



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

October 8, 1996

MEMORANDUM TO: Central File

FROM: Sandra L. Wastler *SLW*  
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 August 9 and 16, 1996 and September 6 and 13, 1996.
2. U.S. Department of Energy Field Test Coordination Report for the Weeks Ending August 16, 23, and 30, 1996 and September 6, 1996.
3. U.S. Geological Survey Progress Report for July, 1996.
4. Report entitled "Summary Report of Chlorine-36 Studies", by J.T. Fabryka-Martin, et al., Los Alamos National Laboratories, LA-CST-TIP-96-003.
5. Report entitled "Summary Report of Chlorine-36 Studies: Sampling, Analysis and Simulation of Cl-36 in the Exploratory Studies Facility", by J.T. Fabryka-Martin, et al., Los Alamos National Laboratories, LA-CST-TIP-96-003.

Attachment(s): As stated

Contact: Sandra L. Wastler, NMSS  
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United States Department of the Interior

U. S. GEOLOGICAL SURVEY  
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IN REPLY REFER TO:

INFORMATION ONLY

August 13, 1996

Wayne Kozai  
Yucca Mountain Site Characterization  
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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, July, 1996

Attached is the USGS progress report in the required format for the month of July, 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:

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# U. S. GEOLOGICAL SURVEY

## EXECUTIVE SUMMARY

July 1996

### WBS 1.2.3.1 Coordination and Planning

U. S. Geological Survey - Yucca Mountain Project Branch is currently processing 191 scientific papers prepared by USGS authors. Of these, 63 are related to hydrologic studies and 128 to geologic studies. In addition, 48 abstracts by USGS authors are being processed, as well as 17 reports from LBL.

### WBS 1.2.3.2 Geology

#### Geologic Framework

Personnel involved in site stratigraphic studies completed their reexamination of cores, cuttings and geophysical logs for a more precise delineation of ten principal lithostratigraphic contacts in boreholes G-2, GU-3, SD-7, SD-12, ONC#1, WT-2, WT-10, UZ-7a, and UA-14. Lithostratigraphic contacts were correlated with borehole geophysical logs, including calculated porosity and water-saturation profiles.

Stratigraphic contacts, fractures, and faults were examined in the ESF, including the Thermal Test Facility (Alcove 5) and the Upper Paintbrush Tuff Contact Alcove (Alcove 6). Studies of the aeromagnetic anomalies produced by the Topopah Spring Tuff suggest that such data offer a means for calculating attitudes of buried faults.

Efforts continued in the interpretation of the regional seismic reflection profile across Crater Flat and Yucca Mountain, and in the integration of the reflection data with the models being developed from gravity and magnetic surveys. Emphasis is on the resolution of seismic reflection horizons and fault geometry. Digital magnetic data sets were provided to LBL and such data were also prepared for submittal to the USGS technical data base, thus completing these work elements in the geophysical studies program. Additional funding was acquired for continued vertical seismic profiling in support of LBL's synthesis of shear-wave velocity data and for additional processing and imaging of central block structure and interpreting high-resolution seismic reflection data by LBL staff.

The 1:6000-scale geologic map of the central block of Yucca Mountain and accompanying text and cross sections are being reviewed and processed for eventual release as a USGS Open-File Report. The report contains detailed lithologic descriptions of the many units within the Timber Mountain and Paintbrush Groups being mapped, together with descriptions of all the main faults that transect the area and a synopsis of the structural development of the central block. The fault data provided valuable input to the synthesis report on the seismotectonic framework of Yucca Mountain (discussed below).

Project personnel discussed critical structural issues related to the development of the 3-D framework geologic model with the M&O modeling team, and began final interpretations of the ground-based geophysical data from the Midway Valley area to decipher the location of buried faults.

Geologic mapping of the ESF was accomplished as follows: (1) full periphery geologic mapping was completed to station 59+68; (2) detailed line survey was completed to station 59+68; and (3) stereophotography was completed to station 59+64.40.

### Seismotectonic Studies

The synthesis report, "Seismotectonic framework and characterization of faulting at Yucca Mountain, Nevada", was completed on July 31. In addition to an introductory chapter that summarizes the history of seismotectonic studies in the Yucca Mountain area and the regulatory and design requirements and technical issues involved in site characterization, the report contains eleven chapters that discuss the results of the several major areas of investigation that were pursued to obtain essential information on tectonism and seismicity that may affect repository performance. Chapter headings are:

1. Geologic Setting of Yucca Mountain
2. Neogene Tectonic Evolution of Yucca Mountain
3. Quaternary Faults in the Yucca Mountain Region
4. Quaternary Paleoseismology and Stratigraphy of the Yucca Mountain Site area
5. Models of Earthquake Recurrence and Preliminary Paleoearthquake Magnitudes at Yucca Mountain
6. Geodesy and Contemporary Strain in the Yucca Mountain Region
7. Historical Seismicity in the Yucca Mountain Region
8. Synthesis of Tectonic Models for the Yucca Mountain Area
9. Fault Displacement Hazard: A Summary of Issues and Information
10. Estimation of Vibratory Ground Motion at Yucca Mountain
11. Relevant Earthquake Sources

Combined, the topics listed above lead to (1) identifying and characterizing faults, both at Yucca Mountain and in the surrounding areas, with emphasis on faults with demonstrable Quaternary activity; (2) determining the distribution and geochronology of Quaternary deposits; (3) calculating amounts, rates, and recurrence intervals of Quaternary fault displacements; (4) estimating earthquake magnitudes and recurrence rates at Yucca Mountain; (5) locating and characterizing relevant earthquake sources; and (6) developing tectonic models. These are all items of primary importance to comprehensive site characterization, and the results and interpretations provide critical data for probabilistic seismic hazard analysis.

### WBS 1.2.3.3 Hydrology

#### Regional Hydrology

Processing of QA records for meteorological instrument calibrations was continued. Work on the preparation of the data package for submittal was continued. The data from the weather stations is in technical review. The data from the expanded network of tipping bucket precipitation gages was prepared and is being technically reviewed.

Data was collected from the tipping bucket precipitation network. Analysis of precipitation amounts and intensities measured using the tipping bucket network was continued.

Routine maintenance was made on the three streamflow-gaging stations located along Fortymile Wash. Project staff kept vigilance for potential precipitation and runoff associated with several storms that tracked through the southern Nevada area. Runoff was neither observed nor reported during the reporting period for the three gages or for the Yucca Mountain area.

Records for the continuous-recording streamflow gaging stations planned for publication were given final review by the Nevada District Data Section. Camera-ready copies of all surface-water and precipitation data tables have been prepared and are being transmitted to the Principal Investigator. The report on FY 1995 streamflow and precipitation data and the associated data records package are delayed because the Nevada District Data Section has just completed reviewing records for the continuous-recording streamflow gaging stations. Camera-ready copies of all surface-water and precipitation data tables have been prepared and are being transmitted to the Principal Investigator. The delays have resulted from reassignment of project personnel, electronic data processing problems, and backlogs associated with District staff review of the continuous and peak-discharge surface-water data. The completion dates for these activities have been rescheduled for the end of August, which should allow for sufficient time to check the tables, complete the text, prepare the data records package, and submit them for further USGS processing.

Because of operational delays in the drilling and rig support, USW G-2 tests were not completed on time. The report has not been drafted, but the draft milestone has been completed by notifying DOE of the test/report delay. Management discussions are under way concerning the future of the report.

Recovery data are still being collected from well USW G-2. Residual drawdown on July 29, 1996, 95 days following completion of the single-well pumping test, was 3.24 feet. Adjustments were made to the G-2 data files for the two June calibration checks when the transducer was moved from its set point.

A data package containing temperature log data collected in USW G-2 and another containing geophysical log data and computations were reviewed and submitted to the USGS Data Management Coordinator.

The water quality segment of the FY95 Fortymile Wash data package was submitted to the USGS Data Management Coordinator.

Project staff completed work on the delayed draft of the regional saturated-zone modeling report, and submitted the report for colleague review. Both reviewers agreed to begin work on the report immediately, and to complete the review as expeditiously as possible. The authors and all members of the modeling unit will make responses to colleague review comments and post-review revisions to the report their top priority. No delay in completion of the related Level 3 Milestone (3GRM600M) is anticipated.

Regional SZ modeling staff continued to work on software QA for 3 post-processor programs for MODFLOWP. The records package for the MODFLOWP Software QA documentation was submitted to the USGS Records Coordinator.

Members of the saturated-zone modeling unit met on July 11 with Ike Winograd (USGS, Reston, VA) and Alan Burns (USGS, Denver, CO) to discuss regional modeling results and conceptual models of the ground-water flow system of the Death Valley Region.

#### Unsaturated Zone

The completed infiltration-properties data packages and map were submitted to the Project Technical Database Administrator on July 25, 1996, completing milestone 3GUI600M. Milestones 3GUI240M and 3GUI241M were also completed by submittal of the U.S. Geological Survey Water-Resources Investigations Report entitled "Estimation of shallow infiltration and presence of potential fast pathways for shallow infiltration in the Yucca Mountain area, Nevada".

To support development of the stochastic infiltration flux map, annual rainfall distribution maps for a dry year (1989) and a wet year (1993) were developed into GIS coverages. These will be used to estimate shallow infiltration and develop GIS coverages of shallow infiltration with different rainfall scenarios.

Unsaturated-zone prototype holes at the HRF continued to be monitored on an on-going basis for the 57th month. Borehole data from these holes as well as NRG-7a, NRG-6, 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 as such. Staff supported the monitoring activity with numerous calibrations, systems repairs and adjustments, and maintenance/repair visits to the field sites.

The stemming plan for SD-7 was completed and reviewed for accuracy. A copy of the plan was forwarded to DOE for their review and approval on July 31, 1996, completing activity 3GUP631.

Fabricating the instrumentation for SD-7 is on hold pending approval of the stemming plan by DOE and assignment of a date to begin instrumentation of this borehole. Figures for UZ-7a have



been compiled for the borehole monitoring data report, and compilation of those for SD-12 will begin in early August.

The first draft of the report on borehole completion of USW UZ-14 was completed and submitted for data and technical reviews in June. Reviews are not yet finished. Expected completion date for reviews is August 31, 1996. Staff completed and submitted the final draft of the completion report for UZ-16. The data package and information for the technical data base also were submitted.

Spectral analyses of the UZ-7a and SD-12 pneumatic pressure data were completed in conjunction with the preparation of the pneumatic synthesis report, "Interpretation of Pneumatic and Chemical Data for the Unsaturated Zone, Yucca Mountain, Nevada."

The unusual responses from instrument station 'D', at NRG-7a, located in the PTn (base of the Yucca Mountain Tuff) at NRG-7a, continue to be observed. Since the last monthly status report, water potentials have been slowly recovering to their pre-disturbance state (i.e. pre-May 9, 1996). No correlation of the anomalous behavior of this instrument station with respect to construction activities in the ESF has yet been found. Instrument malfunction has been ruled out as a possible explanation. Data indicate that the disturbance must have originated and propagated from above the instrument station, via enhanced communication with the outside atmosphere. Apparently the disturbance has abated, at least temporarily. Data from this station will continue to be closely monitored to try to establish a cause for the unusual responses.

A draft outline for the report on the hydrology of the ESF main drift has been prepared and is currently being reviewed for compliance with the criteria statement for the associated milestone (3GUP665A). A second revised draft of the North Ramp Hydrology report, along with responses to the colleague review comments, were forwarded to the four reviewers of this report during the second week of July. Acceptance/rejection responses from two of the reviewers have been returned; two are still outstanding. Report is in the final stage of preparation for submittal to the USGS editorial review staff. A concurrent QA review will be conducted while this report is in editorial review.

A data package containing temperature log data collected in Exploratory Shaft Facility Alcoves in 1995 and 1996 was reviewed and submitted to the USGS Data Management Coordinator.

Staff forwarded 445 pneumatic data files on 24 microdiskettes to LBL during the third week of July. These files contained pneumatic pressure, dry-bulb temperature, thermistor temperature, and water potential data through July 15, 1996 for NRG-6, NRG-7a, UZ#4, UZ#5, SD-12, and SD-7, completing activity 3GUP665NM.

A draft report on UZ hydrogeologic units and matrix properties was completed and submitted for technical review. Prototype development for the preparation of a technical procedure to operate the ultracentrifuge continues. A proposal was completed to evaluate thermal effects on unsaturated hydraulic conductivity. Samples are being tested on the high pressure permeameter to finalize the technical procedure.

In the Bow Ridge Fault Alcove, the USGS field staff continued cross-hole pneumatic and tracer testing in the Bow Ridge Fault and Tiva Canyon lower lithophysal zone. The boreholes are horizontal, parallel, 3 meters apart, and both penetrate the Bow Ridge Fault at a depth of approximately 51 feet. The cross-hole tests indicate fault breccia permeability values of 20 darcies. This agrees with the single-hole pneumatic test results of 10 darcies. The cross-hole pneumatic tests also indicate fault breccia porosity values of 29%. Tracer tests between the boreholes had travel time that vary from 30 to 90 minutes.

The boreholes for testing in the Upper and Lower Paintbrush Nonwelded Contact Alcoves have been sealed off from the alcoves and are not scheduled for additional testing until FY 1997. All instruments requiring calibration (pressure transducers, thermistors, mass flow controllers, power supplies, and data loggers) used in alcoves 2 and 3 have been sent for close-out calibrations.

Interpretation of the occurrence of perched water and the magnitude of perched water bodies continues. Perched water chemistry data are currently being synthesized for inclusion in the milestone memo to the TPO due later in FY 96. The report on results of perched water testing is currently undergoing colleague review.

In support of the ESF Moisture Dryout study, calibration of the heat dissipation probes is being continued. Field data loggers in the main tunnel and alcoves have been checked and downloaded. Data are being compiled and submitted to LBL for incorporation into an analysis report.

In preparation for the section on gas circulation and pneumatic pathways in the UZ synthesis report, detailed frequency analyses are being conducted on pressure data from several boreholes in order to determine the phase lag and amplitude of barometric pressure induced changes, both before and after the effects of the ESF were noticed. These analyses have quantified some of the ESF effects that have been identified only through graphical comparison. Comparative analysis of pneumatic data from NRG-6, NRG-5, NRG-7a, SD-9 SD-7, UZ-7a, and SD-12 is ongoing to chart the effects of the TBM as it moves along the Ghost Dance Fault. A small-scale 3-dimensional model of the North Ramp and part of the Main Drift is being refined to analyze the horizontal permeability of the rocks affected by the ESF excavation. The model simulates the progress of the TBM by applying barometric stresses at the ESF horizon and will be calibrated against both pressure changes within each geologic unit and the time at which the borehole first began to be affected by the ESF. Pneumatic diffusivity modeling is being conducted on data from borehole SD-7 and UZ-7a for inclusion in the milestone Gas Phase Circulation report. The completion of this report has been delayed to allow for further analysis of important data being collected from borehole SD-7, and to allow for further development of a model being constructed to assess the horizontal permeability of zones affected by TBM excavation.

Gas sample collection from fifteen stations was completed at SD-12. CO<sub>2</sub>, CH<sub>4</sub> and SF<sub>6</sub> concentrations were measured with the gas chromatograph on-site. C-13/C-12 gas samples were collected in mylar balloons and C-14 gas samples were collected on molecular sieves in stainless steel cylinders. The C-13/C-12 gas samples were transported to the USGS Denver laboratory for

analysis. The C-14 gas samples were transported to Denver where the molecular sieves will be degassed.

Ten UZ water samples (2 NRG-6, 2 NRG-7A, 3 SD-12, and 3 ESF) were prepared for tritium analysis, and twenty UZ water samples (2 NRG-6, 2 NRG-7A, 11 SD-12, and 5 ESF) have been counted for tritium concentration and the data reduced. Three SD-12, two SD-7, one SD-9, and two NRG-7A core samples were distilled for tritium and deuterium and oxygen-18 analyses, and nine SD-9 core samples were compressed for chemical composition and C-14 analyses.

The analysis paper entitled "Preliminary 3-Dimensional Discrete Fracture Model, Tiva Canyon Tuff, Yucca Mountain Area, Nye County, Nevada", by Lawrence O. Anna, (3GUF105M) has been completed and transmitted to YMPO.

Preliminary three-dimensional discrete fracture networks of the upper part of the Topopah Spring Tuff have been successfully simulated. Fracture orientation and spacing were "bootstrapped" directly from ESF fracture mapping. Twenty realizations were run (Monte Carlo simulations) for each of 4 different scaled cubes, at 50 m, 100 m, 150 m, 200 m on a side. Mapped intensities were matched with simulated intensities. Conductive intensities have been calculated from air-permeability data. The model will include stratigraphic units from the top of the Topopah Spring to the bottom of the middle non-lithophysal unit (tptpmn). Network and pathway analysis are nearly complete. Some preliminary flow simulations have begun.

The preliminary outline for the report on the Topopah Spring Tuff model has been completed and submitted as a Level 4 milestone to the USGS TPO. Preparation of the report itself has been initiated in parallel with the model development in order to minimize the delay resulting principally from the unanticipated large amount of data from the ESF.

A letter that includes tables of limited simulated outcome of the number of fracture connections, connection probabilities, directional permeability and permeability tensor calculations has been submitted to LBL.

The USGS and LBL authors (E. Kwicklis, G.S. Bodvarsson and A. Flint) of the report on the conceptual model of UZ hydrologic system met in Berkeley on July 17-19 to discuss topics central to the report. The authors reached a consensus on several issues, including (1) likely entry points of water from the unsaturated zone to the saturated zone, (2) uses and limitations of chloride accumulation data for estimating percolation flux, (3) use of temperature data for estimating percolation flux, (4) relative importance of vapor diffusion under ambient conditions, and (5) the possible lack of correspondence between "high-flux" areas and areas where environmental isotopes with "post-bomb" concentrations have been found. The conclusions of this meeting were recorded in a meeting summary sent to the participants. The draft report has not been completed due to the principal author's unanticipated involvement in the North Ramp Hydrogeology Report and in preparing a presentation to the NWTRB (July 9-10, Denver) on the findings of this report.

