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

MAR 13 1998

OVERNIGHT MAIL

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

SUBMITTAL OF PARTICIPANTS' MONTHLY PROGRESS REPORT

As you have requested, the U.S. Nuclear Regulatory Commission is on distribution to receive a copy of the Yucca Mountain Site Characterization Project participant's monthly status report on a regular basis. Enclosed is the U.S. Geological Survey Progress Report for December 1997.

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

Stephan Brocoum
Assistant Manager for Licensing

AML:AVG-0698

Enclosure:
Ltr, 01/15/98, Craig to Kozai, w/encl.

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Enclosure

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Box 25046 M.S. 425
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IN REPLY REFER TO

INFORMATION ONLY

January 15, 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, December, 1997

Attached is the USGS progress report in the required format for the month of December, 1997.

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

DECEMBER 1997

WBS 1.2.3.1 COORDINATION AND PLANNING

U.S. Geological Survey - Yucca Mountain Branch is currently processing 162 scientific papers prepared by USGS authors. Of these, 99 are related to geologic studies and 63 to hydrologic studies. In addition, 12 abstracts are being processed, as well as 17 reports by LBL personnel.

WBS 1.2.3.2 GEOLOGY

Geologic Framework

Technical review of Milestone report SPG39IM4 was returned to participants of the USGS stratigraphic studies project, with several comments to the effect that alternative picks should be considered in finalizing stratigraphic correlations. Such comments have prompted a review of all the datasets used in the original picks, including borehole television camera observations, core photos, and others that were not considered by the reviewers but which have a direct bearing on the final correlations; this review is still in progress.

Project staff conducted field mapping in southern Yucca Mountain as part of the 1:50,000-scale geologic map compilation for the saturated-zone site area. The focus of studies in that area is on the evaluation of faults and fault zones as potential flow channels or hydrologic barriers. The overall evaluation is based not only on the new mapping, but also utilizes existing geologic mapping as appropriate to the study.

A color plate that includes the Cross Repository Drift cross section, geologic map, and explanation was completed and transmitted to M&O and Bureau of Reclamation staff. Preparation of a text for incorporation in the Cross Repository Drift predictive report is continuing. A short report documenting geologic and geophysical evidence as a basis for subsurface bedrock fault interpretations in the Midway area was prepared and submitted for technical review. This report is intended for presentation at the next High-Level Nuclear Waste Conference.

The submittal of structural data, including surface and subsurface (ESF) geologic mapping and fracture data, in support of LANL's contribution to the ECRB predictive report, is continuing. Work conducted as part of LANL's development of a conceptual model to explain the distribution of bomb-pulse chlorine-36 in the ESF included refinement sample classification and descriptions and continued analysis and interpretation of pertinent structural data. Materials are also being assembled for the participation of USGS staff in the chlorine-36 peer review scheduled for mid-January.

Additional fracture data from the video logs of boreholes SD-7, -9, -12 and H-5 were collected for use as indicators of fracture densities in the Topopah Spring Tuff welded units (Tsw1 and Tsw2). Fracture orientation and density data were also gathered from the lower nonlithophysal zone of the Topopah Spring Tuff in the Prow Pass area in an effort to estimate relative fracture densities along the alignment of the cross-block drift.

Seismotectonic Studies

PSHA staff completed Milestone Report SPG28LM3, entitled "Deterministic Evaluations of Potential Type I Faults at Yucca Mountain", and submitted it to DOE. An abbreviated version of the report, proposed for presentation at the American Nuclear Society meeting in May, 1998, was submitted for review. The Seismic Source Characterization expert teams completed the revision of their fault displacement models and activity reports. The calculations team completed preliminary calculations for all potential fault

displacement locations. Project personnel attended a seismic design meeting at Woodward-Clyde offices in Oakland to review revised chapters and appndices for the Seismic Design Topical Report.

- Investigation and clarification of the relevance of tectonic models to coupled processes at the Yucca Mountain site continued.

WBS 1.2.3.3 HYDROLOGY

Regional Hydrology

Technical review began of all streamflow and precipitation data collected during FY97. Streamflow and precipitation data for the three recording streamflow gages along Fortymile Wash were entered into tabular format for submittal to the Nevada District Data Section. Routine maintenance of stream gages on Fortymile Wash and upper and lower Split and Pagany Washes on Yucca Mountain continued during the period. Project staff kept vigilance during the reporting period for potential precipitation and runoff associated with several storms that passed through the southern Nevada area. Runoff was neither observed nor reported for the five recording stream gages or for the Yucca Mountain vicinity.

Unsaturated-Zone Hydrology

Monitoring of instrumentation in boreholes continued. Borehole data from NRG-7a, UZ #4, UZ #5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived to optical disk on a routine basis throughout the month. Daily EKES files were checked for shelter activity. Sensor readings were checked daily as well for unusual occurrences, and any statistical outliers were flagged. The communications computer at SD-12 was replaced. Computer operations were restarted at NRG-6, and the sensors were checked out. The IDISPLAY program was modified to handle large gaps in the data set, such as that from NRG-6 where the borehole had been inactive for a year. Staff began digital scanning of sensor calibration reports for field sites 3 through 7 for submittal. Activities included calibration runs on three pressure transducers and two thermistors. Forty-eight trips were made to field sites for correction of generator, UPS, and chiller problems, including 19 visits for generator maintenance and 15 visits to correct communications problems and to collect data. Data were collected at NRG-6 from December 3 until December 19, when the generator went down. The field site was shut down on December 22, and the generator was removed.

A data submittal titled "Deep Unsaturated-Zone Surface-Based Borehole Instrumentation Program—Interim Data Submittal for Boreholes USW NRG-7a, UE-25 UZ #4, UE-25 UZ #5, USW UZ-7a, and USW SD-12 for the Time Period July 1, 1997, through September 30, 1997" was submitted to the Records Processing Center and the Technical Data Base on December 31, 1997.

