



# United States Department of the Interior

U. S. GEOLOGICAL SURVEY  
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Denver Federal Center  
Denver, Colorado 80225

IN REPLY REFER TO

INFORMATION ONLY

April 10, 2003

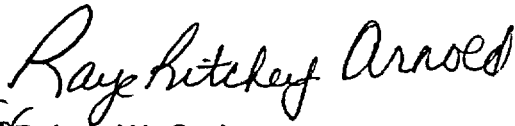
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SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS)  
Progress Report, March, 2003

Attached is the USGS progress report in the required format for the month of March, 2003.

If you have any questions or need further information, please call Raye Ritchey Arnold at (303)236-5050, ext 296.

Sincerely,

  
for Robert W. Craig  
Technical Project Officer  
Yucca Mountain Project Branch  
U.S. Geological Survey

Enclosure:

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**U.S. GEOLOGICAL SURVEY**  
Executive Summary  
**YUCCA MOUNTAIN PROJECT BRANCH**

March 2003

**GEOLOGICAL STUDIES**

In on-going support to the Nye County early-warning drilling program (EWDP), USGS staff examined samples obtained from Nye County's Phase IV drilling, in work on development of borehole-based lithostratigraphy. Interpretation of subsurface units continued, based on additional examinations of bit cuttings, correlations of selected geophysical logs, and correlation with optical televiewer logs from boreholes NC-EWDP-28P and NC-EWDP-27P. Processing of samples from borehole NC-EWDP-16P also continued. Further work continued on finalization of the data package for Phase III Nye county cross sections, based on technical and checker reviews. Modifications include addition of a "depth-to-basement" contour map with other geophysical data. Other changes include modification of fault-trace coverage to symbolize inferred and exposed fault traces. In related unscheduled work, staff met with DOE and Nye County Drilling Program personnel to discuss interpretation of subsurface geology, borehole-geophysical interpretations, preliminary interpretation of Schlumberger soundings, and future drilling. [Please note that any use herein of private brand, trade, or firm names is for identification and explanatory purposes only and does not constitute endorsement by the United States Geological Survey or other agency of the U.S. government.]

Additional attributions were compiled for the completed geologic map of the potential southern repository-expansion area. That attribution of geologic units and related information to the map helps allow use of the map in a fully digital GIS mode necessary for review by the USGS publications group for USGS Director's approval. Those attributions also are critically important, for example, for use in computer-based hydrogeologic modeling.

Rock-mechanics testing on samples collected from ECRB excavations continued by the Bureau of Reclamation team. Comment resolution on both technical and checker reviews of the Direct Shear data package was completed. Laboratory rock testing (creep testing) continued. Of four 12-in samples and six 6-in samples, one 12-in sample and one 6-in sample remained intact as testing progressed. Testing is anticipated to continue for six months, pending re-evaluation of schedule. The creep tests, it should be noted, are long-term activities which require several months for completion.

Several activities in characterization of fracture and lithophysal features of the repository host horizon (RHH) continued, including collection of samples for thin-section analysis, mapping of lithophysal panels and traverses, conduct of fault-related fracture studies, and conduct of small-scale fracture traverses. Preparation for continuation of small-scale fracture surveys continued, although that activity has been delayed in order to allow

completion of other ECRB testing activities. Plans are in development for tunnel-rib cleaning to allow additional lithophysal studies in the Topopah Spring Tuff upper lithophysal unit. Unanticipated efforts in review and assembly of the Drift Degradation AMR were undertaken. In related unscheduled work, staff prepared and delivered a presentation on fracture geometry of the RHH to the Bureau of Reclamation Construction Geology Conference. Additional preparations were directed to presentation of analytical results at the upcoming RDTME technical exchange, which will address aspects of the Repository Design Thermal-Mechanical Effects key technical issue.

Comment resolution from technical reviews of the Deterministic Seismic Hazards Analysis (DSHA) report was still underway, as required revisions have taken longer than anticipated due to schedule conflicts. There is no impact on program elements, however, since the DSHA report is not directly linked to other Project activities or products.

## SATURATED-ZONE STUDIES

Activities supporting cross-hole hydraulic testing at the Alluvial Test Complex (ATC) continued. Monitoring for barometric response from transducers installed in Nye County early-warning drilling program borehole NC-EWDP-19IM1 continued, as it has since activation of the MAGI Westbay data logger in January 2003. That logger records pressure measurements which will be used in calculation of barometric efficiency.

On-going work supporting QA qualification of computer software also continued. Previously submitted software management reports (SMRs) returned from review by the Independent Verification and Validation (IVV) Group, and responses (and revisions as necessary) were prepared. The SMR package for the program INJECTION-PUMPBACK.vi, version 1, was re-submitted in March, and re-submittal of the package for STRELTSOVA-ADAMS.vi, version 1, was expected by the end of the month. Work also has been underway on the SMR for the program RECIRC.vi, and that package went to review on March 14. It was expected to be submitted to the IVV Group in early April.

In developments related to the SMR work, preliminary analyses of qualified data began on March 24 with QA-approved programs and data down-loaded from the TDMS. Those data will be run through the qualified code packages THEIS.vi., version 1, and NEUMAN.vi., version 1. Developed data packages will be created with the subsequent results.