Analysis of the pneumatic pressure data collected from the upper 9 monitoring stations at borehole UZ#1 was completed. This analysis resulted in estimates of effective permeability to air in the stratigraphic intervals bounded by the monitoring stations. All intervals were estimated to have effective permeabilities to air greater than  $10^{-12} \text{ m}^2$ , except for the intervals defined by stations 5 and 6, which included the Tptrv2, Tptrv3, Tpb2 and lowermost Tpp units ( $3.8 \times 10^{-14} \text{ m}^2$ ), and the interval defined by stations 6 and 7, which included the Tptrv2, Tptrv1 and Tptrn units ( $9.0 \times 10^{-14} \text{ m}^2$ ). The low effective permeability to air of the interval defined by stations 5 and 6 may have resulted from high water saturations rather than a small intrinsic permeability, because the drained porosity which provided the best fit of the model to the data was only 0.01.

#### Saturated Zone

The main part of the 3GWF650M (January - June 1996) data milestone submittal will be for data from a short pump test in the Lower-Bullfrog / Tram in January that will be analyzed as an aquifer test, and from the February-March combined hydraulic/tracer test in the same unit. The latter test was a convergent, conservative tracer test using iodide (in the form of NaI) as tracer, with UE-25 c#3 as the pumping well and UE-25 c#2 as the injection well.

During July, several sections of the draft letter report on the results of the hydraulic and conservative tracer tests at the C-wells were written, including introductory material on the February-March tests in Bullfrog/Tram interval and details of the equipment used during the tests. The data package consolidating all the January-June data from the raw-data files collected by the Labview data-acquisition program, and from sample concentrations digital files obtained from UNLV, was finalized and prepared to be submitted for review.

The c-holes conservative tracer testing program of the USGS has been suspended temporarily while LANL conducts reactive tracer tests in the Lower-Bullfrog interval. The LANL NaI two-well partial-recirculation test, with UE-25 c#1 as the injection well and UE-25 c#3 as the pumping well, has not been successful, indicating that such a test with the reactive tracers lithium bromide and microspheres would not be successful either. Therefore, a request has been submitted to the State of Nevada for the use of lithium bromide and microspheres in a two-well partial-recirculation test, with UE-25 c#2 as the injection well and UE-25 c#3 as the pumping well, because tracer connectivity has already been established between UE-25c #3 and UE-25c #2. This test was planned to start on July 17, but the State of Nevada has not acted on the request yet. Further delays in the State's action on the request may develop because the use of liquid tracers at the C-hole complex and gaseous tracers in the ESF are governed by the same permit.

A letter report was prepared and submitted to the USGS-YMPB TPO on July 31 to meet the level-4 milestone, 3GWF733M, Process FY 1995 tests at the C-well complex.

The 1996 routine water-level data network includes 28 zones in 22 wells to be measured manually on a quarterly schedule (manual measurements) and 3 zones in 2 wells to be measured hourly (transducer measurements). During July, 27 manual measurements were completed, and 8 zones in 6 wells were monitored hourly with transducer measurements. The hourly monitoring

included: wells UE-25p #1 and USW H-5 upper and lower zones, the two wells and 3 zones of the 1996 network; well USW G-2, which has been monitored since January 1996 in support of hydraulic testing of the well; wells UE-25 WT #3, UE-25 WT #14, and USW H-4 upper and lower zones, which were instrumented during May 1996 in support of the testing at the C-hole complex. Continuous analog data were collected from two zones in one well (USW H-5 upper and lower zones) in order to monitor water-level responses to seismic events.

The 1995 hourly data have been reviewed and will be included in the 1985 - 1995 water-level synthesis report and in the 1995 water-level data report.

A modification to HP-60, R4, "Method for Monitoring Water Level Changes Using Pressure Transducers and Pressure Transmitters," was reviewed and processed. The change eliminates the option of documenting transducer failures in ways other than writing a Nonconformance Report.

Work has continued on calibration of the site saturated-zone flow model, using simplified boundaries and hydraulic properties (without the parameter-estimation module). Recharge and discharge areas have been added to the model. Questions remain as to model run times using the original large model area and using the parameter-estimation module. However, significant progress has been made in speeding up model-run times. Some time has been spent in getting visualization software, obtained from LANL, running on USGS computers. Staff worked on revising the software QA documentation for the parameter-estimation software (PEST).

The report on the preliminary site flow model could not be completed because of delays in obtaining the grid necessary to run the model. A considerable amount of work is completed on the report, and once the preliminary simulations are done, those parts of the report can be written. Completion of a draft of the letter report to submit for review (Level 4 Milestone 3GWM610M) has been made a top priority for the Site SZ Modeling group, so that this milestone and activity can be completed early in August. No delay in the Level 3 Milestone, 3GWM611M, is anticipated. That milestone will meet all required criteria, but will be in the form of a letter report to DOE rather than a USGS-series report.

#### WBS 1.2.3.6 Climatology and Paleohydrology

Data on modern diatoms from Oregon and British Columbia reveal that the major freshwater diatom assemblage in the Owens Lake records is characteristic of lakes that are located at latitudes at least 6 degrees farther north than the present site of Owens Lake. Some of the diatoms living in Owens Lake during past glacial times now live in areas with two to three times the mean annual precipitation and about 1,000 m higher in elevation (as compared to present-day Owens Lake). Diatom counts from the most complete Owens Lake cores are providing a stratigraphically complete record back to 500 ka. Unique assemblages in overlapping parts of all cores provide unambiguous correlations between cores.

Diatoms, ostracodes, and samples for water chemical analyses (major ions and isotopes) are being collected from springs, rivers, lakes, and reservoirs in the Owens Lake Basin to provide

analog data that help to interpret the paleoclimate records for both Owens Lake and the Lathrop Wells deposits.

A draft of the Paleoclimate Synthesis Report is nearing completion.

U-series analyses of 7 samples of boulder rinds from surficial unit 4f, which represents an intermediate stage of incision of Fortymile Wash between the time of initial downcutting and the present, show that the innermost rinds span a narrow age range from 21 to 31 ka. All samples have elevated initial  $^{234}\text{U}/^{238}\text{U}$  ratios relative to all other alluvial and colluvial samples outside of the incised Fortymile Wash channel. These ages correspond to a time when paleodischarge sites were active, indicating increased effective moisture availability throughout the region.

Initial uranium and thorium analyses of samples from trenches CFF-T1a, CFF-T2a, and RV-T3 are encouraging with respect to data quality, consistency of resulting ages, and uniformity of initial ratios. The resulting data underscore the viability of the present method of microsampling the silica-rich inner rind layers for dating the times of deposition.

A determination of whether the last event recorded by secondary mineral occurrences within the Yucca Mountain tuffs was precipitation or dissolution of calcite or opal is important for interpreting the ages of the latest mineral surfaces. To address this question, calcite surfaces were experimentally corroded by prolonged ultrasonic attack in deionized water. These experiments produced extreme corrosion, and studies are currently being conducted with the use of the scanning electron microscope to determine the effect of corrosion and the textures that might result from the calcite being corroded by unsaturated-zone water.

Deionized water leaches of four samples of cuttings from borehole UZ-14 were analyzed for strontium isotope compositions; the resulting isotopic ratios are very close to the values obtained on perched water from UZ-14. Additional samples are being prepared in the effort to isotopically characterize pore water in the unsaturated zone and to compare it with fracture water.

Raw data from line surveys between stations 22 and 30 in the ESF were compiled and converted to estimates of the abundance of calcite and opal in fractures and lithophysal cavities. The results clearly display the heterogeneous occurrence of these secondary minerals. One sample (at station 26+88) provides the youngest U-series age yet obtained: 28.3 ka with an initial ratio  $^{234}\text{U}/^{238}\text{U}$  ratio of 6.4. This and other samples collected from outermost growth surfaces in areas where bomb-pulse Cl-36 values have been obtained are normal in both ages (28 to 380 ka) and initial U ratios (typically between 4 and 9). Younger ages with low initial ratios (1.4 to 1.8) would have been expected had the calcite and opal been deposited from waters moving downward along fast pathways.

#### WBS 1.2.13.4.7 Water-Resources Monitoring

Staff measured ground-water levels at 27 sites and measured discharge at one flowing well. Staff also checked and filed ground-water data collected during June. Water-level data were not

collected at site MV-1 because the well does not have an access tube to allow water-level measurements. Water levels will be obtained at that location only when project staff are notified that the pump installed in the well has been removed. Site CF-1 has been eliminated from the monitoring network. An obstruction, which has prevented access to the water surface since March 1996, resulted from a new owner's testing of the pump in the well. No data could be collected at site CF-1 this month, and no future water-level measurements will be made by USGS unless the obstruction in the well is removed. Monitoring may resume in the area following drilling and completion of an observation well; the new owners intend to construct the observation well downgradient from planned withdrawals to support mining operations.

Monthly measurements of water levels in wells CF-2 (VH-1), J-13, J-12, JF-1 (WT-15), JF-2 (WT-13), and J-11 are planned by USGS-SCP personnel during the remainder of FY96. Measurements by EMP personnel at sites CF-2 and J-12 provided supplemental data at those locations during July. Supplemental monitoring of water levels at sites J-13, JF-1 (WT-15), JF-2 (WT-13), and J-11 by EMP personnel will occur following preparation of a draft report on data collected and compiled for calendar year 1995 and testing and calibration of recently obtained equipment.

USGS Nevada District participation in SAIC's planned radiological-monitoring program was discussed with DOE and SAIC personnel. Discussions also addressed changes in criteria for milestone completion.

After resolving comments associated with YMP data reviews, staff began preparation of the data-records package for the summary monitoring report through CY95 for submittal to the USGS Records Coordinator. The draft base map was forwarded to USGS-Nevada District reports section on July 2, and staff began preparation of the draft report.

In support of the FY 1996 third-quarter monitoring report, periodic measurements and information on pressure-sensor calibrations were obtained from site-characterization personnel. Data on ground-water levels were compiled for 7 sites, and staff reviewed data on ground-water levels and discharge collected and compiled for monitoring sites during April through June, 1996. Staff prepared and delivered courtesy copies of the report to DOE and SAIC on July 26.

# USGS Level 3 Milestone Report

October 1, 1995 - July 31, 1996

Sorted by Baseline Date

| <u>Deliverable</u>  | <u>Due<br/>Date</u> | <u>Expected<br/>Date</u> | <u>Completed<br/>Date</u> | <u>Comments</u> |
|---|---------------------|--------------------------|---------------------------|-----------------|
| SYNTHESIS OF HYDROGEOLOGIC UNIT/MATRIX PROPERTIES<br>Milestone Number: 3GUP603M | 5/30/96             | 9/10/96                  |                           |                 |
| SURFICIAL DEPOSITS MAP SHEETS 14-17, 23-24 29-30<br>Milestone Number: 3GCI1201M | 6/28/96             | 8/30/96                  |                           |                 |
| LETTER REPORT<br>Milestone Number: 3GWR626M                                     | 7/30/96             | 7/30/96                  | 7/30/96                   |                 |
| Compl Seismotectonic Synthesis Report<br>Milestone Number: 3GSI1100M            | 8/1/96              | 8/1/96                   |                           |                 |
| MOD FLOW IN UNSAT FRAC NET TOPOPAH SPRING UNIT ES<br>Milestone Number: 3GUF604M | 8/16/96             | 9/30/96                  |                           |                 |
| SYNTHESIS GAS PHASE CIRCULATION IN THE ESF<br>Milestone Number: 3GGP605M        | 8/28/96             | 9/27/96                  |                           |                 |
| Characteristics of Fractures at Yucca Mtn, NV<br>Milestone Number: 3GGF205M     | 8/30/96             | 8/30/96                  |                           |                 |
| LETR RPT: REGIONAL GROUND-WATER FLOW MODELING<br>Milestone Number: 3GRM600M     | 8/30/96             | 8/30/96                  |                           |                 |
| SYNTHESIS OF UNSAT ZONE INFILTRATION YUCCA MTN AR<br>Milestone Number: 3GUI623M | 8/30/96             | 8/30/96                  |                           |                 |



| <u>Deliverable</u>   | <u>Due<br/>Date</u> | <u>Expected<br/>Date</u> | <u>Completed<br/>Date</u> | <u>Comments</u> |
|--|---------------------|--------------------------|---------------------------|-----------------|
| GEOLOGIC MAP OF YUCCA MOUNTAIN, NEVADA<br>Milestone Number: 3GGF204M           | 8/30/96             | 8/30/96                  |                           |                 |
| SYNTHESIS INTERMED UNSAT-ZONE HYDRCHEMSTRY AT YM<br>Milestone Number: 3GUH607M | 8/30/96             | 10/31/96                 |                           |                 |
| TR: RSLTS HYDRA/CONSERVATIVE TRACER TST C-WELLS<br>Milestone Number: 3GWF660M  | 8/30/96             | 8/30/96                  |                           |                 |
| RELIMIN SITE SATURATED-ZONE GRND-WTR FLOW MOD<br>Milestone Number: 3GWM611M    | 8/30/96             | 8/30/96                  |                           |                 |
| YNTII QUAT RSP YM UNSAT & SAT HYDROL CLMT CHNG<br>Milestone Number: 3GCA102M   | 8/30/96             | 8/30/96                  |                           |                 |
| SYNTHESIS OF SELECTED PALEODISCHARGE SITES<br>Milestone Number: 3GQH671M       | 8/30/96             | 8/30/96                  |                           |                 |
| PT: RESULTS OF AGE SAMPLING DETERMAINATION<br>Milestone Number: 3GQH450M       | 8/30/96             | 9/30/96                  |                           |                 |
| TR RPT: AIR PERMEABILITY & HYDROCHEMISTY IN ESF<br>Milestone Number: 3GUS619M  | 8/30/96             | 8/30/96                  |                           |                 |

# USGS Level 4 Milestone Report

October 1, 1995 - July 31, 1996

Sorted by Baseline Date

| <u>Deliverable</u>  | <u>Due<br/>Date</u> | <u>Expected<br/>Date</u> | <u>Completed<br/>Date</u> | <u>Comments</u> |
|---|---------------------|--------------------------|---------------------------|-----------------|
| REVIEW DRAFT: IN-SITU MONITORING DATA PACKAGE<br>Milestone Number: 3GUP661M     | 2/28/96             | 8/30/96                  |                           |                 |
| REVIEW DRAFT: HYDROGEOLOGIC UNITS & MATRIX PROP<br>Milestone Number: 3GUP602M   | 2/29/96             | 7/29/96                  | 7/29/96                   |                 |
| DATA TO TDB/CRF: IN-SITU B1 MONITORING, 9/95-2/96<br>Milestone Number: 3GUP660M | 3/28/96             | 9/30/96                  |                           |                 |
| DATA TO CRF: FY95 FORTY MILE WASH<br>Milestone Number: 3GRG624M                 | 3/29/96             | 8/16/96                  |                           |                 |
| LTR RPT: SYNTHESIS OF TECTONICS MDLS FOR YM AREA<br>Milestone Number: 3GTE610M  | 3/29/96             | 8/30/96                  |                           |                 |
| ADMIN RPT: AIR-K TESTING IN SB B1 THRU FY95<br>Milestone Number: 3GUP610M       | 3/29/96             | 8/30/96                  |                           |                 |
| MEMO: SUMM OF FY1995 DATA<br>Milestone Number: 3GWI1608M                        | 3/29/96             | 8/30/96                  |                           |                 |
| ADMIN RPT: DEATH VALLEY HYDROCHEMISTRY<br>Milestone Number: 3GWI1609M           | 3/29/96             | 8/30/96                  |                           |                 |
| Compl Report: Surf Faulting in Basin/Range<br>Milestone Number: 3GSS105M        | 4/29/96             | 8/1/96                   |                           |                 |
| REVIEW DRAFT: CONCEPTUAL MODEL OF UZ HYDRO SYS<br>Milestone Number: 3GUM603M    | 4/30/96             | 8/30/96                  |                           |                 |
| REVIEW DRAFT: GAS PHASE CIRCULATION IN VIC OF ESF<br>Milestone Number: 3GGP604M | 5/1/96              | 8/9/96                   |                           |                 |
| ADMIN REPORT: NORTH RAMP HYDROLOGY<br>Milestone Number: 3GUP667M                | 5/13/96             | 8/30/96                  |                           |                 |

