



# United States Department of the Interior

U. S. GEOLOGICAL SURVEY

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Denver Federal Center  
Denver, Colorado 80225

IN REPLY REFER TO:

QA: N/A

June 11, 2004

Wayne Kozai  
Acting Director, Business and Finances Services Division  
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, May, 2004

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

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

Sincerely,

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

Enclosure:

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

May 2004

**GEOLOGICAL STUDIES**

The USGS geological team completed graphical representation of subsurface stratigraphy, lithology, alteration, and borehole geophysics for Nye County early-warning drilling program (EWDP) borehole NC-EWDP-24P. Because borehole geophysical measurements were made by two separate geophysical companies, information had to be displayed on two separate sheets. Those sheets not only become part of the data package as hole-summary information, but they are essential for detection of correlations between the subsurface geology and subsurface geophysical measurements.

Isotopic and hydrochemical support to the Nye County EWDP work also continued. New samples were collected from Nye County boreholes NC-EWDP-19PB, NC-EWDP-3s, and from the Washburn borehole in early May. The new samples have been analyzed for cations and anions, as well as for minor constituents. An annotated outline for a report on Site-scale hydrochemistry has been completed and currently is being expanded into the draft report. In related work that originally was unscheduled, procedures for obtaining water samples from the NC-EWDP-19PB sonic core were developed. Full-scale sample extraction and analysis began in late May and will continue for several weeks.

Other geological studies involved video-based borehole analysis. Overlay graphs (grids) of down-hole bore dimensions, which were initially developed for analog video recordings displayed on a VCR monitor, were updated for digital borehole-image recordings to be displayed on a computer monitor. The grids (one is a down-hole perspective, and the other is for radial positions around the borehole) are used to locate the position of specific features on the borehole wall. Those position values are entered into Excel workbooks along with other recorded information such as type, shape, and area of each feature.

## SATURATED-ZONE STUDIES

Work again continued in many subject areas in support of modeling of the Death Valley regional flow system (DVRFS). Efforts in hydrogeologic data integration continued during May. Staff participated in conference discussions directing further development of the Model Analyses Tool (MAT) of the GeoPro software application. Other work went to compilation of the periodic DVRFS modeling data-management progress report to the TPO. (Completion date for that effort occurred after the submittal date for the present monthly narrative. More details should appear next month.) Development of the 3-D hydrogeologic model also continued, with several major efforts underway. Conceptual hydrogeologic evaluations were conducted in support of model calibration, and work continued on update of the hydrogeologic framework model with new data for the transient model. (Both of those efforts are several months from the respective planned completion dates.) In further memoranda to the TPO, compilation of the periodic reporting of HFM updates continued. Flow-model calibration and evaluation continued, with iterative sequences of model runs in support of sensitivity analysis and model evaluation. Similar developmental efforts were made in modification of model input arrays and temporary target heads and in calibration of the regional transient flow model. As noted in regard to other efforts, compilation of episodic reports to the TPO continued during the period.

Activity also continued in the DVRFS knowledge-exchange arena. Senior chapter authors presented their efforts toward finalization of the DVRFS modeling report for editing (with editorial review to be conducted by the Colorado District), formatting, and publishing. Preparation of responses to technical editorial comments began, even as internal editing by DVRFS modeling staff continued. Tables were finalized for consistency between report chapters, with particular effort toward summarizing pumping wells and head-observation wells by hydrographic area and model sub-regions. Several other perspectives of consistency between chapters continued as well. Several DVRFS report chapters (text and figures for chapters A, B, C, D, and E, plus appendices 1 and 2) were submitted to the YMPB Publications Specialist for technical edit. DVRFS project personnel and interested parties participated in the Knowledge Exchange meeting on May 11, 2004. The following personnel were in attendance for this meeting via phone conference: Kelly Ashton-Reis (FedSource, Tucson, AZ), Wayne Belcher (USGS-WRD-NV, Las Vegas, NV), Joan Blainey (USGS-WRD, Tucson, AZ), Michael Chornack (USGS-WRD-YMPB, Denver, CO), Robert Craig (USGS-WRD-YMPB, Las Vegas, NV), Claudia Faunt (USGS-WRD-CA, San Diego, CA), Jim Harrill (NPS Consultant, Carson City, NV), Mary Hill (USGS-WRD-NRP, Boulder, CO), Leigh Justet (Anteon Corporation, Las Vegas, NV), Randy Lacznia (USGS-WRD-NV, Las Vegas, NV), Carma San Juan (USGS-WRD-YMPB, Denver, CO), Don Sweetkind (USGS-GD, Denver, CO), and Bonnie Thompson (USGS-WRD-NV, Las Vegas, NV). The participation of project personnel at the Devils Hole workshop, status of the report, status of GeoPro, new team members, and future meetings were discussed. The May 2004 Knowledge Exchange summary was prepared and submitted to the USGS/DOE Program Manager (Bonnie Thompson) and to the YMPB Technical Program Officer (Robert Craig). The summary was also posted to the DVRFS internal website. Knowledge

Exchange meeting web pages on the DVRFS web site (<http://www.regmod.wr.usgs.gov>) were examined to assess need for updated material and changes needed to better support the Knowledge Exchange meetings.