Air-permeability and hydrochemical testing in the ESF continued. Permeability and porosity values from the Northern Ghost Dance Fault Drill Room 3-D cross-hole air-injection tests agree with the earlier 2-D test results with minor differences. The addition of borehole MF#3 allowed testing of the fault-zone vertical permeability which indicated that the vertical permeability in the fault zone (up to 20 darcies) may be slightly larger than the 2-D horizontal permeability values (4 to 14 darcies). This preliminary analysis appears to indicate some anisotropy in the fault zone; a true understanding of the 3-D flow system, however, will require significantly more analysis before final conclusions can be reached. Instrumentation of the three Northern Ghost Dance Fault Drill Room boreholes was completed, and USGS field staff conducted 3-D cross-hole air-injection tests. Boreholes MF#1 and MF#2 were instrumented with multi-packer systems that divided the boreholes in to 20 isolated monitor intervals. Borehole MF#3 was instrumented with an air-injection packer assembly. The cross-hole 3-D testing was successful with multiple monitor-interval pressure responses in borehole MF#1 and MF#2 during air-injection in borehole MF#3. The successful 3-D air-injection testing will provide estimates of the permeability and porosity of the Ghost Dance Fault at a scale of 5 to 15 m.

South-Ramp hydrologic studies continued with ongoing collection of water-potential data from the sets of heat-dissipation (HD) probes installed at ESF stations 66+99, 67+33, 70+54, and 70+56. Water-content data were collected from the time-domain reflectometry (TDR) instrumentation installed at ESF station 66+99. The areas around these instruments are still covered with plastic to monitor the recovery of the rocks from the drying effects due to tunnel ventilation. Data have been compiled and graphed. Pore-water extraction from a single lexan-enclosed sample from each South Ramp borehole was continued using a centrifuge. Pore water was extracted from 33 boreholes. The water samples which could be extracted from core were sent to LANL for analysis of Cl^-, Br^-, and SO_4^{-2} using ion chromotography. Analysis has been completed on 24 samples, and the analysis continued. Equipment has been sent to LANL to allow extractions to be done at LANL. Planning for core distribution and types of analysis to be done on core samples from South Ramp boreholes continued, and distribution of samples began. Core will be divided between the USGS and LANL; proposed analyses include Cl^-, Br^-, SO_4^{-2}, ^{36}Cl, $^3H^+$, ^{14}C, major ions, $\ddot{a}^{18}O$, Sr/U isotopes, petrographic analysis of thin sections, and XRD.

Moisture monitoring in the ESF continued with several efforts as part of enhanced characterization of the potential repository block (ECRB), including analysis of water migration related to the TBM. Collection of temperature and relative-humidity data continued at eight sites in the ESF. Wind-speed data currently are being collected at five sites. Water-potential and water-content data are being collected with HD and TDR probes at selected locations throughout the ESF. Planning and preparation for water-balance data collection in the cross drift has begun. Various types of instrumentation systems are being developed and tested for use in the TBM water-migration study. Borehole videos for boreholes CWAT #1 and #2 have been reviewed to see if any rock features would explain differences in construction-water migration between the two holes. Water-use data were obtained from the TCO and are being reviewed as part of the water-migration study. Work to evaluate the evaporation characteristics of the surfactant CW-10 was initiated. Different concentrations (ranging from 1:100 to 1:2000) were used and allowed to evaporate in the laboratory with air-flow rates between 0.5 and 1.5 m/s. Attempts are being made to determine the amount of residual surfactant remaining following evaporation of the water. The amount of residual surfactant will be used to calculate the amount of surfactant volatilized during evaporation. Imbibition experiments have also been initiated to determine the influence of changes in contact angle between the solutions and the rock surface and the sorptivity of the rock. In both experiments, comparisons are being made against standard deionized water.

Work on net-infiltration studies continued in two areas, updating of the model with a surface-runoff module and estimation of potential infiltration rates at Yucca Mountain. Work continued on a Fortran program for defining surface drainage boundaries and for calculating the upstream drainage area for each grid cell using the 30-m elevation grid as input. Testing of modifications made to allow occurrence of surface water storage also continued. Analysis of results obtained for watershed-modeling domains for the Solitario Canyon, the Drill Hole Wash, and the Dune Wash—Busted Butte drainages was conducted. 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 El Niño climatic oscillation (ENSO) continued. Calibration of the coupled infiltration-runoff model using available stream-flow records for several drainages on Yucca Mountain also continued. A preliminary soil-depth model was developed using ground surface slope. Field studies for the development of a soil-depth model are anticipated for January 1998. In work on potential infiltration, application of the coupled infiltration-runoff routing model to three different 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. Results test assumptions concerning effects of overland flow in response to current and wetter future climates made in development of the 1996 model. Evaluation of the analog sites selected for developing stochastic simulations of daily precipitation for various potential future climate scenarios continued. Application of the 1980-95 daily precipitation record to predict net infiltration in response to an active ENSO continued.

In work to evaluate percolation flux across the repository horizon in ECRB, preliminary locations (northing, easting, and elevation) were obtained for the cross-drift station locations at 50-m spacings.

Preliminary geologic contacts in the cross drift were identified. Analysis to predict hydrologic conditions and physical properties was started. Laboratory tests using the surfactant being used for dust control have begun to determine a suitable detection method for the surfactant. Tests will also determine effects of the surfactant on rock hydraulic properties. Monitoring equipment (HD probes, data loggers, temperature/relative humidity probes, and related accessories) has started to arrive. Scheduling of HD-probe calibrations has been started.

In studies of lateral diversion in the PTn, boreholes NR-4 and NR-5 were monitored for water potential using HD probes. NR-4, located at the base of the Tiva Canyon Tuff in the altered crystal-poor vitric zone (Tpcpv2) measured about -2.3 bars and has equilibrated. NR-5, located in unaltered Tpcpv2, measured less than 1.0 bar and appeared to be drying slightly with passing time. Preliminary estimates of *in situ* saturation and moisture retention indicated that those are reliable measurements. Instrumentation of the remaining boreholes is anticipated for January. Finalization of the data set from these boreholes is ongoing. Saturated hydraulic conductivity (K_{sat}) is being measured on the same samples that were run in the UFA for unsaturated conductivity (K_{theta}). Several of the cores will then be re-run in the UFA. Curves will be regenerated from the moisture-retention curves using measured K_{sat} and compared to the final K_{theta} curves. Preliminary calculations currently are being done to estimate flux through the PTn from the water-potential gradient measured on preserved samples. Evidence from the borehole data indicates that the dry-out from the North Ramp did not extend beyond the 2-m borehole depth and that the water-potential measurements are reliable. However, the final numerical model development will be conducted when the vertical boreholes are drilled and the initial and boundary conditions are confirmed from measurements on core collected from deep boreholes drilled in the alcoves much further away from the North Ramp excavation.

