5		21.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.3
*1.2.5.3		21.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.3
0G541FA2	Viability Assessment Scenarios Developme	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
1.2.5.4.1		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
0G544FA1	UZ Flow Model Abstractions for VA	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
0G544FA2	SZ Flow Model Abstractions for VA	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
1.2.5.4.4		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
*1.2.5.4		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
**1.2.5		21.3	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.3
0G825FA1	Federal Occupation Safety & Health	8.8	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9
1.2.8.2.5		8.8	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9
*1.2.8.2		8.8	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9
0G845FA1	Radiation Protection	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
1.2.8.4.5		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
0G847FA1	Water Resources Envir Impact Stmt Suppor	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
0G847FA2	Rad Water Quality Sample Collection	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
0G847FB1	Water Resources	30.4	29.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0
1.2.8.4.7		30.4	29.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0
*1.2.8.4		30.4	29.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0
**1.2.8		39.2	36.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.9
0G912FA1	Participant Technical Project Office	25.0	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.2
1.2.9.1.2		25.0	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.2
*1.2.9.1		25.0	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.2
0G922FA1	Participant Project Control - USGS	21.4	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
1.2.9.2.2		21.4	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
*1.2.9.2		21.4	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
**1.2.9		46.4	41.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.2
0GC522FA1	Satellite Records Operations	3.8	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
1.2.12.5.2.2		3.8	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/96 - 11/30/96

		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
*1.2.12.5		3.8	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
**1.2.12		3.8	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
OGF23FA1	Support/Personnel Services	32.4	28.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.1
OGF23FA2	Facilities Management - Space	61.7	61.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.4
OGF23FA3	Facilities Management - Computers/Phones	16.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.4
OGF23FA4	Facilities Management - Other	12.5	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
OGF23FA5	Procurement/Property Management - USGS	10.2	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.2
1.2.15.2.3		133.5	130.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	264.1
*1.2.15.2		133.5	130.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	264.1
OGF3FA1	USGS Training Support	4.5	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7
1.2.15.3		4.5	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7
*1.2.15.3		4.5	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7
**1.2.15		138.0	134.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	272.8
1.2 OPERATING		1066.1	1021.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2087.2
CAPITAL EQUIPMENT		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
GRAND TOTAL		1066.1	1021.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2087.2
FTEs														
FEDERAL		112.7	108.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT		17.0	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL		129.7	126.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

* Fourth level WBS roll-up
** Third level WBS roll-up

S. Wastler

United States Department of the Interior

U. S. GEOLOGICAL SURVEY
Box 25046 M.S. 425
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IN REPLY REFER TO:

INFORMATION ONLY

April 14, 1997

Wayne Kozai
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
P.O. Box 30307
Las Vegas, Nevada 89036-0307

SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS) Progress Report, March, 1997

Attached is the USGS progress report in the required format for the month of March, 1997.

If you have any questions or need further information, please call Raye Ritchey Arnold at (303)236-0516, ext. 282.

Sincerely,

Raye Ritchey Arnold
for Robert W. Craig
Technical Project Officer
Yucca Mountain Project Branch
U.S. Geological Survey

Enclosure:
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U. S. GEOLOGICAL SURVEY
EXECUTIVE SUMMARY
March, 1997

WBS 1.2.3.1 Coordination and Planning

U. S. Geological Survey - Yucca Mountain Project Branch is currently processing 186 scientific papers prepared by USGS authors. Of these, 100 are related to hydrologic studies and 86 to geologic studies. In addition, 48 abstracts are being processed, as well as 17 reports by LBL personnel.

WBS 1.2.3.2 Geology

Geologic Framework

Level 4 Milestone SPG212M4 report that discusses the procedures being followed in verifying the status of geophysical log interpretations for pre-1991 boreholes was completed. The report (1) summarizes the results of a comprehensive data transcription verification with respect to geophysical logging data collected prior to 1991; (2) documents the Q-status (qualified vs. non-qualified) of digital borehole geophysical logs used in petrophysical analysis activities; and (3) addresses the Q-status of calculated geophysical logs of porosity, water content, and saturation. Two existing pre-1991 geophysical-log databases were used in the verification process, one represented by USGS Geophysical Investigations Map GP-1001 published in 1991 (P. H. Nelson and others, Geophysical Logs and Core Measurements from Forty Boreholes at Yucca Mountain, Nevada) and the other included in USGS Open-File Report 96-078 published in 1996 (P. H. Nelson, Computation of Porosity and Water Content from Geophysical Logs, Yucca Mountain, Nevada). To verify data transcriptions, original field copies of logs were compared with these data bases, and determinations made as to the accuracy of the data transfers. A table in the report records the status of all the logs examined for each of the boreholes studies; inconsistencies in data transcription were found to be rare.

Bedrock geologic mapping at the scale of 1:24,000 continued in the northwestern part of the site area, principally in the Yucca Wash, Prow, Windy Wash, and Fatigue Wash areas. Mapping along the northern Windy Wash fault zone shows it to be a complex block-bounding zone in which the hanging-wall (on the west) is made up of long (2 km), thin (200 m) panels of welded units of the Yucca Mountain Tuff and Tiva Canyon Tuff separated by steep faults. These fault-bound structural panels form north-northwest-striking relays between the Fatigue Wash fault on the east and another north-striking block-bounding fault located approximately in the floor of Windy Wash to the west. The structural panels merge southward into the trace of the northern Windy Wash fault, and

in places the Rainier Mesa Tuff (11.6 Ma) was observed to be in fault contact with rocks of the Yucca Mountain Tuff. This relationship leads to a new interpretation regarding the history of deformation in this area. Earlier workers had stressed a structural model in which the Rainier Mesa Tuff was erupted and emplaced after much of the regional tectonism had taken place prior to 11.6 Ma, and was therefore not involved in that episode of faulting. The new mapping indicates, to the contrary, that the Rainier Mesa Tuff was erupted prior to the faulting, and that displacement along the Windy Wash fault took place after 11.6 Ma. A preliminary version of the 1:24,000-scale geologic map of the site area is being prepared for use in preparation of the Site Description report.

In conjunction with LANL, project scientists participated in the preparation and completion of a level 4 milestone report (by LANL) regarding chlorine-36 fast pathways in the ESF. The report (1) describes progress to date in the development of conceptual models for several fast pathways; (2) summarizes the analytical methods used to collect and analyze samples for isotopic and mineralogic characteristics; and (3) discusses the guidelines used for descriptions of structural features in the field. Fast pathways are discussed in the context of major tectonic structures and the smaller scale fracture networks at Yucca Mountain, focusing on the manner in which these structural features establish a framework for flow paths. The report (a mid-year progress report) emphasizes those aspects of the fast pathway studies that will continue to be the focus of the joint LANL/USGS effort, culminating in the development of a conceptual model for fast pathway distribution at Yucca Mountain and in recommendations as to how the resulting model can be incorporated into site-scale flow and transport models.

Geologic mapping in the ESF was accomplished as follows: (1) full-periphery geologic mapping was completed to station 76+60; (2) detailed line survey at the heading was completed to station 76+65.33, (3) stereophotography was completed at the heading to station 76+60, (4) detailed line surveys were completed in the cross-over drift and the heated drift of Testing Alcove #5, and (5) full-periphery geologic mapping was completed in the heated drift of Testing Alcove #5. Project geologists participated in a meeting designed to provide guidelines for geologic mapping in the potential repository.

Project personnel continued preparation of papers on site stratigraphy, site structural geology, and fracture characteristics for inclusion in the Site Description report.

Seismotectonic Studies

Formal elicitation of experts' interpretations regarding seismic source characterization has been completed for preliminary calculations of seismic source geometry and potential earthquake magnitudes and recurrence rates. The calculations team will

present the preliminary results of seismic source characterization to the experts for sensitivity analyses and feedback discussions at a workshop scheduled in April. The ground motion experts will also present their interpretations at the April workshop, although actual ground motion calculations are not expected to be completed until sometime in May. Preparation of the probabilistic seismic hazard analysis report is continuing, and workshop discussions and summaries are incorporated as they are completed.

Work toward evaluation of tectonic scenarios for performance assessment included review of numerous relevant documents and data sources. Three days were spent in the field investigating structural and stratigraphic features that are deemed important to these evaluations.

Project personnel continued to prepare sections for the Site Description report on subjects covering regional geologic setting (structure and stratigraphy), seismicity and seismic hazards, surficial geology and erosion, and tectonic models. Several of the investigators were also closely involved in activities and plans related to the workshops for probabilistic seismic hazard analyses.

WBS 1.2.3.3 HYDROLOGY

Regional Hydrology

Analysis and interpretation of regional precipitation data continued. Data packages for the rain-wedge and tipping-bucket datasets have been submitted, completing **milestone SPH21IM4 [Memo to TPO: Meteorological Data FY96 to RPC/TDB]** on March 14. Transfer of 14 tipping bucket precipitation stations to SAIC had been previously completed. Submittal of three data packages ("FY96 Site Meteorology Data: Relative Humidity, Temperature, Wind Speed, Wind Direction, and Net Solar Radiation from 2 Weather Stations in the Yucca Mountain Area for October 1 to December 3, 1995," DTN: GS970108312111.001; "Precipitation data from the non-recording gage network at Yucca Mountain, Nevada, for water year 1995 (October 1, 1994 to September 30, 1995)," DTN: GS970108312111.002; and "Precipitation Rate Measurements from 11 Locations at Yucca Mountain, Nevada, 1994 to 1996") were completed as part of this milestone.

Collection of site streamflow data continued during the period. Discharge and precipitation records for the three recording streamgage sites on Fortymile Wash have been computed, checked, and reviewed, and 1996 Water-Year (WY96) records were submitted to the Nevada District Data Section for final tabulation and publication in the annual data report. Due to the recent winter floods which occurred in the Reno and Carson City areas, Data Section staff were reassigned to assist in the collection and processing of hydrologic data associated with the flooding. The District's annual report has been delayed until the end of June, but data have been released for Project use.

The data records package for streamflow and precipitation data collected during WY96 for the three recording streamgage sites on Fortymile Wash was submitted to the RPC/TDB on March 14. Completion of this activity fulfills **milestone SPH22DM4 [Memo to TPO: Subm FY96 Data to RPC/TDB]**. Streamflow and precipitation data collected through February have been compiled and stored in project files. During the month, routine maintenance was made on the three recording streamflow gages along Fortymile Wash. Project staff kept vigilance during the reporting period for potential precipitation and runoff within the southern Nevada area. Runoff was neither observed nor reported during the period for the three gages.

In work on the regional saturated-zone synthesis report, the regional hydrogeologic framework model received two technical reviews and was submitted to DOE on March 14, completing this activity and **milestone SPH23DM4 [Memo to TPO: Final Hydrogeo Framewrk Data to RPC]**.

Work continued on the draft text and illustrations for the regional synthesis report, and discussions were held concerning the logistics for completion of illustrations. About 75% of the text has been written.

In unscheduled work, staff participated in a three-day workshop on future goals and directions for ground-water modeling in the USGS, March 18 through 20. Although there is no specific activity for continuing model simulations, simulation of past and future climate scenarios has been continuing, and significant progress is being made. Post-processing work has been required to aid in interpretation. Currently, work is being done on a method to automatically compare model-predicted discharge areas with those regions previously believed to be discharge areas.

Unsaturated-Zone Hydrology

Efforts continued on the unsaturated-zone numerical infiltration model. Work was completed on developing a transfer function for using results from the Global Climate Model to estimate recharge and infiltration in the Yucca Mountain region. A memo was written to the TPO describing these results, satisfying the requirements for **milestone SPH22FM4 [Memo to TPO: Transfer Functions Precipitation/Infiltration of Numerical Model]**, which was completed on March 14. Work also was completed on the development and refinement of the numerical model of shallow infiltration.

Preparation of the Main Drift Hydrology report was completed to fulfill Level 3 **milestone SPH223M3 [Main Drift Hydrology Report]** on March 14. The report received technical, QA, and data review and was forwarded to DOE. The report contains pneumatic-pressure, temperature, and water-potential data from four instrumented boreholes along the Main Drift of the ESF. These data are being used in the 3-D site-scale model to characterize flow in the UZ and imply limited areal extent of the perched water zone in encountered in borehole SD-12. Temperatures in all but the

deepest Topopah Spring Tuff instrument station have reversed to a cooling trend since the onset of tunnel-induced disturbance. Tunnel interference effects have been observed only on the footwall side of the Ghost Dance fault zone. Within the Topopah Spring welded hydrogeologic unit, the imbition capacity of the matrix is low, but within the Tiva Canyon hydrogeologic unit, matrix suctions are high and result in an unsaturated environment less conducive to deep fracture flow.

Monitoring data from instrumented UZ boreholes in the main drift of the ESF and other locations were synthesized in a memorandum emphasizing pneumatic and hydrogeological properties of geologic structures associated with the boreholes (Level 4 **milestone SPH22IM4 [Memo to TPO: Synthesize UZ monitoring data from main drift of ESF]**). This activity was completed on March 14.

A memorandum was completed to fulfill Level 4 **milestone SPH22KM4 [Memo to TPO: Results of Matrix Hydro-Prop determinations]**. The memo presented interpretations based on analyses of matrix-properties data collected during the period from October 1, 1996, to January 17, 1997. Analyses and interpretation were based on 1) a study conducted in the main drift of the ESF to assess the spatial variability of properties within the middle nonlithophysal unit of the Topopah Spring Tuff (Tptpmn); 2) samples collected from various alcove boreholes; 3) samples collected from the borehole intersecting the Ghost Dance fault in Alcove #6; 4) analyses done to correlate hydrologic properties with measured mineral percentages (from LANL) on borehole core samples; and 5) measurements of unsaturated hydraulic conductivity using the ultra-centrifuge.

A memorandum was completed on March 11 detailing compilation and submittal of data from hydrologic property measurements made in the ESF during the period from October 1996 through January 1997, in fulfillment of Level 4 **milestone SPH22LM4 [Memo to TPO: Matrix-Hydro-Prop Compl pkg to RPC]**. Completed data packages include the following: (1) DTN: GS970108312231.001, "Physical properties and water content calculated from relative humidity: dried core samples from ESF alcove boreholes ESF-AL#2-HPF#1, ESF-BRFA-HPF#2, ESF-AL#3-RBT#1, ESF-AL#3-RBT#4, and ESF-AL#4-RBT#1; (2) DTN: GS970108312231.002,: "Physical properties of surface samples from the ESF Main Drift (29+00 m to 57+00 m)"; and (3) DTN: GS970208312231.003, "Physical properties, water content and water potential on samples from boreholes ESF-NAD-GTB#1 and ESF-NAD-GTB#1A from Alcove 6 in the ESF."

Monitoring of selected boreholes and compilation of data continued during the period. Borehole data from NRG-7a, UZ#4, UZ#5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived to optical disk on a routine basis throughout the month. Daily EKES files were checked for any shelter activity. Sensor readings were checked daily as well for unusual occurrences, and any statistical

outliers were flagged. Data packages were submitted in completion of Level 4 **milestone SPH22NM4 [borehole instrumentation records and data through 31 January to RPC]** on March 14. Eight Druck pressure transducers and four thermistors were calibrated for the ESF air-permeability (air-K) testing program. A malfunctioning computer and Hart Water Bath were replaced on thermistor calibration rack #8. Monitors, video cards, and other computer components were swapped in order to get one fully-functional pressure transducer and one thermistor calibration rack operational. Two functional computers are available as spares for these two racks;

most other computer equipment in the Cal Lab is not functional, and may not be repairable because of obsolescence.

Several trips were made to field sites for routine generator maintenance and to correct generator problems, and to exchange UPS battery packs at SD-12 (possibly degraded due to generator problems). Expectation is that batteries at NRG-7a will last another 6 to 10 months, and those at the other field sites 18 to 40 months, depending mainly on the number of generator failures. Eight site visits were made to correct data acquisition-related problems.

Permeability measurements were conducted on samples from the systematic sampling of the main drift in the ESF as part of the broad effort to evaluate matrix properties of unsaturated tuffs as constraints on UZ flow models. Samples have been requested from Alcove 7, the south Ghost Dance alcove. Most of the available samples show flow properties too low for measurement of permeabilities using the present instrumentation and will be processed using the high-pressure permeameter which is currently under development. Prototype methodology for the steady-state centrifuge, with which unsaturated hydraulic conductivity measurements will be made, as well as moisture-retention curves, are still being developed. Revisions to the technical procedure for this method continued with incorporation of technical review comments.

USGS staff provided discussion of spatial distribution of infiltration to engineering staff in order to establish a baseline understanding of the potential for spatially variable flux at the repository level as a guide to design details. USGS milestone report 3GUI623M, "Conceptual and numerical model of infiltration for the Yucca Mountain area, Nevada," was provided as well.

The current phase (through January 1997) of ESF air-permeability and hydrochemical testing was completed. All data collected through the end of January have been analyzed, interpreted and presented in a report to the TPO as required to meet Level 4 **milestone SPH35EM4 [Memo to TPO: Tech Anal/Interp air-k and hydrochem in ESF]**, completed on March 14. The interpretations of this memo were accompanied by submittal of data packages to the RPC in completion of **milestone SPH35FM4 [Memo to TPO: Submit air-k / hydrochem testing data to RPC]**, also completed on March

14.

Newly initiated field estimation of *in situ* percolation flux across the repository horizon was begun during the period. Evaluation of instrumentation for developing field measurement of water potential and water content using two new time-domain reflectometry (TDR) systems and heat dissipation probes (HDP) was started. Single sensors for each type of TDR will be ordered for field evaluation in April. The manufacturer will provide technical consultation and additional monitoring instrumentation for the evaluation phase of this work.

Temperature and relativity humidity data from four sites in the ESF collected between October 1, 1996, and January 31, 1997, have been assembled, reviewed, and submitted to the RPC and TDB. The data package "Moisture Monitoring in the ESF, October 1, 1996 to January 31, 1997" (DTN: GS970208312242.001) represents completion of this Level 4 **milestone SPH22RM4 [Memo to TPO: Data Collected thru Jan 97 to RPC]**. A further memo to the TPO discussing analyses and interpretation of data collected in the ESF between October 1, 1996 and January 31, 1997 was completed and submitted to the TPO. This Level 4 **milestone SPH22QM4 [Memo to TPO: Results analyses/Interpret thru Jan 97]** has been completed. Collection of temperature and relativity humidity data continued at four sites in the ESF. Wind speed data are currently being collected at two locations (near Alcoves 3 and 4). Barometric pressure, temperature and relative humidity are being collected in Alcove 4 and near station 70+50 (meters). Collection of data from four heat-dissipation probes in Alcove 3 continued.

A project designed to preserve the *in situ* water content of selected sites in the tunnel continued. Plastic sheets (1.5 X 1.5 m) are being attached to the tunnel wall (below the spring line) using nails and silicon sealer. These selected locations may be the site of future sampling and/or instrumentation locations. To date approximately 43 pieces of plastic have been installed. As the TBM advances, additional plastic will be installed.