Work continued on development of DVRFS predictive capability. W. Belcher and Newfields (the current USGS Decision Analysis contractor) selected a decision problem for use in testing the improved Decision Support Tool. The decision problem involves the pumping of a well for water supply and examining the effects on spring flow, using the latest pumpage data set, GIS coverages, and documentation of the DVRFS flow model boundary conditions (which consisted of the text and figures from the draft DVRFS model report). Work also continued on development of prediction-evaluation techniques, including workflow and testing.

In unscheduled work, Wayne Belcher prepared a presentation for the Devils Hole workshop, to be held on June 2-4, 2004 in Pahrump, NV, on the future of the DVRFS flow model effort. Updates were presented on DVRFS modeling activities. Similar presentations were prepared for the Desert Managers Group, meeting at the same time. In other unscheduled work, staff demonstrated the capabilities of GeoPro to Kathy Carlson, NNSA/NSO Manager, and similar demonstrations were given to NAME (Stoller-Navarro) for potential for use with the UGTA (the NTS Underground Testing Area) data and reports. It was proposed that a work scope be submitted to examine the utility of using GeoPro with a subset of UGTA data.

## UNSATURATED-ZONE STUDIES

The UZ infiltration/tracer experiment in Alcove #8/Niche #3 continued. Water has been applied continuously to the large plot through the month of May. The experiment has been running smoothly since the removal of the tracer with the exception of occasional hang-up of a few of the plot floats. A cleaning schedule was instituted for the plot floats to minimize the likelihood that they will get stuck and therefore disrupt water application to the plot at a steady rate. The plot float system has been otherwise working very well, with most variability in the application rates for the individual plots a result of small malfunctions with the plot floats or of disruptive work in the alcove. There have been no floods in the alcove. The ruler system installed in March continued to be used for measuring the change in the height of the ponded water in each plot. The measurements collected from the ruler system are being used simply as a tool to make sure that the plot floats are maintaining a nearly constant volume of water on each plot. Monitoring of the collection system in Niche 3 continued. Once a month, the valves of the water collection system are closed in Niche 3. Water is then allowed to collect in the trays over a weekend (4 days). The water is then collected, measured and recorded by location. The array of data collection continued, utilizing the well-practiced retrieval from the TCO.

Three data packages will be assembled for the large-plot experiment. "Surface Infiltration in a Large Plot in Alcove 8 using Permeameters from 8/28/03 to 3/17/04" will address large-plot infiltration prior to the tracer application. The second data package

will cover the tracer application from 3/1/04 to 4/13/04, and the third will cover large plot infiltration after the tracer application, from 3/17/04 to a currently uncertain closing date.

Bulkhead moisture monitoring continued, with an emphasis on data-package matters. A thermocouple-data package remained in preparation. New calibration curves for heat-dissipation probes (HDPs) have been determined, and the total sum of errors has been improved by approximately 47% for the 631 HDPs. The new HDP parameters are being put into the data spreadsheets for stations actively collecting HDP data. No decision has been made regarding data previously submitted using the "old" calibration parameters. The data with the new parameters will be compiled, and the results will be compared to submitted results to determine the impact of the new parameters. After the calibration equations are finalized and results analyzed, work will begin on assembly of the RTD/HDP (resistance-temperature device and heat-dissipation probe) data. Routine moisture monitoring continued.

In on-going work related to moisture monitoring in the ESF and in the Cross Drift of the ECRB, work continued on processing of data and of spreadsheet files. Preliminary plans for re-entry to retrieve pads for water analysis from the Alcove #7 moisture-monitoring plot were developed. Instrumentation was changed out at one of the temperature/relative humidity stations (that is, at TRH09). Processing of data continued.

Work in characterization of the isotopic and chemical compositions of pore water was largely unscheduled. Z. Peterman and B. Marshall participated in meetings to help Project personnel with presentations on geochemistry for the May meeting of the NWTRB. Z. Peterman participated in the NWTRB meeting on May 18 and 19 in Washington. Marshall presented a poster "Strontium Isotopes in Pore Water as an Indicator of Water Flow at the Proposed High-Level Radioactive Waste Repository, Yucca Mountain, Nevada" at the Joint Assembly of the American Geophysical Union and Canadian Geophysical Union in Montreal on May 18. Work in isotope support for thermal testing was similarly supportive in nature, as the isotopic team documented traceability of illustrations displaying Sr and U data from the Drift Scale Test. The illustrations are used in the Thermal Testing Analysis Report, which is in preparation for review. Additionally, the team prepared a data package containing Sr compositions of introduced materials in the ESF and Drift Scale Test in support of the Thermal Testing Analysis Report.

