Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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JUN 05 1998

OVERNIGHT MAIL

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High Level Waste & Uranium Recovery
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U.S. Nuclear Regulatory Commission
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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 April 1998.

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

Stephan Brocoum
Assistant Manager for Licensing

AML:AVG-1891

Enclosure:
Ltr, 05/14/98, Craig to Kozai, w/encl.

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102.8
WM-11

YMP-5

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May 14, 1998

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

Attached is the USGS progress report in the required format for the month of April, 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
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U.S. GEOLOGICAL SURVEY
EXECUTIVE SUMMARY
April, 1998

COORDINATION AND PLANNING

U.S. Geological Survey-Yucca Mountain Branch is currently processing 133 scientific papers prepared by USGS authors. Of these, 75 are related to geological studies and 58 to hydrologic studies. In addition, 9 abstracts are being processed.

Reports published in April:

Geldon, A.L., Umari, Amjad, M.A., Earle, John D., Fahy, Michael F., Gemmell, James M., and Darnell, Jon, 1998, Analysis of a multiple-well interference test in Miocene Tuffaceous rocks at the c-hole complex, May-June 1995, Yucca Mountain, Nye County, Nevada: U.S. Geological Survey Water-Resources Investigations Report 97-4166, 33 p.

Flint, L.E., 1998, Characterization of hydrogeologic units using matrix properties, Yucca Mountain, Nevada: U.S. Geological Survey Water-Resources Investigations Report 97-4243, 64 p.

Anna, L.O., 1998, Preliminary three-dimensional discrete fracture model, Tiva Canyon Tuff, Yucca Mountain area, Nye County, Nevada: U.S. Geological Survey Open-File Report 97-833, 33 p.

Anna, L.O., 1998, Preliminary three-dimensional discrete fracture model of the Topopah Spring Tuff in the exploratory studies facility, Yucca Mountain area, Nye County, Nevada: U.S. Geological Survey Open-File Report 97-834, 41 p.

La Camera, R.J., and Locke, G.L., 1998, Selected ground-water data for Yucca Mountain region, southern Nevada and eastern California through December 1996: U.S. Geological Survey Open-File Report 97-821, 79 p.

Graves, R.P., and Goemaat, R.L., 1998, Water levels in the Yucca Mountain area, Nevada, 1995: U.S. Geological Survey Open-File Report 97-101, 92 p.

GEOLOGY
Geologic Framework

Project staff activities included:

1) Began compilation of preliminary geophysical logs into CONTACT workbook.

2) Developed data collection techniques for fracture and lithologic features in boreholes of the drift-scale and single-heater test.

3) Participated in a "core-party" to examine overcore and post-testing core from the single-heater test.

4) Presented latest progress on lithostratigraphic data bases for a NEPO management review.

5) Attended two one-half day workshops on Geologic Framework Model 3.0 and zeolite distribution models.

6) Continued preparation of the ARC file for the Site Area geologic map, cross sections, and text, for publication as a USGS map product.

7) Completed preparation of the Cross Drift cross sections, map, and text.

8) Prepared text for a report, "Structural Geology of Yucca Mountain", intended for outside publication.

As part of the 1:50,000-scale geologic map compilation for the SZ Site Area, field work was conducted in northern Crater Flat, Little Skull Mountain, Jackass Flat, Rock Valley, and the Calico Hills. Linework for some of this mapping was also digitized as part of the compilation effort. Activities related to the ECRB cross-drift included: (1) testing digital photographs to develop capabilities of this technique for use in cross-drift reports; (2) completion of the initial phase of the Rock Mass Data macros for use in calculating the RQD, Q, and RMR; (3) completion of the initial phase of the DLS550 macros in recording discontinuity data from the cross-drift; and (4) refinement of sample description and classification for existing ESF samples in support of statistical analysis of distribution of bomb-pulse chlorine-36 in the ESF.

Seismotectonic Studies

Data were assembled and a text was prepared for an analysis and a model of coupled volcanic processes relative to tectonic scenario evaluations for performance assessment. A tectonic scenario is an extrapolated history of deformation with respect to the integrity of nuclear waste isolation at Yucca Mountain. The history is a description of the origin and evolution of some observable tectonic feature, such as a fault or a volcano. The scenario also includes an extrapolation that continues the evolution to involve the repository in various ways, the probability of which is constrained by some feature of the repository or its proximal environment (conditions, processes).

The approach used for scenario development and evaluation includes the following steps:

1. Begin with the "initiating event". An initiating event:
   - involves a significant transfer of energy or strain release within the earth sufficient to threaten the natural or engineered barrier system of the potential repository,

- involves nonrecoverable strain and results in a new structural configuration (disruptive feature),

- occurs as a discrete event in time,

- could occur within the lifetime of the repository.

2. Establish the process by working backward using data from the observable disruptive feature (physical, chemical properties, history, structural context) to the cause (the initiating conditions), aided, where appropriate, by one or more process models.

3. Assess the various possible outcomes of the initiating event (disruptive effects on the repository). Outcomes include not only structures, but consequent processes which could be transient, permanent, or long-lived (characterized by a decay function).

4. Estimate the risk to the repository: the probability that disruption could happen at the repository versus the probability that the event could happen elsewhere (or happen at all).

5. Consider the kinds and extent of effects on waste. This is largely an engineering problem as it depends on the condition of the waste package, which has its own evolution. It also depends on the extent of the disruption (ranges from minimal to worst case).

Based on the tectonic history of Yucca Mountain within the last million years (i.e., within a plausible recurrence time frame), three kinds of initiating events are likely to be of consequence to a nuclear waste repository: (1) basaltic intrusion and eruption at or near the mountain, (2) fault displacement and fracture-related phenomena at the mountain, (3) ground motion caused by proximal or distant earthquakes.

These events may have important consequent effects on the hydrologic regime. Since the disruptive features are structural, their influence may be significant only in the presence of increased groundwater infiltration rates, which is a function of climate change. For example, dike intrusion and fault displacement could create groundwater dams or more efficient flowpaths that could change the height of the water table or the configuration of perched water bodies. Such changes could become exacerbated under conditions of high infiltration or increased groundwater flow volumes. The problems and uncertainties associated with groundwater are thus complex, involving both endogenous (tectonic) influences and exogenous (climatic) influences, and require scenarios that link tectonics and groundwater.

Evaluation of tectonic disruption scenarios is proceeding by an analysis of basaltic volcanism, its possible disruptive effects and hazards, and its possible coupling with fault displacement and earthquakes at Yucca Mountain. The analysis traces the evidence for structural control of volcanism, location of intrusions, and triggering processes, in the context of Pleistocene extension in Crater Flat. Plio-Pleistocene volcanism centered in Crater Flat is an aspect of late tectonic development of the basin. Crater Flat basin is essentially a hole in the crust controlled by deep fracturing and faulting. From time to time the fractures become dilatant or new fractures

form and allow magma to ascend through the crust. The timing of these events, and the precipitating conditions are unknown, so little predictive power is provided by the analysis. For example, it is unclear whether fractures propagate upward from the magma sources due to fluid pressure buildup, or whether strain thresholds in the crust are exceeded during extension, and resident magma bodies are tapped by fractures generated in the crust. It is likely that faults at Yucca Mountain are reactivated during the preceding volcanic events, an inference supported by fault fissures at Yucca Mountain that contain basaltic ash.

A memorandum report (SPG28RM4) was submitted, summarizing the results of the Probabilistic Seismic Hazard Assessment project. During the final project meeting, held in Las Vegas April 6, 1998, members of the management team outlined the PSHA project, and described the major results. Additional presentations discussed how the results are being used for seismic design inputs and that they are being incorporated into the total system performance assessment for the proposed repository. The meeting audience, in addition to project personnel and some members of the expert panels, included representatives of the Nuclear Regulatory Commission and Nuclear Waste Technical Review Board, as well as staff from several affected governmental units.

The following topics that were summarized for the PSHA final results meeting included:

1. Seismic source models to assess vibratory ground motion hazards.

2. Ground motion characterization, including types of seismic sources considered, site conditions, and estimates for median, aleatory variability, epistemic uncertainty in the median, and epistemic uncertainty in aleatory variability.

3. Models and approaches used to characterize fault displacement hazards.

4. Results of fault displacement analyses.

5. Development of seismic design inputs.

6. Use of seismic design inputs in both surface and subsurface design, including vibratory ground motions, fault displacement hazard curves, and dynamic strain assessments.

7. Seismic disturbance calculations being conducted for the total system performance and viability assessments.

HYDROLOGY

Regional Hydrology

The FY1997 site streamflow and precipitation data have been submitted to the RPC in completion of Level 4 **milestone SPH36DM4 [Memo to the TPO: Submit FY97 streamflow data to RPC/TDB]**, completing that activity on April 6. Final records packages for all streamflow and precipitation data, with supporting information, have been submitted. Final tables of streamflow and precipitation data were prepared by the Nevada District data section for inclusion into the annual water-resources data report, in completion of Level 4 **milestone SPH36CM4 [Publish selected streamflow and precipitation data for FY97]**.

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. Computation continued of peak discharges for the February runoff event for the four recording sites and at miscellaneous sites on and near Yucca Mountain.