Sets of tensiometer and heat-dissipation probes continued to monitor the dry-out of the tunnel wall. To date, a total of eight tensiometers and eight heat dissipation probes have been installed at two locations. Monitoring of the probes shows the change in water potential in the rock. The collected data are being assembled for a data package submittal.

Investigations into south-ramp hydrology have been initiated. Plastic sheets were located in key areas in the south ramp to protect the rock from water spray during mapping and from dry-out after mapping. These locations will be evaluated as possible locations for boreholes for collecting core and installing instrumentation. Tensiometers and heat-dissipation probes were installed at two locations in the south ramp to

evaluate dry-out conditions prior to drilling boreholes. Two prototype boreholes were drilled, and core was collected for laboratory analysis. Physical and chemical analyses will be conducted on core samples removed from the 2-m boreholes.

Borehole locations were sited in the PTn in the north ramp in preparation for investigation of lateral diversion in the PTn. Instrument packer designs were evaluated in the laboratory to force contact between tensiometers and heat-dissipation probes with the rock in the boreholes. These instruments will be used to measure *in situ* water potentials.

In work for the ESF drift-scale flux and niche study, the site for Niche #1 was selected at ESF station 35+66 based on the location of a shear at 35+57. Bomb pulse ^{36}Cl was found at the shear and at the Sundance Fault (station 35+98). Niche #1 will cross the shear, and boreholes will be drilled to cross the fault. This niche is designed to provide valuable insight into the hydrologic conditions of the Topopah Spring middle nonlithophysal zone (Tptpmn) in a known fast pathway.

Niche #2 was located at ESF station 35+50 based on the location of Niche #1 and measured non-bomb pulse ^{36}Cl at station 35+77. Repository design required that Niche #2 be south of Niche #1. The rock appears typical of the Topopah Spring middle nonlithophysal (Tptpmn) unit. This niche was designed to provide insight into hydrologic conditions of the Topopah Spring middle nonlithophysal zone in a known non-bomb-pulse pathway.

Studies of hydrochemistry in the UZ continued during the period. Level 4 **Milestone SPH22XM4 [Memo to TPO: Pkg of Chem Anal thru Jan 97 to RPC]** was completed on March 14 with finalization of the data package for tabulated chemical analyses. Isotope investigations continued with eight ESF pore water samples from ESF alcoves counted for tritium concentration, and the tritium data were reduced and recorded in the tritium data base. Collection of data from samples from the SD-12 borehole was completed as of March 14. Water collection by compression and distillation methods during March was recorded in the water-collection database. Pore water from nine SD-9 core samples (six from shallow depths, three from the saturated zone) was collected using one-dimensional compression. CO_2 was distilled from eight SD-9 and SD-12 core samples, and the acidification part of the distillation method was performed on two of the core samples. The extracted CO_2 will be analyzed for carbon isotopes, and the extracted pore water will be analyzed for tritium. Four CO_2 gas samples for shipment to Beta Analytical Laboratory for carbon-isotope analysis. The CO_2 samples were extracted from SD-9 cores using the distillation and acidification methods.

Interpretations of the results of chemical and isotopic data collection through January were drafted and sent for colleague review and further review by Team Chief in early March. The Level 4 milestone memo was written and filed with TPO on March 14

(milestone SPH22WM4 [Memo to TPO: Rslts Chem Analysis Thru Jan 1997]).

In geochronological studies, five samples from TSw and CHn hydrogeologic units were degassed and acidified to extract CO_2 for ^{14}C age determinations on pore water.

In unscheduled work, four spring-water samples, collected from Coffers Ranch, Nevada, were distilled and analyzed for tritium concentration. Preparations for inserting the Seamist packer liner into borehole UZ-14 were completed. Liner insertion is expected to be conducted the week of April 7.

Saturated-Zone Hydrology

Processing of saturated-zone data obtained at the C-hole complex between July and December 1996 continued during the period. Pressure and water-level data collected at the C-holes and nearby wells UE-25 ONC-1, USW H-4, UE-25 WT#14, UE-25 WT#3, and UE-25 p#1, had been processed for submittal as one data package and reviewed during February 1997; the package was submitted to the Records Processing Center (RPC) and the Technical Data Base (TDB) during the last week of March 1997.

A memo describing the tracer testing in UE-25 c#1 and c#2 was completed on March 14 as Level 4 **milestone SPH23NM4 [Memo to TPO: results of tracer tests July through December 1996]**. This memorandum had been planned to describe the USGS purely-convergent tracer test with Pyridone injection into UE-25 c#1 and 2,6, Difluoro-benzoic acid (2,6 DFBA) injection into UE-25 c#2 through 1996, but delays required modification of the memo. The test was finally initiated in January 1997. The memo described analysis of (recent) previous tracer experiments at the C-hole complex by USGS and LANL, including pumping tests of the Bullfrog Tuff at c#3, predictions for breakthrough of tracer materials in the convergent test, and preliminary interpretations of the current tests. During February and March 1997, the concentration of 2,6 DFBA steadily decreased, forming a very clearly-defined breakthrough curve. On March 14, the 2,6 DFBA test had been in progress for 63 days. No Pyridone has been detected to date. In order to locate the Pyridone plume, a two-part plan was developed. The first step required removal of the tracer-injection tubing from UE-25 c#2 in order to obtain bailed samples of fluid from the packed-off Lower Bullfrog interval. This would ascertain whether the Pyridone had traveled along preferential pathways from UE-25 c#1 to UE-25 c#2 formed by fracture zones representing the intersection of the Paintbrush Canyon (or Midway Valley) fault with the vertical plane passing through these two boreholes. Secondly, recirculation of a portion of the water pumped from UE-25 c#3 into UE-25 c#1 was planned, to speed the migration of the Pyridone plume, which is presumably between UE-25 c#1 and UE-25 c#3.

The USGS proposal to conduct hydraulic and tracer tests in the low-transmissivity Prow Pass Tuff at the C-hole complex was approved in January 1997, and plans were

established to stop the current 2,6,DFBA / Pyridone test on July 1 and to start reconfiguration of the C-holes to enable testing of the Prow Pass. Planning and design of the down-hole mixing and sampling system that will be used for the *in situ* mixing of the tracer in the injection zone, and for obtaining samples of the injection-zone fluid at the surface, continued during the period. A meeting was held on March 24 with representatives from Baker Oil Tools, Inc., who presented a down-hole mixing and sampling system that Baker previously had rented to Sandia National Laboratory (SNL) to conduct tracer tests at the WIPP site near Carlsbad, New Mexico.

Processing of data obtained since January 1997 at the C-hole complex continued. Concentrations of 2,6 difluorobenzoic acid as a function of time, from the tracer test conducted between January and March 1997, will be submitted as one data package. The pressure and water-level data collected at the C-holes and nearby wells UE-25 ONC-1, USW H-4, UE-25 WT#14, UE-25 WT#3, and UE-25 p#1, will be processed for submittal as another data package.

Efforts in support of site-scale potentiometric-level monitoring were ongoing. For the month of March, 31 manual measurements were completed. Five zones in four wells were monitored hourly with transducer measurements. Monitored wells include UE-25 WT#3, UE-25 WT#14, UE-25 p#1, and USW H-4 (upper and lower intervals). Hourly monitoring of the lower interval of USW H-4 was discontinued on March 25. Water-level measurements were made at numerous sites during the month, including USW WT-1 and USW WT-2 on March 3; UE-25 WT#4 and UE-25 b#1, upper interval, on March 4; USW H-1 (tubes 1, 2, 3, and 4) on March 5; J-11, J-12, and J-13 on March 6; UE-25 WT#6 and UE-25 WT#16 on March 10; UE-25 WT#13, USW G-2, and UE-25 WT#15 on March 11; USW H-3, upper and lower intervals, and USW H-5, upper and lower intervals, on March 12; USW VH-1, USW WT-7, USW WT-10, USW WT-11, and USW H-6 (upper and lower intervals) on March 18; USW H-4, upper and lower intervals, on March 25; and UE-25 WT#3, UE-25 WT#14, and UE-25 p#1 on March 26. Transducers were calibrated at several sites on March 25 and 26. In some cases, transducers were removed for water-level measurements, calibrated and returned to the well. A new transducer was installed at UE-25 WT#14. Data were downloaded from 21X recorders at several wells, including USW H-4 (upper and lower zones), UE-25 WT #3, UE-25 WT #14, and UE-25 p#1. Staff participated in an audit of field and technical procedures on March 5.

In a newly started activity to measure eH and pH in WT holes, USGS personnel met to discuss a variety of sampling and hole-selection issues for eH, pH, and hydrochemical analyses attendant with this new activity. USGS personnel are exploring possible software for use in developing a spatial data base of hydrochemical and isotopic data as well as key extensive and intensive parameters to be included in the data synthesis.

In a recent trip to Sweden to attend an SKB workshop on the geochemistry and stability of saline waters in the circum-Baltic region, USGS staff discussed the construction and deployment of a Finnish-designed tube sampler with Runarr Blomqvist (Finnish Geological Survey), Marcos Laaksoharju (Intera) and Shaun Frape (University of Waterloo, Canada). The tube sampler is a simple device that can be used for discrete sampling in wells that have previously been purged and have come into equilibrium with the aquifer. The USGS is exploring the possibility of using this sampler in some of the H holes at Yucca Mountain.

Work continued on preparation of potentiometric-surface maps that will be used for SZ flow-model calibration and for the Site SZ flow-model synthesis report. Analysis of water-level fluctuations to estimate hydraulic properties of saturated-zone rock units also continued.

Refinement of the grid spacing of the hydrogeologic framework model to 250 meters was completed. The model was regridded and visually inspected, but formal review has not yet been done. The updated model, containing three different upper surfaces corresponding to three interpretations of the potentiometric surface of the site model area, was sent to LANL for generation of the site flow model mesh. Grid generation is proceeding, and although these are different data sets, there are no new operational details, and grid generation is expected to be a smooth process. Some delays were encountered at both LANL and Colorado School of Mines when new operating systems and revisions of the Stratamodel software were installed. Software QA documents for Stratamodel were submitted to the USGS QA office, and the software was determined to be exempt for anticipated applications at Yucca Mountain. Planning was done for a new Stratamodel scenario in which the top of the model will be the potentiometric surface but, unlike other models, vertical subdivisions within the units which contain hydraulic-head observation points will be specified. Without this subdivision, model elements may have thicknesses spanning the thickness of the model.

Calibration efforts for the site flow model continued. Numerous (>50) simulations were run using an older mesh for optimal acquisition of steady-state hydrostatic conditions. A routine to extract nodal coordinates from an arbitrary node list was developed. Also developed were routines to process and sort pressure results from the flow, heat, and transport simulator, FEHMN, and to automatically edit lists of control files used in the execution of FEHMN. Specific-capacity data from wells at and in the vicinity of Yucca Mountain were processed using a method developed by Czarnecki and Craig (1985) to yield transmissivity values.

In a significant achievement toward calibration of the flow model, boundary-condition preprocessors to FEHMN were developed. The preprocessors enable operators 1) to reference fluid-pressure boundary conditions at the water table to nodal elevations within the model; and 2) to project hydrostatic-pressure boundary conditions based on

the referenced water-table boundary conditions down and along the outside faces of the model domain. These specifications resulted in a stable, rapidly converging flow and heat simulation using FEHMN for both homogeneous and heterogeneous permeability distributions using an early version of a three-dimensional, irregular finite-element mesh consisting of 3,223 nodes and 15,964 tetrahedral elements. This mesh was constructed such that its top represented a smoothed rendition of the potentiometric surface located approximately 100 m above the actual potentiometric surface; the bottom of the mesh paralleled this top surface. The actual potentiometric surface was represented by nodes that were added within the mesh. However, for the testing of the boundary-condition preprocessors, the smoothed top surface was used as the potentiometric surface so that fully saturated conditions could be maintained. Subsequent model meshes are designed with the water table representing the top of the model. Vector fields of flow for these simulations developed using an Advanced Visualization System network show well-behaved magnitude and direction.

Work continued on writing various sections of the draft saturated-zone synthesis report. Assignments as to required sections from co-authors were made, and a list and description of figures was compiled. Staff continued work on revisions to a table of aquifer hydraulic characteristics.

In support of oversight activities, follow-up discussions had occurred in February 1997 with the M&O and DOE regarding M.J. Umari's (USGS) presentation to the NWTRB on January 29. There was disagreement about the placement of a interpreted northwest-striking fault that hydraulically connects the C-hole complex with UE-25 ONC-1 and USW H-4 in Antler Wash, which had been inferred from the shape of the cone of depression resulting from pumping UE-25 c#3. The NRC had also inquired about the matter. During March, these disagreements were ironed out. On March 19, a conference call was conducted with P. Justus of the NRC, who declared the matter closed.

Work on the viability-assessment of the SZ flow-model sensitivity analysis continued with investigations of alternate conceptual flow models. Water-level measurements were made at site NT-1, near the Funeral Mountains. A difference in head of about 12 m (40 ft) was found between the upper and lower piezometers indicating that the alluvial and carbonate parts of the flow system are not well connected. A draft of a report documenting results of aquifer testing at well USW G-2, a critical site in looking at alternative conceptual models of flow at the large hydraulic gradient, was completed. Supervisor's review of the report was completed, and the report is being revised in preparation for colleague review.

Planning continued with SNL for a workshop that will address critical issues on SZ flow modeling and the transfer of information obtained in process modeling for use by PA

modelers. Staff also prepared presentations and input to the Abstraction/Testing Workshop for PA, scheduled for April 1 through 3.

In unscheduled work, staff participated in a workshop on future directions for ground-water modeling in the USGS, March 18 through 20, and attended a Symposium on the Application of Geophysics in Environmental and Engineering Problems, March 24 through 26. Staff also participated in the annual meeting of the USGS Borehole Geophysics Advisory Group, March 27.

WBS 1.2.3.6 CLIMATOLOGY and PALEOHYDROLOGY

In studies of lakes, playas, and marshes for climatic history, additional samples of Owens Lake core OL 92/2 have been counted to provide higher-resolution paleoclimate analyses back to 500 ka than are currently available. Count data have been entered to spreadsheets for graphic and numeric analysis. The final database for diatom analysis of the Owens Lake core will contain about 1000 samples with a temporal resolution of 500 to 750 years for the past 500 kyr. Diatom data, along with the ostracode data, provide the means with which to estimate the rate of change and timing (duration) of regional climate change. Rate of change and timing are key factors sought by the NRC in their deliberations about the future behavior of the potential repository.

Collection of ostracode data from Owens Lake is complete. The final data set includes about 1400 samples with a temporal resolution of about 500 to 750 years for the past 500 kyr. Work has begun on study of ostracode morphological change through long Quaternary lake records in order to document within-species range changes that may enhance the paleoclimatic resolving power of the ostracode record.

Several efforts were ongoing. Preparation of diatom samples from Owens Lake cores and from analog sites continued during the period. Picking of ostracodes from prepared sediment residues continued, for inclusion in the baseline data set. Collection of ostracode data from the Las Vegas and Indian Springs Valley deposits for stable isotope analyses also continued for study of ground-water flow at critical sites. Aquatic molluscs were picked from sediment residues of samples from the ostracode baseline data set. The molluscs will be identified (by Saxon Sharpe at the Desert Research Institute) and used to identify the source(s) of past discharge at sites located in Crater Flat, along Highway 95, and near the Amargosa River.

Climate staff met with 3-D regional hydrologic framework modelers to discuss preliminary output from the model. Staff provided a written synopsis of the climatic context of paleodischarge and paleohydrologic history for the local Yucca Mountain area to accompany the paleodischarge model report.

In support of the paleoclimate synthesis report, staff attended the PISA Climate Site Description/Integration meeting with DOE and M&O officials in Denver. General plans

for the climate chapter were discussed including anticipated content of the paleoclimate chapters.

Work continued on several manuscripts. One describes the common ostracode taxa from the wetland sediments in the Yucca Mountain area. This manuscript once complete will provide the key documentation of paleontological data used in the interpretations of past climate and past discharge. A paper titled "Reliable late-Pleistocene stratigraphic ages and shorter ground-water travel times from ^{14}C in fossils snails from the southern Great Basin," by Bob Brennen and Jay Quade, will be published soon in *Quaternary Research*. A manuscript titled "Paleoenvironments of black mats in the southern Great Basin," by Jay Quade, Richard M. Forester, William L. Pratt, and Claire Carter, has been reviewed by the USGS, revised, and submitted for Director's Approval. Staff continued work on a manuscript that treats the climate and hydrological states that existed in the Las Vegas and Indian Springs Valley during the Pleistocene. Three manuscripts were recently published in Geological Society of America *Special Paper* 317: "A diatom-paleohydrologic record of climate change for the past 800 ky from Owens Lake, California," by J. Platt Bradbury; "Ostracodes in Owens Lake Core OL-92: Alternation of saline and freshwater forms through time," by Claire Carter; and "Synthesis of the paleoclimate record from Owens Lake Core OL-92" by George I. Smith, James L. Bischoff, and J. Platt Bradbury. Each of the above manuscripts fulfills a portion of milestone SPC332M4, submittal for publication of parts of updated FY96 climate synthesis report, due in August.

Evaluation of paleo ground-water discharge continued with staff attendance at the Devil's Hole Workshop on March 26. Staff also met with representatives from the USGS Las Vegas Subdistrict and the Nevada District (Carson City), Lawrence Livermore National Laboratory, and the Desert Research Institute to discuss potential new work on the Oasis Valley ground-water system with particular reference to flow from Pahute Mesa westward towards Oasis Valley. Although this work, if funded, will be conducted under the DOE Environmental Restoration Program, the results will have direct bearing to furthering the understanding the regional flow systems including that of Yucca Mountain.

Level 4 **milestone report SPC23FM4** "Geochronology of fracture fill material, ESF, and estimated past water fluxes" was delivered on schedule to the USGS TPO on March 14. The report contains new analyses completed since August 31, 1996, including U-series, ^{14}C, and U-Pb ages for calcite and opal, stable-isotope and strontium data for calcite, and strontium isotope data for pore water salts extracted from SD-7 core samples. The new U-Pb data allow complete characterization of the depositional range of the calcite-opal deposits and temporal calibration of the stable and strontium isotopic records contained within these minerals. Deposition in fractures and cavities appears to have commenced 2 to 4 million years after emplacement of the host tuffs and continued either episodically or continuously until relatively recently. Long-term growth

rates were remarkably constant over the past 8 million years for four samples that have been analyzed in detail. These data indicate that the unsaturated-zone hydrologic system has remained remarkably stable during this interval and that the system will likely be stable during the functional life span of the potential repository. Additional detailed analyses will be conducted on other samples to test this hypothesis. Long-term rates of mineral growth have remained constant to within a factor of 1.5 for a given sample site or a factor of 4 among sites over the history of the mountain in spite of wide ranges in climatic conditions. The implications with regard to a possible system buffered from climate change require further investigation. Collectively, the new age and isotopic data support a UZ flow model involving some lateral diversion of percolation by the PTn, and as a result, lowered fluxes in much of the ESF main drift. These implications can be comprehensively tested in the proposed east-west drift which will access a part of the repository block that may not have been geologically characterized by the ESF.

