



United States Department of the Interior

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

IN REPLY REFER TO:

INFORMATION ONLY

May 16, 1994

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

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

Dear Vince:

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

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

Sincerely,

for Raye E. Ritchey
Larry R. Hayes
Technical Project Officer
Yucca Mountain Project Branch
U.S. Geological Survey

Enclosure:

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

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U.S. Geological Survey
EXECUTIVE SUMMARY
April 1994

WBS 1.2.3.1 - Coordination and Planning

United States Geological Survey-Yucca Mountain Project Branch (USGS-YMPB) is currently processing 90 hydrologic-related scientific publications, 66 geologic and climate-related scientific publications, 13 USGS-LBL hydrologic-related scientific publications, and 74 abstracts.

WBS 1.2.3.2 - Geology

In support of surface and subsurface stratigraphic studies, Sr chemistry analyses were initiated on whole-rock samples obtained from UE-25 NRG#3 drill core. Four NIST SRM 611 glass wafers were prepared, spiked, and digested for Sr isotope dilution analysis; results of the analysis will test the current Sr spike calibration. Preparation of whole-rock powders and x-ray fluorescence (XRF) mounts were completed on the remaining 26 of 32 samples of volcanic rocks from drill hole UE-25 NRG#2A.

Construction of lithostratigraphic unit surfaces for the 3-D site scale model within LYNX continued. Model YMP.R1 now incorporates 14 surfaces which are separated into nine distinct fault blocks. New fault geometry has been established and new surfaces have been decided upon for the next version of the lithostratigraphic model. A map was prepared of all faults within the site-scale model from available published data and subdivides the faults based on the amount of vertical separation exhibited by each fault. Contact picks, depths to contacts, unit thicknesses, borehole locations, and references were reviewed for 41 boreholes for the 3-D model database.

Scientists in the surface-based geophysics studies participated in an integrated review of vertical seismic profiles (VSP), surface seismic reflection, gravity, and magnetic studies of the Ghost Dance fault system in the region near USW WT-2 and UE-25 UZ#16. Magnetic results to shallow depths and VSP/seismic methods to greater than about 610 m appear consistent with geology mapped from surface exposures.

Geologic mapping of zonal features studies continued with the completion of first-pass mapping of lithologies and structures at a scale of one inch equals five feet at the ARP-1 exposure; field quality checking is in progress. Opaque mineral phases that characterize each zone within the Tiva Canyon tuff, Antler Ridge section, and USW GU-3 were summarized showing the opaque mineral phases identified with respect to stratigraphic position.

At the Exploratory Studies Facility (ESF), photogrammetric mapping of the starter tunnel is nearly complete. To date, approximately 2,300 fractures have been recorded using the photogrammetric method. Digitizing and editing the full-periphery geologic map of Test Alcove #1 using AutoCAD and editing the full-periphery drawing of sample locations in the starter tunnel and Test Alcove #1 were completed.

In seismic tomography/vertical seismic profiling studies, the far-offset data from USW WT-2 and UE-25 NRG#6 were further processed for refining the images associated with faulting in the vicinity of the wells. In the case of USW WT-2, there is clear evidence from the far-offset VSP at 305 m, that the Ghost Dance fault is a system of faults in a zone at least several hundred feet wide and extending at least 305 m deep.

Thirteen samples of Tiva Canyon Tuff were collected from a faulted area at the eastern end of Antler Ridge and prepared for XRF analyses. Results of the analyses will be used in the mapping of zonal features study to distinguish

between the upper lithophysal zone (high-silica rhyolite) and the upper cliff zone (quartz latite) to verify field picks of the contacts between the two zones.

In the mapping of surficial deposits, U-Th chemistry was completed on four aliquots of a rhizolith sample from an eolian sand deposit underlying Fortymile Wash high-terrace gravels and on four samples from the upper and lower soil carbonate horizons. Preliminary results indicate an excess of ^{230}Th relative to ^{238}U in the aliquots analyzed that is most likely related to uranium loss. Estimation of $^{230}\text{Th}/\text{U}$ ages will be made after additional samples are analyzed.

In geochronological studies, preliminary $^{230}\text{Th}/\text{U}$ age estimates, based on analyses of carbonate nodules and calcified plant material from the Horse Tooth Deposit, suggest that the site may have been saturated as recently as 12 ka. This constrains the open-water stage of the deposit to between 12 and 30 ka, a prominent period of high-water stands noted elsewhere throughout the Great Basin. However, additional analyses are required before final stage estimates are obtained for this evaluation of past discharge areas.

