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

AUG 28 1998

OVERNIGHT MAIL

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

SUBMITTAL OF PARTICIPANTS' MONTHLY PROGRESS REPORT

As you have requested, the U.S. Nuclear Regulatory Commission is on distribution to receive a copy of the Yucca Mountain Site Characterization Project participants' monthly status report on a regular basis. Enclosed is the U.S. Geological Survey Progress Report for July 1998.

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

Stephan Brocoum
Assistant Manager for Licensing

AML:AVG-2552

Enclosure:
Ltr, 08/12/98, Craig to Kozai, w/encl.

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YMP-5

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IN REPLY REFER TO:

INFORMATION ONLY

August 12, 1998

Wayne Kozai
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
P.O. Box 30307
Las Vegas, Nevada 89036-0307

SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS) Progress Report, July, 1998

Attached is the USGS progress report in the required format for the month of July, 1998.

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

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U. S. GEOLOGICAL SURVEY
EXECUTIVE SUMMARY
July, 1998

COORDINATION AND PLANNING

U.S. Geological Survey-Yucca Mountain Branch is currently processing 121 scientific papers prepared by USGS authors. Of these, 82 are related to geologic studies and 39 are related to hydrologic studies. In addition, 11 abstracts are being processed.

Report published in July:
O'Brien, Grady, 1998, Analysis of aquifer tests conducted in borehole USW G-2, 1996, Yucca Mountain, Nevada: U.S. Geological Survey Water Resources Investigations Report WRIR-98-4063.

GEOLOGY

Geologic Framework

A preliminary version of the 1:50,000-scale geologic map compilation for the Saturated Zone (SZ) Site Area was completed and submitted to the USGS Technical Project Officer. Preparation of cross sections, subsurface structure maps, and text for the map continued. Project personnel also conducted field studies of Quaternary units, worked on digitizing information on these units for the SZ Site Area map, provided digital mapping and GIS support for geologic input to the regional saturated-zone modeling effort, and responded to further review comments on the sections on site structure and site stratigraphy for the Site Description report.

Ongoing activities related to LANL isotopic studies consisted of continuing refinement of descriptions and classification for existing ESF samples in support of a statistical analysis of the distribution of bomb-pulse ^{36}Cl in the ESF and for hypothesis testing. With regard to fracture analysis and modeling studies, discussions were held with LBNL modelers on fracture characteristics in the ESF and on interpretations of fracture data collected at outcrops on Busted Butte. The fracture dataset is currently being finalized for submittal to the Technical Data Base.

Drill cuttings, cores, and geophysical logs were examined, in collaboration with Sandia personnel, to develop a lithostratigraphic log of borehole WT-24. Logging of structural characteristics derived from borehole videos of 25 boreholes in the thermal test facility was completed.

Mapping in the ECRB cross drift included: (1) detailed line survey was completed to station 9+00, (2) full-periphery geologic mapping was completed to station 8+95, (3) RQD estimation was completed to station 9+35, and (4) Q and RMR was completed to station 8+50.

Seismotectonic Studies

A report, titled "Strain accumulation at Yucca Mountain, Nevada, 1983-1998" was completed. The report is based on surveys of a 13-station, 50-km-aperture, geodetic array centered on the potential repository site that were conducted in 1983, 1984, 1993, and 1998 to determine the rate of strain accumulation at Yucca Mountain. The results and interpretations are currently under technical review. In a complementary study of strain patterns, a statement of work was prepared and the procurement completed for the acquisition of interferometric satellite aperture radar (ISAR) images of the Little Skull Mountain (LSM) earthquake epicentral area near Yucca Mountain. The images were taken several months to a few years apart within the period preceding and following the LSM mainshock (between 1991 and 1998). The images are analyzed with differential processing to resolve the horizontal and vertical ground displacement fields associated with the mainshock (June 29, 1992) and principal aftershock sequence as detected in the ISAR data. The study will use differential ISAR methods to possibly image the

surface displacement field associated with the LSM earthquake sequence to discriminate the effects of the LSM "strain contamination" from the regional secular strain resulting from progressive Basin and Range extension in the Yucca Mountain region. If the existing geodetic ground control points (within the 50-km-aperture trilateration network at Yucca Mountain and vicinity) can be identified on the radar images, coseismic and postseismic displacements measured with differential ISAR can be subtracted from geodetic monument positions to improve estimates of secular strain. Processing and analysis of the resulting data is a scheduled activity for FY 99. Review comments were received on a report submitted to SNL last month on basaltic volcanism; the responses required some text revisions and additional editing. The report, which includes a discussion of coupled igneous and tectonic processes and an evaluation of intrusive and extrusive scenarios relevant to repository performance, was resubmitted to SNL. Project personnel also responded to further review comments on sections that were prepared for the Site Description report. A preliminary evaluation was made of several existing papers related to tectonic studies at Yucca Mountain to determine their status regarding future publication in a USGS publication series.

HYDROLOGY

Regional Hydrology

Routine maintenance of stream gages on Fortymile Wash and upper and lower Split and Pagany Washes on Yucca Mountain continued. Project staff kept vigilance during the reporting period for potential precipitation and runoff associated with several storms that passed through the southern Nevada area. Runoff was neither observed nor reported for the Yucca Mountain area. Work continued on a draft USGS Fact Sheet documenting the February runoff in and about the Yucca Mountain region. All estimates of peak flow associated with the February runoff have been reviewed by the Nevada District Flood Specialist. Streamflow and precipitation data collected through June have received initial checks and been placed in Project files.

Unsaturated-Zone Hydrology

Borehole analytical work continued with several efforts. Staff began incorporation of editorial suggestions into revision of the report tentatively titled *Drilling, logging, and testing information from borehole USW UZ-14, Yucca Mountain, Nevada*, by F. Thamir. Assorted revisions and corrections were completed to the data package titled "Supporting information for the deep unsaturated-zone surface-based borehole instrumentation program." That data package has been submitted. Staff also reviewed technical procedures for gas handling and performed a data-transcription check for a manuscript by E. Kwicklis. Borehole data from NRG-7a, NRG-6, UZ #4, UZ #5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived on a routine basis throughout the month. Sensor readings were checked daily for unusual occurrences, and statistical outliers were flagged. Staff reviewed YMP 12.3Q and began review of technical procedure HP-14, R3. Calibration activities included a PRED run on a DPT calibration bench and on two THM calibration benches, in-house calibration of Fluke/SPRTs, and shipment of Datron and Guideline Precision instruments for calibration. Close-out calibrations were completed on five Keithley instruments and one HP-3457A.

Routine shelter and instrument maintenance continued. Some 36 trips were made to field sites for correction of generator, UPS, chiller, and data-collection problems, including 17 trips related to generators and 19 visits related to data collection. Chiller and UPS problems have occurred at SD-12 (site 7), and data collection has been hanging up at UZ-7a (site 6). Staff assisted with logging at J-11 and in Crater Flat and Amargosa Valley.

In net-infiltration studies, calibration of the coupled net-infiltration/surface-flow (runoff-routing) model used available historic stream flow records for gages in Yucca Wash, Drill Hole Wash, Pagany Wash, Wren Wash, and Split Wash. Results have indicated some difficulties in matching observed flows due to limitations in the spatial accuracy of daily precipitation input, particularly for thunderstorms occurring during the summer of 1984. Testing and calibration of a preliminary soil-depth model continued, using the 1980—95 daily precipitation record and 100-year stochastic

simulation of current climate. Final simulations using the extracted watershed domains covering the area of the 3-D UZ flow model were initiated. A sensitivity analysis of soil depth and effective bedrock permeability continued. Preparation of a memo updating the net-infiltration and surface-flow models also continued. Based on input from paleoclimatic studies, evaluation of analog sites for developing stochastic simulations of daily precipitation for various potential future climates was completed using historic precipitation and air-temperature records available for analog sites. Application of the coupled net-infiltration/surface-flow (runoff-routing) model to the Drill Hole Wash, Solitario Canyon, and Dune Wash watershed-modeling domains using various wetter future climate analogs to analyze potential channel-flow volumes and to compare net infiltration along channel segments and lower sideslopes continued. Sensitivity analysis of the impact of air temperature on net infiltration and stream flow for potential future climates also continued.

In work on estimation of percolation flux across the repository horizon, rewriting of the USGS open-file report titled *Estimates of physical properties and moisture conditions along the East-West Cross Drift alignment at Yucca Mountain, Nevada* continued. Tables of estimated physical properties including additions recommended by the USGS publications staff have been made. Heat-dissipation (HD) probes were installed in 2-m-deep drill holes at Cross Drift Stations 3+75, 4+00, 4+25, 4+50, 4+75, 5+50, 5+75, 6+00, 6+25, 6+75, 7+00, and 7+25. Water potential was monitored in those drill holes as well as in drill holes at 25-m intervals between Cross Drift Stations 0+50 and 3+50. Problems with insertion of HD probes into blocked holes are being corrected with re-drilling or by cleaning out the holes. Hydraulic-contact problems have been identified with some probes, and corrections are being attempted with re-installation. Work to finalize HD probe calibrations and to apply those calibrations to the collected data was started. The HD data will be submitted with the calibrations applied. Boreholes (2-m length) were drilled, cored, and neutron logged at Cross Drift Stations 4+00, 4+50, 5+00, 5+50, 6+00, 6+50, 7+00, 7+50, and 8+00. The seven 2-m boreholes at 50-m intervals between Cross Drift stations 0+50 and 3+50, and the borehole arrays in the Test Zones, underwent neutron logging. Temperature, relative humidity, and wind-speed data were collected from monitoring stations at Cross Drift Stations 0+25, 2+37, 2+88, and 3+38. Temperature and relative humidity data were collected from the vent line at Cross Drift Station 0+00 and on the TBM.