Geochronological and isotope-tracer studies continued during the period. Microsampling of calcite and opal specimens continued for U-series, ^{14}C and U-Pb dating as well as for stable and strontium isotopic analyses. An abstract entitled "Strontium isotopes in pore water from the unsaturated zone at Yucca Mountain, Nevada," by B. Marshall, K. Futa, and Z. Peterman, was submitted to the 1997 Goldschmidt Conference to be held in Tucson AZ.

Staff (B. Marshall, L. Neymark, Z. Peterman, and J. Whelan) responded to a request from the M&O for assistance in addressing allegations in an article by Mary Manning in the Las Vegas Sun concerning the hydrologic significance of dating calcite and "zircon" in fractures at Yucca Mountain. The following response was prepared jointly with the M&O (M. McGraw):

> "The U.S. Geological Survey has an active program to determine the age and origin of the calcite at the surface and in fractures and cavities within Yucca Mountain. The results from age studies in the ESF indicate that calcite deposition within the rock mass is a slow and relatively constant process that has spanned the past 10 million years. Ongoing chemical and isotopic studies indicate that calcite is formed at low temperature from rain water trickling down from the surface along fractures within the volcanic rocks. There is no chemical, mineralogical, or isotopic evidence to suggest that the [potential] repository horizon was ever flooded by water in the past.
>
> USGS and other Project scientists are well aware of the presence of zircon in the surficial calcite deposits including near-surface fracture fillings. All zircon at Yucca Mountain is of igneous origin. This mineral is ubiquitous in trace amounts in the Miocene volcanic rocks and younger volcanic ashes that were deposited in the region. Zircon is a very hard mineral which is highly resistant to abrasion

and weathering. It is transported by both wind and water along with silt and sand particles which fall into cracks and crevices where the particles are eventually incorporated into calcite deposits. Therefore, the presence of zircon in the deposits does not indicate high formation temperatures for the enclosing material. Previous research conducted by the USGS, Los Alamos National Laboratory, and by scientists of the University of Utah at Trench 14 indicated that the calcite deposits were formed by low-temperature pedogenic processes rather than from upwelling fluids. The National Academy of Sciences in their 1991 report concurred with these conclusions.

The static water level at Yucca Mountain is roughly at 2400 ft above mean sea level. A rise of 300 to 450 ft, as indicated by Frankie Sue Del Papa, is consistent with evidence of past rises first determined by Yucca Mountain Project scientists. [A] cross section of the [potential] repository and the static water level. . .[indicates] that a 300- to 450-ft rise would not flood the repository and would therefore pose no direct threat to the ability of the natural and engineered systems to contain and isolate the waste."

WBS 1.2.3.9 SPECIAL STUDIES

Preparation of PISA Chapter 2.3 (Geological Systems) continued. The Principal Investigator (PI) and six others from the USGS attended a meeting with DOE and the M&O on March 18 and presented a detailed description of contents of the site structure subsection. USGS provided a rough draft (about 80% complete) of that subsection to other chapter authors. A draft (about 90% complete) on the regional geology and stratigraphy and a similar draft for the tectonic model were also provided to co-authors of the geology chapter.

The geological-systems PI met with DOE and the M&O on March 5 to discuss implementation of the Web-based Information System (WBIS); a management plan for this effort was also reviewed.

The geological-systems PI worked with M&O personnel on problems with reference format and accession numbers. Accession numbers for references identified thus far by contributing authors from the USGS (around 400 references) have been identified. As many as one-third of these references lack accession numbers.

Preparation of the PISA Hydrology chapter sections continued during the period. A revision of the PISA Content Guide has redesignated the Hydrology Chapter, formerly Chapter 2.4, as Chapter 2.5. Proposed revisions of the Content Guide were evaluated. The revisions would have required descriptions of the applications of hydrologic findings to the resolution of the Nuclear Regulatory Commission's "Key Technical Issues," to confirming the hypotheses in the DOE's Waste Containment and Isolation Strategy, and to additional transport and engineering considerations. It was

recommended that these changes to the existing scope should not be imposed. Authors continued preparation of draft sections of the hydrology chapter. **Milestone SPH394M4 [Memo to TPO: Rev Drft PISA Chap 2.4]** was completed on March 13.

The PISA climate/meteorology chapter outline was revised to incorporate new subchapters dealing with paleoclimate. The new subchapters will systematically target the drivers of past and future climate, their actual (past) and probable future impact on the timing and rate of change of regional climate, the magnitude of climate change within the Yucca Mountain area, and record of climate change within the Yucca Mountain UZ. Staff attended a climate chapter kickoff meeting with M&O staff. General logistics were discussed, and some items to be discussed in some subchapters were presented.

In support of Site Characterization Progress Report (SCPR) summary activities, work continued on revision of SCPR Appendix A, which is documenting differences between the site-characterization program outlined in the SCP and the current program. Revisions involve expanding the text prepared for SCPR #15 by inserting additional rationale for program changes and literature citations to support interpretations and conclusions. These revisions were made in response to review comments from M&O and DOE staff. The final section of Appendix A on the USGS Climate program was completed and submitted. It is expected that revisions will continue during the upcoming months as Appendix A progresses through the review process.

USGS input to SCPR #16 for Rock Characteristics (Geologic Framework), Geohydrology, Climate, Postclosure Tectonics, and Preclosure Tectonics was compiled, edited, and transmitted to the M&O. The input included progress and forecast narratives for 29 SCP activities encompassing 27 summary accounts. About 10 questions and comments on the SCPR #16 input were received from M&O staff within the first week after submittal of the USGS input. All questions and comments were expeditiously resolved. Revisions to the USGS input to SCPR #16 will continue during the next several months as SCPR #16 progresses through the review process.. The M&O/USGS interactive review is scheduled for April 30 through May 2, and the YMSCO and DOE-HQ reviews are scheduled for June and July, respectively. In addition, work continued on the collection and transmittal of hard copies of reports and memoranda cited as references in SCPR #16.

In unscheduled work, revisions to the text of the North Ramp UZ hydrogeology report in response to the editorial review were completed. The report was transmitted to the YMPB Reports Specialist for further processing towards approval and publication as a USGS Water-Resources Investigations Report.

In interactions with the Nuclear Regulatory Commission, USGS staff participated in a video-conference briefing by USGS Headquarters for Debra Knopman, a newly

appointed member of the Nuclear Waste Technical Review Board. The technical lead for the SCPR gave a presentation on the status of USGS studies at Yucca Mountain based on the content of the recently compiled SCPR Appendix A. Emphasis was given to unresolved uncertainties in various aspects of the Rock Characteristics, Geohydrology, and Climate programs. Of particular interest during the discussions were the densely fractured zone mapped in the repository horizon in the ESF Main Drift, the large hydraulic gradient in the saturated zone, fracture flow through the PTn and into the repository horizon in the TSw, the history of flux through the TSw recorded in fracture coatings, and future studies designed to determine the magnitude of vertical flux and lateral diversion within the PTn.

WBS 1.2.8.4.7 WATER-RESOURCES MONITORING

Modification of technical procedures (necessitated by additional sample collection, processing, and laboratory analyses scheduled during the third quarter of FY 1997) continued during the reporting period. Collection and delivery of water samples to personnel associated with the M&O's Radiological/Environmental Field Programs was completed on March 14. Equipment preparation began for collection of water samples in May.

Ground-water levels were measured at 29 sites and at one flowing well. Ground-water data collected during February were checked and filed.

In support of the FY 1997 environmental program, staff participated in USGS Headquarters and Nevada-District review of project activities on March 6. The NWIS database was checked for consistency with previously stored and reported monitoring data after the merging of USGS-NV District and USGS-ESIP databases, and inconsistencies were discussed with USGS-NV District data-management personnel. Staff attended the Devil's Hole Workshop in the Amargosa Valley on March 26 and 27. On March 31, staff prepared materials and participated in DOE's mid-year financial and technical review. Potential modifications to future data-collection activities in the immediate vicinity of Yucca Mountain (to continue satisfying requirements of the water-appropriations permit) were discussed with DOE and USGS-YMPB personnel.

Preparations for the water-resources summary monitoring report (through calendar-year 1996) continued during the period. Evaluation of electric-tape calibration data was completed. Processing and checking of pressure-sensor data collected at wells JF-3 and AD-6 were begun. Checking continued of periodic USGS water-level measurements. Water-use data for Amargosa Desert and water-level and discharge data for monitoring sites in Ash Meadows were obtained, respectively, from the Nevada State Engineer and from USFWS personnel. The initial version of the base map to be included in the summary monitoring report was modified; a revised version was received from USGS-NV District reports personnel.

USGS Level 3 Milestone Report

October 1, 1996 - March 31, 1997

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
LETTER REPORT Milestone Number: SSH13BM3	11/1/96	10/30/96	10/30/96	
LETTER REPORT Milestone Number: SSH13CM3	1/31/97	1/30/97	1/30/97	
Ltr Rpt: Geo S.R. Sta 55+00 to STA 63+47 Milestone Number: SPG42BM3	2/28/97	2/27/97	2/27/97	
Rpt Geo North/South Main Drft Sta 28+00 to55+00 Milestone Number: SPG42AM3	2/28/97	2/28/97	2/28/97	
Main Drift Hydrogeology Report Milestone Number: SPH223M3	3/14/97	3/14/97	3/14/97	

USGS Level 4 Milestone Report

October 1, 1996 - March 31, 1997

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: SS Hazards Methodologies Wrkshop Milestone Number: SPG28FM4	10/25/96	10/24/96	10/24/96	
Memo to TPO: Jan-Jun96 Perio Wtr Lvl Data to RPC Milestone Number: SPH21CM4	10/31/96	10/30/96	10/30/96	
Memo to TPO: SS Hazards Method. Wrkshop Summary Milestone Number: SPG28GM4	11/15/96	11/14/96	11/14/96	
Memo toTPO: Seis. Src. Mdls & Proponents Wrkshop Milestone Number: SPG28HM4	11/27/96	11/26/96	11/26/96	
Memo to TPO: Comp Frac Data Coll:Cal. Hills,Prow Milestone Number: SPG34M4	11/27/96	11/27/96	11/27/96	
Memo to TPO: Comp Re-Eval Priority Strat Contact Milestone Number: SPG21M4	12/13/96	12/13/96	12/13/96	
Memo to TPO: Detailed Content Outline Milestone Number: SPH391M4	12/13/96	12/13/96	12/13/96	
Memo to TPO: SS Modls & Propnents Wrkshop Summry Milestone Number: SPG28IM4	12/19/96	12/19/96	12/19/96	
Report: Mod Flow In UZ Frac Ntwk TS W-U in ESF Milestone Number: SPH21AM4	12/31/96	12/19/96	12/19/96	
Memo to TPO: Monitoring Data Apr-Sep 1996 to RPC Milestone Number: SPH22GM4	12/31/96	12/23/96	12/23/96	
Memo to TPO: GM Models and Interpret. Workshop Milestone Number: SPG28AM4	1/17/97	1/13/97	1/13/97	
Memo to TPO: Seismic Source Interp. Wrkshop Milestone Number: SPG28JM4	1/17/97	1/13/97	1/13/97	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Clim Scenarios Recvd & Sim Started Milestone Number: SPH23AM4	1/30/97	1/13/97	1/13/97	
Memo to TPO: SS Interpretations Wrkshop Summary Milestone Number: SPG28KM4	2/4/97	2/3/97	2/3/97	
Memo to TPO: GM Modls & Interpret Wrkshp Summry Milestone Number: SPG28BM4	2/6/97	2/5/97	2/5/97	
Memo to TPO: Sub Bh Video Frac Db to GENISES Milestone Number: SPG211M4	2/28/97	2/27/97	2/27/97	
Memo to TPO: Jul-Dec96 Perio Wtr Lvl Data to RPC Milestone Number: SPH21BM4	2/28/97	2/7/97	2/7/97	
Memo to TPO: Annotated Outline Site SZ Synth Rpt Milestone Number: SPH23VM4	2/28/97	2/11/97	2/11/97	
Memo to TPO: Summary of Meetings with PA Mdlrs Milestone Number: SPH25CM4	2/28/97	2/13/97	2/13/97	
Memo to TPO: Rslts New Age & Iso Determinations Milestone Number: SPC23FM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: 1995 Water-Level Data Milestone Number: SPH21FM4	3/14/97	2/13/97	2/13/97	
Memo to TPO: Meteorlogical Data FY96 to RPC/TDB Milestone Number: SPH21IM4	3/14/97	3/14/97	3/14/97	
Publish Sel Streamflow & Precip Data for FY96 Milestone Number: SPH22CM4	3/14/97	6/30/97		
Memo to TPO: Subm FY96 Data to RPC/TDB Milestone Number: SPH22DM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: Trans Funct Precip/Infil of Num Mdl Milestone Number: SPH22FM4	3/14/97	3/11/97	3/11/97	
Memo to TPO: Synth UZ Mont Data fm MD of ESF Milestone Number: SPH22IM4	3/14/97	3/14/97	3/14/97	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Reslt of Matrix-Hydro-Prop Determin Milestone Number: SPH22KM4	3/14/97	3/11/97	3/11/97	
Memo to TPO: Matrix-Hydro-Prop Compl Pkg to RPC Milestone Number: SPH22LM4	3/14/97	3/11/97	3/11/97	
Memo to TPO: Monitoring Data Thru Jan 97 to RPC Milestone Number: SPH22NM4	3/14/97	3/7/97	3/7/97	
Memo to TPO: Rslts Analyses/Interpret thru Jan97 Milestone Number: SPH22QM4	3/14/97	3/11/97	3/11/97	
Memo to TPO: Data Collected thru Jan 97 to RPC Milestone Number: SPH22RM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: Rslts Chem Analysis Thru Jan 1997 Milestone Number: SPH22WM4	3/14/97	3/10/97	3/10/97	
Memo to TPO: Pkg of Chem Anal thru Jan 97 to RPC Milestone Number: SPH22XM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: Final Hydrogeo Framewrk Data to RPC Milestone Number: SPH23DM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: Test Data for July-Dec 1996 to RPC Milestone Number: SPH23MM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: Results of Tests Comp Jul-Dec 96 Milestone Number: SPH23NM4	3/14/97	3/14/97	3/14/97	
Memo to TPO: Tech Anal/Interp Air-Perm & Hydroch Milestone Number: SPH35EM4	3/14/97	3/13/97	3/13/97	
Memo to TPO: Subm Air-Perm/Hydrochem Tstg to RPC Milestone Number: SPH35FM4	3/14/97	3/14/97	3/14/97	
Memo to TPO:Elicit of Experts Interpret Complete Milestone Number: SPG28LM4	3/20/97	3/20/97	3/20/97	
Memo to TPO: Comp QA Eval pre-1992 Bh Geo Logs Milestone Number: SPG212M4	3/28/97	3/26/97	3/26/97	

Participant USGS

Prepared - 04/15/97:07:46:14

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

01-Mar-97 to 31-Mar-97
Page - 1
Inc. Dollars in Thousands

WBS No. - 1.2

WBS Title - Yucca Mountain Project

Parent WBS No. - 1.0

Parent WBS Title - Mined Geologic Disposal System

Element ID - 12

Statement of Work:

See the current WBS Dictionary

Cost/Schedule Performance

		Current Period					FY1997 Cumulative to Date					FY1997 at Completion		
Id	Description	BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.3	Site Investigations	990	1019	1037	29	-18	5662	5831	5555	169	276	11402	12756	-1354
1.2.5	Regulatory	43	43	40	0	3	224	224	188	0	36	504	500	4
1.2.8	Environment, Safety, and H	51	51	98	0	-47	304	304	296	0	8	612	656	-44
1.2.9	Project Management	52	52	42	0	10	312	312	268	0	44	664	618	46
1.2.12	Information Management	6	6	4	0	2	39	39	24	0	15	80	75	5
1.2.15	Support Services	146	146	135	0	11	859	859	813	0	46	1722	1717	5
Total		1288	1317	1356	29	-39	7400	7569	7144	169	425	14984	16322	-1338

Resource Distributions by Element of Cost

Fiscal Year 1997

Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	19540	19599	16166	20824	21329	20182	22106	22047	22573	22479	21615	20362	248822
LABOR	885	899	632	866	876	906	909	904	921	919	891	856	10464
SUBS	139	143	87	148	145	145	140	150	153	149	148	136	1683
TRAVEL	25	43	34	45	43	47	35	37	38	36	35	31	449
PM&E	7	6	7	5	9	6	7	6	9	7	5	4	78
OTHER	197	201	179	206	285	184	178	182	176	179	170	173	2310
Total BCWS	1253	1292	939	1270	1358	1288	1269	1279	1297	1290	1249	1200	14984

Actual Cost of Work Performed

LBRHRS	19283	18578	18523	18723	17133	18725	0	0	0	0	0	0	110965
LABOR	771	712	732	829	727	782	0	0	0	0	0	0	4553
SUBS	127	139	117	185	134	179	0	0	0	0	0	0	881
TRAVEL	11	24	61	53	42	46	0	0	0	0	0	0	237
PM&E	43	16	88	85	89	110	0	0	0	0	0	0	431
OTHER	119	129	145	158	252	239	0	0	0	0	0	0	1042
Total ACWP	1071	1020	1143	1310	1244	1356	0	0	0	0	0	0	7144

WBS No. - 1.2 -Yucca Mountain Project

Resource Distributions by Element of Cost

Fiscal Year 1997
Estimate to Complete

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	0	0	0	0	0	0	23045	23657	24443	24246	23064	21821	140276
LABOR	0	0	0	0	0	0	956	992	1018	1003	973	921	5863
SUBS	0	0	0	0	0	0	181	191	205	209	194	177	1157
TRAVEL	0	0	0	0	0	0	52	54	57	57	62	52	334
PM&E	0	0	0	0	0	0	9	51	9	7	7	1	84
OTHER	0	0	0	0	0	0	290	296	259	228	299	368	1740
Total ETC	0	0	0	0	0	0	1488	1584	1548	1504	1535	1519	9178

Resource Distributions

Fiscal Year 1997	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1253	1292	939	1270	1358	1288	1269	1279	1297	1290	1249	1200	14984
BCWP	1195	1245	1131	1353	1328	1317	0	0	0	0	0	0	7569
ACWP	1071	1020	1143	1310	1244	1356	0	0	0	0	0	0	7144
ETC	0	0	0	0	0	0	1488	1584	1548	1504	1535	1519	9178

Fiscal Year Distribution

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
BCWS	15914	14984	9432	980	0	0	0	0	0	0	0	0	41310
BCWP	15609	7569	0	0	0	0	0	0	0	0	0	0	
ACWP	15908	7144	0	0	0	0	0	0	0	0	0	0	
ETC	0	9178	9432	980	0	0	0	0	0	0	0	0	42642

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey
Date Prepared 04/15/97 08:54

MONTHLY COST/FTE REPORT

Fiscal Month/Year MARCH 1997

	CURRENT MONTH END						FISCAL YEAR		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON HOURS	PURCHASE COMMITMENTS	SUBCON COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.3	1032	14943	3276	0	848	95	11387	9110	5538
1.2.5	40	368	672	0	152	0	504	404	185
1.2.8	97	1292	0	0	0	0	612	490	296
1.2.9	42	840	168	0	58	5	664	530	269
1.2.12	4	168	0	0	0	6	80	64	24
1.2.15	133	1114	336	0	54	35	1722	1378	801
TOTALS	1348	18725	4452	0	1112	141	14969	11976	7113

