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

OVERNIGHT MAIL

Sandra L. Wastler
High Level Waste & Uranium Recovery
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 September 1998.

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

April V. Gil

FOR Stephan Brocoum
Acting Assistant Manager, Office of
Licensing and Regulatory Compliance

OL&RC:AVG-0515

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Ltr, 10/14/98, Craig to Kozai, w/encl.

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IN REPLY REFER TO:

INFORMATION ONLY

October 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, September, 1998

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

September 1998

COORDINATION AND PLANNING

The U.S. Geological Survey-Yucca Mountain Branch currently is processing some 85 documents prepared by USGS authors. Of these listed items, 15 are USGS reports, one report is at the printers, 26 are Records Packages, five are journal articles and abstracts, and 38 represent reports that have been withdrawn for various reasons (reports started without specific funding, authors no longer with the Project, no current funding, or no requirement for completion of the report). Five complete publication packages (two open-file reports, one Proceedings, and two Investigation maps) were sent to the Records Coordinator for submittal to the Records Processing Center during September. Five OSTI packages were sent to DOE. Six complete QA packages were sent to the Records Coordinator for submittal to the RPC. The 26 Records Packages include five submitted to the RPC during September which will be tracked until USGS is notified of receipt by the RPC.

Reports published in September:

Day, W.C., Dickerson, R.P., Potter, C.J., Sweetkind, D.S., San Juan, Carma, Drake, R.M., II, and Fridrich, C.J., 1998, Bedrock geologic map of the Yucca Mountain area, Nye County, Nevada: U.S. Geological Survey Miscellaneous Investigations Map I-2627, 1 sheet, scale 1:24,000, pamphlet text, 21 p.

Yang, In C., Pei, Yu, Rattray, G.W., Ferarese, J.S., and Ryan, J.N., 1998, Hydrochemical investigations in characterizing the unsaturated zone at Yucca Mountain, Nevada: U.S. Geological Survey Water-Resources Investigations Report 98-4132, 57 p.

Graves, R.P., 1998, Water levels in the Yucca Mountain area, Nevada, 1996: U.S. Geological Survey Open-File Report 98-169, 81 p.

Whelan, J.F., Moscati, R.J., Allerton, S.B.M., and Marshall, B.D., 1998, Applications of isotope geochemistry to the reconstruction of Yucca Mountain, Nevada, paleohydrology—Status of investigations: June 1996: U.S. Geological Survey Open-File Report 98-83, 41 p.

GEOLOGY

Geologic Framework

Several efforts continued in support of the 1:50,000-scale geologic map compilation for the Saturated-Zone (SZ) Site Area. Project staff worked on cross sections, depictions of subsurface geologic structure, and the text for the compilation. Staff also conducted one week of field geologic mapping. Other staff worked on the digital geologic map coverages of Quaternary units within the SZ Site Area. The maps, cross sections, and text are anticipated for submittal to USGS peer review in October. Staff also participated in planning for geologic support to the Death Valley regional saturated-zone modeling effort, including a trip to Tucson for a planning meeting.

Revised components of the 3-D geologic model were delivered in support of model development, completing Level 4 milestone SPG315M4 [Memo to TPO: Rev/revised components of model] on

September 30. In work on stratigraphic description of cores, staff completed review of the WT-24 lithostratigraphic log and submitted it to Sandia National Laboratory. Development of the lithologic log for SD-6 continued.

The underground mapping team gathered geologic and geotechnical data throughout September. Tunnel boring-machine progress has been slightly slower than anticipated, and the corresponding mapping (which can't go faster than the TBM) is approximately eight weeks behind the original schedule. The TBM currently is mired in the Solitario Canyon fault zone, and progress is slow. Geologists continue daily to monitor ground conditions at the heading. Characterization was completed as follows:

- Full-periphery geologic mapping was completed in the ECRB Cross Drift to Station 24+20
- Detailed line surveys were completed in the ECRB Cross Drift to Station 24+20
- Q and RMR calculations were completed in the ECRB Cross Drift to Station 22+00
- RQD estimations were completed in the ECRB Cross Drift to Station 24+00.

Technical review of full-periphery geologic maps for areas between stations 0+00 and 10+00 was completed during the week of September 25. Data review of data acquired between stations 0+00 and 15+00 was completed during the week of September 11.

Preparation of structural evaluation of the ^{36}Cl sampling, and Level 4 milestone SPG405M4 [Memo to TPO: Structural evaluation of ^{36}Cl sampling to LANL], were completed on September 30. Due to the construction schedule of the Cross Drift, no samples have yet been taken from the Cross Drift for ^{36}Cl analysis. As a result, there are no new data from that drift to interpret, no data packages were submitted to the TDB, and no interpretive report was produced. Construction delay was not anticipated when this milestone was planned a year ago. Chlorine-36 studies in the Cross Drift, and USGS structural support of those studies, are a funded activity in FY1999. That work will begin in the Cross Drift with LANL scientists in early October to begin sampling from that drift. A series of FY1999 milestones are in place to assure that 1) USGS structural data in support of this activity are submitted to the TDB in FY1999; 2) if possible, USGS Scientific Notebook SN-0103, "Structural Description of ESF Sampling Localities" will be closed out following all sampling in the Cross Drift; and 3) USGS interpretive material is fully processed through the QA system and not submitted only as a memo to the USGS TPO. This milestone (SPG405M4) is being statused as complete, rather than deferring it in some way, because 1) deferring it to FY1999 would simply create overlap with new FY1999 milestones that address ^{36}Cl studies in the Cross Drift; and 2) USGS staff did provide guidance and assistance to LANL staff in the preparation of the LANL year-end milestone SP33DDM4, "Evaluation of flow and transport models of Yucca Mountain, based on chlorine-36 and chloride studies for FY98", submitted on September 10. USGS effort involved assisting LANL staff to incorporate current existing geologic data into their discussions. USGS staff also planned FY1999 activities regarding small-scale fracturing in the Cross Drift.

Seismotectonic Studies

The Probabilistic Seismic Hazard Analysis (PSHA) Final Report received USGS Director's approval on September 28, and that report was submitted to DOE on September 29 in fulfillment of Level 3 milestone SPG28NM3. Another report, *Strain Accumulation at Yucca Mountain, Nevada*, by J. Savage and others, completed technical review; the report, however, cannot be processed further until the software programs supporting it have been released. Considerable progress has been made on editing and compiling several reports for the upcoming digital data publication on the tectonics papers resulting from the 1994 tectonics workshop. Work with records pertaining to data sources of the 1996 Seismotectonics Synthesis Report continued.

HYDROLOGY

Regional Hydrology

Staff continued routine maintenance of stream gages at five sites on Fortymile Wash and upper and lower Split and Pagany Washes on Yucca Mountain. 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 observed to have occurred in Fortymile Wash sometime between September 5 and

September 7. The flow apparently originated within the Stockade Wash drainage on Pahute Mesa. Reported runoff extended downstream of the confluence with Yucca Wash but stopped upstream of the H Road crossing. Estimates of peak discharge were made at the former Fortymile Wash at Narrows stream gage and in the vicinity of Pah Canyon. Runoff was not observed to have occurred within any of the drainages on Yucca Mountain. Technical review was completed of a draft USGS Fact Sheet documenting the February 1998 runoff in the Yucca Mountain region. Streamflow and precipitation data collected through August have received initial checks and have been placed in Project files.

Unsaturated-Zone Hydrology

Borehole data from NRG-7a, NRG-6, UZ#4, UZ#5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived on a routine basis throughout the month. Sensor readings were checked daily as well for unusual occurrences, and statistical outliers were flagged. Staff met to discuss plans for continuation in October of data collection from boreholes. A monthly backup of data was performed. Staff reviewed AP3.10Q and worked on YAP12.3Q. Calibration activities included PREDs run on racks #5 and #8, and THM control runs also were made on rack #8. The rack passed all tests in a run on September 25. Work continued on repair and calibration of the Keithley nanovoltmeter. Mass-flow controllers and barometers were checked for other staff. Identification and transmittal to Denver of calibration paperwork from the period September 1997 to September 1998 continued; most has been sent. Problems with air conditioning occurred at sites 3 (NRG-7a) and 6 (UZ-7a). Problems with UPS units occurred at two sites. The UPS batteries were replaced at site 5 (UZ #4 and #5). Some 36 trips were made to field sites for correcting generator, UPS, chiller, and data-collection problems, including 15 visits for routine generator problems or maintenance and 11 site visits to collect data or to correct data-collection problems. Four site visits were made for shelter PREDs. Staff continued revisions and data checks on F. Thamir's report, *Drilling, logging, and testing information from borehole USW UZ-14, Yucca Mountain, Nevada*. A few figures have been redone. Work also has been done on a core-information table which will be included. Staff also provided assistance in resolving problems with macros in lithostratigraphic applications.

Updating of the net-infiltration model continued. Calibration of the coupled net-infiltration/surface-flow (runoff-routing) model was completed using available historic stream-flow records for gages in Drill Hole Wash, Pagany Wash, Wren Wash, and Split Wash. The calibrated model includes an enhanced soil moisture-storage algorithm which allows multiple layers (including a bottom bedrock layer for shallow soils) and improved modeling of surface evaporation and root-zone transpiration. Final simulations using 10 extracted watershed domains covering the area of the 3-D UZ flow model were conducted. A sensitivity analysis of soil depth, soil saturated permeability, effective bedrock permeability, precipitation, and potential evapotranspiration was completed. Preparation of a memo to the TPO was completed and submitted in completion of Level 4 milestone SPH253M4 **[Memo to TPO: Analytical conditions for input to the site-scale model]** on September 30. Application of that coupled net-infiltration/surface-flow (runoff-routing) model to the composite watershed modeling domain overlying the area of the UZ ground-water flow model using five different analog future-climate 100-yr simulations was completed. Post-processing of the output was completed, and maps indicating modeled precipitation, net infiltration, runoff, and surface water flow were generated. Preparation of a memo was completed on September 30 in completion of Level 4 milestone SPH225M4 **[Memo to TPO: Analysis of boundary conditions October—July 1998]**.

