United States Department of the Interior

U. S. GEOLOGICAL SURVEY
Box 25046 M.S. 421
Denver Federal Center
Denver, Colorado 80225

IN REPLY REFER TO:

QA: N/A

March 11, 2004

WM-11

Victor W. Trebules
Director, Office of Project Control
U.S. Department of Energy
Office of Repository Development
1551 Hillshire Drive
Las Vegas, NV 89134-6321

SUBJECT: Yucca Mountain Project Branch – U.S. Geological Survey (YMPB-USGS) Progress Report, February, 2004

Attached is the USGS progress report in the required format for the month of February, 2004.

If you have any questions or need further information, please call Raye Ritchey Arnold at (702)236-5050, ext. 296.

Sincerely,

Raye Ritchey Arnold
for Robert W. Craig
Technical Project Officer for the
Yucca Mountain Project
U.S. Geological Survey

Enclosure:
cc: J. Bresee, DOE/OCRWM-HQ/Forrestal
S. Hanauer, DOE/Las Vegas
W. J. Arthur III, DOE, Las Vegas
R. Dyer, DOE, Las Vegas
D. Barr, DOE, Las Vegas
W. Boyle, DOE, Las Vegas
D. Coleman, DOE, Las Vegas
A. Gil, DOE, Las Vegas

NMSS07

T. Gunter, DOE, Las Vegas
W. Kozai, DOE, Las Vegas
S. Mellington, DOE, Las Vegas
S. Petersen, DOE, Las Vegas
E. Smistad, DOE, Las Vegas
B. Terrell, DOE, Las Vegas
M. Tynan, DOE, Las Vegas
R. Latta, NRC, Las Vegas (2 copies)
R. Andrews, M&O/BSC, Las Vegas
G. Bodvarsson, M&O/LBNL, Las Vegas
P. Dixon, M&O/LANL, Las Vegas
A. Eddebbarh, M&O/LANL, Las Vegas
E. Hardin, M&O/BSC, Las Vegas
R. Henning, M&O/BSC, Las Vegas
J. Houseworth, M&O/LBNL, Las Vegas
S. Kuzio, M&O/SNL, Albuquerque
S. Pedersen, M&O/BSC, Las Vegas
M. Peters, M&O/LANL, Las Vegas
J. Wang, M&O/LBNL, Berkeley
W. Alley, USGS, Reston
D. Duncan, USGS, Reston
R. W. Craig, USGS, Las Vegas
R. Arnold, USGS, Denver
M. Mustard, USGS, Denver
T. Chaney, USGS, Denver
M. Chornack, USGS, Denver
C. Hunter, USGS, Denver
Z. Peterman, USGS, Denver
W. Scott, USGS, Denver
J. Stuckless, USGS, Denver
D. Sinks, BSC, Denver

U.S. GEOLOGICAL SURVEY

YUCCA MOUNTAIN PROJECT BRANCH

Executive Summary

February 2004

GEOLOGICAL STUDIES

Lithologic description and lithostratigraphic analysis of samples and borehole geology of Nye County early-warning drilling-program (EWDP) Phase IV-b drill holes continued. Additional sample acquisition and subsequent analysis of samples were needed to clarify lithostratigraphic interpretations. Unexpectedly, twice as many geophysical logs were run in Phase IV-b holes than in other holes, requiring additional geophysical analyses and comparisons.

Although no new water samples were collected from Nye/Inyo County early-warning wells during the reporting period, interpretation of analytical results on previously collected water samples continued. Details about those samples, taken from Nye County wells during October and November of 2003, and subsequent analytical results have been added to the hydrochemical/isotopic data base. All available new hydrochemical data have been incorporated into an updated interpretation of flow paths and hydrochemical facies to be presented to the Nuclear Waste Technical Review Board in early March.

