



Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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JUL 27 1998

OVERNIGHT MAIL

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Division of Waste Management
Office of Nuclear Material Safety
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U.S. Nuclear Regulatory Commission
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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 June 1998.

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

Stephan Brocoum
Assistant Manager for Licensing

AML:AVG-2274

Enclosure:
Ltr, 07/14/98, Craig to Kozai, w/encl.

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United States Department of the Interior

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INFORMATION ONLY

July 14, 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, June, 1998

Attached is the USGS progress report in the required format for the month of June, 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
June, 1998**

COORDINATION AND PLANNING

U.S. Geological Survey-Yucca Mountain Branch is currently processing 119 scientific papers prepared by USGS authors. Of these, 81 are related to geological studies and 38 are related to hydrologic studies. In addition, 9 abstracts are being processed.

Reports published in June:

Thamir, Falah, Thordarson, William, Kume, Jack, Rousseau, J.P., Long, Roy, and Cunningham, D.M., Jr., 1998, Drilling, logging, and testing information from borehole UE-25 UZ#16, Yucca Mountain, Nevada: U.S. Geological Survey Open-File Report 97-596, 44p.

Le Cain, G.D., 1998, Results from air-injection and tracer testing in the upper Tiva Canyon, Bow Ridge fault, and upper Paintbrush contact alcoves of the Exploratory Studies Facility, August 1994 through July 1996, Yucca Mountain, Nevada: U.S. Geological Survey Water-Resources Investigations Report 98-4058, 28 p.

D'Agnes, F.A., Faunt, C.C., and Turner, A.K., 1998, An estimated potentiometric surface of the Death Valley region, Nevada and California, developed using geographic information system and automated interpolation techniques: U.S. Geological Survey Water-Resources Investigations Report 97-4052, 15 p., 1 plate.

GEOLOGY

Geologic Framework

Geologic mapping continued in the northern Crater Flat, upper Yucca Wash, upper Fortymile Wash, Calico Hills, and Shoshone Mountain areas as part of the 1:50,000-scale geologic map compilation for the Saturated-Zone Site Area. Additional digitized linework for this map was completed, as were plates (geology, topography, culture, boreholes, and map explanation) for a preliminary version of the map to satisfy the requirements of a Level 4 milestone.

The 1:24,000-scale Yucca Mountain Site Area geologic map, which received USGS Director's approval in March, 1998, as USGS Map I-2627, has been accepted for printing following review of the galley proof. The Sundance Fault report and map received approval to publish as USGS Open-File Report 98-266. The report that accompanies the Cross Drift predictive cross section was edited in response to reviewers' comments, and is being processed further as a USGS Open-File Report. Preparation of text for a report on the "Structural Geology of Yucca Mountain" continued; this report is intended for outside publication.

Project staff reviewed fracture data collected at outcrops on Busted Butte. The purpose of these data is to characterize the geometry and spacing of joints in outcrops proximal to faults along a segment of a splay associated with the Paintbrush Canyon fault zone. The data are currently being prepared for submittal to the Technical Data Base.

Refinement of sample descriptions and classification of existing ESF samples in support of LANL's isotopic studies and statistical analysis of the distribution of bomb-pulse chlorine-36 in the ESF continued. Mapping in the ECRB cross drift included: (1) detailed line survey was completed to station 2+90; (2) full-periphery geologic mapping was completed to station 3+30; (3) Q, Kirsten Q, and RMR calculations were completed to station 2+10; and (4) RQD calculations were completed to station 2+20. Although excavation of the cross drift had proceeded to station 7+20,

the lack of wall-cleaning prevented further mapping. The mapping floor is currently being modified to accommodate the mapping team requirements.

Spreadsheets and the identification of appropriate parameters to be recorded for TV observations of fractures in boreholes were finalized and the results are currently being used in data collection. At a Thermal Alcove Workshop held in Albuquerque in June, a presentation was given on the progress of the borehole video study of fractures in the thermal alcove. Work continued on the filling of the borehole spreadsheet with pertinent stratigraphic data.

Seismotectonic Studies

A report on basaltic volcanism, with a discussion of coupled igneous and tectonic processes and an evaluation of intrusive and extrusive scenarios relevant to repository performance, was completed and submitted to Sandia PA personnel for review and comment. In summary, tectonic extension in the Yucca Mountain area is part of the regional deformation that continues to evolve the structure of the southern Great Basin. The principal effects of extension are sporadically recurrent faulting and earthquakes, and local basaltic volcanism. In a tectonic sense, Yucca Mountain represents the exposed and eroded part of a slab of volcanic rock that has been faulted by extension and has partly subsided into Crater Flat basin. Crater Flat basin has been a site of tectonic activity for at least 12 m.y. and is the center of most recent extension, as indicated by the basaltic volcanoes and the alluvial fill that hides the bedrock structure. Yucca Mountain and Bare Mountain are both peripheral to this activity. However, the rate and variability of extension is uncertain. At times, extension in the basin proceeds to the point where basaltic magma sources at sub-crustal depths are tapped, and magma ascends through basin-restricted fractures to eruption. Such volcanism is coupled to local faulting at Yucca Mountain. Intrusion of basalt counteracts local extension for some unknown period of time. This phenomenon and the unknown rates of extension in the basin make prediction of future volcanism impossible. However, geologic history provides us with three reasonable conclusions: (1) volcanism appears to be decreasing in volume with time; (2) future volcanism will be restricted to Crater Flat basin or its southwestern margin; and (3) Yucca Mountain may experience faulting associated with volcanism, but not intrusion.

HYDROLOGY

Regional Hydrology

Staff continued routine maintenance of five stream gages on Fortymile Wash and upper and lower Split and Pagany Washes on Yucca Mountain. Runoff was neither observed nor reported for the Yucca Mountain area. Work continued on a draft USGS Fact Sheet documenting the February runoff. Equipment was removed from former gaging sites on Upper Fortymile Wash, East Cat Canyon, and Stockade Wash. Streamflow and precipitation data collected through May 1998 have received initial checks and been placed in Project files. All streamflow and precipitation data collected during FY1997 have been computed, checked, and technically reviewed. The FY1997 data-records package, along with supporting information, has been submitted to the RPC/TDB in completion of Level 4 milestone SPH36DM4 [Memo to TPO: Submittal of FY97 data to RPC/TDB]. Final tables of streamflow and precipitation data have been tabulated by the Nevada District Data Section and were included in the annual water-resources data report. The report (*Water Resources Data, Nevada, Water Year 1997*, USGS report NV-97-1, by Laurie J. Bonner and others) was published and distributed on June 23. That activity (and Level 4 milestone SPH36CM4 [Publish Selected Streamflow & Precipitation Data for FY1997]) also is complete.

Unsaturated-Zone Hydrology

Borehole data from NRG-7a, NRG-6, UZ #4, UZ #6, 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. In QA-related work, staff made revisions to several technical procedures, including HP-14, HP-162, HP-189, and HP-244, and reviewed a draft of AP-12-1Q. A data transcription check was performed for a report by E. Kwicklis (USGS).