Hydrochemical work focused on Site-scale hydrochemistry and on-going hydrochemical and isotopic support to the Nye County early-warning drilling program. Samples collected from two Inyo County (California) drilling-program boreholes have been analyzed. Anticipated collection of spring-discharge samples did not occur, but that sampling may be accomplished in April depending on results of Project-level budgetary re-planning. A USGS open-file report describing the Site-scale hydrochemical data base has undergone technical review. (The data base with that information currently is available to Project investigators.) Preparation of an interpretive report on saturated-zone

hydrochemistry also continued; that synthesis is approximately 75% complete. All sampling equipment likely needed in the work-overs of water-table (WT) boreholes has been purchased. (Some additional requirements may arise when the work-over plans have been finalized.)

Integration of hydrogeologic data remained a focus of the Death Valley regional flow-system (DVRFS) modeling effort, as did model calibration and correction. Work continued on transfer of flow-model evaluations visualized in ARCVIEW projects to ARCMAP documents, utilizing VISUAL BASIC and ARCOBJECTS programming. Visualization of flow-model head observations has been completely transferred to ARCMAP. As part of data-base integration, a web site (<http://sun1daztcn.wr.usgs.gov/>) supported knowledge exchange between project participants. On-going improvements to the spatial data base included compilation of results from hydrogeologic investigations in support of the DVRFS transient flow model. Such compilation will become part of the final transient flow-model report.

Other work focused on improved hydrogeologic parameterization and on development of the three-dimensional (3-D) hydrogeologic framework model (HFM), including details of incorporation of data from other 3-D models. Revision and correction of the HFM continued. The HFM was updated based on inconsistencies found in alluvial units, including adjustment of alluvial aquifers where playas and Tertiary limestone were found to exist together. Hydrologic flow barriers (HFBs) were updated to split middle parts of the Las Vegas Valley shear zone (LVVSZ). The HFBs were attributed (see brief discussion above under "Geologic Studies") as to which faults cut Quaternary units, and elsewhere, HFBs were removed where imaged faults did not cut Quaternary units. That attributed information was compared to unit descriptions in the HFM, and the Timber Mountain Volcanic Aquifer (TMVA) HFB file was updated accordingly, including writing of code to automatically generate revisions using data in GIS coverages. New zonation was developed for depiction of both the upper and lower volcanic sedimentary units. That zonation included locations of playa deposits, allowing depiction of the zone of fine-grained deposits to extend vertically through the alluvium and to improve modeled discharge at numerous springs.

Flow-model calibration and evaluation also continued. The well-input generator was modified to include options for apportionment of pumpage by model-layer hydraulic conductivity and for adjustments in the model for thickness and related model-layer conductivity. Compilation of historical ground-water withdrawal information and summary of weighting methods was prepared for inclusion in the transient model report. Improvements to flow-model calibration included redefinition of spatial extent of general head boundary (GHB) to correct over-representation of discharge areas; clarification of minimum elevation of discharge in model cells to minimize the model artifact of recirculation (water entering the model then being discharged at a nearby cell) within individual discharge areas; addition of depth decay in the Lower Clastic Confining Unit (LCCU) to improve visualization of higher permeability near the surface and decreasing permeability with depth; and improved representation of basin-fill units by new definitions of vertical anisotropy. Efforts also continued on automation of particle

tracking and incorporation into 3-D visualizations with various input data sets and on visualization of flow-model output with the HFM. Definitions of recharge zones were updated, including information on the upper five layers of confining units. Other continued work focused on incorporation of constant-head information and codes into the preprocessing environment. Adjustments in the depth-decay option improved modeled spring flow and was particularly useful in modeling of the Ash Meadows and Spring Mountains areas. Features were added to the DVRFS post-processor to calculate and display head-observation (well) weightings. Code was integrated to calculate and display connections of hydrogeologic unit(s) and wells. Additional code was developed to extract MODFLOW2000 simulated hydraulic conductivity values at given well locations. The hydraulic conductivity values, reported by model layer and by hydrogeologic unit, were extracted for assessment of methods of apportionment. A progress report describing flow modeling activities was prepared for the TPO, in completion on March 31 of milestone **PAGSM34AM5 [Progress on Flow Modeling Activities]**.

Knowledge exchange continued as an important part of DVRFS modeling work. Summaries of knowledge-exchange meetings (held March 11 and 12) were delivered to the TPO and posted to the modeling-project web site (<http://sun1daztcn.wr.usgs.gov>) in completion on March 31 of milestone **PAGSM37JM5 [Knowledge Exchange Meeting Summary to TPO]**. Preparations continued for the Geological Society of America sessions on studies in the Great Basin, including plans to solicit presentations at the upcoming Devils Hole workshop. The HFM construction and data-base evaluation chapters of the transient flow-model report were submitted to the report editor, in completion on March 31 of milestone **PAGSM32DM5 [3-D Hydrogeologic Model Development]**.

Developmental work on DVRFS predictive capability focused on potential scenarios for model predictions and on possible improvements for more flexible routines and work flows for predicting impacts related to ground-water pumping.