Uranium-series delineation of UZ flow zones continued. Additional U-series isotope ( $^{234}\text{U}/^{238}\text{U}$ ,  $^{230}\text{Th}/^{238}\text{U}$ , and  $^{232}\text{Th}/^{230}\text{Th}$ ) analyses of ECRB (Enhanced Characterization of the Repository Block) rock samples associated with the Solitario Canyon fault were made. In addition to that isotopic work, chemical analyses of water-soluble leachates from ECRB whole-rock samples were completed for the suite of Solitario Canyon fault rock samples by USGS Analytical Services. Data are being compiled along with early bulk-rock analyses.

Isotopic work also contributed to understanding microclimate records in secondary fracture minerals. Samples of secondary mineral coatings from the Yucca Mountain unsaturated zone were taken to the USGS-Stanford University ion microprobe at Stanford

(California) for U-series dating. Approximately 220 analyses were acquired over a 4-day period including approximately 30 analyses of a secular-equilibrium standard. Preliminary ages calculated from those data varied from about 30 ka to >1 Ma. Detailed cross sections were analyzed for a number of profiles across the outer parts of mineral coatings in order to provide a geochronological basis for calculating growth rates, an age framework in which associated stable (oxygen) isotope profiles can be evaluated, and the range of  $^{234}\text{U}/^{238}\text{U}$  initial ratios in different areas of the mountain that may be related to progressive isotopic evolution. The technical procedure for micro-XRF (X-ray fluorescence) analyses of secondary mineral coatings received final approval in the last week of May. Chemical mapping of secondary mineral coatings will be initiated in early June. These maps will allow calculation of mineral abundances and identification of compositional signatures that can be used to more accurately determine the presence and amounts of late-stage deposits formed in the last several million years. That material specifically is most pertinent to understanding the subsurface record of climate variation and the response of increased infiltration and deep percolation.

Geochemical and isotopic investigations continued on several fronts. Characterization of ESF dust continued, with six samples from the Cross Drift sized by mechanical sieving to +60, -60-200, 200-325, 325-500, and -500 mesh sizes. Splits of the sieved samples were prepared for chemical analyses and submitted to the [USGS] Crustal Imaging and Characterization Team in Geologic Discipline for major and trace element analyses, as well as for cation and anion analyses of water-soluble fractions. The chlorine-36 validation effort also continued, with finalization of the LANL contributions to the validation report. During a telecon on May 13, 2004 (including Robert Jones (BSC), Robert Roback (LANL), Catherine Madore (USGS) and Zell Peterman (USGS), it was agreed that the USGS would incorporate existing input from LANL into the revision of the chlorine-36 report. That revision will be reviewed by LANL under Activity PAGSZ307. No chemical analyses of Nye County drilling-program samples were conducted during May.

## WATER-RESOURCES MONITORING

In routine, on-going water-resources monitoring, ground-water levels were measured at 34 sites, and ground-water discharge was measured at five springs and at one flowing well. Ground-water and spring-discharge data collected during April were checked and filed.

**USGS Milestone Report**  
**October 1, 2003 May 31, 2004**  
Sorted by Milestone Level and Baseline Date

**Level: 3**

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



**USGS Milestone Report**  
**October 1, 2003 May 31, 2004**  
Sorted by Milestone Level and Baseline Date

**Level: 4**

<b>Deliverable</b>	<b>Due Date</b>	<b>Expected Date</b>	<b>Completed Date</b>
<b>FY2004</b>			
<b>PAGSW266M4</b> Letter Report: 4th Qtr FY03	10/31/2003	10/31/2003	10/31/2003
<b>PAGSW268M4</b> Letter Report: 1st Qtr FY04	1/30/2004	1/30/2004	1/30/2004
<b>PAGSW610M4</b> Rev 00A of Report	1/30/2004	7/30/2004	
<b>PAGSW605M4</b> Fract & Lithophysal Char Final Data to TDMS/RPC	3/8/2004	6/15/2004	
<b>PAGSZ705M4</b> Data to TDMS/RPC	3/12/2004	3/25/2004	3/25/2004
<b>PAGSW270M4</b> Letter Report: 2nd Qtr FY04	4/30/2004	4/28/2004	4/28/2004
<b>PAGSW612M4</b> SAR on Fracture & Lithophysal Characteristics	5/12/2004	9/29/2004	
<b>PAGSM239M4</b> Lithologies Data Pkg to TDMS/RPC	5/28/2004	9/3/2004	
<b>PAGSW85M4</b> ESF Moisture Monitoring Data Pkg to TDMS/RPC	5/28/2004	9/8/2004	