Calibration efforts included work on correction of problems with the precision-resistor calibrations, and calibration runs were performed on several pressure transducers and thermistors. Precision diagnostic runs (PREDS) were performed on pressure-transducer and thermistor benches. Work continued on the Sierra bench in preparation for automated calibrations. Site 06 (borehole NRG-7a) was restarted on June 3 and shut down on June 10. Some 33 trips were made to field sites for correction of various generator, UPS, chiller, and data-collection problems, with most trips made for data collection or collection-system problems. In addition, staff prepared final borehole-data figures for the North Ramp report.

Hydrologic characterization of surface-based boreholes continued with receipt of WT-24 hydrologic data, and analysis and interpretations were performed for WT-24 hydrologic properties. Difficulties arose in interpretations in the saturation and water-potential data due to inadequate core packaging at the drill rig. Saturations were far more variable and lower than expected or than was reasonable, especially in samples from below the water table. The physical properties for the Calico Hills samples had mean values that were not statistically different from the predicted values, but the variability in individual samples was larger in that region of the site than seen in other boreholes.

Work on infiltration models continued. The calibration of the coupled net infiltration/surface flow (runoff routing) model continued, using available historic stream-flow records for gages in Yucca Wash, Drill Hole Wash, Pagany Wash, Wren Wash, and Split Wash. Testing and calibration of a preliminary soil-depth model also continued, using the 1980—95 daily precipitation record and 100-year stochastic simulation of current climate. Model input was finalized using the updated geologic map (Day and others, 1998) and the revised soil-depth map. A sensitivity analysis of soil depth and effective bedrock permeability continued. Preparation of a memorandum describing updating of the infiltration model continued. 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. A sensitivity analysis of the impact of air temperature on net infiltration and streamflow for potential future climates continued. Based on input from paleoclimatic studies, evaluation of analog sites for developing stochastic simulations of daily precipitation for various potential future climates continued to use historical precipitation and air-temperature records available for analog sites.

In work on determination of percolation flux across the repository horizon, editorial comments by the USGS-YMPB publications staff on the USGS open-file report titled *Estimates of Physical Properties and Moisture Conditions along the East-West Cross Drift Alignment at Yucca Mountain, Nevada* were incorporated into the draft report. Substantial rewriting of the report continued. Heat-dissipation (HD) probes were installed in 2-m-deep drill holes at Cross Drift Stations 1+75, 2+00, 2+25, 2+50, 2+75, 3+00, 3+25, and 3+50. Water potential was monitored in those drill holes as well as the drill holes at Cross Drift Stations 0+50, 0+75, 1+00, 1+25, and 1+50. Boreholes (2-m length) were drilled, cored, and neutron logged at Cross Drift stations 2+00, 2+50, 3+00, and 3+50. The three 2-m boreholes at Cross Drift stations 0+50, 1+00, and 1+50 also were neutron logged. A monitoring station to measure temperature, relative humidity, and wind speed was established at Cross Drift Station 2+37. Data were collected from that station and at the station at Cross Drift Station 0+22. Temperature and relative humidity data were collected from the vent line.

Moisture monitoring in the ESF and ECRB continued. Six temperature and relative humidity stations have been established in the ECRB to evaluate TBM water migration. Three of those stations also measure wind speed. Thirteen HD probes have been installed in 2-m holes. An HD probe was installed at Construction Station (CS) 0+50, and others were installed at 25-m intervals along the drift. Thirteen HQ drill holes have been completed in the ECRB. One sequence of holes started at CS 0+50 with holes drilled at 50-m spacings. The holes are horizontal and are 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 extended to Station 2+88. In that zone, only water was used. Four boreholes were drilled in the test zone at CS 2+53. One hole was drilled vertically to a depth of 10 m, and a second hole was drilled at an angle of 45 degrees from vertical and to a depth of 6 m. The third hole was a 2-m-deep horizontal borehole. The second test zone began at CS 2+88 and extended to CS 3+28. A similar borehole array was drilled in that test zone 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 be logged periodically to determine the volumetric water loss from the tunnel walls. Strontium analysis of infiltrated construction water from CWAT#3 continued. Several CWAT#3 samples were analyzed for stable isotopes by distillation. Preliminary data from CWAT#1 and #2 indicate fairly deep penetration of construction water. All available construction data have been collected into a master spreadsheet. Estimates of water evaporated from the rock formation are being calculated from neutron-borehole logs. The total evaporation out of the tunnel is being calculated with data from monitoring sensors. The evaporation of construction water is being estimated as the difference in the total evaporation out of the tunnel and the water evaporated from the formation.

The report on results and analysis of air-injection and tracer testing in the Upper Tiva Canyon, Bow Ridge Fault, and Upper Paintbrush Contact Alcoves has been printed and distributed. The official identification number for the report (*Results from air-injection and tracer testing in the Upper Tiva Canyon, Bow Ridge Fault, and Upper Paintbrush Contact Alcoves of the Exploratory Studies Facility, August 1994 through July 1996, Yucca Mountain, Nevada*) is USGS Water-Resources Investigations Report (WRIR) 98-4058, by G. LeCain. In current air-permeability work, analysis of the Ghost Dance Fault pneumatic and tracer testing, and report preparation, continued. The USGS continued to use the Bureau of Reclamation line-survey fracture data to develop a discrete fracture model of the Ghost Dance Fault. The discrete fracture model should provide better understanding of control of tracer transport in fractured tuff.

Moisture studies continued. Borehole-monitoring data for PTn lateral diversion studies are not complete, with several points still required. Those are being run on the centrifuge at the HRF. Duplicate cores were prepared from each borehole to verify conductivity and porosity measurements. Heat-dissipation probes need to be installed in five of the 21 boreholes. Final measurements on samples from Alcove #3 have been completed and are being evaluated. Samples from Alcove #4 have been received. Data on hydrologic properties from all 21 boreholes have been completed and submitted; geochemical analyses are ongoing. Derivation of UZ matrix-flow properties also continued. Imbibition data have not been collected, as laboratory equipment is still being developed and acquired. Parameters for comparison of methods are being collected but have not been completed. Conductivity measurements have been completed for surface-based boreholes and North Ramp samples. The conductivity data package has been prepared and is in internal review. Samples have been sent to LANL for mineralogic determinations to allow analysis of unsaturated properties based on percentage of altered minerals. Preparation and analysis of salts from SD-12 pore-water samples continued as part of the investigation of matrix water sources.

The ESF drift-scale flux and niche study continued with atmospheric monitoring in Alcove #1 to evaluate surface evaporation as water drips into the collection chambers. Heat-dissipation data were collected to monitor moisture conditions in the rock. Four of the sensors show a wet-up of the rock, and water is dripping from both the shotcreted and "non-shotcreted" zones at the end of the alcove. Time-domain reflectometry data are being used to determine changes in water content to complement the water-potential measurements. The rate of seepage is related to the surface application rate, which has been reduced to conserve water while awaiting the tracer permit. Atmospheric monitoring in Alcove #7 also 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. Petri dishes were set out in Alcove #7 to determine quantities of dust settling out of

the air. Those dishes will be recovered in August. In isotopic support to thermal testing, water samples for Sr and stable isotope analyses were received and are being processed.

In characterization of seepage in the ESF, monitoring of temperature, relative humidity, and barometric pressure continued at selected alcoves. Data also are 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. Installation of the drip irrigation system for the Alcove #1 seepage study has been completed. The seepage experiment in Alcove #1 started on March 9, 1998, and to date approximately 52,700 gallons of water have been applied to the site. As of July 1, 1638 gallons of water have been collected from approximately 146 collection trays. Selected samples are being tested for pH, electrical conductivity (EC), and various water-chemistry analyses.