In ongoing studies of percolation flux across the repository horizon, boreholes (2-m depth) were drilled and cored at locations from Station 14+50 to 19+50 at 50-m intervals. Heat-dissipation (HD) probes were installed in 2-m-deep holes at Cross Drift Stations 11+75 and at additional locations at 25-m steps along the drift to Station 16+25 and from 17+50 to 21+50. Water potential was measured in those holes as well as in the drill holes located at 25-m intervals from Station 0+50 to 16+50. A temperature, relative humidity, and wind-speed monitoring station was installed at Cross Drift Station 21+07, and data were collected from that station and from monitoring instruments at Cross Drift Stations 0+25, 2+37, 2+88, 3+38, and 10+03, as well as from the vent line at Station 0+00 and on the TBM. Data packages were prepared, reviewed, and submitted to the RPC/TDB for HD probe data and temperature, relative humidity, and wind-speed data. Level 4 milestones SPH352M4 **[Memo to TPO: Data package conditions/properties to RPC/TDB]** and SPH353M4 **[Memo to TPO: Results of analysis and interpretation October97—August98]** were completed on September 30 with memos describing results to date and submittal of the data package

"Water potentials measured with heat-dissipation probes in the ECRB holes from 4/23/98 to 7/31/98" (DTN: GS980908312242.035).

Moisture monitoring in the ECRB continued with analysis of TBM water migration. Eight temperature and relative humidity stations have been established in the ECRB. Five of those stations also measure wind speed. Ninety HD probes have been installed in 2-m-deep holes. Twenty-one HQ drill holes have been completed in the ECRB. During tunnel construction, two test zones were established to evaluate, in detail, the use of water and surfactant as a dust-control agent. All of those holes are neutron-logged periodically to monitor the tunnel-wall dry-out. All available construction data have been collected into a master spreadsheet to analyze water balance in the Cross Drift. Evaporation of construction water is estimated as the difference between total evaporation out of the tunnel and water evaporated from the formation, determined from monitoring sensors and neutron borehole logs, respectively. A memo and attached report were submitted detailing water balance in the Cross Drift, completing Level 4 milestone SPH363M4 [Memo to TPO: Results of analysis & interpretations] on September 30. Five data packages were prepared, technically reviewed and submitted to the RPC and the TDB, with submittal letters attached to a TPO memo. The data packages are (1) DTN: GS980908312242.024: "Moisture Monitoring in the ESF from August 1, 1997 to July 31, 1998;" (2) DTN:GS980908312242.030: "Physical Properties of Borehole Core Samples from ESF-ECRB-SLANT#2;" (3) DTN: GS980908312242.034: "Physical and Hydrologic Properties of Borehole Core Samples and Water-Potential Measurements Using the Filter-Paper Technique for Borehole Samples from ECRB-CWAT#1, ECRB-CWAT#2, and ECRB-CWAT#3;" (4) DTN: GS980908312242.036: "Moisture Monitoring in the ECRB from 04/08/98 to 07/31/98;" and (5) DTN: GS980908312242.035: "Water Potentials Measured With Heat-Dissipation Probes in the ECRB Holes from 4/23/98 to 7/31/98." That work completed Level 4 milestone SPH361M4 [Memo to TPO: Sept 97 to July 98 data packages submitted to the RPC/TDB], also on September 30.

In other moisture-related studies, data packages for data collected in study of PTn lateral diversion were completed, and data were analyzed for inclusion in numerical models, completing Level 4 milestones SPH272M4 [Memo to TPO: Submittal of data package to RPC/TDB] and SPH271M4 [Memo to TPO: Analysis/interpretation of data 10/1/97—8/31/98], both on September 30. Work on unsaturated matrix flow properties resulted in compilation of data packages of SD-6 properties and conductivities and SD-6 retention, North Ramp conductivities, data for selected samples tested for retention, and data for properties, mineralogy, and conductivity data for selected samples. All measurements were completed. That work completed Level 4 milestone SPH259M4 [Memo to TPO: Submittal of data package to RPC/TDB] on September 30. Also on September 30, the data packages related to ESF drift-scale flux and niche studies were submitted and described in a memo to the TPO in completion of Level 4 milestone SPH283M4 [Memo to TPO: Submittal of data to the RPC/TDB]. Monitoring of temperature, relative humidity, and barometric pressure continued at selected ESF alcoves. Data 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. Approximately 63,375 gal of water have been applied in the Alcove #1 experiment; 1899 gal of water have been collected from approximately 146 trays. Selected samples are being tested for pH, electrical conductivity, and various hydrochemical analyses. The five data packages included (1) DTN: GS980908312242.018: "Physical Properties of Borehole Core Samples from ESF-MD-Niche3566#1, ESF-MD-Niche3566#2, ESF-MD-Niche3566#3A, ESF-MD-Niche3566LT#1, ESF-MD-Niche3566LT#2, ESF-MD-Niche3566LT#3, ESF-MD-Niche3566LT#4, ESF-MD-Niche3566LT#5, and ESF-MD-Niche3566LT#6;" (2) DTN: GS980908312242.019: "Physical Properties of Borehole Core Samples from ESF-MD-NICHE3107#1, ESF-MD-NICHE3107#2, ESF-MD-NICHE3107#3, ESF-MD-NICHE3107#4, ESF-MD-NICHE3107#5, ESF-MD-NICHE3107#6, and ESF-MD-NICHE3107#7;" (3) DTN: GS980908312242.020: "Physical Properties of Borehole Core Samples from ESF-MD-Niche3650#1, ESF-MD-Niche3650#2, ESF-MD-Niche3650#3, ESF-MD-Niche3650#4, ESF-MD-Niche3650#5, ESF-MD-Niche3650#6, and ESF-MD-Niche3650#7;" (4) DTN: GS980908312242.021: "Temperature, Relative Humidity, and Barometric Pressure Data for Niche 1 (ESF-NICHE3566) and Niche 2 (ESF-NICHE3650) of the ESF from 02/01/98 to 07/31/98;" and (5) DTN: GS980908312242.022: "Water Potentials Measured With Heat-Dissipation Probes in Twenty-one Drill Holes in Niche 1 (ESF-NICHE3566) from 11/04/97 to 07/31/98."

Air-permeability testing continued. Analysis of the Ghost Dance fault pneumatic and tracer testing, and report preparation, continued. USGS scientists continued use of the Bureau of Reclamation fracture line-survey data to develop a discrete fracture model of the Ghost Dance fault. That discrete fracture model will provide a better understanding of fracture control of tracer transport in fractured tuff.

Isotopic analysis continued to contribute to several activities. In analytical support to thermal testing, water samples from the drift-scale test have been received by the analytical lab. A milestone report and two data packages containing strontium and uranium isotopic data were submitted on September 30 in completion of Level 4 milestone SPH37AM4 [Memo to TPO: Results of analysis/interpretations FY98]. Those data relate to water collected from the Single-Heater Test. In other isotopic support, staff completed a brief data report on infiltration of construction water in the ESF/ECRB, supported by two data packages, in completion of Level 4 milestone SPH373M4 [Memo to TPO: Preliminary interpretations of data] on September 30. The stable isotope and strontium isotope data from the CWAT core both suggest a deeper penetration of construction water than do the Br/Cl ratios, although this may in part reflect the relatively small data set on pore-water compositions. More samples could be analyzed if deemed necessary. In work on matrix water sources and fracture-matrix interaction, analysis of SD-12 samples continued. Most SD-12 analyses, however, will be performed under a separate task with only minimal effect on the preliminary interpretations of the Sr data to be provided for the UZ model.

Isotopic and hydrochemical efforts continued, using several analytical approaches. Pore water was extracted from ten SD-6 core samples using ultracentrifugation methods. Extracted pore water will be analyzed for major ions by ion chromatography. Pore water was extracted from eight WT-24 core samples by vacuum distillation. That extracted pore water will be analyzed for tritium, D/H, and $^{18}O/^{16}O$ isotopes. Three SD-6 and two WT-24 water samples were analyzed for anions, and two SD-6, one SD-9, and five WT-24 water samples were analyzed for cations. Moisture contents were measured for five WT-24 core samples. Pore water was collected from five WT-24 core samples using high-pressure one-dimensional compression. The extracted pore water will be analyzed for chemistry, carbon isotopes, D/H, and $^{18}O/^{16}O$ isotopes. Eight water samples (four from WT-24 and four from SD-6) were prepared for tritium analysis and counted for tritium concentration, and the data were reduced. Water collection by compression and distillation during September was recorded in the water-collection data base. Water samples analyzed for tritium and for major ions during September were recorded in the tritium and major-ion data bases. A data package was prepared for the tritium and stable isotope results from pore water extracted from CWAT boreholes. That package received technical review and was forwarded to the Data Management group. Staff conducted tests to determine if gravimetric dilution of small water samples would provide acceptable accuracy. Results for cation tests were favorable. Determination of alkalinity on undiluted samples and anion and silica analysis for diluted samples are in progress. The LKB Liquid Scintillation Counter was calibrated. Standard reference water sample M-148 was analyzed for anions and cations. Other pH, alkalinity, and concentration tests will be performed, and the results will be forwarded to the WRD Office of Water Quality for appraisal.

In other work, staff reviewed a data package for borehole studies. Technical procedure HP-300, "Pore-Water Extraction using High-Speed Centrifugation," was reviewed on its technical aspects and is in the final stage for QA review. Pierre Glynn of the National Research Program, Eastern Region, continued work on a draft report titled *^{14}C age correction on perched water at Yucca Mountain using the NETPATH geochemical model.* Technical reviews were completed for a draft paper titled *Changes in ^{14}C activity over time during vacuum distillation of carbon from rock pore water*, by Davidson and Yang. The paper is currently under review by the USGS QA Office. A draft paper titled *^{14}C activity of carbon dioxide obtained by vacuum-distillation and one-dimensional compression methods and tritium by enrichment on Yucca Mountain cores, Nevada* was revised after co-author comments. That paper will be sent to the Reports Section of YMPB for further processing. The published UZ Hydrochemistry milestone report by Yang and others, titled *Hydrochemical investigations in characterizing the unsaturated zone at Yucca Mountain, Nevada* is expected to be distributed in October. Staff assisted in preparation of level 4 milestone report SPH373M4, which is related to infiltration of construction water in the ESF-ECRB, and contributed to the stable isotope, δD and $\delta^{18}O$ parts of the report. The report was submitted to the TPO on September 30.

Saturated-Zone Hydrology

The partial-recirculation conservative tracer test from UE-25 c#3 to UE-25 c#2 continued during September. As of September 18, the concentration of 2,4,5 trifluorobenzoic acid (TFBA) dropped to 0.76 ppm (from a peak of 3.7 ppm), and the iodide concentration dropped to 0.5 ppm (from 2.7 ppm), reporting preliminary figures subject to revision. The primarily convergent tracer test from UE-25 c#1 to c#2 also continued, with concentration of 2,3,4,5 tetrafluorobenzoic acid (TeFBA) rising to 79 ppb by September 18. On September 23 and 25, LANL injected microspheres and a cocktail of reactive and conservative tracers (lithium bromide and chloride, and pentafluorobenzoic acid). Details of that test should be obtained from the LANL monthly report.