| <u>Deliverable</u>  | <u>Due Date</u> | <u>Expected Date</u> | <u>Completed Date</u> | <u>Comments</u> |
|---|-----------------|----------------------|-----------------------|-----------------|
| DATA TO CRF: FY95 SITE METEOROLOGY<br>Milestone Number: 3GMM600M                | 5/31/96         | 8/30/96              |                       |                 |
| VIEW DRAFT: REGIONAL GROUND WATER FLOW<br>Milestone Number: 3GRM601M            | 5/31/96         | 7/22/96              | 7/22/96               |                 |
| DOMIN RPT: STREAMFLOW & PRECIPITATION DATA, FY95<br>Milestone Number: 3GRS600M  | 5/31/96         | 8/30/96              |                       |                 |
| DATA TO CRF: FY95 STREAMFLOW DATA<br>Milestone Number: 3GRS602M                 | 5/31/96         | 8/30/96              |                       |                 |
| VIEW DRAFT: PRELIM SITE SZ 3-D GW FLOW MODEL<br>Milestone Number: 3GWM610M      | 5/31/96         | 8/16/96              |                       |                 |
| VIEW DRAFT: PALEOCLIMATE SYNTHESIS REPORT<br>Milestone Number: 3GCA101M         | 6/28/96         | 8/16/96              |                       |                 |
| VIEW DRAFT: MDLNG FLOW UZ FRAC NTRKS TSW UNIT ESF<br>Milestone Number: 3GUF603M | 6/28/96         | 8/30/96              |                       |                 |
| VIEW DRAFT: INTERMEDIATE UZ HYDROCHEMISTRY AT YM<br>Milestone Number: 3GUH606M  | 6/28/96         | 8/30/96              |                       |                 |
| INSTRUMENTATION PLAN FOR BOREHOLE USW SD-7<br>Milestone Number: 3GUP631M        | 6/28/96         | 7/30/96              | 7/30/96               |                 |
| Transmittal of Results TSW Fract Model to LBL<br>Milestone Number: 3GUF604NM    | 7/30/96         | 7/29/96              | 7/29/96               |                 |
| Provide UZ Pneumatic Data for Boreholes to LBL<br>Milestone Number: 3GUP665NM   | 7/30/96         | 7/30/96              | 7/30/96               |                 |
| DATA TO TDB/CRF: PRELIM. SURF PROPERTIES MAP<br>Milestone Number: 3GUI600M      | 7/31/96         | 7/25/96              | 7/25/96               |                 |
| MEMO TO TPO: CONCEPTUAL MODEL OF UZ HYDRO SYSTEM<br>Milestone Number: 3GUM612M  | 7/31/96         | 9/12/96              |                       |                 |
| MEMO: TESTS RESULTS THROUGH DEC 1995<br>Milestone Number: 3GWF733M              | 7/31/96         | 7/30/96              | 7/30/96               |                 |

| <u>Deliverable</u>   | <u>Due<br/>Date</u> | <u>Expected<br/>Date</u> | <u>Completed<br/>Date</u> | <u>Comments</u> |
|--|---------------------|--------------------------|---------------------------|-----------------|
| LETTER REPORT: PNEUMATIC DATA FROM SD-7<br>Milestone Number: 3GUP671M          | 8/1/96              | 8/15/96                  |                           |                 |
| DATA TO CRF: ESF MAPS AND DATA<br>Milestone Number: 3GGF600M                   | 8/15/96             | 8/15/96                  |                           |                 |
| LTR DESCRIBING HYDRAULIC PROP WT-SERIES WELLS<br>Milestone Number: 3GWF625M    | 8/29/96             | 8/29/96                  |                           |                 |
| LTR RPT: PALEO HYDR/CLIM SIGNIF OF SURF DEPOSITS<br>Milestone Number: 3GCH103M | 8/30/96             | 8/30/96                  |                           |                 |
| LETTER REPORT: USW G-2<br>Milestone Number: 3GRG604M                           | 8/30/96             | 9/30/96                  |                           |                 |
| Compl Rpt: Charact Fault Displ for PS11A<br>Milestone Number: 3GSS100M         | 8/30/96             | 8/1/96                   |                           |                 |
| REVIEW DRAFT: IN-SITU MONITORING DATA PACKAGE<br>Milestone Number: 3GUP662M    | 8/30/96             | 8/30/96                  |                           |                 |
| MEMO TO TPO: RSLTS OF PERCHED-WATER TESTING<br>Milestone Number: 3GUS600M      | 8/30/96             | 8/30/96                  |                           |                 |

## Yucca Mountain Project Variance Analysis Report

Entered on: 08/13/96 07:40 AM

Entered by: Raye Arnold

WBS: 1.2.3.1.2

WBS Title: Participant Management and Integration

AM: JONES S.

OM: STATTON T.

Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS

Submitted by: Raye Arnold

Reporting Period: 07/96

Data:

**Cumulative Cost Variance: (\$-99K / -13.9%)**

**Cause:**

The negative cost variance is due largely to the 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 level adequate even for basic staffing requirements, leaving no funding for supplies & materials, office machine maintenance, secretarial support, publications, vehicle support, etc.

**Impact:**

There is a projected cost overrun in this P&S account of approximately \$116K at this time. Cost underruns have been identified in P&S account OG33131 to help offset this cost overrun.

**Corrective Action:**

All unbudgeted costs to this P&S account require TPO approval. Account is being closely monitored to minimize overruns. Staff time is being rebudgeted and charged to other WBS elements, as appropriate.

**Cumulative Schedule Variance: (\$0K / 0%)**

Variances are within tolerance.

**Variance at Complete: (\$-116K / -13.6%)**

See "Cumulative Cost Variance"

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Approved:

|                                  |           |
|----------------------------------|-----------|
| <input type="radio"/>            | No        |
| <input type="radio"/>            | Tech. Mgr |
| <input checked="" type="radio"/> | TPO       |
| <input type="radio"/>            | Yes       |

## **Yucca Mountain Project Variance Analysis Report**

**Entered on:** 08/14/96 09:38 AM

**Entered by:** Raye Arnold

**WBS:** 1.2.3.2.8.3.6

**WBS Title:** Probabilistic Seismic Hazards Analyses

**AM:** JONES S.

**OM:** STATTON T.

**Subject:** Cost/Schedule Variance Analysis

**YMP Participant:** USGS

**Submitted by:** Raye Arnold

**Reporting Period:** 07/96

**Data:**

**Cumulative Cost Variance:** (\$-22K / -17.6%)

Variances are within tolerance.

**Cumulative Schedule Variance:** (\$0K / 0%)

Variances are within tolerance.

**Variance at Complete:** (\$-73K / -23.3%)

**Cause:**

The negative variance at complete is due to the need to hire additional staff in order to complete the seismotectonic synthesis report level 3 milestone.

**Impact:**

There will be a cost overrun in P&S account; however, there are adequate projected cost underruns within the USGS 1.2.3 WBS element to offset these cost overruns. There will be no schedule variance; the milestone was completed by the due date of August 1, 1996.

**Corrective Action:**

Ensure adequate cost underruns within the third level WBS to cover this cost overrun.

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**Approved:**

|                                  |           |
|----------------------------------|-----------|
| <input type="radio"/>            | No        |
| <input type="radio"/>            | Tech. Mgr |
| <input checked="" type="radio"/> | TPO       |
| <input type="radio"/>            | Yes       |

## Yucca Mountain Project Variance Analysis Report

Entered on: 08/14/96 09:37 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: STATTON T.

Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS

Submitted by: Raye Arnold

Reporting Period: 07/96

### Data:

Cumulative Cost Variance: (\$-26K / -10.7%)

Variances are within tolerance.

Cumulative Schedule Variance: (\$0K / 0%)

Variances are within tolerance.

Variance at Complete: (\$-70K / -23.3%)

### Cause:

This negative variance at complete is projected due to significantly more field work was required than had been planned or funded this 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 budget.

### Impact:

There will be a cost overrun in P&S account; however, there are adequate projected cost underruns within the USGS 1.2.3 WBS element to offset these cost overruns.

### Corrective Action:

Ensure adequate cost underruns within the third level WBS to cover this cost overrun.

Approved:

|                                  |           |
|----------------------------------|-----------|
| <input type="radio"/>            | No        |
| <input type="radio"/>            | Tech. Mgr |
| <input checked="" type="radio"/> | TPO       |
| <input type="radio"/>            | Yes       |

## **Yucca Mountain Project Variance Analysis Report**

**Entered on:** 08/13/96 07:50 AM

**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:** STATTON T.

**Subject:** Cost/Schedule Variance Analysis

**YMP Participant:** USGS

**Submitted by:** Raye Arnold

**Reporting Period:** 07/96

**Data:**

**Cumulative Cost Variance:** (\$108K / 11.4%)

**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.

**Impact:**

There is no schedule impact to this cost variance. Work was completed with less time and resources than budgeted. There is a projected cost underrun in this P&S account of approximately \$64K at this time. These funds have been identified to help offset the projected overrun in P&S account OG312.

**Corrective Action:**

No corrective action required. Projected underrun will be used to help offset projected overrun.

**Cumulative Schedule Variance:** (\$3K / 0.3%)

Variances are within tolerance.

**Variance at Complete:** (\$64K / 5.6%)

Variances are within tolerance.

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**Approved:**

|                                      |
|--------------------------------------|
| <input type="radio"/> No             |
| <input type="radio"/> Tech. Mgr      |
| <input checked="" type="radio"/> TPO |
| <input type="radio"/> Yes            |



## Yucca Mountain Project Variance Analysis Report

Entered on: 08/13/96 07:54 AM

Entered by: Raye Arnold

WBS: 1.2.3.6.2.2.1

WBS Title: Quaternary Regional Hydrology

AM: JONES S.

OM: STATTON T.

Subject: Cost/Schedule Variance Analysis

YMP Participant: USGS

Submitted by: Raye Arnold

Reporting Period: 07/96

### Data:

**Cumulative Cost Variance: (\$120K / 12.5%)**

#### Cause:

This positive cost variances results from new, unplanned work being added to the scope of this P&S account. Time-phasing of other budgets within this P&S account was not adjusted resulting in an artificially high spend rate in the earlier months of the fiscal year. This results in an apparent, but not real, underrun condition. Further, invoices which have been received from DRI for costs incurred are in dispute and therefore, not paid or costed. Also, expenditures for laboratory analysis are planned to be very high in the fourth quarter of the fiscal year. There is also an unplanned vacancy resulting from the departure of a subcontract employee.

#### Impact:

There is some expected underrun in this account (approximately 47K at this time). It is not likely that the unplanned vacancy will be filled this fiscal year.

#### Corrective Action:

Contact DRI to resolve invoicing problems.

**Cumulative Schedule Variance: (\$2K / 0.2%)**

Variances are within tolerance.

**Variance at Complete: (\$47K / 4.3%)**

Variances are within tolerance.

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Approved:

|                                      |
|--------------------------------------|
| <input type="radio"/> No             |
| <input type="radio"/> Tech. Mgr      |
| <input checked="" type="radio"/> TPO |
| <input type="radio"/> Yes            |

Participant USGS96

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

01-Jul-96 to 31-Jul-96

Prepared - 08/08/96:08:10:19

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 |                            |                |      |      |     |     |                           |       |       |      |     |                      |       |      |
|---------------------------|----------------------------|----------------|------|------|-----|-----|---------------------------|-------|-------|------|-----|----------------------|-------|------|
| Id                        | Description                | Current Period |      |      |     |     | FY1996 Cumulative to Date |       |       |      |     | FY1996 at Completion |       |      |
|                           |                            | BCWS           | BCMP | ACWP | SV  | CV  | BCWS                      | BCMP  | ACWP  | SV   | CV  | BAC                  | EAC   | VAC  |
| 1.2.3                     | Site Investigations        | 1094           | 1053 | 1117 | -41 | -64 | 10343                     | 10238 | 9816  | -105 | 422 | 12394                | 12508 | -114 |
| 1.2.5                     | Regulatory                 | 32             | 32   | 41   | 0   | -9  | 307                       | 307   | 260   | 0    | 47  | 365                  | 363   | 2    |
| 1.2.8                     | Environment, Safety, and H | 42             | 42   | 50   | 0   | -8  | 431                       | 432   | 411   | 1    | 21  | 515                  | 515   | 0    |
| 1.2.9                     | Project Management         | 56             | 56   | 89   | 0   | -33 | 554                       | 554   | 508   | 0    | 46  | 664                  | 664   | 0    |
| 1.2.12                    | Information Management     | 8              | 8    | 2    | 0   | 6   | 68                        | 68    | 63    | 0    | 5   | 80                   | 80    | 0    |
| 1.2.15                    | Support Services           | 156            | 156  | 147  | 0   | 9   | 1560                      | 1560  | 1602  | 0    | -42 | 1871                 | 1888  | -17  |
| Total                     |                            | 1388           | 1347 | 1446 | -41 | -99 | 13263                     | 13159 | 12660 | -104 | 499 | 15889                | 16018 | -129 |

## Resource Distributions by Element of Cost

Fiscal Year 1996

## Budgeted Cost of Work Scheduled

|            | Oct   | Nov   | Dec   | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Total  |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| LBRHRS     | 23259 | 23807 | 23340 | 23449 | 24069 | 25071 | 23358 | 27690 | 24694 | 23874 | 23805 | 23543 | 289959 |
| LABOR      | 954   | 972   | 944   | 959   | 980   | 1021  | 955   | 1177  | 1032  | 1009  | 1006  | 1003  | 12012  |
| SUBS       | 34    | 41    | 39    | 46    | 75    | 109   | 106   | 117   | 139   | 133   | 126   | 120   | 1085   |
| TRAVEL     | 30    | 41    | 38    | 38    | 43    | 46    | 42    | 40    | 35    | 37    | 25    | 22    | 437    |
| PM&E       | 25    | 18    | 23    | 37    | 35    | 29    | 27    | 35    | 30    | 19    | 15    | 4     | 297    |
| OTHER      | 157   | 159   | 155   | 165   | 165   | 214   | 180   | 181   | 171   | 190   | 151   | 154   | 2042   |
| CAPITAL    | 0     | 0     | 0     | 0     | 0     | 0     | 16    | 0     | 0     | 0     | 0     | 0     | 16     |
| Total BCWS | 1200  | 1231  | 1199  | 1245  | 1298  | 1419  | 1326  | 1550  | 1407  | 1388  | 1323  | 1303  | 15889  |

## Actual Cost of Work Performed

|            |       |       |       |       |       |       |       |       |       |       |   |   |        |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|--------|
| LBRHRS     | 21987 | 21558 | 21063 | 22761 | 20217 | 20627 | 19331 | 21820 | 20636 | 22047 | 0 | 0 | 212047 |
| LABOR      | 825   | 785   | 801   | 909   | 860   | 867   | 816   | 977   | 883   | 963   | 0 | 0 | 8686   |
| SUBS       | 56    | 72    | 97    | 111   | 118   | 170   | 188   | 220   | 170   | 195   | 0 | 0 | 1397   |
| TRAVEL     | 8     | 43    | 29    | 26    | 40    | 60    | 25    | 52    | 56    | 33    | 0 | 0 | 372    |
| PM&E       | 0     | 0     | 0     | 44    | 151   | -20   | 48    | 66    | 39    | 83    | 0 | 0 | 411    |
| OTHER      | 129   | 152   | 170   | 182   | 277   | 150   | 167   | 193   | 186   | 172   | 0 | 0 | 1778   |
| CAPITAL    | 0     | 0     | 0     | 0     | 0     | 0     | 16    | 0     | 0     | 0     | 0 | 0 | 16     |
| Total ACWP | 1018  | 1052  | 1097  | 1272  | 1446  | 1227  | 1260  | 1508  | 1334  | 1446  | 0 | 0 | 12660  |

WBS No. - 1.2 -Yucca Mountain Project

### Resource Distributions by Element of Cost

**Fiscal Year 1996**  
**Estimate to Complete**

|           | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug   | Sep   | Total |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|
| LBRHRS    | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 25187 | 24307 | 49494 |
| LABOR     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1112  | 1075  | 2187  |
| SUBS      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 219   | 220   | 439   |
| TRAVEL    | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 55    | 45    | 100   |
| PM&E      | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 39    | 18    | 57    |
| OTHER     | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 289   | 286   | 575   |
| CAPITAL   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0     | 0     | 0     |
| Total ETC | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1714  | 1644  | 3358  |

## Resource Distributions

**Fiscal Year 1996**[illegible]

### Fiscal Year Distribution

**Prior**

[illegible]

## YMP PLANNING AND CONTROL SYSTEM (PACS)

Participant U.S. Geological Survey

## MONTHLY COST/FTE REPORT

Fiscal Month/Year JULY 1996Date Prepared 08/14/96 11:13Page 1 of 1

|               | <u>CURRENT MONTH END</u> |                      |                 |                         |                       |                  |                    | <u>FISCAL YEAR</u> |                      |
|---------------|--------------------------|----------------------|-----------------|-------------------------|-----------------------|------------------|--------------------|--------------------|----------------------|
| WBS ELEMENT   | ACTUAL<br>COSTS          | PARTICIPANT<br>HOURS | SUBCON<br>HOURS | PURCHASE<br>COMMITMENTS | SUBCON<br>COMMITMENTS | ACCRUED<br>COSTS | APPROVED<br>BUDGET | APPROVED<br>FUNDS  | CUMMULATIVE<br>COSTS |
| 1.2.3         | 1115                     | 17563                | 3496            | 0                       | 456                   | 283              | 12588              | 0                  | 9776                 |
| 1.2.5         | 40                       | 512                  | 368             | 0                       | 36                    | 0                | 365                | 0                  | 259                  |
| 1.2.8         | 49                       | 724                  | 0               | 0                       | 0                     | 0                | 515                | 0                  | 410                  |
| 1.2.9         | 89                       | 1362                 | 368             | 0                       | 30                    | 3                | 664                | 0                  | 505                  |
| 1.2.12        | 2                        | 184                  | 0               | 0                       | 0                     | 0                | 80                 | 0                  | 63                   |
| 1.2.15        | 147                      | 1702                 | 368             | 0                       | 21                    | 25               | 1871               | 0                  | 1598                 |
| <b>TOTALS</b> | <b>1442</b>              | <b>22047</b>         | <b>4600</b>     | <b>0</b>                | <b>543</b>            | <b>311</b>       | <b>16083</b>       | <b>0</b>           | <b>12611</b>         |