Work on the drift-scale flux and niche studies continued. Drilling continued on boreholes located in Niche #3. Core samples were collected and packaged as required. All collected data have been documented and stored in digital files, including data from Niches #1 and #2. Phase I seepage testing is complete. Dust-collection methodology in the niches was discussed in preparation for evaluation of dust settlement on waste canisters. Atmospheric monitoring in Alcove #1 continued, to evaluate "wet-up" conditions in the alcove. HD-probe data were collected to monitor that wetting. The bulkhead was closed but was not sealed, awaiting installation of additional instrumentation. Similar monitoring was initiated in Alcove #7 to evaluate wet-up there. Air temperature, relative humidity, and barometric pressure are being measured in the fault zone to evaluate ambient rock conditions and to monitor wet-up conditions after sealing of the bulkhead.

Development work was completed on a system for placing HD probes in vertical boreholes. Twenty-one HD probes were installed in Niche #1 to monitor changes in niche water potential. Twenty HD probes also were installed in Alcove #1. Those probes are in highly fractured rock and are located in the crown of the alcove. Temperature, relative humidity, and barometric pressure are being measured in the alcove. HD-probe holes were drilled in Alcove #7 (58 holes) in preparation for installation of additional probes. Eight HD probes have been installed in Alcove #7. Temperature, relative humidity, and barometric pressure are being measured in each of the bulkhead zones. Data collection in Alcove #7 began with the installation of a temperature/relative humidity probe on November 6. Eight HD probes were installed on December 4, and data collection began on December 8. The bulkhead doors were closed on December 12, and collection of data from *in situ* conditions continued. Eight HD probes have been installed in the surface soil above Alcove #7. Two sets of probes have been installed at two depth levels (at depth of 10 cm and at the soil/rock contact) in the fault zone, and two sets similarly were installed outside the fault zone.

Isotopic investigations of water continued. In studies of infiltration of construction water in the ESF, core samples have been obtained for two boreholes in the ESF. Those samples are being prepared for detailed sampling and analysis. Studies of matrix water sources and fracture-matrix interactions continued with sampling by USGS staff of SD-9 core. Sampling of SD-12 material is anticipated for January. Strontium analysis of SD-9 samples continued. Discussion of analysis of SD-9 and SD-12 pore-water salts continued

with preparation of two presentations on pore-water Sr data from SD-7. A poster was presented at the Fall American Geophysical Union meetings entitled *Hydrologic inferences from strontium isotopes in pore water from the unsaturated zone at Yucca Mountain, Nevada* on December 12, and an oral presentation was given at the Field Testing and Associated Modeling (FTAM) Workshop at LBNL on December 15. The reference for the abstract is:

> Marshall B.D., Futa K., and Peterman Z.E., 1997, Hydrologic inferences from strontium isotopes in pore water from the unsaturated zone at Yucca Mountain, Nevada: *EOS, Transactions*, American Geophysical Union, v. 78, no. 46, p. F308.

USGS staff developed a simple model for pore-water Sr compositions within the Topopah Spring welded thermo-mechanical unit (TSw) which relates the pore water to the overlying rock section and to calcite sampled in the ESF. This interpretation is similar to one developed by E. Sonnenthal and D. DePaolo, with whom it was discussed. Further work will refine the model, which has implications for determining ages of TSw calcites. Staff attended the expert elicitation meeting on the Near Field, December 5—7, related to the examination of water from the drift-scale testing. Staff discussed obtaining at least two more samples of water evolved at later stages of the Single Heater Test with Y. Tsang. Comparison of the Sr and U data on all three waters evolved during the test could be valuable in evaluation of extent of water-rock interaction.

Work in UZ hydrochemistry continued with extraction and analysis of water from ESF core and from WT-24. Two ESF pore-water samples were prepared for tritium analysis and counted for tritium concentration; the data were reduced. In work on WT-24, one ground-water sample was distilled. Extracted pore water will be analyzed for tritium, D/H and $^{18}O/^{16}O$ isotopes. Ten 55-gal drums of WT-24 drill cuttings were transferred from the Nevada Test Site (NTS) to the Denver Federal Center.

Numerous other hydrochemical analytical efforts continued. Five pore-water samples from borehole UZ-7a, three from borehole SD-12, two from borehole SD-9, and two from borehole SD-7 core samples were all distilled. The water samples will be analyzed for tritium, D/H, and $^{18}O/^{16}O$ isotopes. Five CO_2 gas samples were shipped to Beta Analytic Inc., in Miami, Florida, for $^{13}C/^{14}C$ analyses. Three CO_2 gas samples from SD-9 cores, and two from SD-7 cores, were extracted using distillation and acidification methods. Lithologic logs of boreholes NRG-7a, SD-7, SD-9, SD-12, UZ-7a, and CWAT #1 and #2 were examined in preparation for selection of core samples for pore-water/gas extraction. Selected cores were transported to Denver for isotopic and chemical analyses. Two pore-water samples from borehole NRG-7a core, four from borehole SD-9, and six from borehole SD-7 were mixed with scintillation cocktail for tritium analysis. Samples were counted in the liquid-scintillation counter for tritium concentration. Data were reduced, and concentrations were calculated. Two core samples each from boreholes SD-7 and SD-9 were distilled to extract dissolved CO_2 from pore water. Residual cores after vacuum distillation, one from borehole SD-7 and one from borehole SD-9, were then acidified with phosphoric acid to extract CO_2 from precipitated calcite. The extracted CO_2 gas was stored inside sealed glass tubes for further analyses of carbon isotopes. The distilled pore water will be analyzed for tritium, D/H and ^{18}O isotopic compositions. Two core samples from borehole UZ-7A were compressed to extract pore water for chemical composition, ^{14}C, and stable-isotope analyses. The LKB liquid -scintillation counter was calibrated. All analytical data obtained during December were recorded into the database. Staff prepared the closing entry for scientific notebook #0032, *Method for Removing Traced Drilling Air from UZ Boreholes*.

Staff presented a paper titled *Isotopic data for pore water extracted from UZ cores at Yucca Mountain, Nevada* (by I.C. Yang) at the American Geophysical Union meeting in San Francisco (December 8—12) and at the FTAM workshop at LBNL in Berkeley (December 15—16).

Saturated-Zone Hydrology

Planning for the Second Tracer Complex (which began in October with discussion of criteria for the complex) continued with a meeting (on December 2—3) of representatives from the USGS, LANL, and LBNL at Los Alamos, New Mexico, to start the process of selecting a site. Four sites were discussed. A

follow-up meeting was planned for the second week of January 1998 at NTS to finalize the selection.