Routine water-level measurements were conducted in various boreholes, including USW H-1 (tubes 1, 2, 3, and 4) on September 2; USW VH-1, USW H-6 (upper and lower intervals), USW WT-7, and USW WT-10 on September 3; UE-25 WT#6 on September 15; USW G-2 on September 16 and 17; UE-25 WT#4, UE-25 WT#15, UE-25 WT#16, UE-25 p#1, and USW H-1 (tube 1) on September 21; USW WT-2, UE-25 WT#13, USW H-1 (tubes 2, 3, and 4), and USW H-4 (lower interval) on September 22; USW WT-1, UE-25 WT#12, UE-25 J-12, UE-25 J-13, and USW H-3 (upper and lower intervals) on September 23; UE-25 J-11 and USW H-5 (upper and lower intervals) on September 24; UE-25 WT#3 on September 28; UE-25 WT#17 on September 29; and USW WT-7, USW WT-10, USW VH-1, and USW H-6 (upper and lower intervals) on September 30. All boreholes were measured with Chain 3 except for WT#3 and WT#17 which were measured with the multiconductor cable unit. Several items of equipment were changed on September 9, including barometer (s/n) 433311 which was removed from borehole UE-25 WT#6 and replaced with barometer 433310, and barometer 588128 removed from borehole USW G-2 and replaced with barometer 490487. Calibration checks were completed on barometers 433311 and 588128 on September 17. Both barometers passed the calibration check. Barometers 433311, 588128, and 385846 were returned to Setra for calibration on September 21. A calibration check of Paroscientific transducer 65017 (located in borehole UE-25 WT#6) was conducted on September 15. Calibration check completed, the transducer was removed for manual water-level measurement and returned to the well; another calibration check was completed. In a calibration check of Paroscientific transducer 65021 located in borehole USW G-2, the transducer was removed on September 16 to be returned to the factory for two-year calibration. Manual water-level measurement was made, and Paroscientific transducer 65024 was placed in borehole and a transducer check completed on September 16 and 17. Data were retrieved from boreholes G-2 and WT#6 through September 21. The data package (for data obtained from January through June 1998) was in review by the Data Management group. The package is being prepared by the Data Management group for submittal to the Records Center.

Through September 30, the total depth of borehole USW WT-24 remained at 2,834 ft below land surface (bls). Further drilling currently is waiting on the appropriation of funds needed to complete borehole WT-24 into the lower volcanic aquifer. No drilling activity at USW WT-24 occurred during September. Inspection of the drilling rig at WT-24 was completed on September 28, and the rig checked out successfully with a note to repair a broken hydraulic ram pocket. Also through September 30, the total depth of borehole USW SD-6 remained at about 2,541 ft bls. Progress on drilling at SD-6 currently is waiting on M&O contracting to bring in a vendor to attempt to fish the drill bit and four links of drill pipe out of the borehole. No drilling occurred at USW SD-6 during September; a TCO camera run in the borehole to the top of fill at about 2,421 ft revealed no fluid in the hole. The drilling rig at SD-6 checked out successfully in an inspection conducted on September 28. Geophysical logging of the two boreholes will not be conducted until completion into the lower volcanic aquifer and removal of stuck drilling equipment, respectively. No water has been sampled from SD-6 because the borehole is not deep enough.

In work on isotopic and hydrochemical analysis of SZ water, existing isotopic and major-ion chemical data have been entered into the isotopic/hydrochemical data base, completing that task. New data collected during FY1998 are being added to the data base as the information comes in from the labs. Major-ion chemistry from 24 Amargosa Valley wells has been entered. Perched water and initial saturated-zone samples were collected earlier in FY1998 from WT-24. Additional samples will be collected when the borehole is deepened. No samples have been collected from SD-6 because the borehole has not yet been drilled deeply enough to collect water samples. Analyses of samples from WT-17 and WT-3 are complete, and data have been entered into the data base, completing that task.

Several aspects of geologic support continued to the Death Valley regional flow model. A preliminary compilation of available gravity data (and relevant registration data) has been completed. A preliminary data base for U-series and thermoluminescence dating of modern and paleospring discharge has been started. A preliminary digital version of a geologic map of Death Valley has been completed. Numerous maps needed to complete the compilation still need to be digitized. Previously unpublished geologic mapping has been digitized for the central portion of the area. Preliminary interpretations of some of the Quaternary deposits and structures in the Death Valley region have been compiled. A preliminary data base for $^{40}Ar/^{39}Ar$ data was started. Preliminary processing of gravity data for the Amargosa region has been completed, and a preliminary gravity map has been developed. Preliminary versions of ten geologic cross sections have been developed. Those sections mainly are based on early sections done by Grose and Smith in 1984.

Work on the regional hydrogeologic framework and flow models continued. Level 4 milestone **SPH40NM4 [Memo to TPO: Possible perched water occurrences north of Yucca Mountain]** was completed on September 30 in testing of alternate conceptual models. Work continued on refining the regional hydrogeologic framework model, as did revisions to integrate the model with the UGTA ground-water flow model. Additional modifications were made to MODFLOWP with parallel programmers at ARSC. Ground-water model-evaluation runs continued, to determine where best to add vertical discretization to the regional ground-water flow model. Model-developing sensitivity distributions were tested. Level 4 milestones **SPH40RM4 [Memo to TPO: Report: Updated regional flow model]** and **SPH40SM4 [Memo to TPO: Framework model to RPC]** were completed on September 30. Documentation of the evapotranspiration (ET) data package was finalized and submitted in completion of Level 4 milestone **SPH41FM4 [Memo to TPO: ET estimating procedures and ET estimates]**, also completed on September 30. Work continued on updating of the framework model, including (1) work on extending (deepening) the base of the model to 3,500 m below sea level to include more of the carbonate lithology, and (2) resampling of some of the recharge data in order to include such data in the model, and (3) clipping the top of the model to a revised potentiometric surface. Work began on construction of a revised potentiometric-surface map that will be used in the framework and flow models and which will be illustrated in the report. The revision includes adding information from more detailed site-scale potentiometric-surface maps and re-examination of data from the Amargosa Desert area. Work on SZ flow-model calibration by USGS personnel has stopped with the departure of the PI from the project. Effort on that activity will be continued by staff at LANL. Work began on submitting data and data documentation of GIS coverages that were used in the preliminary site SZ flow model. Staff continued work related to YMP input to the USGS NWIS national data base.

CLIMATE and PALEOHYDROLOGY

Hydrologic and climatic data for the Owens Lake region were assembled to develop analog models for determining precipitation and temperature changes for the past 400 ky. That activity also involved searching for suitable analog sites for past-climate parameters to feed modeling efforts to determine future, climate-induced infiltration values at Yucca Mountain. Responses to review comments on the climate-synthesis milestone open-file report were completed, and the manuscript was returned to the Reports Unit for further processing. Staff participated in an Owens Lake workshop (USGS Geologic Division climate team) to discuss a wide array of paleoclimatic proxy data and proxy roles in refining climatic interpretations for the past interglacial period. Several GD and academic scientists are collaborating on the interpretation of that important record.

Isotopic/geochronological staff completed a memo to the USGS TPO describing work completed on East-West Cross-Drift studies as of the end of FY1998, fulfilling the requirements for Level 4 milestone **SPC235M4 [Memo to TPO: Results of geochronologic/isotopic analysis]** on September 30. Staff examined East-West Cross Drift walls between stations 25 and 8. No mineral line surveys were made, in favor of waiting until construction is completed and the conveyor belt can be locked out. (Due to the rotation of the TBM cutter head and the geometry of muck removal, the right rib above the conveyor belt is much cleaner than the left rib above the air and water pipes. Survey data obtained from the right rib are

expected to be of superior quality to those collected from the left rib. Construction should be completed in the first month of FY1999.) Some 20 samples of secondary calcite and opal mineralization were collected from tunnel walls of the East-West Cross Drift between stations 25 and 8. Sample sites were concentrated in the Topopah Spring Tuff lower lithophysal unit and lower portions of the upper lithophysal unit. Fracture cavities with secondary mineralization were present but scarce. Deposits are similar to those observed in the ESF primarily coating the floors of lithophysal cavities. Samples were returned to Denver for inventory, cleaning, subsampling, and analysis. Collection of fracture fillings from the Solitario Canyon fault was delayed. The TBM is currently at the Solitario Canyon fault, and access is not permitted until further TBM advance. The TCO, however, is collecting bulk-rock samples of the highly fractured material for analysis of CO_2 contents and isotopic ratios of leachates.

Planning continued for coring of past-discharge sites. Coring will commence at the Lathrop Wells diatomite deposit in early FY1999 as part of the Nye County Early Warning Drilling Program. Core will be collected from three sites (Lathrop Wells Diatomite [a.k.a. the Horsetooth Site], Crater Flat Deposit [a.k.a. Site 199] and Crater Flat Wash Deposit [a.k.a. the Root Cast Deposit]). Coring will be done with a rotary drill rig using drilling fluids and will extend to the base of the deposits. The current drilling schedule has these sites being completed by late December 1998.

Staff completed a memo to the USGS TPO on September 30 and satisfied the criteria for Level 4 milestone **SPC26LM4 [Memo to TPO: Submit data package of data obtained 10/1/97 through 8/15/98]**. The memo described three data packages submitted to the RPC and TDB for work completed on subsurface calcite and opal during the reporting period. The three data packages include 1) GS980908315213.002: "Stable carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$) isotopic compositions of calcite from 18 samples of secondary mineralization;" 2) GS980908315215.016: "Uranium-series analyses of opal from the ESF determined under contract at the Royal Ontario Museum;" and 3) GS980908315215.015: "Uranium-thorium isotope data including calculated $^{230}Th/U$ ages and initial $^{234}U/^{238}U$ activity ratios for *in situ* microdigestions of outermost opal-rich mineral coatings."

SPECIAL STUDIES

Support to development of the Geologic System chapter of the Site Description largely consisted of responding to questions about citations and references. Staff also assisted with geologic and geochemical questions in sections of the Site Description. Work scope and budget for changing the geologic site description into part of the working draft license application (WDLA) were updated. Integration of the geochemistry section with the geology and hydrology sections began. Similar support to citation and reference questions was provided for hydrologic sections.