U.S. GEOLOGICAL SURVEY  
ESTIMATED COSTS FOR 10/1/95 - 07/31/96

|   | OCT<br>EST | NOV<br>EST | DEC<br>EST | JAN<br>EST | FEB<br>EST | MAR<br>EST | APR<br>EST | MAY<br>EST | JUN<br>EST | JUL<br>EST | AUG<br>EST | SEP<br>EST | TOTAL  |
|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------|
| OG311968 Scientific Programs Management and Integ   | 13.9       | 15.6       | 15.2       | 17.0       | 29.6       | 30.6       | 29.7       | 30.7       | 19.4       | 18.5       | 0.0        | 0.0        | 220.2  |
| 1.2.3.1.1   | 13.9       | 15.6       | 15.2       | 17.0       | 29.6       | 30.6       | 29.7       | 30.7       | 19.4       | 18.5       | 0.0        | 0.0        | 220.2  |
| OG3129682 U.S. Geological Survey Support            | 79.6       | 93.3       | 92.1       | 107.4      | 174.8      | 34.2       | 66.3       | 78.7       | 24.1       | 60.1       | 0.0        | 0.0        | 810.6  |
| 1.2.3.1.2   | 79.6       | 93.3       | 92.1       | 107.4      | 174.8      | 34.2       | 66.3       | 78.7       | 24.1       | 60.1       | 0.0        | 0.0        | 810.6  |
| *1.2.3.1  | 93.5       | 108.9      | 107.3      | 124.4      | 204.4      | 64.8       | 96.0       | 109.4      | 43.5       | 78.6       | 0.0        | 0.0        | 1030.8 |
| OG32211096 Compilation and Synthesis of Existing St | 11.4       | 14.1       | 11.9       | 37.6       | 24.4       | 32.7       | 10.7       | 33.3       | 22.2       | 19.8       | 0.0        | 0.0        | 218.1  |
| OG32211K96 Geophysical Investigations               | 3.5        | 0.1        | 0.0        | 0.0        | 0.8        | -3.6       | 0.0        | 51.5       | 6.0        | 25.7       | 0.0        | 0.0        | 84.0   |
| OG32211K96 Analysis of Pre 1985 Geophysical Logs    | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.6        | 0.0        | 60.8       | 3.0        | 4.2        | 0.0        | 0.0        | 68.6   |
| 1.2.3.2.2.1.1                                       | 14.9       | 14.2       | 11.9       | 37.6       | 25.2       | 29.7       | 10.7       | 145.6      | 31.2       | 49.7       | 0.0        | 0.0        | 370.7  |
| OG32212H96 Geologic Map of the Central Block of the | 34.1       | 33.4       | 34.0       | 31.8       | 35.2       | 55.4       | 60.5       | 39.7       | 47.3       | 43.1       | 0.0        | 0.0        | 414.5  |
| OG32212J96 Exploratory Studies Facility Mapping (US | 111.3      | 100.7      | 135.7      | 183.3      | 192.8      | 244.4      | 157.1      | 165.7      | 253.0      | 266.9      | 0.0        | 0.0        | 1810.9 |
| 1.2.3.2.2.1.2                                       | 145.4      | 134.1      | 169.7      | 215.1      | 228.0      | 299.8      | 217.6      | 205.4      | 300.3      | 310.0      | 0.0        | 0.0        | 2225.4 |
| OG32831A96 Summary of Geologic, Geophysical, and Se | 5.9        | 6.3        | 5.9        | 6.5        | 6.9        | 5.9        | 6.8        | 40.6       | 12.5       | 17.1       | 0.0        | 0.0        | 114.4  |
| 1.2.3.2.8.3.1                                       | 5.9        | 6.3        | 5.9        | 6.5        | 6.9        | 5.9        | 6.8        | 40.6       | 12.5       | 17.1       | 0.0        | 0.0        | 114.4  |
| OG32833A96 Coordination and Review of Ground Motion | 0.0        | 11.5       | 24.0       | 14.0       | 24.1       | -10.8      | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 62.8   |
| 1.2.3.2.8.3.3                                       | 0.0        | 11.5       | 24.0       | 14.0       | 24.1       | -10.8      | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 62.8   |
| OG32836A96 Seismotectonics Summary and Synthesis    | 7.8        | 16.6       | 14.2       | 16.7       | 16.9       | 12.4       | 10.7       | 17.8       | 14.2       | 19.7       | 0.0        | 0.0        | 147.0  |
| 1.2.3.2.8.3.6                                       | 7.8        | 16.6       | 14.2       | 16.7       | 16.9       | 12.4       | 10.7       | 17.8       | 14.2       | 19.7       | 0.0        | 0.0        | 147.0  |
| OG32846A96 Quaternary Faulting at the Site          | 14.7       | 21.7       | 17.7       | 21.9       | 25.1       | 35.8       | 42.8       | -0.2       | 28.0       | 30.6       | 0.0        | 0.0        | 238.1  |
| OG32846K96 Trench Samp Dates Quat. Flts Hist GD, RV | 0.0        | 0.0        | 0.0        | 0.0        | 3.8        | 0.0        | 0.7        | 10.1       | 8.2        | 7.8        | 0.0        | 0.0        | 30.6   |
| 1.2.3.2.8.4.6                                       | 14.7       | 21.7       | 17.7       | 21.9       | 28.9       | 35.8       | 43.5       | 9.9        | 36.2       | 38.4       | 0.0        | 0.0        | 268.7  |
| OG3284CC96 Prepare Final Report on Tectonic Models  | 18.2       | 5.8        | 10.3       | 7.0        | 7.9        | 7.7        | 6.4        | 14.1       | 14.5       | 15.7       | 0.0        | 0.0        | 107.6  |
| 1.2.3.2.8.4.12                                      | 18.2       | 5.8        | 10.3       | 7.0        | 7.9        | 7.7        | 6.4        | 14.1       | 14.5       | 15.7       | 0.0        | 0.0        | 107.6  |
| *1.2.3.2  | 206.9      | 210.2      | 253.7      | 318.8      | 337.9      | 380.5      | 295.7      | 433.4      | 408.9      | 450.6      | 0.0        | 0.0        | 3296.6 |
| OG33111B96 Collection of Site Meteorological Data f | 6.2        | 7.3        | 5.9        | 6.7        | 6.9        | 7.9        | 8.4        | 7.3        | 9.4        | 11.2       | 0.0        | 0.0        | 77.2   |
| 1.2.3.3.1.1.1                                       | 6.2        | 7.3        | 5.9        | 6.7        | 6.9        | 7.9        | 8.4        | 7.3        | 9.4        | 11.2       | 0.0        | 0.0        | 77.2   |
| OG33112C96 Collection of Site Streamflow Data       | 7.0        | 19.4       | 9.6        | 10.2       | 8.3        | 4.4        | 1.1        | 3.3        | 5.1        | 4.9        | 0.0        | 0.0        | 73.3   |
| 1.2.3.3.1.1.2                                       | 7.0        | 19.4       | 9.6        | 10.2       | 8.3        | 4.4        | 1.1        | 3.3        | 5.1        | 4.9        | 0.0        | 0.0        | 73.3   |
| OG33113A96 Assessment of Key Data/Modeling Problems | 0.1        | 5.2        | 8.8        | 1.1        | 1.9        | 1.1        | 2.6        | 4.5        | 13.2       | 5.7        | 0.0        | 0.0        | 44.2   |
| OG33113C96 Fortymile Wash Recharge                  | 5.8        | 4.9        | 4.0        | 2.5        | 6.2        | 5.8        | 5.0        | 6.7        | 2.2        | 4.4        | 0.0        | 0.0        | 47.5   |
| 1.2.3.3.1.1.3                                       | 5.9        | 10.1       | 12.8       | 3.6        | 8.1        | 6.9        | 7.6        | 11.2       | 15.4       | 10.1       | 0.0        | 0.0        | 91.7   |
| OG33114D96 Regional Saturated- Zone Numerical Model | 7.1        | 6.2        | 1.5        | 2.7        | 10.4       | 24.6       | 6.0        | 28.9       | 32.0       | 20.0       | 0.0        | 0.0        | 139.4  |
| OG33114E96 Regional Saturated- Zone Boundary Condit | 5.0        | 12.5       | 12.2       | 15.5       | 4.3        | 3.4        | -0.2       | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 52.7   |
| OG33114F96 Regional Saturated- Zone Framework Model | 0.0        | 0.0        | 12.3       | 22.8       | 16.0       | 10.2       | 5.8        | 14.1       | 9.1        | 1.3        | 0.0        | 0.0        | 91.6   |
| 1.2.3.3.1.1.4                                       | 12.1       | 18.7       | 26.0       | 41.0       | 30.7       | 38.2       | 11.6       | 43.0       | 41.1       | 21.3       | 0.0        | 0.0        | 283.7  |
| OG33121C96 Infiltration Distribution                | 7.8        | 9.5        | 9.0        | 11.3       | 11.2       | 8.2        | 9.7        | 5.7        | 4.6        | 0.5        | 0.0        | 0.0        | 77.5   |
| OG33121D96 Infiltration Properties                  | 5.7        | 6.7        | 5.7        | 9.9        | 11.0       | 5.8        | 6.2        | 10.0       | 6.8        | 10.1       | 0.0        | 0.0        | 77.9   |

U.S. GEOLOGICAL SURVEY  
ESTIMATED COSTS FOR 10/1/95 - 07/31/96

|   | OCT<br>EST | NOV<br>EST | DEC<br>EST | JAN<br>EST | FEB<br>EST | MAR<br>EST | APR<br>EST | MAY<br>EST | JUN<br>EST | JUL<br>EST | AUG<br>EST | SEP<br>EST | TOTAL  |
|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------|
| OG33121E96 Infiltration Processes                   | 15.4       | 18.1       | 16.9       | 20.3       | 23.7       | 20.0       | 16.2       | 19.2       | 16.1       | 20.8       | 0.0        | 0.0        | 186.7  |
| 1.2.3.3.1.2.1                                       | 28.9       | 34.3       | 31.6       | 41.5       | 45.9       | 34.0       | 32.1       | 34.9       | 27.5       | 31.4       | 0.0        | 0.0        | 342.1  |
| OG33123C96 Vertical Seismic Profiling: Borehole UE- | 17.5       | 20.0       | 13.2       | 32.7       | 21.1       | 10.1       | 9.5        | 19.9       | 18.4       | -9.5       | 0.0        | 0.0        | 152.9  |
| OG33123D96 Unsaturated Zone Borehole Instrumentatio | 74.8       | 82.1       | 66.5       | 38.2       | 57.3       | 41.1       | 49.5       | 55.1       | 45.8       | 71.3       | 0.0        | 0.0        | 581.7  |
| OG33123G96 Integrated Analysis and Interpretation   | 0.0        | 0.0        | 12.4       | 12.9       | 15.3       | 16.7       | 17.1       | 16.1       | 13.9       | 10.9       | 0.0        | 0.0        | 115.3  |
| OG33123H96 Matrix Properties of Hydrologic Units    | 12.2       | 9.3        | 9.4        | 7.2        | 7.7        | 7.2        | 6.1        | 14.4       | 11.3       | 13.4       | 0.0        | 0.0        | 98.2   |
| OG33123K96 Temporary Instrumentation of SD-7        | 0.0        | 0.0        | 0.0        | 4.6        | 6.6        | 5.8        | 7.5        | 10.2       | 6.3        | -2.7       | 0.0        | 0.0        | 38.3   |
| 1.2.3.3.1.2.3                                       | 104.5      | 111.4      | 101.5      | 95.6       | 108.0      | 80.9       | 89.7       | 115.7      | 95.7       | 83.4       | 0.0        | 0.0        | 986.4  |
| OG33124E96 Air-Permeability and Hydrochemistry Test | 29.5       | 33.8       | 37.6       | 42.4       | 56.3       | 24.9       | 41.2       | 29.1       | 49.6       | 43.4       | 0.0        | 0.0        | 387.8  |
| OG33124F96 Perched Water Testing in the Exploratory | 0.9        | 0.0        | 2.8        | 4.3        | 3.0        | 1.0        | 12.4       | 22.0       | -12.8      | 4.4        | 0.0        | 0.0        | 38.0   |
| OG33124K96 ESF Moisture/Dryout                      | 0.0        | 0.0        | 0.0        | 0.0        | 7.0        | 7.5        | 12.9       | 18.3       | 12.6       | 21.4       | 0.0        | 0.0        | 79.7   |
| 1.2.3.3.1.2.4                                       | 30.4       | 33.8       | 40.4       | 46.7       | 66.3       | 33.4       | 66.5       | 69.4       | 49.4       | 69.2       | 0.0        | 0.0        | 505.5  |
| OG33126B96 Gas Circulation and Pneumatic Pathways   | 9.6        | 11.5       | 9.0        | 13.7       | 9.6        | 8.9        | 8.7        | 10.3       | 11.7       | 8.0        | 0.0        | 0.0        | 101.0  |
| 1.2.3.3.1.2.6                                       | 9.6        | 11.5       | 9.0        | 13.7       | 9.6        | 8.9        | 8.7        | 10.3       | 11.7       | 8.0        | 0.0        | 0.0        | 101.0  |
| OG33127B96 Unstaturated-Zone Hydrochemistry         | 26.2       | 26.4       | 32.2       | 23.4       | 53.2       | 18.3       | 46.8       | 28.9       | 28.7       | 30.4       | 0.0        | 0.0        | 314.5  |
| 1.2.3.3.1.2.7                                       | 26.2       | 26.4       | 32.2       | 23.4       | 53.2       | 18.3       | 46.8       | 28.9       | 28.7       | 30.4       | 0.0        | 0.0        | 314.5  |
| OG33128A96 Fluid Flow in Unsaturated-Zone Fractured | 6.9        | 6.9        | 6.6        | 7.2        | 8.4        | 8.8        | 9.3        | 15.3       | 9.3        | 10.3       | 0.0        | 0.0        | 89.0   |
| 1.2.3.3.1.2.8                                       | 6.9        | 6.9        | 6.6        | 7.2        | 8.4        | 8.8        | 9.3        | 15.3       | 9.3        | 10.3       | 0.0        | 0.0        | 89.0   |
| OG33129B96 Intermediate Site Unsaturated-Zone FlowM | 7.3        | 8.6        | 15.2       | 30.5       | 6.3        | 16.6       | 17.7       | 23.0       | 1.8        | 7.8        | 0.0        | 0.0        | 134.8  |
| 1.2.3.3.1.2.9                                       | 7.3        | 8.6        | 15.2       | 30.5       | 6.3        | 16.6       | 17.7       | 23.0       | 1.8        | 7.8        | 0.0        | 0.0        | 134.8  |
| OG33131A96 Conduct Hydraulic/Tracer Tests, C-Wells  | 39.6       | 40.5       | 40.7       | 49.0       | 57.6       | 7.2        | 10.1       | 8.6        | 0.9        | 23.2       | 0.0        | 0.0        | 277.4  |
| OG33131F96 Site Potentiometric Levels Monitoring    | 11.7       | 17.5       | 17.2       | 0.4        | 3.7        | 10.3       | 10.8       | 16.8       | 3.5        | 14.1       | 0.0        | 0.0        | 106.0  |
| OG33131G96 Pumping and Testing Existing Monitoring  | 11.8       | 14.0       | 5.4        | 20.7       | 20.8       | 21.4       | 31.8       | 17.6       | 43.7       | 27.3       | 0.0        | 0.0        | 214.5  |
| OG33131K96 Enhanced C-Wells Hydraulic and Conservat | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 51.2       | 42.1       | 52.1       | 45.6       | 50.5       | 0.0        | 0.0        | 241.5  |
| 1.2.3.3.1.3.1                                       | 63.1       | 72.0       | 63.3       | 70.1       | 82.1       | 90.1       | 94.8       | 95.1       | 93.7       | 115.1      | 0.0        | 0.0        | 839.4  |
| OG33132D96 Saturated-Zone Hydrochemical Sample and  | 6.7        | 6.9        | 6.3        | 8.7        | 6.9        | 6.9        | 7.4        | 7.0        | 0.6        | 0.0        | 0.0        | 0.0        | 57.4   |
| 1.2.3.3.1.3.2                                       | 6.7        | 6.9        | 6.3        | 8.7        | 6.9        | 6.9        | 7.4        | 7.0        | 0.6        | 0.0        | 0.0        | 0.0        | 57.4   |
| OG33133D96 Site Saturated Zone Framework Model      | 14.9       | 10.2       | 4.6        | 0.1        | 0.1        | 0.7        | 11.2       | 16.7       | 10.1       | 10.4       | 0.0        | 0.0        | 79.0   |
| OG33133E96 Site Saturated Zone Numerical Model      | 11.5       | 10.1       | 3.3        | 13.4       | 17.4       | 21.1       | 15.2       | 22.0       | 14.8       | 14.3       | 0.0        | 0.0        | 143.1  |
| 1.2.3.3.1.3.3                                       | 26.4       | 20.3       | 7.9        | 13.5       | 17.5       | 21.8       | 26.4       | 38.7       | 24.9       | 24.7       | 0.0        | 0.0        | 222.1  |
| *1.2.3.3  | 341.2      | 387.6      | 368.3      | 412.4      | 458.2      | 377.1      | 428.1      | 503.1      | 414.3      | 427.8      | 0.0        | 0.0        | 4118.1 |
| OG352196B Tracer Gas Support                        | 5.2        | 5.2        | 5.1        | 5.4        | 5.4        | 5.5        | 5.3        | 5.9        | 5.0        | 5.7        | 0.0        | 0.0        | 53.7   |
| 1.2.3.5.2.1   | 5.2        | 5.2        | 5.1        | 5.4        | 5.4        | 5.5        | 5.3        | 5.9        | 5.0        | 5.7        | 0.0        | 0.0        | 53.7   |
| *1.2.3.5  | 5.2        | 5.2        | 5.1        | 5.4        | 5.4        | 5.5        | 5.3        | 5.9        | 5.0        | 5.7        | 0.0        | 0.0        | 53.7   |
| OG36212B96 Paleoclimate Study of Lake, Playa and Ma | 21.0       | 18.3       | 14.8       | 25.4       | 23.3       | 29.2       | 16.0       | -29.7      | 5.1        | 9.7        | 0.0        | 0.0        | 133.1  |
| 1.2.3.6.2.1.2                                       | 21.0       | 18.3       | 14.8       | 25.4       | 23.3       | 29.2       | 16.0       | -29.7      | 5.1        | 9.7        | 0.0        | 0.0        | 133.1  |
| OG36214A96 Geochronological Studies of Surface Desp | 22.4       | 16.3       | 17.1       | 3.4        | 0.9        | -10.3      | 11.2       | 9.5        | 8.4        | 12.3       | 0.0        | 0.0        | 91.2   |