## UNSATURATED-ZONE STUDIES

The USGS completed a major, complex data-submittal milestone reporting lengthy moisture monitoring in ESF Alcoves #3, #4, and #7 and in the ECRB Cross Drift. That milestone, **PAGSW917M4 [Alcove 3, 4 & 7 Moisture Monitoring Data to TDMS]**, completed on March 7, consists of three data packages submitted to the TDMS and RPC:

“Water Potential, Temperature, and Relative Humidity Data from Alcove 7 Using Heat-Dissipation and Temperature/Relative-Humidity Probes for 12/8/1997 to 6/ 3/2002” (GS030108312242.002: un-Q pending closing calibrations);

“Temperature and Water-Potential Data from Alcoves 3 and 4 Using Heat Dissipation Probes for 4/1/2000 to 3/31/2002” (GS021008312242.003: Q); and

“Pressure, Temperature, and Water-Potential Data from Alcove 7 and the Bulk-headed Portion of the ECRB Cross Drift Using "Borehole Type" Instrumentation

for 9/20/2001 to 3/31/2002" (GS020808312231.002: un-Q pending closing calibrations).

Work on the Alcove #8/Niche #3 infiltration experiment continued with routine handling of data received from the TCO. Data collected from the large plot include weight (as a proxy for volume) of water applied to the plot, heat-dissipation probe (HDP) data acquired around the large plot, and temperature, relative humidity (TRH), and barometric pressure measured behind the bulkhead. Evaporation data also are collected. Heat-dissipation probe data alone are being collected from the trench. Ten of the large-plot stations were removed from the download list, but with the future re-start of fully ponded conditions prior to tracer application, those stations will be returned to the download list.

The tracer part of the experiment has been postponed, because pre-test model predictions are not complete. Length of that postponement is unknown. The Alcove #8 experiment has been re-configured in attempts to make qualitative observations of Niche #3 regarding fracture connectivity. Initial re-start conditions will include application of water at 50% of the rate previously applied, with application in only two of the plots (plots 2 and 12). Some dry-out is expected in Niche #3. Presence of and rate of dry-out may provide insight into fracture connectivity and allow comparison to quantitative measurements to be made during the tracer part of the tests. Mold continued to be a problem in Alcove #8, requiring Tyvek suits and protective gear for work and maintenance behind the bulkhead.

Two data packages were finalized and submitted to the TDMS and the RPC in completion on March 14 of milestone **PAGSW22M4 [Fault Infiltration/Tracer Experiment Data Package to TDMS/RPC]**, reporting unsaturated trench fault infiltration in Alcove #8 using permeameters and TRH data recorded behind the bulkhead in Alcove #8.

Moisture monitoring in the ESF and the ECRB Cross Drift continued. New data-logger programs were installed at Stations TRH03 and TRH10. Those programs will record hourly-average readings and maximum and minimum instantaneous readings, thereby providing data to assess hourly variability of moisture conditions in the tunnel atmosphere. Calibration checks of neutron moisture-monitoring meters were completed. Equipment was changed out at Stations TRH03 and TRH10, adding barometers to each station, and data loggers at each station were adjusted to Greenwich Mean Time. Temperature and relative-humidity data received in spreadsheets from the TCO were processed. Compilation of data packages continued, pending closing calibrations and final distributions of relevant data from the TCO.

Collection and preparation of temperature, relative-humidity (TRH), barometric-pressure, and wind-speed data continued. The schedule for opening of bulkheads and retrieval of instruments for closing calibrations and compilation of data package(s), however, is unknown. Bulkhead moisture monitoring has continued in spite of electrical power remaining off behind the bulkheads. At least 18 of 23 data loggers behind bulkheads continued to operate. Connections cannot be made to two additional loggers; those may or may not be recording data. Battery voltage apparently has fallen below requirements

for three other loggers. A proposal was made by Site engineering staff to use only a 12-volt system behind the bulkheads to provide all power for lighting and camera operation. The 120-volt system currently in place does not meet electrical codes for the wet conditions behind the bulkheads. A 120-volt system with manual shut-off and provision for monitoring of power input (for safety) is deemed necessary by USGS staff for the monitoring cameras; a 12-volt system could keep batteries charged but would be insufficient for camera lighting. Schedules for bulkhead re-entry and maintenance of equipment have not been determined. In the meantime, moisture-monitoring data were received from the TCO and processed. Thirteen video tapes and some nine DVD recordings were prepared.

In progress on on-going evaluation of lithophysical characteristics, a data package reporting spot and rim hydrologic properties was prepared, along with additional documents necessary for data review, and that review began. The review and checking were completed in March, and reviewer comments were resolved. The package is in preparation for submittal to the TDMS/RPC.