Unsaturated-Zone Hydrology

Analysis and interpretation of borehole monitoring data continued with submittal of the data package titled "Deep Unsaturated-Zone Surface-Based Borehole Instrumentation Program—Data Submittal for USW NRG-7a, USW NRG-6, UE-25 UZ #4, UE-25 UZ #5, USW UZ-7a, and USW SD-12 for the time period October 1, 1997 through March 31, 1998," in completion of Level 4 **milestones SPH36IM4** and **SPH36TM4**. In other borehole-related work, staff presented a talk at the monthly progress meeting on the

transient effects of El Niño on borehole data from UZ #4 and #5. Staff also submitted a proposal to instrument shallow boreholes in alluvial material to determine more closely the movement of recharge through the alluvium.

Several routine borehole-monitoring activities continued. 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 as well for unusual occurrences, and any statistical outliers were flagged. Proposed modifications to three technical procedures were revised and returned to the QA group. Scanning of supporting sensor-calibration records has now been completed. In calibration and maintenance activities, two pressure-transducer calibration runs were performed, as were three thermistor calibration runs. Set-up was completed for automated calibrations on the Sierra calibration bench. Two Hastings mass-flow controllers were calibrated. The QA audit team visited the calibration lab and shelter UZ-7a. Some 37 trips were made to field sites for correction of generator, chiller, UPS, and data-collection problems, including 20 visits for routine generator maintenance. Thirteen visits were made for data collection or to fix data-collection problems.

The land line for the phone at site #7 (SD-12) was finally repaired at the beginning of April. It then went down again which meant personnel again needed to retrieve data manually from the site. The line has since been repaired, but the generator then failed after taking out a large shelter UPS. We are currently waiting to switch the UPS with a spare unit; repair of the UPS will require a service call.

In air-permeability work, a report on the results and analysis of air-injection and tracer testing in the Upper Tiva Canyon, Bow Ridge Fault, and Upper Paintbrush Contact Alcoves has been approved by USGS Headquarters and will be released as USGS Water Resources Investigations Report 98-4058. The WRIR currently is preparation for printing. Three-dimensional cross-hole tracer testing was conducted in the Northern Ghost Dance Fault Alcove. Helium and SF_6 were released from isolated intervals of major-faults boreholes MF #2 and MF #3, and the travel time to the convergent borehole MF #1 was measured. Tracer-arrival plots were prepared and interpreted to yield effective porosity values. Initial analysis of the tracer tests indicated effective porosity values in the range from .01 to .33. That result indicated that the effective porosity values are 2 to 3 orders of magnitude larger than the fracture-porosity values, and therefore particle transport times will be 2 to 3 orders of magnitude larger than times calculated using fracture-porosity estimates. Analysis of the Ghost Dance fault pneumatic and tracer testing, as well as report preparation on that work, continued. Analysis of the second phase of cross-hole tracer testing was completed. The second-phase effective porosity values (.01 to .33) agree with the earlier results (0.02 to 0.24). Use of fracture line-survey data to develop a discrete fracture model of the Ghost Dance fault continued. The discrete fracture model will provide a better understanding of fracture control of tracer transport in fractured tuff.

Several efforts in ESF hydrology continued. Data collected in Phase II drift-scale flux testing during the period from October 1997 through January 1998 were submitted to the

RPC, completing level 4 **milestone SPH282M4 [Memo to TPO: Submittal of data package to the RPC/TDB]** on April 30 in a data package entitled "Temperature, Relative Humidity, and Barometric Pressure for ESF-Niche 3566 (Niche 1) and ESF-Niche 3650 (Niche 2) from 6/27/97 to 1/31/98" [the DTN is GS980408312242.009]. Data collection for the next period (through July 1998) has been initiated. Atmospheric monitoring in Alcove #1 evaluated wet-up conditions of the alcove. Data also were collected from 78 heat-dissipation (HD) probes located in Alcoves #1 and #7 and in Niche #1 to monitor wet-up conditions. Time-domain reflectometry data are being used to determine changes in water content to complement the water-potential measurements. Eight surface-based HD probes are monitoring soil water potential in and near the Ghost Dance fault. A drip-detection system was placed under approximately 42 ft of the Ghost Dance fault zone in Alcove #7. An additional 35 ft of drip-detection system was installed in the rear of the alcove. Installation of the drip-irrigation system for the Alcove #1 seepage study was completed. Fourteen drip lines (35 drippers in each line) were placed every 2 ft. Two sets of HD probes and four tensiometers have been placed in the infiltration plot to monitor water infiltration. Approximately 29,000 gallons of water have been applied to the site since the experiment started on March 9. Only two isolated drips of water were detected in the alcove by the end of the reporting period. Those drips appeared to be associated with a rock bolt and to increases in the relative humidity in the alcove. As of May 8, however, 172 liters of water were collected from Alcove #1. All of the water is construction water, on the evidence of preliminary Br analysis, and represents some 5% of the applied water. The increasing rate of influx appears related to areal increase of the wet zone. There is no evidence of structural control of the water.

Atmospheric monitoring in Alcove #7 continued. Air-temperature, relative humidity and barometric pressure measurements are being made in the fault zone, adjacent to the fault zone, and in the main drift for comparison. No moisture changes have been detected in the subsurface. In an attempt to better understand the movement of moisture outside of the heated alcove experiment, HD probes were installed in the crown outside of the bulkhead in Alcove #5 to determine the water-potential and temperature gradients associated with the dripping surfaces. No interpretations are being made until equilibrium between the rock and the probes is reached, as the probes initially are installed saturated.

In study of lateral diversion in the PTn, nine boreholes continue to be monitored for water potential. Several packers have required repair. Remaining boreholes are expected to receive instrumentation in May. No additional drilling has been done; the date of drilling of Alcove #4 boreholes is uncertain. A data package of unsaturated hydraulic properties of borehole samples from the PTn exposure in the ESF North Ramp was compiled and given technical review. The package was submitted to the RPC and TDB as of April 30, 1998, completing level 4 **milestone SPH258M4 [Memo to TPO: Submittal of data package to RPC/TDB]**. That data package (DTN: GS980408312242.008) is titled "Unsaturated Hydraulic Properties of Borehole Samples from the PTn Exposure in the ESF North Ramp (ESF Station 7+27 m to ESF Station 10+70 m) Measured Using a Centrifuge." Several samples have been run in the ultracentrifuge for determination of

moisture retention and for verification of previously determined values obtained from UFA Ventures. Those data have not yet been analyzed.

Moisture monitoring in the ECRB continued. In work on TBM water migration, two temperature and relative humidity stations have been established in the ECRB. One of the stations is also measuring wind speed. Three HD probes have been installed in 2-m-deep holes. The first probe is installed at Station 0+50 meters and the others are installed at additional 25-m spacing, at Stations 0+75 and 1+00. All of the stations have been connected to a coaxial network to enhance the data-downloading process. Two HQ drill holes have been completed in the ECRB. The first hole is at Station 0+50, and the second hole is at Station 1+00. The holes have been cored and neutron-logged. The holes will be logged, when possible, to determine the volumetric water loss from the tunnel walls. The ECRB Slant Hole #2 has also been neutron-logged. That is the slant hole that was under the first 25 m of tunnel mined by the TBM. The hole was originally 30 m long. However, during the TBM start-up process, the hole casing was punctured and 9 m of fill entered the hole. All available Cross-Drift construction data are being gathered. The information consists of daily TBM advance rates, water use in the ECRB, and changes to the vent system. The information is being placed into a spreadsheet that will be used to calculate the amount of water lost from the tunnel due to evaporation. That information, combined with the TBM water-migration data, is being used to determine how much of the water loss is due to construction water relative to formation water.

The predictive analysis for hydrologic conditions and physical properties in the East-West Cross Drift was completed as milestone SPH351M4 in January. Work has continued for conversion that memo to a USGS-approved open-file report. Data packages for the data used in that report have received technical review and were submitted to the RPC and the TDB. Responses to technical reviews have been incorporated. Technical suggestions and revisions made by the M&O also were incorporated. Figures, graphs, and tables in the report were revised. The current draft of a proposed USGS open-file report entitled *Predictions of physical properties and moisture conditions in the Cross Drift at Yucca Mountain, Nevada* previously was submitted to meet level 4 milestone SP33ABM4. That draft report provided the basis for and the results of estimates of the spatial distribution of bulk rock properties (such as bulk density, porosity, and grain density), saturations, water contents, water potentials, and overlying surface net infiltration along the alignment of the East-West Cross Drift. The report requires substantial revision to meet USGS requirements for approval.

Samples have been received from coring in SD-6 and WT-24 for hydrologic characterization of those surface-based boreholes. Determinations of physical properties and water contents are expected to be completed within the next reporting period. Sidewall coring will be performed in both boreholes with the expectation of acquiring additional information.

Work on net infiltration continued with efforts on a Fortran program for defining surface flow for all watersheds overlying the area of the UZ ground-water flow modeling

domain, based on the 30-m elevation grid used for the net-infiltration model. Development of an empirical channel-area model based on the number of upstream cells continued. Development of a stochastic air-temperature module was initiated, and the development of a new evapotranspiration (ET) module (which accounts for bare-soil evaporation and utilizes parameters defining vegetation type and density) also continued. Testing of modifications made to allow for annual and daily mass-balance terms for each grid location continued. Application of the model to the WT-2 Wash sub-drainage model for predicting net infiltration rates over Alcove 7 in response to an active ENSO and for conducting model sensitivity analysis continued. Calibration of the coupled net infiltration—surface-flow (runoff routing) model continued, using available streamflow records for gages in Drill Hole Wash, Pagany Wash, Wren Wash, and Split Wash. Testing and calibration of a preliminary soil-depth model used the 1980—95 daily precipitation record and 100-yr stochastic simulation of current climate. Incorporation of the updated geologic map into the geospatial parameter input file continued, as did sensitivity analysis of soil depth and effective bedrock permeability.