Several efforts were underway by the mapping team in determination of fracture and lithophysal characteristics of the repository host horizon (RHH). Collection of lithophysal data is on track to meet planned completion dates. Analysis of fracture data, however, is delayed due to concentration of effort on the revised Drift Degradation AMR. Fracture data (specifically, stochastic and statistical analysis of fracture data) will be attached to the ICN of the AMR. Technical review of borehole video analysis is on-going, and reviews and checks are nearing completion.

SATURATED-ZONE STUDIES

Several major efforts continued on elements of the Death Valley regional flow-system (DVRFS) modeling, including data integration, model development and calibration, and knowledge exchange. In hydrogeologic data integration throughout February, enhancement of accesses and linkages between data bases and software continued. Work continued with reVision, Inc., staff (contractors) to finalize the water-level flagging utility within the ARCMAP environment which will be incorporated into GEOPRO.

Changes mandated by review comments were completed to the pumpage and water-level data bases used to create flow-model input data sets. Changes to the water-level data base included reinsertion of about 10 wells in western Yucca Flat (which are open to the Eleana Formation). Also added were five new wells drilled by Nye County, four new wells drilled under the Environmental Restoration (ER) program in Yucca Flat and Pahute Mesa, and three new wells drilled by the NPS (National Park Service) in Sarcobatus Flat. Major changes to the pumpage data base included modifications to the weights associated with drawdown observations and inclusion of information from a new pumping well located on western Pahute Mesa. In addition, computer code used to develop target head observations and pumping stress rates were revised to incorporate modifications made to the layer discretization to allow modeling of a fluctuating water table. Pre- and post-processing codes which integrate the spatial data base with the DVRFS flow model were modified to provide capability to support the on-going model refinement and calibration process resulting from technical comments made by the review panel. Staff worked with Edward Banta (USGS) to incorporate changes necessary to support the double-precision mode of MODFLOW2000. Additional YMPB collaboration with R. Winston (USGS) worked to implement modifications to a USGS code package, named "Ground Water Chart," to attain new visualization capabilities within that product. Collaboration with reVision, Inc., developed a portable demonstration of GEOPRO, version 2.2.2, in which the DVRFS model database and the entire suite of Project software tools were re-deployed to support demonstration on a laptop computer. Another portable demonstration was developed to present the "Dynamic Report," which in the current prototype includes the first implementation and use of multi-media as a report component. The dynamic link from the electronic report to GEOPRO and to the ROCKPLOT 3-D visualizer also was implemented.

Efforts in development of the 3-D hydrogeologic model were limited during the month, but evaluation of conceptualizations of the hydrogeologic framework in support of calibration of the flow model continued. Representation of hydrogeologic units in each flow-model layer were calculated for use with the YMP site-scale saturated-zone flow model. Visualization tools were updated in efforts aimed generally at flow-model calibration and evaluation but with specific application to examination of model-run residuals. Pre-processing steps for determination of constant-head cells around model boundaries were updated, with staff attention also placed to improve consistency in application of the related code package. Model runs examining effects of estimating hydraulic properties in concert with storage values continued. Although the related run times are much slower, the transient data sets help provide more information to better define hydraulic properties. Temperature and discharge data from flowing springs were compiled and analyzed to determine and document appropriate classification in the DVRFS transient model. Reviewer comments were evaluated for possible requirement of additional model runs for comment resolution. A range of steps was taken toward calibrating the flow model. Model runs were conducted, incorporating changes and scenarios including

1. Model layers were adjusted to correspond better with the water table. A convertible upper layer was added. As recalibration with new layers progresses, that convertible layer will get periodic use.

2. General head boundaries/drains were moved to 10 m below the lowest point on the top of the land surface in each area (as derived from the framework model).
3. Depth decay of hydraulic conductivity was added for all units.
4. New observation data for heads were incorporated.
5. Constant head nodes were updated using only large flux values based on water-budget estimates.
6. The updated layers allow better geometric definition in some of the alluvial and volcanic units. The hydraulic parameters for those units are being estimated accordingly.