U.S. GEOLOGICAL SURVEY  
ESTIMATED COSTS FOR 10/1/95 - 07/31/96

|  | OCT<br>EST | NOV<br>EST | DEC<br>EST | JAN<br>EST | FEB<br>EST | MAR<br>EST | APR<br>EST | MAY<br>EST | JUN<br>EST | JUL<br>EST | AUG<br>EST | SEP<br>EST | TOTAL  |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------|
| 0G36214896 Surface Deposits Mapping                  | 5.9        | 5.9        | 6.2        | 7.2        | 8.0        | 7.2        | 10.1       | 12.3       | 6.2        | 7.3        | 0.0        | 0.0        | 76.3   |
| 1.2.3.6.2.1.4  | 28.3       | 22.2       | 23.3       | 10.6       | 8.9        | -3.1       | 21.3       | 21.8       | 14.6       | 19.6       | 0.0        | 0.0        | 167.5  |
| 0G36215A96 Paleoclimate/Paleoenvironmental Synthesis | 9.1        | 9.1        | 15.4       | 3.3        | 13.8       | 8.9        | 13.5       | 33.0       | 11.5       | 21.8       | 0.0        | 0.0        | 139.4  |
| 1.2.3.6.2.1.5  | 9.1        | 9.1        | 15.4       | 3.3        | 13.8       | 8.9        | 13.5       | 33.0       | 11.5       | 21.8       | 0.0        | 0.0        | 139.4  |
| 0G36221E96 Subsurface Mineral Record of Past Hydrol  | 16.9       | 36.8       | 25.6       | 27.0       | 18.8       | 28.2       | 21.4       | -3.4       | 6.8        | -5.2       | 0.0        | 0.0        | 172.9  |
| 0G36221F96   | 0.0        | 0.2        | 4.5        | 12.2       | 16.5       | 8.1        | 8.4        | 35.7       | 17.1       | 24.8       | 0.0        | 0.0        | 127.5  |
| 0G36221G96 Evaluation of Paleo Ground-Water Dischar  | 9.5        | 4.1        | -0.7       | 0.0        | 1.7        | 4.2        | 14.9       | 60.2       | 30.6       | 20.6       | 0.0        | 0.0        | 145.1  |
| 0G36221K96 Dating of Fracture Coatings in ESF        | 0.0        | 0.0        | 24.3       | 50.5       | 86.9       | 53.0       | 31.3       | 34.4       | 50.0       | 60.9       | 0.0        | 0.0        | 391.3  |
| 1.2.3.6.2.2.1  | 26.4       | 41.1       | 53.7       | 89.7       | 123.9      | 93.5       | 76.0       | 126.9      | 104.5      | 101.1      | 0.0        | 0.0        | 836.8  |
| *1.2.3.6   | 84.8       | 90.7       | 107.2      | 129.0      | 169.9      | 128.5      | 126.8      | 152.0      | 135.7      | 152.2      | 0.0        | 0.0        | 1276.8 |
| **1.2.3  | 731.6      | 802.6      | 841.6      | 990.0      | 1175.8     | 956.4      | 951.9      | 1203.8     | 1007.4     | 1114.9     | 0.0        | 0.0        | 9776.0 |
| 0G5249682 Regulatory Documentation                   | 5.7        | 5.9        | 0.0        | 8.9        | 0.9        | 0.0        | 0.0        | -5.0       | 11.2       | 0.3        | 0.0        | 0.0        | 27.9   |
| 1.2.5.2.4  | 5.7        | 5.9        | 0.0        | 8.9        | 0.9        | 0.0        | 0.0        | -5.0       | 11.2       | 0.3        | 0.0        | 0.0        | 27.9   |
| *1.2.5.2   | 5.7        | 5.9        | 0.0        | 8.9        | 0.9        | 0.0        | 0.0        | -5.0       | 11.2       | 0.3        | 0.0        | 0.0        | 27.9   |
| 0G535968 Technical Data Base Input                   | 7.2        | 10.3       | 12.5       | 14.1       | 11.8       | 13.1       | 20.8       | 21.4       | 17.5       | 19.9       | 0.0        | 0.0        | 148.6  |
| 1.2.5.3.5  | 7.2        | 10.3       | 12.5       | 14.1       | 11.8       | 13.1       | 20.8       | 21.4       | 17.5       | 19.9       | 0.0        | 0.0        | 148.6  |
| *1.2.5.3   | 7.2        | 10.3       | 12.5       | 14.1       | 11.8       | 13.1       | 20.8       | 21.4       | 17.5       | 19.9       | 0.0        | 0.0        | 148.6  |
| 0G541968 Interact with Site Characterization and     | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 11.1       | 3.5        | 0.0        | 0.0        | 14.6   |
| 1.2.5.4.1  | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 11.1       | 3.5        | 0.0        | 0.0        | 14.6   |
| 0G546968 Planning and Coordination of Flow- and-T    | 0.0        | 0.0        | 0.4        | 10.2       | -3.1       | 0.3        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 7.8    |
| 1.2.5.4.6  | 0.0        | 0.0        | 0.4        | 10.2       | -3.1       | 0.3        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 7.8    |
| *1.2.5.4   | 0.0        | 0.0        | 0.4        | 10.2       | -3.1       | 0.3        | 0.0        | 0.0        | 11.1       | 3.5        | 0.0        | 0.0        | 22.4   |
| 0G553968   | 0.0        | 0.0        | 0.0        | 0.1        | -0.1       | 0.3        | 0.0        | 0.2        | 0.0        | 0.0        | 0.0        | 0.0        | 0.5    |
| 1.2.5.5.3  | 0.0        | 0.0        | 0.0        | 0.1        | -0.1       | 0.3        | 0.0        | 0.2        | 0.0        | 0.0        | 0.0        | 0.0        | 0.5    |
| *1.2.5.5   | 0.0        | 0.0        | 0.0        | 0.1        | -0.1       | 0.3        | 0.0        | 0.2        | 0.0        | 0.0        | 0.0        | 0.0        | 0.5    |
| 0G57968 Technical Evaluation                         | 0.9        | 0.0        | 0.0        | 0.9        | 0.5        | -0.2       | 0.0        | 15.9       | 25.3       | 16.1       | 0.0        | 0.0        | 59.4   |
| 1.2.5.7  | 0.9        | 0.0        | 0.0        | 0.9        | 0.5        | -0.2       | 0.0        | 15.9       | 25.3       | 16.1       | 0.0        | 0.0        | 59.4   |
| *1.2.5.7   | 0.9        | 0.0        | 0.0        | 0.9        | 0.5        | -0.2       | 0.0        | 15.9       | 25.3       | 16.1       | 0.0        | 0.0        | 59.4   |
| **1.2.5  | 13.8       | 16.2       | 12.9       | 34.2       | 10.0       | 13.5       | 20.8       | 32.5       | 65.1       | 39.8       | 0.0        | 0.0        | 258.8  |
| 0G825968 Occupational Safety and Health              | 7.3        | 7.4        | 7.0        | 7.7        | 7.8        | 7.5        | 7.5        | 10.8       | 10.1       | 11.8       | 0.0        | 0.0        | 84.9   |
| 1.2.8.2.5  | 7.3        | 7.4        | 7.0        | 7.7        | 7.8        | 7.5        | 7.5        | 10.8       | 10.1       | 11.8       | 0.0        | 0.0        | 84.9   |
| *1.2.8.2   | 7.3        | 7.4        | 7.0        | 7.7        | 7.8        | 7.5        | 7.5        | 10.8       | 10.1       | 11.8       | 0.0        | 0.0        | 84.9   |
| 0G845968 Radiological Studies                        | 0.0        | 0.0        | 0.0        | 0.1        | 0.0        | -0.4       | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | -0.3   |
| 1.2.8.4.5  | 0.0        | 0.0        | 0.0        | 0.1        | 0.0        | -0.4       | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | -0.3   |
| 0G84796H Water Resources Monitoring                  | 33.3       | 26.9       | 27.4       | 27.8       | 31.9       | 31.6       | 39.8       | 32.8       | 36.4       | 37.3       | 0.0        | 0.0        | 325.2  |
| 1.2.8.4.7  | 33.3       | 26.9       | 27.4       | 27.8       | 31.9       | 31.6       | 39.8       | 32.8       | 36.4       | 37.3       | 0.0        | 0.0        | 325.2  |
| *1.2.8.4   | 33.3       | 26.9       | 27.4       | 27.9       | 31.9       | 31.2       | 39.8       | 32.8       | 36.4       | 37.3       | 0.0        | 0.0        | 324.9  |

U.S. GEOLOGICAL SURVEY  
ESTIMATED COSTS FOR 10/1/95 - 07/31/96

|  | OCT<br>EST | NOV<br>EST | DEC<br>EST | JAN<br>EST | FEB<br>EST | MAR<br>EST | APR<br>EST | MAY<br>EST | JUN<br>EST | JUL<br>EST | AUG<br>EST | SEP<br>EST | TOTAL   |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|---------|
| **1.2.8  | 40.6       | 34.3       | 34.4       | 35.6       | 39.7       | 38.7       | 47.3       | 43.6       | 46.5       | 49.1       | 0.0        | 0.0        | 409.8   |
| OG9121968 Participant Technical Project Office     | 27.1       | 29.1       | 29.7       | 25.2       | 24.4       | 22.6       | 15.8       | 34.4       | 23.4       | 44.6       | 0.0        | 0.0        | 276.3   |
| 1.2.9.1.2.1  | 27.1       | 29.1       | 29.7       | 25.2       | 24.4       | 22.6       | 15.8       | 34.4       | 23.4       | 44.6       | 0.0        | 0.0        | 276.3   |
| *1.2.9.1   | 27.1       | 29.1       | 29.7       | 25.2       | 24.4       | 22.6       | 15.8       | 34.4       | 23.4       | 44.6       | 0.0        | 0.0        | 276.3   |
| OG922968 Participant Project Control - USGS        | 19.9       | 20.9       | 19.7       | 20.5       | 27.0       | 18.8       | 18.1       | 22.0       | 17.9       | 44.3       | 0.0        | 0.0        | 229.1   |
| 1.2.9.2.2  | 19.9       | 20.9       | 19.7       | 20.5       | 27.0       | 18.8       | 18.1       | 22.0       | 17.9       | 44.3       | 0.0        | 0.0        | 229.1   |
| *1.2.9.2   | 19.9       | 20.9       | 19.7       | 20.5       | 27.0       | 18.8       | 18.1       | 22.0       | 17.9       | 44.3       | 0.0        | 0.0        | 229.1   |
| **1.2.9  | 47.0       | 50.0       | 49.4       | 45.7       | 51.4       | 41.4       | 33.9       | 56.4       | 41.3       | 88.9       | 0.0        | 0.0        | 505.4   |
| OGC521968 Records Operation (USGS)                 | 5.4        | 3.5        | 3.3        | 4.8        | 4.9        | 6.7        | 15.3       | 8.8        | 8.0        | 2.3        | 0.0        | 0.0        | 63.0    |
| 1.2.12.5.2.1                                       | 5.4        | 3.5        | 3.3        | 4.8        | 4.9        | 6.7        | 15.3       | 8.8        | 8.0        | 2.3        | 0.0        | 0.0        | 63.0    |
| *1.2.12.5  | 5.4        | 3.5        | 3.3        | 4.8        | 4.9        | 6.7        | 15.3       | 8.8        | 8.0        | 2.3        | 0.0        | 0.0        | 63.0    |
| **1.2.12   | 5.4        | 3.5        | 3.3        | 4.8        | 4.9        | 6.7        | 15.3       | 8.8        | 8.0        | 2.3        | 0.0        | 0.0        | 63.0    |
| OGF239681 Support/Personnel Services               | 49.0       | 42.6       | 37.2       | 41.8       | 39.7       | 52.0       | 43.6       | 29.5       | 38.0       | 30.0       | 0.0        | 0.0        | 403.4   |
| OGF239682 Facilities Management - Space            | 85.4       | 57.6       | 71.0       | 71.3       | 71.3       | 71.3       | 71.3       | 71.3       | 71.3       | 71.3       | 0.0        | 0.0        | 713.1   |
| OGF239683 Facilities Management - Computers/Phones | 24.9       | 17.1       | 20.4       | 20.8       | 20.8       | 20.8       | 20.8       | 20.8       | 20.8       | 20.8       | 0.0        | 0.0        | 208.0   |
| OGF239684 Facilities Management - Other            | 13.3       | 8.7        | 11.2       | 11.1       | 11.1       | 11.1       | 11.1       | 11.1       | 11.1       | 11.1       | 0.0        | 0.0        | 110.9   |
| OGF239685 Procurement/Property Management - USGS   | 2.2        | 12.4       | 7.9        | 8.6        | 7.8        | 8.5        | 8.8        | 9.8        | 7.9        | 7.8        | 0.0        | 0.0        | 81.7    |
| 1.2.15.2.3   | 174.8      | 138.4      | 147.7      | 153.6      | 150.7      | 163.7      | 155.6      | 142.5      | 149.1      | 141.0      | 0.0        | 0.0        | 1517.1  |
| *1.2.15.2  | 174.8      | 138.4      | 147.7      | 153.6      | 150.7      | 163.7      | 155.6      | 142.5      | 149.1      | 141.0      | 0.0        | 0.0        | 1517.1  |
| OGF3968 YMP Support For The Training Mission (US   | 5.6        | 5.0        | 4.0        | 3.6        | 7.7        | 4.3        | 14.2       | 15.1       | 15.4       | 5.9        | 0.0        | 0.0        | 80.8    |
| 1.2.15.3   | 5.6        | 5.0        | 4.0        | 3.6        | 7.7        | 4.3        | 14.2       | 15.1       | 15.4       | 5.9        | 0.0        | 0.0        | 80.8    |
| *1.2.15.3  | 5.6        | 5.0        | 4.0        | 3.6        | 7.7        | 4.3        | 14.2       | 15.1       | 15.4       | 5.9        | 0.0        | 0.0        | 80.8    |
| **1.2.15   | 180.4      | 143.4      | 151.7      | 157.2      | 158.4      | 168.0      | 169.8      | 157.6      | 164.5      | 146.9      | 0.0        | 0.0        | 1597.9  |
| 1.2 OPERATING                                      | 1018.8     | 1050.0     | 1093.3     | 1267.5     | 1440.2     | 1224.7     | 1239.0     | 1502.7     | 1332.8     | 1441.9     | 0.0        | 0.0        | 12610.9 |
| CAPITAL EQUIPMENT                                  | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 16.0       | 0.0        | 0.0        | 0.0        | 0.0        | 0.0        | 16.0    |
| GRAND TOTAL  | 1018.8     | 1050.0     | 1093.3     | 1267.5     | 1440.2     | 1224.7     | 1255.0     | 1502.7     | 1332.8     | 1441.9     | 0.0        | 0.0        | 12626.9 |
| FTEs   |            |            |            |            |            |            |            |            |            |            |            |            |         |
| FEDERAL  | 118.1      | 125.4      | 123.4      | 133.7      | 118.8      | 121.9      | 112.7      | 127.9      | 121.1      | 129.6      | 0.0        | 0.0        |         |
| CONTRACT   | 7.9        | 8.6        | 11.1       | 15.4       | 17.4       | 21.5       | 22.7       | 28.0       | 27.1       | 26.9       | 0.0        | 0.0        |         |
| TOTAL  | 126.0      | 134.0      | 134.5      | 149.1      | 136.2      | 143.4      | 135.4      | 155.9      | 148.2      | 156.5      | 0.0        | 0.0        |         |

\* Fourth level WBS roll-up

\*\* Third level WBS roll-up



WEEKLY HIGHLIGHTS REPORT FOR W/E AUGUST 9, 1996

TO: Daniel A. Dreyfus, RW-1

FROM: Wesley E. Barnes, YMSCO

DATE: August 9, 1996

SUBJECT: Weekly Report

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

Major Events

None to report

Key Accomplishments

The Tunnel Boring Machine has advanced to Station 61+68.3 M or 20,237.1 ft. as of 08:00 August 9, 1996. 53.0 M or 173.8 ft. of tunnel has been excavated in the past week. Ground conditions are still Category 3a. The North Ghost Dance Fault Alcove advanced to Station 00+68.7 M or 225.4 ft. in the last week.

The Assistant Manager for Suitability & Licensing supported and participated in a U.S. Department of Energy/U.S. Nuclear Regulatory Commission teleconference to prepare for an upcoming technical exchange videoconference on the U.S. Department of Energy Long Range Plans scheduled for August 15, 1996.

On August 6, 1996, Allen Benson, Director, Office of Public Affairs, appeared on AM Southern Nevada, KVVU-TV, Channel 5, to discuss Discovery Day. AM Southern Nevada is a local program that highlights community events. Discovery Day will be held August 10, 1996, at the Yucca Mountain Science Center. The public is invited to attend and participate in hands-on scientific activities.

The Office of Public Affairs staff gave a Yucca Mountain Site Characterization Project presentation to the Esmeralda County Commission on August 6, 1996. Topics included a Project update and discussions on the following items: the revised Program Plan, pending Yucca Mountain legislation (authorization and appropriations), Exploratory Studies Facility progress, Fiscal Year 1997 oversight funding, Court of Appeals ruling requiring the U.S. Department of

Energy to accept spent fuel in 1998, and the Math and Science Gift Program. It was mentioned that 14 computer systems have been reserved for their school district under the Math and Science Gift Program. Commissioner Susan Dudley, tasked to monitor Yucca Mountain activities after the Esmeralda County Yucca Mountain Oversight Office closed due to absence of oversight funds, asked several questions regarding the Project, including: Exploratory Studies Facility progress, 180(c) comment period, and the revised Program Plan. The Commission asked the staff to update the Commission as new happenings or findings occur.