In work to reinstrument the C-holes for hydraulic and tracer testing in the Prow Pass interval, the packer/transducer string in UE-25c #2 and the pump/packer/transducer string in UE-25c #3 were removed from the boreholes during the weeks of December 8 and 15. New instrument strings, for testing the Prow Pass interval, are expected to be installed in January.

In work to evaluate the hydrologic character of boreholes SD-6 and WT-24, final revisions to predictive reports have been completed. No core has yet been received. The second full suite of samples for chemical analyses of water from WT-24 was collected on December 12. This is the final set of samples that will be collected until the borehole is deepened. The samples were distributed to various labs for analyses. Borehole SD-6 was drilled to a depth of 378 ft through December 10. Perched water was not encountered.

From December 1 through 11, borehole WT-24 was pumped seven times at rates of about 1.46 gal/min for the purpose of documenting potential residual drawdown. Water-quality samples were collected from the borehole on December 2 and 10. A hydraulic test was conducted on December 3. The hole was pumped six additional times at similar rates from December 12 through 19.

Ground-water flow models will be used as a basis for the site SZ transport model, which will in turn be used to assess the performance of the potential repository. Site framework and flow models will directly feed the transport model. The regional framework and flow models will provide updated boundary conditions, at reduced uncertainty, to the site flow model for present- and possible future-climate conditions. Alternate conceptual models of hydrologic conditions for large hydraulic gradients also provide increased confidence in flow-model results. Staff continued the iterative process of obtaining data from the USGS NWIS database. Water-level, geologic, and well-completion data are being obtained from NWIS. The selection of parameters is being evaluated and refined to obtain the most complete and useful data set for this study. Data retrievals are also being modified for the regional area so that extraneous sites are omitted and required sites are included. The data are also being formatted to allow for easier inclusion into the data inventory. Staff met repeatedly to discuss structure and format of the regional data inventory in order to develop the most useful analytical tool. Staff also discussed the geophysical and fracture data bases for possible inclusion into the data inventory for evaluation of perched water. Regional water-chemistry data and ongoing updates appeared appropriate for analysis of water conditions within the Death Valley region.

Efforts on regional hydrogeologic framework and flow models continued with revisions in light of plans to integrate models with the UGTA ground-water flow model. Staff began constructing ground-water model evaluation runs to determine where best to add additional vertical discretization to the regional ground-water flow model. Staff met with USGS-Geologic Division staff to coordinate improvements to the regional hydrogeologic framework model with the National Cooperative Geologic Mapping Program. Acquisition of image data for delineating evapotranspiration areas in Death Valley also began. Arrangements were made for staff to visit springs in the Shoshone/Tecopa area of Death Valley National Park.

In support to VA, sensitivity analyses for the SZ flow model were run using the site SZ flow model. These analyses yielded scaled sensitivity values at 94 observation wells which reflect the response of the model to 19 different potential parameters, most of which are specified permeability values. The analyses will be used to identify which parameters have the greatest effect on the site model and which merit the most attention for refinement. Planning for the next phase of model gridding and simulations was completed. Staff will be trained in the process of gridding a 500-m sampled hydrogeologic model into a finite-element mesh of the site model. Gridding is expected to begin in January 1998. An additional simulation was made with the regional flow model in order to simulate a treble increase in rainfall at Yucca Mountain. Increased water levels at Yucca Mountain and increased SZ fluxes beneath the repository were calculated

for inclusion into TSPA-VA calculations. A first draft of sections summarizing site and regional saturated-zone hydrogeology and model simulations by the USGS was completed and forwarded to PA. A poster entitled *Construction and calibration of a preliminary three-dimensional finite-element ground-water flow model of the site saturated zone at Yucca Mountain, Nevada*, by J. Czarnecki, C. Faunt, C. Gable (LANL), and G. Zyvoloski (LANL) was presented at the American Geophysical Union meeting in San Francisco. Attendance and interest in the poster was excellent. A companion presentation of the same topic was made at LBNL the following week at the FTAM workshop.

WBS 1.2.3.6 CLIMATE AND PALEOHYDROLOGY

Efforts to estimate future climatic scenarios continued with work related to Owens Lake. Preparation continued of ostracode and diatom samples from the Owens Lake core from the interval deposited between about 350 ka and 410 ka. The paleoclimatic reconstruction of that period will provide a basis for estimating climatic boundary conditions in the period of the next 10 to 100 ky based on the argument of climate cyclicity.

Samples have been obtained from the Owens Lake record for stable isotope analyses.

In work preparing for paleoclimatic confirmatory analyses for license application, as part of the reconnaissance of down-gradient past-discharge sites, staff discussed U.S. Fish and Wildlife Service (USFWS) and USGS-Las Vegas subdistrict research being done to quantify modern discharge in various environments. USGS-YMPB work to characterize modern deposits in those different environments, and dating of past deposits at Ash Meadows planned for winter and spring, were also described. An additional meeting between USFWS and USGS including R. Laczniak to discuss discharge research in detail was arranged for early February. Climate-team staff also helped lead an NWTRB field trip to Ash Meadows and past-discharge sites in the Amargosa Valley. The focus of the trip was to examine current water usage in the Amargosa Valley, to view evidence and present data on the timing of past discharge of the regional ground-water system in the valley down-gradient of the potential repository, and to discuss the potential for higher water-table elevations under future climatic conditions.

Investigation of the age and distribution of fracture-fill minerals as part of the determination of water flux through the potential repository block continued with work in the ESF. Staff surveyed and sampled secondary mineral occurrences in ESF alcoves and niches. Line surveys of the ESF at a frequency of 30 m for every 100 m of tunnel have now been completed. Nine occurrences of secondary mineralization were sampled from Alcove #7, Alcove #6, Niche #1, and the shallow parts of the North Ramp. An additional three samples of bulk rock were collected from Alcove #7 across the Ghost Dance fault. Samples will be used for pore-water/salt leach studies of evidence of fast-path behavior in Sr and U isotopic distributions. USGS and M&O/TRW staff discussed acquisition of photogrammetric images of the ESF. Two previously surveyed intervals in the tunnel were selected, and photographs of those areas are being printed. If secondary minerals can be identified in those prints and if results can be correlated with those of surveys, the photogrammetry can be used to obtain more complete coverage of secondary mineral distribution throughout the ESF.