Estimation of net infiltration rates in response to potential future climates continued, with 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. The simulated air-temperature module was modified to allow for variable mean annual air temperature and a variable range between maximum summer temperature and minimum winter temperature. A sensitivity analysis of the impact of air temperature on net infiltration and stream flow for potential future climates was initiated. Based on input from paleoclimatic studies, evaluation of analog sites for developing stochastic simulations of daily precipitation for various potential future climates continued, using both precipitation and air-temperature records available for those sites. Input from paleoclimatic studies is also being used to estimate soil depth and soil type, as well as vegetation associations and densities for potential future climates.

Isotopic efforts in support of hydrology and water-matrix interaction continued. In results of analysis of SD-9 and SD-12 pore-water salts, data from SD-9 samples show a less smooth variation in Sr isotopes with depth than seen in similar data from SD-7. Strontium concentrations, however, decrease smoothly with depth in the PTn. A water-rock interaction model is being developed to explain these data. In isotopic support for thermal testing, three additional samples from the single-heater test were obtained. The samples will be analyzed for Sr and U. Six samples of ECRB construction water were analyzed for Sr isotopes. Nine samples were distilled, and water was collected for analysis of H and O isotopes.

Several efforts in UZ hydrochemistry continued, especially in analysis of ESF core and in analysis of water from boreholes, including WT-24 and SD-6. Dissolved CO_2 and pore water were vacuum-distilled from six South Ramp (SR)-Moisture Study core samples using Scientific Notebook procedure SN-0102. The extracted CO_2 will be analyzed for carbon isotopes, and the extracted pore water will be analyzed for tritium, D/H, and

$^{18}O/^{16}O$. Pore water was extracted from three ESF cores, and from 10 SD-6 samples, one WT-24 sample, and four UZ-7a samples, for similar analysis. Alkalinities were determined for six SD-6, two WT-24, and two SD-12 pore-water samples. Thirteen SD-6, one WT-24, and three SD-9 pore-water samples were counted for tritium concentrations. Pore water was extracted from three WT-24 and seven SD-6 core samples using high-pressure one-dimensional compression. Seven CO_2 gas samples extracted from ESF cores and four sets of SD-6 pore-water samples were sent to Beta Analytic for carbon isotope analysis. Six SD-6 pore-water samples were delivered for stable isotope (TIC, D/H, and $^{18}O/^{16}O$) analyses, and four SD-6 pore-water samples and one disguised spike were delivered to Huffman Laboratories for anion and cation analyses. Samples from boreholes WT-24, SD-6, and CWAT#3 were requested from the SMF for shipment to Denver.

In other work, water collection by compression and distillation methods, tritium concentrations, and major-ion data from water samples were entered into the appropriate data bases. The liquid scintillation counter was calibrated. Due to inability to get satisfactory bicarbonate analyses with the ion chromatograph, the UZ hydrochemistry laboratory purchased equipment necessary to perform alkalinity titration on small-volume water samples. The titration procedure is set up and producing satisfactory results. Staff attended a one-day meeting at LBNL on April 16 for discussion of hydrochemical data and modeling, and to provide new data for the UZ site-scale process modelers. Additional needs for new data were also discussed. Plans were made for USGS participation in development of a ^{14}C age correction on perched water using the NETPATH geochemical model. Staff revised the paper titled *Hydrochemical investigations and geochemical modeling in characterizing the unsaturated zone at Yucca Mountain, Nevada* in response to technical review comments from USGS Headquarters.

Saturated-Zone Hydrology

Hydraulic testing of SZ boreholes continued. As of April 22, borehole USW WT-24 was drilled to a depth of 2,037 ft and cored to a depth below land surface of 2,492 ft. A fracture and water both were encountered at 2,492 ft. As of April 24, the water level in the borehole had risen to a depth of 2,172 ft below land surface. Final equilibrium of the water table has not been reached. Bailed samples of the upper part of the regional SZ were collected from WT-24 immediately after the SZ was encountered. Those samples have been submitted to several laboratories for analysis. Logging of the hole will take place after the borehole is completed. Also through April 22, borehole SD-6 was drilled to a depth of 2,008 ft, without encountering the regional water table or perched water.

Numerous borehole water-level measurements were conducted, including UE-25 J-11 on March 31; USW WT-1 on April 1; USW H-3 (upper and lower intervals) on April 2; UE-25 c#1, p#1, and WT#15 on April 7; UE-25 J-13, J-12, WT#13, WT#6, WT#16, and USW WT-2 on April 8; USW VH-1, WT-10, WT-11, WT-7, and H-6 (upper and lower intervals) on April 9; USW H-1 (tubes 1, 2, 3, and 4) on April 13; UE-25 b#1, WT#4, and USW H-4 (lower interval) on April 15; USW H-5 (upper and lower intervals) and UE-25 WT#12 on April 16; UE-25 J-11 on April 21; UE-25 WT#6, WT#15, and WT#16 on

April 22; and UE-25 WT#13 and p#1 on April 23. Review of April 1998 water levels was initiated.

Level 4 **milestone SPH37HM4 [Memo to TPO: 1996 Water-level data]** was completed ahead of schedule with several actions. A memo to the TPO was completed on April 2, and the report titled *Water levels in the Yucca Mountain area, Nevada, 1996* was approved as USGS Open-File Report 98-169, also on April 2, and sent to the Colorado District Reports Processing Unit.

During April, re-analysis of results from a hydraulic test conducted in JF-3 in 1992 began. The results from the pumped well had been analyzed at the time (1992), and an effort now is being made to interpret the drawdown in J-12, resulting from the pumping in JF-3, as the drawdown in an observation well. Also, the drawdowns in JF-3 and J-12 are being analyzed to evaluate interpretation as drawdowns in observation wells during intermittent pumping of J-13. The objective of this effort is to obtain reliable saturated aquifer properties of the Crater Flat Group in the Jackass Flats areal domain defined in the Second Tracer Complex proposal. The effort will also lead to a proposal to conduct cross-hole tests between J-13, J-12, and JF-3 under tightly controlled conditions and with similar equipment as used during the long-term test at the C-hole complex (May 1996 to November 1997). Drawdowns from that test at observation wells H-4, WT-14, ONC-1, and WT-3 were analyzed to obtain reliable estimates of the transmissivity and storativity of the saturated Crater Flat Group within the area of influence of the test. Planning continued for expansion of the C-hole complex with one borehole downgradient of the present complex, and one located upgradient, to allow large-scale tracer tests and to obtain hydraulic and transport parameters of the fault zone intersecting the bottoms of the existing C-holes.

During the first part of April, the downhole instrumentation of boreholes UE-25 c#2 and c#3 for testing the Prow Pass interval was completed. A series of hydraulic tests began on April 20 with preliminary testing of c#3. Pumping was conducted with the packers deflated to determine pump performance. A step-drawdown test was conducted in c#3 to determine the relationship for specific capacity and discharge for calculation of well efficiency and to determine the pump settings needed to produce different discharge rates from the Prow Pass interval. A 24-hour hydraulic test was conducted in c#3 to obtain preliminary hydraulic parameters for the Prow Pass interval and for calculation of well efficiency. Similar preliminary hydraulic testing of borehole c#2 was conducted during the week of April 27 and also was successful. That preliminary testing of boreholes c#3 and c#2 indicated that although the Prow Pass can be pumped at rates up to about 12 gpm, the pumping is not sustainable at higher rates. It appears that hydraulic and tracer testing will have to be conducted at a 5-gpm rate.

Several ongoing efforts continued in the testing of alternate conceptual models and refinement of regional hydrogeologic framework and flow models. Staff refined the methods used to populate the relational database structure with data from NWIS. The processes used to populate the data base have been organized into eight separate macros that remove data errors and populate each table in the data base. Improvements to the

database design will enhance processing of the original NWIS data retrieval and any future retrievals. Previously developed code and queries were revised to fix general data errors rather than specific data errors found in the source data. Preparation of documentation of the data base continued. Various routines were developed to convert data codes to meaningful text and to relate discrete parts of a borehole individually to all other available data for the borehole. Work continued on improvement of the regional hydrogeologic framework model. The UGTA regional framework grids were compared to the YMP cross sections and found to match reasonably well. Minor edits of inconsistencies were corrected. Emphasis was placed on pre-Cenozoic surfaces. Planning also continued for integration of the regional ground-water flow model with the UGTA flow model and for support of the Death Valley regional model. Integration of the Hydrologic Flow Barrier Package into MODFLOWP was completed and evaluated on one test case. Hydrologic flow barriers can now be present when other parameters are being estimated, and parameters that govern the conductance of the barriers can be included in the regression. Additional verification runs will be conducted. Conversion to version 3.3. of MODFLOWP was tested on the 70,000-cell model. Ground-water evaluation runs continued for evaluation of best addition of vertical discretization to the regional flow model. Runs for development of sensitivity distributions were completed. Image acquisition and georegistration was completed for work with evapotranspiration (ET). A preliminary classification of ET areas has been developed.