Intensive work was performed on Site Characterization Progress Report #19 and the Documentation of Program Change (formerly Appendix A). For PR #19, the USGS technical lead compiled potential items for inclusion in the site-characterization section of the progress report and transmitted them to the technical leads in NEPO for their consideration. About seven pages of narrative summaries of USGS work were compiled from monthly reports to YMSCO for April through August 1998. Technical topics in the compilation included

- Geologic Field Investigations
- ESF Alcove and Niche Studies
- Enhanced Characterization of the Repository Block (ECRB)
- Unsaturated-Zone Numerical Infiltration Model
- C-holes Hydraulic and Tracer Testing
- Large Hydraulic Gradient
- Hydraulic Testing and Sampling of the Saturated Zone
- Regional and Site-Scale Flow Modeling
- Development of a Future Climate Scenario
- Probabilistic Seismic Hazard Assessment

- Potentially Disruptive Events.

Updates to the Documentation of Program Change (DPC) also were prepared and submitted to M&O NEPO and the M&O Licensing group. The narratives for about 50 SCP studies were updated using information gleaned from the NEPO Planning data base, the Multi-year Planning System, and the Viability Assessment. Reference citations in the DPC also were updated for USGS reports whose publication status had changed since the last DPC update.

WATER-RESOURCES MONITORING

Ground-water levels were measured at 34 sites, and ground-water discharge was measured at one flowing well. Ground-water data collected during August were checked and filed. Work on the summary monitoring report through calendar year 1997 continued, with completion of responses to colleague, specialist, editorial, supervisory and USGS-Nevada Subdistrict reviews of the report. The draft report was forwarded to USGS-YMPB and TRW/SAIC staff in completion of Level 3 milestone SSH13NM3 [REPORT: Summary monitoring through calendar year 1997] on September 15. The report was sent on September 21 to the Nevada District Chief for USGS approval. Staff participated in planning and budgeting for FY1999 monitoring activities.

Preparations were completed for collection of water samples in support of the M&O Radiological and Environmental Field programs for the fourth quarter of FY1998. Final sample collection and transfer of samples to M&O staff were completed during the week of September 21.

USGS Level 3 Milestone Report

October 1, 1997 - September 30, 1998

Sorted by Baseline Date

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

Deliverable	Due Date	Expected Date	Completed Date	Comments
Directors Approval PSHA Final Report Milestone Number: SPG28NM3	7/17/98	9/29/98	9/29/98	
Letter Report: 3rd QTR FY 1998 Milestone Number: SSH13KM3	7/31/98	7/31/98	7/31/98	
Paleohydrology Data Qualification Evaluation Milestone Number: SPC26BM3	8/31/98	8/27/98	8/27/98	
Paleoclimate Data Qualification Evaluation Milestone Number: SPC26AM3	8/31/98	8/27/98	8/27/98	
Summary Monitoring Through Calendar Year 1997 Milestone Number: SSH13NM3	9/15/98	9/15/98	9/15/98	
Report: Geodetic Network Resurvey Milestone Number: SPG720M3	9/15/98	12/31/98		

USGS Level 4 Milestone Report

October 1, 1997 - September 30, 1998

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Draft PISA Hydrology Chaptr Section Milestone Number: SPH392M4	8/29/97	7/21/98	7/21/98	
Memo to TPO: Hydro-Property Measurements Milestone Number: SPH235M4	9/4/97	8/31/98	8/31/98	
Memo to TPO: Docmnt Data Package Submittal Milestone Number: SPH236M4	9/10/97	8/14/98	8/14/98	
Memo to TPO: Chem/Iso Anlys on Wtr Samples WT-17 Milestone Number: SPC34CM4	9/24/97	10/16/98		
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	11/30/98		
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	5/27/98	5/27/98	
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	7/21/98	7/21/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Rev Draft SDD Climate Chapter Milestone Number: SPC322M4	12/9/97	1/9/98	1/9/98	
Memo to TPO: Doc Hydraul Prop. Test WT-24 Milestone Number: SPH241M4	12/19/97	4/16/99		
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	12/31/98		
Memo to TPO: Summary of Fracturing in the ESF Milestone Number: SPG242M4	1/30/98	1/30/98	1/30/98	
Memo to TPO: Geologic Map of N. of Yucca Wash Milestone Number: SPG237M4	2/2/98	1/30/98	1/30/98	
Memo to TPO: Final Rev Draft SDD Climate Chpter Milestone Number: SPC323M4	2/20/98	3/6/98	3/6/98	
Memo to TPO: Rev Drft SDD Hydro Chptr. Milestone Number: SPH394M4	2/20/98	7/21/98	7/21/98	
Memo to TPO: Frac Connectivity Data to SNL/LBL Milestone Number: SPG230M4	2/27/98	2/20/98	2/20/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Jul-Sep97 Perio Wtr Lvl Data to RPC Milestone Number: SPH37GM4	2/27/98	2/13/98	2/13/98	
Memo to TPO: Evaluation of Grid Refinement Milestone Number: SPH40EM4	2/27/98	2/27/98	2/27/98	
Memo to TPO: Hydraulic Testing BH USW WT-24 Milestone Number: SPH572M4	3/4/98	4/16/99		
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	10/30/98		
Memo to TPO: ECRB Spatiotemporal Predictions Milestone Number: SPC237M4	3/27/98	10/30/98		
Memo to TPO: Lithostratigraphy Log for WT-24 Milestone Number: SPG223M4	3/27/98	3/9/99		
Memo to TPO: Final Workshop Summary Milestone Number: SPG28RM4	3/27/98	4/27/98	4/27/98	
Memo to TPO: Rslts of Sampling Completed Milestone Number: SPH232M4	3/30/98	2/19/99		
Memo to TPO: Borhle Monitoring Oct 1996-Sep 1997 Milestone Number: SPH36NM4	3/30/98	3/30/98	3/30/98	
Memo to TPO: Data Pkg of Core/Bh Data Aug-Dec 97 Milestone Number: SPH35CM4	3/31/98	3/31/98	3/31/98	
Memo to TPO:Data & Rslts Analys/Inter Sep-Dec 97 Milestone Number: SPH35DM4	3/31/98	3/31/98	3/31/98	
Memo to TPO: Data Pkg of Core/Bh Data Aug-Dec 97 Milestone Number: SPH38CM4	3/31/98	3/31/98	3/31/98	
Memo to TPO: Data&Rslts Analys/Inter Sep-Dec 97 Milestone Number: SPH38DM4	3/31/98	3/31/98	3/31/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Inventory of Hydro Data Completed Milestone Number: SPH40MM4	3/31/98	3/24/98	3/24/98	
Memo to TPO: Updated Reg Frmwrk Mdl to Rev Milestone Number: SPH40QM4	3/31/98	6/29/98	6/29/98	
Memo to TPO: Progress on Delineation of ET Area Milestone Number: SPH41GM4	3/31/98	5/29/98	5/29/98	
Memo to TPO: Doc Hydraul rop. Test SD-6 Milestone Number: SPH246M4	4/6/98	3/1/99		
Publish Sel Streamflow & Precip Data for FY97 Milestone Number: SPH36CM4	4/6/98	7/6/98	7/6/98	
Memo to TPO: Subm FY97 Data to RPC/TDB Milestone Number: SPH36DM4	4/6/98	4/3/98	4/3/98	
Memo to TPO: 1996 Water Level Data Milestone Number: SPH37HM4	4/6/98	4/3/98	4/3/98	
Memo to TPO: Data to RPC Pmp/Monit BH WT-24 Milestone Number: SPH243M4	4/14/98	9/30/99		
Memo to TPO: Data to RPC Pmp/Moni Prch Wtr SD-6 Milestone Number: SPH247M4	4/14/98	5/27/98	5/27/98	
Memo to TPO: Lithostratigraphy of SD-6 Milestone Number: SPG23AM4	4/17/98	11/18/98		
Review Draft: Conceptual Model of UZ Milestone Number: 3GUM603M	4/30/98	5/11/98	5/11/98	
Memo to TPO: Chpt 6.X of TSPA-VA Docum Milestone Number: SPH133M4	4/30/98	4/10/98	4/10/98	
Memo to TPO: Subm of Data Pkg to RPC/TDB Milestone Number: SPH258M4	4/30/98	4/30/98	4/30/98	
Memo to TPO: Subm of Data Pkg to RPC/TDB Milestone Number: SPH282M4	4/30/98	4/30/98	4/30/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Prov Analy of Pred vs Actual, WT-24 Milestone Number: SPG33UM4	5/15/98	7/1/98	7/1/98	
Memo to TPO: Hydraulic Prop. Test WT-24 Milestone Number: SPH244M4	5/20/98	1/4/00		
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	3/1/99		
Memo to TPO: Lithostratigraphic Log of SD-6 Milestone Number: SPG233BM4	6/19/98	1/26/99		
Memo to TPO: Conceptual Model of UZ Milestone Number: 3GUM612M	6/30/98	12/31/98		
Memo to TPO: Framework Mdl to RPC Milestone Number: SPH40SM4	6/30/98	9/22/98	9/22/98	
Memo to TPO: Prelim SZ Geo Map to TSPA/LA Milestone Number: SPG248M4	7/1/98	7/1/98	7/1/98	
Memo to TPO: OCT97-Mar98 Data to RPC/TDB Milestone Number: SPH36IM4	7/1/98	5/26/98	5/26/98	
Memo to TPO: Oct97-Mar98 Data to RPC/TDB Milestone Number: SPH36TM4	7/1/98	5/26/98	5/26/98	
Memo to TPO: Data to RPC Pmp/Monit BH SD-6 Milestone Number: SPH249M4	7/6/98	7/9/99		
Memo to TPO: Prov Analy Pred vs Actual, SD-6 Milestone Number: SPG33VM4	7/15/98	9/8/98	9/8/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo TPO: Index Map Publ/Unpubl Geol Map Data Milestone Number: SPDG20M4	7/30/98	9/22/98	9/22/98	
Memo to TPO: Backfill materials hydro props rpt Milestone Number: SPH261M4	7/31/98	7/31/98	7/31/98	
Memo to TPO: Subm Data Pkg WT-24 to RPC/TDB Milestone Number: SPH573M4	7/31/98	9/30/99		
Memo to TPO: Model Input/Output Update Data Milestone Number: SPH605M4	7/31/98	7/24/98	7/24/98	
Memo to TPO: Hydraulic Properties - SD-6 Milestone Number: SPH248M4	8/14/98	10/7/99		
Memo TPO: Prog Rpt 1:250,000 DV Geol Map Milestone Number: SPDG30M4	8/31/98	8/31/98	8/31/98	
Memo to TPO: Struct Geo of Yucca Mt Milestone Number: SPG236M4	8/31/98	8/28/98	8/28/98	
Memo TPO:Bckfl matls hydro prop data pkg RPC/TDB Milestone Number: SPH262M4	8/31/98	8/31/98	8/31/98	
Memo to TPO: Rpt: Updated Reg Flow Model Milestone Number: SPH40RM4	8/31/98	9/29/98	9/29/98	
Memo to TPO: ET Est. Procedures & ET Ests Milestone Number: SPH41FM4	8/31/98	9/29/98	9/29/98	
Memo to TPO: Hydra Props of BH USW WT-24 Milestone Number: SPH574M4	8/31/98	1/4/00		
Memo to TPO: Draft Report of Findings Milestone Number: SPH606M4	8/31/98	8/24/98	8/24/98	
Anals PPR: Quat Flting Solitario Milestone Number: 3GPF500M	9/1/98	3/1/99		
RPT: Char Quat Flting Rock Valley Fault Milestone Number: 3GTN500M	9/1/98	11/30/98		