**USGS Milestone Report**  
**October 1, 2003 May 31, 2004**  
Sorted by Milestone Level and Baseline Date

**Level: 5**

<b>Deliverable</b>	<b>Due Date</b>	<b>Expected Date</b>	<b>Completed Date</b>
<b>FY2004</b>			
<b>PAGSM38EM5</b> Mtg Summary to TPO: Oct03	10/31/2003	10/31/2003	10/31/2003
<b>PAGSM38FM5</b> Mtg Summary to TPO: Nov03	11/28/2003	11/30/2003	11/30/2003
<b>PAGSM31AM5</b> Memo to TPO: Data Mgmt Progress Report	12/31/2003	12/23/2003	12/23/2003
<b>PAGSM33AM5</b> Memo to TPO: Progress Report HFM Updates	12/31/2003	12/31/2003	12/31/2003
<b>PAGSM35AM5</b> Memo to TPO: Prg Rpt Transient Model Calibration	12/31/2003	12/31/2003	12/31/2003
<b>PAGSM38GM5</b> Mtg Summary to TPO: Dec03	12/31/2003	12/31/2003	12/31/2003
<b>PAGSM38HM5</b> Mtg Summary to TPO: Jan04	1/30/2004	1/31/2004	1/31/2004
<b>PAGSM36CM5</b> Update on Predictive Capability Progress	2/27/2004	2/27/2004	2/27/2004
<b>PAGSM38IM5</b> Mtg Summary to TPO: Feb04	2/27/2004	2/27/2004	2/27/2004
<b>PAGSZ305M5</b> LANL Input to USGS	3/29/2004	6/14/2004	
<b>PAGSM38AM5</b> Memo to TPO: Submit Revised Transient Model Rpt	3/31/2004	3/30/2004	3/30/2004
<b>PAGSM38BM5</b> Memo to TPO: Complete Response Reviewer Comments	3/31/2004	3/30/2004	3/30/2004
<b>PAGSM38JM5</b> Mtg Summary to TPO: Mar04	3/31/2004	3/30/2004	3/30/2004
<b>PAGSZ306M5</b> Review Draft to Checking	4/19/2004	6/18/2004	
<b>PAGSM38KM5</b> Mtg Summary to TPO: Apr04	4/30/2004	4/30/2004	4/30/2004
<b>PAGSM31BM5</b> Memo to TPO: Data Mgmt Progress Report	5/28/2004	5/28/2004	5/28/2004
<b>PAGSM33BM5</b> Memo to TPO: Progress Report HFM Updates	5/28/2004	5/28/2004	5/28/2004
<b>PAGSM35BM5</b> Memo to TPO: Prg Rpt Transient Model Calibration	5/28/2004	5/28/2004	5/28/2004

**USGS Milestone Report**  
**October 1, 2003 May 31, 2004**  
Sorted by Milestone Level and Baseline Date

**Level: 5**

<b>Deliverable</b>	<b>Due Date</b>	<b>Expected Date</b>	<b>Completed Date</b>
<b>PAGSM38LM5</b> Mtg Summary to TPO: May04	5/28/2004	5/11/2004	5/11/2004

# YMP PLANNING AND CONTROL SYSTEM (PACS)

## MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey  
Date Prepared 6/4/2004 09:02 AM

Fiscal Month/Year May 31, 2004

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<u>CURRENT MONTH END</u>							<u>FISCAL YEAR</u>		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.5.01.01	256	2175	589	0	152	0	2833	0	1596
1.5.01.05	39	441	396	0	57	0	444	0	315
1.5.01.06	30	332	273	0	54	0	291	0	233
1.5.01.07	56	340	0	0	0	0	579	0	366
1.5.01.09	247	922	1556	0	300	0	2499	0	1432
1.5.03.01	5	41	0	0	0	0	627	0	27
1.5.03.03	85	1032	800	0	224	0	1341	0	811
1.5.03.04	106	1373	91	0	28	0	1230	0	621
1.5.03.07	86	868	0	0	34	0	619	0	448
1.5.03.08	8	168	0	0	0	0	50	0	8
1.5.03.12	5	74	0	0	0	0	250	0	52
1.5.03.13	47	185	889	0	223	0	675	0	389
1.5.03.14	17	74	0	0	11	0	146	0	59
1.5.04.01	0	0	0	0	0	0	0	0	0
9.6.01.03	4	0	0	0	0	0	852	0	4
	991	8025	4594	0	1083	0	12436	0	6361