Activity continued on sections of the TSPA-VA report concerning ground-water flow modeling. Transmittal of sections of chapter 2.9 occurred on April 10, completing that task and level 4 **milestone SPH133M4 [Memo to TPO: Chapter 6.x of the TSPA-VA document]**. Planning continued for upcoming review of selected sections of the VA and TSPA-VA documents with Sandia staff. Revisions were made to a USGS administrative report documenting pathline analysis for TSPA-VA abstraction/testing, including revision of illustrations. The report has conditional USGS approval, pending changes. Review of the current site hydrogeologic framework model also continued, as did work on a report describing that model. Staff participated in discussions in Las Vegas on status of the ISM 3.0 site-scale geologic model on April 23. Current plans are to incorporate ISM 3.0 into the site-scale hydrogeologic framework model, which will be used to construct the revised site-scale flow model for LA. To refine model calibrations, specification of fluxes into the site SZ flow model using a grid with uniform 1,000-m horizontal spacing continued, based on flux distributions from the USGS regional models. Computational errors along the northern boundary of the model continued to pose potential delays and constraints on flow-model revisions. Uniform spacing and structural grids are being used exclusively to increase computational efficiency and to shorten simulation run times with the flow model.

In other work, the data package for WT-24 perched-water hydraulic testing was revised and finalized and was submitted for data review. Revisions to the USW G-2 aquifer-test report were completed following USGS Director's approval. Work continued in response to reviewers' comments on a report on past- and future-climate simulations; that report has received conditional USGS approval. Work continued for completion of a comprehensive water-level and spring data base for use in both site-scale and regional

modeling. A review of 1997 water-level data was provided to the environmental monitoring program, and work began on plotting of hydrographs for investigation of water-level trends in the Yucca Mountain area.

CLIMATE and PALEOHYDROLOGY

Work on development of climatic analogs continued with efforts on collecting and analyzing diatom data from Owens Lake core OL-92/2 at depth intervals between 162.7 and 190.33 m to provide high-resolution paleoclimatic interpretations for the period 400—350 ka as a potential future regional climate-analog scenario for Yucca Mountain. Staff completed revisions of a manuscript that provides high-resolution diatom data obtained from samples taken between 32 and 84 m of Owens Lake core OL-92. Additional revisions to that report concerning preliminary climatic interpretation of high-resolution ostracode data collected from the same 32- to 84-m interval in the OL-92 core were also completed. Staff organized a meeting of USGS-ESIP, DOE, M&O, and Sandia personnel to discuss the status of future-climate estimates based on past-climate records and to coordinate those efforts with PA.

Staff completed a second major revision of a draft report giving the basis for and estimates of the abundances and isotopic characteristics of hydrogenic minerals in the East-West Cross Drift. The report has been resubmitted as an open-file report titled *Interpretations of paleohydrology from calcite and opal deposits in the Exploratory Studies Facility and estimates of the distribution and isotopic compositions of these minerals along the East-West Cross Drift alignment, Yucca Mountain, Nevada*, by J. Paces, B. Marshall, J. Whelan, L. Neymark, and Z. Peterman. The report is expected to be submitted for USGS approval in May.

Isotopic analysis of opal and calcite continued. A micropipetting dispenser was used to perform *in situ* hydrofluoric (HF) digestions on opal hemispheres from an ESF sample taken at Station 30+50, in efforts to develop a technique for removal of smaller numbers of micrometer-thick layers than is possible through mechanical sampling. Because of the very slow growth rates exhibited by those minerals, the thinnest subsamples should give the youngest ages and largest initial $^{234}U/^{238}U$ ratios. Although surface tension made controlling the droplet difficult, analytical results for the two attempts appeared successful. Only 0.6 and 0.04 nanograms of total uranium were analyzed, equating to probable sample weights of 5 to 0.5 micrograms of opal. Preliminary ages of 11.6 ± 1.4 ka and 4.0 ± 5.9 ka were calculated with initial $^{234}U/^{238}U$ activity ratios of 6.9 and 6.8. Such results are consistent with an earlier *in situ* microdigestion. Previously reported results using conventional subsampling of outermost opal from the same mineral coating yielded ages between 150 and 226 ka with initial activity ratios between 4.23 and 2.71. These results support the concept of slow, nearly continuous growth of opal in the deep UZ and prove that the microdigestion technique can provide reliable results. These data do not, however, provide unambiguous evidence of Holocene mineral growth. Future work will try to improve techniques used through enhanced control the HF droplet.

In ongoing work on past-discharge sites, preparation of samples from Ash Meadows for reconnaissance $^{230}Th/U$ dating was started. Ages for those deposits are unknown and may range from late Pleistocene to Pliocene. Determination of the ages of those dissected deposits above the modern potentiometric surface is important to assessment of the extent of past water-table fluctuations needed for calculation of past-discharge volumes.

Staff prepared oral presentations for the High-Level Radioactive Waste Management conference in Las Vegas. Titles of presentations include:

Secondary mineral records past percolation flux at Yucca Mountain, Nevada, by B.D. Marshall, J.B. Paces, L.A. Neymark, J.F. Whelan, and Z.E. Peterman.

History of calcite and opal deposition at Yucca Mountain, Nevada: evidence for long-term stability of the unsaturated zone, by L.A. Neymark, Yu V. Amelin, J.B. Paces, and Z.E. Peterman.

Inferences for Yucca Mountain saturated-zone hydrology from secondary minerals, by J.B. Paces, L.A. Neymark, B.D. Marshall, J.F. Whelan, and Z.E. Peterman.

Unsaturated-zone calcite $\delta^{13}C$ evidence of southern Nevada climates during the past 9 million years, by J.F. Whelan and R.J. Moscati.

Secondary mineral evidence for past water table change, by J.F. Whelan, R.J. Moscati, and B.D. Marshall.

SPECIAL STUDIES

Coordination of work on the Site Description chapter 3 (Natural System) included USGS staff attendance at a kickoff meeting for the review of the first chapter of the Viability Assessment. A review of chapter 1 was completed. Personnel attended a geochemistry integration meeting at LBNL. Staff turned over to the M&O a condensed version of the entire chapter 3.3 (geologic system) for inclusion in the VA.

Because of the drastically reduced effort for the letter-report format for SCPR #18, no systematic solicitation of input from USGS PIs was conducted. Instead, material for PR #18 was abstracted from USGS monthly reports to DOE-YMSCO for the period October 1997 through February 1998. USGS input was transmitted to technical leads and to the PR coordinator in M&O NEPO. USGS input consisted of about four pages of narrative and eight reference citations covering the following topics:

- East-West Cross Drift
- Integrated Site Model / Geologic Framework
- Drilling and Testing of Borehole SD-6
- C-holes Testing
- ESF Alcove and Niche Studies
- Effects of El Niño on UZ Infiltration

Prepared - 05/12/98:09:43:46 | WBS Status Sheet (WBS02) | Inc. Dollars in Thousands

WBS No. - 1.2

WBS Title - Yucca Mountain Project

Parent WBS No. - 1.0

Parent WBS Title - Mined Geologic Disposal System

Element ID - 12

Statement of Work:

See the current WBS Dictionary

Cost/Schedule Performance

		Current Period					FY1998 Cumulative to Date					FY1998 at Completion		
Id	Description	BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.1	Systems Engineering	43	43	12	0	31	302	302	290	0	12	726	703	23
1.2.3	Site Investigations	963	1091	1419	128	-328	7204	7142	6659	-62	483	12438	13330	-892
1.2.5	Regulatory	53	53	39	0	14	367	367	259	0	108	638	646	-8
1.2.8	Environment, Safety, and H	52	52	37	0	15	353	353	329	0	24	600	661	-61
1.2.9	Project Management	58	58	67	0	-9	397	397	401	0	-4	683	684	-1
1.2.12	Information Management	6	6	4	0	2	45	45	26	0	19	77	65	12
1.2.15	Support Services	146	146	136	0	10	1014	1014	913	0	101	1743	1694	49
Total		1321	1449	1714	128	-265	9682	9620	8877	-62	743	16905	17783	-878

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	17856	17329	16062	15656	222867
LABOR	924	986	983	993	669	703	727	766	774	734	667	654	9580
SUBS	150	160	165	180	219	228	235	244	279	277	264	268	2669
TRAVEL	28	59	60	76	62	70	74	78	74	65	60	48	754
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	228	242	260	323	290	303	285	333	525	355	367	391	3902
Total BCWS	1330	1447	1468	1572	1240	1304	1321	1421	1652	1431	1358	1361	16905

Actual Cost of Work Performed

LBRHRS	19347	15629	18106	16797	14905	16396	16949	0	0	0	0	0	118129
LABOR	698	634	670	735	608	727	635	0	0	0	0	0	4707
SUBS	190	151	226	140	242	228	268	0	0	0	0	0	1445
TRAVEL	6	27	75	31	49	38	63	0	0	0	0	0	289
PM&E	0	62	22	131	215	127	495	0	0	0	0	0	1052
OTHER	16	275	148	204	328	160	253	0	0	0	0	0	1384
Total ACWP	910	1149	1141	1241	1442	1280	1714	0	0	0	0	0	8877