On-going USGS work to characterize the chemical and isotopic composition of pore water continued. Staff extracted water (by ultracentrifuge) from two samples of stored existing core drilled from the ECRB Cross Drift. Core material used in those extractions was taken adjacent to the location of previously extracted samples which gave preliminary indications of high concentration of organic acids. The current experiment tested whether organic acids again could be detected from that "re-sampling" of earlier samples, because analyses of water extracted from more recently drilled core samples typically show no organic acids. Preliminary analysis in the current testing of extracted water reported large amounts of organic acids, particularly propionic acid (detected at 510 mg/L). Major- and trace-element analyses of the extracted samples were obtained for comparison with previous analyses. Although awaiting additional results, the current preliminary results nonetheless confirmed previous findings and indicated likely production of organic acids during storage or handling of the core, because pore-water samples from recently drilled material show no elevation of acid content. The organic acids found in water extracted from stored core likely are not characteristic of pore water in the natural system. Further work will attempt to clarify those sample-handling and sample-storage issues. In related but unscheduled work, staff prepared a presentation on strontium isotopes in pore water for the International High-Level Radioactive Waste Management conference held at the end of March.

Isotopic support to Thermal Testing continued, but the thermal test workshop scheduled for March or April has been postponed, and no new date has been set by the thermal test team pending completion of other Project priorities. Borehole CHEMSAMP3, however, currently is being drilled. Core cannot be requested for analysis until released by the SMF, perhaps early in April. Borehole CHEMSAMP2 is scheduled for drilling immediately following completion of CHEMSAMP3. Extraction of water and chemical analyses are expected to commence in April or May.



Compilation of carbon-14 ( $^{14}\text{C}$ ) data obtained as part of characterization of the hydrochronology of the Yucca Mountain flow system continued, with that work awaiting results of additional analysis of standards and related data reductions. In other on-going work on hydrochronology of the YM flow system, interpretation of new data and correlation with results of dating of inorganic material continued. Direct comparison of  $\delta^{14}\text{C}$  from inorganic material and  $\delta^{14}\text{C}$  from organic sources from 14 different well samples yielded no readily discernable correlation. Final analysis awaits results (expected soon) of analysis of additional organic  $^{14}\text{C}$  standards. Analyses of those standards will help evaluate reliability of the  $\delta^{14}\text{C}$  ages.

A data package containing results of analysis of water, water-vapor, and gas chemistry in the ESF/ECRB drifts was completed and submitted on March 27 in completion of milestone PAGESZ389M4 [Gas and Water Vapor Data Package to TDMS/RPC]. Other work on chemical analysis of ECRB water, water-vapor, and gas samples (including installation of wick samplers on the ceilings of ECRB excavations and installation of sample tubing while bulkheads are open, set-up of continuous-monitoring equipment, collection and analysis of gas and water-vapor samples, monitoring of  $\text{CO}_2$  and pneumatic pressure, and construction of a MODFLOW model to interpret data) has been delayed until opening of the ECRB bulkheads. Projected time-frames for those activities currently are unknown.

Work continued on U-series isotopic delineation of UZ flow zones. A suite of samples from USW SD-7, -9, and -12 drill core was selected for whole-rock U-series isotopic analyses. Samples were crushed, and representative samples were split, screened, and pulverized. Those samples will be used to evaluate vertical variations of  $^{234}\text{U}/^{238}\text{U}$  and  $^{230}\text{Th}/^{238}\text{U}$  disequilibrium throughout the UZ repository block. In related unscheduled work, an oral presentation was prepared for the 2003 High-Level Radioactive Waste Management conference held starting at the end of March.

In additional unscheduled work on microclimate records in fracture minerals, staff revised and edited a manuscript documenting previous opal-dating efforts using ion-microprobe and microdigestion methods. That manuscript has been returned to the YMPB publication team for processing toward USGS Director's approval.

In preparation for on-going work in geochemical and physical characterization of ESF dust, USGS staff participated in planning for the dust/radon test proposed for Alcove #6. Initial (proposed) USGS efforts would collect and analyze existing dust in the alcove, to provide a baseline prior to bulkhead construction. Radon testing, as discussed, would require six months to a year, during which time cycles of overpressuring and depressuring the alcove would be carried out. The USGS may become involved in that testing to monitor for seepage during the depressuring cycle(s), when pressure would reach -3 inches of water gauge relative to atmosphere.

## WATER-RESOURCES MONITORING

Ground-water and spring-flow monitoring continued during March. Ground-water levels were measured at 34 sites, and ground-water discharge was measured at five springs and at one flowing well. Spring-discharge and ground-water data collected during February were checked and filed, in routine on-going work. The USGS provided environmental-program support as staff met with personnel from the National Park Service to measure water levels in the Barrick Bullfrog monitoring-well network (with relation to the Barrick Bullfrog, Inc., Bullfrog gold mine). In addition, staff continued preparation of the water-level data package for calendar year 2002.

Compilation by W. Clay Hunter, U.S. Geological Survey, Yucca Mountain Project Branch, with contribution from Dan Gillies, also of YMPB.