# YMP PLANNING AND CONTROL SYSTEM (PACS)

## MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey  
Date Prepared 6/9/2004 02:57 PM

Fiscal Month/Year May 31, 2004  
Page 1 of 1

<u>CURRENT MONTH END</u>							<u>FISCAL YEAR</u>		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.5.01.01	256	2175	589	0	152	0	2833	0	1596
1.5.01.05	39	441	396	0	57	0	444	0	315
1.5.01.06	30	332	273	0	54	0	291	0	233
1.5.01.07	56	340	0	0	0	0	579	0	366
1.5.01.09	247	922	1556	0	300	0	2499	0	1432
1.5.03.01	5	41	0	0	0	0	627	0	27
1.5.03.03	85	1032	800	0	224	0	1341	0	811
1.5.03.04	106	1373	91	0	28	0	1230	0	621
1.5.03.07	86	868	0	0	34	0	619	0	448
1.5.03.08	8	168	0	0	0	0	50	0	8
1.5.03.12	5	74	0	0	0	0	250	0	52
1.5.03.13	47	185	889	0	223	0	675	0	389
1.5.03.14	17	74	0	0	11	0	146	0	59
1.5.04.01	0	0	0	0	0	0	0	0	0
9.6.01.03	4	0	0	0	0	0	852	0	4
	991	8025	4594	0	1083	0	12436	0	6361

U.S. GEOLOGICAL SURVEY

ESTIMATED COSTS FOR October 1, 2003 - May 31, 2004

8/9/2004 2:57:16 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
4568-9U001 Science Advisors	22.1	13.1	19.9	13.0	21.9	25.9	-21.5	99.8	0.0	0.0	0.0	0.0	194.20
4568-9U010 Publications	13.1	0.2	4.8	3.2	8.0	17.4	41.7	15.9	0.0	0.0	0.0	0.0	104.27
4568-9U035 Chemical Thermodynamic Data Review o	0.0	0.0	0.0	0.0	0.0	19.3	3.2	-1.8	0.0	0.0	0.0	0.0	20.69
4568-9U040 Tectonics	8.1	7.3	7.0	11.8	6.0	3.7	3.2	1.9	0.0	0.0	0.0	0.0	48.91
4568-9U041 Water Levels	5.0	5.4	2.2	2.6	2.4	3.3	4.0	3.5	0.0	0.0	0.0	0.0	28.46
4568-9U042 Geophysics	0.0	1.5	6.6	1.2	0.0	4.9	3.6	3.2	0.0	0.0	0.0	0.0	21.02
4568-9U060 Mapping Expertise (USBR)	4.5	5.5	7.4	22.7	-3.0	4.2	35.8	5.6	0.0	0.0	0.0	0.0	82.82
4568-9U081 Geochemistry	67.7	47.2	40.2	98.9	70.9	93.3	17.1	50.1	0.0	0.0	0.0	0.0	485.36
819Y01 USGS Technical Advisory Capability	120.5	80.1	88.1	153.6	106.2	172.1	86.9	178.2	0.0	0.0	0.0	0.0	985.72
4568-9U002 Br Chief, Asst Br Chief, Deputy TPO, Tea	32.0	15.8	43.7	43.7	21.8	61.8	68.2	45.2	0.0	0.0	0.0	0.0	332.08
819Y11 USGS Branch Management	32.0	15.8	43.7	43.7	21.8	61.8	68.2	45.2	0.0	0.0	0.0	0.0	332.08
4568-9U003 Planning & Project Control	29.7	24.7	21.4	37.1	36.5	49.9	45.6	33.1	0.0	0.0	0.0	0.0	277.97
819Y21 USGS Planning & Project Control	29.7	24.7	21.4	37.1	36.5	49.9	45.6	33.1	0.0	0.0	0.0	0.0	277.97
1.5.01.01 Project Support - Project Man	182.3	120.5	153.3	234.4	164.5	283.7	200.7	256.5	0.0	0.0	0.0	0.0	1,595.77
4568-9U030 Regulatory Compliance Support	41.0	27.3	33.0	40.5	43.3	60.0	31.0	38.9	0.0	0.0	0.0	0.0	314.97
819Y31 USGS Regulatory Compliance Support	41.0	27.3	33.0	40.5	43.3	60.0	31.0	38.9	0.0	0.0	0.0	0.0	314.97
1.5.01.05 Project Support - Compliance	41.0	27.3	33.0	40.5	43.3	60.0	31.0	38.9	0.0	0.0	0.0	0.0	314.97
4568-9U024 Computer/Network Support	30.0	21.4	30.0	30.8	30.5	33.8	26.5	30.2	0.0	0.0	0.0	0.0	233.32
819Y15 USGS Commputer/Network Support	30.0	21.4	30.0	30.8	30.5	33.8	26.5	30.2	0.0	0.0	0.0	0.0	233.32
1.5.01.06 Project Support - Information	30.0	21.4	30.0	30.8	30.5	33.8	26.5	30.2	0.0	0.0	0.0	0.0	233.32
4568-9U061 Water Resources Monitoring	20.3	17.0	33.7	18.8	91.3	30.0	36.8	47.6	0.0	0.0	0.0	0.0	295.43
819Y41 USGS Water Resources Monitoring	20.3	17.0	33.7	18.8	91.3	30.0	36.8	47.6	0.0	0.0	0.0	0.0	295.43
4568-9U062 Safety	9.1	3.7	7.0	7.8	5.9	14.0	14.5	8.3	0.0	0.0	0.0	0.0	70.25
819Y51 USGS Safety	9.1	3.7	7.0	7.8	5.9	14.0	14.5	8.3	0.0	0.0	0.0	0.0	70.25