Prepared - 05/12/98:09:43:46 | WBS Status Sheet (WBS02) | 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	22537	22626	21939	20761	19392	107255
LABOR	0	0	0	0	0	0	0	993	990	967	903	852	4705
SUBS	0	0	0	0	0	0	0	273	285	295	296	302	1451
TRAVEL	0	0	0	0	0	0	0	99	86	91	85	71	432
PM&E	0	0	0	0	0	0	0	0	0	4	0	0	4
OTHER	0	0	0	0	0	0	0	324	561	507	475	447	2314
Total ETC	0	0	0	0	0	0	0	1689	1922	1864	1759	1672	8906

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	1652	1431	1358	1361	16905
BCWP	1270	1404	1415	1520	1205	1357	1449	0	0	0	0	0	9620
ACWP	910	1149	1141	1241	1442	1280	1714	0	0	0	0	0	8877
ETC	0	0	0	0	0	0	0	1689	1922	1864	1759	1672	8906

Fiscal Year Distribution

	Prior	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Future	At Complete
BCWS	32296	16905	9517	4027	920	279	0	0	0	0	0	0	63944
BCWP	32009	9620	0	0	0	0	0	0	0	0	0	0	
ACWP	32040	8877	0	0	0	0	0	0	0	0	0	0	
ETC	0	8906	9517	4026	920	279	0	0	0	0	0	0	64565

USGS Level 3 Milestone Report

October 1, 1997 - April 30, 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	

USGS Level 4 Milestone Report

October 1, 1997 - April 30, 1998

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Draft PISA Hydrology Chaptr Section **Milestone Number:** SPH392M4	8/29/97	5/29/98		
Memo to TPO: Hydro-Property Measurements **Milestone Number:** SPH235M4	9/4/97	6/16/98		
Memo to TPO: Docmnt Data Package Submittal **Milestone Number:** SPH236M4	9/10/97	6/16/98		
Memo to TPO: Chem/Iso Anlys on Wtr Samples WT-17 **Milestone Number:** SPC34CM4	9/24/97	7/17/98		
Memo to TPO: Jan-Jun97 Perio Wtr Lvl Data to RPC **Milestone Number:** SPH37FM4	10/31/97	10/17/97	10/17/97	
Memo to TPO: Trans Frac Density Data to 3-D Mdl **Milestone Number:** SPG232M4	11/14/97	11/13/97	11/13/97	
Memo to TPO:Rslts of Prch Wtr Hydraul Tst WT-24 **Milestone Number:** SPH228M4	11/14/97	11/10/97	11/10/97	
Memo to TPO: Tech Data Sub for Incorp in GENISES **Milestone Number:** SPH395M4	11/25/97	7/31/98		
Memo to TPO: ECRB Spatiotemporal Predictions **Milestone Number:** SPC233M4	11/28/97	11/25/97	11/25/97	
Memo to TPO: Data Pkg Struc Data/Obs to TDB **Milestone Number:** SPG385M4	11/28/97	6/1/98		
Memo to TPO: Struc Data/Interps to LANL **Milestone Number:** SPG395M4	12/1/97	11/25/97	11/25/97	
Memo to TPO: Eval Draft Txt SDD Hydrol Chptr. **Milestone Number:** SPH393M4	12/5/97	5/29/98		

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	6/16/98		
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	8/10/98		
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	8/14/98		
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	5/29/98		
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	6/16/98		
Memo to TPO:Data to RPC Pmp/Monit Prch Wtr WT-24 **Milestone Number:** SPH242M4	3/13/98	6/16/98		
Memo to TPO: Analys Cond/Properties Cross Drift **Milestone Number:** SP33ACM4	3/27/98	5/29/98		
Memo to TPO: ECRB Spatiotemporal Predictions **Milestone Number:** SPC237M4	3/27/98	5/29/98		
Memo to TPO: Lithostratigraphy Log for WT-24 **Milestone Number:** SPG223M4	3/27/98	9/29/98		
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	6/30/98		
Memo to TPO: Progress on Delineation of ET Area **Milestone Number:** SPH41GM4	3/31/98	6/1/98		
Memo to TPO: Doc Hydraul rop. Test SD-6 **Milestone Number:** SPH246M4	4/6/98	11/25/98		
Publish Sel Streamflow & Precip Data for FY97 **Milestone Number:** SPH36CM4	4/6/98	5/15/98		
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	10/16/98		
Memo to TPO: Data to RPC Pmp/Moni Prch Wtr SD-6 **Milestone Number:** SPH247M4	4/14/98	3/18/99		
Memo to TPO: Lithostratigraphy of SD-6 **Milestone Number:** SPG23AM4	4/17/98	9/15/98		
Review Draft: Conceptual Model of UZ **Milestone Number:** 3GUM603M	4/30/98	5/29/98		
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	

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey
Date Prepared: 5/14/98 09:14 AM

Fiscal Month/Year April 30, 1998

	CURRENT MONTH END						FISCAL YEAR		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.1	11	598	240	0	51	0	702	0	287
1.2.3	1422	11800	4093	0	955	0	12647	0	6697
1.2.5	39	296	857	0	217	0	652	0	262
1.2.8	36	1629	0	0	0	0	595	0	335
1.2.9	67	1148	318	0	89	0	652	0	402
1.2.12	4	168	0	0	0	0	73	0	25
1.2.15	135	1310	369	0	67	0	1665	0	914
	1714	16949	5877	0	1379	0	16986	0	8922

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR October 1, 1997 - April 30, 1998
5/6/98 3:15:43 PM

		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	0.0	0.0	0.0	0.0	0.0	287.4
121C9075U1	USGS Engineering Assurance (EA)	35.7	25.2	72.7	32.8	40.0	69.6	11.3	0.0	0.0	0.0	0.0	0.0	287.4
0G1CGA2	Documentation/Backlog Issues	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
0G1CGA3	Personnel Qualification	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
121C9075U2	Support to Line Org. for Documentatio	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
121C9075		35.7	25.2	72.7	32.8	40.0	69.6	11.3	0.0	0.0	0.0	0.0	0.0	287.4
	1.2.1.1	35.7	25.2	72.7	32.8	40.0	69.6	11.3	0.0	0.0	0.0	0.0	0.0	287.4
	1.2.1	35.7	25.2	72.7	32.8	40.0	69.6	11.3	0.0	0.0	0.0	0.0	0.0	287.4
0G311GA1	Scientific Programs Management & Integ	19.7	14.8	24.4	14.1	19.8	20.2	18.9	0.0	0.0	0.0	0.0	0.0	131.9
0G312GA1	Manage Nevada Operations/Earth Scien	73.3	53.2	53.6	52.7	111.1	30.2	44.4	0.0	0.0	0.0	0.0	0.0	418.6
12319090U1	USGS SP&I	93.0	68.0	78.0	66.8	130.9	50.5	63.3	0.0	0.0	0.0	0.0	0.0	550.4
12319090		93.0	68.0	78.0	66.8	130.9	50.5	63.3	0.0	0.0	0.0	0.0	0.0	550.4
	1.2.3.1	93.0	68.0	78.0	66.8	130.9	50.5	63.3	0.0	0.0	0.0	0.0	0.0	550.4
0G32836FB1	Conduct Probabilistic Seismic Hazards A	11.5	-3.7	19.5	1.5	4.3	-2.4	11.2	0.0	0.0	0.0	0.0	0.0	42.0
0G32836GB3	Support Seismic Design Input	18.9	22.6	6.6	27.2	17.4	18.3	2.1	0.0	0.0	0.0	0.0	0.0	113.2
12321155U1	Prepare Seismic Design Inputs	30.5	18.9	26.2	28.7	21.8	15.9	13.3	0.0	0.0	0.0	0.0	0.0	155.2
0G32836FB1	Conduct Probabilistic Seismic Hazards A	0.0	6.1	1.0	10.5	11.6	6.1	11.9	0.0	0.0	0.0	0.0	0.0	47.3
12321155UC	Conduct Prob. Seismic Hazards Ass.	0.0	6.1	1.0	10.5	11.6	6.1	11.9	0.0	0.0	0.0	0.0	0.0	47.3
0G32836FB1	Probabilistic Seismic Hazards Analysis -	0.0	0.0	0.0	11.2	1.2	26.8	12.3	0.0	0.0	0.0	0.0	0.0	51.4
12321155UY	PSHA - Deferred	0.0	0.0	0.0	11.2	1.2	26.8	12.3	0.0	0.0	0.0	0.0	0.0	51.4
12321155		30.5	25.0	27.2	50.4	34.6	48.8	37.5	0.0	0.0	0.0	0.0	0.0	253.9
0G32211GA1	Stratigraphic Support to LA & Confirmati	21.4	9.6	12.5	20.8	19.2	9.1	5.6	0.0	0.0	0.0	0.0	0.0	98.1
12322210U1	Stratigraphy	21.4	9.6	12.5	20.8	19.2	9.1	5.6	0.0	0.0	0.0	0.0	0.0	98.1
0G32212GA3	Structural Support to LA & Confirmation	0.8	0.2	4.3	-1.8	3.5	0.0	6.0	0.0	0.0	0.0	0.0	0.0	12.9
0G32212GB1	Conduct Fracture Studies	3.9	3.7	7.8	1.4	2.2	5.6	9.2	0.0	0.0	0.0	0.0	0.0	33.7
0G32212GB2	Publish Maps & Reports for Structural St	12.0	5.1	-8.5	12.2	0.8	-5.7	10.0	0.0	0.0	0.0	0.0	0.0	25.9
0G32212GB4	Structural Support to TSPA/VA	2.1	3.1	9.3	4.0	3.2	28.6	26.8	0.0	0.0	0.0	0.0	0.0	77.1
12322210U2	Structure	18.7	12.1	12.9	15.8	9.6	28.4	52.0	0.0	0.0	0.0	0.0	0.0	149.6
0G32211GB3	Detailed Char. of BH Video Logs from Dr	1.3	8.6	-5.1	0.4	0.2	16.7	14.6	0.0	0.0	0.0	0.0	0.0	36.7
12322210U4	Eval. BH Video Logs - DSHT BHs	1.3	8.6	-5.1	0.4	0.2	16.7	14.6	0.0	0.0	0.0	0.0	0.0	36.7
0G32211FB2	Stratigraphic Descriptions - WT-24/SD-6	0.0	18.5	2.6	1.4	0.5	0.7	0.4	0.0	0.0	0.0	0.0	0.0	24.2