# USGS Milestone Report

October 1, 2002 - March 29, 2002

Sorted by Baseline Date

Level: 3

Deliverable	Due Date	Expected Date	Completed Date
<b>PAGSC2040D</b> Training Cost Information Annual Update	12/19/2002	12/12/2002	12/12/2002

## USGS Milestone Report

October 1, 2002 - March 29, 2002

Sorted by Baseline Date

Level: 4

Deliverable	Due Date	Expected Date	Completed Date
<b>PAGSW932M4</b> Supplemental Fracture Data to TDB/RPC	10/25/2002	11/1/2002	11/1/2002
<b>PAGSW258M4</b> Letter Report: 4th Qtr FY02	10/31/2002	10/31/2002	10/31/2002
<b>PAGSM930M4</b> USGS Dir. Approval of Map of S. Expansion Area	11/8/2002	4/25/2003	
<b>PAGSW930M4</b> Phase II Lithophysal Data to TDMS/RPC	11/15/2002	1/31/2003	1/31/2003
<b>PAGSW931M4</b> Phase I Lithophysal Data to TDB/RPC	11/15/2002	1/31/2003	1/31/2003
<b>PAGSM935M4</b> S. Expansion Area Data to TDMS/RPC	11/26/2002	5/9/2003	
<b>PAGSZ132M4</b> Interpretive Rpt on Opal Geochronology	12/13/2002	12/13/2002	12/13/2002
<b>PAGSZ651M4</b> Interpretive Rpt on Initial U-series Data	12/13/2002	12/13/2002	12/13/2002
<b>PAGSM920M4</b> Phase 3 Lithologies Data Pkg to TDMS/RPC	12/17/2002	2/18/2003	2/18/2003
<b>PAGSZ303M4</b> Final Report to Customer & TDMS	12/27/2002	6/11/2003	
<b>PAGSW530M4</b> Rock Mech (Direct Shear) Data to TDMS/RPC	1/10/2003	4/21/2003	
<b>PAGSW260M4</b> Letter Report: 1st Qtr FY03	1/31/2003	1/31/2003	1/31/2003
<b>PAGSW604M4</b> Fract & Lithophysal Char Prelim Data to TDMS/RPC	1/31/2003	6/30/2003	
<b>PAGSM925M4</b> Phase 3 X-sections DP to TDMS/RPC	2/21/2003	5/14/2003	
<b>PAGSW22M4</b> Fault Infiltration/Tracer Exp Data Pkg--TDMS/RPC	2/28/2003	3/14/2003	3/14/2003
<b>PAGSW937M4</b> Spot & Rim Hydrologic Prop DP - TDMS/RPC	3/31/2003	4/29/2003	

**USGS Milestone Report**  
**October 1, 2002 - March 29, 2002**  
Sorted by Baseline Date

**Level: 5**

Deliverable	Due Date	Expected Date	Completed Date
<b>PAGSM37EM5</b> Mtg Summary to TPO	10/31/2002	10/25/2002	10/25/2002
<b>PAGSM37FM5</b> Mtg Summary to TPO	11/29/2002	11/29/2002	11/29/2002
<b>PAGSM30AM5</b> Intro Chap Rpt Contribution to Rpt Editor	12/31/2002	12/20/2002	12/20/2002
<b>PAGSM32CM5</b> Intro Chapters Rpt Contribution to Rpt Editor	12/31/2002	12/20/2002	12/20/2002
<b>PAGSM32EM5</b> Mid-Year Progress HFM Discretization	12/31/2002	12/19/2002	12/19/2002
<b>PAGSM32GM5</b> Prg Rpt - Updates Based on Hydrgeo Parameteriztn	12/31/2002	12/19/2002	12/19/2002
<b>PAGSM34CM5</b> Intro Chapters Rpt Contribution to Rpt Editor	12/31/2002	12/20/2002	12/20/2002
<b>PAGSM373M5</b> Annotated Outline of Report to TPO	12/31/2002	12/18/2002	12/18/2002
<b>PAGSM37GM5</b> Mtg Summary to TPO	12/31/2002	12/20/2002	12/20/2002
<b>PAGSM32AM5</b> Progress HFM Updates - Transient Model	1/31/2003	1/31/2003	1/31/2003
<b>PAGSM37HM5</b> Mtg Summary to TPO	1/31/2003	2/7/2003	2/7/2003
<b>PAGSM30BM5</b> Update Hydrogeologic Data Integration Progress	2/28/2003	2/28/2003	2/28/2003
<b>PAGSM36AM5</b> Update on Predictive Capability Progress	2/28/2003	2/28/2003	2/28/2003
<b>PAGSM37AM5</b> Memo to TPO: Completion - Editing Intro Chapters	2/28/2003	2/28/2003	2/28/2003
<b>PAGSM37IM5</b> Mtg Summary to TPO	2/28/2003	2/28/2003	2/28/2003
<b>PAGSM32DM5</b> Report Contribution to Report Editor	3/31/2003	3/31/2003	3/31/2003
<b>PAGSM34AM5</b> Progress Report Flow Modeling	3/31/2003	3/31/2003	3/31/2003
<b>PAGSM37JM5</b> Mtg Summary to TPO	3/31/2003	3/31/2003	3/31/2003

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey  
 Date Prepared 4/10/2003 02:18 PM

Fiscal Month/Year March 31, 2003  
Page 1 of 1

CURRENT MONTH END

FISCAL YEAR

WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.5.01.1	6	0	155	0	0	0	175	0	10
1.5 02.2	348	18414	2027	0	0	0	4607	0	2167
1.5 04.6	1426	32851	2378	0	0	0	8665	0	3719
	1780	51265	4560	0	0	0	13447	0	5896

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR October 1, 2002 - March 31, 2003