An experiment was conducted on opal from the ESF to test feasibility of analysis of very small quantities of outermost mineral material by controlled *in situ* HF leaching. A millimeter-sized opal hemisphere was selected for an initial test. Previous $^{230}Th/U$ dating of similar hemispheres weighing 3 to 10 milligrams from the same sample yielded ages of 150 to 225 ka with initial $^{234}U/^{238}U$ activity ratios of 2.7 to 4.2. Concentrated hydrofluoric acid (HF) was applied to the outermost opal surface using a Teflon capillary tube. The resulting HF-opal solution was aspirated back into the tube, expelled into a Teflon vial, spiked, and loaded directly into the mass spectrometer. Successful analysis was done on only 0.5 nannograms of U. Estimates of the digested sample weight are on the order of 1 to 10 micrograms. Resulting isotopic ratios yield the youngest age yet obtained, 9 ±3 ka with an initial $^{234}U/^{238}U$ activity ratio of about 7. These encouraging results support previously developed theories of very slow mineral growth and may provide a means of evaluating the timing of the most recent additions to surfaces of secondary minerals.

Oral presentations were made at the Fall meeting of the American Geophysical Union (December 12) and at the FTAM Workshop at LBNL (December 15). The talks discussed evidence for a possible UZ origin for secondary minerals in a 300-m zone subjacent to the present water table and implications of much lower water tables some time in the past. Titles were the same for both presentations:

> Whelan, J.F., and Moscati, R.J., 1997, Secondary mineral evidence of large-scale water table fluctuations at Yucca Mountain, Nye County, Nevada,: *EOS, Transactions*, American Geophysical Union, v. 78, no. 46, p. F329.

WBS 1.2.3.9 SPECIAL STUDIES

Work on chapters of the PISA report continued. Sections on Surface Water System and Regional Hydrologic System (PISA Chapter 2.4, Hydrology) were distributed in early December for internal review. Revisions to the various subsections of the Site Hydrology section continued. The revised UZ chemistry subsection was returned to the original contributors for evaluation. Work on the climate chapter involved edit and review of paleoclimate and future-climate subchapters. Other PISA chapters are being examined for content and cross references to climate studies. A revised draft of the meteorology chapter was completed and is being reviewed. Staff attended a meeting at LANL on the geochemistry input to the Site Description. Geochemical data and draft write-ups were exchanged with authors at LANL. Staff attended a planning meeting for peer review of ^{36}Cl studies and attended a workshop on field data and modeling of the hydrologic system. Work on Site Description Chapter 2.3 (Geologic Systems) also continued. Draft responses to comments received from the M&O on sections 3.3.1 and 3.3.2 (Regional Geologic Setting and Tectonic Model) were completed. Work began on comments received from DOE on sections describing geologic and tectonic topics. Staff assisted M&O and LANL staff on other sections.

The USGS technical lead for Site Characterization Progress Report (SCPR) #17 participated in the M&O/USGS interactive review of the November 24 PR #17 draft. On behalf of the USGS, 67 formal comments were transmitted: 4 on the Executive Summary, 1 on Chapter 1 (Introduction), 8 on Chapter 2 (Repository Performance), 2 on Chapter 3 (Design), 39 on Chapter 4 (Site Characterization), 3 on Chapter 5 (Progress Towards Future Objectives), 4 on Chapter 6 (References), and 6 on Documentation of Program Changes (formerly Appendix A). The 39 comments on Chapter 4 also were transmitted via the WBIS, the web-based system for preparation and review of documents that was being prototyped with PR #17. Unfortunately, many of the comments on Chapter 4 (Site Characterization) may have been preempted because while the interactive review was underway, sections of Chapter 4 were being rewritten by the M&O SPO. To help rectify this confusing situation, the USGS technical lead worked directly with the M&O Licensing Group Chapter 4 Aauthor@ to ensure that the rewritten sections (Geologic Framework, Unsaturated Zone, and Saturated Zone) addressed the review comments submitted by the USGS. To supplement the rewritten sections of Chapter 4, the USGS technical lead provided additional technical material to the M&O Licensing Group Chapter 4 author that had been included in the original USGS input to PR #17 but not included in either the November 24 interactive review draft or the Chapter 4 rewrite. Topics covered by the additional material included 1) the quality-assurance aspects of the reevaluation of

lithostratigraphic contacts, 2) specific examples of faults that illustrate the Astructural model@ of Yucca Mountain, 3) synthesis of all quality-assured fracture data for the site-scale UZ flow model, 4) presence of tritium in the ESF to help confirm fast flow paths identified by ^{36}Cl, 5) results of ESF moisture-balance studies that illustrate the large daily evaporation rates due to ventilation, 6) quantification of the range of flux estimates derived from borehole-temperature profiles, and 7) progress on calibration of the UZ site-scale flow model.

WBS 1.2.8 WATER-RESOURCES MONITORING

Ground-water levels at 34 sites and ground-water discharge at one flowing well were measured. USGS-ESIP personnel were contacted to coordinate concurrent steel- and electric-tape measurements for water levels between about 600 and 1500 ft below land surface and to obtain periodic water-level measurements or information on pressure-sensor calibrations collected as part of the site-characterization program. Ground-water data collected during November were checked and filed.

In support to the Environmental Program, staff participated in the National Park Service (NPS) geohydrology meeting in Furnace Creek on December 2—4. Status of well drilling and subsequent collection of water samples in Death Valley National Park were discussed with NPS personnel.