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12322210UC	Stratigraphic Descriptions - SD6/WT2	0.0	18.5	2.6	1.4	0.5	0.7	0.4	0.0	0.0	0.0	0.0	0.0	24.2
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	0.0	0.0	0.0	0.0	0.0	312.4
0G32212FB2	Complete Site Area Geologic Map - ECR	0.0	29.6	35.7	29.7	37.9	10.4	-6.7	0.0	0.0	0.0	0.0	0.0	136.6
0G32212FB5	Geologic Mapping of the ECRB	55.2	69.6	46.7	71.4	59.0	63.2	120.0	0.0	0.0	0.0	0.0	0.0	485.2
0G32733FB1	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	0.0	0.0	0.0	0.0	0.0	668.7
12326050		55.9	106.7	94.1	111.4	108.4	75.4	116.9	0.0	0.0	0.0	0.0	0.0	668.7
0G32212GB3	Structural Support to Isotopic Age Studie	3.9	0.9	0.2	1.7	0.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0	12.6
12327025U1	Structural Support to Isotopic Age Stud	3.9	0.9	0.2	1.7	0.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0	12.6
12327025		3.9	0.9	0.2	1.7	0.7	5.2	0.0	0.0	0.0	0.0	0.0	0.0	12.6
	1.2.3.2	131.6	181.4	148.0	202.0	173.2	184.4	227.0	0.0	0.0	0.0	0.0	0.0	1247.6
0G33133GBF	Support VA SZ Flow Model Sensitivity A	2.3	2.2	3.7	2.7	1.0	3.3	0.7	0.0	0.0	0.0	0.0	0.0	15.8
12331200U1	Abs/Testing SZ Flow Model for VA	2.3	2.2	3.7	2.7	1.0	3.3	0.7	0.0	0.0	0.0	0.0	0.0	15.8
12331200		2.3	2.2	3.7	2.7	1.0	3.3	0.7	0.0	0.0	0.0	0.0	0.0	15.8
0G33124GB5	PTn Lateral Diversion (Phase II)	6.9	7.4	3.3	9.3	4.1	0.2	6.7	0.0	0.0	0.0	0.0	0.0	37.9
12332245U1	Hydrostratigraphy	6.9	7.4	3.3	9.3	4.1	0.2	6.7	0.0	0.0	0.0	0.0	0.0	37.9
0G33123GB4	Est. of Effective Porosity Values for Topa	0.0	0.0	4.1	0.2	-3.5	6.5	13.7	0.0	0.0	0.0	0.0	0.0	21.1
12332245U2	Surface-Based Borehole Testing	0.0	0.0	4.1	0.2	-3.5	6.5	13.7	0.0	0.0	0.0	0.0	0.0	21.1
0G33124FBB	Air-K & Hydrochemistry Testing ESF	45.0	36.6	71.8	43.8	52.1	51.2	58.7	0.0	0.0	0.0	0.0	0.0	359.1
12332245U3	ESF Borehole Testing	45.0	36.6	71.8	43.8	52.1	51.2	58.7	0.0	0.0	0.0	0.0	0.0	359.1
0G33123GB3	Unsaturated Matrix Flow Properties	6.3	17.8	0.9	11.9	12.1	21.9	12.7	0.0	0.0	0.0	0.0	0.0	83.5
12332245U4	Hydrologic Properties Measurements	6.3	17.8	0.9	11.9	12.1	21.9	12.7	0.0	0.0	0.0	0.0	0.0	83.5
0G33124GB7	ESF Drift-Scale Flux & Niche Study (Pha	0.0	5.5	23.5	-3.5	9.8	13.1	7.4	0.0	0.0	0.0	0.0	0.0	55.7
0G33124GBF	Characterization of Seepage in Alcoves	11.3	36.4	38.6	34.8	35.6	9.5	93.9	0.0	0.0	0.0	0.0	0.0	260.0
12332245U5	Percolation and Seepage	11.3	41.8	62.0	31.3	45.4	22.6	101.3	0.0	0.0	0.0	0.0	0.0	315.7
0G33131GB2	Hydraulic/Tracer Test of Prow Pass Tuff	20.2	7.1	10.0	5.4	11.6	39.7	39.9	0.0	0.0	0.0	0.0	0.0	133.7
0G33131GB4	SZ Hydraulic Testing of Borehole USW	0.0	2.4	0.3	1.8	37.1	11.6	49.2	0.0	0.0	0.0	0.0	0.0	102.3
0G33131GB5	SZ Hydraulic Testing of Borehole USW	0.0	0.0	0.6	0.0	0.0	2.8	9.6	0.0	0.0	0.0	0.0	0.0	13.0
0G33133GA3	Planning for STC SZ Confirmation Studi	1.5	-1.2	6.4	3.4	7.5	8.6	6.3	0.0	0.0	0.0	0.0	0.0	32.6

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12332245U6	Saturated Zone Testing	21.7	8.3	17.2	10.6	56.2	62.7	104.9	0.0	0.0	0.0	0.0	0.0	281.6
0G33127GB1	Matrix Water Sources and Fract.-Matrix I	10.7	8.7	6.1	12.2	3.6	8.1	8.2	0.0	0.0	0.0	0.0	0.0	57.5
0G33127GB2	Iso./Hydrochem. Studies of UZ Water an	13.5	17.3	16.8	19.8	44.5	6.7	81.7	0.0	0.0	0.0	0.0	0.0	200.2
12332245U7	UZ Hydrochemistry	24.2	25.9	22.9	32.0	48.1	14.8	89.9	0.0	0.0	0.0	0.0	0.0	257.7
0G33123FBF	Hydrologic Charac. of SB BH - WT-24/S	0.0	0.0	11.2	3.8	4.6	13.1	-3.2	0.0	0.0	0.0	0.0	0.0	29.6
12332245UC	Matrix Properties - SD6/WT24	0.0	0.0	11.2	3.8	4.6	13.1	-3.2	0.0	0.0	0.0	0.0	0.0	29.6
0G33131FBG	Perched Wtr & SZ Hydrologic Tstg - WT	27.2	11.5	28.2	17.2	21.2	39.4	39.5	0.0	0.0	0.0	0.0	0.0	184.2
0G33131FBH	Iso/Hydrochem Smplg/Anal of SZs - WT	8.2	7.3	5.6	8.0	13.4	1.9	-0.3	0.0	0.0	0.0	0.0	0.0	44.1
12332245UD	Hydrologic Tst/Hydrochem. Samping	35.4	18.8	33.8	25.1	34.6	41.3	39.2	0.0	0.0	0.0	0.0	0.0	228.2
0G33124FBF	South Ramp Hydrology (RM)	1.5	6.1	3.6	19.2	13.2	32.1	6.6	0.0	0.0	0.0	0.0	0.0	82.3
0G33124FBG	PTn Lateral Diversion - Ph I (RM)	0.0	0.8	0.0	0.9	17.1	12.2	22.3	0.0	0.0	0.0	0.0	0.0	53.3
12332245UR	Risk Mitigation - Hydrostratigraphy	1.5	6.9	3.6	20.0	30.3	44.3	28.9	0.0	0.0	0.0	0.0	0.0	135.6
0G33124FBH	ESF Drift Scale & Niche Study (RM)	7.3	2.6	-2.9	20.0	28.2	22.7	0.9	0.0	0.0	0.0	0.0	0.0	78.8
0G33124GA1	Support E&I Design Basis Modeling (RM	0.7	-0.7	0.0	0.0	0.0	3.8	6.1	0.0	0.0	0.0	0.0	0.0	9.9
12332245US	Risk Mitigation - Percolation & Seepag	8.0	1.9	-2.9	20.0	28.2	26.5	6.9	0.0	0.0	0.0	0.0	0.0	88.6
0G33123FBF	Char. Hydr. of SB Boreholes - Deferred	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
12332245UW	Matrix Properties WT-24 Deferred	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
0G33131FBG	Conduct Perched Water & SZ Hydraulic	1.5	40.1	-16.7	4.5	60.7	0.0	1.1	0.0	0.0	0.0	0.0	0.0	91.3
0G33131FBH	Iso/Hydrochem Smplg/Init Analyses of S	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
12332245UX	Hydrologic Testing/Hydrochem Sampli	1.5	40.1	-16.7	4.5	60.7	0.0	1.1	0.0	0.0	0.0	0.0	0.0	91.3
0G33131FBB	Conduct Chemical & Isotopic Analysis -	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	3.6
0G33131FBF	Conduct C-Holes Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	3.9	0.0	0.0	0.0	0.0	0.0	109.7
12332245UY	SZ Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	7.5	0.0	0.0	0.0	0.0	0.0	113.4
0G33121GB2	Update & Enhance Net Infiltration Numer	7.1	17.7	5.7	14.2	17.1	12.2	2.5	0.0	0.0	0.0	0.0	0.0	76.4
0G33121GB3	Prediction of Future Net Infil. Rates in Re	0.0	0.0	0.0	5.2	0.5	11.0	29.8	0.0	0.0	0.0	0.0	0.0	46.6
12332247U1	UZ Modeling	7.1	17.7	5.7	19.4	17.5	23.2	32.3	0.0	0.0	0.0	0.0	0.0	122.9
0G33131GB8	Reduce Uncert. in Flux Values Used to C	2.2	7.9	3.7	5.0	5.4	3.0	3.4	0.0	0.0	0.0	0.0	0.0	30.6
0G33133FB6	Confirm SZ Hydrologic Flow Models	14.3	20.6	21.4	20.6	22.3	-0.2	8.0	0.0	0.0	0.0	0.0	0.0	107.0
0G33133GB4	Refine Calibration of Site SZ Flow Model	8.6	7.2	9.2	10.6	13.7	22.3	10.3	0.0	0.0	0.0	0.0	0.0	81.8
0G33133GB6	Test Alternate Conceptual Models	6.1	2.9	6.6	10.7	3.1	11.0	3.7	0.0	0.0	0.0	0.0	0.0	44.1
0G33133GB7	Refine Regional Hydrogeologic Framewo	20.4	8.8	24.8	17.6	22.3	15.2	16.3	0.0	0.0	0.0	0.0	0.0	125.5