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/96 - 03/31/97

		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
OG311FA1	Scientific Programs Management & Integra	15.7	16.6	12.0	21.8	62.3	32.4	0.0	0.0	0.0	0.0	0.0	0.0	160.8
1.2.3.1.1		15.7	16.6	12.0	21.8	62.3	32.4	0.0	0.0	0.0	0.0	0.0	0.0	160.8
OG312FA1	Nevada Operations/Earth Science Investig	55.0	57.4	62.9	66.3	98.9	87.7	0.0	0.0	0.0	0.0	0.0	0.0	428.2
1.2.3.1.2		55.0	57.4	62.9	66.3	98.9	87.7	0.0	0.0	0.0	0.0	0.0	0.0	428.2
*1.2.3.1		70.7	74.0	74.9	88.1	161.2	120.1	0.0	0.0	0.0	0.0	0.0	0.0	589.0
OG32211FB1	Review & Revision of Lithostratigraphy B	14.1	13.4	50.3	23.9	8.6	14.0	0.0	0.0	0.0	0.0	0.0	0.0	124.3
1.2.3.2.2.1.1		14.1	13.4	50.3	23.9	8.6	14.0	0.0	0.0	0.0	0.0	0.0	0.0	124.3
OG32212FB2	Complete Site Area Geologic Map	36.9	24.9	34.2	12.0	21.2	50.7	0.0	0.0	0.0	0.0	0.0	0.0	179.9
OG32212FB3	Fracture Studies	6.3	16.8	14.9	12.2	9.9	9.7	0.0	0.0	0.0	0.0	0.0	0.0	69.8
OG32212FB4	Geologic Mapping of the Exploratory Stud	119.7	139.2	106.3	155.8	135.2	146.7	0.0	0.0	0.0	0.0	0.0	0.0	802.9
1.2.3.2.2.1.2		162.9	180.9	155.4	180.0	166.3	207.1	0.0	0.0	0.0	0.0	0.0	0.0	1052.6
OG3252FB1	Evalute Tectonic Scenarios for PA	10.6	4.1	-4.1	2.3	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	15.4
1.2.3.2.5.2		10.6	4.1	-4.1	2.3	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	15.4
OG32836FB1	Conduct Probabilistic Seismic Hazards An	88.3	62.1	54.3	46.4	36.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	290.6
1.2.3.2.8.3.6		88.3	62.1	54.3	46.4	36.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	290.6
*1.2.3.2		275.9	260.5	255.9	252.6	211.4	226.6	0.0	0.0	0.0	0.0	0.0	0.0	1482.9
OG33111FB4	Collection of Site Meteor. Data for Hydr	7.8	8.8	12.2	17.5	14.3	29.6	0.0	0.0	0.0	0.0	0.0	0.0	90.2
1.2.3.3.1.1.1		7.8	8.8	12.2	17.5	14.3	29.6	0.0	0.0	0.0	0.0	0.0	0.0	90.2
OG33112FB1	Collection of Site Streamflow Data	5.6	5.1	5.3	7.4	5.7	7.1	0.0	0.0	0.0	0.0	0.0	0.0	36.2
OG33112FB2	Collection of Site Streamflow Data	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
1.2.3.3.1.1.2		5.6	5.1	5.3	7.4	5.7	7.1	0.0	0.0	0.0	0.0	0.0	0.0	36.2
OG33114FB3	Regional Saturated Zone Synthesis Report	7.6	7.6	0.0	12.5	29.1	11.6	0.0	0.0	0.0	0.0	0.0	0.0	68.4
1.2.3.3.1.1.4		7.6	7.6	0.0	12.5	29.1	11.6	0.0	0.0	0.0	0.0	0.0	0.0	68.4
OG33121FB1	Infiltration Processes	21.5	16.0	19.0	18.3	30.7	41.4	0.0	0.0	0.0	0.0	0.0	0.0	146.9
1.2.3.3.1.2.1		21.5	16.0	19.0	18.3	30.7	41.4	0.0	0.0	0.0	0.0	0.0	0.0	146.9
OG33123FB4	Integrated Analysis & Interpretation	14.5	5.4	14.5	20.9	38.8	10.6	0.0	0.0	0.0	0.0	0.0	0.0	104.7
OG33123FB5	Matrix Properties of Hydrologic Units	14.1	12.0	16.2	17.8	1.8	3.7	0.0	0.0	0.0	0.0	0.0	0.0	65.6
OG33123FBA	Unsaturated Zone Borehole Instrumentatio	31.9	36.3	32.6	32.3	34.2	-10.8	0.0	0.0	0.0	0.0	0.0	0.0	156.5
OG33123FBB	Unsaturated Zone Borehole Instrumentatio	0.0	0.0	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
OG33123FBC	Integrated Analysis & Interpretation	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0	0.0	9.3
OG33123FBD	Matrix Properties of Hydrologic Units	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
1.2.3.3.1.2.3		60.5	53.7	63.3	71.0	74.8	23.8	0.0	0.0	0.0	0.0	0.0	0.0	347.1
OG33124E96	Air-K and Hydrochemisty Test - North Ram	5.5	3.1	6.4	6.1	1.4	5.8	0.0	0.0	0.0	0.0	0.0	0.0	28.3
OG33124FA1	Support E&I Design Basis Modeling	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
OG33124FB7	Air Permeability & Hydrochem Testing ESF	46.1	40.6	40.9	68.9	62.7	21.6	0.0	0.0	0.0	0.0	0.0	0.0	280.8
OG33124FB8	Percolation Flux across Repository Horiz	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	3.9
OG33124FBA	Moisture Monitorning in the ESF	2.4	2.4	1.5	18.3	8.3	2.6	0.0	0.0	0.0	0.0	0.0	0.0	35.5

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/96 - 03/31/97

		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
OG33124FBB	Air-Permeability & Hydrochem Testing ESF	0.0	0.0	0.0	0.0	0.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	14.5
OG33124FBD	Moisture Monitoring in the ESF	0.0	0.0	0.0	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	4.9
OG33124FBF	South Ramp Hydrology	0.0	0.0	0.0	0.0	0.0	44.3	0.0	0.0	0.0	0.0	0.0	0.0	44.3
OG33124FBG	PTn Lateral Diversion (Phase I)	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
OG33124FBH	ESF Drift Scale Flux and Niche Study	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
1.2.3.3.1.2.4		54.0	46.1	48.8	93.3	72.4	101.6	0.0	0.0	0.0	0.0	0.0	0.0	416.2
OG33127B96	UZ Hydrochemistry	0.0	0.0	0.0	20.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	20.4
OG33127FBA	UZ Hydrochemistry	23.0	27.1	22.0	1.2	18.0	14.5	0.0	0.0	0.0	0.0	0.0	0.0	105.8
OG33127FBB	UZ Hydrochemistry	0.0	0.0	0.0	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	12.8
1.2.3.3.1.2.7		23.0	27.1	22.0	21.2	18.0	27.7	0.0	0.0	0.0	0.0	0.0	0.0	139.0
OG33128FBD	Fluid Flow in Unsaturated Zone Fractured	7.6	5.3	2.9	6.0	4.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6
1.2.3.3.1.2.8		7.6	5.3	2.9	6.0	4.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6
OG33129FBG	Site Unsaturated Zone Flow Model	7.8	6.4	8.3	25.5	-13.3	10.9	0.0	0.0	0.0	0.0	0.0	0.0	45.6
OG33129FBK	Support UZ Model Expert Elicitation	0.0	21.2	6.8	8.6	7.4	3.5	0.0	0.0	0.0	0.0	0.0	0.0	47.5
1.2.3.3.1.2.9		7.8	27.6	15.1	34.1	-5.9	14.4	0.0	0.0	0.0	0.0	0.0	0.0	93.1
OG33131FBA	C-Well Complex Hydraulic & Conservative	46.5	42.2	46.6	74.2	58.5	31.3	0.0	0.0	0.0	0.0	0.0	0.0	299.3
OG33131FBB	C-Well Complex Hydraulic & Tracer Test	0.0	0.0	0.0	0.0	0.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	22.2
OG33131FBC	Water-Level Monitoring	20.7	17.8	20.5	18.2	14.3	6.2	0.0	0.0	0.0	0.0	0.0	0.0	97.7
OG33131FBD	Water-Level Monitoring	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
OG33131FBF	WT Eh and Ph Measurements	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
1.2.3.3.1.3.1		67.2	60.0	67.1	92.4	72.8	65.7	0.0	0.0	0.0	0.0	0.0	0.0	425.2
OG33133FB3	Site Saturated Zone Flow Model	16.5	25.9	21.8	27.0	22.2	10.3	0.0	0.0	0.0	0.0	0.0	0.0	123.7
OG33133FB4	Site Saturated Zone Synthesis Report	1.3	0.0	2.5	0.3	11.0	6.2	0.0	0.0	0.0	0.0	0.0	0.0	21.3
OG33133FB5	Conduct VA SZ Flow Model Sensitivity An	4.0	2.0	2.6	8.5	8.9	12.9	0.0	0.0	0.0	0.0	0.0	0.0	38.9
OG33133FB6	Confirm SZ Hydrologic Flow Models	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	1.4
1.2.3.3.1.3.3		21.8	27.9	26.9	35.8	42.1	30.8	0.0	0.0	0.0	0.0	0.0	0.0	185.3
*1.2.3.3		284.4	285.2	282.6	409.5	358.8	355.7	0.0	0.0	0.0	0.0	0.0	0.0	1976.2
OG3521FA1	Tracer Gas Support	5.7	5.1	6.0	6.8	5.4	9.5	0.0	0.0	0.0	0.0	0.0	0.0	38.5
1.2.3.5.2.1		5.7	5.1	6.0	6.8	5.4	9.5	0.0	0.0	0.0	0.0	0.0	0.0	38.5
*1.2.3.5		5.7	5.1	6.0	6.8	5.4	9.5	0.0	0.0	0.0	0.0	0.0	0.0	38.5
OG36212FB1	Confirmatory Aquatic Investigations	0.0	2.1	6.9	7.9	3.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	24.0
1.2.3.6.2.1.2		0.0	2.1	6.9	7.9	3.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	24.0
OG36215FB2	Paleoclimate/Paleoenvironmental Synthesi	40.1	38.6	31.7	62.4	37.8	19.5	0.0	0.0	0.0	0.0	0.0	0.0	230.1
1.2.3.6.2.1.5		40.1	38.6	31.7	62.4	37.8	19.5	0.0	0.0	0.0	0.0	0.0	0.0	230.1
OG36221FB1	Evaluation of Paleo Ground-Water Dischar	17.4	15.4	27.9	28.8	13.0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	112.4
OG36221FB2	Geo. Fract. Fill Mater, ESF & Est Past W	57.0	39.2	87.6	70.6	85.8	107.1	0.0	0.0	0.0	0.0	0.0	0.0	447.3
OG36221FB3	Syn.Dist.&Anal Geochron. Age Dets Potent	0.0	0.0	0.0	0.0	0.0	24.4	0.0	0.0	0.0	0.0	0.0	0.0	24.4

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		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
1.2.3.6.2.2.1		74.4	54.6	115.5	99.4	98.8	141.4	0.0	0.0	0.0	0.0	0.0	0.0	584.1
*1.2.3.6		114.5	95.3	154.1	169.7	139.6	165.0	0.0	0.0	0.0	0.0	0.0	0.0	838.2
OG39BFA1D	Support Systems Engineering Reports & St	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
OG39BFA1F	Data & Del Mgt., QA Compl, Oversite Sup,	14.6	13.0	13.3	10.9	15.1	26.8	0.0	0.0	0.0	0.0	0.0	0.0	93.7
OG39BFB1	Support Development of PISA Ch 2.3 (Geol	30.1	29.7	43.9	50.1	55.5	50.1	0.0	0.0	0.0	0.0	0.0	0.0	259.4
OG39BFB1C	Provide Support to LA Plan	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
OG39BFB1E	Provide Input to SC Progress Report 16	9.9	11.0	10.9	5.6	13.1	9.1	0.0	0.0	0.0	0.0	0.0	0.0	59.6
OG39BFB2	Develop PISA Chapter 2.4 (Hydrology)	11.6	12.5	33.0	31.0	43.5	54.0	0.0	0.0	0.0	0.0	0.0	0.0	185.6
OG39BFB2E	Provide Input to SC Progress Report 17	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
OG39BFB4	Dev Climate/Meteorologic Sys Desc (PISA	0.0	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	0.0	16.1
1.2.3.9.11		66.2	66.2	101.1	97.6	127.2	156.1	0.0	0.0	0.0	0.0	0.0	0.0	614.4
*1.2.3.9		66.2	66.2	101.1	97.6	127.2	156.1	0.0	0.0	0.0	0.0	0.0	0.0	614.4
**1.2.3		817.4	786.3	874.6	1024.3	1003.6	1033.0	0.0	0.0	0.0	0.0	0.0	0.0	5539.2
OG535FA1	Provide FY97 Technical Data Base Input	21.3	18.0	18.0	40.7	25.5	29.9	0.0	0.0	0.0	0.0	0.0	0.0	153.4
1.2.5.3.5		21.3	18.0	18.0	40.7	25.5	29.9	0.0	0.0	0.0	0.0	0.0	0.0	153.4
*1.2.5.3		21.3	18.0	18.0	40.7	25.5	29.9	0.0	0.0	0.0	0.0	0.0	0.0	153.4
OG541FA2	Viability Assessment Scenarios Developme	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
1.2.5.4.1		0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
OG544FA1	UZ Flow Model Abstractions for VA	0.0	0.0	5.5	1.3	5.2	8.3	0.0	0.0	0.0	0.0	0.0	0.0	20.3
OG544FA2	SZ Flow Model Abstractions for VA	0.0	0.0	7.1	-0.4	-0.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	7.9
1.2.5.4.4		0.0	0.0	12.6	0.9	4.8	9.9	0.0	0.0	0.0	0.0	0.0	0.0	28.2
*1.2.5.4		0.0	0.0	12.6	4.4	4.8	9.9	0.0	0.0	0.0	0.0	0.0	0.0	31.7
**1.2.5		21.3	18.0	30.6	45.1	30.3	39.8	0.0	0.0	0.0	0.0	0.0	0.0	185.1
OG825FA1	Federal Occupation Safety & Health	8.8	7.1	9.0	8.9	7.3	7.4	0.0	0.0	0.0	0.0	0.0	0.0	48.5
1.2.8.2.5		8.8	7.1	9.0	8.9	7.3	7.4	0.0	0.0	0.0	0.0	0.0	0.0	48.5
*1.2.8.2		8.8	7.1	9.0	8.9	7.3	7.4	0.0	0.0	0.0	0.0	0.0	0.0	48.5
OG845FA1	Radiation Protection	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.2.8.4.5		0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OG847FA1	Water Resources Envir Impact Stmt Suppor	0.0	0.0	0.0	0.0	2.4	2.8	0.0	0.0	0.0	0.0	0.0	0.0	5.2
OG847FA2	Rad Water Quality Sample Collection	0.0	0.0	0.0	0.0	0.0	49.3	0.0	0.0	0.0	0.0	0.0	0.0	49.3
OG847FB1	Water Resources	30.4	29.6	30.3	48.3	17.0	37.6	0.0	0.0	0.0	0.0	0.0	0.0	193.2
1.2.8.4.7		30.4	29.6	30.3	48.3	19.4	89.7	0.0	0.0	0.0	0.0	0.0	0.0	247.7
*1.2.8.4		30.4	29.6	30.4	48.3	19.4	89.7	0.0	0.0	0.0	0.0	0.0	0.0	247.8
**1.2.8		39.2	36.7	39.4	57.2	26.7	97.1	0.0	0.0	0.0	0.0	0.0	0.0	296.3
OG912FA1	Participant Technical Project Office	25.0	23.2	27.3	25.9	29.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	152.6
1.2.9.1.2		25.0	23.2	27.3	25.9	29.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	152.6
*1.2.9.1		25.0	23.2	27.3	25.9	29.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	152.6

U.S. GEOLOGICAL SURVEY

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		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
OG922FA1	Participant Project Control - USGS	21.4	18.6	18.1	20.5	17.5	19.9	0.0	0.0	0.0	0.0	0.0	0.0	116.0
1.2.9.2.2		21.4	18.6	18.1	20.5	17.5	19.9	0.0	0.0	0.0	0.0	0.0	0.0	116.0
*1.2.9.2		21.4	18.6	18.1	20.5	17.5	19.9	0.0	0.0	0.0	0.0	0.0	0.0	116.0
**1.2.9		46.4	41.8	45.4	46.4	46.5	42.1	0.0	0.0	0.0	0.0	0.0	0.0	268.6
OGC522FA1	Satellite Records Operations	3.8	3.5	4.7	4.2	4.2	3.9	0.0	0.0	0.0	0.0	0.0	0.0	24.3
1.2.12.5.2.2		3.8	3.5	4.7	4.2	4.2	3.9	0.0	0.0	0.0	0.0	0.0	0.0	24.3
*1.2.12.5		3.8	3.5	4.7	4.2	4.2	3.9	0.0	0.0	0.0	0.0	0.0	0.0	24.3
**1.2.12		3.8	3.5	4.7	4.2	4.2	3.9	0.0	0.0	0.0	0.0	0.0	0.0	24.3
OGF23FA1	Support/Personnel Services	32.4	28.7	35.4	25.6	22.5	27.7	0.0	0.0	0.0	0.0	0.0	0.0	172.3
OGF23FA2	Facilities Management - Space	61.7	61.7	61.7	61.7	61.7	61.7	0.0	0.0	0.0	0.0	0.0	0.0	370.2
OGF23FA3	Facilities Management - Computers/Phones	16.7	16.7	16.7	16.7	16.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0	100.2
OGF23FA4	Facilities Management - Other	12.5	12.5	12.5	12.5	12.5	12.5	0.0	0.0	0.0	0.0	0.0	0.0	75.0
OGF23FA5	Procurement/Property Management - USGS	10.2	11.0	8.0	7.3	11.5	9.9	0.0	0.0	0.0	0.0	0.0	0.0	57.9
1.2.15.2.3		133.5	130.6	134.3	123.8	124.9	128.5	0.0	0.0	0.0	0.0	0.0	0.0	775.6
*1.2.15.2		133.5	130.6	134.3	123.8	124.9	128.5	0.0	0.0	0.0	0.0	0.0	0.0	775.6
OGF3FA1	USGS Training Support	4.5	4.2	3.7	4.8	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	25.6
1.2.15.3		4.5	4.2	3.7	4.8	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	25.6
*1.2.15.3		4.5	4.2	3.7	4.8	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	25.6
**1.2.15		138.0	134.8	138.0	128.6	129.1	132.7	0.0	0.0	0.0	0.0	0.0	0.0	801.2
1.2 OPERATING		1066.1	1021.1	1132.7	1305.8	1240.4	1348.6	0.0	0.0	0.0	0.0	0.0	0.0	7114.7
CAPITAL EQUIPMENT		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
GRAND TOTAL		1066.1	1021.1	1132.7	1305.8	1240.4	1348.6	0.0	0.0	0.0	0.0	0.0	0.0	7114.7
FTEs														
FEDERAL		112.7	108.9	108.0	109.3	99.7	109.6	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT		17.0	17.8	19.2	26.5	22.1	25.9	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL		129.7	126.7	127.2	135.8	121.8	135.5	0.0	0.0	0.0	0.0	0.0	0.0	

* Fourth level WBS roll-up

** Third level WBS roll-up

APR 1 1 1997

cc w/encls:
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FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING APRIL 4, 1997

Enclosure 1 lists site characterization field activities that are currently active. Many of these are ongoing monitoring and mapping activities; therefore, only those activities having significant status change are addressed below.