In moisture monitoring in the ESF and the ECRB, seven temperature and relative humidity stations have been established in the ECRB. Four of those stations also measure wind speed. Thirty-two HD probes have been installed in 2-m holes. The HD probes were installed at Construction Station (CS) 0+50 and at stations spaced every additional 25 m. Seventeen HQ drill holes have been completed in the ECRB. One sequence of holes started at CS 0+50, and holes were drilled every 50 m. Those holes are horizontal and 2 m deep. During tunnel construction two test zones were established to evaluate, in detail, the use of water and surfactant as a dust-control agent. Test zone 1 started at CS 2+38 and ended at 2+88. In that zone, only water was used. Four boreholes were drilled in that test zone at CS 2+53. One hole was drilled vertically to a depth of 10 m; the next was drilled at an angle of 45 degrees from vertical and is 6 m deep. The third hole was a 2-m horizontal borehole. The second test zone began at CS 2+88 and ended at CS 3+28. The same borehole array was drilled in that test zone as at CS 3+00. Seven days after the first 10-m holes were drilled, a 15-m vertical hole was drilled in each test zone. All of the holes were neutron logged and will continue to be logged to determine the volumetric water loss from the tunnel walls. All available construction data have been collected into a master spreadsheet. Calculation of estimated water loss from the rock is being done from the borehole neutron logs, and total tunnel evaporation is being calculated from sensor data. Evaporation of construction water is being estimated as the difference between the total tunnel evaporation and the water evaporated from the rock formation.

Air-permeability and hydrochemical work continued in the ESF. Field staff prepared boreholes in the North Ghost Dance Fault (NGDF) alcove for hydrochemical sampling. That sampling is scheduled to begin in early August. Analysis of the Ghost Dance fault pneumatic and tracer testing, and related report preparation, continued. The Bureau of Reclamation (BoR) fracture

line-survey data are being used to develop a discrete fracture model of the Ghost Dance fault, to investigate fracture control on tracer transport in fractured tuff.

In other moisture-related studies, investigation of lateral diversion in the PTn continued with processing and analysis of core data and borehole-monitoring data. Samples from Alcove #4 are being processed, and centrifuge runs on core continued. Hydraulic conductivity and water-potential data from studies of unsaturated matrix-flow properties are in internal review. Data for comparison of methods are still being collected. All conductivity measurements have been completed, and mineral analysis continued at LANL for comparison to conductivity. Preparation of the drift-scale flux data package for the period February through July continued. No drilling was performed during July. Experiments in ESF alcoves continued with no changes from last month. Monitoring of temperature, relative humidity, and barometric pressure continued at selected alcoves as part of the seepage experiments. Data are also being collected from 78 HD probes located in Alcoves #1 and #7 and in Niche #1. Eight surface-based HD probes are monitoring soil water potential in and adjacent to the Ghost Dance fault. The drip-detection system in Alcove #7 was checked, and no drips were seen. In the Alcove #1 seepage study, to date approximately 58,497 gallons of water have been applied to the site. Water began dripping into the alcove on about May 5 (between May 2 and May 5). As of July 1, 1680 gallons of water have been collected from approximately 146 collection trays in Alcove #1. Selected samples are being tested for pH, electrical conductivity and various hydrochemical analyses. In work on evaluation of infiltration of construction water in the ESF-ECRB, isotopic analyses are complete, and data packages are in preparation. In other ongoing isotopic studies, investigation of matrix water sources and fracture-matrix interactions continued with preparation and Sr analysis of pore-water samples (salts) from SD-12. Strontium and uranium isotopic analyses of water samples from the drift-scale thermal test and the Single-Heater Test also continued.

Data collection for hydrologic characterization of surface-based borehole SD-6 has been completed with the exception of moisture-retention curves to be obtained on the centrifuge. Data have been proofed and organized and are being evaluated for comparison to predictions. In the absence of an official lithologic log, the final document will use a preliminary log. That document has been outlined, and illustrations have been started.

Characterization of hydrologic properties of backfill materials was completed in support of EBS (Engineered Barrier System) water-contact studies and reported in a memorandum (Level 4 **milestone SPH261M4 [Memo to TPO: Backfill materials hydrologic properties report]**) on July 31. Additional work will supplement LLNL's backfill experiments.

Multiple efforts continued in UZ hydrochemistry. Work on core samples included distillation tests on four ESF Alcove #6 core samples to extract dissolved CO_2 and pore water. Extracted CO_2 and pore water from those samples and from ESF moisture-study cores will be analyzed for carbon isotopes and tritium, respectively. Pore water extracted by distillation of eight ESF/CWAT core samples will be analyzed for tritium, D/H, and ^{18}O isotopes. Distillation provided water samples from SD-6 and WT-24 for similar analysis, and compression extraction was used on five additional WT-24 samples; several samples were shipped for carbon isotopic analysis. Distilled and squeezed water samples from borehole cores were sent for inorganic carbon and oxygen-isotope studies. Other water samples (including samples from WT-24 and SD-6) underwent major-ion and silica-concentration analyses, including determination of alkalinity by micro-titration. Water distilled and compressed from additional ESF/CWAT samples and from samples obtained from boreholes SD-6 and UZ-7a was sent for similar analyses, including Sr isotopes. Associated rock samples also were sent for Sr analysis. One-dimensional compression was used to extract water from ESF moisture-study core. One previously distilled WT-24 core sample was acidified to evolve CO_2 gas from precipitated calcite. The degree of distillation fractionation will be investigated through carbon isotope analysis. Twenty water samples from boreholes (WT-24, SD-6 and SD-12, and UZ-7a) were prepared and counted for tritium concentration. In supporting work, a data package containing FY1998 analyses by Huffman Laboratories was sent for technical review. Various data were transferred to appropriate data bases during the month. The

scintillation counter was calibrated, a dozen cylinders containing molecular sieves were heat-evacuated, and the ultracentrifuge and associated equipment were set up and tested; several SD-9 core samples underwent extraction as part of the tests. (Technical procedure HP-110, previous procedure for extraction of pore water by ultracentrifuge, is being reactivated and modified for use as the official procedural document for the new instrument.)

In unscheduled work, staff assisted in preparation of responses to review comments on the geochemistry section of the Site Description document. Review comments were also assembled for the draft LBNL document titled *UZ flow and transport issues*. Various materials were provided to P. Glynn (USGS Eastern Region National Research Program) for preparation of a report tentatively titled *^{14}C age correction on perched water at Yucca Mountain, Nevada, using the NETPATH geochemical model*. Staff also co-authored a draft manuscript for the RADIOCARBON Journal titled *Changes in ^{14}C activity over time during vacuum distillation of carbon from rock pore water*, written with G. Davidson of the University of Mississippi. The paper was sent for technical review. An additional paper, *Comparison of ^{14}C determination by vacuum-distillation and one-dimensional compression methods and tritium by enrichment on Yucca Mountain, Nevada, cores*, by I. Yang, G. Davidson, and K. Scofield, was sent for co-author comment.

Saturated-Zone Hydrology

The Prow Pass partial-recirculation conservative tracer test from UE-25 c#3 to c#2 (initiated on June 17) continued during July. According to preliminary data (subject to revision), the peak for the 2,4,5 trifluorobenzoic acid (TFBA) breakthrough curve (concentration of 3.7 ppm) occurred on June 23; the iodide peak occurred on June 25 with a peak of 2.7 ppm. By July 22, iodide had dropped to 0.8 ppm, and 2,4,5 TFBA had dropped to 1.1 ppm. On July 31, 2,3,4,5 tetrafluorobenzoic acid was injected into borehole c#1 to initiate a primarily convergent tracer test from c#1 to c#2.

Planning for the Alluvium Testing Complex continued, with a conference call on July 30 involving USGS, LANL, M&O, and Nye County staff. The discussion prompted initiatives for the use of the FY1999 Nye County drilling program as a nucleus for the Alluvium Testing Complex, for which hydraulic and tracer tests are planned for FY2000.

Water-level measurements were performed at boreholes UE-25 J-12, UE-25 J-13, UE-25 WT#12, UE-25 WT#13, and UE-25 p#1 on July 1; at USW H-1 (tubes 1, 2, 3, and 4) on July 6; at USW VH-1 and UE-25 WT#16 on July 8; at UE-25 WT#13, UE-25 J-11, UE-25 WT#4, and UE-25 WT#15 on July 9; at USW WT-2 and USW H-4 (lower interval) on July 13; at USW WT-24 on July 14; at USW H-4 (upper interval) and UE-25 WT#14 on July 16; at UE-25 J-11, USW H-5 (upper and lower intervals), and USW WT-1 on July 21; at USW H-3 (upper and lower intervals) on July 22; at USW H-6 (upper and lower intervals) on July 27; at USW WT-11, USW WT-10, and USW WT-7 on July 28; and at UE-25 WT#14 and USW H-4 (upper interval) on July 22. Data were retrieved from USW G-2 and UE-25 WT#6 through July 23. The data package (SPH37K: data collected from January through June 1998) was revised and prepared for technical review. The Druck transducers at UE-25 WT#14 and USW H-4 (upper interval) were calibrated on July 12 and July 22.

Through July 31, borehole WT-24 remains at 2,834 ft below land surface (bls), bottomed in the Calico Hills Formation. There was no drilling activity during July. There also was no drilling activity at SD-6, drilled to 2,541 ft bls and with equipment stuck in the bottom of the borehole. Geophysical logging will not occur until the boreholes are completed. Sampling of perched water in SD-6 cannot occur until deeper penetration is achieved. No samples of SZ ground water were obtained from WT-24 or SD-6 during July, awaiting further deepening and additional water production from fractures. Samples were collected from boreholes WT-3 and WT-17 as well as from 10 wells in the Amargosa Farms area downgradient from Yucca Mountain. Results of the analyses have not been received.

The report *Water levels in the Yucca Mountain area, Nevada, 1996*, by R.P. Graves, approved as Open-File Report 98-169 in April 1998 and sent to the Colorado District Reports Unit on April 21, was returned to the author on July 31.