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1.5.01.07 Project Support - Environment	29.4	20.6	40.7	26.6	97.2	44.0	51.3	55.9	0.0	0.0	0.0	0.0	365.68
4568-9U011 Reports Specialists	13.3	7.2	8.9	9.6	6.6	15.2	24.6	6.1	0.0	0.0	0.0	0.0	91.51
4568-9U012 Data Management	36.0	16.5	30.1	30.6	28.9	42.2	29.7	30.0	0.0	0.0	0.0	0.0	243.98
4568-9U013 Records Support	7.6	5.1	7.3	6.2	6.5	7.7	7.2	7.0	0.0	0.0	0.0	0.0	54.64
4568-9U014 QAS Support	22.5	18.0	23.0	20.8	21.4	28.3	26.7	25.0	0.0	0.0	0.0	0.0	185.85
819Y12 USGS Data, Records & Reports	79.4	46.8	69.3	67.2	63.4	93.5	88.2	68.2	0.0	0.0	0.0	0.0	575.98
4568-9U021 Administrative Support & Personnel Servi	29.7	8.9	19.0	17.4	13.3	24.2	20.1	14.0	0.0	0.0	0.0	0.0	146.58
4568-9U022 Facilities Management	0.0	114.4	52.2	98.6	53.1	-59.7	110.4	120.4	0.0	0.0	0.0	0.0	489.34
4568-9U026 Facilities Other	1.6	0.1	0.0	-0.7	1.7	0.1	19.0	29.6	0.0	0.0	0.0	0.0	51.39
819Y13 USGS Administration & Facilities	31.3	123.3	71.2	115.2	68.0	-35.4	149.5	164.0	0.0	0.0	0.0	0.0	687.31
4568-9U023 Training	19.9	10.8	14.4	12.9	17.3	11.1	10.1	7.1	0.0	0.0	0.0	0.0	103.68
819Y14 USGS Training	19.9	10.8	14.4	12.9	17.3	11.1	10.1	7.1	0.0	0.0	0.0	0.0	103.68
4568-9U025 Property Management	7.9	7.1	7.1	7.7	8.6	10.3	8.4	7.6	0.0	0.0	0.0	0.0	64.61
819Y16 USGS Property Management	7.9	7.1	7.1	7.7	8.6	10.3	8.4	7.6	0.0	0.0	0.0	0.0	64.61
1.5.01.09 Project Support - General Proj	138.6	188.0	162.0	203.0	157.4	79.4	256.3	247.0	0.0	0.0	0.0	0.0	1,431.58
1.5.01	421.2	377.9	419.0	535.2	492.9	500.9	565.8	628.4	0.0	0.0	0.0	0.0	3,941.33
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	0.02
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	0.02
4568-9U008 LA Chapter Preparation	10.3	5.3	5.9	-0.6	0.0	1.5	-2.3	-0.2	0.0	0.0	0.0	0.0	19.85
APAG03 USGS LA Chapter Preparation Support	10.3	5.3	5.9	-0.6	0.0	1.5	-2.3	-0.2	0.0	0.0	0.0	0.0	19.85
4568-9U007 KTI Support	0.0	2.9	-0.4	0.0	0.0	0.2	-0.6	0.0	0.0	0.0	0.0	0.0	2.06
APAG04 USGS KTI Support	0.0	2.9	-0.4	0.0	0.0	0.2	-0.6	0.0	0.0	0.0	0.0	0.0	2.06
4568-9U009 USGS Support to Regulatory Integration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	4.76
ARTG01 Regulatory Integration Project - USGS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0	4.76