Deliverable	Due Date	Expected Date	Completed Date	Comments
Rpt: Quat Cane Springs Fault System Milestone Number: 3GTN520M	9/1/98	11/30/98		
Memo: Summ of FY1995 Data Milestone Number: 3GWH608M	9/15/98	10/30/98		
Memo TPO: Recvd, Prelim Map Pre-CZ Bsmt Amarg Milestone Number: SPDP70M4	9/15/98	9/22/98	9/22/98	
Memo TPO: Recvd, Prelim Digit Pre-CZ Bsmt Amarg Milestone Number: SPDP80M4	9/15/98	9/22/98	9/22/98	
Memo TPO: Recvd, Prelim Map Intrp Flts Amarg Milestone Number: SPDP90M4	9/15/98	9/22/98	9/22/98	
Memo to TPO: Subm Pkg of Data 10/1/97-8/15/98 Milestone Number: SPH26LM4	9/15/98	9/30/98	9/30/98	
Memo to TPO: Preliminary Interpretations of Data Milestone Number: SPH373M4	9/15/98	9/30/98	9/30/98	
Memo to TPO:Rslts of Analys/Interpretations FY98 Milestone Number: SPH37AM4	9/15/98	9/30/98	9/30/98	
Memo to TPO: Eval and Grade Predictions Milestone Number: SPC234M4	9/30/98	10/20/98		
Memo to TPO: Rslts Geochronologic/Isotopic Analy Milestone Number: SPC235M4	9/30/98	9/28/98	9/28/98	
Memo TPO: Recvd, Prelim Digital Comp DV Geol Map Milestone Number: SPDG40M4	9/30/98	9/29/98	9/29/98	
Memo TPO: Prog Rpt Grav Data DV Flow System Milestone Number: SPDP50M4	9/30/98	9/22/98	9/22/98	
Memo TPO: Recvd, Prelim Grav Anom Map Amargosa Milestone Number: SPDP60M4	9/30/98	9/22/98	9/22/98	
Memo TPO: Recvd, Prelim Geol Cross Sections Milestone Number: SPDZ95M4	9/30/98	9/29/98	9/29/98	

Deliverable	Due Date	Expected Date	Completed Date	Comments
Memo to TPO: Geologic Map for the YM Area Milestone Number: SPG235M4	9/30/98	7/10/98	7/10/98	
Memo to TPO: Borehole Observations Milestone Number: SPG267M4	9/30/98	8/17/98	8/17/98	
Memo to TPO: Rev/Revised Components of Model Milestone Number: SPG315M4	9/30/98	9/30/98	9/30/98	
Memo to TPO: Struc Eval of 36-Cl Sampling to LANL Milestone Number: SPG405M4	9/30/98	9/30/98	9/30/98	
Memo to TPO: Analys Boundry Condx Oct-Jul98 Milestone Number: SPH225M4	9/30/98	10/2/98		
Memo to TPO: Hydro-Property Measurements Milestone Number: SPH237M4	9/30/98	9/8/98	9/8/98	
Memo to TPO: Docmnt Data package Submittal Milestone Number: SPH238M4	9/30/98	9/3/98	9/3/98	
Memo to TPO: Analy Cond for Input Site Scale Mdl Milestone Number: SPH253M4	9/30/98	10/2/98		
Memo to TPO: Subm of Data Pkg to RPC/TDB Milestone Number: SPH259M4	9/30/98	9/30/98	9/30/98	
Memo to TPO:Analy/Interp of Data 10/1/97-8/31/98 Milestone Number: SPH271M4	9/30/98	9/30/98	9/30/98	
Memo to TPO: Subm of Data Pkg to RPC/TDB Milestone Number: SPH272M4	9/30/98	9/30/98	9/30/98	
Memo to TPO: Subm of Data Pkg to RPC/TDB Milestone Number: SPH283M4	9/30/98	9/30/98	9/30/98	
Memo to TPO:Data Pkg Condx/Properties to RPC/TDB Milestone Number: SPH352M4	9/30/98	9/30/98	9/30/98	
Memo to TPO: Rslts Analysis & Interp Oct97-Aug98 Milestone Number: SPH353M4	9/30/98	9/30/98	9/30/98	

Deliverable	Due Date	Expected Date	Completed Date	Comment
Memo to TPO: Rslts of Analysis & Interpretations	9/30/98	9/30/98	9/30/98	
Milestone SPH363M4				
Memo to TPO: Poss Perched Wtr Occurences N. of YM	9/30/98	9/30/98	9/30/98	
Milestone SPH40NM4				
October 1998 milestone delivered early (part of FY98 schedule for FY99)				
Memo to TPO: Sep97-Jul98 Data Pkg to RPC/TDB	10/19/98	10/19/98	9/30/98	
Milestone SPH361M4				

Inc. Dollars in Thousands

WBS No. - 1.2

WBS Title - Yucca Mountain Project

Parent WBS No. - 1.0

Parent WBS Title - Mined Geologic Disposal System

Element ID - 12

Statement of Work:

See the current WBS Dictionary

Cost/Schedule Performance

Id	Description	Current Period BCWS	BCWP	ACWP	SV	CV	FY1998 Cumulative to Date BCWS	BCWP	ACWP	SV	CV	FY1998 at Completion BAC	EAC	VAC
1.2.1	Systems Engineering	88	88	55	0	33	726	726	581	0	145	726	581	145
1.2.3	Site Investigations	1024	944	1356	-80	-412	12681	12029	12364	-652	-335	12681	12364	317
1.2.5	Regulatory	55	55	73	0	-18	638	638	563	0	75	638	563	75
1.2.8	Environment, Safety, and H	49	49	44	0	5	600	600	595	0	5	600	595	5
1.2.9	Project Management	57	57	64	0	-7	683	683	713	0	-30	683	713	-30
1.2.12	Information Management	7	7	11	0	-4	77	77	56	0	21	77	56	21
1.2.15	Support Services	147	147	182	0	-35	1743	1743	1604	0	139	1743	1604	139
Total		1427	1347	1785	-80	-438	17148	16496	16476	-652	20	17148	16476	672

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	17197	16071	224697
LABOR	924	986	983	993	669	703	727	766	782	742	708	673	9656
SUBS	150	160	165	180	219	228	235	244	283	281	315	315	2775
TRAVEL	28	59	60	76	62	70	74	78	74	66	60	48	755
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	228	242	260	323	290	303	285	333	529	359	419	391	3962
Total BCWS	1330	1447	1468	1572	1240	1304	1321	1421	1668	1448	1502	1427	17148

Actual Cost of Work Performed

LBRHRS	19347	15629	18106	16797	14905	16396	16949	18484	14713	23465	21696	17955	214442
LABOR	698	634	670	735	608	727	635	725	683	732	1045	988	8880
SUBS	190	151	226	140	242	228	268	191	315	198	218	231	2598
TRAVEL	6	27	75	31	49	38	63	59	77	40	46	93	604
PM&E	0	62	22	131	215	127	495	113	59	222	389	209	2044
OTHER	16	275	148	204	328	160	253	140	248	184	130	264	2350
Total ACWP	910	1149	1141	1241	1442	1280	1714	1228	1382	1376	1828	1785	16476

Participant YMP_USGS

Prepared - 10/14/98:09:41:35

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

01-Sep-98 to 30-Sep-98

Inc. Dollars in Thousands

WBS No. - 1.2 -Yucca Mountain Project

Resource Distributions by Element of Cost

Fiscal Year 1998
Estimate to Complete

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	0	0	0	0	0	0	0	0	0	0	0	0	0
LABOR	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBS	0	0	0	0	0	0	0	0	0	0	0	0	0
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0	0	0
Total ETC	0	0	0	0	0	0	0	0	0	0	0	0	0

Resource Distributions

Fiscal Year 1998	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1330	1447	1468	1572	1240	1304	1321	1421	1668	1448	1502	1427	17148
BCWP	1270	1404	1415	1520	1205	1357	1449	1409	1516	1247	1357	1347	16496
ACWP	910	1149	1141	1241	1442	1280	1714	1228	1382	1376	1828	1785	16476
ETC	0	0	0	0	0	0	0	0	0	0	0	0	0

Fiscal Year Distribution

	Prior	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Future	At Complete
BCWS	32296	17148	9517	4027	920	279	0	0	0	0	0	0	64187
BCWP	32009	16496	0	0	0	0	0	0	0	0	0	0	
ACWP	32040	16476	0	0	0	0	0	0	0	0	0	0	
ETC	0	0	9517	4026	920	279	0	0	0	0	0	0	63258