In regional modeling work, numerous efforts continued. A preliminary version of the isostatic gravity map was compiled. Work continued toward updating available reference data and refining estimated depth to the top of the basement, including processing of additional gravity data for the Amargosa region. Existing information on depth to basement is being used to calibrate the depth interpretations. Work also continued on the development of a U-series/thermoluminescence data base relating to dating of modern and paleospring discharge. New geologic mapping from Death Valley is being digitized, and a topographic base map has been compiled for the Death Valley regional ground-water basin. All geologic maps necessary for the regional Death Valley ground-water basin have been compiled. Digitizing of nondigital sources continued, as did work on interpretation of Quaternary deposits and structures in the Death Valley region. Development of interpretive geologic cross sections and efforts toward development of a $^{40}Ar/^{39}Ar$ data base also continued.

Various modeling efforts continued. In testing of alternate conceptual models, staff continued to refine the data base to allow for easier and more efficient data storage and retrieval. Work continued on the "moving window" analysis, which will help to identify water-level sites that may represent perched water conditions using an unbiased statistical approach to identify anomalous water levels. Several criteria have been developed that may indicate whether a water-level site represents perched conditions and whether favorable conditions exist for perched water. Database queries and GIS coverages are being compiled and developed to evaluate the existing data. The regional hydrologic framework model was refined, correcting inconsistencies with the UGTA framework model and with emphasis on the pre-Cenozoic surfaces. Modifications to MODFLOWP with parallel programmers at ARSC also continued. Staff met with ARSC staff in Fairbanks (July 13—17) to discuss possible parallel programming to include 3-D scientific visualization applications. Ground-water model-evaluation runs determined where best to increase vertical discretization to the regional ground-water flow model. Staff of the USGS-Nevada District continued image processing on evapotranspiration (ET) areas and conducted field investigations to improve delineation of ET areas. Staff completed a review of Chapter 8 of the TSPA-VA Technical Basis Document (SZ flow and transport) on July 6. Thirteen technical comments and minor editorial comments were provided to PA, and most comments concerned PA flow modeling and the limited detail describing the model. Efforts continued for release of MODFLOW-96, an update to previously released versions of MODFLOW. Technical review of the updated framework model was completed, and the framework model was revised. A major comment identified an error in outcrop exposure of the Tram Tuff south of Yucca Mountain; those outcrops are probably Bullfrog Tuff. A data package is being assembled for that work. Efforts also continued on a report describing the updated site SZ hydrogeologic framework model. A memo documenting the updated framework model was submitted on July 24, completing Level 4 **milestone SPH605M4 [Memo to TPO: Model input/output update data]**. Modeling staff also continued work on digital geologic maps for updating of the regional and site-scale hydrogeologic framework models, as well as GIS support to the models, and assisted the SZ hydrochemical sampling program in the Amargosa Desert.

CLIMATE and PALEOHYDROLOGY

In work on the future-climate record, staff completed spreadsheet entry of geochemical data derived from bulk-sediment analyses that provide geochemical signatures of the types of sediments deposited in Owens Lake. (During the glacial periods, for example, the elements derived from Sierran granite increase.) The stratigraphic profiles of various elements offer one means of identifying timing and variability of the Owens Lake paleoenvironment as it changed from an interglacial to a glacial lake, thereby providing a component of the input terms for the TSPA-LA models. Stable isotope analyses of bulk-sediment samples from Owens Lake are nearly complete. Preliminary examination of the data shows systematic changes in the oxygen

isotope content of the sediments. Presuming the primary stable isotope signature in this data set comes from calcite precipitated in the lake, the observed changes provide a key insight into the lake's input/output hydrology as climate changed from interglacial to glacial and back to an interglacial period. As with the geochemical data, the isotopic data will provide a means of characterizing the variability of the climatic system during climate change, an input term for TSPA-LA. Staff also continued collecting and analyzing diatom data from Owens Lake core OL-92/2 intervals between 162.7 and 190.33 m to provide high-resolution paleoclimatic interpretations for the period 400—350 ka as a potential regional future climatic analog for Yucca Mountain.

Work continued on reports, including revision of the Climate and Past Discharge open-file report. Revisions were completed to a manuscript titled *A paleolimnologic record of climate change from Owens Lake, California, for the past 50,000 years*, by J.P. Bradbury and R. Forester, and the report was submitted for Yucca Mountain Branch and USGS approval.

Staff examined tunnel walls of the East-West Cross Drift between stations 0+00 and 6+00. Calcite and opal deposits on the left rib within 60 cm centered on the BoR Detailed Line Survey were documented between stations 5+50 and 6+00 in the lower part of the Topopah Spring Tuff upper lithophysal unit. The deposits are similar to those observed in the ESF primarily coating the floors of lithophysal cavities. A major problem in that part of the East-West Cross Drift, however, is the thick cement-like smear produced during excavation. Although some of that material was washed off the walls prior to BoR mapping, it typically completely fills lithophysal voids with a cement-like aggregate which is extremely difficult to remove. The smear significantly obscures secondary mineralization to the point where the accuracy of the mineral surveys is compromised. The right rib, however, does not have the same amount of smear due to the combination of rotation and muck-removal geometry at the cutter head of the TBM. Therefore, it was concluded that surveying of that part of the tunnel would be accomplished best by mapping off the conveyor belt after construction is complete. TCO personnel indicated that the smear problem is reduced further on in the tunnel, but that claim could not be evaluated because the tunnel was inaccessible beyond station 6+00 due to construction of a niche. Staff collected secondary mineral coatings between stations 1+19 and 3+03. All samples consist of coatings from lithophysal cavities, although two (1+19 and 1+25) were from very large (larger than 1 m), complex cavities which contain evidence of long histories of block collapse and re-coating episodes. Samples were returned to Denver and await cleaning, subsampling, and analysis.

In paleoclimate work on past-discharge sites, staff completed analysis of a suite of reconnaissance materials collected from several sites in the Ash Meadows discharge area. Samples represent carbonate (tufas and travertine veins) deposited from ground-water discharge in the past, and the sites are at elevations approximately 10 to 25 m above current ground-water discharge sites (the Fairbanks Spring, Longstreet Spring and School Spring areas). Two of three samples from the Fairbanks Butte area have ages between 245 and 284 ka with initial $^{234}U/^{238}U$ activity ratios of 2.65 and 3.13. Eight subsamples from four separate samples from the Longstreet Spring area have $^{230}Th/U$ or model $^{234}U/^{238}U$ ages between about 250 and 280 ka with initial $^{234}U/^{238}U$ activity ratios of 2.5 to 3.4. Model $^{234}U/^{238}U$ ages for the Fairbanks and Longstreet samples using an assumed initial ratio of 2.75 (Ludwig and others, 1992, *Science*, v. 258, p. 284) range from 170 to 300 ka. Three analyses of late calcite cementing fine-grained deposits in the School Spring area show $^{230}Th/U$ between 18.5 and 18.8 with identical initial $^{234}U/^{238}U$ activity ratios of 2.73. These analyses indicate that areas saturated with ground water were more widespread in the middle and late Pleistocene than water-table elevations currently support. The data are consistent with a water table up to 9 m higher relative to modern levels in Browns Room in Devils Hole at times during the past 100 ka (Szabo and others, 1994, *Quaternary Research*, v. 41, p. 59-69). Those data can be used to provide upper limits on areas within Ash Meadows that have been saturated by ground water over the last several hundred thousand years. If present-day discharge volume to vegetated areas can be scaled to the more widespread deposits indicative of past saturation, further checks on flow volumes determined from the regional hydrologic flow model during pluvial periods might be established.

Staff examined secondary fracture minerals in the ESF between stations 30+00 and 30+30. Stereoscopic photographs of that part of the ESF were used to evaluate usefulness of mapping secondary mineral sites directly onto photographs (or overlays). The advantage of the approach is that the photos were taken soon after water washing and reveal a much cleaner wall than currently is available. Cavities (both fracture and lithophysal) are clearly evident in stereovision and can be used to identify potential mineralization sites. Field checking to observe calcite and opal at those sites can be used to determine the proportions of tunnel wall that received past water flux. That information has not been captured in previous mineralogic line surveys because sites of potential mineralization (cavities with apertures greater than about 1 cm) were not documented. This type of mineralogic survey mapping will be used throughout the East-West Cross Drift and may be employed in some parts of the ESF.

Staff also examined mineralized fractures in the shallow part of the North Ramp where Y. Dublyansky and J. Szymanski collected samples for fluid-inclusion studies. Sites included one of their recent collections consisting of a thumbnail-size fragment from a 0.5-cm-thick calcite coating. All older collection sites between Alcove #2 and the north portal reported in Dublyansky and Reutsky (1995 TRAC report) were located and examined. Most contained early opal or chalcedony and appear consistent with other locations observed and sampled from the Tiva Canyon Tuff by the USGS Environmental Science Team. Two of our (USGS) samples dated by U-Pb methods have ages between 3 and 5 Ma for outer materials and may show effects of open-system behavior (Neymark and others, 1998, *in* Proceedings, 1998 International High-Level Radioactive Waste Management Conference, Las Vegas, NV, May 11—14, 1998, American Nuclear Society, LaGrange Park, IL, p. 85-87). U-series ages also show older ages in coatings from the Tiva Canyon Tuff relative to the Topopah Spring Tuff (Paces and others, 1996, unpublished USGS milestone report 3GQH450M, and 1997, unpublished USGS milestone report SPC23FM4) and have been interpreted as reflecting slower growth rates or depositional hiatuses resulting in a larger proportion of older material in the outermost layers. As a result of these findings, any hydrologic interpretations obtained from such mineral coatings must be tempered by the strong likelihood that they represent ancient materials unrelated to hydrologic processes occurring over the last several million years. Dating of fluid-inclusion samples is currently scheduled for FY1999.