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<b>1.5.03.01</b> Integration	10.3	8.1	5.5	-0.6	0.0	1.7	-2.8	4.5	0.0	0.0	0.0	0.0	26.69
4568-9U063 Alcove 8/Niche 3 Infiltration	16.6	15.3	21.7	44.9	26.2	52.0	36.2	38.3	0.0	0.0	0.0	0.0	251.23
4568-9U064 Moisture Monitoring ESF/X-Drift Closeout	8.2	5.7	7.4	11.7	18.3	11.5	7.5	7.2	0.0	0.0	0.0	0.0	77.38
4568-9U065 Bulkhead Moisture Monitoring	34.5	14.4	18.0	9.8	11.2	16.1	-0.6	11.5	0.0	0.0	0.0	0.0	114.93
4568-9U073 Alcove 7 Moisture Monitoring	3.2	1.7	0.6	2.4	0.5	1.1	0.7	0.4	0.0	0.0	0.0	0.0	10.55
<b>AUZG01</b> USGS UZ Moisture Studies	62.4	37.0	47.8	68.9	56.1	80.7	43.8	57.4	0.0	0.0	0.0	0.0	454.08
4568-9U085 Geochemical Testing of UZ Flow	15.8	8.8	3.6	18.8	5.7	17.0	7.1	16.9	0.0	0.0	0.0	0.0	93.71
4568-9U086 Complete Chlorine 36 Validation	0.0	4.2	0.3	2.7	0.0	0.6	0.9	-0.1	0.0	0.0	0.0	0.0	8.68
4568-9U087 Chemical & Isotopic Composition of Pore	9.7	6.9	15.6	9.2	9.3	21.2	19.2	9.4	0.0	0.0	0.0	0.0	100.48
4568-9U089 Mineral Records of UZ Flow	8.8	18.4	-17.8	30.2	5.1	4.3	6.1	-5.7	0.0	0.0	0.0	0.0	49.33
4568-9U094 Thermal History of Yucca Mountain	2.3	5.3	5.9	7.8	2.4	4.2	6.3	6.6	0.0	0.0	0.0	0.0	40.89
<b>AUZG02</b> USGS UZ Isotope Hydrology	36.6	43.7	7.7	68.7	22.5	47.2	39.6	27.1	0.0	0.0	0.0	0.0	293.09
4568-9U090 Isotope Support for Thermal Testing	4.0	11.4	15.2	13.0	6.1	6.3	7.4	0.2	0.0	0.0	0.0	0.0	63.72
<b>AUZG03</b> USGS Drift-Scale Test ESF	4.0	11.4	15.2	13.0	6.1	6.3	7.4	0.2	0.0	0.0	0.0	0.0	63.72
<b>1.5.03.03</b> Safety Analyses - Unsaturated	103.1	92.1	70.7	150.6	84.7	134.2	90.8	84.7	0.0	0.0	0.0	0.0	810.89
4568-9U043 Hydrogeologic Data Integration	0.0	1.7	-0.2	2.7	-0.2	0.3	0.8	3.7	0.0	0.0	0.0	0.0	8.70
4568-9U044 3D Hydrogeologic Model Development	0.0	0.0	0.6	18.9	1.1	8.8	18.1	29.1	0.0	0.0	0.0	0.0	76.55
4568-9U045 Flow Model Calibration and Evaluation	5.2	5.1	9.0	6.7	18.0	7.2	7.1	23.9	0.0	0.0	0.0	0.0	81.98
4568-9U046 DVRFS Knowledge Exchange Protocol	0.0	0.0	0.0	0.0	16.1	52.2	4.4	21.9	0.0	0.0	0.0	0.0	94.63
4568-9U047 DVRFS Predictive Capability	0.0	3.6	-0.5	0.0	0.0	0.2	-0.7	0.0	0.0	0.0	0.0	0.0	2.58
<b>819Y61</b> USGS Death Valley Regional Flow Mode	5.2	10.3	8.8	28.3	35.0	68.7	29.7	78.5	0.0	0.0	0.0	0.0	264.44
4568-9U049 Nye County EWDP Borehole Lithostratigr	8.0	9.0	24.3	10.3	11.8	18.4	14.3	7.3	0.0	0.0	0.0	0.0	103.32
<b>ASZG01</b> USGS SZ Investigations	8.0	9.0	24.3	10.3	11.8	18.4	14.3	7.3	0.0	0.0	0.0	0.0	103.32
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	35.5	41.9	19.4	0.0	0.0	0.0	0.0	242.76
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
<b>ASZG02</b> USGS SZ Isotope Hydrology	33.4	15.0	28.6	37.8	31.3	35.5	41.9	19.4	0.0	0.0	0.0	0.0	242.76