U.S. GEOLOGICAL SURVEY

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

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		OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
0G1CGA1	USGS Engineering Assurance	35.7	25.2	72.7	32.8	40.0	69.6	11.3	37.7	39.8	35.2	48.8	46.8	495.7
121C9075U1	USGS Engineering Assurance (EA)	35.7	25.2	72.7	32.8	40.0	69.6	11.3	37.7	39.8	35.2	48.8	46.8	495.7
0G1CGA2	Personnel Qualification	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.4	0.0	3.8	7.9
0G1CGA2	Support to Line Org. for Ongoing Docum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.0	62.3	4.8	5.8	77.1
121C9075U2	Support to Line Org. for Documentatio	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	6.7	62.7	4.8	9.6	85.0
121C9075		35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	97.9	53.6	56.4	580.6
1.2.1.1		35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	97.9	53.6	56.4	580.6
1.2.1		35.7	25.2	72.7	32.8	40.0	69.6	11.3	38.9	46.4	97.9	53.6	56.4	580.6
0G311GA1	Scientific Programs Management & Integ	19.7	14.8	24.4	14.1	19.8	20.2	18.9	19.2	14.6	18.4	24.6	17.4	226.1
0G312GA1	Manage Nevada Operations/Earth Scien	73.3	53.2	53.6	52.7	111.1	30.2	44.4	37.9	39.3	36.2	174.2	37.5	743.7
12319090U1	USGS SP&I	93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	54.6	198.8	54.9	969.8
12319090		93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	54.6	198.8	54.9	969.8
1.2.3.1		93.0	68.0	78.0	66.8	130.9	50.5	63.3	57.2	53.9	54.6	198.8	54.9	969.8
0G32636FB1	Conduct Probabilistic Seismic Hazards A	11.5	-3.7	19.5	1.5	4.3	-2.4	11.2	-5.3	4.3	3.2	0.0	5.2	49.4
0G32636GB3	Support Seismic Design Input	18.9	22.6	6.6	27.2	17.4	18.3	2.1	23.8	15.2	0.9	7.1	17.2	177.3
12321155U1	Prepare Seismic Design Inputs	30.5	18.9	26.2	28.7	21.8	15.9	13.3	18.4	19.5	4.1	7.1	22.4	226.7
0G32636HB3	Conduct Strain Measurements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	53.3	3.2	24.0	87.9
12321155U2	Conduct Strain Mesurements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	53.3	3.2	24.0	87.9
0G32636FB1	Conduct Probabilistic Seismic Hazards A	0.0	6.1	1.0	10.5	11.6	-9.8	27.9	3.6	7.8	-39.3	0.0	0.0	19.4
12321155UC	Conduct Prob. Seismic Hazards Ass.	0.0	6.1	1.0	10.5	11.6	-9.8	27.9	3.6	7.8	-39.3	0.0	0.0	19.4
0G32636FB1	Conduct Probabilistic Seismic Hazards A	0.0	0.0	0.0	11.2	1.2	26.8	12.3	11.0	1.8	-1.8	18.2	10.1	90.7
12321155UY	PSHA - Deferred	0.0	0.0	0.0	11.2	1.2	26.8	12.3	11.0	1.8	-1.8	18.2	10.1	90.7
12321155		30.5	25.0	27.2	50.4	34.6	32.9	53.5	33.1	36.6	16.3	28.4	56.4	424.8
0G32211GA1	Stratigraphic Support to LA & Confirmati	21.4	9.6	12.5	20.8	19.2	9.1	5.6	8.7	1.6	21.0	4.4	3.1	136.9
12322210U1	Stratigraphy	21.4	9.6	12.5	20.8	19.2	9.1	5.6	8.7	1.6	21.0	4.4	3.1	136.9
0G32212GA3	Structural Support to LA & Confirmation	0.8	0.2	4.3	-1.8	3.5	0.0	6.0	11.8	13.5	7.3	4.0	10.2	59.7
0G32212GB1	Conduct Fracture Studies	3.9	3.7	7.8	1.4	2.2	5.6	9.2	2.7	5.2	1.4	2.4	3.1	48.6
0G32212GB2	Publish Maps & Reports for Structural St	12.0	5.1	-8.5	12.2	0.8	-5.7	10.0	19.2	25.9	3.9	-2.2	12.5	85.2
0G32212GB4	Structural Support to TSPA/VA	2.1	3.1	9.3	4.0	3.2	28.6	26.8	16.3	40.4	13.5	17.3	59.3	223.8
12322210U2	Structure	18.7	12.1	12.9	15.8	9.6	28.4	52.0	50.0	84.9	26.1	21.6	85.2	417.4
0G32211GB3	Detailed Char. of BH Video Logs from Dr	1.3	8.6	-5.1	0.4	0.2	16.7	14.6	5.7	3.6	-0.2	3.6	-3.4	46.0

U.S. GEOLOGICAL SURVEY

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

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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
12322210U4	Eval. BH Video Logs - DSHT BHs	1.3	8.6	-5.1	0.4	0.2	16.7	14.6	5.7	3.6	-0.2	3.6	-3.4	46.0
0G32211FB2	Stratigraphic Descriptions - WT-24/SD-6	0.0	18.5	2.6	1.4	0.5	0.7	0.4	2.4	6.7	12.0	12.2	13.8	71.3
12322210UC	Stratigraphic Descriptions - SD6/WT2	0.0	18.5	2.6	1.4	0.5	0.7	0.4	2.4	6.7	12.0	12.2	13.8	71.3
0G32212GB5	Prep QA, Proc. For Field at Lab Tests	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0	17.0
12322210UM	Earthquake and Foundation Engineerin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0	17.0
0G32211FB2	Develop Stratigraphic Description - Defer	0.0	0.0	3.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
12322210UW	Stratigraphic Descriptions - WT-24 De	0.0	0.0	3.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
12322210		41.4	48.7	26.6	38.5	29.5	55.0	72.6	66.9	96.8	58.8	41.6	115.6	692.3
0G32212FB2	Complete Site Area Geologic Map - ECR	0.0	29.6	35.7	29.7	37.9	10.4	-6.7	9.1	-0.3	1.1	-0.2	0.0	146.3
0G32212FB5	Geologic Mapping of the ECRB	55.2	69.6	46.7	71.4	59.0	63.2	120.0	106.5	117.4	96.3	117.5	147.0	1070.0
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	25.1	72.0
12326050U2	Structural Features and ESF Testing	55.9	106.7	94.1	111.4	108.4	75.4	116.9	115.6	117.1	97.4	117.3	172.2	1288.3
12326050		55.9	106.7	94.1	111.4	108.4	75.4	116.9	115.6	117.1	97.4	117.3	172.2	1288.3
0G32212GB3	Structural Support to Isotopic Age Studie	3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	3.0	0.5	0.0	19.7
12327025U1	Structural Support to Isotopic Age Stud	3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	3.0	0.5	0.0	19.7
12327025		3.9	0.9	0.2	1.7	0.7	5.2	0.0	1.7	1.9	3.0	0.5	0.0	19.7
	1.2.3.2	131.6	181.4	146.0	202.0	173.2	168.5	243.0	217.3	252.4	175.6	168.1	344.2	2425.1
0G33133GBF	Support VA SZ Flow Model Sensitivity A	2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	7.1	0.4	0.0	38.2
12331200U1	Abs/Testing SZ Flow Model for VA	2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	7.1	0.4	0.0	38.2
12331200		2.3	2.2	3.7	2.7	1.0	3.3	0.7	8.7	6.3	7.1	0.4	0.0	38.2
0G33124GB5	PTn Lateral Diversion (Phase II)	6.9	7.4	3.3	9.3	4.1	0.2	6.7	12.7	9.4	81.8	21.4	21.8	185.0
12332245U1	Hydrostratigraphy	6.9	7.4	3.3	9.3	4.1	0.2	6.7	12.7	9.4	81.8	21.4	21.8	185.0
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	27.0	27.6	32.9	134.0
12332245U2	Surface-Based Borehole Testing	0.0	0.0	4.1	0.2	-3.5	6.5	13.7	13.6	11.9	27.0	27.6	32.9	134.0
0G33124FBB	Air-K & Hydrochemistry Testing ESF	45.0	36.6	71.8	43.8	52.1	51.2	58.7	43.8	36.3	11.3	25.9	15.3	491.7
12332245U3	ESF Borehole Testing	45.0	36.6	71.8	43.8	52.1	51.2	58.7	43.8	36.3	11.3	25.9	15.3	491.7
0G33123GB3	Unsaturated Matrix Flow Properties	6.3	17.8	0.9	11.9	12.1	21.9	12.7	1.3	0.0	8.9	0.2	12.9	107.9
0G33123GB5	Backfill Hydrologic Properties Measurem	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.5	6.8	21.4	-16.1	46.6
12332245U4	Hydrologic Properties Measurements	6.3	17.8	0.9	11.9	12.1	21.9	12.7	1.3	34.5	16.8	21.6	-3.2	154.4
0G33124GB7	ESF Drift-Scale Flux & Niche Study (Pha	0.0	5.5	23.5	-3.5	9.8	13.1	7.4	13.9	4.6	8.7	20.1	19.5	122.5
0G33124GBF	Characterization of Seepage in Alcoves	11.3	36.4	38.6	34.8	35.6	9.5	93.9	23.4	11.2	15.2	17.1	3.2	330.1