Analyses were completed of water obtained from the Single Heater Test, borehole 16-4, in Alcove #5. Four water samples were collected from a single packed interval between November 1996 and May 1997. Uranium concentrations vary from about 0.1 ppb in the first water to about 0.03 in the last. $^{234}U/^{238}U$ activity ratios vary smoothly from about 8 in the earliest sample to about 4 in the latest. The data are consistent with a model involving distillation of pore water in the hottest zones, migration of vapor to cooler rock, condensation, and liquid migration along fracture pathways to the site of water collection. Elevated $^{234}U/^{238}U$ ratios in the earliest liquids are obtained by preferential dissolution of ^{234}U relative to ^{238}U as a consequence of the natural build-up of the ^{234}U daughter product on fracture surfaces. Percolation forming the subsequent water samples has much smaller $^{234}U/^{238}U$ because the ^{234}U removed during the initial rinsing of fracture surfaces was not reestablished by radioactive decay of ^{238}U. The activity ratio of about 4 in the last sample may be approaching the $^{234}U/^{238}U$ value inherent in the pore waters themselves. The similarity of the uranium isotopic composition of the first water sample to initial $^{234}U/^{238}U$ activity ratios measured in fracture-coating minerals has important implications on the periodicity of infrequent fracture-percolation events in the unsaturated zone below the PTn.

Staff completed and submitted an abstract to the 1998 annual meeting of the Geological Society of America for presentation in the DOE-hosted theme session titled "Radionuclide transport experiments at underground research laboratories." The abstract, *Isotopic evidence for the origin of low-temperature calcite and opal exposed in an underground laboratory at Yucca Mountain, Nevada*, by B.D. Marshall, J.B. Paces, Z.E. Peterman, L.A. Neymark, J.F. Whelan, and K. Futa,

describes the subsurface secondary minerals at Yucca Mountain and their implications for UZ hydrology.

Staff examined past-climate data in the M&O database. Data relevant to the NRC report were identified and sorted for duplicates. A preliminary file with the Project-related data packages was created for input to that data-qualification effort. Other non-Project data sets that are either key or supportive for the overall characterization of Yucca Mountain in climatic terms were identified. Staff discussed the current options available for qualification of non-Q data.

SPECIAL STUDIES

Internal review of the SD Hydrology Chapter draft and resolution of comments were conducted iteratively and in parallel. Resolution of comments to the extent necessary to proceed to the next stage of processing, submittal to the DOE for its review, have been completed. Level 4 **milestones SPH393M4 [Memo to TPO: Evaluate draft text SDD hydrology chapter]** and **SPH394M4 [Memo to TPO: Revise draft SDD hydrology chapter]** were completed by memoranda of July 21 to the USGS TPO.

Examination of Draft A (April 1998) of the Site Description showed that portions prepared by non-USGS authors had been submitted and incorporated into the Hydrology Chapter. Therefore, it was determined that Activity SPH391 [Prepare drafts PISA hydrology chapter sections] had been completed as of March 31, 1998, and Level 4 **milestone SPH392M4 [Memo to TPO: draft PISA hydrology chapter section]** was subsequently satisfied by memorandum of July 21 to the USGS TPO.

Staff provided technical correctness review for the RIB report of Karen Low (M&O) on paleoclimatic data for Yucca Mountain. Review of an additional RIB report is underway. USGS staff provided input and review for past-glacial continental ice maps being used in presentations to be given by DOE staff. Final edits were made to the climate chapter of the Site Description.

WATER-RESOURCES MONITORING

An additional suite of samples was collected during the week of July 27 in support of the M&O Radiological/Environmental Field Program. The additional samples were collected at the request of Program staff to alleviate QA concerns related to laboratory analytical services. Sample collection also is scheduled for September.

Ongoing monitoring activities produced measurements of ground-water levels at 34 sites and ground-water discharge at one flowing well. Staff met with USGS-ESIP personnel to calibrate electric tapes. Ground-water data collected during June were checked and filed. In addition, reviews were performed on ground-water level and discharge data collected and compiled for the period April through June, 1998. A letter report was prepared and delivered to DOE and TRW/SAIC on July 31 (Level 3 **milestone SSH13KM3 [Letter Report: water data 3rd-quarter FY98]**) for acceptance review. In work on the summary monitoring report, compilations of data on ground-water withdrawals and computation of summary statistics for water levels in Jackass Flats were completed. Tables and figures were prepared for inclusion in the summary report.

Staff discussed discrepancies between current monitoring locations/site designators and those listed in the Yucca Mountain Site Atlas with the NWTRB member on July 7. On July 10, staff provided information on J-13 construction to TRW, and a map of the 1997 monitoring network was prepared and provided to TRW on July 15 for inclusion in the annual Site Evaluation Report.

L. Hayes, M&O/TRW, Las vegas
C. Lugo, M&O/SAIC, Las Vegas
R. Craig, USGS, Las Vegas
M. Chornack, USGS, Denver
L. Ducret, USGS, Denver
W. Dudley, USGS, Denver
D. Edwards, USGS, Las Vegas
D. Gillies, USGS, Denver
D. Hoxie, USGS, Las Vegas
C. Hunter, USGS, Denver
R. Keefer, USGS, Denver
B. Parks, USGS, Denver
Z. Peterman, USGS, Denver
W. Scott, USGS, Las Vegas
R. Arnold, USGS, Denver
D. Soeder, USGS, Las Vegas
A. Whiteside, SAIC, Denver

Inc. Dollars in Thousands

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

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 BCWS	BCWP	ACWP	SV	CV	FY1998 Cumulative to Date BCWS	BCWP	ACWP	SV	CV	FY1998 at Completion BAC	EAC	VAC
1.2.1	Systems Engineering	85	85	98	0	-13	556	556	473	0	83	726	590	136
1.2.3	Site Investigations	1048	847	966	-201	-119	10549	10122	9533	-427	589	12582	12813	-231
1.2.5	Regulatory	53	53	57	0	-4	528	528	435	0	93	638	592	46
1.2.8	Environment, Safety, and H	52	52	51	0	1	502	502	474	0	28	600	591	9
1.2.9	Project Management	58	58	48	0	10	569	569	548	0	21	683	746	-63
1.2.12	Information Management	6	6	5	0	1	64	64	40	0	24	77	55	22
1.2.15	Support Services	146	146	151	0	-5	1451	1451	1360	0	91	1743	1684	59
Total		1448	1247	1376	-201	-129	14219	13792	12863	-427	929	17049	17071	-22

Resource Distributions by Element of Cost

Fiscal Year 1998

Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	22445	22408	22390	22479	15544	15933	16774	17991	17996	17469	16202	15656	223287
LABOR	924	986	983	993	669	703	727	766	782	742	675	654	9604
SUBS	150	160	165	180	219	228	235	244	283	281	315	315	2775
TRAVEL	28	59	60	76	62	70	74	78	74	66	60	48	755
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	228	242	260	323	290	303	285	333	529	359	372	391	3915
Total BCWS	1330	1447	1468	1572	1240	1304	1321	1421	1668	1448	1422	1408	17049

Actual Cost of Work Performed

LBRHRS	19347	15629	18106	16797	14905	16396	16949	18484	14713	23465	0	0	174791
LABOR	698	634	670	735	608	727	635	725	683	732	0	0	6847
SUBS	190	151	226	140	242	228	268	191	315	198	0	0	2149
TRAVEL	6	27	75	31	49	38	63	59	77	40	0	0	465
PM&E	0	62	22	131	215	127	495	113	59	222	0	0	1446
OTHER	16	275	148	204	328	160	253	140	248	184	0	0	1956
Total ACWP	910	1149	1141	1241	1442	1280	1714	1228	1382	1376	0	0	12863

Inc. Dollars in Thousands

WBS No. - 1.2 -Yucca Mountain Project

Resource Distributions by Element of Cost

Fiscal Year 1998
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	22777	21199	43976
LABOR	0	0	0	0	0	0	0	0	0	0	975	909	1884
SUBS	0	0	0	0	0	0	0	0	0	0	390	376	766
TRAVEL	0	0	0	0	0	0	0	0	0	0	99	93	192
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	745	621	1366
Total ETC	0	0	0	0	0	0	0	0	0	0	2209	1999	4208

Resource Distributions

Fiscal Year 1998	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1330	1447	1468	1572	1240	1304	1321	1421	1668	1448	1422	1408	17049
BCWP	1270	1404	1415	1520	1205	1357	1449	1409	1516	1247	0	0	13792
ACWP	910	1149	1141	1241	1442	1280	1714	1228	1382	1376	0	0	12863
ETC	0	0	0	0	0	0	0	0	0	0	2209	1999	4208

Fiscal Year Distribution

	Prior	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Future	At Complete
BCWS	32296	17049	9517	4027	920	279	0	0	0	0	0	0	64088
BCWP	32009	13792	0	0	0	0	0	0	0	0	0	0	
ACWP	32040	12863	0	0	0	0	0	0	0	0	0	0	
ETC	0	4208	9517	4026	920	279	0	0	0	0	0	0	63853