Current seismicity data were recorded by CUSP for all sites in April, with 43 minutes of downtime due to power outage and a minor CUSP software error. Seismic calibrations were performed at 20 sites of the SGBSN. All of the April seismic events were picked.

Studies to evaluate age and recurrence of movement on Quaternary faults continued with the compilation of preliminary logs (where field mapping is complete) for trenches T8, SCF-T1, SCF-T1A and SCF-T3 in Solitario Canyon. Sites were determined for topographic profiling of the Ghost Dance fault on Whaleback and Antler ridges and sites selected for sample collection for exposure dating across the fault zone.

WBS 1.2.3.3 - Hydrology

Collection of synoptic weather data continued in the form of weather charts and weather satellite images. Two precipitation events were recorded at Yucca Mountain in March. The first, on April 9, was accompanied by lightning; the rain gage network recorded an average of 4.3 mm. A slow-moving upper air, low-pressure system resulted in intermittent light rain and showers from the 25th through the 28th; lightning, small hail, and a funnel cloud over Skull Mountain was reported on the 28th. The gage network recorded about 6.4 mm of precipitation for the four days.

Cumulative rainfall measured for network sites averaged about 3.3 mm. Precipitation totals for monitoring sites on the Nevada Test Site ranged from 0 to 11.7 mm. There was no runoff recorded or reported at any of the Yucca Mountain streamflow-monitoring sites. The Amargosa River at Tecopa, California continued to maintain a base flow of about 0.006 m³/sec for the month.

Reduction and tabulation of all streamflow and precipitation data collected in FY 91-93 were completed and submitted to the Nevada District Office in Carson City for review.

Ponding and infiltration experiments continued in the Fortymile Wash recharge study. Additional data collected included: precipitation data from gages in Fortymile Canyon; neutron logs from UE-29UZN#91 and #92; water-level measurements in UE-29a #1, a #2, and UE-29 UZN #91.

The surficial-materials experiment to study the effects of diameter variation behind borehole casings on the output of neutron-neutron tools, similar to experiments done with the gamma-gamma tool in January and the neutron-neutron tool in March of this year, was repeated. For the experiment, both tools were dragged repeatedly through a 4.6-m section of drill-hole casing placed on the ground in contact with uniform, dense desert soil along a 45.7-m transect. Following each run, holes of various sizes were excavated beneath the casing; in

one area, both lead and boron blocks were placed under the casing. Both tools were able to detect the different treatments. Results of the study will aid in determining the geometry of washout zones behind the casing in drilled holes.

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

Data from the air-permeability testing at UE-25 UZ#16 are being analyzed. To obtain a first estimate of the permeability in the hole, all the tests will be initially analyzed by a steady-state method for elliptical flow. This initial analysis will provide an estimate of the range and variance between and among the formations tested. The packer assembly from the hole was removed and transported to Test Cell C along with all field support equipment. It was discovered that two of the four packers were damaged; both packer will have to be disassembled and the inflatable packers replaced.

USW UZ-14 support studies continued; coring operations were overseen throughout the reporting period. The borehole was advanced to 611 m, and water levels were measured at a depth of 599 m; additional water was encountered at a depth of 666 m. It appeared to flow from a single fracture in the Bullfrog member of the Crater Flat tuff; samples of the water will be obtained in May. Projected total depth of the borehole is 678 m. Logging of fractures from core recovered continued to a depth of 488 m.

Six cores from USW UZ-14 were prepared for compression tests and computed moisture contents. Five core samples were compressed by high-pressure, one-dimensional compression. Water was obtained from four Pah Canyon samples and one pedded tuff sample. Samples obtained will be analyzed for tritium, 180/160, and D/H.

The large-block, prototype ESF percolation experiment was restarted. Currently, water is flowing continuously through the block fractures between about 1 - 2 cm³/hr. Average water pressure along the block top is between -20 and -16 cm of water. Measurements of water pressure in the block matrix and fracture are being made with tensiometers. Pressures along the top will be decreased until water flow stops, then increased until flow begins again to determine any hysteretic behavior that may affect water flow in fractures.