Emerging Issues

None to report

Secretarial Commitments

None to report

WEEKLY HIGHLIGHTS REPORT FOR W/E AUGUST 16, 1996

TO: Daniel A. Dreyfus, RW-1

FROM: Wesley E. Barnes, YMSCO 

DATE: August 16, 1996

SUBJECT: Weekly Report

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

Major Events

- A videoconference connection to listen to the Advisory Committee on Nuclear Waste 85th Meeting and Workshop on coupled processes is scheduled for August 21, 1996.

Key Accomplishments

The Tunnel Boring Machine has advanced to Station 62+24.6 M or 20,416.9 ft. as of 08:00 August 16, 1996. 56.3 M or 179.8 ft. of tunnel has been excavated in the past week. Ground conditions are still Category 3a. The North Ghost Dance Fault Alcove advanced to Station 00+75.9 M or 249 ft. in the last week.

The Office of Public Affairs staff gave a workshop/presentation on the Yucca Mountain Project to the Inyo County Board of County Supervisors, in Bishop, California, on August 13, 1996. Topics included a Project update and discussions on the following items: the revised Program Plan, pending Yucca Mountain legislation (authorization and appropriations), Exploratory Studies Facility progress, Fiscal Year 1997 oversight funding, Court of Appeals ruling requiring the Department of Energy to accept spent fuel in 1998, and the Math and Science Gift Program.

A geology "Discovery Day" was held at the Las Vegas Yucca Mountain Science Center on August 10, 1996, from 11 a.m. to 3 p.m. The objective was to provide a science activity environment for the general public, adults and children, to learn about the different types of science that are taking place at the site. This also supports a commitment to increasing student interest in science and math. Representatives from the U.S. Department of Energy and several Civilian Radioactive Waste Management System Management and Operating

AUG 16 1996

Contractor organizations provided demonstrations and activities at nine different stations, including hydrology, geology, earthquakes, environmental, volcanology, rocks and minerals, and paleontology. Over 200 members of the public participated in the presentations. Local CBS affiliate KLAS-TV, Channel 8, covered the event and interviewed Allen Benson, Director, Office of Public Affairs, as well as several people attending the event. The event was very well received by those in attendance and the news media. All feedback indicates that this was a successful effort.

The Office of Public Affairs staff coordinated and conducted four tours of Yucca Mountain for 45 guests. Of special interest were tours for two guests from Assignment Idaho, and for nine guests from the Nuclear Waste Fund Audit Committee.

- The August 1996 New Work Update video was mailed to 259 individuals in the Video Distribution category of the mailing list.

The Office of Public Affairs staff gave a presentation on the background and history of the proposed repository at Yucca Mountain to 100 guests of the U.S. Armed Forces Nuclear Energy Association, in Reno, Nevada.

The Yucca Mountain Site Characterization Office participated in a U.S. Department of Energy/U.S. Nuclear Regulatory Commission videoconference on Long-Range Plans on August 15, 1996. The purpose of the videoconference was to discuss the Department's long-range planning documents, their bases, and the assumptions used to develop the planning documents.

The Fourteenth Semiannual Site Characterization Progress Report has been approved by the U.S. Department of Energy Office of Civilian Radioactive Waste Management and is currently in Congressional Programs and General Counsel concurrence.

#### Emerging Issues

None to report

#### Secretarial Commitments

None to report

WEEKLY HIGHLIGHT REPORT FOR W/E SEPTEMBER 6, 1996

TO: *Dan*  
Daniel A. Breyfus, RW-1

FROM: Wesley E. Barnes, YMSCO *Wes*

DATE: September 6, 1996

SUBJECT: Weekly Report

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

Major Events

A U.S. Department of Energy/U.S. Nuclear Regulatory Commission Appendix 7 Meeting on Probabilistic Volcanic Hazards Assessment is scheduled for September 10, 1996, via video conference between Washington, D.C. and Las Vegas, Nevada.

A U.S. Department of Energy/U.S. Nuclear Regulatory Commission Exploratory Studies Facility Technical Meeting is scheduled for September 12, 1996, via video conference between Washington, D.C. and Las Vegas, Nevada.

A U.S. Department of Energy/U.S. Nuclear Regulatory Commission Management Meeting is scheduled for September 19, 1996, via video conference between Washington, D.C.

Key Accomplishments

The Tunnel Boring Machine advanced to Station 63+47 M or 20,818 feet as of 8:00 a.m., Thursday, September 5, 1996. Ground conditions currently require Category 1 support (rock bolts/wire mesh). The North Ghost Dance Fault Alcove remains at Station 00+89.6 M or 294 feet this week.

The Yucca Mountain Site Characterization Office participated in a dry run to prepare for the U.S. Department of Energy/U.S. Nuclear Regulatory Commission Exploratory Studies Facility Technical Meeting scheduled for September 12, 1996. The agenda for the meeting includes status of the construction, testing, and design; and discussion of the Commission's questions and concerns regarding the thermal tests.

The Office of Public Affairs completed the summer intern programs for both the Historically Black Colleges and Universities and the School-to-Work program. Six Historically Black Colleges and Universities and four School-to-Work students participated during this summer and the program was deemed very successful by both the students and the Civilian Radioactive Waste Management System Management and Operating Contractor managers.

The Office of Public Affairs coordinated and conducted a tour of Yucca Mountain for two guests from United Kingdom Nirex.

Emerging Issues

No items to report.

Secretarial Commitments

No items to report.

WEEKLY HIGHLIGHT REPORT FOR W/E SEPTEMBER 13, 1996

TO: Daniel A. Dreyfus, RW-1

FROM: *for* Wesley E. Barnes, YMSCO *Arthur J. White*

DATE: September 13, 1996

SUBJECT: Weekly Report

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

Major Events

A U.S. Department of Energy/U.S. Nuclear Regulatory Commission Management Meeting is scheduled for September 19, 1996, via video conference between Washington, D.C. and Las Vegas, Nevada.

YMSCO announced the selection of Jason Associates Corporation as the Repository Environmental Impact Statement contractor.

Key Accomplishments

The Tunnel Boring Machine continues to hold at Station 63+47 M or 20,818 feet as of 8:00 a.m., Thursday, September 12, 1996. Ground conditions currently require Category 1 support (rock bolts/wire mesh). Progress at the Thermal Test Alcove and the North Ghost Dance Fault Alcove also remains constant this week.

Yucca Mountain Project Manager, Wesley Barnes, gave an update on Project activities to the Nevada Legislative Committee on High-Level Radioactive Waste on September 9, 1996, in Las Vegas, Nevada. The Office of Public Affairs staff coordinated the preparation of Mr. Barnes' presentation, and the Director and staff from the Office of Public Affairs attended the meeting. A general Project update was also given to twenty guests of the River Mountain Ranch Estate Homeowners Association in Henderson, Nevada.

A Science Discovery Day was held at the Pahrump Science Center in Pahrump, Nevada, on September 7, 1996. Representatives from several Civilian Radioactive Waste Management Systems Management and Operating Contractor organizations provided demonstrations and activities at five different stations, including geology, environmental,

volcanology, rocks and minerals, and paleontology. Seventy-three members of the public and staff members from the *Pahrump Valley Gazette* and *Pahrump Valley Times* newspapers participated in the activities and visited the permanent displays and exhibits in the science center. The event successfully accomplished the goal of providing an environment of science activities for the public to learn about the different types of science that are taking place at Yucca Mountain. This activity also supported the commitment to increase student interest in science and math.

The Yucca Mountain Site Characterization Office participated in a U.S. Department of Energy/U.S. Nuclear Regulatory Commission Appendix 7 Meeting on Probabilistic Volcanic Hazards Assessment on September 10, 1996, in Las Vegas, Nevada. The meeting focused on the U.S. Nuclear Regulatory Commission staff review of the Department's Probabilistic Volcanic Hazards Assessment. The staff feedback on the process and documentation of the expert elicitation used in the assessment will enable the Department to improve upon future expert elicitation.

The Yucca Mountain Site Characterization Office participated in a U.S. Department of Energy/U.S. Nuclear Regulatory Commission Exploratory Studies Facility Technical Meeting on September 12, 1996, via video conference between Washington, D.C. and Las Vegas, Nevada. The meeting focused on Exploratory Studies Facility construction, testing, design, and thermal tests.

Site Characterization Progress Report #14 has completed all concurrences and the camera-ready copy was transmitted to U.S. Department of Energy Headquarters for printing on September 10, 1996.

The dedication of the McCaw School of Mines was held at Gordon McCaw Elementary School on September 11, 1996, in Henderson, Nevada. This facility is a 4,649 square foot structure that was built by the school to give students the experience of being in a real mine and to enhance studies in geology, the history of mining in Nevada, and other related subjects. Project personnel have participated as members of the Mine Development Team, exhibit coordinators, and technical advisors. Display materials such as rock samples and photos have also been donated. Approximately 1,100 people, including staff from the Office of Public Affairs and Yucca Mountain Project Manager, Wesley Barnes, attended the opening ceremony and dedication.



The Office of Public Affairs staff prepared a presentation for Project personnel for a Biosphere Modeling Group Workshop, to discuss biosphere modeling with international scientists.

Allen Benson, Director of the Office of Public Affairs, and Max Powell, Institutional Specialist, met with the staff of Councilman Mike McDonald of the City of Las Vegas to introduce Allen as the new director and to discuss the availability of subject matter experts as a resource to provide information to the Council.

Emerging Issues

No items to report.

Secretarial Commitments

No items to report.



**Department of Energy**  
Office of Civilian Radioactive Waste Management  
Yucca Mountain Site Characterization Office  
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**SEP 13 1996**

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**FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING SEPTEMBER 6, 1996**

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.

**BOREHOLE USW G-2 AQUIFER TEST**

Fluid level recovery from the pump test conducted in April 1996 continues to be monitored by an automated data collector. The data were downloaded on Monday, September 2, 1996, at which time the level had risen to 1.7 feet below the pre-test water level or a rise of 0.2 feet. Water level fluctuations due to barometric pressure are on the same order of magnitude and this data has not been corrected for barometric pressure. The pre-test water elevation was 3,346.3 feet. The borehole collar elevation is 5,098.4 feet. Monitoring will continue. Data from the pump test will yield information in support of the study of the high hydraulic gradient in the vicinity of G-2.

**C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING**

Sodium iodide tracer was injected into well C#1 at 8 a.m. on Tuesday, June 18, 1996. Monitoring of the pumped effluent from well C#3 for tracer continued all week. Based on examination of data obtained to date, the investigators have tentatively called a sodium iodide breakthrough on July 10, 1996, which was 22 days after the start of the test. The tracer concentration appears to have peaked on about August 15, 1996, or 68 days after the start of the test and has been dropping slowly but steadily since that date. This data is still preliminary. Planned testing with reactive tracers is currently pending while awaiting permits from the State of Nevada. This test and future tests using reactive (sorbing) tracers will yield data for modeling groundwater travel times for radionuclides.

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**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

The Tunnel Boring Machine (TBM) progressed to station 63+47.1 meters as of 8 a.m., Friday, September 6, 1996. The TBM was halted for most of the week for repairs to the ventilation system and modifications of the safety program for control of dust. Instrument installation and data collection in support of construction monitoring continues. Geologic mapping and sampling were completed to approximate station 62+73 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

**ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift):**

Drilling of instrumentation holes in support of the Heated Drift Test was initiated on Tuesday, July 23, 1996, and is continuing. To date, 16 of 26 planned boreholes have been completed. A summary of boreholes completed and in progress as of the end of the shift on Friday, September 6, 1996, follows:

| <u>Hole number</u> | <u>Surface Depth<br/>From Ground Surface</u> | <u>Purpose</u>   |
|--------------------|--|------------------|
| ESF-HD-ERT-2       | 39.8 meters Total Depth (TD)                 | Tomography       |
| ESF-HD-CHE-6       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-ERT-1       | 39.6 meters TD                               | Tomography       |
| ESF-HD-CHE-7       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-NEU-1       | 39.8 meters TD                               | Neutron Moisture |
| ESF-HD-NEU-2       | 39.7 meters TD                               | Neutron Moisture |
| ESF-HD-CHE-10      | 39.6 meters TD                               | Chemistry        |
| ESF-SDM-MPBX-1     | 26.3 meters TD                               | Extensometer     |
| ESF-SDM-MPBX-2     | 26.2 meters TD                               | Extensometer     |
| ESF-HD-NEU-5       | 39.7 meters TD                               | Neutron Moisture |
| ESF-SDM-MPBX-3     | 26.6 meters TD                               | Extensometer     |
| ESF-HD-CHE-1       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-HYD-7       | 39.9 meters TD                               | Hydrology        |
| ESF-HD-CHE-2       | 39.9 meters TD                               | Chemistry        |
| ESF-HD-HYD-10      | 40.0 meters TD                               | Hydrology        |
| ESF-HD-CHE-5       | 39.9 meters TD                               | Chemistry        |
| ESF-HD-HYD-1       | 12.3 meters (in progress)                    | Hydrology        |

Current plans are to complete drilling of ESF-HD-HYD-1, and place drilling operations in the Access/Observation Drift on hiatus pending completion of the excavation for the Heated Drift Test.

SEP 13 1996

Multiple Addressees

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The Heated Drift Test will heat a large volume (approximately 15,000 cubic meters) of the rock of the repository horizon to a temperature of 100 degrees centigrade in order to investigate the hydrologic properties under thermal loading.

**ESF Alcove 5 (Thermomechanical Alcove):**

The Single Element Heater Test started on schedule on August 26, 1996. The instruments are reported to be working properly and data is being collected. The Single Element Heater Test will heat approximately 25 cubic meters of rock to 100 degrees centigrade. The purpose of this test is to understand heat related processes and 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):**

Excavation of the alcove was completed last week to a station of 0+89.7 meters from ESF Tunnel centerline. A niche for equipment storage was excavated to a depth of 7.8 meters from the centerline of the Northern Ghost Dance Fault Alcove at alcove station 00+25 meters. Further alcove excavation will not be performed until after the initial phase of planned hydrologic testing is completed. Drilling of a vertical borehole for extensometer installation is in progress and has progressed to a depth of 15.6 meters. A near-horizontal borehole across the Ghost Dance Fault from the alcove is planned to start when the extensometer hole is completed. Planned hydrologic properties of faults testing in the alcove will yield additional information on the hydrologic and pneumatic properties of the Ghost Dance Fault.

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



Drew H. Coleman  
Field Test Coordination  
Assistant Manager for Scientific Programs

AMSP:DHC-2602

**Enclosures:**

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

SEP 13 1996

Multiple Addressees

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Record Processing Center

## 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+20m

Pre-Ranier Mesa Tuff

2+20

Fault (4.3m offset)\*\*\*

2+20 to 2+63.5m

Pre-Ranier Mesa Tuff

2+63.5 to 3+37m

Tuff "X"

3+37 to 3+49.5m

Pre-Tuff "X"

3+49.5 to 3+59.5m

Tiva Canyon vitric zone

3+59.5 to 4+30m

Tiva Canyon crystal rich nonlithophysal zone

4+30m

Fault (~10m offset)\*\*\*

4+30 to 4+34

Tiva Canyon crystal rich nonlithophysal zone

4+34 to 4+39m

Tiva Canyon crystal rich lithophysal zone

4+39 to 5+50m

Tiva Canyon crystal poor upper lithophysal zone

5+50m

Fault (~5m offset)\*\*\*

5+50 to 5+53

Tiva Canyon crystal poor upper lithophysal zone

5+53 to 5+87m

Tiva Canyon crystal poor middle nonlithophysal zone

## ESF TUNNEL STRATIGRAPHY CONTINUED\*

|                   |   |
|-------------------|---|
| 5+87 to 6+19m     | Tiva Canyon crystal poor lower lithophysal zone   |
| 6+19 to 7+00m     | Tiva Canyon crystal poor lower nonlithophysal zone  |
| 7+00m             | Fault (~20m? offset)***   |
| 7+00 to 7+77m     | Tiva Canyon crystal poor lower nonlithophysal zone.<br><br><u>Alcove #3</u> (centerline station intersection): 7+54.    |
| 7+77 to 8+69m     | Tiva Canyon crystal poor vitric zone  |
| 8+69 to 9+12m     | Bedded tuffs (including thin Yucca Mountain member)   |
| 9+12 to 10+20m    | Pah Canyon Member.  |
| 10+20 to 10+51.5m | Pre-Pah Canyon tuffs<br><br><u>Alcove #4</u> (centerline station intersection): 10+27.8                                 |
| 10+51.5 to 11+93m | Topopah Spring crystal rich vitric zone   |
| 11+93 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 35+93m   | Topopah Spring crystal poor middle nonlithophysal zone<br><br><u>Alcove #5</u> (centerline station intersection): 28+27 |
| 35+93m            | Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)                 |
| 35+93 to face     | Topopah Spring crystal poor middle nonlithophysal zone  |
| 57+30             | Splay of the Ghost Dance Fault - Offset is approximately 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.

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

# Site Characterization Field Activities in Progress

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>  |
|---------------------|--|--|
| 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), surface of 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 <sup>36</sup> measurements (SBT drillholes, ESF)          |

Activities in Progress Continued



| <b><u>SCP ACTIVITY</u></b> | <b><u>TITLE</u></b>  | <b><u>ACTIVITY</u></b>                  |
|----------------------------|--|---|
| 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

**AUG 22 1996**

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**FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING AUGUST 16, 1996**

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.