USGS Level 3 Milestone Report

October 1, 1997 - July 31, 1998

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
PSHA Final Report **Milestone Number:** SP32IM3	9/25/97	2/23/98	2/23/98	
Letter Report: 4th Qtr FY 1997 **Milestone Number:** SSH13HM3	10/31/97	10/30/97	10/30/97	
Regional Saturated Zone Synthesis Report **Milestone Number:** SP23OM3R1	11/21/97	11/12/97	11/12/97	
Site Saturated-Zone Synthesis Report **Milestone Number:** SP23NM3R1	11/28/97	1/15/98	1/15/98	
Initiate Test of In-Situ Conditions (Alcove 7) **Milestone Number:** SP3507MC	12/12/97	12/9/97	12/9/97	
Deterministic Evals. For Type 1 Faults at YM **Milestone Number:** SPG28LM3	12/19/97	12/19/97	12/19/97	
Letter Report: 1st QTR FY 1998 **Milestone Number:** SSH13IM3	1/30/98	1/28/98	1/28/98	
Letter to DOE: PSHA Final Report Completed **Milestone Number:** SPG28MM3	2/23/98	2/23/98	2/23/98	
Letter Report: 2nd QTR FY 1998 **Milestone Number:** SSH13JM3	4/30/98	4/29/98	4/29/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Directors Approval PSHA Final Report **Milestone Number:** SPG28NM3	7/17/98	8/31/98		
Letter Report: 3rd QTR FY 1998 **Milestone Number:** SSH13KM3	7/31/98	7/31/98	7/31/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Rev Draft SDD Climate Chapter **Milestone Number:** SPC322M4	12/9/97	1/9/98	1/9/98	
Memo to TPO: Doc Hydraul Prop. Test WT-24 **Milestone Number:** SPH241M4	12/19/97	12/23/98		
Memo to TPO: Raw Data to RPC **Milestone Number:** SPH36LM4	1/2/98	12/31/97	12/31/97	
Memo to TPO: Monitoring Data FY 1997 to RPC/TDB **Milestone Number:** SPH36OM4	1/2/98	12/31/97	12/31/97	
Memo to TPO: Rslts of Prch Wtr Hydr Tstng - SD-6 **Milestone Number:** SPH245M4	1/12/98	5/27/98	5/27/98	
Memo to TPO: Predictive Geotech. Analysis ECRB **Milestone Number:** SP327AM4	1/14/98	1/14/98	1/14/98	
Memo to TPO: Predictive Cross Section and Memo **Milestone Number:** SPG22M4	1/14/98	1/13/98	1/13/98	
Memo to TPO: Analys Condx/Properties Cross Drift **Milestone Number:** SPH351M4	1/15/98	1/15/98	1/15/98	
Memo to TPO: Lithostratigraphy of WT-24 **Milestone Number:** SPG213M4	1/26/98	10/8/98		
Memo to TPO: Summary of Fracturing in the ESF **Milestone Number:** SPG242M4	1/30/98	1/30/98	1/30/98	
Memo to TPO: Geologic Map of N. of Yucca Wash **Milestone Number:** SPG237M4	2/2/98	1/30/98	1/30/98	
Memo to TPO: Final Rev Draft SDD Climate Chpter **Milestone Number:** SPC323M4	2/20/98	3/6/98	3/6/98	
Memo to TPO: Rev Drft SDD Hydro Chptr. **Milestone Number:** SPH394M4	2/20/98	7/21/98	7/21/98	
Memo to TPO: Frac Connectivity Data to SNL/LBL **Milestone Number:** SPG230M4	2/27/98	2/20/98	2/20/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Jul-Sep97 Perio Wtr Lvl Data to RPC **Milestone Number:** SPH37GM4	2/27/98	2/13/98	2/13/98	
Memo to TPO: Evaluation of Grid Refinement **Milestone Number:** SPH40EM4	2/27/98	2/27/98	2/27/98	
Memo to TPO: Hydraulic Testing BH USW WT-24 **Milestone Number:** SPH572M4	3/4/98	12/23/98		
Memo to TPO:Data to RPC Pmp/Monit Prch Wtr WT-24 **Milestone Number:** SPH242M4	3/13/98	6/16/98	6/16/98	
Memo to TPO: Analys Cond/Properties Cross Drift **Milestone Number:** SP33ACM4	3/27/98	8/31/98		
Memo to TPO: ECRB Spatiotemporal Predictions **Milestone Number:** SPC237M4	3/27/98	8/31/98		
Memo to TPO: Lithostratigraphy Log for WT-24 **Milestone Number:** SPG223M4	3/27/98	12/15/98		
Memo to TPO: Final Workshop Summary **Milestone Number:** SPG28RM4	3/27/98	4/27/98	4/27/98	
Memo to TPO: Rslts of Sampling Completed **Milestone Number:** SPH232M4	3/30/98	2/19/99		
Memo to TPO: Borhle Monitoring Oct 1996-Sep 1997 **Milestone Number:** SPH36NM4	3/30/98	3/30/98	3/30/98	
Memo to TPO: Data Pkg of Core/Bh Data Aug-Dec 97 **Milestone Number:** SPH35CM4	3/31/98	3/31/98	3/31/98	
Memo to TPO:Data & Rslts Analys/Inter Sep-Dec 97 **Milestone Number:** SPH35DM4	3/31/98	3/31/98	3/31/98	
Memo to TPO: Data Pkg of Core/Bh Data Aug-Dec 97 **Milestone Number:** SPH38CM4	3/31/98	3/31/98	3/31/98	
Memo to TPO: Data&Rslts Analys/Inter Sep-Dec 97 **Milestone Number:** SPH38DM4	3/31/98	3/31/98	3/31/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Inventory of Hydro Data Completed **Milestone Number: SPH40MM4**	3/31/98	3/24/98	3/24/98	
Memo to TPO: Updated Reg Frmwrk Mdl to Rev **Milestone Number: SPH40QM4**	3/31/98	6/29/98	6/29/98	
Memo to TPO: Progress on Delineation of ET Area **Milestone Number: SPH41GM4**	3/31/98	5/29/98	5/29/98	
Memo to TPO: Doc Hydraul rop. Test SD-6 **Milestone Number: SPH246M4**	4/6/98	2/11/99		
Publish Sel Streamflow & Precip Data for FY97 **Milestone Number: SPH36CM4**	4/6/98	7/6/98	7/6/98	
Memo to TPO: Subm FY97 Data to RPC/TDB **Milestone Number: SPH36DM4**	4/6/98	4/3/98	4/3/98	
Memo to TPO: 1996 Water Level Data **Milestone Number: SPH37HM4**	4/6/98	4/3/98	4/3/98	
Memo to TPO: Data to RPC Pmp/Monit BH WT-24 **Milestone Number: SPH243M4**	4/14/98	4/27/99		
Memo to TPO: Data to RPC Pmp/Moni Prch Wtr SD-6 **Milestone Number: SPH247M4**	4/14/98	5/27/98	5/27/98	
Memo to TPO: Lithostratigraphy of SD-6 **Milestone Number: SPG23AM4**	4/17/98	11/5/98		
Review Draft: Conceptual Model of UZ **Milestone Number: 3GUM603M**	4/30/98	5/11/98	5/11/98	
Memo to TPO: Chpt 6.X of TSPA-VA Docum **Milestone Number: SPH133M4**	4/30/98	4/10/98	4/10/98	
Memo to TPO: Subm of Data Pkg to RPC/TDB **Milestone Number: SPH258M4**	4/30/98	4/30/98	4/30/98	
Memo to TPO: Subm of Data Pkg to RPC/TDB **Milestone Number: SPH282M4**	4/30/98	4/30/98	4/30/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Prov Analy of Pred vs Actual, WT-24 Milestone Number: SPG33UM4	5/15/98	7/1/98	7/1/98	
Memo to TPO: Hydraulic Prop. Test WT-24 Milestone Number: SPH244M4	5/20/98	7/23/99		
Memo to TPO: Updated Reg Flow Model to Rev Milestone Number: SPH40PM4	5/29/98	5/29/98	5/29/98	
Memo to TPO: Geologic Map of Sundance Fault Milestone Number: SPG238M4	6/1/98	5/29/98	5/29/98	
Memo to TPO: Review Comments for TSPA-VA Rpt Milestone Number: SPH134M4	6/5/98	6/3/98	6/3/98	
Memo to TPO: Hydraulic Testing BH USW SD-6 Milestone Number: SPH582M4	6/15/98	2/11/99		
Memo to TPO: Lithostratigraphic Log of SD-6 Milestone Number: SPG233BM4	6/19/98	1/6/99		
Memo to TPO: Conceptual Model of UZ Milestone Number: 3GUM612M	6/30/98	12/31/98		
Memo to TPO: Framework Mdl to RPC Milestone Number: SPH40SM4	6/30/98	9/30/98		
Memo to TPO: Prelim SZ Geo Map to TSPA/LA Milestone Number: SPG248M4	7/1/98	7/1/98	7/1/98	
Memo to TPO: OCT97-Mar98 Data to RPC/TDB Milestone Number: SPH36IM4	7/1/98	5/26/98	5/26/98	
Memo to TPO: Oct97-Mar98 Data to RPC/TDB Milestone Number: SPH36TM4	7/1/98	5/26/98	5/26/98	
Memo to TPO: Data to RPC Pmp/Monit BH SD-6 Milestone Number: SPH249M4	7/6/98	7/8/99		
Memo to TPO: Prov Analy Pred vs Actual, SD-6 Milestone Number: SPG33VM4	7/15/98	9/8/98		

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo TPO: Index Map Publ/Unpubl Geol Map Data Milestone Number: SPDG20M4	7/30/98	7/30/98		
Memo to TPO: Backfill materials hydro props rpt Milestone Number: SPH261M4	7/31/98	7/31/98	7/31/98	
Memo to TPO: Subm Data Pkg WT-24 to RPC/TDB Milestone Number: SPH573M4	7/31/98	4/27/99		
Memo to TPO: Model Input/Output Update Data Milestone Number: SPH605M4	7/31/98	7/24/98	7/24/98	
DUE AFTER JULY 31, 1998 AND TRANSMITTED EARLY				
Memo to TPO: Geologic Map for the YM Area Milestone Number: SPG235M4	9/30//98	7/13/98	7/13/98	

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey
Date Prepared: 8/7/98 02:54 PM

Fiscal Month/Year July 31, 1998

	CURRENT MONTH END						FISCAL YEAR		
WBS EMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.1	98	1483	155	0	17	0	702	0	471
1.2.3	973	16412	4228	0	342	0	13230.1	0	9572
1.2.5	57	563	1017	0	82	0	652	0	438
1.2.8	53	825	0	0	0	0	664	0	481
1.2.9	48	915	315	0	42	0	652	0	548
1.2.12	5	240	0	0	0	0	73	0	39
1.2.15	151	1945	1030	0	38	0	1665	0	1361
	1385	22383	6745	0	521	0	17638	0	12910