Work under the knowledge-exchange protocol continued. Responses to comments on Chapter A (Introduction) of the Death Valley transient-flow modeling report included additional explanatory text and illustrations showing land use and various boundaries in the DVRFS region. Chapter C (Conceptual Hydrology) was updated on the basis of reviewers' comments, with numerous revisions also made to illustrations. Comment response in those areas is nearly complete. Response to Chapter E (Hydrogeologic Framework Model [HFM]) comments continued. Staff discussed additional model runs which might be needed to address viewer comments on Chapter F (Transient Flow Model).

A knowledge-exchange meeting was held in Las Vegas on February 10. Topics included authors' progress on comment response to their particular chapters, consolidation of whole-report reviews into a common document, scheduling of the next few months of meetings, and a demonstration of GEOPRO (including the "Dynamic Report" concept). Staff presented a status report and demonstration of GEOPRO, the Dynamic Report, the Model Analysis Tool (MAT), the Stella Dynamic System Model (DSM), and the prototype of the dynamic link from the electronic report to GEOPRO and to the ROCKPLOT 3-D visualizer. (That presentation was repeated for Denver-based participants on February 12.) Staff from the DVRFS modeling project met with other workers to discuss use of the Death Valley model in other work at the Nevada Test Site. On February 17, a report on the status of the DVRFS transient model was presented to the Hydrologic Resources Management Program (HRMP) team at the request of Bruce Hurley, DOE HRMP manager.

UNSATURATED-ZONE STUDIES

Collection of data in the large-plot infiltration experiment in Alcove #8 and Niche #3 continued, as continuous water application to the large plot also was on-going. Weight data from 12 permeameters in Alcove #8 (for determination of volume of water applied to the large plot), "climate" (temperature, relative humidity, and pressure) data from behind the bulkhead, evaporation information, and heat-dissipation probe data are captured. Twelve pressure transducers collected data to provide measure of the height of ponded water within the plot. Scales beneath permeameters were removed for calibration (February 9 to 11) with reinstallation after the calibration. The new float system used at the plot (installed on January 26) worked well. All of the plots have drained the

[unplanned excess] water from the December flood, although application rates for a few plots remain slightly unstable. In general, however, application rates have settled into relatively stable modes. Preparations were underway for initiation of tracer application (expected about March 1). A data package entitled "Evaporation test in Alcove 8 using a permeameter from September 18, 2002 to January 8, 2004" was sent to review on February 20.

Bulkhead moisture-monitoring efforts were focused on compilation of data packages, including thermocouple data from behind the bulkhead, to be followed by assembly of RTD/HDP (resistance temperature device and heat-dissipation probe) data also gathered behind the bulkhead. That package will be assembled with expectation of adding calibration data at a later time. Bulkhead moisture-monitoring equipment received maintenance work.

Analysis of chemical and isotopic composition of pore water supported the Project in several areas. Development of existing data on the chemical and isotopic composition of pore water continued during the reporting period. An abstract describing strontium-isotope variations in pore water from the proposed repository horizon and from construction-water boreholes was written and submitted for the 2004 Joint Assembly of the American Geophysical Union, which will take place in May. The abstract title is "Strontium isotopes in pore water as an indicator of water flow at the proposed high-level radioactive waste repository, Yucca Mountain, Nevada," and the abstract was authored by B.D. Marshall and K. Futa of the USGS. Isotope support to the thermal testing program also continued. Staff performed delicate dilutions of exceedingly small water samples recovered from CHEMSAMP3 core taken from an approximate depth of 114 feet. The chemical analyses are not yet complete, but preliminary results appear promising. If the technique does work, it will allow determination of chemical composition of pore water from samples with very low moisture content. In other isotopic test-support work, a data package documenting moisture-content measurements on CHEMSAMP core was prepared, and the transcription check and other preparations for review of the package were completed.