Monitoring of perched water in the ESF by other investigators was continued. To date, the starter tunnel has been drilled and blasted to about 61 m. Drilling of the three radial boreholes has been completed. No natural water flows have been encountered.

Gaseous-phase chemical investigations in the unsaturated zone continued. A second test to determine the equilibration between gas and sample for concentrations of SF₆ < 0.1 ppm was initiated; the first test was run for 320 hours and did not reach equilibrium. Gas samples of SF₆ were collected from USW UZ-1 to study the continuing effects of drilling at USW UZ-14.

As part of the aqueous-phase chemical investigations, a perched water sample was collected from between 459.7 and 461.0 m at UE-25 NRG#7 and sent for organic and inorganic, 14C, D/H, and 180/160 determinations. Distilled three core samples from UE-25 UZ#16 and five from USW UZ-14 which had previously been squeezed using one-dimensional compression methods and submitted for analyses of tritium, D/H, and 180/160.

Previous runs of the two-dimensional model of the unsaturated zone beneath Pagany Wash, made using an infiltration rate of 20 mm/yr against a background rate of 0.1 mm/yr, have indicated a tendency for localized sources of infiltration to spread laterally with depth as a result of stratigraphic heterogeneity. New runs were made using an infiltration rate of 35 mm/yr in the wash. Again, substantial

lateral spreading occurred so that the vertical flux entering the repository unit was spatially uniform and greatly reduced from the peak input value. Plots of flux and velocity vectors from the model output indicate those stratigraphic horizons most responsible for the lateral spreading of water, and it appears that some of the strongest lateral-flow components occur above the vitric caprock of the Topopah Spring member where lateral flow is promoted by capillary barrier effects. Travel times calculated for particle trajectories indicate ground-water age distributions consistent with water ages determined at USW UZ #4 and UE-25 UZ #5 by ¹⁴C age-dating and support the contention that infiltration into the channel has been a significant component of past net infiltration.

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

WBS 1.2.3.6 - Climatology

As part of Paleoclimate studies, extracted ostracodes and other material from 37 samples collected as part of an earlier time series study under analog recharge; extracted ostracodes and related material from 24 Jay Quade fossil samples that will be used to identify climate variability during the late Pleistocene and early Holocene in southern Nevada

In support of calcite and opaline silica deposit studies, about 80 samples of ostracodes from a section of Late Pleistocene wetland sediments from the Las Vegas Valley near Corn Creek Springs were analyzed for $\delta^{13}C$ and $\delta^{18}O$. These data provide strong support for the snail stable isotope data from the same sequence that indicated the Late Pleistocene was wetter and/or colder than at present.

Soil pit MWV p10 in Midway Valley was described as part of surficial deposits mapping studies; samples were collected and will be analyzed in HRF laboratories for soil properties needed to characterize a major alluvial map unit of hypothesized latest Pleistocene age.

WBS 1.2.3.7 - Resource Potential

Sample preparation was completed on a second set of 13 samples from Antler Ridge and the remaining 26 of 32 samples from UE-25 NRG#2A for XRF analyses. Sample preparation was completed on the remaining 70 of 95 samples collected for the mineral resource assessment study and was begun on about 25 of the 63 samples collected on the second field trip.

WBS 1.2.12 - Information Management

One-hundred fifty nine individual records, eight non-data criteria packages, 41 data packages, eight publication packages, and no cited reference lists were received into the LRC. Current material transmitted to the CRF from the LRC included 38 individual records and 29 non-data critical packages (1,453 pages), six publication packages, 35 data package (5,334 pages), and nine cited references. Backlog material transmitted included seven data packages (838 pages). The total pages transmitted for current and backlog material was 9,363 pages.