C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING

The U.S. Geological Survey (USGS) received permission from the State of Nevada to inject up to 4 kilograms of the tracer pyridone into borehole C#1 and up to 15 kilograms of the tracer 2,6 difluorobenzoic acid (DFBA) into borehole C#2. The tracers were injected on January 9, 1997. Breakthrough of DFBA occurred on January 16, 1997. Sampling and analysis of the water pumped from C#3 continues. Peak concentration values of DFBA arrived on January 21, 1997. Breakthrough of the pyridone tracer injected in C#3 has not occurred yet.

The pump is operating normally at this time and sampling for pyridone tracer is continuing. There are also plans to pull the injection tubing from borehole C#2 next week in order to obtain water samples from #2 and test them for pyridone tracer.

ENGINEERED BARRIER - LARGE BLOCK TEST

Lawrence Livermore National Laboratory successfully started the thermal testing that began on schedule on February 28, 1997, at about 10 a.m. The heaters were turned on and began heating the rock. As of April 3, 1997, the temperatures measured at two places closest to the plane of the heaters were 96.10°C and 86.6°C. The Large Block Test will yield information on movement of water under thermal load, geochemistry of refluxing water, and biological organism (microbe) activity.

EXPLORATORY STUDIES FACILITY (ESF) TESTING

The Tunnel Boring Machine (TBM) continued this week to station 77+75.1 meters as of 8 a.m., Friday, April 4, 1997. The excavation rate is currently averaging about 12 to 15 meters per day in the Tiva Canyon middle nonlithopysal zone. There are approximately 102 meters remaining to TBM hole-through at the South Portal. The TBM is now expected to hole-through sometime the week of April 14, 1997.

Instrument installation and data collection in support of construction monitoring continues. Geologic mapping continued to station 76+60 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 2.

ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift [AOD], Connecting Drift, and Heated Drift):
Placement of concrete in the invert of the heated drift is substantially complete up to station 0+48 meters. The forms have been set in place and preparations are underway to pour concrete in the lined portion of the drift. Drilling of instrumentation holes may resume next week. The Heated Drift Test will heat approximately 15,000 cubic meters of the rock of the repository horizon to a temperature of 100°C or greater in order to investigate the coupled processes under thermal loading.

ESF Alcove 5 (Thermomechanical Alcove):
The Single Heater Test (SHT) started on schedule on August 26, 1996. The instruments, except the water chemistry probes, are reported to be working properly and data are being collected. The SHT will heat approximately 25 cubic meters of rock to 100°C or greater.

The following temperature readings have been reported from three thermocouple holes parallel to the heater. The holes are at radial distances from the heater of 0.33, 0.67, and 1.48 meters. Each measurement is made at an axial distance along the thermocouple hole that puts the measurements at the mid-length of the heater. These measurements were made on April 7, 1997, and continue to show an increase in temperature.

Radial Distance from heater centerpoint (m)	Temperature in degrees Celsius
0.33 meters	157.3°
0.67 meters	121.7°
1.48 meters	76.5°

The purpose of this test is to understand heat related processes and measure physical parameters. Some of these processes include heat transfer (conduction and convection), moisture movement, and geochemical changes (water chemistry changes due to heating of the rock). In addition, the results from the SHT provide guidance for instrumentation and conducting the Drift Scale Test in

Alcove 5. The results will be available for the Viability Assessment design; specifically, thermal properties, deformation of the rock at elevated temperatures, and performance of rock bolts at elevated temperatures.

ESF Alcove 6 (Northern Ghost Dance Fault Alcove):
Excavation using an Alpine Miner AM-50 resumed on March 27, 1997. Currently, the excavation is on hiatus, but plans are to resume excavation using the AM-75 next week. The excavation has progressed to Alcove station 1+50.2 meters. The excavation will continue through the Ghost Dance Fault and provide a location for further testing of the fault.

ESF Alcove 7 (Southern Ghost Dance Fault Alcove):
The excavation of the Southern Ghost Dance Fault Alcove is complete at 1+34.4 meters (design length was 135 meters).

Drilling of a horizontal borehole, ESF-SAD-GTB1, across the Ghost Dance Fault from the end of Alcove 7 is in progress but encountered difficulty in drilling across the fault. The borehole had progressed to 33.0 meters as of March 10, 1997. Reaming of the hole to a depth of 33 meters was completed on March 24, 1997, and casing was set. Coring resumed on March 25, 1997, and was completed to a final depth of 77.7 meters on April 2, 1997. A splay of the Ghost Dance Fault has been tentatively picked at 30.5 to 33.0 meters and the main Ghost Dance Fault at 62.8 to 64.6 meters. Testing of thermal and pneumatic properties of the Ghost Dance Fault will take place in the borehole next and will constitute one of the important project milestones for fiscal year 1997.

If you have any questions, please contact Drew H. Coleman at 295-7825.

Drew H. Coleman
Field Test Coordination
Assistant Manager for Licensing

AML:DHC-1371

Enclosures:
1. Site Characterization Field Activities in Progress
2. Tunnel Stratigraphy

Site Characterization Field Activities in Progress

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.3.2.1	Mineralogy, Petrology, and Rock Chemistry of Transport Pathways	ESF Sampling, Borehole Sampling
8.3.1.3.2.2	Mineralogic and Geochemical Alteration	ESF Sampling, Borehole Sampling
8.3.1.4.2.2	Structural Features Within Site Area	Surface & ESF Mapping
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mtn.	Surface Mapping
8.3.1.17.4.4	Quaternary Faulting in NE-Trending Fault Zones	Surface Mapping
8.3.1.17.4.6	Quaternary Faulting Within Site Area	Trench Logging
8.3.1.2.1.1	Precipitation and Meteorological Monitoring for Regional Hydrology	Ongoing Measurements
8.3.1.2.1.2	Runoff and Streamflow	Ongoing Measurements
8.3.1.4.2.1	Characterization of Vertical/Lateral Distribution Stratigraphic Units in Site Area	Core Logging (all boreholes), surfaceof geophysical surveys
8.3.1.2.1.3	Regional Groundwater Flow System	Ongoing monitoring
8.3.1.2.2.1	Unsaturated Zone Infiltration	Shallow borehole neutron logging
8.3.1.2.2.2	Water Movement Tracer Tests	Cl^{36} measurements (SBT drillholes, ESF)

ENCLOSURE

Site Characterization Field Activities in Progress Continued

SCP ACTIVITY	TITLE	ACTIVITY
8.3.1.2.2.4	Characterization of Unsaturated Zone (ESF)	Hydrochemistry/Radial Boreholes testing
8.3.1.2.2.6	Gaseous Phase Movement in the Unsaturated Zone	Pneumatic pathways monitoring
8.3.1.2.3.1	Site Saturated Zone Groundwater Flow System	Ongoing monitoring, C-well testing
8.3.1.2.3.2	Saturated Zone Hydrochemistry	Ongoing monitoring
8.3.1.4.3.1	Systematic Acquisition of Site Specific Subsurface Information	Core logging
8.3.1.15.1.8	In Situ Design verification	Construction monitoring/testing
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain	Rock sampling
8.3.1.3.4.2	Biological Sorption and Transport	Sampling in ESF
8.3.1.19.5.1	Engineered Barrier System Field Tests	Sampling in ESF

ESF TUNNEL STRATIGRAPHY*

STATION	
0+00 to 0+99.5m	Tiva Canyon crystal poor upper lithophysal zone.
	Alcove #1 (centerline station intersection):0+42.5
0+99.5 to 1+90m	Tiva Canyon crystal poor middle nonlithophysal zone
	Alcove #2 (centerline station intersection):1+68.2
1+90 to 1+99.5m	Tiva Canyon crystal poor lower lithophysal zone.
1+99.5 to 2+02m	Bow Ridge Fault Zone (placing Pre-Ranier Mesa Tuff against Tiva Canyon Tuff)
2+02 to 2+63.5m	Pre-Ranier Mesa bedded tuffs
2+20	Fault (4.3m offset)***
2+63.5 to 3+33m	Tuff "X"
3+33to 3+49.5m	Pre-Tuff "X"
3+49.5 to3+59.5m	Tiva Canyon crystal rich vitric zone
3+59.5 to 4+34m	Tiva Canyon crystal rich nonlithopysal zone
4+30m	Fault (~10m offset)***
4+34 to 4+39m	Tiva Canyon crystal rich lithopysal zone
4+39 to 5+53m	Tiva Canyon crystal poor upper lithophysal zone
5+50m	Fault (~5m offset)***
5+53to 5+87m	Tiva Canyon crystal poor middle nonlithophysal zone
5+87 to 6+17m	Tiva Canyon crystal poor lower lithophysal zone

ENCLOSURE

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
6+17 to 7+77m	Tiva Canyon crystal poor lower nonlithophysal zone
7+00m	Fault (~20m? offset)***
	Alcove #3 (centerline station intersection):7+54.
7+77 to 8+69m	Tiva Canyon crystal poor vitric zone
8+69 to 8+72.5m	Pre-Tiva Canyon bedded tuffs
8+72.5 to 8+73.5m	Yucca Mountain Tuff
8+73.5 to 9+12m	Pre-Yucca Mountain bedded tuffs
9+12 to 10+20m	Pah Canyon Tuff
10+20 to 10+51.5m	Pre-Pah Canyon bedded tuffs
	Alcove #4 (centerline station intersection):10+27.8
10+51.5 to 12+00m	Topopah Spring crystal rich vitric zone
12+00 to 17+17m	Topopah Spring crystal rich nonlithophysal zone
17+17 to 17+97m	Topopah Spring crystal rich lithophysal zone
17+97 to 27+20m	Topopah Spring crystal poor upper lithophysal zone
27+20 to 63+08m	Topopah Spring crystal poor middle nonlithophysal zone
	Alcove #5 (centerline station intersection):28+27
35+93m	Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)
	Alcove #6 (centerline intersection): 37+37
	Alcove #7 (centerline intersection): 50+64

ESF TUNNEL STRATIGRAPHY CONTINUED*

STATION	
57+30	Splay of the Ghost Dance Fault - Offset is approximately 2 meters
63+08 to 64+53	Topopah Spring crystal poor upper lithophysal zone
63+25	Fault with the offset estimated as 3.8 meters
64+53 to 65+13	Topopah Spring crystal rich lithophysal zone
65+13 to 65+23	Topopah Spring crystal rich nonlithophysal zone
65+23	Fault
65+23 to 65+35	Topopah Spring crystal rich lithophysal zone
65+35 to 66+35	Topopah crystal rich nonlithophysal zone
66+35 to 66+40	Topopah Spring vitric zone
66+40 to 66+98	Pre-Pah Canyon bedded tuffs
66+98 to 67+26	Tiva Canyon crystal poor vitric zone
67+26 to 67+62	Tiva Canyon crystal poor lower nonlithophysal zone
67+62 to 67+70	Tiva Canyon crystal poor vitric zone
67+70 to 67+88	Tiva Canyon crystal poor lower nonlithophysal zone
67+88 to 67+91	Dune Wash fault (offset is greater than 10m)
67+91 to 68+47	Topopah Spring crystal poor upper lithophysal zone
68+47 to 68+85	Topopah Spring crystal rich lithophysal zone
68+85 to 69+84	Topopah Spring crystal rich nonlithophysal zone
69+84 to 69+96?	Topopah Spring crystal rich vitric zone
69+96 to 70+58?	Bedded tuffs

ESF TUNNEL STRATOGRAPHY CONTINUED*

STATION	
70+58	Fault (Offset greater than 10 meters)
70+58 to 71+68?	Topopah Spring crystal poor middle nonlithophysal zone
71+31?	Fault
71+68 to 73+00?	Topopah Spring crystal poor upper lithophysal zone
73+00 to 73+41?	Topopah Spring crystal rich lithophysal zone
73+41? to 74+36?	Topopah spring crystal rich nonlithophysal zone
74+36 to 74+63?	Topopah Spring vitric zone
74+63 to 74+99?	pre -Pah Canyon bedded tuffs
?	Pah Canyon Tuff
?	pre-Yucca mountain bedded tuffs
?	Yucca Mountain Tuff
? to 74+99?	pre-Tiva Canyon bedded tuffs
74+99? to 75+16?	Tiva Canyon crystal poor vitric zone
75+16? to 76+03?	Tiva Canyon crystal poor lower nonlithophysal zone
76+03? to face	Tiva Canyon crystal poor middle nonlithophysal zone
76+32	Fault - offset estimated to be 0.2 meters

Note: Starting at station 57+02 and ending at 59+80, the crystal poor lower lithophysal zone is exposed in the lower portion of the tunnel (below springline).

* All stations given are referenced to the right springline unless otherwise noted. Station 0+00 is located at coordinates N765352.7, E569814.4.

? Indicates that contact is preliminary and has not been verified by USGS geologists.

*** Only significant faults are noted on the table.

United States Department of the Interior

U. S. GEOLOGICAL SURVEY
Box 25046 M.S. 425
Denver Federal Center
Denver, Colorado 80225

IN REPLY REFER TO:

INFORMATION ONLY

March 14, 1997

Wayne Kozai
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
P.O. Box 30307
Las Vegas, Nevada 89036-0307

SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS) Progress Report, February, 1997

Attached is the USGS progress report in the required format for the month of February, 1997.

If you have any questions or need further information, please call Raye Ritchey Arnold at (303)236-0516, ext. 282.

Sincerely,

Raye Ritchey Arnold
for Robert W. Craig
Technical Project Officer
Yucca Mountain Project Branch
U.S. Geological Survey

Enclosure:
cc: S. Hanauer, DOE/Forrestal
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T. Hawe, DOE, Las Vegas
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U.S. GEOLOGICAL SURVEY
EXECUTIVE SUMMARY
February, 1997

WBS 1.2.3.2 GEOLOGY

In work performed on review of lithostratigraphic borehole data, USGS staff completed Level 4 **milestone SPG211M4 [Subsurface Borehole Video Fracture Database to GENISES]**, and the milestone was submitted ahead of schedule on February 27. The milestone memo includes tabulation of data from characterization of fractures encountered in boreholes but was not planned to contain interpretations.

Work on text, illustrations, and tables for the "Site Stratigraphy" chapter of the PISA report continued.. An initial draft has been distributed to the Stratigraphic Studies Project staff for comments, additions, and editing.

Geologic mapping continued during February toward completion of the 1:24,000-scale site area geologic map. The site area coincides with the area encompassed by the 3-D geologic- framework ISM2.0 computer model, extending from approximately the Prow of Yucca Mountain on the north to Busted Butte on the south, and from Windy Wash on the west to Fortymile Wash on the east. The new mapping effort concentrates on critical areas that hold keys to both the structural and stratigraphic development of Yucca Mountain. Since the first of the fiscal year, Busted Butte, Fran Ridge, Alice Point, Dune Wash, WT-12 basin, Iron Ridge, Crater Flat, upper Black Glass Canyon, upper Fortymile Wash, upper Yucca Wash, upper Teacup Wash, upper Fatigue Wash, Castellated Ridge, and the Prow were all mapped in detail. The new mapping is delineating structural complexities of both hanging-wall and footwall deformation associated with the major block-bounding faults, such as the Solitario Canyon, Fatigue Wash, Windy Wash, and Iron Ridge faults. These well-known north-striking, block-bounding faults are typically linked kinematically by northwest-striking relay faults and associated structures, which act to disperse the regional tectonic strain across several of the faults. The block-bounding faults are generally west-dipping, down-to-the-west fault zones with numerous secondary faults that separate large blocks of east-dipping volcanic strata. Previous workers recognized that within the fault zones themselves there are west-dipping structural panels. Because the trailing edges of the hanging walls of the north-striking block-bounding faults are commonly highly faulted, they are buried in the wash bottoms. The new mapping, however, has better defined the footwall deformation (eastern margin of the fault zones). In general, mapping associated with the FY96 central-block mapping as well as the current FY97 mapping campaign for the site map has documented that numerous intrablock faults (such as the Ghost Dance, Abandoned Wash, and Busted Butte faults) form horsetail geometries toward the surface, creating a nest of bifurcating faults that converge at depth. The new mapping has delineated a similar pattern in the block-bounding faults. The block-bounding fault zones can be thought of as west-dipping, upward-widening "curtains" whose western dip varies from relatively shallow (45 to 50 degrees) to steep (75 to 85 degrees). As the upward-widening fault zones, or curtains, lay over with shallower dips, the amount of secondary faulting preserved in the footwall increases dramatically. The total deformation associated with the block-bounding faults is a combination of down-to-the-west normal faulting and sinistral oblique-slip motion. As such, curving fault-zone curtains have releasing and restraining bends along their trace. The releasing bends are commonly areas in which the fault "curtains" lie over more shallowly and preserve numerous secondary faults, whereas in the restraining bends, the fault "curtains" dip more steeply and have relatively less deformation preserved in the footwall and locally contain compressional faults (reverse faults).

Work near the Prow confirmed the existence of growth faulting during eruption of Paintbrush Group tuffs. Substantial thickening of the Pah Canyon Tuff was mapped across the Fatigue Wash Fault on the southwestern margin of Yucca Wash. This thickening was not apparent to Scott and Bonk (1984) because they did not recognize the full thickness of the Pah Canyon Tuff in this area. As in many other areas, the new mapping modifies the fault patterns mapped by Scott and Bonk. In addition, NW-striking basaltic dikes mapped by Scott and Bonk along axes of ridges SE of the Prow are not present as mapped. (Scattered basaltic float exists, but there is no outcrop.)

A preliminary geologic cross section across the northern part of the site area geologic map of Yucca Mountain was constructed. This cross section was completed from a point in northern Fortymile Wash westward to the northern extension of the Solitario Canyon Fault. Additional cross sections will be prepared as new field mapping data become available. Staff also prepared and gave a talk to the monthly USGS-YMP branch meeting entitled "Geological and

geophysical evidence for normal faulting in Yucca Wash". As a result of this talk, several free-ranging discussions ensued in the following days on the implications of new structural interpretations of the Yucca Wash area on various hydrologic models.

Work on the first draft of the Site Structural Geology section of the Site Description continued during the period. A key aspect of this work is the definition of ten structural domains in the site area. The structural-domain concept is being integrated with structural details of the central block and with syntheses of fractured-rock-mass studies, to establish a new descriptive structural model for Yucca Mountain as part of the Site Description document.