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		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
0G1CGA1	USGS Engineering Assurance	35.7	25.2	72.7	32.8	40.0	69.6	11.3	37.7	39.8	35.2	0.0	0.0	400.1
121C9075U1	USGS Engineering Assurance (EA)	35.7	25.2	72.7	32.8	40.0	69.6	11.3	37.7	39.8	35.2	0.0	0.0	400.1
0G1CGA2	Support to Line Org. for Ongoing Docum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.0	62.3	0.0	0.0	66.5
0G1CGA2	Personnel Qualification	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.4	0.0	0.0	4.0
121C9075U2	Support to Line Org. for Documentatio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	6.7	62.7	0.0	0.0	70.5
121C9075		35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	97.9	0.0	0.0	470.6
	1.2.1.1	35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	97.9	0.0	0.0	470.6
	1.2.1	35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	97.9	0.0	0.0	470.6
0G311GA1	Scientific Programs Management & Integ	19.7	14.8	24.4	14.1	19.8	20.2	18.9	19.2	14.6	18.4	0.0	0.0	184.1
0G312GA1	Manage Nevada Operations/Earth Scien	73.3	53.2	53.6	52.7	111.1	30.2	44.4	37.9	39.3	36.2	0.0	0.0	532.0
12319090U1	USGS SP&I	93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	54.6	0.0	0.0	716.1
12319090		93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	54.6	0.0	0.0	716.1
	1.2.3.1	93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	54.6	0.0	0.0	716.1
0G32836FB1	Conduct Probabilistic Seismic Hazards A	11.5	-3.7	19.5	1.5	4.3	-2.4	11.2	-5.3	4.3	3.2	0.0	0.0	44.2
0G32836GB3	Support Seismic Design Input	18.9	22.6	6.6	27.2	17.4	18.3	2.1	23.8	15.2	0.9	0.0	0.0	153.1
12321155U1	Prepare Seismic Design Inputs	30.5	18.9	26.2	28.7	21.8	15.9	13.3	18.4	19.5	4.1	0.0	0.0	197.2
0G32836FB1	Conduct Probabilistic Seismic Hazards A	0.0	6.1	1.0	10.5	11.6	-9.8	27.9	3.6	7.8	-39.3	0.0	0.0	19.4
12321155UC	Conduct Prob. Seismic Hazards Ass.	0.0	6.1	1.0	10.5	11.6	-9.8	27.9	3.6	7.8	-39.3	0.0	0.0	19.4
0G32836FB1	Conduct Probabilistic Seismic Hazards A	0.0	0.0	0.0	11.2	1.2	26.8	12.3	11.0	1.8	-1.8	0.0	0.0	62.5
12321155UY	PSHA - Deferred	0.0	0.0	0.0	11.2	1.2	26.8	12.3	11.0	1.8	-1.8	0.0	0.0	62.5
12321155		30.5	25.0	27.2	50.4	34.6	32.9	53.5	33.1	29.1	-37.0	0.0	0.0	279.1
)211GA1	Stratigraphic Support to LA & Confirmati	21.4	9.6	12.5	20.8	19.2	9.1	5.6	8.7	1.6	21.0	0.0	0.0	129.4
12322210U1	Stratigraphy	21.4	9.6	12.5	20.8	19.2	9.1	5.6	8.7	1.6	21.0	0.0	0.0	129.4
0G32212GA3	Structural Support to LA & Confirmation	0.8	0.2	4.3	-1.8	3.5	0.0	6.0	11.8	13.5	7.3	0.0	0.0	45.4
0G32212GB1	Conduct Fracture Studies	3.9	3.7	7.8	1.4	2.2	5.6	9.2	2.7	5.2	1.4	0.0	0.0	43.0
0G32212GB2	Publish Maps & Reports for Structural St	12.0	5.1	-8.5	12.2	0.8	-5.7	10.0	19.2	25.9	3.9	0.0	0.0	74.9
0G32212GB4	Structural Support to TSPA/VA	2.1	3.1	9.3	4.0	3.2	28.6	26.8	16.3	40.4	13.5	0.0	0.0	147.3
12322210U2	Structure	18.7	12.1	12.9	15.8	9.6	28.4	52.0	50.0	84.9	26.1	0.0	0.0	310.6
0G32211GB3	Detailed Char. of BH Video Logs from Dr	1.3	8.6	-5.1	0.4	0.2	16.7	14.6	5.7	3.6	-0.2	0.0	0.0	45.8
12322210U4	Eval. BH Video Logs - DSHT BHs	1.3	8.6	-5.1	0.4	0.2	16.7	14.6	5.7	3.6	-0.2	0.0	0.0	45.8
0G32211FB2	Stratigraphic Descriptions - WT-24/SD-6	0.0	18.5	2.6	1.4	0.5	0.7	0.4	2.4	6.7	12.0	0.0	0.0	45.3

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12322210UC	Stratigraphic Descriptions - SD6/WT2	0.0	18.5	2.6	1.4	0.5	0.7	0.4	2.4	6.7	12.0	0.0	0.0	45.3
0G32211FB2	Develop Stratigraphic Description - Defer	0.0	0.0	3.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
12322210UW	Stratigraphic Descriptions - WT-24 De	0.0	0.0	3.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
12322210		41.4	48.7	26.6	38.5	29.5	55.0	72.6	66.9	96.8	58.8	0.0	0.0	534.9
0G32212FB2	Complete Site Area Geologic Map - ECR	0.0	29.6	35.7	29.7	37.9	10.4	-6.7	9.1	-0.3	1.1	0.0	0.0	146.5
0G[illegible]2FB5	Geologic Mapping of the ECRB	55.2	69.6	46.7	71.4	59.0	63.2	120.0	106.5	117.4	96.3	0.0	0.0	805.4
0G[illegible]33FB1	Predictive Geotechnical Analysis for EC	0.6	7.5	11.6	10.3	11.5	1.8	3.5	0.0	0.0	0.0	0.0	0.0	46.9
12326050U2	Structural Features and ESF Testing	55.9	106.7	94.1	111.4	108.4	75.4	116.9	115.6	117.1	97.4	0.0	0.0	998.8
12326050		55.9	106.7	94.1	111.4	108.4	75.4	116.9	115.6	117.1	97.4	0.0	0.0	998.8
0G32212GB3	Structural Support to Isotopic Age Studie	3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	3.0	0.0	0.0	19.2
12327025U1	Structural Support to Isotopic Age Stud	3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	3.0	0.0	0.0	19.2
12327025		3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	3.0	0.0	0.0	19.2
	1.2.3.2	131.6	181.4	148.0	202.0	173.2	168.5	243.0	217.3	244.9	122.3	0.0	0.0	1832.1
0G33133GBF	Support VA SZ Flow Model Sensitivity A	2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	7.1	0.0	0.0	37.8
12331200U1	Abs/Testing SZ Flow Model for VA	2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	7.1	0.0	0.0	37.8
12331200		2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	7.1	0.0	0.0	37.8
0G33124GB5	PTn Lateral Diversion (Phase II)	6.9	7.4	3.3	9.3	4.1	0.2	6.7	12.7	9.4	81.8	0.0	0.0	141.8
12332245U1	Hydrostratigraphy	6.9	7.4	3.3	9.3	4.1	0.2	6.7	12.7	9.4	81.8	0.0	0.0	141.8
0G33123GB4	Est. of Effective Porosity Values for Topa	0.0	0.0	4.1	0.2	-3.5	6.5	13.7	13.6	11.9	27.0	0.0	0.0	73.5
12332245U2	Surface-Based Borehole Testing	0.0	0.0	4.1	0.2	-3.5	6.5	13.7	13.6	11.9	27.0	0.0	0.0	73.5
0G33124FBB	Air-K & Hydrochemistry Testing ESF	45.0	36.6	71.8	43.8	52.1	51.2	58.7	43.8	36.3	11.3	0.0	0.0	450.5
[illegible]32245U3	ESF Borehole Testing	45.0	36.6	71.8	43.8	52.1	51.2	58.7	43.8	36.3	11.3	0.0	0.0	450.5
0G33123GB3	Unsaturated Matrix Flow Properties	6.3	17.8	0.9	11.9	12.1	21.9	12.7	1.3	0.0	9.9	0.0	0.0	94.8
0G33123GB5	Backfill Hydrologic Properties Measurem	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.5	6.8	0.0	0.0	41.3
12332245U4	Hydrologic Properties Measurements	6.3	17.8	0.9	11.9	12.1	21.9	12.7	1.3	34.5	16.8	0.0	0.0	136.1
0G33124GB7	ESF Drift-Scale Flux & Niche Study (Pha	0.0	5.5	23.5	-3.5	9.8	13.1	7.4	13.9	4.6	8.7	0.0	0.0	82.8
0G33124GBF	Characterization of Seepage in Alcoves	11.3	36.4	38.6	34.8	35.6	9.5	93.9	23.4	11.2	15.2	0.0	0.0	309.8
12332245U5	Percolation and Seepage	11.3	41.8	62.0	31.3	45.4	22.6	101.3	37.2	15.8	23.9	0.0	0.0	392.6
0G33131GB2	Hydraulic/Tracer Test of Prow Pass Tuff	20.2	7.1	10.0	5.4	11.6	39.7	39.9	32.3	54.0	41.5	0.0	0.0	261.5
0G33131GB4	SZ Hydraulic Testing of Borehole USW	0.0	2.4	0.3	1.8	37.1	11.6	49.2	18.9	19.1	3.3	0.0	0.0	143.6
0G33131GB5	SZ Hydraulic Testing of Borehole USW	0.0	0.0	0.6	0.0	0.0	2.8	9.6	1.1	0.5	0.0	0.0	0.0	14.5