WBS 1.2.13 - Environment, Safety, and Health

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

USGS LEVEL 3 MILESTONE REPORT
OCTOBER 1, 1993 - APRIL 30, 1994
Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
G300: FINAL RPT, CROSS-HOLE PROTOTYPE TESTING Milestone Number: 3GUT004M	03/31/93	05/31/94		
PUBLICATION: RAILROAD VALLEY ANALOG Milestone Number: 3GNR02AM	09/30/93	05/31/94		
PUBLICATION: DEVELOPMENT OF 1-D COMPRESSION Milestone Number: 3GUH045M	01/31/94	06/30/94		
PUBLICATION: FY92 DATA FROM ANALOG RECHARGE SITE Milestone Number: 3GQH12CM	01/31/94	05/31/94		
ANALYSIS PAPER: UZ-16 COMPLETION REPORT (P013) Milestone Number: 3GUP066M	02/01/94	09/30/94		
ANLYS PAPER: LAB MEASUREMENT OF UNSATURATED FLOW Milestone Number: 3GUS034M	02/04/94	06/30/94		
ANALYSIS PAPER: LITHOLOGIC LOGGING - PHASE 1 Milestone Number: 3GGU131M	02/28/94	05/31/94		
ANALYSIS PPR: DATA-STARTER TUNNEL & NORTH PORTAL Milestone Number: 3GGF012M	02/28/94	05/02/94		
STUDY PLAN TO DOE: INTACT FRACTURE TESTS - ESF Milestone Number: 3GUS048M	02/28/94	04/25/94	04/25/94	
STUDY PLAN TO DOE: PERCOLATION TESTS IN ESF Milestone Number: 3GUS037M	02/28/94	04/25/94	04/25/94	
CRITERIA LETTER: TECH SUPPORT FOR X-HOLE TESTING Milestone Number: 3GWF086M	02/28/94	09/30/94		
PUB: ASSESSMENT OF SITE SZ HYDROCHEM DATA (Z255) Milestone Number: 3GWH001M	02/28/94	05/20/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
ANLYS PPR: MAG/GRAV INTERP YUC WASH/MDWAY VALLEY Milestone Number: 3GGU463M	03/31/94	06/29/94		
ANLYS PPR: MAPS SOUTH-CNTRL GHOST DANCE FAULT Milestone Number: 3GGF122M	03/31/94	05/31/94		
STUDY PLAN TO DOE: GRND MOTION FROM EARTHQUAKES Milestone Number: 3GES008M	03/31/94	04/12/94	04/12/94	
PUBLICATION: FORTYMILE WASH RECHARGE DATA FY92 Milestone Number: 3GRG021M	03/31/94	05/13/94		
PUB: STRUCTURAL FLOW-PATH ANLYS W/TRANSPT & CHEM Milestone Number: 3GFH009M	03/31/94	05/31/94		
PRELIMINARY DIGITAL GEOLOGIC MAP Milestone Number: 3GRM036M	03/31/94	05/27/94		
PUBLICATN: RESULTS - ZERO OFFSET & WALKAWAY DATA Milestone Number: 3GUP086M	03/31/94	05/31/94		
PUB: INTRABOREHOLE FLOW AND STRESS TEST (P891) Milestone Number: 3GWF010M	03/31/94	05/31/94		
PUB: FINAL ANALOG RECHARGE: PRMS & CHLORIDE ION Milestone Number: 3GQH21CM	03/31/94	04/28/94	04/28/94	
PUBLICATION: CL-36 AGES OF SOIL, ARID-ZONE INFIL Milestone Number: 3GQH007M	03/31/94	08/31/94		
PUBLICATION: GEOPHYSICAL STUDY/WINDY WASH FAULT Milestone Number: 3GPF039M	04/15/94	05/31/94		
ANALYSIS PPR: MAG/GRAV ACROSS GHOST DANCE FAULT Milestone Number: 3GGU440M	04/29/94	05/31/94		
PUBLICATION: ASSESS LITTLE SKULL MTN EQ Milestone Number: 3GSM149M	04/29/94	05/31/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUBLICATION: STREAMFLOW & PRECIP DATA FY91-93 Milestone Number: 3GRS033M	04/29/94	05/31/94		
PUBLICATION: INFILT STUDY; DEVELOPMENT/TESTING Milestone Number: 3GUI636M	04/29/94	06/30/94		
PUBLICATION: 1992 WATER-LEVEL DATA AT YUCCA MTN Milestone Number: 3GWF043M	04/29/94	04/07/94	04/07/94	
PUBLICATION: MAP NORTHERN 1/3 YUCCA MOUNTAIN Milestone Number: 3GCH036M	04/29/94	04/29/94	04/29/94	
PUBLICATION: 1-D AND 2-D MATRIX MODELS Milestone Number: 3GPA006M	04/29/94	06/30/94		
LETTER REPORT: GROUND-WATER DATA 2ND QTR FY94 Milestone Number: 3GWR041M	04/29/94	04/25/94	04/25/94	
TECH PROCEDURE: METHODOLOGY -ID MAX BACKGROUND EQ Milestone Number: 3GSS105M	04/30/94	04/15/94	04/15/94	
PUBLICATION: MAP - CRATER FLAT Milestone Number: 3GTD012M	04/30/94	05/31/94		
ANLYS PPR: ISOTOPIC PARAMETERS- DRILLCORE SECTNS Milestone Number: 3GGU22BM	05/31/94	09/30/94		
ANLYS PPR: MAP-GHOST DANCE FAULT PAVEMENT Milestone Number: 3GGF202M	05/31/94	05/31/94		
PUB: PETROGRAPH & GEOCHEM CHAR/TIVA CANYON TUFF Milestone Number: 3GGF203M	05/31/94	05/31/94		
PUB: STRUCTURAL CHAR PAINTBRUSH CANYON FAULT Milestone Number: 3GGF204M	05/31/94	05/31/94		
PUBLICATION: FINAL SUMMARY RPT - MIDWAY VALLEY Milestone Number: 3GFP029M	05/31/94	09/28/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PUBLICATION: MAP - CALICO HILLS Milestone Number: 3GTD018M	05/31/94	06/30/94		
PUBLICATION: MAP- EAST OF BEATTY QUADRANGLE Milestone Number: 3GTD028M	05/31/94	05/31/94		
ANLYS PPR: SCARP DEGRADATION/EVOL N. WINDY WASH Milestone Number: 3GPF034M	05/31/94	08/15/94		
PUBLICATION: STAGE COACH RD FAULT Milestone Number: 3GPF118M	05/31/94	08/02/94		
ANLYS PAPER: RESULTS PROTO BOREHOLE INSTR AT HRF Milestone Number: 3GUP063M	05/31/94	04/29/94	04/29/94	
PUB: DETAILED MOIRE METHOD - FRACTURE-SURF CHAR Milestone Number: 3GUS015M	05/31/94	05/31/94		
ANALYSIS PAPER: EST PRECIP/TEMP FROM FOSSIL OSTR Milestone Number: 3GCL113M	05/31/94	04/29/94	04/29/94	
ANALYSIS PAPER: LEVEL/STYLE PRECIP-FOSSIL OSTRCD Milestone Number: 3GCL114M	05/31/94	04/29/94	04/29/94	
ANALYSIS PAPER: HYDRO CYCLE/LATE GLACIAL-MODERN Milestone Number: 3GCL115M	05/31/94	04/29/94	04/29/94	
ANALYSIS PAPER: MOLLUSCS AS CLIMATE INDICATORS Milestone Number: 3GCL136M	05/31/94	04/29/94	04/29/94	