Measurements of WT-24 have been completed for the hydrologic characterization of surface-based boreholes. Data packages are being assembled. Measurements of SD-6 are nearly complete.

Pore water was collected from two ESF moisture-study core samples using high-pressure one-dimensional compression. Extracted water will be analyzed for chemistry, carbon isotopes, D/H, and $^{18}\text{O}/^{16}\text{O}$ isotopes. Four ESF pore-water samples were analyzed for major cations and anions, as well as for silica concentration. Alkalinity of two ESF pore-water samples was determined by microtitration. Pore water and CO_2 was extracted from three additional ESF moisture-study core samples and from one WT-24 core sample. Extracted CO_2 will be analyzed for carbon isotopes; extracted water will be analyzed for tritium. Seven CWAT#3 and two ESF moisture-study core samples were distilled to collect pore water for tritium, D/H, and oxygen isotope studies. Four individual WT-24 pore-water samples were shipped for carbon isotope analysis. A previously distilled WT-24 sample was acidified to collect CO_2 gas from precipitated CaCO_3 ; the gas will be analyzed for carbon isotopes. Additional SD-6, UZ-7a, and WT-24 distilled and compressed water samples were delivered for inorganic carbon, D/H, and oxygen isotope analyses. One WT-24 and three SD-6 pore-water samples were analyzed for silica; two SD-6, two WT-24, and three WT-3 water samples were analyzed for major anions; and the alkalinity of one WT-3 and two SD-6 water samples was determined by microtitration. Moisture contents were determined for 20 WT-24 core samples. Twenty water samples from WT-24, UZ-7a, SD-6 and SD-12 were counted for tritium concentration. In an attempt to improve the accuracy of major ion analyses, the anion and cation suppressors, columns, and the detector were cleaned and recalibrated. A data package containing analyses by Huffman Laboratories during FY1998 was prepared and sent for technical review. Water collection by compression and distillation, major ion data, and tritium results were recorded in appropriate data bases.

In unscheduled efforts, staff assisted in development of laboratory safety protocols and contributed to responses to review comments on the geochemistry section of the Site Description. A catalog of UZ hydrochemical research was compiled for DOE/Washington, D.C. to describe current vadose-zone work. Planning efforts were continued for a report to be titled *^{14}C age correction on perched water at Yucca Mountain, Nevada, using the NETPATH geochemical model.*

Saturated-Zone Hydrology

On June 2, 1998 a 3-day hydraulic test was initiated in the Prow Pass interval at the C-hole complex by pumping c#2 and using c#1 and c#3 as observation wells. On June 17, a conservative tracer test from c#3 to c#2 was initiated by injecting iodide (in the form of sodium iodide) and 2,4,5 trifluorobenzoic (TFBA) acid into c#3 while c#2 continued to be pumped. Forty hours after the injection, breakthrough of the tracers occurred in water pumped out of C#2. The test is being conducted as a partial-recirculation tracer test in which 1.5 gallons per minute (gpm) of the 5.1 gpm pumped out of c#2 are reinjected (recirculated) into c#3. Exact masses and peak concentrations of the breakthrough curves of iodide and 2,4,5 TFBA are anticipated for the July

1998 status report. During continued pumping of c#2, initiation of a conservative tracer test in the Prow Pass interval was attempted by injection of 2,3,4,5-tetrafluorobenzoic acid into c#1, but the test was delayed by equipment problems. A failed valve was removed on June 26.

Water-level measurements were performed at boreholes UE-25 J-11, UE-25 J-12, UE-25 WT#12, UE-25 WT#13 and UE-25 p#1 on June 10; at UE-25 b#1 (upper interval) and UE-25 WT#4 on June 11; at USW H-1 (tubes 1, 2, 3, and 4) on June 15; at USW H-5 (upper and lower intervals), USW H-3 (upper and lower intervals), and USW WT-1 on June 17; at USW H-4 (lower interval), USW WT-2, UE-25 WT#15, and UE-25 WT#16 on June 22; at UE-25 J-13 on June 23; and at USW WT-7, USW WT-10, USW WT-11, USW H-6 (upper and lower intervals), and USW VH-1 on June 25. Data were retrieved from USW G-2 and UE-25 WT#6 through June 30. Field notes of water-level data collected through May 1998 were reviewed and filed.

Hydrologic testing and hydrochemical sampling of boreholes WT-24 and SD-6 continued during the period. Through June 29, WT-24 reached a depth of 2,834 ft below land surface (bls). A review of the last core pulled from WT-24 indicated that the bottom of WT-24 lies in the Calico Hills Formation. A request has been made to deepen WT-24, but no drilling activity occurred at WT-24 during June. Also through June 29, the depth of borehole SD-6 is about 2,541 ft bls. No drilling activity occurred at SD-6 during June. The drill bit and about four joints of drill pipe remain stuck at the bottom of the SD-6 borehole. Geophysical logging of WT-24 will continue when the borehole is completed. Logging at SD-6 has not yet started. Level 4 milestone SPH242M4 [Memo to TPO: Data to RPC, pumping and monitoring of perched water in WT-24] was completed on June 16. Sampling of perched water in SD-6 awaits the decision on deepening the borehole. Final sampling from WT-24 similarly awaits the decision to deepen that borehole. In other investigations of SZ ground-water hydrochemistry, bailed water samples were collected from WT-3 for comparison to pumped samples.

In SZ hydrologic modeling efforts, testing and review of the relational database structure continued. Additional modifications were made to enhance efficiency, documentation, and standardization. Documentation of recently developed customized code was begun. Incorporation of the UGTA data base (IT/GeoTrans) into the regional modeling data base was started, as a way around Oracle-based software discontinuities. The regional hydrogeologic framework model was refined, with mostly minor edits and corrections of inconsistencies, especially with regard to pre-Cenozoic surfaces. Revisions of work plans for the regional ground-water model were made to support integration of that model with the UGTA ground-water flow model. Prediction-scaled sensitivities for advective travel for the Yucca Mountain flow path and other underground testing areas were calculated, and modifications were made to MODFLOWP. Staff continued ground-water model-evaluation runs to determine where best to add additional vertical discretization to the regional ground-water flow model, and staff completed runs of model-development sensitivity distributions. Staff also completed a progress report to fulfill Level 4 milestone SPH40QM4 [Memo to TPO: Revised regional framework model progress report] which documented refinements to the regional hydrogeologic framework model. Staff from the USGS-Nevada District office continued image processing on evapotranspiration (ET) areas and conducted field investigations to improve delineation of ET zones. Changes to the WT-24 perched-water data package were completed following the data review, and the package was submitted to the RPC. Additional revisions were made to the past-and-future-climate simulations report, particularly with regard to unpublished references. More work is required before re-submittal to the USGS Director. Text and figures were compiled for a new report on perched water in the Yucca Mountain area. Staff edited a journal article describing YMP MODFLOWP models and assisted in preparations for the DOE water-appropriations hearings.