Participant YMP_USGS

Prepared - 01/14/98:10:57:30

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

01-Dec-97 to 31-Dec-97
Page - 1
Inc. Dollars in Thousands

WBS No. - 1.2

WBS Title - Yucca Mountain Project

Parent WBS No. - 1.0

Parent WBS Title - Mined Geologic Disposal System

Element ID - 12

Statement of Work:

See the current WBS Dictionary

Cost/Schedule Performance

		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	73	0	-30	130	130	134	0	-4	526	526	0
1.2.3	Site Investigations	1113	1156	818	43	338	3197	3137	2280	-60	857	12428	12942	-514
1.2.5	Regulatory	52	52	41	0	11	155	155	111	0	44	638	677	-39
1.2.8	Environment, Safety, and H	51	51	26	0	25	149	149	95	0	54	600	597	3
1.2.9	Project Management	57	57	65	0	-8	167	167	170	0	-3	683	692	-9
1.2.12	Information Management	7	7	4	0	3	18	18	11	0	7	77	74	3
1.2.15	Support Services	145	145	114	0	31	429	429	399	0	30	1743	1737	6
Total		1468	1511	1141	43	370	4245	4185	3200	-60	985	16695	17245	-550

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	21230	21110	20785	20754	20575	18946	17255	17247	247624
LABOR	924	986	983	993	933	946	917	922	907	826	737	749	10823
SUBS	150	160	165	180	178	186	181	183	189	179	169	174	2094
TRAVEL	28	59	60	76	64	73	71	74	64	53	42	35	699
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	228	242	260	323	257	267	255	254	247	248	246	252	3079
Total BCWS	1330	1447	1468	1572	1432	1472	1424	1433	1407	1306	1194	1210	16695

Actual Cost of Work Performed

LBRHRS	19347	15629	18106	0	0	0	0	0	0	0	0	0	53082
LABOR	698	634	670	0	0	0	0	0	0	0	0	0	2002
SUBS	190	151	226	0	0	0	0	0	0	0	0	0	567
TRAVEL	6	27	75	0	0	0	0	0	0	0	0	0	108
PM&E	0	62	22	0	0	0	0	0	0	0	0	0	84
OTHER	16	275	148	0	0	0	0	0	0	0	0	0	439
Total ACWP	910	1149	1141	0	0	0	0	0	0	0	0	0	3200

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Participant YMP_USGS

Prepared - 01/14/98:10:57:30

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

01-Dec-97 to 31-Dec-97
Page - 2
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	24499	24462	23384	22422	21797	20957	20797	21175	20804	200297
LABOR	0	0	0	1249	1081	1048	1026	961	932	943	940	943	9123
SUBS	0	0	0	198	200	196	192	184	191	202	194	209	1766
TRAVEL	0	0	0	80	70	79	79	74	66	56	43	34	581
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	350	282	286	278	272	263	244	323	277	2575
Total ETC	0	0	0	1877	1633	1609	1575	1491	1452	1445	1500	1463	14045

Resource Distributions

Fiscal Year 1998	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1330	1447	1468	1572	1432	1472	1424	1433	1407	1306	1194	1210	16695
BCWP	1270	1404	1511	0	0	0	0	0	0	0	0	0	4185
ACWP	910	1149	1141	0	0	0	0	0	0	0	0	0	3200
ETC	0	0	0	1877	1633	1609	1575	1491	1452	1445	1500	1463	14045

Fiscal Year Distribution

	Prior	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Future	At Complete
BCWS	32296	16695	9517	4027	920	279	0	0	0	0	0	0	63734
BCWP	32009	4185	0	0	0	0	0	0	0	0	0	0	
ACWP	32040	3200	0	0	0	0	0	0	0	0	0	0	
ETC	0	14045	9517	4027	920	279	0	0	0	0	0	0	64028

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USGS Level 3 Milestone Report

October 1, 1997 - December 31, 1997

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
PSHA Final Report **Milestone Number:** SP32IM3	9/25/97	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	1/13/98		
Initiate Test of In-Situ Conditions (Alcove 7) **Milestone Number:** SP3507MC	12/12/97	12/12/97	12/9/97	
Deterministic Evals. For Type 1 Faults at YM **Milestone Number:** SPG28LM3	12/19/97	12/19/97	12/19/97	

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USGS Level 4 Milestone Report

October 1, 1997 - December 31, 1997

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	1/6/98		
Memo to TPO: Hydro-Property Measurements **Milestone Number:** SPH235M4	9/4/97	9/30/98		
Memo to TPO: Docmnt Data Package Submittal **Milestone Number:** SPH236M4	9/10/97	9/30/98		
Memo to TPO: Chem/Iso Anlys on Wtr Samples WT-17 **Milestone Number:** SPC34CM4	9/24/97	2/27/98		
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	3/20/98		
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	2/17/98		

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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		
Memo to TPO: Doc Hydraul Prop. Test WT-24 **Milestone Number:** SPH241M4	12/19/97	3/27/98		
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	

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey
Date Prepared: 1/15/98 02:23 PM

Fiscal Month/Year DECEMBER 1997

	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	73	772	248	0	150	0	526	0	134
1.2.3	842	14290	3680	0	1660	0	13181	0	2305
1.2.5	43	224	920	0	339	0	683	0	113
1.2.8	28	522	0	0	0	0	600	0	98
1.2.9	65	618	408	0	137	0	683	0	172
1.2.12	4	184	0	0	0	0	77	0	11
1.2.15	114	1496	368	0	85	0	1743	0	401
	1169	18106	5624	0	2371	0	17493	0	3234

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U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/97 - 12/31/97
1/9/98 10:26:04 AM

		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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.6
121C9075U1	USGS Engineering Assurance (EA)	35.7	25.2	72.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.6
121C9075		35.7	25.2	72.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.6
	1.2.1.1	35.7	25.2	72.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.6
	1.2.1	35.7	25.2	72.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.6
0G311GA1	Scientific Programs Management & Integ	19.7	14.8	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.8
0G312GA1	Manage Nevada Operations/Earth Scien	73.3	53.2	53.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.1
12319090U1	USGS SP&I	93.0	68.0	78.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	238.9
12319090		93.0	68.0	78.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	238.9
	1.2.3.1	93.0	68.0	78.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	238.9
0G32836FB1	Conduct Probabilistic Seismic Hazards A	11.5	-3.7	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.3
0G32836GB3	Support Seismic Design Input	18.9	22.6	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.2
12321155U1	Prepare Seismic Design Inputs	30.5	18.9	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.5
0G32836FB1	Conduct Probabilistic Seismic Hazards A	0.0	6.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1
12321155UC	Conduct Prob. Seismic Hazards Ass.	0.0	6.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1
0G32836FB1	Probabilistic Seismic Hazards Analysis -	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
12321155UY	PSHA - 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
12321155		30.5	25.0	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	82.6
0G32211GA1	Stratigraphic Support to LA & Confirmati	21.4	9.6	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.5
12322210U1	Stratigraphy	21.4	9.6	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.5
0G32212GA3	Structural Support to LA & Confirmation	0.8	0.2	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
0G32212GB1	Conduct Fracture Studies	3.9	3.7	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4
0G32212GB2	Publish Maps & Reports for Structural St	12.0	5.1	-8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6
0G32212GB4	Structural Support to TSPA/VA	2.1	3.1	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5
12322210U2	Structure	18.7	12.1	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.8
0G32211GB3	Detailed Char. of BH Video Logs from Dr	1.3	8.6	-5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
12322210U4	Eval. BH Video Logs - DSHT BHs	1.3	8.6	-5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
0G32211FB2	Stratigraphic Descriptions - WT-24/SD-6	0.0	18.5	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.1
12322210UC	Stratigraphic Descriptions - SD6/WT2	0.0	18.5	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.1
0G32211FB2	Develop Stratigraphic Description - Defer	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
12322210UW	Stratigraphic Descriptions - WT-24 De	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