4/10/2003 2.19:12 PM

	OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
4568-9U015 USGS Data Verification	0.0	0.0	1.0	2.1	1.1	5.8	0.0	0.0	0.0	0.0	0.0	0.0	9.97
DTAG01 USGS Data Verification	0.0	0.0	1.0	2.1	1.1	5.8	0.0	0.0	0.0	0.0	0.0	0.0	9.97
1.5.01.1.2.0 Data Verification	0.0	0.0	1.0	2.1	1.1	5.8	0.0	0.0	0.0	0.0	0.0	0.0	9.97
1.5.01.1	0.0	0.0	1.0	2.1	1.1	5.8	0.0	0.0	0.0	0.0	0.0	0.0	9.97
1.5.01	0.0	0.0	1.0	2.1	1.1	5.8	0.0	0.0	0.0	0.0	0.0	0.0	9.97
4568-9U048 Cross-hole Hydraulic & Tracer Testing AT	27.4	27.2	18.7	14.6	17.3	21.7	0.0	0.0	0.0	0.0	0.0	0.0	126.89
4568-9U049 Nye County EWDP Borehole Lithostratigr	12.3	10.2	1.1	17.9	10.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	62.29
4568-9U051 Deferred - Lithostratigraphic Support to N	0.0	0.0	18.6	4.2	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.31
4568-9U052 Deferred - X-Hole Hydraulic & Tracer Tstg	0.0	0.0	14.6	7.1	13.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	43.51
4568-9U053 Deferred - Map Proposed Repository Exp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
4568-9U072 Support to Proposed Surface Workover T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
ASZG01 USGS SZ Investigations	39.8	37.5	53.1	43.7	38.8	41.1	0.0	0.0	0.0	0.0	0.0	0.0	254.01
4568-9U082 Isotopic/Hydrochemical Support to the AT	0.0	4.1	0.0	0.2	0.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0	5.94
4568-9U083 Hydrochronology of the Yucca Mountain	0.0	0.0	0.0	0.0	11.8	-1.3	0.0	0.0	0.0	0.0	0.0	0.0	10.52
4568-9U084 Site-Scale Hydrochemistry	19.4	-0.1	15.8	15.0	6.3	13.5	0.0	0.0	0.0	0.0	0.0	0.0	70.01
4568-9U092 Isotope/Hydrochemical Support to Nye C	7.7	23.9	-1.4	6.4	17.1	-7.7	0.0	0.0	0.0	0.0	0.0	0.0	46.11
ASZG02 USGS SZ Isotope Hydrology	27.1	28.0	14.4	21.6	35.4	6.1	0.0	0.0	0.0	0.0	0.0	0.0	132.58
1.5.02.2.3 Saturated Zone	66.9	65.5	67.5	65.3	74.2	47.2	0.0	0.0	0.0	0.0	0.0	0.0	386.59
4568-9U050 Alcove 7/X-Drift Instrument Strains	7.8	5.5	3.9	20.4	7.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	45.54
4568-9U063 Alcove 8/Niche 3 Infiltration	25.9	22.1	29.9	21.4	28.3	22.4	0.0	0.0	0.0	0.0	0.0	0.0	150.09
4568-9U064 Moisture Monitoring ESF & X-Drift	19.2	14.7	13.3	20.8	11.6	23.6	0.0	0.0	0.0	0.0	0.0	0.0	103.35
4568-9U065 Bulkhead Moisture Monitoring	8.2	7.7	21.4	17.6	14.9	32.4	0.0	0.0	0.0	0.0	0.0	0.0	102.09
4568-9U066 Support to UZ In-Situ Processes AMR	7.3	7.7	2.6	5.0	-0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	21.95
AUZG01 USGS UZ Moisture Studies	68.4	57.6	71.2	85.3	61.6	78.8	0.0	0.0	0.0	0.0	0.0	0.0	423.02
4568-9U085 U-Series Delineation of UZ Flow Zones	26.8	5.8	20.1	17.3	9.2	3.7	0.0	0.0	0.0	0.0	0.0	0.0	82.81
4568-9U086 Complete Chlorine 36 Validation	5.0	13.8	11.8	9.9	24.3	10.9	0.0	0.0	0.0	0.0	0.0	0.0	75.70
4568-9U087 Chemical & Isotopic Composition of Pore	30.4	38.0	52.2	32.4	25.3	23.6	0.0	0.0	0.0	0.0	0.0	0.0	201.78
4568-9U088 ECRB H2O, H2O Vapor & Gas Chemistry	0.0	4.6	1.6	0.3	5.2	26.8	0.0	0.0	0.0	0.0	0.0	0.0	38.52
4568-9U089 Microclimate Records in Fracture Mineral	13.9	17.0	13.3	16.6	20.1	41.8	0.0	0.0	0.0	0.0	0.0	0.0	122.56