USGS LEVEL 4 MILESTONE REPORT
OCTOBER 1, 1993 - APRIL 30, 1994
 Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PROV. RESULTS: ISOTOPE DATING/EOLIAN SANDS/SOIL Milestone Number: 3GCH161M	08/31/93	06/30/94		
REPORT: PRECARIOUS ROCK METHODOLOGY Milestone Number: 3GSM100M	09/30/93	04/29/94	04/29/94	
PRELIMINARY SUMMARY PALEOFLOOD STUDIES Milestone Number: 3GQH010M	09/30/93	06/29/94		
REVIEW DRAFT: SUMMARY REPORT - MIDWAY VALLEY Milestone Number: 3GFP028M	01/20/94	06/29/94		
DATA TO LRC: FY93 MOISTURE DATA Milestone Number: 3GRG002M	01/31/94	04/05/94	04/05/94	
PROV. RESULTS: ISOTOPIC COMP/FLUID INCLUSION Milestone Number: 3GQH850M	01/31/94	04/13/94	04/13/94	
DATA TO LRC: TRENCH LOGS Milestone Number: 3GFP017M	02/21/94	06/29/94		
PROV. RESULTS: EVAL. MODEL ON SECONDARY CALCITE Milestone Number: 3GQH868M	03/11/94	06/30/94		
REVIEW DRAFT: TRENCHES STAGE COACH RD FLT Milestone Number: 3GPF117M	03/15/94	05/16/94		
REVIEW DRAFT: TRENCHES STAGECOACH ROAD FAULT Milestone Number: 3GPF21M	03/30/94	05/16/94		
PROVISIONAL RESULTS: GROUND MOTION MODEL Milestone Number: 3GSG109M	03/31/94	04/19/94	04/19/94	
REVIEW DRAFT: CATALOG OF EVENTS CAL YEAR 1993 Milestone Number: 3GSM024M	03/31/94	05/31/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
DATA TO LRC: SEISMIC DATA Milestone Number: 3GSM24AM	03/31/94	05/31/94		
PROVISIONAL RESULTS: LOGGING OF TRENCH 17 Milestone Number: 3GFP021M	03/31/94	06/29/94		
PROV. RESULTS: QUAT ACT PNTBRSH CANYON & B BUTTE Milestone Number: 3GPF19M	03/31/94	04/08/94	04/08/94	
REPORT: ASSESS SURF CHANGES/LITTLE SKULL EQ Milestone Number: 3GTM07JM	03/31/94	05/31/94		
DATA TO LRC:FY93 CONSOLIDATED/UNCONSOLIDATED MTL Milestone Number: 3GUI105M	03/31/94	04/28/94	04/28/94	
DATA TO LRC: UE-25 UZ#16 AIR-K DATA Milestone Number: 3GUP039M	03/31/94	05/31/94		
DATA TO LRC: FRACTURE LOGS DATA Milestone Number: 3GUP305M	03/31/94	11/30/94		
DATA TO LRC: GAS/H2O VAPOR DATA-UZ#16/NRG-6/UZ-1 Milestone Number: 3GUH022M	03/31/94	09/30/94		
PROVISIONAL RESULTS: PALEONTOLOGIC/ISOTOPE DATA Milestone Number: 3GCL117M	03/31/94	04/28/94	04/28/94	
DATA TO LRC: C14 ANALYSIS Milestone Number: 3GCL109M	03/31/94	04/04/94	04/04/94	
TECHNICAL PROCEDURE: DETERMINE H/D RATIO OF H2O Milestone Number: 3GQH860M	03/31/94	04/29/94	04/29/94	
REVIEW DRAFT: PRELIM BOUNDARY ELEMENT MODELING Milestone Number: 3GTE077M	04/05/94	04/29/94	04/29/94	
SELECT SEISMIC CONTRACTOR(S) Milestone Number: 3GGU265M	04/29/94	07/29/94		