Level 4 milestone SPH134M4 [Memo to TPO: Review comments for TSPA-VA report] documenting review of chapter 3.7 of the TSPA-VA report was completed with submittal of the memorandum on June 2. Chapter 8 of the TSPA-VA technical basis document was received for review on June 30. Staff completed revision of a USGS administrative report that documents pathline analysis for TSPA-VA abstraction/testing. The report has received USGS approval, and

copies were forwarded to DOE and to Sandia (SNL-PA). Updating of the hydrogeologic framework model was completed by incorporation of the ISM-3.0 model, and technical review of the updated framework model began in June, as work continued on a report describing the updated model. Updating and review of the scientific notebook used to document work on the site SZ flow model were completed. (The notebook will form the basis for the summary of the modeling work.)

Work on model calibration by USGS personnel has stopped with the departure of the PI from the project. Work on that activity will be continued by personnel at Los Alamos National Laboratory. Additional work on data submittal and documentation will be an on-going part of this activity for the remainder of the fiscal year. A telephone conference between all involved participants (USGS, LANL, SNL, & NEPO) was held on June 10 to discuss the future of the site-scale flow and transport model and the need for additional updates to the hydrogeologic framework model. All participants agreed that an updated framework model is needed to support the flow and transport and PA models. In unscheduled work, staff completed comment resolution for a review of 1997 water-level data for the environmental monitoring program and completed data input to Excel spreadsheets for use in plotting hydrographs of water-level trends. Work continued on digital geologic maps to update regional and site-scale hydrogeologic framework models. Staff also assisted in completion of illustrations and tables for various reports on SZ modeling efforts.

CLIMATE and PALEOHYDROLOGY

In work on the 100-ky climate-records report, collection and preparation continued of samples and analysis of diatom data from Owens Lake core OL-92/2 core intervals 162.7—190.33 m. Similar efforts continued for ostracode data. Those efforts are intended to produce high-resolution paleoclimatic interpretations for the period 400—350 ka as a potential future-climate analog scenario for Yucca Mountain. In data-qualification efforts for the report, preliminary information was requested from Project participants, and a planning meeting was conducted with various YMPB QA, data, and climate staff.

In effort toward publication of other results, staff responded to review comments on the previously submitted Climate and Past Discharge open-file report. Revisions also are underway to a manuscript titled *A paleolimnologic record of climate change from Owens Lake, California, for the past 50 ky*, by J.P. Bradbury and R. Forester, after peer review of that document.

The revised open-file report titled *Summary of 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.B. Paces, B.D. Marshall, J.F. Whelan, L.A. Neymark and Z.E. Peterman, was submitted for and received QA and TPO approval. The report (describing abundances and characteristics of hydrogenic minerals in the East-West Cross Drift) was submitted to Reston for USGS Director's approval and to DOE on May 29, 1998. Those actions completed the requirements for Level 4 milestone SPC237M4 [Memo to TPO: ECRB spatiotemporal predictions], completed on May 29. Preparations continued for surveying and sampling of the East-West Cross Drift for calcite and opal studies. The first sampling trip is anticipated for late July.

In efforts on past-discharge sites and paleoclimatic analysis, staff subsampled a suite of materials collected from several sites in the Ash Meadows discharge area. The samples represent carbonate deposited from ground-water discharge (tufas and travertine veins) in the past, and sampled locations lie at elevations approximately 10 to 20 m above current ground-water discharge (the Fairbanks Spring, Longstreet Spring, and School Spring areas). Five U-Th isotopic determinations were completed, and all produced substantial measured $^{234}\text{U}/^{238}\text{U}$ activity ratios. Calculated $^{230}\text{Th}/\text{U}$ ages for the youngest parts of travertine cutting the deposits range from about 260 ka to 7 ka. Analyses have initial $^{234}\text{U}/^{238}\text{U}$ activity ratios within error of the values observed in the nearby Devils Hole calcite vein (Ludwig and others, 1992) which represents ground-water $^{234}\text{U}/^{238}\text{U}$ compositions over the last 600 ka. Additional subsamples are currently

being processed. Cumulative reconnaissance data will yield a general sense for the overall ages of abandoned discharge deposits at Ash Meadows that show prominently on satellite images. Those data are intended to help establish a relation between discharge volume and lateral area.

Isotopic analysis and dating of calcite and opal proceeded, with acquisition of materials to control the placement and manipulation of tiny amounts of concentrated hydrofluoric acid on curvilinear opal surfaces. In-place digestions of small amounts (several micrograms) of opal made using these techniques allow dating of only the outermost few micro-layers of the finely laminated material by uranium-series disequilibrium. Younger ages and larger initial $^{234}\text{U}/^{238}\text{U}$ ratios (relative to values previously obtained using mechanically manipulated sampling methods) are expected using these techniques. Similar in-place digestions of opals obtained from both the North and South Ramps will begin in July. Staff revised a manuscript describing a subset of U-Th isotopic data from ESF and drill-core opals and a model of slow, continuous mineral growth that accounts for the observed isotopic behavior. The manuscript, titled *U-Th systematics in slow-growing opal, Yucca Mountain, Nevada, USA*, by L.A. Neymark and J.B. Paces, was prepared for submission to the peer-reviewed technical journal "Chemical Geology." The manuscript has received internal technical reviews, editorial review, and QA approval, and it is expected to be resubmitted to the YMPB publications unit in July. A first draft of an abstract was completed for submission to the DOE-hosted theme session titled "Radionuclide transport experiments at underground research laboratories" to be held at the 1998 annual meeting of the Geological Society of America. The abstract, titled *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 aspects of subsurface secondary minerals at Yucca Mountain and their implications for UZ hydrology. The abstract has completed technical review and was submitted to the YMPB publications unit for editorial review.

SPECIAL STUDIES

Staff completed and submitted to the M&O a review of volume 3 (TSPA) of the VA document. Concurrence to proposed resolution of comments on geology, hydrology and geochemistry as part of the VA document also was provided. In work on the Site Description (SD) document, internal review comments have been resolved, and internal review of the SD Hydrology chapter is complete. Draft PISA Hydrology chapter sections have been completed and incorporated into the Yucca Mountain Site Description (Draft A). Responses to comments on Draft A (April 1998) of the Site Description are being prepared, including necessary revisions to the text. At DOE's request, USGS staff reviewed the geologic part of the geochemistry section of the Site Description. Responses to over 300 comments on the geology section of the PISA are underway. Several revisions to sections 2, 3, 4, 5, and 6 were completed and provided to the M&O. Responses were completed for all comments to the Climate/Meteorology section of the SD.

There was no activity on the Site Characterization Progress Report during the month of June, but in unscheduled work, the USGS technical lead for the SCPR served as a "reviewer of record" for Viability Assessment Volume 3 (TSPA). Using the computerized VA storyboard, 50 mandatory and 6 non-mandatory comments were submitted. A central issue in the review was the manner in which climate change was simulated in the TSPA. The USGS technical lead for the SCPR also prepared numerous responses to review comments on the unsaturated-zone studies sections of chapter 5 of the Site Description. In response to many of the comments, text modifications were submitted to CRWMS M&O staff who are compiling the draft SD.

WATER-RESOURCES MONITORING

Preparations for third-quarter FY1998 radiological water-quality sample collection were completed, and samples were collected during the week of June 22 in support of the M&O's Radiological/Environmental Field Programs. As previously agreed with the

radiological/environmental field-program staff, samples were collected from alternate well UE-25 c#2 due to reconfiguration of equipment in wells c#2 and c#3.