U.S. GEOLOGICAL SURVEY

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

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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
12332245U5	Percolation and Seepage	11.3	41.8	62.0	31.3	45.4	22.6	101.3	37.2	15.8	23.9	37.2	22.8	452.6
0G33131GB2	Hydraulic/Tracer Test of Prow Pass Tuff	20.2	7.1	10.0	5.4	11.6	39.7	39.9	32.3	54.0	41.5	40.4	21.0	322.9
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	3.3	-17.3	3.0	129.3
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	3.0	-0.9	16.6
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	1.2	6.9	42.8
12332245U6	Saturated Zone Testing	21.7	8.3	17.2	10.6	56.2	62.7	104.9	55.8	72.1	44.8	27.3	29.9	511.5
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	2.9	19.6	5.7	94.8
0G33127GB2	Iso./Hydrochem. Studies of UZ Water an	13.5	17.3	16.8	19.8	44.5	6.7	81.7	11.0	0.4	13.5	43.8	23.4	292.2
12332245U7	UZ Hydrochemistry	24.2	25.9	22.9	32.0	48.1	14.8	89.9	15.0	5.5	16.3	63.4	29.1	387.0
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	6.6	13.6	-2.7	57.9
12332245UC	Matrix Properties - SD6/WT24	0.0	0.0	11.2	3.8	4.6	13.1	-3.2	-2.6	13.4	6.6	13.6	-2.7	57.9
0G33131FBG	Perched Wtr & SZ Hydrologic Tstg - WT	27.2	11.5	28.2	17.2	21.2	39.4	39.5	34.8	49.9	30.7	57.0	46.0	402.5
0G33131FBH	Iso/Hydrochem Smplg/Anal of SZs - WT	8.2	7.3	5.6	8.0	13.4	1.9	-0.3	-36.8	10.7	0.0	0.0	8.8	24.7
12332245UD	Hydrologic Tst/Hydrochem. Samping	35.4	18.8	33.8	25.1	34.6	41.3	39.2	-4.0	60.5	30.7	57.0	54.8	427.2
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	0.8	12.6	98.3
0G33124FBG	Eval Pot Lateral Diversion of Infiltrating	0.0	0.8	0.0	0.9	17.1	12.2	22.3	7.2	22.3	0.3	0.0	0.0	83.1
12332245UR	Risk Mitigation - Hydrostratigraphy	1.5	6.9	3.6	20.0	30.3	44.3	28.9	11.1	21.1	0.3	0.7	12.6	181.4
0G33124FBH	Evaluate Drift Scale Flux in ESF Niches (	7.3	2.6	-2.9	20.0	28.2	22.7	0.9	5.4	2.2	0.0	0.0	0.0	86.4
0G33124GA1	Support E&I Design Basis Modeling (RM	0.7	-0.7	0.0	0.0	0.0	3.8	6.1	3.8	9.0	0.0	0.0	0.0	22.7
12332245US	Risk Mitigation - Percolation & Seepag	8.0	1.9	-2.9	20.0	28.2	26.5	6.9	9.3	11.2	0.0	0.0	0.0	109.1
0G33123FBF	Char. Hydr. of SB Boreholes - Deferred	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	2.3	4.3	1.8	17.1
12332245UW	Matrix Properties WT-24 Deferred	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	2.3	4.3	1.8	17.1
0G33131FBG	Conduct Perched Water & SZ Hydraulic	1.5	40.1	-16.7	4.5	60.7	0.0	1.1	0.0	0.0	-0.4	0.0	0.0	90.9
0G33131FBH	Iso/Hydrochem Smplg/Init Analyses of S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.6	-11.0	0.0	0.0	0.0	45.6
12332245UX	Hydrologic Testing/Hydrochem Sampli	1.5	40.1	-16.7	4.5	60.7	0.0	1.1	56.6	-11.0	-0.4	0.0	0.0	136.5
0G33131FBB	Conduct C-Holes Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	3.9	9.9	4.4	8.9	10.8	75.0	218.7
0G33131FBF	Conduct Chemical & Isotopic Analysis -	0.0	0.0	0.0	0.0	0.0	0.0	3.6	6.3	0.7	1.2	0.8	1.9	14.5
12332245UY	SZ Testing - Deferred	3.4	6.8	29.3	34.0	21.5	10.9	7.5	16.2	5.0	10.0	11.6	76.9	233.2
0G33121GB2	Update & Enhance Net Infiltration Numer	7.1	17.7	5.7	14.2	17.1	12.2	2.5	5.8	8.4	2.7	13.8	-4.2	102.8
0G33121GB3	Prediction of Future Net Infil. Rates in Re	0.0	0.0	0.0	5.2	0.5	11.0	29.8	1.7	9.7	25.0	8.8	10.5	102.2
12332247U1	UZ Modeling	7.1	17.7	5.7	19.4	17.5	23.2	32.3	7.5	18.1	27.7	22.6	6.2	205.1

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0G33131GBA	Reduce Uncert. in Flux Values Used to C	2.2	7.9	3.7	5.0	5.4	3.0	3.4	9.8	8.2	33.1	9.7	11.9	103.4
0G33131GBA	Oasis Valley ET - Saturated Zone	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	22.5	8.2	14.8	-6.5	52.0
0G33133DV1	Geologic Support to Regional Flow Model	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	5.1	48.4	131.2	64.9	252.4
0G33133FB6	Confirm SZ Hydrologic Flow Models	14.3	20.6	21.4	20.6	22.3	-0.2	8.0	7.7	11.5	16.1	13.3	11.9	167.5
0G33133GB4	Refine Calibration of Site SZ Flow Model	8.6	7.2	9.2	10.6	13.7	22.3	10.3	11.8	1.9	3.5	8.0	22.9	130.0
0G33133GB6	Test Alternate Conceptual Models	6.1	2.9	6.6	10.7	3.1	11.0	3.7	9.2	5.9	2.9	17.7	15.2	94.9
0G33133GB7	Refine Regional Hydrogeologic Framewo	20.4	8.8	24.8	17.6	22.3	15.2	16.3	6.1	8.3	38.7	27.7	59.6	265.8
12332247U2	SZ Modeling	51.6	47.3	65.8	64.5	66.7	51.3	41.7	60.4	63.4	150.9	222.3	180.0	1066.0
0G33132GB1	Iso/Hydrochem. Analysis of SZ Ground	24.9	26.2	-0.3	21.3	87.2	24.8	110.7	29.8	33.8	52.9	46.0	51.0	510.4
12332247U4	Isotopic/Hydrochemical SZ Studies	24.9	26.2	-0.3	21.3	87.2	24.8	110.7	29.8	33.8	52.9	46.0	51.0	510.4
12332245		248.7	305.7	311.8	351.8	565.8	415.3	653.2	363.7	409.6	502.9	602.6	529.1	5260.2
0G33124FB8	Percolation Flux Across Repository Horiz	0.0	26.4	24.4	68.0	36.2	-10.0	5.8	16.5	5.2	43.0	34.3	21.1	270.9
0G33124FBD	Moisture Monitoring in the ESF - ECRB	5.9	8.0	7.0	-6.3	0.9	5.2	39.5	49.3	68.8	-16.1	9.2	22.4	193.8
0G33124GBA	Infiltration of Construction Water in ESF	10.7	-3.0	0.2	15.1	6.8	1.7	13.2	4.8	2.6	6.9	13.8	4.1	76.8
12336050U3	Infiltration, Percolation & Seepage	16.6	31.3	31.6	76.7	43.9	-3.1	58.5	70.6	76.5	33.9	57.4	47.6	541.5
12336050		16.6	31.3	31.6	76.7	43.9	-3.1	58.5	70.6	76.5	33.9	57.4	47.6	541.5
0G33112FB2	Collect Site Streamflow Data (1997)	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	31.5	20.1	17.5	28.7	15.0	170.1
0G33112GB1	Collect Site Streamflow Data (1998)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12337025U2	Surface Water Monitoring	11.7	-0.7	6.2	24.8	7.4	21.2	-13.4	31.5	20.1	17.5	28.7	15.0	170.1
0G33123FBB	UZ Borehole Instrumentation & Monitorin	18.4	16.1	25.8	30.7	-11.7	10.3	-6.0	-0.9	0.9	0.4	0.3	2.9	87.2
0G33123FBC	Integrated Analysis & Interpretation	13.6	7.7	14.4	19.5	-13.1	13.2	0.2	-0.2	0.9	0.0	0.0	11.2	67.4
0G33123GB1	UZ Borehole Instrumentation & Monitorin	6.9	6.1	7.6	6.3	29.5	19.0	29.2	38.6	25.6	26.1	25.8	28.6	249.3
0G33123GB2	Integrated Analysis & Interpretation	0.0	0.0	0.0	5.0	3.8	-1.3	0.0	0.0	15.8	4.6	17.6	4.7	50.1
12337025U3	Surface Based Hydrologic Monitoring	38.9	29.9	47.8	61.5	8.5	41.1	23.4	37.6	43.3	31.0	43.7	47.4	454.0
0G33131FBD	Water-Level Monitoring	10.3	0.1	-1.9	0.5	4.2	9.0	8.1	0.8	1.0	0.7	1.0	2.4	36.4
0G33131GB1	Water-Level Monitoring	5.5	11.2	8.8	7.5	6.9	4.8	12.4	5.6	19.4	26.0	40.5	21.0	169.8
12337025U5	Saturated-Zone Monitoring	15.8	11.4	6.9	8.0	11.1	13.8	20.5	6.5	20.4	26.7	41.6	23.4	206.1
0G33127GB3	Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	-2.6	23.0	11.7	10.8	9.2	79.3
12337025U6	Isotope Support for Thermal Testing	0.0	8.0	4.4	4.9	5.3	2.2	2.2	-2.6	23.0	11.7	10.8	9.2	79.3
12337025		66.4	48.5	65.3	99.2	32.3	78.4	32.7	72.9	106.8	87.0	124.8	95.1	909.5
	1.2.3.3	334.0	387.6	412.4	530.4	642.9	493.8	745.2	516.0	599.3	630.9	785.2	671.8	6749.4

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0G36215GB2	Future 100K Climate Records	0.0	4.7	4.1	9.6	7.1	4.2	30.2	13.7	16.1	16.9	25.6	33.4	165.5
12362252U1	Paleoclimate Analysis	0.0	4.7	4.1	9.6	7.1	4.2	30.2	13.7	16.1	16.9	25.6	33.4	165.5
0G36221GB3	Water Flux Det. Thru Repos. Blk - Age,	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	2.8	23.3	12.3	12.2	14.1	156.1
12362252U2	Geochronology of Fracture Minerals - L	17.4	3.8	23.8	15.2	22.5	-3.1	11.8	2.8	23.3	12.3	12.2	14.1	156.1
0G36221GB1	Paleoclimate Confirmatory Analyses - LA	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	10.6	-4.7	4.6	22.4	14.6	191.6
12362252U3	Paleohydrology and WT Fluctuations	11.8	9.2	-4.9	9.3	16.9	10.8	91.0	10.6	-4.7	4.6	22.4	14.6	191.6
12362252		29.2	17.6	23.0	34.1	46.4	12.0	133.0	27.1	34.7	33.7	60.1	62.1	513.2
0G36221FB3	Syn. Distr./Anal. Geochron. Age Dets. (E	6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	31.2	51.1	64.5	420.8
12366050U1	Fracture Mineral Age Dating	6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	31.2	51.1	64.5	420.8
12366050		6.2	12.5	41.6	14.9	8.1	17.6	127.1	20.5	25.5	31.2	51.1	64.5	420.8
0G36221GB4	Data Qualification for NRC	0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	15.6	6.9	0.0	33.9
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	15.6	6.9	0.0	33.9
12367027		0.0	0.0	0.0	2.9	3.7	-3.7	0.6	5.4	2.6	15.6	6.9	0.0	33.9
	1.2.3.6	35.5	30.1	64.6	51.8	58.3	25.6	260.7	53.0	62.7	80.5	118.2	126.6	967.9
0G39BGB6	Support PISA Geology Section	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.1	6.5	6.4	0.8	0.1	58.8
12392142U1	SDD - Geology Chapter	3.0	2.7	1.5	3.7	10.7	18.3	4.9	0.1	6.5	6.4	0.8	0.1	58.8
0G39BFB2	Develop PISA Chapter 3.5 (Hydrology)	20.5	20.8	27.0	31.0	46.2	28.8	19.0	21.0	18.2	16.6	19.8	23.7	292.6
12392142U2	SDD - Hydrology Chapter	20.5	20.8	27.0	31.0	46.2	28.8	19.0	21.0	18.2	16.6	19.8	23.7	292.6
0G39BFB4	Dev. Climate/Met. Site Desc.	29.5	42.0	51.5	28.4	34.7	37.8	44.4	-3.1	12.0	1.5	0.4	22.5	301.5
12392142U3	SDD - Climate/Meteorol. Chapter	29.5	42.0	51.5	28.4	34.7	37.8	44.4	-3.1	12.0	1.5	0.4	22.5	301.5
0G39BGB5	Support Devel. of PISA Geochem. Sectio	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	9.0	2.4	5.9	0.0	0.0	62.1
12392142U4	SDD - Geochemistry Chapter	12.5	7.5	5.9	-2.9	5.7	6.6	9.4	9.0	2.4	5.9	0.0	0.0	62.1
0G39BGB6	Chapter Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	18.2	7.5	16.6	22.4	13.3	197.6
12392142U6	SDD - Coord/Consol/Review	23.7	6.0	19.8	23.4	13.9	15.5	17.2	18.2	7.5	16.6	22.4	13.3	197.6
0G32211GB4	USGS Support to 3-D Integrated Site Mo	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	11.0	6.3	7.5	7.4	40.5
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	6.3	7.5	7.4	40.5
0G39BGA1	Support PR Input/Review	9.5	2.9	3.9	1.0	0.2	0.0	2.9	0.2	0.1	0.0	4.0	7.2	31.8
12392570U1	PR Review/Input	9.5	2.9	3.9	1.0	0.2	0.0	2.9	0.2	0.1	0.0	4.0	7.2	31.8
12392142		98.7	81.8	109.7	84.5	119.8	107.0	97.8	45.5	57.7	53.2	54.9	74.3	984.9
0G39BGA1C	Provide Regulatory Support	0.0	0.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	10.6	10.2	15.4	38.1
0G39BGA1F	Provide QA Implementation Support	9.3	11.7	27.4	13.6	10.4	46.2	-19.4	7.2	20.3	54.8	30.2	41.4	253.2