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0G33133GA3	Planning for STC SZ Confirmation Studi	1.5	-1.2	6.4	3.4	7.5	8.6	6.3	3.6	-1.5	0.0	0.0	0.0	34.7
12332245U6	Saturated Zone Testing	21.7	8.3	17.2	10.6	56.2	62.7	104.9	55.8	72.1	44.8	0.0	0.0	454.3
0G33127GB1	Matrix Water Sources and Fract.-Matrix I	10.7	8.7	6.1	12.2	3.6	8.1	8.2	4.0	5.1	2.9	0.0	0.0	69.5
0G33127GB2	Iso./Hydrochem. Studies of UZ Water an	13.5	17.3	16.8	19.8	44.5	6.7	81.7	11.0	0.4	13.5	0.0	0.0	225.0
12332245U7	UZ Hydrochemistry	24.2	25.9	22.9	32.0	48.1	14.8	89.9	15.0	5.5	16.3	0.0	0.0	294.5
0G[illegible]23FBF	Hydrologic Charac. of SB BH - WT-24/S	0.0	0.0	11.2	3.8	4.6	13.1	-3.2	-2.6	13.4	6.6	0.0	0.0	47.0
[illegible]2245UC	Matrix Properties - SD6/WT24	0.0	0.0	11.2	3.8	4.6	13.1	-3.2	-2.6	13.4	6.6	0.0	0.0	47.0
0G33131FBG	Perched Wtr & SZ Hydrologic Tstg - WT	27.2	11.5	28.2	17.2	21.2	39.4	39.5	34.8	49.9	30.7	0.0	0.0	299.5
0G33131FBH	Iso/Hydrochem Smplg/Anal of SZs - WT	8.2	7.3	5.6	8.0	13.4	1.9	-0.3	-38.8	10.7	0.0	0.0	0.0	15.9
12332245UD	Hydrologic Tst/Hydrochem. Samping	35.4	18.8	33.8	25.1	34.6	41.3	39.2	-4.0	60.5	30.7	0.0	0.0	315.5
0G33124FBF	Evaluate Hydrology of South Ramp (RM)	1.5	6.1	3.6	19.2	13.2	32.1	6.6	4.0	-1.2	0.0	0.0	0.0	85.1
0G33124FBG	Eval Pot Lateral Diversion of Infiltrating	0.0	0.8	0.0	0.9	17.1	12.2	22.3	7.2	22.3	0.3	0.0	0.0	83.1
12332245UR	Risk Mitigation - Hydrostratigraphy	1.5	6.9	3.6	20.0	30.3	44.3	28.9	11.1	21.1	0.3	0.0	0.0	168.2
0G33124FBH	Evaluate Drift Scale Flux in ESF Niches (	7.3	2.6	-2.9	20.0	28.2	22.7	0.9	5.4	2.2	0.0	0.0	0.0	86.4
0G33124GA1	Support E&I Design Basis Modeling (RM	0.7	-0.7	0.0	0.0	0.0	3.8	6.1	3.8	9.0	0.0	0.0	0.0	22.7
12332245US	Risk Mitigation - Percolation & Seepag	8.0	1.9	-2.9	20.0	28.2	26.5	6.9	9.3	11.2	0.0	0.0	0.0	109.1
0G33123FBF	Char. Hydr. of SB Boreholes - Deferred	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	2.3	0.0	0.0	11.0
12332245UW	Matrix Properties WT-24 Deferred	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	2.3	0.0	0.0	11.0
0G33131FBG	Conduct Perched Water & SZ Hydraulic	1.5	40.1	-16.7	4.5	60.7	0.0	1.1	0.0	0.0	-0.4	0.0	0.0	90.9
0G33131FBH	Iso/Hydrochem Smplg/Init Analyses of S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.6	-11.0	0.0	0.0	0.0	45.6
12332245UX	Hydrologic Testing/Hydrochem Sampli	1.5	40.1	-16.7	4.5	60.7	0.0	1.1	56.6	-11.0	-0.4	0.0	0.0	136.5
[illegible]31FBB	Conduct C-Holes Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	3.9	9.9	4.4	8.9	0.0	0.0	132.9
0G33131FBF	Conduct Chemical & Isotopic Analysis -	0.0	0.0	0.0	0.0	0.0	0.0	3.6	6.3	0.7	1.2	0.0	0.0	11.8
12332245UY	SZ Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	7.5	16.2	5.0	10.0	0.0	0.0	144.7
0G33121GB2	Update & Enhance Net Infiltration Numer	7.1	17.7	5.7	14.2	17.1	12.2	2.5	5.8	8.4	2.7	0.0	0.0	93.3
0G33121GB3	Prediction of Future Net Infil. Rates in Re	0.0	0.0	0.0	5.2	0.5	11.0	29.8	1.7	9.7	25.0	0.0	0.0	83.0
12332247U1	UZ Modeling	7.1	17.7	5.7	19.4	17.5	23.2	32.3	7.5	18.1	27.7	0.0	0.0	176.3
0G33131GBA	Reduce Uncert. in Flux Values Used to C	2.2	7.9	3.7	5.0	5.4	3.0	3.4	9.8	8.2	33.1	0.0	0.0	81.7
0G33133FB6	Confirm SZ Hydrologic Flow Models	14.3	20.6	21.4	20.6	22.3	-0.2	8.0	7.7	11.5	16.1	0.0	0.0	142.2
0G33133GB4	Refine Calibration of Site SZ Flow Model	8.6	7.2	9.2	10.6	13.7	22.3	10.3	11.8	1.9	3.5	0.0	0.0	99.1
0G33133GB6	Test Alternate Conceptual Models	6.1	2.9	6.6	10.7	3.1	11.0	3.7	9.2	5.9	2.9	0.0	0.0	62.1

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0G33133GB7	Refine Regional Hydrogeologic Framewo	20.4	8.8	24.8	17.6	22.3	15.2	16.3	6.1	8.3	38.7	0.0	0.0	178.6
12332247U2	SZ Modeling	51.6	47.3	65.8	64.5	66.7	51.3	41.7	44.6	35.8	94.3	0.0	0.0	563.7
0G33132GB1	Iso/Hydrochem. Analysis of SZ Ground	24.9	28.2	-0.3	21.3	87.2	24.8	110.7	29.8	33.8	52.9	0.0	0.0	413.4
12332247U4	Isotopic/Hydrochemical SZ Studies	24.9	28.2	-0.3	21.3	87.2	24.8	110.7	29.8	33.8	52.9	0.0	0.0	413.4
12332245		248.7	305.7	311.8	351.8	565.8	415.3	653.2	347.9	382.1	446.4	0.0	0.0	4028.6
0G[illegible]4FB8	Percolation Flux Across Repository Horiz	0.0	26.4	24.4	68.0	36.2	-10.0	5.8	16.5	5.2	43.0	0.0	0.0	215.5
0G[illegible]24FBD	Moisture Monitoring in the ESF - ECRB	5.9	8.0	7.0	-6.3	0.9	5.2	39.5	49.3	68.8	-16.1	0.0	0.0	162.1
0G33124GBA	Infiltration of Construction Water in ESF	10.7	-3.0	0.2	15.1	6.8	1.7	13.2	4.8	2.6	6.9	0.0	0.0	59.0
12336050U3	Infiltration, Percolation & Seepage	16.6	31.3	31.6	76.7	43.9	-3.1	58.5	70.6	76.5	33.9	0.0	0.0	436.6
12336050		16.6	31.3	31.6	76.7	43.9	-3.1	58.5	70.6	76.5	33.9	0.0	0.0	436.6
0G33112FB2	Collect Site Streamflow Data (1997)	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	31.5	20.1	17.5	0.0	0.0	126.3
0G33112GB1	Collect Site Streamflow Data (1998)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12337025U2	Surface Water Monitoring	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	31.5	20.1	17.5	0.0	0.0	126.3
0G33123FBB	UZ Borehole Instrumentation & Monitorin	18.4	16.1	25.8	30.7	-11.7	10.3	-6.0	-0.9	0.9	0.4	0.0	0.0	84.0
0G33123FBC	Integrated Analysis & Interpretation	13.6	7.7	14.4	19.5	-13.1	13.2	0.2	-0.2	0.9	0.0	0.0	0.0	56.1
0G33123GB1	UZ Borehole Instrumentation & Monitorin	6.9	6.1	7.6	6.3	29.5	19.0	29.2	38.6	25.6	26.1	0.0	0.0	194.9
0G33123GB2	Integrated Analysis & Interpretation	0.0	0.0	0.0	5.0	3.8	-1.3	0.0	0.0	15.8	4.6	0.0	0.0	27.8
12337025U3	Surface Based Hydrologic Monitoring	38.9	29.9	47.8	61.5	8.5	41.1	23.4	37.6	43.3	31.0	0.0	0.0	362.9
0G33131FBD	Water-Level Monitoring	10.3	0.1	-1.9	0.5	4.2	9.0	8.1	0.8	1.0	0.7	0.0	0.0	32.9
0G33131GB1	Water-Level Monitoring	5.5	11.2	8.8	7.5	6.9	4.8	12.4	5.6	19.4	26.0	0.0	0.0	108.2
12337025U5	Saturated-Zone Monitoring	15.8	11.4	6.9	8.0	11.1	13.8	20.5	6.5	20.4	26.7	0.0	0.0	141.1
[illegible]27GB3	Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	-2.6	23.0	11.7	0.0	0.0	59.2
12337025U6	Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	-2.6	23.0	11.7	0.0	0.0	59.2
12337025		66.4	48.5	65.3	99.2	32.3	78.4	32.7	72.9	106.8	87.0	0.0	0.0	689.6
	1.2.3.3	334.0	387.6	412.4	530.4	642.9	493.8	745.2	500.1	571.7	574.4	0.0	0.0	5192.6
0G36215GB2	Future 100K Climate Records	0.0	4.7	4.1	9.6	7.1	4.2	30.2	13.7	16.1	16.9	0.0	0.0	106.5
12362252U1	Paleoclimate Analysis	0.0	4.7	4.1	9.6	7.1	4.2	30.2	13.7	16.1	16.9	0.0	0.0	106.5
0G36221GB3	Water Flux Det. Thru Repos. Blk - Age,	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	2.8	23.3	12.3	0.0	0.0	129.8
12362252U2	Geochronology of Fracture Minerals - L	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	2.8	23.3	12.3	0.0	0.0	129.8
0G36221GB1	Paleoclimate Confirmatory Analyses - LA	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	10.6	-4.7	4.6	0.0	0.0	154.7
12362252U3	Paleohydrology and WT Fluctuations	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	10.6	-4.7	4.6	0.0	0.0	154.7