**BOREHOLE USW G-2 AQUIFER TEST**

Fluid level recovery from the pump test conducted in April 1996 continues to be monitored by an automated data collector. The data were downloaded on Monday, August 12, 1996, at which time the level had risen to 2.5 feet below the pre-test water level or a rise of 0.2 feet. The fluctuations due to barometric pressure are on the same order of magnitude rendering the results difficult to interpret. The pre-test water elevation was 3,346.3 feet. The borehole collar elevation is 5,098.4 feet. Monitoring will continue. Data from the pump test will yield information in support of the study of the high hydraulic gradient in the vicinity of G-2.

**C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING**

Sodium iodide tracer was injected into well C#1 at 8 a.m. on Tuesday, June 18, 1996. Monitoring of the pumped effluent from well C#3 for tracer continued all week. The tracer concentration continues to rise slightly. Based on examination of data obtained to date, the investigators are tentatively calling a sodium iodide breakthrough on July 10, 1996, which is 22 days after the start of the test. The concentration level appears to be leveling off or beginning to drop slightly. Interpretation of peak concentration will require additional data. Planned testing with reactive tracers is currently pending while awaiting permits from the State of Nevada. This test and future tests using reactive (sorbing) tracers will yield data for modeling groundwater travel times for radionuclides.

**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

The Tunnel Boring Machine progressed to station 62+24.7 meters as of 8 a.m., Friday, August 16, 1996. Progress has been slowed by difficult excavation conditions. Instrument installation and data collection in support of construction monitoring continues. Geologic

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Multiple Addressees

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mapping and sampling were completed to approximate station 61+33 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

**ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift):**

Drilling of instrumentation holes was initiated on Tuesday, July 23, 1996, and is continuing. To date, 9 of 26 planned boreholes have been completed. Following is a summary of boreholes completed and in progress as of the end of the shift on Friday, August 16, 1996:

| <u>Hole number</u> | <u>Surface Depth<br/>From Ground</u> | <u>Purpose</u>   |
|--------------------|--------------------------------------|------------------|
| ESF-HD-ERT-2       | 39.8 meters (Total Depth)(TD)        | Tomography       |
| ESF-HD-CHE-6       | 39.8 meters (TD)                     | Chemistry        |
| ESF-HD-ERT-1       | 39.6 meters (TD)                     | Tomography       |
| ESF-HD-CHE-7       | 39.8 meters (TD)                     | Chemistry        |
| ESF-HD-NEU-1       | 39.8 meters (TD)                     | Neutron Moisture |
| ESF-HD-NEU-2       | 39.7 meters (TD)                     | Neutron Moisture |
| ESF-HD-CHE-10      | 39.6 meters (TD)                     | Chemistry        |
| ESF-SDM-MPBX-1     | 26.3 meters (TD)                     | Extensometer     |
| ESF-SDM-MPBX-2     | 26.2 meters (TD)                     | Extensometer     |
| ESF-HD-NEU-5       | 15.8 meters (Plan Depth 39.7 meters) | Neutron Moisture |

**ESF Alcove 5 (Thermomechanical Alcove):**

Installation and wiring of the instruments and appurtenant equipment needed in the planned thermomechanical testing is nearly complete. The instruments are being checked and calibrated. The walls of the block have been insulated with fiberglass insulation. Start of the thermal test is scheduled for August 26, 1996, and is reported to be on schedule. The testing will help define properties of the proposed repository horizon under thermal loading.

**ESF Alcove 6 (Northern Ghost Dance Fault Alcove):**

Excavation of the access drift continued this week using drill/blast excavation methods. The excavation progressed to approximate station 0+75.9 meters. Monitoring of rock vibration induced by blasting in the alcove is performed in the near field (approximately 3 to 5 meters), intermediate field (approximately 15 to 20 meters), and far field (approximately 25-30 meters) from the blasted face. The blast monitoring information is used to refine blasting techniques and to gain information regarding damage to the surrounding rock mass during blasting. Design length of the Ghost Dance Fault Access Drift is approximately 90 meters. Planned testing in the alcove will yield additional information on the hydrologic and pneumatic properties of the Ghost Dance Fault.

## ESF TUNNEL STRATIGRAPHY\*

### STATION

|                   |   |
|-------------------|---|
| 0+00 to 0+99.5m   | Tiva Canyon crystal poor upper lithophysal zone.<br><br><u>Alcove #1</u> (centerline station intersection): 0+42.5    |
| 0+99.5 to 1+90m   | Tiva Canyon crystal poor middle nonlithophysal zone<br><br><u>Alcove #2</u> (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+20m     | Pre-Ranier Mesa Tuff  |
| 2+20              | Fault (4.3m offset)***  |
| 2+20 to 2+63.5m   | Pre-Ranier Mesa Tuff  |
| 2+63.5 to 3+37m   | Tuff "X"  |
| 3+37 to 3+49.5m   | Pre-Tuff "X"  |
| 3+49.5 to 3+59.5m | Tiva Canyon vitric zone   |
| 3+59.5 to 4+30m   | Tiva Canyon crystal rich nonlithophysal zone  |
| 4+30m             | Fault (~10m offset)***  |
| 4+30 to 4+34      | Tiva Canyon crystal rich nonlithophysal zone  |
| 4+34 to 4+39m     | Tiva Canyon crystal rich lithophysal zone   |
| 4+39 to 5+50m     | Tiva Canyon crystal poor upper lithophysal zone   |
| 5+50m             | Fault (~5m offset)***   |
| 5+50 to 5+53      | Tiva Canyon crystal poor upper lithophysal zone   |
| 5+53 to 5+87m     | Tiva Canyon crystal poor middle nonlithophysal zone   |

### ESF TUNNEL STRATIGRAPHY CONTINUED\*

|                   |   |
|-------------------|---|
| 5+87 to 6+19m     | Tiva Canyon crystal poor lower lithophysal zone   |
| 6+19 to 7+00m     | Tiva Canyon crystal poor lower nonlithophysal zone  |
| 7+00m             | Fault (~20m? offset)***   |
| 7+00 to 7+77m     | Tiva Canyon crystal poor lower nonlithophysal zone.<br><u>Alcove #3</u> (centerline station intersection): 7+54.    |
| 7+77 to 8+69m     | Tiva Canyon crystal poor vitric zone  |
| 8+69 to 9+12m     | Bedded tuffs (including thin Yucca Mountain member)   |
| 9+12 to 10+20m    | Pah Canyon Member.  |
| 10+20 to 10+51.5m | Pre-Pah Canyon tuffs<br><u>Alcove #4</u> (centerline station intersection): 10+27.8                                 |
| 10+51.5 to 11+93m | Topopah Spring crystal rich vitric zone   |
| 11+93 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 35+93m   | Topopah Spring crystal poor middle nonlithophysal zone<br><u>Alcove #5</u> (centerline station intersection): 28+27 |
| 35+93m            | Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40)             |
| 35+93 to face     | Topopah Spring 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.

\*\*\* Only faults with greater than 4 meters offset are noted on the table.

# Site Characterization Field Activities in Progress

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>  |
|---------------------|--|--|
| 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), surface of 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 <sup>36</sup> measurements (SBT drillholes, ESF)          |

## Activities in Progress Continued

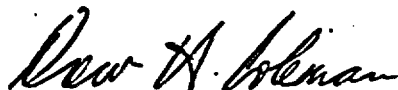
| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>                         |
|---------------------|--|---|
| 8.3.1.2.2.4         | Characterization of Unsaturated Zone (ESF)                     | Hydrochemistry/Radial Boreholes testing |
| 8.3.1.2.2.6         | Gaseous Phase Movement in the Unsaturated 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                         |

AUG 22 1996

Multiple Addressees

-3-

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



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Field Test Coordination  
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Enclosures:

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

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Record Processing Center





**Department of Energy**  
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Yucca Mountain Site Characterization Office  
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**AUG 26 1996**

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**FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING AUGUST 23, 1996**

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.

**BOREHOLE USW G-2 AQUIFER TEST**

Fluid level recovery from the pump test conducted in April 1996 continues to be monitored by an automated data collector. The data were downloaded on Monday, August 19, 1996, at which time the level had risen to 2.1 feet below the pre-test water level or a rise of 0.3 feet. Water level fluctuations due to barometric pressure are on the same order of magnitude and this data has not been corrected for barometric pressure. The pre-test water elevation was 3,346.3 feet. The borehole collar elevation is 5,098.4 feet. Monitoring will continue. Data from the pump test will yield information in support of the study of the high hydraulic gradient in the vicinity of G-2.

**C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING**

Sodium iodide tracer was injected into well C#1 at 8 a.m. on Tuesday, June 18, 1996. Monitoring of the pumped effluent from well C#3 for tracer continued all week. Based on examination of data obtained to date, the investigators have tentatively called a sodium iodide breakthrough on July 10, 1996, which was 22 days after the start of the test. The tracer concentration appears to have peaked on about August 15, 1996, or 68 days after the start of the test and is dropping slowly but steadily since that date. Planned testing with reactive tracers is currently pending while awaiting permits from the State of Nevada. This test and future tests using reactive (sorbing) tracers will yield data for modeling groundwater travel times for radionuclides.

**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

The Tunnel Boring Machine progressed to station 62+64.0 meters as of 8 a.m., Friday, August 23, 1996. Progress was slowed this week by difficult excavation conditions, but ground conditions had improved by the end of the week and progress improved. Instrument installation and data collection in support of construction monitoring continues. Geologic mapping and sampling were completed to approximate station 61+60 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

**ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift):**

Drilling of instrumentation holes in support of the Heated Drift Test was initiated on Tuesday, July 23, 1996, and is continuing. To date, 11 of 26 planned boreholes have been completed. A summary of boreholes completed and in progress as of the end of the shift on Friday, August 16, 1996, follows:

| <u>Hole number</u> | <u>Surface Depth<br/>From Ground Surface</u> | <u>Purpose</u>   |
|--------------------|--|------------------|
| ESF-HD-ERT-2       | 39.8 meters Total Depth (TD)                 | Tomography       |
| ESF-HD-CHE-6       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-ERT-1       | 39.6 meters TD                               | Tomography       |
| ESF-HD-CHE-7       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-NEU-1       | 39.8 meters TD                               | Neutron Moisture |
| ESF-HD-NEU-2       | 39.7 meters TD                               | Neutron Moisture |
| ESF-HD-CHE-10      | 39.6 meters TD                               | Chemistry        |
| ESF-SDM-MPBX-1     | 26.3 meters TD                               | Extensometer     |
| ESF-SDM-MPBX-2     | 26.2 meters TD                               | Extensometer     |
| ESF-HD-NEU-5       | 39.7 meters TD                               | Neutron Moisture |
| ESF-SDM-MPBX-3     | 26.6 meters TD                               | Extensometer     |
| ESF-HD-CHE-1       | 14.2 meters (Plan Depth is 39.7 meters)      | Chemistry        |
| ESF-HD-HYD-7       | Setting up                                   |                  |

**ESF Alcove 5 (Thermomechanical Alcove):**

Installation and wiring of the instruments and appurtenant equipment is complete. The heater and instruments have been tested. The Single Block Heater Test is scheduled to start on August 26, 1996. The testing will help define properties of the proposed repository horizon under thermal loading.

**ESF Alcove 6 (Northern Ghost Dance Fault Alcove):**

Excavation of the alcove was completed this week to a final station of 0+89.7 meters from ESF Tunnel centerline. Drilling of a near-horizontal borehole across the Ghost Dance Fault from the

## ESF TUNNEL STRATIGRAPHY\*

### STATION

|                   |  |
|-------------------|--|
| 0+00 to 0+99.5m   | Tiva Canyon crystal poor upper lithophysal zone.                             |
|                   | <u>Alcove #1</u> (centerline station intersection): 0+42.5                   |
| 0+99.5 to 1+90m   | Tiva Canyon crystal poor middle nonlithophysal zone                          |
|                   | <u>Alcove #2</u> (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+20m     | Pre-Ranier Mesa Tuff   |
| 2+20              | Fault (4.3m offset)***   |
| 2+20 to 2+63.5m   | Pre-Ranier Mesa Tuff   |
| 2+63.5 to 3+37m   | Tuff "X"   |
| 3+37 to 3+49.5m   | Pre-Tuff "X"   |
| 3+49.5 to 3+59.5m | Tiva Canyon vitric zone  |
| 3+59.5 to 4+30m   | Tiva Canyon crystal rich nonlithophysal zone                                 |
| 4+30m             | Fault (~10m offset)***   |
| 4+30 to 4+34      | Tiva Canyon crystal rich nonlithophysal zone                                 |
| 4+34 to 4+39m     | Tiva Canyon crystal rich lithophysal zone                                    |
| 4+39 to 5+50m     | Tiva Canyon crystal poor upper lithophysal zone                              |
| 5+50m             | Fault (~5m offset)***  |
| 5+50 to 5+53      | Tiva Canyon crystal poor upper lithophysal zone                              |
| 5+53 to 5+87m     | Tiva Canyon crystal poor middle nonlithophysal zone                          |

### ESF TUNNEL STRATIGRAPHY CONTINUED\*

|                   |   |
|-------------------|---|
| 5+87 to 6+19m     | Tiva Canyon crystal poor lower lithophysal zone   |
| 6+19 to 7+00m     | Tiva Canyon crystal poor lower nonlithophysal zone  |
| 7+00m             | Fault (~20m? offset)***   |
| 7+00 to 7+77m     | Tiva Canyon crystal poor lower nonlithophysal zone.   |
|                   | <u>Alcove #3</u> (centerline station intersection): 7+54.   |
| 7+77 to 8+69m     | Tiva Canyon crystal poor vitric zone  |
| 8+69 to 9+12m     | Bedded tuffs (including thin Yucca Mountain member)   |
| 9+12 to 10+20m    | Pah Canyon Member.  |
| 10+20 to 10+51.5m | Pre-Pah Canyon tuffs  |
|                   | <u>Alcove #4</u> (centerline station intersection): 10+27.8   |
| 10+51.5 to 11+93m | Topopah Spring crystal rich vitric zone   |
| 11+93 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 35+93m   | Topopah Spring crystal poor middle nonlithophysal zone  |
|                   | <u>Alcove #5</u> (centerline station intersection): 28+27   |
| 35+93m            | Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40) |
| 35+93 to face     | Topopah Spring crystal poor middle nonlithophysal zone  |
| 57+30             | Splay of the Ghost Dance Fault - Offset is approximately 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.

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

## Site Characterization Field Activities in Progress

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>  |
|---------------------|--|--|
| 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), surface of 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 <sup>36</sup> measurements (SBT drillholes, ESF)          |

## Activities in Progress Continued

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>                         |
|---------------------|--|---|
| 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                         |

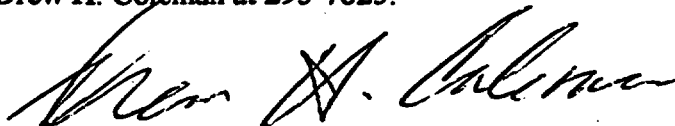
AUG 26 1996

Multiple Addressees

-3-

alcove is scheduled to start in September 1996. Planned hydrologic properties of faults testing in the alcove will yield additional information on the hydrologic and pneumatic properties of the Ghost Dance Fault.

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



Drew H. Coleman  
Field Test Coordination  
Assistant Manager for Scientific Programs

AMSP:DHC-2511

Enclosures:

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

cc w/encls:

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R. W. Craig, USGS, Las Vegas, NV  
C. J. Glenn, NRC, Las Vegas, NV  
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J. T. Sullivan, YMSCO, NV  
M. C. Tynan, YMSCO, NV  
J. T. Gardiner, YMSCO, NV  
R. S. Waters, YMSCO, NV  
J. R. Summerson, YMSCO, NV  
Record Processing Center

WEEKLY HIGHLIGHTS REPORT FOR W/E AUGUST 23, 1996

TO: Daniel A. Dreyfus, RW-1

FROM: *for* Wesley E. Barnes, YMSCO *Wesley E. Barnes*

DATE: August 23, 1996

SUBJECT: Weekly Report

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

Major Events

None to report.

Key Accomplishments

The Tunnel Boring Machine has advanced to Station 62+64 M or 20,551.1 ft. as of 8:00 August 23, 1996. 39.4 M or 129.3 ft. of tunnel has been excavated in the past week. Ground conditions are now Category 1. The Tunnel Boring Machine is approximately 1,279.9 M or 4,198 ft. ahead of schedule which equates to approximately 126 days. The North Ghost Dance Fault Alcove advanced to Station 00+89.6 M or 294 ft. in the last week.

A Yucca Mountain Project exhibit was set up and staffed at the White Pine County Fair, August 17-18, 1996, in Ely, Nevada. The purpose of the exhibit was to update the residents of White Pine on the status of the Project. 233 people visited the exhibit. Visitors expressed both concern and support for the Project. Many of the visitors were men affiliated with the mining industry in the area.

The Office of Public Affairs staff coordinated and conducted six tours of Yucca Mountain for 40 guests. Of special interest were three Nuclear Energy Institute tours for various groups; a tour for a guest from Friends Central School District; and a tour for a guest from the Salt Lake Tribune. The guest from Friends Central School District was also given a tour of the Las Vegas Science Center and an educational overview.

On August 23, 1996, Vernon Poe, Mineral County Nuclear Projects Coordinator, received twelve computers from the Yucca Mountain Site Characterization Office under the Math and Science Gift Program



AUG 23 1996

Memorandum of Understanding between the Yucca Mountain Site  
Characterization Office and the Mineral County School District.

The Office of Public Affairs staff completed development of a flier announcing the October Lecture Series in which Richard Arnold will present "The Song of the Land" at the Las Vegas Science Center on October 1, 1996. The staff also completed development of fliers and an announcement that will be placed in the Pahrump Valley Times informing the public of the Pahrump Discovery Days to be held at the Pahrump Science Center on September 7, 1996.