In ongoing monitoring activities, ground-water levels were measured at 33 sites, and ground-water discharge was measured at one flowing well. Ground-water data collected during May were checked and filed. Formal data reviews were completed for all water-level and discharge data collected and compiled during calendar year 1997. Preparation of data records packages was begun, for submittal of data to YMPB-ESIP.

Staff met with M. King (Hydrodynamics Group) and R. Kane (USGS-Nevada District) in Amargosa Valley on June 18 to discuss surface-water monitoring from Stateline to Death Valley. QA training assignments for USGS-NV staff were discussed with USGS-YMPB and USGS-ESIP personnel. Staff provided laboratory analytical methodologies (utilized by the Environmental Program for water-quality analyses of 1990—97) to TRW. Alternate monitoring scenarios for FY1999 were discussed with TRW/SAIC staff, and cost estimates were prepared. Documentation for potential monitoring scenarios was developed and provided to M&O and USGS-YMPB staff.

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					FY1998 Cumulative to Date					FY1998 at Completion		
		BCWS	BCMP	ACMP	SV	CV	BCWS	BCMP	ACMP	SV	CV	BAC	EAC	VAC
1.2.1	Systems Engineering	83	83	46	0	37	471	471	375	0	96	726	670	56
1.2.3	Site Investigations	1278	1126	1027	-152	99	9501	9275	8567	-226	708	12488	12914	-426
1.2.5	Regulatory	52	52	61	0	-9	475	475	378	0	97	638	605	33
1.2.8	Environment, Safety, and H	48	48	47	0	1	450	450	423	0	27	600	592	8
1.2.9	Project Management	56	56	40	0	16	511	511	500	0	11	683	697	-14
1.2.12	Information Management	7	7	4	0	3	58	58	35	0	23	77	61	16
1.2.15	Support Services	144	144	157	0	-13	1305	1305	1209	0	96	1743	1692	51
Total		1668	1516	1382	-152	134	12771	12545	11487	-226	1058	16955	17231	-276

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	268	268	2681
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	1375	1361	16955

Actual Cost of Work Performed

LBRHRS	19347	15629	18106	16797	14905	16396	16949	18484	14713	0	0	0	151326
LABOR	698	634	670	735	608	727	635	725	683	0	0	0	6115
SUBS	190	151	226	140	242	228	268	191	315	0	0	0	1951
TRAVEL	6	27	75	31	49	38	63	59	77	0	0	0	425
PM&E	0	62	22	131	215	127	495	113	59	0	0	0	1224
OTHER	16	275	148	204	328	160	253	140	248	0	0	0	1772
Total ACMP	910	1149	1141	1241	1442	1280	1714	1228	1382	0	0	0	11487

USGS Level 3 Milestone Report

October 1, 1997 - June 30, 1998

Sorted by Baseline Date

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
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	

<u>Deliverable</u>	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	10/27/98		
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	9/8/98		
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 Chptr 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	7/31/98		
Memo to TPO: Frac Connectivity Data to SNL/LBL Milestone Number: SPG230M4	2/27/98	2/20/98	2/20/98	

<u>Deliverable</u>	<u>Due Date</u>	<u>Expected Date</u>	<u>Completed Date</u>	<u>Comments</u>
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	10/27/98		
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	11/12/98		
Memo to TPO: Final Workshop Summary Milestone Number: SPG28RM4	3/27/98	4/27/98	4/27/98	
Memo to TPO: RsIts 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 & RsIts 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&RsIts Analys/Inter Sep-Dec 97 Milestone Number: SPH38DM4	3/31/98	3/31/98	3/31/98	

<u>Deliverable</u>	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	12/9/98		
Publish Sel Streamflow & Precip Data for FY97 Milestone Number: SPH36CM4	4/6/98	7/31/98		
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	3/3/99		
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	10/6/98		
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	

<u>Deliverable</u>	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		
Memo to TPO: Hydraulic Prop. Test WT-24 Milestone Number: SPH244M4	5/20/98	5/27/99		
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	12/9/98		
Memo to TPO: Lithostratigraphic Log of SD-6 Milestone Number: SPG233BM4	6/19/98	12/11/98		
DUE AFTER JUNE 30, 1998 AND DELIVERED EARLY				
Memo to TPO: Memo to TPO: Oct97-Mar98 Data to RPC/TDB Milestone Number: SPH36IM4	7/1/98	7/1/98	5/26/98	
Memo to TPO: Memo to TPO: Oct97-Mar98 Data to RPC/TDB Milestone Number: SPH36TM4	7/1/98	7/1/98	5/26/98	

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey
 Date Prepared: 7/10/98 10:47 AM

Fiscal Month/Year June 30, 1998
Page 1 of 1

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
1.21	46	525	244	0	23	0	702	0	373
1.23	1031	10526	4708	0	475	0	13230.1	0	8600
1.25	61	216	1200	0	118	0	652	0	382
1.28	46	637	0	0	0	0	664	0	428
1.29	39	445	353	0	57	0	652	0	501
1.2.12	4	136	0	0	0	0	73	0	34
1.2.15	157	1378	455	0	52	0	1665	0	1210
	1384	13863	6960	0	725	0	17638	0	11528

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR October 1, 1997 - June 30, 1998