USGS staff integrated geophysical interpretations (principally from seismic-reflection and ground-magnetic surveys) with structural patterns established through surface geologic mapping in the potential repository area. This involves evaluation of the robustness of structural interpretations from the geophysical data and potentially could result in identification of one or more geophysically determined buried structures that were not apparent in the mapping efforts.

Work continued on evaluation of structural controls on the distribution of ^{36}Cl in the ESF. Sample locations in the ESF that show elevated $^{36}Cl/Cl$ values indicating a component of bomb-pulse ^{36}Cl are analyzed for structural significance through an integration of the following elements: 1) observations of the local structural setting of each sample site; 2) mapped surface and subsurface structural features; and 3) fracture information from detailed line survey (DLS) data in the ESF. Based on work to date using such data, the primary controls on the distribution of bomb-pulse ^{36}Cl in the ESF, ranked by importance, are: 1) the presence of faults that cut the PTn hydrogeologic unit; 2) the magnitude of surface infiltration; and 3) structural features that result in lateral diversion of flow away from fault zones. The most important structural control on the distribution of bomb-pulse ^{36}Cl in the ESF simply seems to be the presence of faults that create breaks in the PTn hydrogeologic unit. A tabulation of all of the faults in the ESF with significant (roughly 3-m or greater) offset shows that with few exceptions, all of the faults sampled and analyzed for ^{36}Cl have elevated $^{36}Cl/Cl$ values indicating a component of bomb-pulse ^{36}Cl. Nearly every fault sampled had bomb-pulse ^{36}Cl along the fault plane, two exceptions being the southwestern splay of the Drill Hole Wash structure and the Ghost Dance fault at the southern end of the main drift of the ESF. In contrast to a number of the sample localities along the north ramp of the ESF where elevated $^{36}Cl/Cl$ values are tightly grouped in the vicinity of a single fault or individual joint, sample localities in the general vicinity of the Sundance fault have elevated $^{36}Cl/Cl$ values that form a broad zone encompassing a 300-m distance along the ESF. The Sundance fault is the only structure mapped in this vicinity that could have served as the pathway through the PTn hydrogeologic unit. The broad zone of elevated $^{36}Cl/Cl$ values north of the fault thus represents lateral diversion of flow away from the plane of the fault. Such lateral diversion implies a connection between the fault and other structures, either small subsidiary faults or interconnected joints, in the rock mass surrounding the fault. Lateral diversion of flow away from the Sundance fault is very unlikely within the upper lithophysal zone of the Topopah Spring Tuff, which has a poorly connected fracture network and few throughgoing discontinuities. Lateral diversion of flow below the level of the PTn hydrogeologic unit is most likely within the middle nonlithophysal zone of the Topopah Spring Tuff where large, relatively closely spaced cooling joints and the common presence of gently-dipping cooling joints serve to promote network connectivity and the chances of a connected pathway in the rock mass surrounding the fault.

Preparation continued of a report (milestone SPG32M3 [Rpt: Complete Fracture Evaluation Report]) supporting development of process models. Fracture data from the surface and the ESF are being compiled and integrated by USGS and Bureau of Reclamation staff. Much of the month was spent compiling fracture data from qualified boreholes (including the NRG holes and USW SD-7, USW SD-9, and USW SD-12). Preliminary comparison of the data sets reveals general correspondence between various data-collection methods and highlights the importance of lithostratigraphic controls, such as degree of welding, on fracture character. A data package of fracture data from the Calico Hills Formation was submitted for review in support of the above report.

Geologic mapping of the ESF continued during the period. Full-periphery geologic mapping and detailed line surveys at the heading were completed to station 74+00. Stereophotography was completed to station 74+15. Calculation of RQD was completed to station 73+19, and calculation of Q and RMR was completed to station 70+60. Full-periphery geologic mapping in Alcove #5 (thermal drift) was completed from station 0+39 to station 0+60. The detailed line survey was completed in Alcove #5 from station 0+22 to 0+60.

Reports on geology of the north/south Main Drift (stations 28+00 to 55+00) and geology of the South Ramp (stations

55+00 to 63+47) were completed and submitted to DOE for approval, completing Level 3 **milestone SPG42AM3 [Report: Geology north/south Main Drift station 28+00 to 55+00]** and Level 3 **milestone SPG42BM3 [Letter Report: Geology of the South Ramp station 55+00 to 63+47]**.

Review of tectonic scenarios and relevant tectonic processes continued in support of Performance Assessment.

The Ground Motion Characterization Workshop was held January 9 and 10 in Salt Lake City, Utah. Summation of the workshop presentations forms a portion of the initial input to the Probable Seismic Hazard Assessment (PSHA) hazard calculations. Project participants have recorded the workshop proceedings, and proceedings together with the experts' input form the substance of the milestone PSHA memo. Work continued on the memorandum describing input for characterization of ground motion.

Summaries of seismic-hazard workshops were prepared. A summary of the Ground Motion Models and Interpretations Workshop (held January 9 to 10) was completed on February 5. The Seismic Source Characterization (SSC) Preliminary Interpretations Workshop (#4) was held January 6 to 8 in Salt Lake City. A summary of the workshop was completed on February 3, completing Level 4 **milestone SPG28KM4 [Memo to TPO: Summary of seismic source characterization preliminary interpretations workshop]**.

The PSHA report is in preparation. The workshop summaries and discussions, as they are completed, are prepared as elements of the PSHA Report. The expert elicitations serve to collect and assemble the input for the Probabilistic Seismic Hazard Assessment of ground motion and fault displacement. Elicitations will continue into March 1997 at which point preliminary calculations will be performed and the results returned to the experts for sensitivity analyses and feedback discussions. The SSC Input to the PSHA report is in preparation, and a draft will be completed after the elicitations and feedback workshops are completed, probably in June 1997.

Numerous efforts were provided in support of unscheduled activities. In unscheduled work in support of 3-D framework modeling (model ISM2.0), stratigraphic-studies staff examined isochore maps and cross sections during an informal review of ISM2.0 in which numerous comments were returned to the primary compilers and modelers of ISM2.0. Staff later assisted with technical review of the manuscript and the visualization of the computer files in the ISM2.0 model. This effort required six man-weeks of staff time.

USGS staff assisted USBR ESF mappers by providing lithostratigraphic descriptions between stations 60+00 and 70+00. This activity included descriptions for map 60+00 to 65+00 and examination of lithostratigraphic relations between 65+00 to 70+00.

Borehole video was examined from the borehole that had collected about 5 liters of water in the Single Heater Test area of the Thermal Test Facility . There were 39 fractures with high- to low-angle dips, and most fractures dip northward and toward the heater element. This configuration is very conducive to fracture flow of vapor that would be driven by the heater element.

Staff concluded evaluation of two small-diameter vertical boreholes in the crown of the southern Ghost Dance fault alcove (SGDFA, also referred to as the southern access drift or SAD) to locate the Tptpul-pmn contact. These boreholes are located at stations 0+12 and 0+60 along the alcove drift. In both boreholes, the contact was less than one meter from that predicted in the 3-D lithostratigraphic model of the central block YMP.R2.0 (Buesch and others, 1996).

USGS stratigraphic-studies staff assisted hydrologic staff and LBNL staff in selection of locations for two hydrologic study niches along the main drift of the ESF.

Mapping staff prepared and co-led a field trip at Yucca Mountain for the expert elicitation panel for Unsaturated Zone Hydrology. Staff also discussed depiction of a fault in Antler Wash on the central-block geologic map with staff from the NRC .

Staff provided major contributions to the Level 4 M&O (LANL) milestone "Status report on investigation of ^{36}Cl" (M&O summary account TR33122FBB), including introductory material describing structural features at Yucca Mountain, including faults and the fracture network, as well as an interpretative section on structural controls of ^{36}Cl

distribution in the ESF which discusses the importance of faults as hydrologic pathways and controls on lateral diversion of flow. Total contribution amounted to approximately 10 pages of text, 4 figures, and a table. Although this work contributes to USGS project SPG32A [Evalate structural controls on distribution of ^{36}Cl in ESF], contributions to separate LANL deliverables were not anticipated in the original schedule.

WBS 1.2.3.3 HYDROLOGY

Regional Hydrology

In efforts toward collection of site meteorological data for the hydrologic flow model, work continued on the analysis and interpretation of precipitation data. Data packages for the rain-wedge and tipping-bucket datasets are have been assembled and given technical review. Transfer of 14 tipping-bucket precipitation stations to SAIC was completed in January, completing that activity.

A data package entitled "Precipitation data from the non-recording gage network at Yucca Mountain, Nevada, for water year 1995 (October 1, 1994 to September 30, 1995)," DTN GS970108312111.002, has been technically reviewed and submitted for additional QA review. A second data package entitled "Precipitation Rate Measurements from 11 Locations at Yucca Mountain, Nevada, 1994 to 1996" has been assembled and given technical review.

During the month, routine maintenance was made on the three recording streamflow gages along Fortymile Wash. No runoff was observed or recorded during the period by the Fortymile Wash gages. Records from these sites have been computed, checked, and reviewed, and the records were submitted to the Nevada District Data Section for final tabulation and inclusion into the annual data report. A data records package for streamflow and precipitation data collected during Water Year 1996 for the three recording streamgage sites on Fortymile Wash (**milestone SPH22DM4 [Memo to TPO: Submit FY96 Data to RPC/TDB]**) was submitted to the Chief, USGS-ESIP, on February 11. The records package is under review and final preparation and is on track to meet its scheduled completion date in March.

Work continued on the regional framework flow model. The regional hydrogeologic framework model received two technical reviews and was submitted to the USGS QA office, essentially completing this activity almost a month early. This step completed **milestone SPH23DH4 [Memo to TPO: Final Hydrogeologic Framework to RPC]** on February 18.

Work began on the draft text and illustrations for the regional synthesis report, and discussions were held concerning logistics for completion of illustrations. About a third of the text has been written.

Preparation of data for initial model simulations was completed in January. Since there is no specific activity for continuing model simulations, however, those will be reported here. Model simulations of past and future climate scenarios have continued, and significant progress is being made. A great deal of work has been required to do post-processing clarification of model results to aid in their interpretation. Work currently is being done on a method to perform automatic comparison of model-predicted discharge areas with previously identified discharge areas.

In unscheduled work, revisions continued on the regional potentiometric-surface map report, which was re-submitted for approval on February 25. Preparation of a report documenting distribution of vegetation types, used as indicators of recharge and discharge areas within the regional model area, was completed. The report received USGS approval and DOE concurrence last year. The manuscript will be submitted to a journal next month. Revisions to the regional modeling report, which received USGS approval in December 1996, are nearly complete. Text of the report was sent to the Colorado District for formatting on February 27. Only one illustration remains to be completed.

Unsaturated-Zone Hydrology

In efforts on infiltration processes, work continued on incorporating results from the Global Climate Model into a transfer function for the numerical infiltration model, which requires daily precipitation input. Calibration of the dynamic root-zone sub-model of the cascading-bucket models continued. Work also continued on improving the Richards-equation sub-model

Interpretation and analysis of UZ data continued. In work on the Main Drift hydrology report, all 75 figures and eight

tables for that report were completed. Approximately 75% of the text was written. TDIF worksheets were prepared for the USGS QA office.

Borehole-monitoring data analysis continued. Pneumatic diffusivity analyses of data from SD-7, UZ-7a, and SD-12 were completed. Non-conductive heat fluxes across the PTn and Tiva Canyon units at UZ-7a, SD-12, and NRG-7a were analyzed. Both of these efforts were in support of the Main Drift hydrology report.

Monitoring of selected instrumented boreholes also continued. Borehole data from NRG-7a, UZ#4, UZ#5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived to optical disk on a routine basis throughout the month. Daily EKES files were checked for any shelter activity. Sensor readings were checked daily as well for unusual occurrences, and statistical outliers were flagged.

A memo to the TPO documenting submittal of the borehole-monitoring data package **(Level 4 milestone SPH22NM4)** was prepared and submitted. Technical and QA review on this data set containing data from instrumentation of NRG-7a, UZ#4, UZ#5, UZ-7a, and SD-12 had been completed previously. Final preparations are underway for completion by the scheduled completion date in March.

In instrument maintenance, two Druck pressure transducers and two thermistors were calibrated for the ESF Air-permeability testing program. The Guildline Precision Resistor Kit #2 was taken to Bechtel - Nevada for recalibration on January 22. Bechtel called on February 24 to report that the resistors have been calibrated.

Several trips were made to field sites. Trips were made to multiple sites because of a failure of the radio modem computer at the HRF. Five trips were made to NRG-7a during the period. One trip was made to retrieve data manually. One trip was made to reprogram the card for the EKES system. Three trips were made to check the operation of the generator after scheduled oil changes.

Seventeen trips were made to UZ-4 and -5 during the period. Seven trips were required because of an unstable generator. One trip was made to reprogram the card for the EKES system. Three trips were made to check the operation of the generator after scheduled oil changes. Two trips were made to repair the utility UPS. Three additional trips were made to verify the operation of all systems.

Twelve trips were made to UZ-7a. Six trips were required because of an unstable generator. Two trips were made to repair the utility UPS. Three trips were made to check the operation of the generator after scheduled oil changes.

Nine trips were made to SD-12 during the period. One trip was made when a different generator was installed at the site. Three trips were made to check the operation of the generator after scheduled oil changes. One trip was made to reprogram the card for the EKES system. Two trips were made because of crashes of the phone modem computer. Two trips were made to change the sensor run descriptions.

Work related to air-permeability and hydrochemical testing in the ESF in the Ghost Dance fault alcoves continued. Air-injection testing was completed in GTB#1a. Testing consisted of five 1-m-long test intervals in the Topopah Spring middle nonlithophysal zone outside the fault zone, seven 1-m-long test intervals in the fault zone, and a 12-m-long test interval that straddled the entire fault zone. Air-injection permeability values of the Topopah Spring middle nonlithophysal zone located outside the fault zone range from 0.06 to 0.48 darcies with an average value of 0.3 darcies. Air-injection permeability values of the Ghost Dance Fault broken zone range from 1.3 to 11.1 darcies with an average value of 5.5 darcies. The permeability value of the 12-m test interval that straddled the entire fault zone was 5.7 darcies.

Preparations for single-hole testing in the southern Ghost Dance Fault geothermal borehole are complete. Assembly and calibration of the downhole equipment is also complete. Preparation of 3-D cross-hole equipment for testing in the northern Ghost Dance Fault alcove continued during the period. Calibration of transducers and data loggers has been completed, and the components for packer construction have been purchased and are ready for assembly.

Collection of temperature and relativity humidity data continued at four sites in the ESF. Wind-speed data currently are being collected at two locations (near Alcoves 3 and 4). Barometric-pressure, temperature, and relative-humidity data

are being collected in Alcove 4. Collection of data from four heat-dissipation probes in Alcove 3 continued. Data collected between October 1, 1996, and January 31, 1997, have been assembled for a data-package submittal.

A project designed to preserve the in-situ water content of selected sites in the tunnel continued. Several additional plastic sheets (1.5 x 1.5 m) have been attached to the tunnel wall (below the spring line) using nails and silicon sealer, for a current total of 29 installations. These selected locations may be the site of future sampling and/or instrumentation locations.

Sets of tensiometer and heat-dissipation probes continue to monitor the dry-out of the tunnel wall. To date, a total of eight tensiometers and eight heat-dissipation probes have been installed at two locations. Monitoring of the probes shows the change in water potential in the rock. The collected data are being assembled for a data package submittal.

A data package consisting of data collected between October 1, 1996, and January 31, 1997, has been compiled, technically reviewed, and submitted to Denver for processing. The data package "Moisture Monitoring in the ESF, October 1, 1996 to January 31, 1997" (DTN:GS970208312242.001) should be submitted to the RPC on schedule. A memo to the TPO discussing analyses and interpretation of data collected in the ESF between October 1, 1996, and January 31, 1997, is being prepared.

The 1996 milestone report (*Hydrochemical investigations and geochemical modeling in characterizing the unsaturated zone at Yucca Mountain, Nevada*, by Yang and others) was completed and sent to DOE/Las Vegas (and to USGS Headquarters for publication approval) on February 19. This action constitutes the completion of this activity (**milestone 3GUH607M,** Level 3). The report is currently in preparation for publication.

Hydrochemical data collection and analysis continued. Water collection by compression and distillation methods during February was recorded in the water-collection database. Water samples analyzed for tritium during February were recorded in the tritium database. Eight ESF pore-water samples were prepared for tritium analysis. Counting of those water samples for tritium concentration was delayed due to equipment malfunction, but tritium data from eight previously counted ESF pore-water samples were reduced, including two from SD-7. Twelve ESF core samples were distilled. The extracted pore water will be analyzed for tritium. CO_2 was extracted from an ESF-AL#4 core sample and an SD-12 (Calico Hills Formation) core sample using the distillation-acidification method for collecting dissolved CO_2. The volumes of CO_2 collected were measured, and the gas samples were sent to Beta Analytical Labs for carbon-isotope analysis.

In water-cation investigations, pore water from SD-9 core samples was collected using one-dimensional compression. Pore-water samples collected from SD-7, SD-9, and SD-12 cores were delivered for stable-isotope analysis. Four SD-9 pore-water samples were prepared for tritium analysis. Tritium data from two previously counted SD-7 pore-water samples were reduced. The LKB Liquid Scintillation Counter was calibrated.

Logistical preparations for gas sampling of the Calico Hills Formation of borehole UZ-14 continued.

Data from chemical and isotopic characterization of pore waters from ESF alcove boreholes were compiled, given technical review, and submitted to the data-management section. This action was in support of upcoming milestone SPH22XM4 [Data from chemical and isotopic analysis of pore water from ESF alcove boreholes completed through 31 January 1997].

In unscheduled work, staff assisted in preparation of the PISA report outline. UZ staff completed the annotated outline on the UZ Hydrochemistry part of the Hydrogeologic section and participated in discussions with DOE and the M&O of the adequacy of the planned content of the hydrogeologic section of the PISA report.

Staff attended the TSPA-VA UZ Radionuclide Transport abstraction/testing Workshop at Sandia National Laboratories, Albuquerque, from February 5 to 7. Staff also prepared a presentation for the Environmental Science Team meeting. UZ Hydrochemistry staff attended the day-long meeting. One staff member attended a geochemical modeling course at the National Training Center.

Saturated-Zone Hydrology

Pressure and water-level data collected at the C-holes and nearby wells UE-25 ONC-1, USW H-4, UE-25 WT#14, UE-25 WT#3, and UE-25 p#1, have been processed for submittal as one data package. The package was submitted for review during February.

Preparation continued of a memorandum describing the purely-convergent tracer test in which Pyridone was injected into UE-25 c#1 and 2,6, Difluoro-benzoic acid (2,6 DFBA) was injected into UE-25 c#2. This tracer test began on January 9. Analytical work supporting the memo continued during the period. The injections were done while the withdrawal well, UE-25 c#3, continued to be pumped at the rate of about 150 gpm, begun on 5/8/96. Five days after injection, 2,6 DFBA began arriving at UE-25 c#3, and about 9 days later (January 24), a peak concentration of about 250 ppb was obtained. During February, the concentration of 2,6 DFBA steadily decreased, forming a very clearly defined breakthrough curve. No Pyridone has been detected to date.