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12332247U2	SZ Modeling	51.6	47.3	65.8	64.5	66.7	51.3	41.7	0.0	0.0	0.0	0.0	0.0	389.0
0G33132GB1	Iso/Hydrochem. Analysis of SZ Ground	24.9	28.2	-0.3	21.3	87.2	24.8	110.7	0.0	0.0	0.0	0.0	0.0	296.9
12332247U4	Isotopic/Hydrochemical SZ Studies	24.9	28.2	-0.3	21.3	87.2	24.8	110.7	0.0	0.0	0.0	0.0	0.0	296.9
12332245		248.7	305.7	311.8	351.8	565.8	415.3	653.2	0.0	0.0	0.0	0.0	0.0	2852.2
0G33124FB8	Percolation Flux Across Repository Horiz	0.0	26.4	24.4	68.0	36.2	-10.0	5.8	0.0	0.0	0.0	0.0	0.0	150.8
0G33124FBD	Moisture Monitoring In the ESF - ECRB	5.9	8.0	7.0	-6.3	0.9	5.2	39.5	0.0	0.0	0.0	0.0	0.0	60.1
0G33124GBA	Infiltration of Construction Water in ESF	10.7	-3.0	0.2	15.1	6.8	1.7	13.2	0.0	0.0	0.0	0.0	0.0	44.6
12336050U3	Infiltration, Percolation & Seepage	16.6	31.3	31.6	76.7	43.9	-3.1	58.5	0.0	0.0	0.0	0.0	0.0	255.5
12336050		16.6	31.3	31.6	76.7	43.9	-3.1	58.5	0.0	0.0	0.0	0.0	0.0	255.5
0G33112FB1	Collection of Site Streamflow Data	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	0.0	0.0	0.0	0.0	0.0	57.2
0G33112GB1	Collection of Site Streamflow Data	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12337025U2	Surface Water Monitoring	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	0.0	0.0	0.0	0.0	0.0	57.2
0G33123FBB	UZ Borehole Instrumentation & Monitorin	18.4	16.1	25.8	30.7	-11.7	10.3	-6.0	0.0	0.0	0.0	0.0	0.0	83.6
0G33123FBC	Integrated Analysis & Interpretation	13.6	7.7	14.4	19.5	-13.1	13.2	0.2	0.0	0.0	0.0	0.0	0.0	55.4
0G33123GB1	UZ Borehole Instrumentation & Monitorin	6.9	6.1	7.6	6.3	29.5	19.0	29.2	0.0	0.0	0.0	0.0	0.0	104.6
0G33123GB2	Integrated Analysis & Interpretation	0.0	0.0	0.0	5.0	3.8	-1.3	7.5	0.0	0.0	0.0	0.0	0.0	15.0
12337025U3	Surface Based Hydrologic Monitoring	38.9	29.9	47.8	61.5	8.5	41.1	30.9	0.0	0.0	0.0	0.0	0.0	258.5
0G33131FBD	Water-Level Monitoring	10.3	0.1	-1.9	0.5	4.2	9.0	8.1	0.0	0.0	0.0	0.0	0.0	30.4
0G33131GB1	Water-Level Monitoring	5.5	11.2	8.8	7.5	6.9	4.8	12.4	0.0	0.0	0.0	0.0	0.0	57.2
12337025U5	Saturated-Zone Monitoring	15.8	11.4	6.9	8.0	11.1	13.8	20.5	0.0	0.0	0.0	0.0	0.0	87.5
0G33127GB3	Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	0.0	0.0	0.0	0.0	0.0	27.1
12337025U6	Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	0.0	0.0	0.0	0.0	0.0	27.1
12337025		66.4	48.5	65.3	99.2	32.3	78.4	40.3	0.0	0.0	0.0	0.0	0.0	430.4
	1.2.3.3	334.0	387.6	412.4	530.4	642.9	493.8	752.7	0.0	0.0	0.0	0.0	0.0	3553.9
0G36215GB2	Future 100K Climate Records	0.0	4.7	4.1	9.6	7.1	4.2	30.2	0.0	0.0	0.0	0.0	0.0	59.8
12362252U1	Paleoclimate Analysis	0.0	4.7	4.1	9.6	7.1	4.2	30.2	0.0	0.0	0.0	0.0	0.0	59.8
0G36221GB3	Water Flux Det. Thru Repos. Blk - Age,	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	0.0	0.0	0.0	0.0	0.0	91.4
12362252U2	Geochronology of Fracture Minerals - L	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	0.0	0.0	0.0	0.0	0.0	91.4
0G36221GB1	Paleoclimate Confirmatory Analyses - LA	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	0.0	0.0	0.0	0.0	0.0	144.2
12362252U3	Paleohydrology and WT Fluctuations	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	0.0	0.0	0.0	0.0	0.0	144.2
12362252		29.2	17.6	23.0	34.1	46.4	12.0	133.0	0.0	0.0	0.0	0.0	0.0	295.4

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0G36221FB3	Syn. Distr./Anal. Geochron. Age Dets. (E	6.2	12.5	41.6	14.9	8.1	17.6	127.1	0.0	0.0	0.0	0.0	0.0	228.0
12366050U1	Fracture Mineral Age Dating	6.2	12.5	41.6	14.9	8.1	17.6	127.1	0.0	0.0	0.0	0.0	0.0	228.0
12366050		6.2	12.5	41.6	14.9	8.1	17.6	127.1	0.0	0.0	0.0	0.0	0.0	228.0
0G36221GB4	Data Qualification for NRC	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	0.0	0.0	0.0	0.0	0.0	3.5
12367027U2	Data Qualification Evaluation for the N	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	0.0	0.0	0.0	0.0	0.0	3.5
12367027		0.0	0.0	0.0	2.9	3.7	-3.7	0.6	0.0	0.0	0.0	0.0	0.0	3.5
	1.2.3.6	35.5	30.1	64.6	51.8	58.3	25.8	260.7	0.0	0.0	0.0	0.0	0.0	526.8
0G39BGB6	Support PISA Geology Section	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.0	0.0	0.0	0.0	0.0	44.9
12392142U1	SDD - Geology Chapter	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.0	0.0	0.0	0.0	0.0	44.9
0G39BFB2	Develop PISA Chapter 3.5 (Hydrology)	20.5	20.8	27.0	31.0	46.2	28.8	19.0	0.0	0.0	0.0	0.0	0.0	193.3
12392142U2	SDD - Hydrology Chapter	20.5	20.8	27.0	31.0	46.2	28.8	19.0	0.0	0.0	0.0	0.0	0.0	193.3
0G39BFB4	Dev. Climate/Met. Site Desc.	29.5	42.0	51.5	28.4	34.7	37.8	44.4	0.0	0.0	0.0	0.0	0.0	268.2
12392142U3	SDD - Climate/Meteorol. Chapter	29.5	42.0	51.5	28.4	34.7	37.8	44.4	0.0	0.0	0.0	0.0	0.0	268.2
0G39BGB5	Support Devel. of PISA Geochem. Sectio	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	0.0	0.0	0.0	0.0	0.0	44.7
12392142U4	SDD - Geochemistry Chapter	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	0.0	0.0	0.0	0.0	0.0	44.7
0G39BGB6	Chapter Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	0.0	0.0	0.0	0.0	0.0	119.5
12392142U6	SDD - Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	0.0	0.0	0.0	0.0	0.0	119.5
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 Geo. Mod. Dev/Re	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
12392212U1	Input to 3-D Integrated Site Model	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
0G39BGA1	Support PR Input/Review	9.5	2.9	3.9	1.0	0.2	0.0	2.9	0.0	0.0	0.0	0.0	0.0	20.3
12392570U1	PR Review/Input	9.5	2.9	3.9	1.0	0.2	0.0	2.9	0.0	0.0	0.0	0.0	0.0	20.3
12392142		98.7	81.8	109.7	84.5	119.8	107.0	97.8	0.0	0.0	0.0	0.0	0.0	699.4
0G39BGA1C	Provide Regulatory Support	0.0	0.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
0G39BGA1F	Provide QA Implementation Support	9.3	11.7	27.4	13.6	10.4	14.8	12.1	0.0	0.0	0.0	0.0	0.0	99.3
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	0.0	0.0	0.0	0.0	0.0
12399090U1	Site Investigations Support	9.3	12.3	28.8	13.6	10.4	14.8	12.1	0.0	0.0	0.0	0.0	0.0	101.3
12399090		9.3	12.3	28.8	13.6	10.4	14.8	12.1	0.0	0.0	0.0	0.0	0.0	101.3
	1.2.3.9	108.0	94.1	138.5	98.2	130.2	121.8	110.0	0.0	0.0	0.0	0.0	0.0	800.8
	1.2.3	702.0	761.2	841.6	949.2	1135.4	876.3	1413.7	0.0	0.0	0.0	0.0	0.0	6679.5