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
PROV RESULTS: TRENCHES SOLITARIO CANYON FAULT Milestone Number: 3GPF20M	04/29/94	04/08/94	04/08/94	
DATA TO LRC:FY93 SYNOPTIC/REGIONAL/SITE MET DATA Milestone Number: 3GMM039M	04/29/94	05/31/94		
PRESENTATION: FINITE ELEMENT MODEL PROCESSORS Milestone Number: 3GRM101M	04/29/94	04/29/94	04/29/94	
DATA TO LRC: FY93 NATURAL INFILTRATION DATA Milestone Number: 3GUI375M	04/29/94	04/29/94	04/29/94	
DATA TO LRC: FY93 MATRIX PROPERTIES DATA Milestone Number: 3GUP034M	04/29/94	05/31/94		
MEMO TO TPO: COMPL SINGLE-HOLE AIR-K TESTING SYS Milestone Number: 3GUS421M	04/29/94	05/05/94		
PROV RESULTS: PROCEDURE X-RAY FLOURES. ANALYSIS Milestone Number: 3GNR038M	04/29/94	04/28/94	04/28/94	
PROVISIONAL RESULTS: ESF TRENCH LOGGING Milestone Number: 3GFP008M	04/30/94	06/29/94		
INPUT TO SCP UPDATE #10 Milestone Number: 3GAT044M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GMM043M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GRG077M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GRG029M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GRM100M	05/13/94	04/08/94	04/08/94	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
INPUT TO SCP UPDATE #10 Milestone Number: 3GRM041M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUI114M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUI378M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUP044M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUP069M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUP094M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUP113M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUP046M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUP310M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS045M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS704M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS040M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS427M	05/13/94	04/08/94	04/08/94	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS004M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS023M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUS407M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GGP16M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUH049M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GUH047M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWF033M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWF059M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWF091M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWF089M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWH006M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWM014M	05/13/94	04/08/94	04/08/94	
INPUT TO SCP UPDATE #10 Milestone Number: 3GWM016M	05/13/94	04/08/94	04/08/94	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
INPUT TO SCP UPDATE #10 Milestone Number: 3GPA019M	05/13/94	04/08/94	04/08/94	
TECH PROCEDURE: ESTABLISH MAXIMUM MAGNITUDE EQs Milestone Number: 3GSS108M	05/31/94	05/16/94		
REVIEW DRAFT: MAP- BIG DUNE QUADRANGLE Milestone Number: 3GTD029M	05/31/94	05/31/94		
PROVISIONAL RESULTS: 14 C/D TRENCH STUDIES Milestone Number: 3GPF036M	05/31/94	05/31/94		
DATA TO LRC: LOGS-TRENCHES- SOUTH WINDY WASH FLT Milestone Number: 3GPF106M	05/31/94	05/31/94		
PROV RESULTS: CSM EXPER MINE CROSS-HOLE DATA Milestone Number: 3GUP085M	05/31/94	04/07/94	04/07/94	
DATA TO LRC: FIRST QUARTER WATER-LEVEL DATA Milestone Number: 3GWF050M	05/31/94	05/02/94		