During the period from July 1 to December 31, 1996, a long-term hydraulic test was conducted in the lower Bullfrog, as a back drop to the series of conservative and reactive tracer tests discussed above. Analysis continued of the effects of this long-term pumping from borehole UE-25 c#3 on boreholes UE-25 c#1 and UE-25 c#2, and on the far-away observation wells UE-25 ONC-1, USW H-4, UE-25 WT#14, UE-25 WT#3, and UE-25 p#1.

For the month of February 1997, 27 manual measurements were completed in on-going support of aquifer testing at the C-hole complex. During February, five zones in four wells were monitored hourly with transducer measurements. Monitored wells include UE-25 WT#3, UE-25 WT#14, UE-25 p#1 and USW H-4 (upper and lower intervals).

Water-level measurements were completed at several wells: USW WT-1 and USW WT-2 on February 3; USW H-1 tube 1, UE-25 b#1 upper interval, and UE-25 WT#4 on February 4; USW H-1 (tubes 2, 3, and 4) on February 5; UE-25 WT#6 and UE-25 WT#16 on February 6; J-12 and J-13 on February 10; USW G-2 and J-11 on February 11; UE-25 WT#13 and UE-25 WT#15 on February 13; USW H-3 (upper and lower intervals) and USW H-5 (upper and lower intervals) on February 19; UE-25 p#1 on February 20; and USW VH-1, USW WT-7, USW WT-10, USW WT-11, and USW H-6 (upper and lower intervals) on February 25.

Calibrations were performed on equipment. Transducer (serial number) 670689 was calibrated and removed from well UE-25 p#1. Transducer 621309 was calibrated and placed in well UE-25 p#1. Transducers 62269 and 62271 were returned to Paroscientific for calibration check and recalibration.

Data were downloaded and retrieved from 21X recorders at wells USW H-4 (upper and lower zones), UE-25 WT #3, UE-25 WT #14, and UE-25 p#1.

Quality-assurance review of the report titled *Water levels in the Yucca Mountain area, Nevada, 1995* was completed on February 6. A copy of the report was submitted to the M&O on February 6 and to DOE on February 13, 1997, completing Level 4 **milestone SPH21FM4 [Memo to TPO: 1995 water-level data]** approximately one month ahead of the scheduled completion date. The report received USGS Director's approval as Open-File Report 97-101 on February 26.

> Graves, R.P., and Goemaat, R.L., *Water levels in the Yucca Mountain area, Nevada, 1995*, U.S. Geological Survey Open-File Report 97-101, *in press*.

In processing of water-level data, Level 4 **milestone SPH21BM4 [Memo to TPO: July through December water-level data to RPC]** was completed three weeks early on February 7.

The report *Analysis of water-level data in the Yucca Mountain area, Nevada, 1985-95* (USGS Director's approval as WRIR 96-4526 on September 30, 1996) was returned to the author on February 24 for review prior to final editing for the printers. Review was completed, and the report was returned to the Colorado District on February 27.

> Graves, R.P., Tucci, Patrick, and O'Brien, G.P., *Analysis of water-level data in the Yucca Mountain area, Nevada, 1985-95*: U.S. Geological Survey Water-Resources Investigations Report 96-4526, *in press*.

In efforts toward indexing final hydrogeologic framework model input/output, work continued on preparation of potentiometric-surface maps that will be used for model calibration and for the synthesis report. Analysis continued of water-level fluctuations to estimate hydraulic properties of the saturated zone rock units. A table of hydraulic properties for use by the site model was compiled.

Refinement of the grid-spacing of the framework model to 250 meters was completed. The model was regridded and visually inspected, but formal review has not yet been done. The updated model, containing three different upper surfaces corresponding to three interpretations of the potentiometric surface of the site model area, was sent to LANL for generation of the site flow model mesh. Grid generation is proceeding, and although these are different data sets, there are no new operational details different than previously used, so it is expected to be a smooth process. Grids that have been generated and tested and ready for FEHMN/PEST runs are expected to be available by the first week of March.

Three alternate variations of the potentiometric surface within the box model were developed and gridded using CPS-3 for use in subsequent model meshes. The variations represented different subsets of the potentiometric data in Ciesnik (1995) combined with 105 observation points within the site model domain. The subsets examined were 1) all the potentiometric data; 2) all data less points with head greater than 850 m; and 3) all data less points with head less than 500 m. This first potentiometric map included all data and assumed that water levels north of Yucca Mountain represent the true water table and are not perched. The second potentiometric map assumed that water levels above 850 m are not representative of the water table but are perched. The third potentiometric map basically assumed that low water levels in Death Valley do not influence ground-water flow in the site model area. These different configurations represent different model boundary head specifications and conceptual models. Further, by gridding a domain which is larger than the actual domain of the model, edge effects in the contouring process have been minimized.

Significant progress was made in calibration of the site flow model with assignment of optimal constant-pressure boundary conditions from the model restart file along the sides of the model domain. Zone definitions for each of the model sides were developed in a way that makes them transferable to any model mesh using the same *x,y* geometries of the model box domain. The boundary conditions specified were set so that the model was always fully saturated. The strategy that was developed (specifying a slightly elevated pressure at the water table surface, letting the model run to steady state, reading back the pressures from that run and fixing the boundary pressures equal to those read in for subsequent runs) will be employed with subsequent model meshes. The elevated pressure specified is then referenced to atmospheric pressure and the difference subtracted at the observation nodes. By fixing pressures only on the sides of the model, model pressures are free to vary within the interior of the model with changes in permeability during parameter estimation.

Numerous test runs were done with FEHMN to examine its restart capabilities under extreme variation in permeability values. Per those tests, discussions were held on the design of the next mesh. A decision was made to make the surface of the water table the top of the new mesh, and to have several meshes corresponding to several versions of the water table. This approach contrasts with previous meshes in which the top of the mesh was above the water table, and points corresponding to the water table were added to the extant mesh. Staff began preparing the surfaces and building the hydrogeologic framework model which will feed the mesh generator.

A FORTRAN routine for extracting which hydrogeologic unit an observation node resides in within the finite-element mesh was developed and tested.

The annotated outline for the site saturated-zone synthesis was completed and submitted to the USGS TPO on February 11, completing this activity about two weeks early (Level 4 **milestone SPH23VM4 [Memo to TPO: Annotated outline site SZ synthesis report]**). Work began (representing a start prior to the scheduled date) on writing various sections of the report. Assignments as to sections required from co-authors were made, and a list and description of figures was compiled.

Staff continued planning a workshop with SNL that will address critical issues on SZ flow modeling and the transfer of information obtained in process modeling for use by PA modelers. Discussions also continued on the influence of faults and fractures on the site model with various PA modelers. USGS staff met with SNL staff on February 26 to discuss the upcoming Abstraction/Testing Workshop. Final plans for logistics, participants, and format were discussed. This first phase of this activity was completed on February 28. Level 4 **milestone SPH25CM4 [Memo to TPO: Summary of**

meetings with PA modelers] was completed on February 13.

In unscheduled work, follow-up discussions occurred with USGS staff and the M&O and DOE regarding M.J. Umari's presentation to the NWTRB on January 29, 1997. There is disagreement about the placement of a postulated northwest-striking fault that hydraulically connects the C-hole complex with boreholes UE-25 ONC-1 and USW H-4, a connection inferred from the shape of the cone of depression resulting from pumping from borehole UE-25 c#3. Staff also contributed to Chapter 2.4 (Hydrology) of the PISA report and participated in meetings with DOE and M&O staff.

Work continued on documenting results of hydraulic testing at well USW G-2 during 1995, following review of the data last month. Staff met with D. Galloway (USGS) in Sacramento, CA, to discuss results of analysis of water-level fluctuations to estimate aquifer hydraulic characteristics at Yucca Mountain.

An application for presentation of a poster at the Penrose conference on Faults and Subsurface Fluid Flow was prepared and submitted. The application identified questions to address regarding characterizing the effects of faults on potential fast pathways from a repository to the accessible environment.

Staff attended a class on the USGS MODFLOWP ground-water simulation code.

WBS 1.2.3.6 CLIMATOLOGY and PALEOHYDROLOGY

Collection and compilation continued of diatom data from Owens Lake to establish a regional climate history for the past 500 ky. The final database for diatom analysis of the Owens Lake core will contain about 1000 samples with a temporal resolution of 500 to 750 years for the past 500 ky. USGS staff has nearly finished collecting ostracode data from Owens Lake as well. The final ostracode data set will include about 1400 samples with a temporal resolution of about 500 to 750 years for the past 500 ky.

Collection has also continued of ostracode data from the Las Vegas and Indian Springs Valley deposits for stable isotope analyses.

Staff continued work on assembling hydrologic and climatic data for the Owens Lake region to develop analog models for determining precipitation and temperature changes for the past 400 ky.

Work is being completed on a manuscript that describes the common ostracode taxa from the wetland sediments in the Yucca Mountain area. This manuscript will provide key documentation of paleontological data used in the interpretations of past climate and past discharge. Staff has also initiated work on ostracode morphological change through long Quaternary lake records in order to document within-species range changes that may enhance the paleoclimatic resolving power of the ostracode record.

In preparation for the paleoclimate synthesis report, staff attended PISA / Geology Site Description / Status Integration meetings with project scientists at Los Alamos, New Mexico, on February 18 and presented a synopsis of the findings and current research directions of the Yucca Mountain Climate Program.

Staff compiled input from Past Discharge activity investigators for the Semi-Annual report. This input included geochronologic, geochemical, stable-isotopic, paleontologic, and field studies of late Pleistocene ground-water discharge deposits from the southern end of Crater Flat near Yucca Mountain, to more distal deposits near Stateline, CA and as far south as Shoshone, CA. Paleo-discharge investigators also met with authors of the PISA hydrology chapter to discuss input from the Past Discharge and ESF Dating activities with others preparing material for the chapter.

In studies in the ESF, staff reviewed two TDIFs, (1) "Carbon and oxygen stable isotope KIEL analyses of calcite from the ESF and USW G-1, G-2, and G-4, UE-25 a#1, NRG-6, NRG-7/7A, and UZ-16, April 1996 - January 1997" which contained, including standards, 660 analyses; and (2) "□Carbon and oxygen stable-isotope analyses of calcite from the ESF and USW G-2, SD-7, and UE-25 a#7, November 1996 - January 1997" which contained, including standards, 172 analyses. Responses to reviewer's comments were compiled, and the TDIFs were submitted to Data Management. The package supports Level 4 **milestone SPC23FM4 [Memo-report to the USGS-TPO]**.

Staff also prepared □^{14}Carbon analyses of calcite from ESF fracture coatings. A TDIF was prepared on analyses of

apparent ^{14}Carbon ages performed by Beta Analytical, Inc. The data package was reviewed and submitted to Data Management. The package supports Level 4 **milestone SPC23FM4 [Memo-report to the USGS-TPO]**.

Some 27 calcite powders were collected from ESF occurrences that have been sampled for U-Pb age determinations, and four opal concentrates were also collected for further age determinations. These calcite □^{13}C and □^{18}O values were included as preliminary data in the ESF Dating milestone report. The data strongly suggest an abrupt shift in climate states sometime between 1 and 4 Ma.

Input from ESF-dating activity investigators was compiled for the semi-annual report. This input included geochronologic, geochemical, and stable isotopic of secondary mineral deposits and Sr isotopic data from SD-7 pore-water leaches. The data and their interpretations place important constraints on unsaturated-zone flux based on observations rather than hypothetical modeling.

The strontium data set from USW SD-7 was finalized, and staff prepared a draft of an abstract for submittal to the 1997 Goldschmidt Conference. The extended abstract discusses Sr isotopic data from pore-water leaches from SD-7 and implications for processes of UZ matrix flow in welded and nonwelded hydrostratigraphic units at Yucca Mountain. The abstract received technical review.

Staff helped diagnose (and partially repaired) a problem with the Finnigan MAT262 mass spectrometer that caused the high voltage to trip.

Staff compiled, organized and prepared a data package of U-Th isotopic data and calculated U-series ages from ESF samples analyzed between September 1996 and February 1997. Technical review of the data package was completed. The data package titled "Uranium and thorium isotope data collected between September 1996 and February 1997 from secondary minerals in the ESF" supports Level 4 **milestone SPC23FM4 [Memo-report to the USGS-TPO]**.

Investigators compiled, organized and prepared a data package of U-Pb isotopic data from ESF samples analyzed between September 1996 and February 1997. Technical review of the data package was completed. The data package titled "Uranium-Lead isotope data for ESF secondary minerals from September 1996 to February 1997" supports Level 4 **milestone SPC23FM4 [Memo-report to the USGS-TPO]**.

Staff evaluated U-Th, U-Pb, stable- and Sr isotopic data from ESF secondary minerals collected over the last six months. The data and interpretations are being synthesized into a memo-report to the USGS-TPO which will satisfy the requirements for milestone SPC23RM4. A first draft of the report that will deal with ages and isotopic compositions of percolation records and their implications on flux values and processes was initiated. The memo-report is expected to be completed on schedule by March 14.

In unscheduled work, staff prepared and presented an informal review of ESF secondary mineral data and hydrologic implications to a general USGS-YMP gathering at the monthly meeting in Denver.

Isotope investigators attended a one-day workshop held within the Environmental Studies Team for the purpose of internal technical exchange.

WBS 1.2.3.9 SPECIAL STUDIES

The USGS PI (for the PISA geologic-systems chapter) and other USGS staff attended a meeting with DOE and the M&O on February 18 for presentations on the surficial-processes and volcanic-hazards subsections of Chapter 2.3 (Geologic Systems) of the PISA report. In an additional meeting on February 26, the PI met with DOE and the M&O to discuss implementation of the Web-based Information System (WBIS). A first draft on the site-stratigraphy and a first draft on the regional-stratigraphy sections were completed. A methodology section for isotopic and geochronologic techniques was started.

Intensive efforts were undertaken to compile input to Site Characterization Progress Report (SCPR) #16, which will describe technical progress for the period October 1, 1996 through March 31, 1997. Detailed instructions for preparation of input for 29 SCP activities encompassing 27 summary accounts were prepared and transmitted to investigators. Each investigator with responsibility for preparation of input received an individualized package of

instructions containing 1) the individual's specific assignment identified by SCP study and activity and by summary account; 2) text of progress and forecast narratives from the previous progress report (SCPR #15) taken from the DOE-HQ draft; 3) a formatted template for use in preparation of input; and 4) a summary of content and format guidelines for preparation of input. Instruction packages were transmitted via electronic mail, and due dates for input were established for "staggered" due dates of February 19 through 25. Investigators were requested to return their input to SCPR #16 via electronic mail. This marked the first time that the process of distributing SCPR instructions and receiving input was handled exclusively utilizing electronic media. In general, complete, high-quality input was received on time from investigators. As of February 28, all SCPR #16 input had been received from investigators, with one exception (Preclosure Tectonics: Probabilistic Seismic Hazard Analysis).

In addition, work continued on revision of SCPR Appendix A, which is documenting differences between the site-characterization program outlined in the SCP and the current program. Revisions involve expanding the text prepared for SCPR #15 by inserting additional rationale for program changes, as well as literature citations to support interpretations and conclusions contained in Appendix A. Revisions to four sections of Appendix A were completed and submitted: Postclosure Tectonics, Geologic Framework, Geohydrology, and Preclosure Tectonics.

In work on the Hydrology section of the PISA report, staff revised and supplemented the December version of the detailed content outline. Future changes to the outline are expected to be minor. Most of the USGS staff for the PISA Hydrology section and the lead authors for the Geology and Climate sections met on February 21 in Denver with representatives of the M&O and DOE to review progress on the Hydrology section and to discuss interfaces with other sections of Chapter 2, the Site Description. Most of the earlier problems in staffing and conflicts have been resolved. Preparation of several parts remain deferred until conflicting March or June 1997 milestones have been completed.

WBS 1.2.8..4.7 WATER-RESOURCES MONITORING

In support of the water-resources environmental-impact statement (EIS), staff completed preparation and review of work plan and budget for water-quality data collection with USGS-NV managers on February 10 (as per a work plan discussed with SAIC personnel in January). Work plan and cost estimates were approved by SAIC personnel on February 11. Staff discussed USGS-ESIP tritium findings at Yucca Mountain and potential implications of those findings with regard to the EIS with SAIC and USGS-ESIP personnel.

Staff began modification of technical procedures necessitated by additional sample collection, processing, and laboratory analyses set to begin during the third quarter of FY 1997. Owners of sampling sites were contacted, and equipment preparations were begun for the March collection and delivery of water samples to personnel associated with the M&O's Radiological/ Environmental Field Programs. Quality-assurance samples (to be delivered to personnel associated with the M&O's Radiological/Environmental Field Programs) were processed.

Ground-water levels were measured at 30 sites. Ground-water discharge was measured at five springs and at one flowing well. Staff replaced and calibrated pressure sensors at sites JF-3 and AD-6. Ground-water data collected during January were checked and filed.

Water-level measurements made in the immediate vicinity of Yucca Mountain as part of the Site-Characterization Program may be reduced during the last two quarters of FY 1997 and in FY 1998. As a result, modifications to current data-collection activities in the immediate vicinity of Yucca Mountain as part of the Environmental Program may be advisable (to provide for comprehensive and defensible monitoring in the region). Potential changes in water-resource monitoring were discussed with USGS-Nevada District and USGS-ESIP personnel on February 19 and 24 (to provide for adequate monitoring following reductions in site-characterization activities). Staff reviewed the revised Memorandum of Agreement between USGS-NV District and USGS-YMPB for FY 1997 and prepared required materials for USGS headquarters and Nevada-District review of project activities. Staff also discussed the status and plans for well drilling by the Daisy Gold Mining Company in Crater Flat, and the possible coordination of data-collection activities, with mining-company personnel on February 13 and 26.

Preparations for the summary report (monitoring through calendar year 1996) continued with development of a detailed schedule for processing the report through technical and editorial reviews. Staff received and checked the initial version of the base map to be included in the report. Evaluation of electric-tape calibration data and checks of periodic water-level measurements continued during the period.