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0G39BGA2C	Provide Support for Dev/Rev of Reg Doc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4	12.4	18.9	18.8	59.5
12399090U1	Site Investigations Support	9.3	12.3	28.8	13.6	10.4	46.2	-19.4	7.2	29.7	77.7	59.3	75.6	350.8
12399090		9.3	12.3	28.8	13.6	10.4	46.2	-19.4	7.2	29.7	77.7	59.3	75.6	350.8
	1.2.3.9	108.0	94.1	138.5	98.2	130.2	153.3	78.5	52.7	87.4	130.9	114.2	149.8	1335.6
	1.2.3	702.0	761.2	841.6	949.2	1135.4	891.8	1390.6	896.1	1055.7	1072.6	1404.4	1347.3	12448.0
0G535GA1	Technical Data Coordination	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	40.2	57.7	472.1
12532186U1	Provide Technical Data Base Input	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	40.2	57.7	472.1
12532186		32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	40.2	57.7	472.1
	1.2.5.3	32.8	25.8	40.7	26.5	43.5	33.0	32.7	44.0	51.1	44.0	40.2	57.7	472.1
0G544GA1	Support to Performance Assessment	5.3	6.4	3.1	3.1	3.4	0.0	5.9	9.3	4.3	0.0	5.6	4.4	50.9
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	5.6	4.4	50.9
0G541FA2	Deferred - Support to Performance Asse	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	4.9	5.6	12.7	8.6	12.0	43.7
12541121UY	Provide Support to Performance Asses	0.0	0.0	-0.7	0.0	0.0	0.0	0.7	4.9	5.6	12.7	8.6	12.0	43.7
12541121		5.3	6.4	2.4	3.1	3.4	0.0	6.6	14.2	9.9	12.7	14.2	16.4	94.6
	1.2.5.4	5.3	6.4	2.4	3.1	3.4	0.0	6.6	14.2	9.9	12.7	14.2	16.4	94.6
	1.2.5	38.1	32.2	43.1	29.6	46.9	33.0	39.3	58.2	61.0	56.6	54.4	74.1	566.7
0G825GA1	Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	15.4	11.8	109.1
12829121U1	Federal Occupational Safety & Health	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	15.4	11.8	109.1
12829121		8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	15.4	11.8	109.1
	1.2.8.2	8.3	6.3	8.2	8.1	7.0	7.9	7.6	9.4	9.6	9.4	15.4	11.8	109.1
0G847GA2	Conduct Rad Water Quality Sample Coll	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	9.3	7.1	1.6	57.0
12842086U1	Rad Water Quality Sample Collection	15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	9.3	7.1	1.6	57.0
12842086		15.7	-4.5	-1.4	0.7	5.8	9.3	4.2	7.9	1.4	9.3	7.1	1.6	57.0
0G847GB1	Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	29.8	34.6	34.1	51.2	28.5	430.0
0G849121GA	Water Appropriations	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	18.3	0.5	6.4	2.7	39.9
12849121U1	Water Resources	0.0	44.0	21.3	29.8	17.0	115.6	24.1	41.8	52.8	34.6	57.6	31.1	469.9
12849121		0.0	44.0	21.3	29.8	17.0	115.6	24.1	41.8	52.8	34.6	57.6	31.1	469.9
	1.2.8.4	15.7	39.5	19.9	30.5	22.8	125.0	28.3	49.7	54.3	43.9	64.7	32.7	526.9
	1.2.8	24.0	45.8	28.1	38.5	29.8	132.9	35.8	59.1	63.9	53.3	80.1	44.5	636.0
0G9121GA	Technical Project Office	26.8	26.7	36.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	40.9	41.8	401.6
12919135U1	USGS Project Management	26.8	26.7	36.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	40.9	41.8	401.6

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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
12919135		28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	40.9	41.8	401.6
	1.2.9.1	28.8	28.7	38.4	32.4	33.1	38.2	44.2	37.5	14.5	23.0	40.9	41.8	401.6
0G922GA	Participant Project Control	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	60.1	22.5	312.1
12929135U1	Project Control - USGS	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	60.1	22.5	312.1
12929135		25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	60.1	22.5	312.1
	1.2.9.2	25.2	24.0	26.4	15.0	21.8	22.9	22.5	22.1	24.9	24.6	60.1	22.5	312.1
	1.2.9	54.0	52.7	64.9	47.4	54.9	61.1	66.7	59.5	39.4	47.6	101.0	64.3	713.7
0GC522GA1	Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	4.7	10.5	53.8
12C59130U1	USGS Satellite Records Operations	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	4.7	10.5	53.8
12C59130		4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	4.7	10.5	53.8
	1.2.12.5	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	4.7	10.5	53.8
	1.2.12	4.0	3.0	3.8	3.8	3.4	3.7	3.6	4.6	3.8	4.8	4.7	10.5	53.8
0GF23GA1	Support/Personnel Services	44.6	42.2	12.4	32.1	32.5	37.2	35.4	39.2	56.3	49.1	38.9	49.3	469.2
0GF23GA5	Procurement & Property Management	4.5	7.6	7.7	5.2	6.8	8.6	9.1	9.7	10.5	10.7	13.1	9.5	103.3
12F29110U1	Personnel/Procurement/Property Servi	49.1	49.9	20.1	37.4	39.2	45.9	44.5	49.0	66.8	59.8	52.0	58.8	572.5
0GF23GA2	Facilities Management (space)	0.0	123.3	61.7	61.7	61.7	44.7	58.8	58.8	58.8	58.8	-71.1	113.2	630.4
0GF23GA3	Facilities Management (computers/phone	0.0	36.3	18.2	18.2	18.2	13.2	17.3	17.3	17.3	17.3	47.4	-15.5	205.3
0GF23GA4	Facilities Management (other)	0.0	19.7	9.8	9.8	9.8	7.3	9.4	9.4	9.4	9.4	5.2	16.7	116.0
12F29110U2	Facilities Management (USGS)	0.0	179.3	89.7	89.7	89.7	65.2	85.6	85.6	85.6	85.6	-18.5	114.4	951.7
12F29110		49.1	229.3	109.8	127.0	128.9	111.0	130.1	134.6	152.4	145.4	33.5	173.2	1524.2
	1.2.15.2	49.1	229.3	109.8	127.0	128.9	111.0	130.1	134.6	152.4	145.4	33.5	173.2	1524.2
0GF3GA1	USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	27.4	7.5	78.6
12F39110U1	USGS Training Support	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	27.4	7.5	78.6
12F39110		4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	27.4	7.5	78.6
	1.2.15.3	4.4	3.3	4.7	4.3	3.6	4.0	4.9	4.1	4.9	5.6	27.4	7.5	78.6
	1.2.15	53.5	232.6	114.4	131.3	132.5	115.0	135.1	138.7	157.3	150.9	60.8	180.6	1602.8

U.S. GEOLOGICAL SURVEY

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

10/2/96 10:50:36 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
1.2 OPERATING	911.4	1152.8	1168.7	1232.7	1443.0	1307.2	1682.4	1255.1	1427.5	1483.8	1759.1	46.8	16601.6
CAPITAL EQUIPMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GRAND TOTAL	911.4	1152.8	1168.7	1232.7	1443.0	1307.2	1682.4	1255.1	1427.5	1483.8	1759.1	46.8	16601.6
FTEs													
FEDERAL	111.7	90.6	104.7	97.4	86.4	94.9	98.4	107.2	86.9	135.9	124.2	103.2	
CONTRACT	31.5	29.4	36.1	28.3	31.4	34.7	37.7	28.3	44.6	43.2	34.0	53.3	
TOTAL	143.2	120.0	140.8	125.7	117.8	129.6	136.0	135.6	131.5	179.1	158.2	156.5	

YMP PLANNING AND CONTROL SYSTEM (PACS

MONTHLY COST/FTE REPORT

Participant U.S. Geological Surve
Date Prepared 10/14/98 10:21 AM

Fiscal Month/Year September 30, 199

	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	56	903	246	0	0	0	702	0	581
1.2.3	1356	12531	6419	0	0	0	13247.1	0	12502
1.2.5	74	478	958	0	0	0	652	0	567
1.2.8	45	1560	0	0	0	0	664	0	636
1.2.9	64	825	284	0	0	0	652	0	714
1.2.12	11	184	0	0	0	0	73	0	54
1.2.15	181	1454	405	0	0	0	1665	0	1603
	1787	17955	8312	0	0	0	17655	0	16657