7/7/98 3:30:48 PM

		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
		EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
OG1CGA1	USGS Engineering Assurance	35.7	25.2	72.7	32.8	40.0	69.6	11.3	37.7	39.8	0.0	0.0	0.0	364.8
121C9075U1	USGS Engineering Assurance (EA)	35.7	25.2	72.7	32.8	40.0	69.6	11.3	37.7	39.8	0.0	0.0	0.0	364.8
OG1CGA2	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	0.0	0.0	0.0	4.2
OG1CGA2	Personnel Qualification	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	3.6
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	0.0	0.0	0.0	7.9
121C9075		35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	0.0	0.0	0.0	372.7
	1.2.1.1	35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	0.0	0.0	0.0	372.7
	1.2.1	35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	0.0	0.0	0.0	372.7
OG311GA1	Scientific Programs Management & Integ	19.7	14.8	24.4	14.1	19.8	20.2	18.9	19.2	14.6	0.0	0.0	0.0	165.7
OG312GA1	Manage Nevada Operations/Earth Scien	73.3	53.2	53.6	52.7	111.1	30.2	44.4	37.9	39.3	0.0	0.0	0.0	495.8
12319090U1	USGS SP&I	93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	0.0	0.0	0.0	661.5
12319090		93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	0.0	0.0	0.0	661.5
	1.2.3.1	93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	0.0	0.0	0.0	661.5
OG32836FB1	Conduct Probabilistic Seismic Hazards A	11.5	-3.7	19.5	1.5	4.3	-2.4	11.2	-5.3	4.3	0.0	0.0	0.0	41.0
OG32836GB3	Support Seismic Design Input	18.9	22.6	6.6	27.2	17.4	18.3	2.1	23.8	15.2	0.0	0.0	0.0	152.2
12321155U1	Prepare Seismic Design Inputs	30.5	18.9	26.2	28.7	21.8	15.9	13.3	18.4	19.5	0.0	0.0	0.0	193.1
OG32836FB1	Conduct Probabilistic Seismic Hazards A	0.0	6.1	1.0	10.5	11.6	6.1	11.9	3.6	7.8	0.0	0.0	0.0	58.7
12321155UC	Conduct Prob. Seismic Hazards Ass.	0.0	6.1	1.0	10.5	11.6	6.1	11.9	3.6	7.8	0.0	0.0	0.0	58.7
OG32836FB1	Conduct Probabilistic Seismic Hazards A	0.0	0.0	0.0	11.2	1.2	26.8	12.3	11.0	1.8	0.0	0.0	0.0	64.3
12321155UY	PSHA - Deferred	0.0	0.0	0.0	11.2	1.2	26.8	12.3	11.0	1.8	0.0	0.0	0.0	64.3
12321155		30.5	25.0	27.2	50.4	34.6	48.8	37.5	33.1	29.1	0.0	0.0	0.0	316.1
OG32211GA1	Stratigraphic Support to LA & Confirmati	21.4	9.6	12.5	20.8	19.2	9.1	5.6	8.7	1.6	0.0	0.0	0.0	108.4
12322210U1	Stratigraphy	21.4	9.6	12.5	20.8	19.2	9.1	5.6	8.7	1.6	0.0	0.0	0.0	108.4
OG32212GA3	Structural Support to LA & Confirmation	0.8	0.2	4.3	-1.8	3.5	0.0	6.0	11.8	13.5	0.0	0.0	0.0	38.2
OG32212GB1	Conduct Fracture Studies	3.9	3.7	7.8	1.4	2.2	5.6	9.2	2.7	5.2	0.0	0.0	0.0	41.6
OG32212GB2	Publish Maps & Reports for Structural St	12.0	5.1	-8.5	12.2	0.8	-5.7	10.0	19.2	25.9	0.0	0.0	0.0	71.0
OG32212GB4	Structural Support to TSPA/VA	2.1	3.1	9.3	4.0	3.2	28.6	26.8	16.3	40.4	0.0	0.0	0.0	133.8
12322210U2	Structure	18.7	12.1	12.9	15.8	9.6	28.4	52.0	50.0	84.9	0.0	0.0	0.0	284.5
OG32211GB3	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	0.0	0.0	0.0	46.0
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	0.0	0.0	0.0	46.0
OG32211FB2	Stratigraphic Descriptions - WT-24/SD-6	0.0	18.5	2.6	1.4	0.5	0.7	0.4	2.4	6.7	0.0	0.0	0.0	33.3

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR October 1, 1997 - June 30, 1998

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	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
	EST	EST	EST	EST									
12322210UC Stratigraphic Descriptions - SD6/WT2	0.0	18.5	2.6	1.4	0.5	0.7	0.4	2.4	6.7	0.0	0.0	0.0	33.3
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	0.0	0.0	0.0	476.1
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	0.0	0.0	0.0	145.4
0G32212FB5 Geologic Mapping of the ECRB	55.2	69.6	46.7	71.4	59.0	63.2	120.0	106.5	117.4	0.0	0.0	0.0	709.0
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	46.8
12326050U2 Structural Features and ESF Testing	55.9	106.7	94.1	111.4	108.4	75.4	116.9	115.6	117.1	0.0	0.0	0.0	901.4
12326050	55.9	106.7	94.1	111.4	108.4	75.4	116.9	115.6	117.1	0.0	0.0	0.0	901.4
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	0.0	0.0	0.0	16.2
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	0.0	0.0	0.0	16.2
12327025	3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	0.0	0.0	0.0	16.2
1.2.3.2	131.6	181.4	148.0	202.0	173.2	184.4	227.0	217.3	244.9	0.0	0.0	0.0	1709.7
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	0.0	0.0	0.0	30.7
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	0.0	0.0	0.0	30.7
12331200	2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	0.0	0.0	0.0	30.7
0G33124GB5 PTn Lateral Diversion (Phase II)	6.9	7.4	3.3	9.3	4.1	0.2	6.7	12.7	9.4	0.0	0.0	0.0	60.0
12332245U1 Hydrostratigraphy	6.9	7.4	3.3	9.3	4.1	0.2	6.7	12.7	9.4	0.0	0.0	0.0	60.0
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	0.0	0.0	0.0	46.5
12332245U2 Surface-Based Borehole Testing	0.0	0.0	4.1	0.2	-3.5	6.5	13.7	13.6	11.9	0.0	0.0	0.0	46.5
0G33124FBB Air-K & Hydrochemistry Testing ESF	45.0	36.6	71.8	43.8	52.1	51.2	58.7	43.8	36.3	0.0	0.0	0.0	439.2
12332245U3 ESF Borehole Testing	45.0	36.6	71.8	43.8	52.1	51.2	58.7	43.8	36.3	0.0	0.0	0.0	439.2
0G33123GB3 Unsaturated Matrix Flow Properties	6.3	17.8	0.9	11.9	12.1	21.9	12.7	1.3	0.0	0.0	0.0	0.0	84.8
0G33123GB5 Backfill Hydrologic Properties Measurem	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.5	0.0	0.0	0.0	34.5
12332245U4 Hydrologic Properties Measurements	6.3	17.8	0.9	11.9	12.1	21.9	12.7	1.3	34.5	0.0	0.0	0.0	119.3
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	0.0	0.0	0.0	74.1
0G33124GBF Characterization of Seepage in Alcoves	11.3	36.4	36.6	34.8	35.6	9.5	93.9	23.4	11.2	0.0	0.0	0.0	294.6
12332245U5 Percolation and Seepage	11.3	41.8	62.0	31.3	45.4	22.6	101.3	37.2	15.8	0.0	0.0	0.0	368.7
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	0.0	0.0	0.0	219.9
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	0.0	0.0	0.0	140.3
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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		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
		EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
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	0.0	0.0	0.0	409.5
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	0.0	0.0	0.0	66.6
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	0.0	0.0	0.0	211.5
12332245U7	UZ Hydrochemistry	24.2	25.9	22.9	32.0	48.1	14.8	89.9	15.0	5.5	0.0	0.0	0.0	278.2
0G33123FBF	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	0.0	0.0	0.0	40.
12332245UC	Matrix Properties - SD6/WT24	0.0	0.0	11.2	3.8	4.6	13.1	-3.2	-2.6	13.4	0.0	0.0	0.0	40.4
0G33131FBG	Perched Wtr & SZ Hydrologic Tstg - WT	27.2	11.5	26.2	17.2	21.2	39.4	39.5	34.8	49.9	0.0	0.0	0.0	268.9
0G33131FBH	Iso/Hydrochem Smpg/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. Sampling	35.4	18.8	33.8	25.1	34.6	41.3	39.2	-4.0	60.5	0.0	0.0	0.0	284.8
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	0.0	0.0	0.0	82.8
12332245UR	Risk Mitigation - Hydrostratigraphy	1.5	6.9	3.6	20.0	30.3	44.3	28.9	11.1	21.1	0.0	0.0	0.0	167.8
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	0.0	0.0	0.0	8.7
12332245UW	Matrix Properties WT-24 Deferred	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	0.0	0.0	0.0	8.7
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 Smpg/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	0.0	0.0	0.0	136.9
0G33131FBB	Conduct C-Holes Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	3.9	9.9	4.4	0.0	0.0	0.0	124.0
0G33131FBF	Conduct Chemical & Isotopic Analysis -	0.0	0.0	0.0	0.0	0.0	0.0	3.6	6.3	0.7	0.0	0.0	0.0	10.6
12332245UY	SZ Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	7.5	16.2	5.0	0.0	0.0	0.0	134.6
0G33121GB2	Update & Enhance Net Infiltration Numer	7.1	17.7	5.7	14.2	17.1	12.2	2.5	5.8	8.4	0.0	0.0	0.0	90.6
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	0.0	0.0	0.0	58.0
12332247U1	UZ Modeling	7.1	17.7	5.7	19.4	17.5	23.2	32.3	7.5	18.1	0.0	0.0	0.0	148.6
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	0.0	0.0	0.0	48.6
0G33133FB6	Confirm SZ Hydrologic Flow Models	14.3	20.6	21.4	20.6	22.3	-0.2	8.0	7.7	11.5	0.0	0.0	0.0	126.2
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	0.0	0.0	0.0	95.6
0G33133GB6	Test Alternate Conceptual Models	6.1	2.9	6.6	10.7	3.1	11.0	3.7	9.2	5.9	0.0	0.0	0.0	59.2