USGS Level 3 Milestone Report

October 1, 1996 - February 28, 1997

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
LETTER REPORT Milestone Number: SSH13BM3	11/1/96	10/30/96	10/30/96	
LETTER REPORT Milestone Number: SSH13CM3	1/31/97	1/30/97	1/30/97	
Ltr Rpt: Geo S.R. Sta 55+00 to STA 63+47 Milestone Number: SPG42BM3	2/28/97	2/27/97	2/27/97	
Rpt Geo North/South Main Drft Sta 28+00 to55+00 Milestone Number: SPG42AM3	2/28/97	2/28/97	2/28/97	

USGS Level 4 Milestone Report

October 1, 1996 - February 28, 1997

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: SS Hazards Methodologies Wrkshop **Milestone Number:** SPG28FM4	10/25/96	10/24/96	10/24/96	
Memo to TPO: Jan-Jun96 Perio Wtr Lvl Data to RPC **Milestone Number:** SPH21CM4	10/31/96	10/30/96	10/30/96	
Memo to TPO: SS Hazards Method. Wrkshop Summary **Milestone Number:** SPG28GM4	11/15/96	11/14/96	11/14/96	
Memo toTPO: Seis. Src. Mdls & Proponents Wrkshop **Milestone Number:** SPG28HM4	11/27/96	11/26/96	11/26/96	
Memo to TPO: Comp Frac Data Coll:Cal. Hills,Prow **Milestone Number:** SPG34M4	11/27/96	11/27/96	11/27/96	
Memo to TPO: Comp Re-Eval Priority Strat Contact **Milestone Number:** SPG21M4	12/13/96	12/13/96	12/13/96	
Memo to TPO: Detailed Content Outline **Milestone Number:** SPH391M4	12/13/96	12/13/96	12/13/96	
Memo to TPO: SS Modls & Propnents Wrkshop Summry **Milestone Number:** SPG28IM4	12/19/96	12/19/96	12/19/96	
Report: Mod Flow In UZ Frac Ntwk TS W-U in ESF **Milestone Number:** SPH21AM4	12/31/96	12/19/96	12/19/96	
Memo to TPO: Monitoring Data Apr-Sep 1996 to RPC **Milestone Number:** SPH22GM4	12/31/96	12/23/96	12/23/96	
Memo to TPO: GM Models and Interpret. Workshop **Milestone Number:** SPG28AM4	1/17/97	1/13/97	1/13/97	
Memo to TPO: Seismic Source Interp. Wrkshop **Milestone Number:** SPG28JM4	1/17/97	1/13/97	1/13/97	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Clim Scenarios Recvd & Sim Started **Milestone Number:** SPH23AM4	1/30/97	1/13/97	1/13/97	
Memo to TPO: SS Interpretations Wrkshop Summary **Milestone Number:** SPG28KM4	2/4/97	2/3/97	2/3/97	
Memo to TPO: GM Modls & Interpret Wrkshp Summry **Milestone Number:** SPG28BM4	2/6/97	2/5/97	2/5/97	
Memo to TPO: Sub Bh Video Frac Db to GENISES **Milestone Number:** SPG211M4	2/28/97	2/27/97	2/27/97	
Memo to TPO: Jul-Dec96 Perio Wtr Lvl Data to RPC **Milestone Number:** SPH21BM4	2/28/97	2/7/97	2/7/97	
Memo to TPO: Annotated Outline Site SZ Synth Rpt **Milestone Number:** SPH23VM4	2/28/97	2/11/97	2/11/97	
Memo to TPO: Summary of Meetings with PA Mdlrs **Milestone Number:** SPH25CM4	2/28/97	2/13/97	2/13/97	
Memo to TPO: 1995 Water-Level Data **Milestone Number:** SPH21FM4	3/14/97	2/13/97	2/13/97	

Participant USGS

Prepared - 03/12/97:10:44:55

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

01-Feb-97 to 28-Feb-97
Page - 1
Inc. Dollars in Thousands

WBS No. - 1.2

WBS Title - Yucca Mountain Project

Parent WBS No. - 1.0

Parent WBS Title - Mined Geologic Disposal System

Element ID - 12

Statement of Work:

See the current WBS Dictionary

Cost/Schedule Performance

		Current Period					FY1997 Cumulative to Date					FY1997 at Completion		
Id	Description	BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.3	Site Investigations	1062	1032	1007	-30	25	4672	4812	4518	140	294	11402	11559	-157
1.2.5	Regulatory	42	42	30	0	12	181	181	148	0	33	504	491	13
1.2.8	Environment, Safety, and H	50	50	26	0	24	253	253	198	0	55	612	605	7
1.2.9	Project Management	54	54	46	0	8	260	260	226	0	34	664	640	24
1.2.12	Information Management	7	7	4	0	3	33	33	20	0	13	80	77	3
1.2.15	Support Services	143	143	131	0	12	713	713	678	0	35	1722	1728	-6
Total		1358	1328	1244	-30	84	6112	6252	5788	140	464	14984	15100	-116

Resource Distributions by Element of Cost

Fiscal Year 1997

Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	19540	19599	16166	20824	21329	20182	22106	22047	22573	22479	21615	20362	248822
LABOR	885	899	632	866	876	906	909	904	921	919	891	856	10464
SUBS	139	143	87	148	145	145	140	150	153	149	148	136	1683
TRAVEL	25	43	34	45	43	47	35	37	38	36	35	31	449
PM&E	7	6	7	5	9	6	7	6	9	7	5	4	78
OTHER	197	201	179	206	285	184	178	182	176	179	170	173	2310
Total BCWS	1253	1292	939	1270	1358	1288	1269	1279	1297	1290	1249	1200	14984

Actual Cost of Work Performed

LBRHRS	19283	18578	18523	18723	17133	0	0	0	0	0	0	0	92240
LABOR	771	712	732	829	727	0	0	0	0	0	0	0	3771
SUBS	127	139	117	185	134	0	0	0	0	0	0	0	702
TRAVEL	11	24	61	53	42	0	0	0	0	0	0	0	191
PM&E	43	16	88	85	89	0	0	0	0	0	0	0	321
OTHER	119	129	145	158	252	0	0	0	0	0	0	0	803
Total ACWP	1071	1020	1143	1310	1244	0	0	0	0	0	0	0	5788

WBS No. - 1.2 -Yucca Mountain Project

Resource Distributions by Element of Cost

Fiscal Year 1997
Estimate to Complete

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	0	0	0	0	0	21138	22344	22180	22690	22595	21787	20467	153201
LABOR	0	0	0	0	0	1003	950	913	913	905	900	865	6449
SUBS	0	0	0	0	0	158	156	160	163	155	155	145	1092
TRAVEL	0	0	0	0	0	53	43	44	38	36	40	33	287
PM&E	0	0	0	0	0	8	9	6	9	7	2	1	42
OTHER	0	0	0	0	0	208	173	178	216	194	186	287	1442
Total ETC	0	0	0	0	0	1430	1331	1301	1339	1297	1283	1331	9312

Resource Distributions

Fiscal Year 1997	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1253	1292	939	1270	1358	1288	1269	1279	1297	1290	1249	1200	14984
BCWP	1195	1245	1131	1353	1328	0	0	0	0	0	0	0	6252
ACWP	1071	1020	1143	1310	1244	0	0	0	0	0	0	0	5788
ETC	0	0	0	0	0	1430	1331	1301	1339	1297	1283	1331	9312

Fiscal Year Distribution

	Prior	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	Future	At Complete
BCWS	15914	14984	9432	980	0	0	0	0	0	0	0	0	41310
BCWP	15609	6252	0	0	0	0	0	0	0	0	0	0	
ACWP	15908	5788	0	0	0	0	0	0	0	0	0	0	
ETC	0	9312	9432	980	0	0	0	0	0	0	0	0	41420

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey

Date Prepared 03/14/97 08:52

MONTHLY COST/FTE REPORT

Fiscal Month/Year FEBRUARY 1997

	CURRENT MONTH END						FISCAL YEAR		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON HOURS	PURCHASE COMMITMENTS	SUBCON COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.3	1003	14272	2736	0	955	95	11387	9110	4506
1.2.5	30	248	0	0	175	0	504	404	145
1.2.8	27	555	0	0	0	0	612	490	199
1.2.9	47	880	152	0	50	5	664	530	227
1.2.12	4	160	0	0	0	10	80	64	20
1.2.15	129	1018	304	0	63	35	1722	1378	668
TOTALS	1240	17133	3192	0	1243	145	14969	11976	5765

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/96 - 02/28/97

		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
0G311FA1	Scientific Programs Management & Integra	15.7	16.6	12.0	21.8	62.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128.4
1.2.3.1.1		15.7	16.6	12.0	21.8	62.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	128.4
0G312FA1	Nevada Operations/Earth Science Investig	55.0	57.4	62.9	66.3	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340.5
1.2.3.1.2		55.0	57.4	62.9	66.3	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340.5
*1.2.3.1		70.7	74.0	74.9	88.1	161.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	468.9
0G32211FB1	Review & Revision of Lithostratigraphy B	14.1	13.4	50.3	23.9	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.3
1.2.3.2.2.1.1		14.1	13.4	50.3	23.9	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.3
0G32212FB2	Complete Site Area Geologic Map	36.9	24.9	34.2	12.0	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.2
0G32212FB3	Fracture Studies	6.3	16.8	14.9	12.2	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.1
0G32212FB4	Geologic Mapping of the Exploratory Stud	119.7	139.2	106.3	155.8	135.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	656.2
1.2.3.2.2.1.2		162.9	180.9	155.4	180.0	166.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	845.5
0G3252FB1	Evalute Tectonic Scenarios for PA	10.6	4.1	-4.1	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.9
1.2.3.2.5.2		10.6	4.1	-4.1	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.9
0G32836FB1	Conduct Probabilistic Seismic Hazards An	88.3	62.1	54.3	46.4	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	287.6
1.2.3.2.8.3.6		88.3	62.1	54.3	46.4	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	287.6
*1.2.3.2		275.9	260.5	255.9	252.6	211.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1256.3
0G33111FB4	Collection of Site Meteor. Data for Hydr	7.8	8.8	12.2	17.5	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.6
1.2.3.3.1.1.1		7.8	8.8	12.2	17.5	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.6
0G33112FB1	Collection of Site Streamflow Data	5.6	5.1	5.3	7.4	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.1
0G33112FB2	Collection of Site Streamflow Data	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
1.2.3.3.1.1.2		5.6	5.1	5.3	7.4	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.1
0G33114FB3	Regional Saturated Zone Synthesis Report	7.6	7.6	0.0	12.5	29.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.8
1.2.3.3.1.1.4		7.6	7.6	0.0	12.5	29.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.8
0G33121FB1	Infiltration Processes	21.5	16.0	19.0	18.3	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	105.5
1.2.3.3.1.2.1		21.5	16.0	19.0	18.3	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	105.5
0G33123FB4	Integrated Analysis & Interpretation	14.5	5.4	14.5	20.9	38.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.1
0G33123FB5	Matrix Properties of Hydrologic Units	14.1	12.0	16.2	17.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.9
0G33123FBA	Unsaturated Zone Borehole Instrumentatio	31.9	36.3	32.6	32.3	34.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	167.3
0G33123FBB	Unsaturated Zone Borehole Instrumentatio	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
0G33123FBC	Integrated Analysis & Interpretation	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
0G33123FBD	Matrix Properties of Hydrologic Units	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
1.2.3.3.1.2.3		60.5	53.7	63.3	71.0	74.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	323.3
0G33124E96	Air-K and Hydrochemisty Test - North Ram	5.5	3.1	6.4	6.1	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.5
0G33124FB7	Air Permeability & Hydrochem Testing ESF	46.1	40.6	40.9	68.9	62.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	259.2
0G33124FB8	Percolation Flux across Repository Horiz	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
0G33124FBA	Moisture Monitorning in the ESF	2.4	2.4	1.5	18.3	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.9
0G33124FBB	Air-Permeability & Hydrochem Testing ESF	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

U.S. GEOLOGICAL SURVEY
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		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
0G33124FBD	Moisture Monitoring in the ESF	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
1.2.3.3.1.2.4		54.0	46.1	48.8	93.3	72.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	314.6
0G33127B96	UZ Hydrochemistry	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
0G33127FBA	UZ Hydrochemistry	23.0	27.1	22.0	1.2	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.3
0G33127FBB	UZ Hydrochemistry	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
1.2.3.3.1.2.7		23.0	27.1	22.0	21.2	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.3
0G33128FBD	Fluid Flow in Unsaturated Zone Fractured	7.6	5.3	2.9	6.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.6
1.2.3.3.1.2.8		7.6	5.3	2.9	6.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.6
0G33129FBG	Site Unsaturated Zone Flow Model	7.8	6.4	8.3	25.5	-13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.7
0G33129FBK	Support UZ Model Expert Elicitation	0.0	21.2	6.8	8.6	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.0
1.2.3.3.1.2.9		7.8	27.6	15.1	34.1	-5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78.7
0G33131FBA	C-Well Complex Hydraulic & Conservative	46.5	42.2	46.6	74.2	58.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	268.0
0G33131FBB	C-Well Complex Hydraulic & Tracer Test	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
0G33131FBC	Water-Level Monitoring	20.7	17.8	20.5	18.2	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.5
0G33131FBD	Water-Level Monitoring	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
1.2.3.3.1.3.1		67.2	60.0	67.1	92.4	72.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	359.5
0G33133FB3	Site Saturated Zone Flow Model	16.5	25.9	21.8	27.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	113.4
0G33133FB4	Site Saturated Zone Synthesis Report	1.3	0.0	2.5	0.3	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1
0G33133FB5	Conduct VA SZ Flow Model Sensitivity An	4.0	2.0	2.6	8.5	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0
0G33133FB6	Confirm SZ Hydrologic Flow Models	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
1.2.3.3.1.3.3		21.8	27.9	26.9	35.8	42.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	154.5
*1.2.3.3		284.4	285.2	282.6	409.5	358.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1620.5
0G3521FA1	Tracer Gas Support	5.7	5.1	6.0	6.8	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0
1.2.3.5.2.1		5.7	5.1	6.0	6.8	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0
*1.2.3.5		5.7	5.1	6.0	6.8	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.0
0G36212FB1	Confirmatory Aquatic Investigations	0.0	2.1	6.9	7.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9
1.2.3.6.2.1.2		0.0	2.1	6.9	7.9	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.9
0G36215FB2	Paleoclimate/Paleoenvironmental Synthesi	40.1	38.6	31.7	62.4	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.6
1.2.3.6.2.1.5		40.1	38.6	31.7	62.4	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210.6
0G36221FB1	Evaluation of Paleo Ground-Water Dischar	17.4	15.4	27.9	28.8	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.5
0G36221FB2	Geo. Fract. Fill Mater, ESF & Est Past W	57.0	39.2	87.6	70.6	85.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340.2
0G36221FB3	Syn.Dist.&Anal Geochron. Age Dets Potent	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
1.2.3.6.2.2.1		74.4	54.6	115.5	99.4	98.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	442.7
*1.2.3.6		114.5	95.3	154.1	169.7	139.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	673.2
0G39BFA1D	Support Systems Engineering Reports & St	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
0G39BFA1F	Data & Del Mgt., QA Compl, Oversite Sup,	14.6	13.0	13.3	10.9	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.9
0G39BFB1	Support Development of PISA Ch 2.3 (Geol	30.1	29.7	43.9	50.1	55.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	209.3

U.S. GEOLOGICAL SURVEY
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		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
OG39BFB1C	Provide Support to LA Plan	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
OG39BFB1E	Provide Input to SC Progress Report 16	9.9	11.0	10.9	5.6	13.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.5
OG39BFB2	Develop PISA Chapter 2.4 (Hydrology)	11.6	12.5	33.0	31.0	43.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	131.6
OG39BFB2E	Provide Input to SC Progress Report 17	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
OG39BFB4	Dev Climate/Meteorologic Sys Desc (PISA	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
1.2.3.9.11		66.2	66.2	101.1	97.6	127.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	458.3
*1.2.3.9		66.2	66.2	101.1	97.6	127.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	458.3
**1.2.3		817.4	786.3	874.6	1024.3	1003.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4506.2
OG535FA1	Provide FY97 Technical Data Base Input	21.3	18.0	18.0	40.7	25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.5
1.2.5.3.5		21.3	18.0	18.0	40.7	25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.5
*1.2.5.3		21.3	18.0	18.0	40.7	25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.5
OG541FA2	Viability Assessment Scenarios Developme	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
1.2.5.4.1		0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
OG544FA1	UZ Flow Model Abstractions for VA	0.0	0.0	5.5	1.3	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
OG544FA2	SZ Flow Model Abstractions for VA	0.0	0.0	7.1	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
1.2.5.4.4		0.0	0.0	12.6	0.9	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3
*1.2.5.4		0.0	0.0	12.6	4.4	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.8
**1.2.5		21.3	18.0	30.6	45.1	30.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145.3
OG825FA1	Federal Occupation Safety & Health	8.8	7.1	9.0	8.9	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.1
1.2.8.2.5		8.8	7.1	9.0	8.9	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.1
*1.2.8.2		8.8	7.1	9.0	8.9	7.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.1
OG845FA1	Radiation Protection	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1.2.8.4.5		0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
OG847FA1	Water Resources Envir Impact Stmt Suppor	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
OG847FA2	Rad Water Quality Sample Collection	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
OG847FB1	Water Resources	30.4	29.6	30.3	48.3	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.6
1.2.8.4.7		30.4	29.6	30.3	48.3	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	158.0
*1.2.8.4		30.4	29.6	30.4	48.3	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	158.1
**1.2.8		39.2	36.7	39.4	57.2	26.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	199.2
OG912FA1	Participant Technical Project Office	25.0	23.2	27.3	25.9	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.4
1.2.9.1.2		25.0	23.2	27.3	25.9	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.4
*1.2.9.1		25.0	23.2	27.3	25.9	29.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.4
OG922FA1	Participant Project Control - USGS	21.4	18.6	18.1	20.5	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.1
1.2.9.2.2		21.4	18.6	18.1	20.5	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.1
*1.2.9.2		21.4	18.6	18.1	20.5	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.1
**1.2.9		46.4	41.8	45.4	46.4	46.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	226.5
OGC522FA1	Satellite Records Operations	3.8	3.5	4.7	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR 10/1/96 - 02/28/97

		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
1.2.12.5.2.2		3.8	3.5	4.7	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4
*1.2.12.5		3.8	3.5	4.7	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4
**1.2.12		3.8	3.5	4.7	4.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4
OGF23FA1	Support/Personnel Services	32.4	28.7	35.4	25.6	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.6
OGF23FA2	Facilities Management - Space	61.7	61.7	61.7	61.7	61.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	308.5
OGF23FA3	Facilities Management - Computers/Phones	16.7	16.7	16.7	16.7	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.5
OGF23FA4	Facilities Management - Other	12.5	12.5	12.5	12.5	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.5
OGF23FA5	Procurement/Property Management - USGS	10.2	11.0	8.0	7.3	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0
1.2.15.2.3		133.5	130.6	134.3	123.8	124.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	647.1
*1.2.15.2		133.5	130.6	134.3	123.8	124.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	647.1
OGF3FA1	USGS Training Support	4.5	4.2	3.7	4.8	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4
1.2.15.3		4.5	4.2	3.7	4.8	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4
*1.2.15.3		4.5	4.2	3.7	4.8	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4
**1.2.15		138.0	134.8	138.0	128.6	129.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	668.5
OG847FA1		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
1.2.8.4.7		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
*1.2.8.4		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
**1.2.8		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 OPERATING		1066.1	1021.1	1132.7	1305.8	1240.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5766.1
CAPITAL EQUIPMENT		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
GRAND TOTAL		1066.1	1021.1	1132.7	1305.8	1240.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5766.1
FTEs														
FEDERAL		112.7	108.9	108.0	109.3	100.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT		17.0	17.8	19.2	26.5	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL		129.7	126.7	127.2	135.8	118.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

* Fourth level WBS roll-up

** Third level WBS roll-up