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	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	EST	
<b>AUZG02</b> USGS UZ Isotope Hydrology	75.9	79.2	99.0	76.6	83.9	106.8	0.0	0.0	0.0	0.0	0.0	0.0	521.37
4568-9U090 Isotope Support for Thermal Testing	7.9	12.9	18.7	29.0	-2.5	12.5	0.0	0.0	0.0	0.0	0.0	0.0	78.48
<b>AUZG03</b> USGS Drift-Scale Test ESF	7.9	12.9	18.7	29.0	-2.5	12.5	0.0	0.0	0.0	0.0	0.0	0.0	78.48
<b>1.5.02.2.3</b> Unsaturated Zone	152.2	149.7	188.9	190.9	143.1	198.1	0.0	0.0	0.0	0.0	0.0	0.0	1,022.87
4568-9U004 USGS Support to Site Description	7.3	8.0	17.8	1.1	14.0	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	46.36
4568-9U006 Support to LANL Cesium Study	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
<b>ANSG01</b> USGS Support to Site Description	7.3	8.0	17.8	1.1	14.0	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	46.36
<b>1.5.02.2.3</b> Natural Systems	7.3	8.0	17.8	1.1	14.0	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	46.36
4568-9U091 Geochem/Physical Characterization of E	2.1	2.8	1.8	3.8	1.5	38.4	0.0	0.0	0.0	0.0	0.0	0.0	50.51
<b>AEBG01</b> USGS Effects of Water-Rock Interactio	2.1	2.8	1.8	3.8	1.5	38.4	0.0	0.0	0.0	0.0	0.0	0.0	50.51
4568-9U067 Quantify Lithophysal Porosity - In Situ Te	8.1	7.5	5.4	8.2	-0.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	30.13
4568-9U070 Deferred - Core & Lithophysae Char Tstg	0.0	0.1	0.9	6.1	5.3	27.8	0.0	0.0	0.0	0.0	0.0	0.0	40.22
<b>AEBG02</b> USGS Nevada Operations Support to E	8.1	7.6	6.3	14.3	5.1	29.0	0.0	0.0	0.0	0.0	0.0	0.0	70.35
4568-9U068 Rock Mechanics Testing in the ECRB (U	91.5	53.5	28.2	46.4	35.2	6.1	0.0	0.0	0.0	0.0	0.0	0.0	260.97
4568-9U069 Fracture & Lithophysal Characteristics of	43.7	53.1	48.7	81.5	65.1	31.0	0.0	0.0	0.0	0.0	0.0	0.0	323.02
4568-9U071 Deferred - QAS & Checking Support USB	0.0	0.0	2.1	3.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.94
<b>AEBG03</b> USBR Testing Activities in Support of D	135.2	106.5	79.1	131.5	100.4	37.2	0.0	0.0	0.0	0.0	0.0	0.0	589.92
<b>1.5.02.2.4</b> Engineered Barrier System	145.4	116.9	87.2	149.6	107.0	104.6	0.0	0.0	0.0	0.0	0.0	0.0	710.77
<b>1.5.02.2</b>	371.8	340.2	361.4	406.9	338.3	348.0	0.0	0.0	0.0	0.0	0.0	0.0	2,166.59
<b>1.5.02</b>	371.8	340.2	361.4	406.9	338.3	348.0	0.0	0.0	0.0	0.0	0.0	0.0	2,166.59
4568-9U001 Science Advisors	41.0	37.7	36.8	42.2	42.0	46.8	0.0	0.0	0.0	0.0	0.0	0.0	246.46
4568-9U010 Publications	19.2	34.2	3.9	8.3	11.4	7.8	0.0	0.0	0.0	0.0	0.0	0.0	84.76
4568-9U040 Tectonics	21.5	10.3	1.7	4.6	6.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	47.44
4568-9U041 Water Levels	3.4	0.0	4.7	0.9	2.8	3.0	0.0	0.0	0.0	0.0	0.0	0.0	14.79
4568-9U042 Geophysics	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.42
4568-9U060 Mapping Expertise (USBR)	14.6	8.0	4.5	9.2	6.1	5.8	0.0	0.0	0.0	0.0	0.0	0.0	48.11
4568-9U081 Geochemistry	11.7	11.5	11.2	11.4	8.3	729.0	0.0	0.0	0.0	0.0	0.0	0.0	783.20
<b>819Y01</b> USGS Technical Advisory Capability	111.4	102.2	62.8	76.6	76.6	795.7	0.0	0.0	0.0	0.0	0.0	0.0	1,225.19