WBS No. - 1.2 -YUCCA MOUNTAIN PROJECT

Fiscal Year 1994	Resource Distributions												Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
BCWS	1568	1670	2109	2103	2031	2035	2410	3482	2431	2347	2557	3090	27833
BCWP	1541	1656	1952	2116	1764	2134	2209	0	0	0	0	0	13372
ACWP	1300	1484	2458	2083	1789	2093	2353	0	0	0	0	0	13560
ETC	0	0	0	0	0	0	0	3348	2665	2897	3196	2769	14875

	Fiscal Year Distribution											At Complete	
	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003		Future
BCWS	24644	27833	51462	48901	42359	29995	19018	9564	5128	97	0	0	259001
BCWP	23158	13372	0	0	0	0	0	0	0	0	0	0	
ACWP	23430	13560	0	0	0	0	0	0	0	0	0	0	
ETC	0	14875	50930	48442	42136	29701	18716	9783	5046	2013	0	0	258632

YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey

MONTHLY COST/FTE REPORT

Fiscal Month/Year APRIL 1994

Date Prepared 05/12/94 10:41

Page 1 of 1

WBS ELEMENT	<u>CURRENT MONTH END</u>				<u>FISCAL YEAR</u>				
	ACTUAL COSTS	PARTICIPANT HOURS	SUBCON HOURS	PURCHASE COMMITMENTS	SUBCON COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.1	7	168	0		0		62		32
1.2.3	1845	13376	9996		2833		21506		10283
1.2.5	101	1196	621		116		1175		604
1.2.9	143	460	603		156		1225		622
1.2.11	161	885	1830		470		1900		1132
1.2.12	37	0	1178		204		500		271
1.2.13	28	0	0		0		543		216
1.2.15	23	0	442		92		287		145
TOTALS	2345	16085	14670	0	3871		27198	0	13305

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: April 30, 1994**

PARTICIPANT: USGS PEM: TYNAN WBS: 1.2.3.2.2.1.1

WBS TITLE: Vertical and Lateral Distribution of Stratigraphic Units in the Site Area

P&S ACCOUNT: OG32211

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
683	683	762	0	0.0	100.0	-79.0	-11.6	89.6	1420	2119	-699	-49.2	1585	54.3

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

The variance is due to the estimate to complete being modified to reflect additional scope/budget associated with running the seismic line. This EAC represents the estimated funds required to complete the work related to the seismic line planned for this fiscal year. The original budget was not adequate to cover all scope addressed in PACS. If the decision is made not to award this contract this fiscal year, the EAC for this fiscal year will be modified, and the corresponding budget moved to fiscal year 1994.

Impact:

None. Funds will be made available when the decision is made to award the contract.

Corrective Action:

None required at this time.

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P&S ACCOUNT MANAGER	DATE	TPO	DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: April 30, 1994**

PARTICIPANT: USGS PEM: DLUGOSZ WBS: 1.2.3.3.1.2.3

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

P&S ACCOUNT: OG33123

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	ICPI
1604	1382	1718	-222	-13.8	86.2	-336.0	-24.3	80.4	3740	3742	-2	-0.1	4652	116.5

Analysis

Cumulative Cost Variance:

Cause:

Most of the negative cost variance (indicating an overspent condition) is due to the behind-schedule condition. However, a little over \$100K of the cost variance is due to the ahead-of-schedule acquisition of materials and equipment needed for instrumentation of UZ boreholes, and the redirection of some resources within the UZ-14 account to analyze samples of the perched water encountered in UZ-14.