Uranium-series (U-series) delineation of UZ flow zones continued, with efforts in several areas. Rock samples collected across the Solitario Canyon fault (exposed in the ECRB Cross Drift) were processed for U-Th separation and purification using standard acid-digestion methods. Analysis of samples for U-series isotopes is expected to occur during March. Experiments with lithium metaborate rock fusions continued. Initial results from a rock standard and from a welded tuff sample appear in good agreement with results obtained by standard acid digestion in high-pressure vessels. Although complete digestion routinely is achieved, the metaborate method does not solve all problems with sample processing and chemical analysis. Evaluation and decision on the usefulness of the lithium metaborate method will be made after several more attempts.

A Thermo Electron staff engineer arrived on February 17 to initiate installation of the Triton mass spectrometer. The instrument now has been uncrated, assembled, connected to line power, and turned on. Testing and adjustment are in progress. The instrument

was shipped from Germany without ion-counting capabilities, but those are expected to be installed on-site (at the Denver Federal Center) in early March. Final testing and training is anticipated between the end of March and the middle of April.

Work to develop microclimate records from data gathered from analysis of fracture minerals continued. Oxygen-isotope data collected last fall were evaluated with respect to possible climate-controlled changes in meteoric water input. Resulting profiles show a range in $\delta^{18}O$ values from about 14 to 18‰ (note: per mill) and possible systematic fluctuations with microstratigraphic position in the calcite blade. No age information, however, currently is available for the $\delta^{18}O$ profiles. The mounts (from which those $\delta^{18}O$ profiles were derived) will be taken to Palo Alto, CA, next month for U-series dating by ion microprobe. In other on-going work, development of the technical procedure for micro-scale X-ray fluorescence continued and is expected to be finalized in March.

In unscheduled work in support of development of microclimate records from fracture minerals, staff completed a review draft of a response to the "Comment" submitted to the technical journal *Applied Geochemistry* by Yuri Dublyansky and others, who continue to maintain that repeated incursions of hydrothermal waters have saturated the Yucca Mountain repository horizon in the past and will do so in the future. That comment attacks numerous aspects of a paper previously published by J. Whelan, J. Paces, and Z. Peterman (see "Physical and stable isotope evidence for formation of secondary calcite and silica in the unsaturated zone, Yucca Mountain, Nevada," *Applied Geochemistry*, 2002, vol. 17, p. 735-750) that describes USGS data and interpretations of UZ secondary calcite and opal deposits. The USGS-YMPB "comment-response" draft went to technical review. Staff also completed preparation of a technical presentation on "Climate Change and Yucca Mountain Unsaturated-Zone Hydrology" to be given at the NWTRB meeting in Las Vegas on March 9, 2004. That presentation summarizes geochronological and isotopic data from subsurface secondary minerals and describes how those data can be used to evaluate the impact of climatic variation on amount and composition of water percolating through fractures.

Petrographic examination and analysis of breccia cementation continued, in on-going work to determine the thermal history of Yucca Mountain. Approximately 20 polished thick sections were received and scanned for photodocumentation. Petrographic study to identify and interpret sample parageneses, mineralogy, and distribution of two-phase fluid inclusions, if present, was started. Mapping of sample surfaces to guide sampling for fluid-inclusion isotopic and geochronological studies began. Preliminary thermal-history simulations have been performed, with such simulations ultimately feeding to modeling of volcanic thermal history in the Yucca Mountain region (with K. Wohletz, LANL).

WATER-RESOURCES MONITORING

On-going routine monitoring of water resources continued during the reporting period. Ground-water levels were measured at 34 sites, and ground-water discharge was

measured at one flowing well. Ground-water and spring-discharge data collected during January were checked and filed.

Compilation by **W. Clay Hunter, U.S. Geological Survey,** Yucca Mountain Project Branch.