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4568-9U002 Br Chief, Asst Br Chief, Deputy TPO, Tea	38.5	63.0	53.9	68.1	91.7	91.2	0.0	0.0	0.0	0.0	0.0	0.0	406.33
819Y11 USGS Branch Management	38.5	63.0	53.9	68.1	91.7	91.2	0.0	0.0	0.0	0.0	0.0	0.0	406.33
4568-9U011 Reports Specialists	18.0	18.5	18.5	20.1	17.4	17.3	0.0	0.0	0.0	0.0	0.0	0.0	109.65
4568-9U012 Data Management	49.3	30.9	31.3	35.4	33.8	33.7	0.0	0.0	0.0	0.0	0.0	0.0	214.40
4568-9U013 Records Support	22.2	2.8	4.5	5.7	21.5	-9.1	0.0	0.0	0.0	0.0	0.0	0.0	47.47
4568-9U014 QAS Support	7.0	6.4	7.3	12.5	29.6	-21.7	0.0	0.0	0.0	0.0	0.0	0.0	41.22
819Y12 USGS Data, Records & Reports	96.5	58.6	61.6	73.6	102.3	20.1	0.0	0.0	0.0	0.0	0.0	0.0	412.75
4568-9U021 Administrative Support & Personnel Servi	33.2	34.8	34.1	67.5	26.0	75.8	0.0	0.0	0.0	0.0	0.0	0.0	271.43
4568-9U022 Facilities Management	0.0	0.0	0.2	10.8	43.0	55.2	0.0	0.0	0.0	0.0	0.0	0.0	109.28
819Y13 USGS Administration & Facilities	33.2	34.8	34.3	78.3	69.0	131.0	0.0	0.0	0.0	0.0	0.0	0.0	380.72
4568-9U023 Training	15.8	17.2	25.4	18.5	6.9	13.7	0.0	0.0	0.0	0.0	0.0	0.0	97.32
819Y14 USGS Training	15.8	17.2	25.4	18.5	6.9	13.7	0.0	0.0	0.0	0.0	0.0	0.0	97.32
4568-9U024 Computer/Network Support	26.4	25.5	23.6	27.2	24.8	19.3	0.0	0.0	0.0	0.0	0.0	0.0	146.79
819Y15 USGS Computer/Network Support	26.4	25.5	23.6	27.2	24.8	19.3	0.0	0.0	0.0	0.0	0.0	0.0	146.79
4568-9U025 Property Management	24.1	20.5	27.0	23.4	20.2	32.5	0.0	0.0	0.0	0.0	0.0	0.0	147.71
819Y16 USGS Property Management	24.1	20.5	27.0	23.4	20.2	32.5	0.0	0.0	0.0	0.0	0.0	0.0	147.71
4568-9U003 Planning & Project Control	27.4	23.4	32.8	33.1	24.0	31.1	0.0	0.0	0.0	0.0	0.0	0.0	171.82
819Y21 USGS Planning & Project Control	27.4	23.4	32.8	33.1	24.0	31.1	0.0	0.0	0.0	0.0	0.0	0.0	171.82
4568-9U030 Regulatory Compliance Support	40.8	40.4	30.3	44.8	35.8	47.1	0.0	0.0	0.0	0.0	0.0	0.0	239.15
819Y31 USGS Regulatory Compliance Support	40.8	40.4	30.3	44.8	35.8	47.1	0.0	0.0	0.0	0.0	0.0	0.0	239.15
4568-9U061 Water Resources Monitoring	16.8	32.5	26.7	22.2	31.1	3.6	0.0	0.0	0.0	0.0	0.0	0.0	132.94
819Y41 USGS Water Resources Monitoring	16.8	32.5	26.7	22.2	31.1	3.6	0.0	0.0	0.0	0.0	0.0	0.0	132.94
4568-9U062 Safety	9.1	9.4	9.3	9.3	9.8	8.9	0.0	0.0	0.0	0.0	0.0	0.0	55.67
819Y51 USGS Safety	9.1	9.4	9.3	9.3	9.8	8.9	0.0	0.0	0.0	0.0	0.0	0.0	55.67
4568-9U043 Hydrogeologic Data Integration	13.4	12.2	-2.6	4.0	3.5	114.0	0.0	0.0	0.0	0.0	0.0	0.0	144.49
4568-9U044 3D Hydrogeologic Model Development	1.2	0.5	0.5	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.58
4568-9U045 Flow Model Calibration and Evaluation	3.9	8.1	6.6	5.7	8.8	47.8	0.0	0.0	0.0	0.0	0.0	0.0	80.85

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4568-9U046 DVRFS Knowledge Exchange Protocol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
4568-9U047 DVRFS Predictive Capability	0.0	0.0	0.0	0.0	0.0	69.6	0.0	0.0	0.0	0.0	0.0	0.0	69.62
819Y61 USGS Death Valley Regional Flow Mod	18.5	20.7	4.5	15.0	12.3	231.5	0.0	0.0	0.0	0.0	0.0	0.0	302.54
1.5.04.6.3.0 DOE Technical Support Services	458.5	448.3	392.1	490.1	504.3	1,425.6	0.0	0.0	0.0	0.0	0.0	0.0	3,718.91
1.5.04.6	458.5	448.3	392.1	490.1	504.3	1,425.6	0.0	0.0	0.0	0.0	0.0	0.0	3,718.91
1.5.04	458.5	448.3	392.1	490.1	504.3	1,425.6	0.0	0.0	0.0	0.0	0.0	0.0	3,718.91
1.5	830.3	788.5	754.5	899.1	843.8	1,779.4	0.0	0.0	0.0	0.0	0.0	0.0	5,895.48
1.5 OPERATING	830.3	788.5	754.5	899.1	843.8	1,779.4	0.0	0.0	0.0	0.0	0.0	0.0	5,895.48
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	830.3	788.5	754.5	899.1	843.8	1,779.4	0.0	0.0	0.0	0.0	0.0	0.0	5,895.48
FTEs													
FEDERAL	62.3	75.5	50.2	52.7	54.6	52.2	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT	34.7	26.8	27.1	29.2	26.6	29.2	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL	97.0	102.4	77.3	81.9	81.2	81.5	0.0	0.0	0.0	0.0	0.0	0.0	