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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
OG33133GB7 Refine Regional Hydrogeologic Framewo	20.4	8.8	24.8	17.6	22.3	15.2	16.3	6.1	8.3	0.0	0.0	0.0	139.8
12332247U2 SZ Modeling	51.6	47.3	65.8	64.5	66.7	51.3	41.7	44.6	35.8	0.0	0.0	0.0	469.4
OG33132GB1 Iso/Hydrochem. Analysis of SZ Ground	24.9	28.2	-0.3	21.3	87.2	24.8	110.7	29.8	33.8	0.0	0.0	0.0	360.5
12332247U4 Isotopic/Hydrochemical SZ Studies	24.9	28.2	-0.3	21.3	87.2	24.8	110.7	29.8	33.8	0.0	0.0	0.0	360.5
12332245	248.7	305.7	311.8	351.8	565.8	415.3	653.2	347.9	382.1	0.0	0.0	0.0	3582.2
OG33124FB8 Percolation Flux Across Repository Horiz	0.0	26.4	24.4	68.0	36.2	-10.0	5.8	16.5	5.2	0.0	0.0	0.0	172.0
OG33124FBD Moisture Monitoring in the ESF - ECRB	5.9	8.0	7.0	-6.3	0.9	5.2	39.5	49.3	68.8	0.0	0.0	0.0	178.2
OG33124GBA Infiltration of Construction Water in ESF	10.7	-3.0	0.2	15.1	6.8	1.7	13.2	4.8	2.6	0.0	0.0	0.0	52.0
12336050U3 Infiltration, Percolation & Seepage	16.6	31.3	31.6	76.7	43.9	-3.1	58.5	70.6	76.5	0.0	0.0	0.0	402.7
12336050	16.6	31.3	31.6	76.7	43.9	-3.1	58.5	70.6	76.5	0.0	0.0	0.0	402.7
OG33112FB2 Collect Site Streamflow Data (1997)	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	31.5	20.1	0.0	0.0	0.0	108.8
OG33112GB1 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	0.0	0.0	0.0	108.8
OG33123FBB UZ Borehole Instrumentation & Monitorin	18.4	16.1	25.8	30.7	-11.7	10.3	-6.0	-0.9	0.9	0.0	0.0	0.0	83.7
OG33123FBC 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
OG33123GB1 UZ Borehole Instrumentation & Monitorin	6.9	6.1	7.6	6.3	29.5	19.0	29.2	38.6	25.6	0.0	0.0	0.0	168.8
OG33123GB2 Integrated Analysis & Interpretation	0.0	0.0	0.0	5.0	3.8	-1.3	0.0	0.0	15.8	0.0	0.0	0.0	23.2
12337025U3 Surface Based Hydrologic Monitoring	38.9	29.9	47.8	61.5	8.5	41.1	23.4	37.6	43.3	0.0	0.0	0.0	331.9
OG33131FBD Water-Level Monitoring	10.3	0.1	-1.9	0.5	4.2	9.0	8.1	0.8	1.0	0.0	0.0	0.0	32.2
OG33131GB1 Water-Level Monitoring	5.5	11.2	8.8	7.5	6.9	4.8	12.4	5.6	19.4	0.0	0.0	0.0	82.3
12337025U5 Saturated-Zone Monitoring	15.8	11.4	6.9	8.0	11.1	13.8	20.5	6.5	20.4	0.0	0.0	0.0	114.4
OG33127GB3 Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	-2.6	23.0	0.0	0.0	0.0	47.5
12337025U6 Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	-2.6	23.0	0.0	0.0	0.0	47.5
12337025	66.4	48.5	65.3	99.2	32.3	78.4	32.7	72.9	106.8	0.0	0.0	0.0	602.6
1.2.3.3	334.0	387.6	412.4	530.4	642.9	493.8	745.2	500.1	571.7	0.0	0.0	0.0	4618.2
OG36215GB2 Future 100K Climate Records	0.0	4.7	4.1	9.6	7.1	4.2	30.2	13.7	16.1	0.0	0.0	0.0	89.7
12362252U1 Paleoclimate Analysis	0.0	4.7	4.1	9.6	7.1	4.2	30.2	13.7	16.1	0.0	0.0	0.0	89.7
OG36221GB3 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	0.0	0.0	0.0	117.5
12362252U2 Geochronology of Fracture Minerals - L	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	2.8	23.3	0.0	0.0	0.0	117.5
OG36221GB1 Paleoclimate Confirmatory Analyses - LA	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	10.6	-4.7	0.0	0.0	0.0	150.1
12362252U3 Paleohydrology and WT Fluctuations	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	10.6	-4.7	0.0	0.0	0.0	150.1

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	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
12362252	29.2	17.6	23.0	34.1	46.4	12.0	133.0	27.1	34.7	0.0	0.0	0.0	357.2
OG36221FB3 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	0.0	0.0	0.0	274.0
12366050U1 Fracture Mineral Age Dating	6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	0.0	0.0	0.0	274.0
12366050	6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	0.0	0.0	0.0	274.0
OG36221GB4 Data Qualification for NRC	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	0.0	0.0	0.0	11.4
12367027U2 Data Qualification Evaluation for the N	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	0.0	0.0	0.0	11.4
12367027	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	0.0	0.0	0.0	11.4
1.2.3.6	35.5	30.1	64.6	51.8	58.3	25.8	260.7	53.0	62.7	0.0	0.0	0.0	642.6
OG398GB6 Support PISA Geology Section	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.1	6.5	0.0	0.0	0.0	51.5
12392142U1 SDD - Geology Chapter	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.1	6.5	0.0	0.0	0.0	51.5
OG398FB2 Develop PISA Chapter 3.5 (Hydrology)	20.5	20.8	27.0	31.0	46.2	28.8	19.0	21.0	18.2	0.0	0.0	0.0	232.5
12392142U2 SDD - Hydrology Chapter	20.5	20.8	27.0	31.0	46.2	28.8	19.0	21.0	18.2	0.0	0.0	0.0	232.5
OG398FB4 Dev. Climate/Met. Site Desc.	29.5	42.0	51.5	28.4	34.7	37.8	44.4	-3.1	12.0	0.0	0.0	0.0	277.2
12392142U3 SDD - Climate/Meteorol. Chapter	29.5	42.0	51.5	28.4	34.7	37.8	44.4	-3.1	12.0	0.0	0.0	0.0	277.2
OG398GB5 Support Devel. of PISA Geochem. Sectio	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	9.0	2.4	0.0	0.0	0.0	56.2
12392142U4 SDD - Geochemistry Chapter	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	9.0	2.4	0.0	0.0	0.0	56.2
OG398GB6 Chapter Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	18.2	7.5	0.0	0.0	0.0	145.3
12392142U6 SDD - Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	18.2	7.5	0.0	0.0	0.0	145.3
OG398FB2 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
OG32211GB4 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	0.0	0.0	0.0	19.3
12392212U1 Input to 3-D Integrated Site Model	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	11.0	0.0	0.0	0.0	19.3
OG398GA1 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	0.0	0.0	0.0	802.6
OG398GA1C 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
OG398GA1F Provide QA Implementation Support	9.3	11.7	27.4	13.6	10.4	14.8	12.1	7.2	20.3	0.0	0.0	0.0	126.8
OG398GA2C 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	0.0	0.0	0.0	9.4
12399090U1 Site Investigations Support	9.3	12.3	28.8	13.6	10.4	14.8	12.1	7.2	29.7	0.0	0.0	0.0	138.2
12399090	9.3	12.3	28.8	13.6	10.4	14.8	12.1	7.2	29.7	0.0	0.0	0.0	138.2
1.2.3.9	108.0	94.1	138.5	98.2	130.2	121.8	110.0	52.7	87.4	0.0	0.0	0.0	940.9