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U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/97 - 12/31/97
1/9/98 10:26:05 AM

		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
12322210		41.4	48.7	22.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	113.1
0G32212FB2	Complete Site Area Geologic Map - ECR	0.0	29.6	35.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.3
0G32212FB5	Geologic Mapping of the ECRB	55.2	69.6	46.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	171.6
0G32733FB1	Predictive Geotechnical Analysis for EC	0.6	7.5	11.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.8
12326050U2	Structural Features and ESF Testing	55.9	106.7	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	256.6
12326050		55.9	106.7	94.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	256.6
0G32212GB3	Structural Support to Isotopic Age Studie	3.9	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
12327025U1	Structural Support to Isotopic Age Stud	3.9	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
12327025		3.9	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
	1.2.3.2	131.6	181.4	144.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	457.3
0G33133GBF	Support VA SZ Flow Model Sensitivity A	2.3	2.2	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2
12331200U1	Abs/Testing SZ Flow Model for VA	2.3	2.2	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2
12331200		2.3	2.2	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2
0G33124GB5	PTn Lateral Diversion (Phase II)	6.9	7.4	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.7
12332245U1	Hydrostratigraphy	6.9	7.4	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.7
0G33123GB4	Est. of Effective Porosity Values for Topa	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1
12332245U2	Surface-Based Borehole Testing	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1
0G33124FBB	Air-K & Hydrochemistry Testing ESF	45.0	36.6	71.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.4
12332245U3	ESF Borehole Testing	45.0	36.6	71.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.4
0G33123GB3	Unsaturated Matrix Flow Properties	6.3	17.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
12332245U4	Hydrologic Properties Measurements	6.3	17.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
0G33124GB7	ESF Drift-Scale Flux & Niche Study (Pha	0.0	5.5	23.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.9
0G33124GBF	Characterization of Seepage in Alcoves	11.3	36.4	38.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.2
12332245U5	Percolation and Seepage	11.3	41.8	62.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	115.1
0G33131GB2	Hydraulic/Tracer Test of Prow Pass Tuff	20.2	7.1	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.2
0G33131GB4	SZ Hydraulic Testing of Borehole USW	0.0	2.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
0G33131GB5	SZ Hydraulic Testing of Borehole USW	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
0G33133GA3	Planning for STC SZ Confirmation Studi	1.5	-1.2	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
12332245U6	Saturated Zone Testing	21.7	8.3	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.2
0G33127GB1	Matrix Water Sources and Fract.-Matrix I	10.7	8.7	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5
0G33127GB2	Iso./Hydrochem. Studies of UZ Water an	13.5	17.3	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.5

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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
12332245U7	UZ Hydrochemistry	24.2	25.9	22.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.0
0G33123FBF	Hydrologic Charac. of SB BH - WT-24/S	0.0	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2
12332245UC	Matrix Properties - SD6/WT24	0.0	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2
0G33131FBG	Perched Wtr & SZ Hydrologic Tstg - WT	27.2	11.5	28.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.9
0G33131FBH	Iso/Hydrochem Smplg/Anal of SZs - WT	8.2	7.3	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.1
12332245UD	Hydrologic Tst/Hydrochem. Samping	35.4	18.8	33.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.0
0G33124FBF	South Ramp Hydrology (RM)	1.5	6.1	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.2
0G33124FBG	PTn Lateral Diversion - Ph I (RM)	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
12332245UR	Risk Mitigation - Hydrostratigraphy	1.5	6.9	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
0G33124FBH	ESF Drift Scale & Niche Study (RM)	7.3	2.6	-2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
0G33124GA1	Support E&I Design Basis Modeling (RM	0.7	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12332245US	Risk Mitigation - Percolation & Seepag	8.0	1.9	-2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.9
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.9
0G33131FBB	Conduct Chemical & Isotopic Analysis -	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
0G33131FBF	Conduct C-Holes Testing - Deferred	3.4	6.8	29.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.5
12332245UY	SZ Testing - Deferred	3.4	6.8	29.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.5
0G33121GB2	Update & Enhance Net Infiltration Numer	7.1	17.7	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5
0G33121GB3	Prediction of Future Net Infil. Rates in Re	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
12332247U1	UZ Modeling	7.1	17.7	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5
0G33131GB8	Reduce Uncert. in Flux Values Used to C	2.2	7.9	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.8
0G33133FB6	Confirm SZ Hydrologic Flow Models	14.3	20.6	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.3
0G33133GB4	Refine Calibration of Site SZ Flow Model	8.6	7.2	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
0G33133GB6	Test Alternate Conceptual Models	6.1	2.9	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5
0G33133GB7	Refine Regional Hydrogeologic Framewo	20.4	8.8	24.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.0
12332247U2	SZ Modeling	51.6	47.3	65.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	164.7
0G33132GB1	Iso/Hydrochem. Analysis of SZ Ground	24.9	28.2	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.8
12332247U4	Isotopic/Hydrochemical SZ Studies	24.9	28.2	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.8