USGS Milestone Report

October 1, 2003 February 29, 2004

Sorted by Milestone Level and Baseline Date

Level: 3

Deliverable		Due Date	Expected Date	Completed Date
FY2004				
PAGSC2070D	Training Cost Information Annual Update	12/19/2003	12/19/2003	12/19/2003

USGS Milestone Report

October 1, 2003 February 29, 2004

Sorted by Milestone Level and Baseline Date

Level: 4

Deliverable		Due Date	Expected Date	Completed Date
FY2004				
PAGSW266M4	Letter Report: 4th Qtr FY03	10/31/2003	10/31/2003	10/31/2003
PAGSW268M4	Letter Report: 1st Qtr FY04	1/30/2004	1/30/2004	1/30/2004
PAGSW610M4	Rev 00A of Report	1/30/2004	4/30/2004	

USGS Milestone Report

October 1, 2003 February 29, 2004

Sorted by Milestone Level and Baseline Date

Level: 5

Deliverable		Due Date	Expected Date	Completed Date
FY2004				
PAGSM38EM5	Mtg Summary to TPO: Oct03	10/31/2003	10/31/2003	10/31/2003
PAGSM38FM5	Mtg Summary to TPO: Nov03	11/28/2003	11/30/2003	11/30/2003
PAGSM31AM5	Memo to TPO: Data Mgmt Progress Report	12/31/2003	12/23/2003	12/23/2003
PAGSM33AM5	Memo to TPO: Progress Report HFM Updates	12/31/2003	12/31/2003	12/31/2003
PAGSM35AM5	Memo to TPO: Prg Rpt Transient Model Calibration	12/31/2003	12/31/2003	12/31/2003
PAGSM38GM5	Mtg Summary to TPO: Dec03	12/31/2003	12/31/2003	12/31/2003
PAGSM38HM5	Mtg Summary to TPO: Jan04	1/30/2004	1/31/2004	1/31/2004
PAGSM36CM5	Update on Predictive Capability Progress	2/27/2004	2/27/2004	2/27/2004
PAGSM38IM5	Mtg Summary to TPO: Feb04	2/27/2004	2/27/2004	2/27/2004

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey
Date Prepared 3/8/2004 11:17 AM

Fiscal Month/Year February 29, 2004

	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
1.5.01.01	164	2063	589	0	267	0	2813	0	855
1.5.01.05	43	417	362	0	115	0	444	0	185
1.5.01.06	31	312	314	0	99	0	291	0	143
1.5.01.07	97	364	0	0	0	0	579	0	215
1.5.01.09	157	989	1493	0	503	0	2499	0	849
1.5.03.01	0	0	0	0	0	0	575	0	23
1.5.03.03	85	669	958	0	338	0	1321	0	501
1.5.03.04	75	717	174	0	48	0	1230	0	303
1.5.03.07	-13	680	0	0	0	0	400	0	220
1.5.03.12	6	81	0	0	0	0	250	0	36
1.5.03.13	47	213	853	0	345	0	675	0	228
1.5.03.14	3	30	0	0	11	0	146	0	44
	695	6535	4743	0	1726	0	11223	0	3602