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1.5.03.04 Safety Analyses - Saturated Z	46.6	34.3	61.7	76.4	78.1	122.6	85.8	105.1	0.0	0.0	0.0	0.0	610.53
4568-9U069 Fracture & Lithophysal Characteristics of	77.0	38.1	57.1	60.9	-12.9	68.0	74.6	82.7	0.0	0.0	0.0	0.0	445.43
AEBG03 USBR Testing Activities in Support of De	77.0	38.1	57.1	60.9	-12.9	68.0	74.6	82.7	0.0	0.0	0.0	0.0	445.43
4568-9U091 Geochem/Physical Characterization of E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	2.77
AEBG04 Geochem/Geophysical Characterization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	2.77
4568-9U067 Quantify Lithophysal Porosity - In Situ Tes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.07
AEBG05 USGS Nevada Operations Support to EB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.07
1.5.03.07 Safety Analyses - EBS Perfor	77.0	38.1	57.1	60.9	-12.9	68.0	74.6	85.5	0.0	0.0	0.0	0.0	448.26
4568-9U018 Seismic Related to PGV Estimates-BCP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	8.30
ADEG01 USGS Support to Disruptive Events	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	8.30
1.5.03.08 Safety Analyses - Disruptive E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	8.30
4568-9U005 YMP Performance Confirmation	13.0	8.5	5.0	3.5	5.7	6.6	5.2	4.8	0.0	0.0	0.0	0.0	52.26
APAG02 USGS Performance Confirmation Suppor	13.0	8.5	5.0	3.5	5.7	6.6	5.2	4.8	0.0	0.0	0.0	0.0	52.26
1.5.03.12 Performance Confirmation Su	13.0	8.5	5.0	3.5	5.7	6.6	5.2	4.8	0.0	0.0	0.0	0.0	52.26
4568-9U016 USGS Data Verification	49.7	29.8	53.5	47.8	47.3	64.8	49.2	47.0	0.0	0.0	0.0	0.0	388.97
APAGD5 USGS Data Verification	49.7	29.8	53.5	47.8	47.3	64.8	49.2	47.0	0.0	0.0	0.0	0.0	388.97
1.5.03.13 Safety Analyses - Technical D	49.7	29.8	53.5	47.8	47.3	64.8	49.2	47.0	0.0	0.0	0.0	0.0	388.97
4568-9U004 USGS Support to Site Description	6.2	7.7	23.4	2.9	3.3	6.2	-6.9	16.5	0.0	0.0	0.0	0.0	59.32
ANSG01 USGS Support to Site Description	6.2	7.7	23.4	2.9	3.3	6.2	-6.9	16.5	0.0	0.0	0.0	0.0	59.32
1.5.03.14 Safety Analyses - Yucca Mou	6.2	7.7	23.4	2.9	3.3	6.2	-6.9	16.5	0.0	0.0	0.0	0.0	59.32

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<b>1.5.03</b>	<b>305.9</b>	<b>218.6</b>	<b>276.9</b>	<b>341.3</b>	<b>206.2</b>	<b>404.1</b>	<b>295.7</b>	<b>356.5</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>2,405.23</b>
4568-9U074 On-Site Infrastructure Seismic Testing - U	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
DCMG2L On-Site Infrastructure Seismic Testing -	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
1.5.04.01.08 Repository Surface Facilities	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
1.5.04.01 Repository Surface Facilities	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>1.5.04</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.00</b>
<b>1.5</b>	<b>727.2</b>	<b>596.5</b>	<b>695.9</b>	<b>876.5</b>	<b>699.1</b>	<b>905.0</b>	<b>861.5</b>	<b>984.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>6,346.55</b>
4568-9U0S Matrix/Fracture Flow in Subrepository Uni	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
4568-9U0S Testing the Concept of Drift Shadow	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
4568-9U0S Natural Analogues of Drift Shadow	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
4568-9U0S Carbon-14 Ground-Water Analysis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
RWSG01 USGS S&T Isotope Studies	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
4568-9U0S Integrate Site & Regional Flow Models	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	1.93
4568-9U0SF Large Scale (2-km) Natural Gradient Trac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	1.89
4568-9U0S Plan Large-Scale Drawdown Test in Volc	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.47
RWSG02 USGS S&T Hydrologic Studies	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	4.30
<b>9.6.01.03</b> Science and Technology Prog	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4.30</b>
<b>9.6.01</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4.30</b>
<b>9.6</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>4.30</b>

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1.5 OPERATING	727.2	596.5	695.9	876.5	699.1	905.0	861.5	989.1	0.0	0.0	0.0	0.0	6,350.85
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	876.5	699.1	905.0	861.5	989.1	0.0	0.0	0.0	0.0	6,350.85
FTEs													
FEDERAL	48.6	43.3	49.0	44.4	43.8	49.5	50.0	47.5	0.0	0.0	0.0	0.0	
CONTRACT	31.9	25.1	29.3	29.4	30.4	36.7	32.3	29.4	0.0	0.0	0.0	0.0	
TOTAL	80.6	68.5	78.3	73.8	74.2	86.2	82.3	77.0	0.0	0.0	0.0	0.0	