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12362252		29.2	17.6	23.0	34.1	46.4	12.0	133.0	27.1	34.7	33.7	0.0	0.0	391.0
0G36221FB3	Syn. Distr./Anal. Geochron. Age Dets. (E	6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	31.2	0.0	0.0	305.2
12366050U1	Fracture Mineral Age Dating	6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	31.2	0.0	0.0	305.2
12366050		6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	31.2	0.0	0.0	305.2
0G36221GB4	Data Qualification for NRC	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	15.6	0.0	0.0	27.0
1[illegible]7027U2	Data Qualification Evaluation for the N	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	15.6	0.0	0.0	27.0
12367027		0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	15.6	0.0	0.0	27.0
	1.2.3.6	35.5	30.1	64.6	51.8	58.3	25.8	260.7	53.0	62.7	80.5	0.0	0.0	723.1
0G39BGB6	Support PISA Geology Section	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.1	6.5	6.4	0.0	0.0	57.9
12392142U1	SDD - Geology Chapter	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.1	6.5	6.4	0.0	0.0	57.9
0G39BFB2	Develop PISA Chapter 3.5 (Hydrology)	20.5	20.8	27.0	31.0	46.2	28.8	19.0	21.0	18.2	16.6	0.0	0.0	249.1
12392142U2	SDD - Hydrology Chapter	20.5	20.8	27.0	31.0	46.2	28.8	19.0	21.0	18.2	16.6	0.0	0.0	249.1
0G39BFB4	Dev. Climate/Met. Site Desc.	29.5	42.0	51.5	28.4	34.7	37.8	44.4	-3.1	12.0	1.5	0.0	0.0	278.6
12392142U3	SDD - Climate/Meteorol. Chapter	29.5	42.0	51.5	28.4	34.7	37.8	44.4	-3.1	12.0	1.5	0.0	0.0	278.6
0G39BGB5	Support Devel. of PISA Geochem. Sectio	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	9.0	2.4	5.9	0.0	0.0	62.1
12392142U4	SDD - Geochemistry Chapter	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	9.0	2.4	5.9	0.0	0.0	62.1
0G39BGB6	Chapter Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	18.2	7.5	16.6	0.0	0.0	161.9
12392142U6	SDD - Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	18.2	7.5	16.6	0.0	0.0	161.9
0G39BFB2	SDD - Hydrology Chapter - Deferred	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
12392142UY	SDD- Hydrology Chapter - Deferred	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
0G32211GB4	USGS Support to 3-D Integrated Site Mo	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	11.0	6.3	0.0	0.0	25.6
[illegible]92212U1	Input to 3-D Integrated Site Model	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	11.0	6.3	0.0	0.0	25.6
0G39BGA1	Support PR Input/Review	9.5	2.9	3.9	1.0	0.2	0.0	2.9	0.2	0.1	0.0	0.0	0.0	20.7
12392570U1	PR Review/Input	9.5	2.9	3.9	1.0	0.2	0.0	2.9	0.2	0.1	0.0	0.0	0.0	20.7
12392142		98.7	81.8	109.7	84.5	119.8	107.0	97.8	45.5	57.7	53.2	0.0	0.0	855.8
0G39BGA1C	Provide Regulatory Support	0.0	0.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	0.0	12.5
0G39BGA1F	Provide QA Implementation Support	9.3	11.7	27.4	13.6	10.4	46.2	-19.4	7.2	20.3	54.8	0.0	0.0	181.6
0G39BGA2C	Provide Support for Dev/Rev of Reg Doc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	12.4	0.0	0.0	21.8
12399090U1	Site Investigations Support	9.3	12.3	28.8	13.6	10.4	46.2	-19.4	7.2	29.7	77.7	0.0	0.0	216.0
12399090		9.3	12.3	28.8	13.6	10.4	46.2	-19.4	7.2	29.7	77.7	0.0	0.0	216.0
	1.2.3.9	108.0	94.1	138.5	98.2	130.2	153.3	78.5	52.7	87.4	130.9	0.0	0.0	1071.8

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1.2.3		702.0	761.2	841.6	949.2	1135.4	891.8	1390.6	880.3	1020.7	962.8	0.0	0.0	9535.7
0G535GA1	Technical Data Coordination	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	0.0	0.0	374.1
12532186U1	Provide Technical Data Base Input	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	0.0	0.0	374.1
12532186		32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	0.0	0.0	374.1
1.2.5.3		32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	0.0	0.0	374.1
0G[illegible]A1	Support to Performance Assessment	5.3	6.4	3.1	3.1	3.4	0.0	5.9	9.3	4.3	0.0	0.0	0.0	41.0
1[illegible]121U1	Support to Performance Assessment	5.3	6.4	3.1	3.1	3.4	0.0	5.9	9.3	4.3	0.0	0.0	0.0	41.0
0G541FA2	Deferred - Support to Performance Asse	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	4.9	5.6	12.7	0.0	0.0	23.1
12541121UY	Provide Support to Performance Asses	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	4.9	5.6	12.7	0.0	0.0	23.1
12541121		5.3	6.4	2.4	3.1	3.4	0.0	6.6	14.2	9.9	12.7	0.0	0.0	64.1
1.2.5.4		5.3	6.4	2.4	3.1	3.4	0.0	6.6	14.2	9.9	12.7	0.0	0.0	64.1
1.2.5		38.1	32.2	43.1	29.6	46.9	33.0	39.3	58.2	61.0	56.6	0.0	0.0	438.2
0G825GA1	Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	0.0	0.0	81.9
12829121U1	Federal Occupational Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	0.0	0.0	81.9
12829121		8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	0.0	0.0	81.9
1.2.8.2		8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	0.0	0.0	81.9
0G847GA2	Conduct Rad Water Quality Sample Coll	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	9.3	0.0	0.0	48.3
12842086U1	Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	9.3	0.0	0.0	48.3
12842086		15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	9.3	0.0	0.0	48.3
0G847GB1	Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	34.1	0.0	0.0	350.4
12849121U1	Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	34.1	0.0	0.0	350.4
12849121		0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	34.1	0.0	0.0	350.4
1.2.8.4		15.7	39.5	19.9	30.5	22.8	125.0	28.3	37.7	36.0	43.4	0.0	0.0	398.7
1.2.8		24.0	45.8	28.1	38.5	29.8	132.9	35.8	47.1	45.6	52.8	0.0	0.0	480.6
0G9121GA	Technical Project Office	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	0.0	0.0	318.8
12919135U1	USGS Project Management	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	0.0	0.0	318.8
12919135		28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	0.0	0.0	318.8
1.2.9.1		28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	0.0	0.0	318.8
0G922GA	Participant Project Control	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	0.0	0.0	229.5
12929135U1	Project Control - USGS	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	0.0	0.0	229.5
12929135		25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	0.0	0.0	229.5

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	1.2.9.2	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	0.0	0.0	229.5
	1.2.9	54.0	52.7	64.9	47.4	54.9	61.1	66.7	59.5	39.4	47.6	0.0	0.0	548.3
0GC522GA1	Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	0.0	0.0	38.6
12C59130U1	USGS Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	0.0	0.0	38.6
12C59130		4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	0.0	0.0	38.6
	1.2.12.5	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	0.0	0.0	38.6
	1.2.12	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	0.0	0.0	38.6
0GF23GA1	Support/Personnel Services	44.6	42.2	12.4	32.1	32.5	37.2	35.4	39.2	56.3	49.1	0.0	0.0	381.1
0GF23GA5	Procurement & Property Management	4.5	7.8	7.7	5.2	6.8	8.6	9.1	9.7	10.5	10.7	0.0	0.0	80.6
12F29110U1	Personnel/Procurement/Property Servi	49.1	49.9	20.1	37.4	39.2	45.9	44.5	49.0	66.8	59.8	0.0	0.0	461.7
0GF23GA2	Facilities Management (space)	0.0	123.3	61.7	61.7	61.7	44.7	58.8	58.8	58.8	58.8	0.0	0.0	588.3
0GF23GA3	Facilities Management (computers/phone	0.0	36.3	18.2	18.2	18.2	13.2	17.3	17.3	17.3	17.3	0.0	0.0	173.3
0GF23GA4	Facilities Management (other)	0.0	19.7	9.8	9.8	9.8	7.3	9.4	9.4	9.4	9.4	0.0	0.0	94.2
12F29110U2	Facilities Management (USGS)	0.0	179.3	89.7	89.7	89.7	65.2	85.6	85.6	85.6	85.6	0.0	0.0	855.8
12F29110		49.1	229.3	109.8	127.0	128.9	111.0	130.1	134.6	152.4	145.4	0.0	0.0	1317.5
	1.2.15.2	49.1	229.3	109.8	127.0	128.9	111.0	130.1	134.6	152.4	145.4	0.0	0.0	1317.5
0GF3GA1	USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	0.0	0.0	43.8
12F39110U1	USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	0.0	0.0	43.8
12F39110		4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	0.0	0.0	43.8
	1.2.15.3	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	0.0	0.0	43.8
	1.2.15	53.5	232.6	114.4	131.3	132.5	115.0	135.1	138.7	157.3	150.9	0.0	0.0	1361.3
OPERATING		911.4	1152.8	1168.7	1232.7	1443.0	1307.2	1682.4	1227.3	1374.1	1373.5	0.0	0.0	12873.3
CAPITAL EQUIPMENT		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRAND TOTAL		911.4	1152.8	1168.7	1232.7	1443.0	1307.2	1682.4	1227.3	1374.1	1373.5	0.0	0.0	12873.3
FTEs														
FEDERAL		111.7	90.6	104.7	97.4	86.4	94.9	98.4	105.4	80.7	129.4	0.0	0.0	
CONTRACT		31.5	29.4	36.1	28.3	31.4	34.7	37.7	28.3	44.6	43.2	0.0	0.0	
TOTAL		143.2	120.0	140.8	125.7	117.8	129.6	136.0	133.7	125.3	172.6	0.0	0.0	