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR October 1, 2003 - February 29, 2004
3/8/2004 11:17:46 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
4568-9U001	Science Advisors	22.1	13.1	19.9	13.0	21.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.99
4568-9U010	Publications	13.1	0.2	4.8	3.2	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.28
4568-9U035	Chemical Thermodynamic Data Review o	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
4568-9U040	Tectonics	8.1	7.3	7.0	11.8	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.10
4568-9U041	Water Levels	5.0	5.4	2.2	2.6	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.66
4568-9U042	Geophysics	0.0	1.5	6.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.36
4568-9U060	Mapping Expertise (USBR)	4.5	5.5	7.4	22.7	-3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.19
4568-9U081	Geochemistry	67.7	47.2	40.2	98.9	70.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	324.92
819Y01	**USGS Technical Advisory Capability**	120.5	80.1	88.1	153.6	106.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	548.50
4568-9U002	Br Chief, Asst Br Chief, Deputy TPO, Tea	32.0	15.8	43.7	43.7	21.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	156.97
819Y11	**USGS Branch Management**	32.0	15.8	43.7	43.7	21.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	156.97
4568-9U003	Planning & Project Control	29.7	24.7	21.4	37.1	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	149.41
819Y21	**USGS Planning & Project Control**	29.7	24.7	21.4	37.1	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	149.41
1.5.01.01	**Project Support - Project Manageme**	182.3	120.5	153.3	234.4	164.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	854.88
4568-9U030	Regulatory Compliance Support	41.0	27.3	33.0	40.5	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	185.13
819Y31	**USGS Regulatory Compliance Support**	41.0	27.3	33.0	40.5	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	185.13
1.5.01.05	**Project Support - Compliance Manag**	41.0	27.3	33.0	40.5	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	185.13
4568-9U024	Computer/Network Support	30.0	21.4	30.0	30.8	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.76
819Y15	**USGS Commputer/Network Support**	30.0	21.4	30.0	30.8	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.76
1.5.01.06	**Project Support - Information Manag**	30.0	21.4	30.0	30.8	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.76
4568-9U061	Water Resources Monitoring	20.3	17.0	33.7	18.8	91.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	181.05
819Y41	**USGS Water Resources Monitoring**	20.3	17.0	33.7	18.8	91.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	181.05
4568-9U062	Safety	9.1	3.7	7.0	7.8	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.47
819Y51	**USGS Safety**	9.1	3.7	7.0	7.8	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.47
1.5.01.07	**Project Support - Environmental, Saf**	29.4	20.6	40.7	26.6	97.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	214.52
4568-9U011	Reports Specialists	13.3	7.2	8.9	9.6	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.52
4568-9U012	Data Management	36.0	16.5	30.1	30.6	28.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.08

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3/8/2004 11:17:46 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
4568-9U013	Records Support	7.6	5.1	7.3	6.2	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.68
4568-9U014	QAS Support	22.5	18.0	23.0	20.8	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	105.77
819Y12	**USGS Data, Records & Reports**	79.4	46.8	69.3	67.2	63.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	326.05
4568-9U021	Administrative Support & Personnel Servi	29.7	8.9	19.0	17.4	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.28
4568-9U022	Facilities Management	0.0	114.4	52.2	98.6	53.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	318.26
4568-9U026	Facilities Other	1.6	0.1	0.0	-0.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.62
819Y13	**USGS Administration & Facilities**	31.3	123.3	71.2	115.2	68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	409.16
4568-9U023	Training	19.9	10.8	14.4	12.9	17.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.35
819Y14	**USGS Training**	19.9	10.8	14.4	12.9	17.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.35
4568-9U025	Property Management	7.9	7.1	7.1	7.7	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.38
819Y16	**USGS Property Management**	7.9	7.1	7.1	7.7	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.38
1.5.01.09	**Project Support - General Project Ser**	138.6	188.0	162.0	203.0	157.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	848.94
1.5.01		**421.2**	**377.9**	**419.0**	**535.2**	**492.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2,246.24**
4568-9U017	Legacy Software Support	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
APAG01	**USGS Legacy Software Support**	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
4568-9U008	LA Chapter Preparation	10.3	5.3	5.9	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.84
APAG03	**USGS LA Chapter Preparation Support**	10.3	5.3	5.9	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.84
4568-9U007	KTI Support	0.0	2.9	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.47
APAG04	**USGS KTI Support**	0.0	2.9	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.47
1.5.03.01	**Integration**	10.3	8.1	5.5	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.31
4568-9U063	Alcove 8/Niche 3 Infiltration	16.6	15.3	21.7	44.9	26.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	124.75
4568-9U064	Moisture Monitoring ESF/X-Drift Closeout	8.2	5.7	7.4	11.7	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.20
4568-9U065	Bulkhead Moisture Monitoring	34.5	14.4	18.0	9.8	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.88
4568-9U073	Alcove 7 Moisture Monitoring	3.2	1.7	0.6	2.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.39
AUZG01	**USGS UZ Moisture Studies**	62.4	37.0	47.8	68.9	56.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	272.23
4568-9U085	Geochemical Testing of UZ Flow	15.8	8.8	3.6	18.8	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.73
4568-9U086	Complete Chlorine 36 Validation	0.0	4.2	0.3	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.24