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	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
1.2.3	702.0	761.2	841.6	949.2	1135.4	876.3	1406.1	880.3	1020.7	0.0	0.0	0.0	8572.9
OG535GA1 Technical Data Coordination	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	0.0	0.0	0.0	330.1
12532186U1 Provide Technical Data Base Input	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	0.0	0.0	0.0	330.1
12532186	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	0.0	0.0	0.0	330.1
1.2.5.3	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	0.0	0.0	0.0	330.1
OG544GA1 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
12541121U1 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
OG541FA2 Deferred - Support to Performance Asses	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	4.9	5.6	0.0	0.0	0.0	10.5
12541121UY Provide Support to Performance Asses	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	4.9	5.6	0.0	0.0	0.0	10.5
12541121	5.3	6.4	2.4	3.1	3.4	0.0	6.6	14.2	9.9	0.0	0.0	0.0	51.4
1.2.5.4	5.3	6.4	2.4	3.1	3.4	0.0	6.6	14.2	9.9	0.0	0.0	0.0	51.4
1.2.5	38.1	32.2	43.1	29.6	46.9	33.0	39.3	58.2	61.0	0.0	0.0	0.0	381.6
OG825GA1 Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	0.0	0.0	0.0	72.5
12829121U1 Federal Occupational Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	0.0	0.0	0.0	72.5
12829121	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	0.0	0.0	0.0	72.5
1.2.8.2	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	0.0	0.0	0.0	72.5
OG847GA2 Conduct Rad Water Quality Sample Coll	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	0.0	0.0	0.0	39.1
12842086U1 Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	0.0	0.0	0.0	39.1
12842086	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	0.0	0.0	0.0	39.1
OG847GB1 Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	0.0	0.0	0.0	316.3
12849121U1 Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	0.0	0.0	0.0	316.3
12849121	0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	0.0	0.0	0.0	316.3
1.2.8.4	15.7	39.5	19.9	30.5	22.8	125.0	28.3	37.7	36.0	0.0	0.0	0.0	355.3
1.2.8	24.0	45.8	28.1	38.5	29.8	132.9	35.8	47.1	45.6	0.0	0.0	0.0	427.8
OG9121GA Technical Project Office	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	0.0	0.0	0.0	295.8
12919135U1 USGS Project Management	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	0.0	0.0	0.0	295.8
12919135	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	0.0	0.0	0.0	295.8
1.2.9.1	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	0.0	0.0	0.0	295.8
OG922GA Participant Project Control	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	0.0	0.0	0.0	204.9
12929135U1 Project Control - USGS	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	0.0	0.0	0.0	204.9
12929135	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	0.0	0.0	0.0	204.9

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	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
1.2.9.2	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	0.0	0.0	0.0	204.9
1.2.9	54.0	52.7	64.9	47.4	54.9	61.1	66.7	59.5	39.4	0.0	0.0	0.0	500.7
OGC522GA1 Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	0.0	0.0	0.0	33.7
12C59130U1 USGS Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	0.0	0.0	0.0	33.7
12C59130	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	0.0	0.0	0.0	33.7
1.2.12.5	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	0.0	0.0	0.0	33.7
1.2.12	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	0.0	0.0	0.0	33.7
OGF23GA1 Support/Personnel Services	44.6	42.2	12.4	32.1	32.5	37.2	35.4	39.2	56.3	0.0	0.0	0.0	332.0
OGF23GA5 Procurement & Property Management	4.5	7.8	7.7	5.2	6.8	8.6	9.1	9.7	10.5	0.0	0.0	0.0	70.0
12F29110U1 Personnel/Procurement/Property Servi	49.1	49.9	20.1	37.4	39.2	45.9	44.5	49.0	66.8	0.0	0.0	0.0	401.9
OGF23GA2 Facilities Management (space)	0.0	123.3	61.7	61.7	61.7	44.7	58.8	58.8	58.8	0.0	0.0	0.0	529.5
OGF23GA3 Facilities Management (computers/phone	0.0	36.3	18.2	18.2	18.2	13.2	17.3	17.3	17.3	0.0	0.0	0.0	156.0
OGF23GA4 Facilities Management (other)	0.0	19.7	9.8	9.8	9.8	7.3	9.4	9.4	9.4	0.0	0.0	0.0	84.8
12F29110U2 Facilities Management (USGS)	0.0	179.3	69.7	69.7	69.7	65.2	85.6	85.6	85.6	0.0	0.0	0.0	770.3
12F29110	49.1	229.3	109.8	127.0	128.9	111.0	130.1	134.6	152.4	0.0	0.0	0.0	1172.2
1.2.15.2	49.1	229.3	109.8	127.0	128.9	111.0	130.1	134.6	152.4	0.0	0.0	0.0	1172.2
OGF3GA1 USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	0.0	0.0	0.0	38.2
12F39110U1 USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	0.0	0.0	0.0	38.2
12F39110	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	0.0	0.0	0.0	38.2
1.2.15.3	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	0.0	0.0	0.0	38.2
1.2.15	53.5	232.6	114.4	131.3	132.5	115.0	135.1	138.7	157.3	0.0	0.0	0.0	1210.4
1.2 OPERATING	911.4	1152.8	1168.7	1232.7	1443.0	1291.7	1698.0	1227.3	1374.1	0.0	0.0	0.0	11499.8
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	1698.0	1227.3	1374.1	0.0	0.0	0.0	11499.8
FTEs													
FEDERAL	111.7	90.6	104.7	97.4	86.4	94.9	98.4	105.4	80.7	0.0	0.0	0.0	
CONTRACT	31.5	29.4	36.1	28.3	31.4	34.7	37.7	28.3	44.6	0.0	0.0	0.0	
TOTAL	143.2	120.0	140.8	125.7	117.8	129.6	136.0	133.7	125.3	0.0	0.0	0.0	