The U.S. Geological Survey has completed gas sampling activities at boreholes USW SD-7 and UE-25 NRG#5. The samples will be analyzed for carbon isotopes, carbon dioxide and methane to support Unsaturated Zone Hydrochemistry and Gas Phase Circulation studies.

Emerging Issues

None to report

Secretarial Commitments

None 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  
**SEP 05 1996**

Dennis R. Williams, DOE/YMSCO, NV  
Winfred A. Wilson, DOE/YMSCO, Mercury, NV, M/S 717

**FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING AUGUST 30, 1996**

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.

**BOREHOLE USW G-2 AQUIFER TEST**

Fluid level recovery from the pump test conducted in April 1996 continues to be monitored by an automated data collector. The data were downloaded on Monday, August 26, 1996, at which time the level had risen to 1.9 feet below the pre-test water level or a rise of 0.3 feet. Water level fluctuations due to barometric pressure are on the same order of magnitude and this data has not been corrected for barometric pressure. The pre-test water elevation was 3,346.3 feet. The borehole collar elevation is 5,098.4 feet. Monitoring will continue. Data from the pump test will yield information in support of the study of the high hydraulic gradient in the vicinity of G-2.

**C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING**

Sodium iodide tracer was injected into well C#1 at 8 a.m. on Tuesday, June 18, 1996. Monitoring of the pumped effluent from well C#3 for tracer continued all week. Based on examination of data obtained to date, the investigators have tentatively called a sodium iodide breakthrough on July 10, 1996, which was 22 days after the start of the test. The tracer concentration appears to have peaked on about August 15, 1996, or 68 days after the start of the test and has been dropping slowly but steadily since that date. Planned testing with reactive tracers is currently pending while awaiting permits from the State of Nevada. This test and future tests using reactive (sorbing) tracers will yield data for modeling groundwater travel times for radionuclides.

SEP 05 1996

**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

The Tunnel Boring Machine progressed to station 62+64.0 meters as of 8 a.m., Friday, August 30, 1996. Instrument installation and data collection in support of construction monitoring continues. Geologic mapping and sampling were completed to approximate station 62+38 meters. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

**ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift):**

Drilling of instrumentation holes in support of the Heated Drift Test was initiated on Tuesday, July 23, 1996, and is continuing. To date, 14 of 26 planned boreholes have been completed. A summary of boreholes completed and in progress as of the end of the shift on Friday, August 16, 1996, follows:

| <u>Hole number</u> | <u>Surface Depth<br/>From Ground Surface</u> | <u>Purpose</u>   |
|--------------------|--|------------------|
| ESF-HD-ERT-2       | 39.8 meters Total Depth (TD)                 | Tomography       |
| ESF-HD-CHE-6       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-ERT-1       | 39.6 meters TD                               | Tomography       |
| ESF-HD-CHE-7       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-NEU-1       | 39.8 meters TD                               | Neutron Moisture |
| ESF-HD-NEU-2       | 39.7 meters TD                               | Neutron Moisture |
| ESF-HD-CHE-10      | 39.6 meters TD                               | Chemistry        |
| ESF-SDM-MPBX-1     | 26.3 meters TD                               | Extensometer     |
| ESF-SDM-MPBX-2     | 26.2 meters TD                               | Extensometer     |
| ESF-HD-NEU-5       | 39.7 meters TD                               | Neutron Moisture |
| ESF-SDM-MPBX-3     | 26.6 meters TD                               | Extensometer     |
| ESF-HD-CHE-1       | 39.8 meters TD                               | Chemistry        |
| ESF-HD-HYD-7       | 39.9 meters TD                               | Hydrology        |
| ESF-HD-CHE-2       | 39.9 meters TD                               | Chemistry        |
| ESF-HD-HYD-10      | 34.4 meters (In Progress)                    | Hydrology        |
| ESF-HD-CHE-5       | 20.5 meters (In Progress)                    | Chemistry        |

Current plans are to place drilling operations in the Access/Observation Drift on hiatus on or about September 9, 1996, and complete the excavations needed for the Heated Drift Test.

The Heated Drift Test will heat a large volume (15,000 cubic meters) of the rock of the repository horizon to a temperature of 100 degrees centigrade in order to investigate the hydrologic properties under thermal loading.

SEP 05 1996

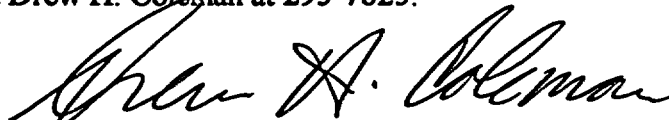
**ESF Alcove 5 (Thermomechanical Alcove):**

The Single Element Heater Test started on schedule on August 26, 1996. The instruments are reported to be working properly and data is being collected. The Single Element Heater Test will heat approximately 25 cubic meters of rock to 100 degrees centigrade. The purpose of this test is to understand heat related processes and 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):**

Excavation of the alcove was completed last week to a final station of 0+89.7 meters from ESF Tunnel centerline. A niche for equipment storage was excavated to a depth of 7.8 meters from the centerline of the Northern Ghost Dance Fault Alcove at alcove station 00+25 meters. Drilling of a near-horizontal borehole across the Ghost Dance Fault from the alcove is planned to start on or about September 9, 1996. Planned hydrologic properties of faults testing in the alcove will yield additional information on the hydrologic and pneumatic properties of the Ghost Dance Fault.

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



Drew H. Coleman  
Field Test Coordination  
Assistant Manager for Scientific Programs

AMSP:DHC-2566

**Enclosures:**

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

## ESF TUNNEL STRATIGRAPHY\*

### STATION

|                   |   |
|-------------------|---|
| 0+00 to 0+99.5m   | Tiva Canyon crystal poor upper lithophysal zone.<br><br><u>Alcove #1</u> (centerline station intersection): 0+42.5    |
| 0+99.5 to 1+90m   | Tiva Canyon crystal poor middle nonlithophysal zone<br><br><u>Alcove #2</u> (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+20m     | Pre-Ranier Mesa Tuff  |
| 2+20              | Fault (4.3m offset)***  |
| 2+20 to 2+63.5m   | Pre-Ranier Mesa Tuff  |
| 2+63.5 to 3+37m   | Tuff "X"  |
| 3+37 to 3+49.5m   | Pre-Tuff "X"  |
| 3+49.5 to 3+59.5m | Tiva Canyon vitric zone   |
| 3+59.5 to 4+30m   | Tiva Canyon crystal rich nonlithophysal zone  |
| 4+30m             | Fault (~10m offset)***  |
| 4+30 to 4+34      | Tiva Canyon crystal rich nonlithophysal zone  |
| 4+34 to 4+39m     | Tiva Canyon crystal rich lithophysal zone   |
| 4+39 to 5+50m     | Tiva Canyon crystal poor upper lithophysal zone   |
| 5+50m             | Fault (~5m offset)***   |
| 5+50 to 5+53      | Tiva Canyon crystal poor upper lithophysal zone   |
| 5+53 to 5+87m     | Tiva Canyon crystal poor middle nonlithophysal zone   |

## ESF TUNNEL STRATIGRAPHY CONTINUED\*

|   |   |
|---|---|
| 5+87 to 6+19m   | Tiva Canyon crystal poor lower lithophysal zone   |
| 6+19 to 7+00m   | Tiva Canyon crystal poor lower nonlithophysal zone  |
| 7+00m   | Fault (~20m? offset)***   |
| 7+00 to 7+77m   | Tiva Canyon crystal poor lower nonlithophysal zone.   |
| <u>Alcove #3</u> (centerline station intersection): 7+54.   |   |
| 7+77 to 8+69m   | Tiva Canyon crystal poor vitric zone  |
| 8+69 to 9+12m   | Bedded tuffs (including thin Yucca Mountain member)   |
| 9+12 to 10+20m  | Pah Canyon Member.  |
| 10+20 to 10+51.5m   | Pre-Pah Canyon tuffs  |
| <u>Alcove #4</u> (centerline station intersection): 10+27.8 |   |
| 10+51.5 to 11+93m   | Topopah Spring crystal rich vitric zone   |
| 11+93 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 35+93m   | Topopah Spring crystal poor middle nonlithophysal zone  |
| <u>Alcove #5</u> (centerline station intersection): 28+27   |   |
| 35+93m  | Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40) |
| 35+93 to face   | Topopah Spring crystal poor middle nonlithophysal zone  |
| 57+30   | Splay of the Ghost Dance Fault - Offset is approximately 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.
- \*\*\* Only significant faults are noted on the table.

# Site Characterization Field Activities in Progress

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>  |
|---------------------|--|--|
| 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), surface of 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 <sup>36</sup> measurements (SBT drillholes, ESF)          |

## Activities in Progress Continued

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>                         |
|---------------------|--|---|
| 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                         |



SEP 05 1996

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-4-

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**FIELD TEST COORDINATION REPORT FOR THE WEEK ENDING SEPTEMBER 13, 1996**

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.

**BOREHOLE USW G-2 AQUIFER TEST**

Fluid level recovery from the pump test conducted in April 1996 continues to be monitored by an automated data collector. The data were downloaded on Monday, September 9, 1996, and the water level remained at 1.7 feet below the pre-test water level, showing a rise of only 0.02 feet for the week. Water level fluctuations due to barometric pressure are on the same order of magnitude and this data has not been corrected for barometric pressure. The pre-test water elevation was 3,346.3 feet. The borehole collar elevation is 5,098.4 feet. Monitoring will continue. Data from the pump test will yield information in support of the study of the high hydraulic gradient in the vicinity of G-2.

**C-HOLE COMPLEX HYDRAULIC INTERFERENCE TESTING**

Sodium iodide tracer was injected into well C#1 at 8 a.m. on Tuesday, June 18, 1996. Monitoring of the pumped effluent from well C#3 for tracer continued all week. Based on examination of data obtained to date, the investigators have tentatively called a sodium iodide breakthrough on July 10, 1996, which was 22 days after the start of the test. The tracer concentration appears to have peaked on about August 15, 1996, or 68 days after the start of the test and continues to slowly decline. This data and interpretation are still preliminary. Planned testing with reactive tracers is currently pending while awaiting permits from the State of Nevada. This test and future tests using reactive (sorbing) tracers will yield data for modeling groundwater travel times for radionuclides.

**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

The Tunnel Boring Machine (TBM) remained at station 63+47.1 meters as of 8 a.m., Friday, September 13, 1996. The TBM was halted for the week for repairs to the ventilation system and modifications of the safety program for control of respirable silica dust. Instrument installation and data collection in support of construction monitoring continues. Geologic mapping remained approximate station 62+73 meters. The Tsw2/Tsw1 contact was tentatively placed at approximate station 63+05. Preliminary tunnel stratigraphy identified to date is summarized in Enclosure 1.

**ESF Alcove 5 (Thermal Testing Facility Access/Observation Drift):**

Drilling of instrumentation holes in support of the Heated Drift Test was initiated on Tuesday, July 23, 1996, and was discontinued on September 9, 1996. To date, 17 of 26 planned boreholes to be drilled from the Access/Observation Drift have been completed. Drilling of ESF-HD-HYD-1 was completed on Friday, September 9, 1996, and drilling operations in the Access/Observation Drift were placed on hiatus pending completion of the excavation for the Heated Drift Test.

A summary of boreholes completed during this round of drilling follows:

| <u>Hole number</u> | <u>Depth From Ground Surface</u> | <u>Purpose</u>   |
|--------------------|----------------------------------|------------------|
| ESF-HD-ERT-2       | 39.8 meters Total Depth (TD)     | Tomography       |
| ESF-HD-CHE-6       | 39.8 meters TD                   | Chemistry        |
| ESF-HD-ERT-1       | 39.6 meters TD                   | Tomography       |
| ESF-HD-CHE-7       | 39.8 meters TD                   | Chemistry        |
| ESF-HD-NEU-1       | 39.8 meters TD                   | Neutron Moisture |
| ESF-HD-NEU-2       | 39.7 meters TD                   | Neutron Moisture |
| ESF-HD-CHE-10      | 39.6 meters TD                   | Chemistry        |
| ESF-SDM-MPBX-1     | 26.3 meters TD                   | Extensometer     |
| ESF-SDM-MPBX-2     | 26.2 meters TD                   | Extensometer     |
| ESF-HD-NEU-5       | 39.7 meters TD                   | Neutron Moisture |
| ESF-SDM-MPBX-3     | 26.6 meters TD                   | Extensometer     |
| ESF-HD-CHE-1       | 39.8 meters TD                   | Chemistry        |
| ESF-HD-HYD-7       | 39.9 meters TD                   | Hydrology        |
| ESF-HD-CHE-2       | 39.9 meters TD                   | Chemistry        |
| ESF-HD-HYD-10      | 40.0 meters TD                   | Hydrology        |
| ESF-HD-CHE-5       | 39.9 meters TD                   | Chemistry        |
| ESF-HD-HYD-1       | 39.6 meters TD                   | Hydrology        |

Excavation of the Cross Drift using drill/blast excavation is expected to resume next week, assuming the problems with respirable dust are satisfactorily resolved.

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The Heated Drift Test will heat a large volume (approximately 15,000 cubic meters) of the rock of the repository horizon to a temperature of 100 degrees centigrade 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 are reported to be working properly and data are being collected. The data will be downloaded approximately every two weeks, and the data will be distributed to the principal investigators and others. Selected updates on the readings from the instruments will be included in this report as they become available. The Single Heater Test will heat approximately 25 cubic meters of rock to 100 degrees centigrade 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):**

Excavation of the alcove is complete to station 0+89.7 meters from ESF Tunnel centerline. Drilling of a vertical borehole (ESF-NAD-CM-MPBX#13) for an extensometer installation was completed to a total depth of 18.2 meters. A near-horizontal borehole (ESF-NAD-GTB#1) was started on September 9, 1996, and has progressed to a depth of 15.7 meters. Planned total depth is 20.0 meters. If the borehole does not cross the Ghost Dance fault within the required 20 meters, additional excavation in the Northern Ghost Dance fault drift will be required. Planned hydrologic properties of faults testing in the alcove will yield additional information on the hydrologic and pneumatic properties of the Ghost Dance Fault.

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



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**Enclosures:**

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

## ESF TUNNEL STRATIGRAPHY\*

### STATION

|                   |   |
|-------------------|---|
| 0+00 to 0+99.5m   | Tiva Canyon crystal poor upper lithophysal zone.<br><br><u>Alcove #1</u> (centerline station intersection): 0+42.5    |
| 0+99.5 to 1+90m   | Tiva Canyon crystal poor middle nonlithophysal zone<br><br><u>Alcove #2</u> (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+20m     | Pre-Ranier Mesa Tuff  |
| 2+20              | Fault (4.3m offset)***  |
| 2+20 to 2+63.5m   | Pre-Ranier Mesa Tuff  |
| 2+63.5 to 3+37m   | Tuff "X"  |
| 3+37 to 3+49.5m   | Pre-Tuff "X"  |
| 3+49.5 to 3+59.5m | Tiva Canyon vitric zone   |
| 3+59.5 to 4+30m   | Tiva Canyon crystal rich nonlithophysal zone  |
| 4+30m             | Fault (~10m offset)***  |
| 4+30 to 4+34      | Tiva Canyon crystal rich nonlithophysal zone  |
| 4+34 to 4+39m     | Tiva Canyon crystal rich lithophysal zone   |
| 4+39 to 5+50m     | Tiva Canyon crystal poor upper lithophysal zone   |
| 5+50m             | Fault (~5m offset)***   |
| 5+50 to 5+53      | Tiva Canyon crystal poor upper lithophysal zone   |
| 5+53 to 5+87m     | Tiva Canyon crystal poor middle nonlithophysal zone   |

## **ESF TUNNEL STRATIGRAPHY CONTINUED\***

|                   |   |
|-------------------|---|
| 5+87 to 6+19m     | Tiva Canyon crystal poor lower lithophysal zone   |
| 6+19 to 7+00m     | Tiva Canyon crystal poor lower nonlithophysal zone  |
| 7+00m             | Fault (~20m? offset)***   |
| 7+00 to 7+77m     | Tiva Canyon crystal poor lower nonlithophysal zone.   |
|                   | <u><b>Alcove #3</b></u> (centerline station intersection): 7+54.  |
| 7+77 to 8+69m     | Tiva Canyon crystal-poor vitric zone  |
| 8+69 to 9+12m     | Bedded tuffs (including thin Yucca Mountain member)   |
| 9+12 to 10+20m    | Pah Canyon Member.  |
| 10+20 to 10+51.5m | Pre-Pah Canyon tuffs  |
|                   | <u><b>Alcove #4</b></u> (centerline station intersection): 10+27.8                                      |
| 10+51.5 to 11+93m | Topopah Spring crystal rich vitric zone   |
| 11+93 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 35+93m   | Topopah Spring crystal poor middle nonlithophysal zone  |
|                   | <u><b>Alcove #5</b></u> (centerline station intersection): 28+27  |
| 35+93m            | Sundance fault (most prominent fault plane, minor fracturing reported between Stations 35+85 and 36+40) |
| 35+93 to 63+05m?  | Topopah Spring crystal poor middle nonlithophysal zone  |
| 57+30             | Splay of the Ghost Dance Fault - Offset is approximately 2 meters                                       |
| 63+05? 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.

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

## Site Characterization Field Activities in Progress

| <u>SCP ACTIVITY</u> | <u>TITLE</u>   | <u>ACTIVITY</u>  |
|---------------------|--|--|
| 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), surface of 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 <sup>36</sup> measurements (SBT drillholes, ESF)          |

Activities in Progress Continued

| <b><u>SCP ACTIVITY</u></b> | <b><u>TITLE</u></b>  | <b><u>ACTIVITY</u></b>                  |
|----------------------------|--|---|
| 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                         |