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4568-9U087	Chemical & Isotopic Composition of Pore	9.7	6.9	15.6	9.2	9.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.72
4568-9U089	Mineral Records of UZ Flow	8.8	18.4	-17.8	30.2	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.74
4568-9U094	Thermal History of Yucca Mountain	2.3	5.3	5.9	7.8	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.74
AUZG02	USGS UZ Isotope Hydrology	36.6	43.7	7.7	68.7	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	179.16
4568-9U090	Isotope Support for Thermal Testing	4.0	11.4	15.2	13.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.77
AUZG03	USGS Drift-Scale Test ESF	4.0	11.4	15.2	13.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.77
1.5.03.03	Safety Analyses - Unsaturated Zone	103.1	92.1	70.7	150.6	84.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	501.16
4568-9U043	Hydrogeologic Data Integration	0.0	1.7	-0.2	11.7	-3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.64
4568-9U044	3D Hydrogeologic Model Development	0.0	0.0	0.6	18.9	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.58
4568-9U045	Flow Model Calibration and Evaluation	5.2	5.1	9.0	6.7	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.84
4568-9U046	DVRFS Knowledge Exchange Protocol	0.0	0.0	0.0	0.0	16.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.12
4568-9U047	DVRFS Predictive Capability	0.0	3.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.09
819Y61	USGS Death Valley Regional Flow Mod	5.2	10.3	8.8	37.2	31.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.28
4568-9U049	Nye County EWDP Borehole Lithostratigr	8.0	9.0	24.3	10.3	11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.41
ASZG01	USGS SZ Investigations	8.0	9.0	24.3	10.3	11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.41
4568-9U055	Site HFM - AMR	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
4568-9U092	Hydrochemistry/Support to Nye Co. EWD	33.4	15.0	28.6	37.8	31.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	146.04
4568-9U093	Geochemistry of Nye Co. Borehole Sampl	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
ASZG02	USGS SZ Isotope Hydrology	33.4	15.0	28.6	37.8	31.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	146.04
1.5.03.04	Safety Analyses - Saturated Zone Flo	46.6	34.3	61.7	85.3	74.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	302.72
4568-9U069	Fracture & Lithophysal Characteristics of	77.0	38.1	57.1	60.9	-12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220.11
AEBG03	USBR Testing Activities in Support of D	77.0	38.1	57.1	60.9	-12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220.11
1.5.03.07	Safety Analyses - EBS Performance	77.0	38.1	57.1	60.9	-12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	220.11
4568-9U005	YMP Performance Confirmation	13.0	8.5	5.0	3.5	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.71
APAG02	USGS Performance Confirmation Supp	13.0	8.5	5.0	3.5	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.71
1.5.03.12	Performance Confirmation Support	13.0	8.5	5.0	3.5	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.71
4568-9U016	USGS Data Verification	49.7	29.8	53.5	47.8	47.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.04

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APAGD5	USGS Data Verification	49.7	29.8	53.5	47.8	47.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.04
1.5.03.13	Safety Analyses - Technical Data Ma	49.7	29.8	53.5	47.8	47.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.04
4568-9U004	USGS Support to Site Description	6.2	7.7	23.4	2.9	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.54
ANSG01	USGS Support to Site Description	6.2	7.7	23.4	2.9	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.54
1.5.03.14	Safety Analyses - Yucca Mountain Si	6.2	7.7	23.4	2.9	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.54
1.5.03		305.9	218.6	276.9	350.3	202.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,354.59
1.5		727.2	596.5	695.9	885.5	695.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,600.82
1.5 OPERATING		727.2	596.5	695.9	885.5	695.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,600.82
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		727.2	596.5	695.9	885.5	695.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,600.82
FTEs														
	FEDERAL	48.6	43.3	49.0	44.4	43.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	CONTRACT	31.9	25.1	29.3	29.4	30.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	TOTAL	80.6	68.5	78.3	73.8	74.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	