Impact:

Unless the UZ-14 summary account is replanned to reflect current delays in drilling and testing, this summary account will be significantly underspent by the end of FY 94. However, because the resources allocated to this summary account are primarily salaries of permanent full-time staff, other closely related summary accounts in WBS 1233123 and 1233127 will overspend because of the redirection of staff to tasks within those summary accounts.

Corrective Action:

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

Cumulative Schedule Variance:

Cause:

Several tasks associated with recently drilled boreholes have been delayed by one to four months. These delays are all related to unexpected conditions encountered in the boreholes and are beyond the control of the USGS. Specifically, both

air-permeability testing and instrumentation of NRG-6 have been delayed because a 50-foot section of casing is still lodged in this borehole. Tasks scheduled for UZ-14 are behind schedule because of the delay in completion of drilling of USW UZ-14 because of the perched water encountered therein. UZ-14 tasks behind schedule include geophysical logging, gas sampling, preparation of data report, gas-phase testing, review of gas and water-vapor data, and air-permeability testing.

Impact:

The delay in instrumentation of NRG-6 will reduce the pre-TBM monitoring period for this borehole by about 4 months. Geophysical logging of UZ-14 has not yet been rescheduled. Reaming of UZ-14 to total depth may be required before logging may be done and the overall YMP drilling schedule may be impacted. Documentation of borehole drilling and coring of UZ-14 will be delayed. In addition, air-permeability testing, gas sampling, and instrumentation of UZ-14 will be delayed.

Corrective Action:

No corrective action is needed with regard to the delays for work at NRG-6. However, because UZ-14 tasks comprise a dedicated summary account, some consideration should be given to a C/SCR to reschedule this account. The C/SCR should be prepared at the end of the third quarter of FY 94 when drilling and reaming are likely to be completed and a realistic schedule for subsequent tasks can be developed.

Variance At Complete:

Not Applicable

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: April 30, 1994**

PARTICIPANT: USGS PEM: Sullivan WBS: 1.2.3.2.6.2.1

WBS TITLE: Surface Facilities Exploration Program

P&S ACCOUNT: OG32621

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

Analysis

Cumulative Cost Variance:

Not Applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

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

Impact:

There is not impact if C/SCR is approved.

Corrective Action:

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

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
 Variance Analysis Report
 Status Thru: April 30, 1994**

PARTICIPANT: USGS PEM: Baumiester WBS: 1.2.13.2.5

WBS TITLE: Occupational Safety and Health

P&S ACCOUNT: OGD25

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
27	27	0	0	0.0	100.0	27	100.0	0.0	110	50	60	54.5	0	166.0

Analysis

Cumulative Cost Variance:

Not applicable

Cumulative Schedule Variance:

Not Applicable

Variance At Complete:

Cause:

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

Impact:

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

Corrective Action:

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

P&S ACCOUNT MANAGER

DATE

TPO

DATE

**Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: April 30, 1994**

PARTICIPANT: USGS PEM: Ryder WBS: 1.2.13.4.7

WBS TITLE: Water Resources

P&S ACCOUNT: OGD47

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SVZ	SPI	CV	CVZ	CPI	BAC	EAC	VAC	VACZ	IEAC	ICPI
220	95	217	-125	-56.8	43.2	-122	-128.4	43.8	433	433	0	0.0	989	156.5

Analysis

Cumulative Cost Variance:

Cause:

Costs have accrued despite the behind-schedule condition because budget consists primarily of salaries of full-time staff, including the Principal Investigator who has been on sick leave for about six weeks.

Impact:

Impact is minimal because by the end of FY 94, work on the JF-3 report will be substantially complete and the account will not be overspent. Only minimal efforts associated with report review will take place in FY 95, and only minimal additional cost will be incurred.

Corrective Action:

An appropriate work-around already has been implemented. The Nevada District has assigned other staff to prepare the JF-3 report.

Cumulative Schedule Variance:

Cause:

A report on the hydrogeology of well JF-3 will be delayed until January 1995 because of a misunderstanding of milestone completion criteria and because of the illness of the principal investigator.

Impact:

There is no impact because all investigators in the Environmental program who need to utilize data from JF-3 already have access to it.

Corrective Action:

The Nevada District has assigned other staff to prepare the JF-3 report.

Variance At Complete:

Not applicable

P&S ACCOUNT MANAGER

DATE

TPO

DATE