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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
12332245		248.7	305.7	311.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	866.1
0G33124FB8	Percolation Flux Across Repository Horiz	0.0	26.4	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.8
0G33124FBD	Moisture Monitoring in the ESF - ECRB	5.9	8.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8
0G33124GBA	Infiltration of Construction Water in ESF	10.7	-3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9
12336050U3	Infiltration, Percolation & Seepage	16.6	31.3	31.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.5
12336050		16.6	31.3	31.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79.5
0G33112FB1	Collection of Site Streamflow Data	11.7	-0.7	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2
0G33123FBB	UZ Borehole Instrumentation & Monitorin	18.4	16.1	25.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.3
0G33123FBC	Integrated Analysis & Interpretation	13.6	7.7	14.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.6
0G33123GB1	UZ Borehole Instrumentation & Monitorin	6.9	6.1	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.6
0G33123GB2	Integrated Analysis & Interpretation	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
12337025U3	Surface Based Hydrologic Monitoring	38.9	29.9	47.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116.5
0G33131FBD	Water-Level Monitoring	10.3	0.1	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5
0G33131GB1	Water-Level Monitoring	5.5	11.2	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.6
12337025U5	Saturated-Zone Monitoring	15.8	11.4	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.1
0G33127GB3	Isotope Support for Thermal Testing	0.0	8.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4
12337025U6	Isotope Support for Thermal Testing	0.0	8.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4
12337025		66.4	48.5	65.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.2
	1.2.3.3	334.0	387.6	412.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1134.0
0G36215GB2	Future 100K Climate Records	0.0	4.7	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8
12362252U1	Paleoclimate Analysis	0.0	4.7	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8
0G36221GB3	Water Flux Det. Thru Repos. Blk - Age,	17.4	3.8	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0
12362252U2	Geochronology of Fracture Minerals - L	17.4	3.8	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.0
0G36221GB1	Paleoclimate Confirmatory Analyses - LA	11.8	9.2	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.1
12362252U3	Paleohydrology and WT Fluctuations	11.8	9.2	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.1
12362252		29.2	17.6	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.9
0G36221FB3	Syn. Distr./Anal. Geochron. Age Dets. (E	6.2	12.5	41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.3
12366050U1	Fracture Mineral Age Dating	6.2	12.5	41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.3
12366050		6.2	12.5	41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.3

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0G36221GB4	Data Qualification for NRC	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
12367027U2	Data Qualification Evaluation for the N	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
12367027		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
	1.2.3.6	35.5	30.1	64.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.2
0G39BGB6	Support PISA Geology Section	3.0	2.7	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
12392142U1	SDD - Geology Chapter	3.0	2.7	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3
0G39BFB2	Develop PISA Chapter 3.5 (Hydrology)	20.5	20.8	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.3
12392142U2	SDD - Hydrology Chapter	20.5	20.8	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.3
0G39BFB4	Dev. Climate/Met. Site Desc.	29.5	42.0	51.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122.9
12392142U3	SDD - Climate/Meteorol. Chapter	29.5	42.0	51.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122.9
0G39BGB5	Support Devel. of PISA Geochem. Sectio	12.5	7.5	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.9
12392142U4	SDD - Geochemistry Chapter	12.5	7.5	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.9
0G39BGB6	Chapter Coord/Consol/Review	23.7	6.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.5
12392142U6	SDD - Coord/Consol/Review	23.7	6.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.5
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	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6
12392212U1	Input to 3-D Integrated Site Model	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6
0G39BGA1	Support PR Input/Review	9.5	2.9	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2
12392570U1	PR Review/Input	9.5	2.9	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.2
12392142		98.7	81.8	113.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	293.9
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.5
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4
12399090		9.3	12.3	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4
	1.2.3.9	108.0	94.1	142.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	344.3
	1.2.3	702.0	761.2	841.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2304.9
0G535GA1	Technical Data Coordination	32.8	25.8	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.3
12532186U1	Provide Technical Data Base Input	32.8	25.8	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.3
12532186		32.8	25.8	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.3

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ESTIMATED COSTS FOR 10/1/97 - 12/31/97
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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
	1.2.5.3	32.8	25.8	40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.3
0G544GA1	Support to Performance Assessment	5.3	6.4	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8
12541121U1	Support to Performance Assessment	5.3	6.4	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8
0G541FA2	Provide Support to PA - Deferred	0.0	0.0	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7
12541121UY	Provide Support to Performance Asses	0.0	0.0	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7
12541121		5.3	6.4	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.2
	1.2.5.4	5.3	6.4	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.2
	1.2.5	38.1	32.2	43.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	113.5
0G825GA1	Safety & Health	8.3	6.3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9
12829121U1	Federal Occupational Safety & Health	8.3	6.3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9
12829121		8.3	6.3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9
	1.2.8.2	8.3	6.3	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.9
0G84GA2	Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7
12842086U1	Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7
12842086		15.7	-4.5	-1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7
0G847GB1	Water Resources	0.0	44.0	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.3
12849121U1	Water Resources	0.0	44.0	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.3
12849121		0.0	44.0	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.3
	1.2.8.4	15.7	39.5	19.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.1
	1.2.8	24.0	45.8	28.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.0
0G9121GA	Technical Project Office	28.8	28.7	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.9
12919135U1	USGS Project Management	28.8	28.7	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.9
12919135		28.8	28.7	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.9
	1.2.9.1	28.8	28.7	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95.9
0G922GA	Participant Project Control	25.2	24.0	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.7
12929135U1	Project Control - USGS	25.2	24.0	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.7
12929135		25.2	24.0	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.7
	1.2.9.2	25.2	24.0	26.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.7
	1.2.9	54.0	52.7	64.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	171.6
0GC522GA1	Satellite Records Operations	4.0	3.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8
12C59130U1	USGS Satellite Records Operations	4.0	3.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8
12C59130		4.0	3.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8

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U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR 10/1/97 - 12/31/97
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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
	1.2.12.5	4.0	3.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8
	1.2.12	4.0	3.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8
0GF23GA1	Support/Personnel Services	44.6	42.2	12.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.2
0GF23GA5	Procurement & Property Management	4.5	7.8	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0
12F29110U1	Personnel/Procurement/Property Servi	49.1	49.9	20.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	119.2
0GF23GA2	Facilities Management (space)	0.0	123.3	61.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	185.0
0GF23GA3	Facilities Management (computers/phone	0.0	36.3	18.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.5
0GF23GA4	Facilities Management (other)	0.0	19.7	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.5
12F29110U2	Facilities Management (USGS)	0.0	179.3	89.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	269.0
12F29110		49.1	229.3	109.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	388.2
	1.2.15.2	49.1	229.3	109.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	388.2
0GF3GA1	USGS Training Support	4.4	3.3	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4
12F39110U1	USGS Training Support	4.4	3.3	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4
12F39110		4.4	3.3	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4
	1.2.15.3	4.4	3.3	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4
	1.2.15	53.5	232.6	114.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.5
1.2 OPERATING		911.4	1152.8	1168.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3232.9
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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3232.9
FTEs														
FEDERAL		111.7	90.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT		31.5	29.4	36.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	TOTAL	143.2	120.0	140.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

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