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0G535GA1	Technical Data Coordination	32.8	25.8	40.7	26.5	43.5	33.0	32.7	0.0	0.0	0.0	0.0	0.0	235.0
12532186U1	Provide Technical Data Base Input	32.8	25.8	40.7	26.5	43.5	33.0	32.7	0.0	0.0	0.0	0.0	0.0	235.0
12532186		32.8	25.8	40.7	26.5	43.5	33.0	32.7	0.0	0.0	0.0	0.0	0.0	235.0
	1.2.5.3	32.8	25.8	40.7	26.5	43.5	33.0	32.7	0.0	0.0	0.0	0.0	0.0	235.0
0G544GA1	Support to Performance Assessment	5.3	6.4	3.1	3.1	3.4	0.0	5.9	0.0	0.0	0.0	0.0	0.0	27.3
12541121U1	Support to Performance Assessment	5.3	6.4	3.1	3.1	3.4	0.0	5.9	0.0	0.0	0.0	0.0	0.0	27.3
0G541FA2	Provide Support to PA - Deferred	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
12541121UY	Provide Support to Performance Asses	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
12541121		5.3	6.4	2.4	3.1	3.4	0.0	6.6	0.0	0.0	0.0	0.0	0.0	27.3
	1.2.5.4	5.3	6.4	2.4	3.1	3.4	0.0	6.6	0.0	0.0	0.0	0.0	0.0	27.3
	1.2.5	38.1	32.2	43.1	29.6	46.9	33.0	39.3	0.0	0.0	0.0	0.0	0.0	262.4
0G825GA1	Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	0.0	0.0	0.0	0.0	0.0	53.5
12829121U1	Federal Occupational Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	0.0	0.0	0.0	0.0	0.0	53.5
12829121		8.3	6.3	8.2	8.1	7.0	7.9	7.6	0.0	0.0	0.0	0.0	0.0	53.5
	1.2.8.2	8.3	6.3	8.2	8.1	7.0	7.9	7.6	0.0	0.0	0.0	0.0	0.0	53.5
0G84GA2	Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	0.0	0.0	0.0	0.0	0.0	29.7
12842086U1	Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	0.0	0.0	0.0	0.0	0.0	29.7
12842086		15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	0.0	0.0	0.0	0.0	0.0	29.7
0G847GB1	Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	0.0	0.0	0.0	0.0	0.0	251.9
12849121U1	Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	0.0	0.0	0.0	0.0	0.0	251.9
12849121		0.0	44.0	21.3	29.8	17.0	115.6	24.1	0.0	0.0	0.0	0.0	0.0	251.9
	1.2.8.4	15.7	39.5	19.9	30.5	22.8	125.0	28.3	0.0	0.0	0.0	0.0	0.0	281.6
	1.2.8	24.0	45.8	28.1	38.5	29.8	132.9	35.8	0.0	0.0	0.0	0.0	0.0	335.0
0G9121GA	Technical Project Office	28.8	28.7	38.4	32.4	33.1	38.2	44.2	0.0	0.0	0.0	0.0	0.0	243.8
12919135U1	USGS Project Management	28.8	28.7	38.4	32.4	33.1	38.2	44.2	0.0	0.0	0.0	0.0	0.0	243.8
12919135		28.8	28.7	38.4	32.4	33.1	38.2	44.2	0.0	0.0	0.0	0.0	0.0	243.8
	1.2.9.1	28.8	28.7	38.4	32.4	33.1	38.2	44.2	0.0	0.0	0.0	0.0	0.0	243.8
0G922GA	Participant Project Control	25.2	24.0	26.4	15.0	21.8	22.9	22.5	0.0	0.0	0.0	0.0	0.0	158.0
12929135U1	Project Control - USGS	25.2	24.0	26.4	15.0	21.8	22.9	22.5	0.0	0.0	0.0	0.0	0.0	158.0
12929135		25.2	24.0	26.4	15.0	21.8	22.9	22.5	0.0	0.0	0.0	0.0	0.0	158.0
	1.2.9.2	25.2	24.0	26.4	15.0	21.8	22.9	22.5	0.0	0.0	0.0	0.0	0.0	158.0

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1.2.9		54.0	52.7	64.9	47.4	54.9	61.1	66.7	0.0	0.0	0.0	0.0	0.0	401.7
0GC522GA1	Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	0.0	0.0	0.0	0.0	0.0	25.4
12C59130U1	USGS Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	0.0	0.0	0.0	0.0	0.0	25.4
12C59130		4.0	3.0	3.8	3.8	3.4	3.7	3.6	0.0	0.0	0.0	0.0	0.0	25.4
1.2.12.5		4.0	3.0	3.8	3.8	3.4	3.7	3.6	0.0	0.0	0.0	0.0	0.0	25.4
1.2.12		4.0	3.0	3.8	3.8	3.4	3.7	3.6	0.0	0.0	0.0	0.0	0.0	25.4
0GF23GA1	Support/Personnel Services	44.6	42.2	12.4	32.1	32.5	37.2	35.4	0.0	0.0	0.0	0.0	0.0	236.4
0GF23GA5	Procurement & Property Management	4.5	7.8	7.7	5.2	6.8	8.6	9.1	0.0	0.0	0.0	0.0	0.0	49.7
12F29110U1	Personnel/Procurement/Property Servi	49.1	49.9	20.1	37.4	39.2	45.9	44.5	0.0	0.0	0.0	0.0	0.0	286.2
0GF23GA2	Facilities Management (space)	0.0	123.3	61.7	61.7	61.7	44.7	58.8	0.0	0.0	0.0	0.0	0.0	411.8
0GF23GA3	Facilities Management (computers/phone	0.0	36.3	18.2	18.2	18.2	13.2	17.3	0.0	0.0	0.0	0.0	0.0	121.3
0GF23GA4	Facilities Management (other)	0.0	19.7	9.8	9.8	9.8	7.3	9.4	0.0	0.0	0.0	0.0	0.0	65.9
12F29110U2	Facilities Management (USGS)	0.0	179.3	89.7	89.7	89.7	65.2	85.6	0.0	0.0	0.0	0.0	0.0	599.1
12F29110		49.1	229.3	109.8	127.0	128.9	111.0	130.1	0.0	0.0	0.0	0.0	0.0	885.3
1.2.15.2		49.1	229.3	109.8	127.0	128.9	111.0	130.1	0.0	0.0	0.0	0.0	0.0	885.3
0GF3GA1	USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	0.0	0.0	0.0	0.0	0.0	29.2
12F39110U1	USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	0.0	0.0	0.0	0.0	0.0	29.2
12F39110		4.4	3.3	4.7	4.3	3.6	4.0	4.9	0.0	0.0	0.0	0.0	0.0	29.2
1.2.15.3		4.4	3.3	4.7	4.3	3.6	4.0	4.9	0.0	0.0	0.0	0.0	0.0	29.2
1.2.15		53.5	232.6	114.4	131.3	132.5	115.0	135.1	0.0	0.0	0.0	0.0	0.0	914.5
1.2 OPERATING		911.4	1152.8	1168.7	1232.7	1443.0	1291.7	1705.5	0.0	0.0	0.0	0.0	0.0	8905.9
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	1291.7	1705.5	0.0	0.0	0.0	0.0	0.0	8905.9
FTEs														
FEDERAL		111.7	90.6	104.7	97.4	86.4	94.9	98.4	0.0	0.0	0.0	0.0	0.0	
CONTRACT		31.5	29.4	36.1	28.3	31.4	34.7	37.7	0.0	0.0	0.0	0.0	0.0	
TOTAL		143.2	120.0	140.8	125.7	117.8	129.6	136.0	0.0	0.0	0.0	0.0	0.0	