



United States Department of the Interior

U. S. GEOLOGICAL SURVEY

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Denver, Colorado 80225

IN REPLY REFER TO:

INFORMATION ONLY

November 15, 2001

Victor W. Trebules
Director, Office of Project Control
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
P.O. Box 364629
Las Vegas, Nevada 89036-8629

SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS)
Progress Report, October, 2001

Attached is the USGS progress report in the required format for the month of October, 2001.

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

Sincerely,

Raye Ritchey Arnold
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

October 2001

GEOLOGY

Technical support to the Nye County early-warning drilling program continued, with ongoing efforts focused on lithostratigraphic data packages. Responses were completed to comments from the "checking review" of the Nye County Lithostratigraphy Phase II data package. That revised package was resubmitted for entry into the TDMS. (The data package has been assigned DTN GS011008314211.001.) In work on the Nye County hydrostratigraphic cross sections, additional QA documents were completed for submittal for checking review of the data package titled "Geologic Cross Sections Nye-1, Nye-2, and Nye-3, Nye County, Nevada." In particular, distinctions were drawn between Q data and "accepted data." That data package has been submitted for checking. Additional related support to the Nye County work involved writing text and developing illustrations for the "Lithostratigraphy of Nye County Boreholes" section of the saturated-zone white paper, included as part of the Technical Update Impact Letter Report (TUILR).

In activity related to geologic mapping of potential repository expansion, preparation of planning documents continued during October. (Documents were sent October 15 for approval.) Preparations also were underway for field mapping work. Results of previous mapping have been obtained in both digital and hard-copy (analog) form for preparation of base maps and field compilations. The mapping will produce map(s) of expansion areas south and west of the current potential repository footprint at a scale of 1:6000, building on earlier USGS-YMP site-area maps at coarser 1:24,000 scale. The new mapping will follow the approach of the so-called "central block" Yucca Mountain map and will use current stratigraphic nomenclature and standards for map resolution, in support of design efforts.

The technical work plan and other planning documents for the deterministic seismic hazards analysis (DSHA) were compiled and reviewed. Staff participated in conferences to plan aspects of the DSHA activity. Chapters of the Paleoseismic Data Report (which feeds DSHA) were reviewed; those chapters represent significant progress in presentation of methodology and base data.

The Bureau of Reclamation mapping team provided support to Waste Handling Building efforts during October, with those efforts focused on completion of data submittals and support to AMR development. In addition, in work on deferred activities, staff began preparation of data from the supplemental surface fracture study for submittal to the TDMS.

SATURATED-ZONE STUDIES

In work on deferred activities, efforts continued on preparation of the water-level AMR. Review comments were received (on October 24) several weeks after the comment due date, delaying compilation of final revisions. Responses to review comments were prepared, the AMR was revised accordingly, and that revised AMR was sent to the reviewers for comment resolution on October 29.

Work continued on hydraulic tests at the Alluvial Testing Complex (ATC). Work on writing the single-hole tracer testing report commenced in October. That text is anticipated to take several weeks for preparation. Planning efforts continued for cross-hole hydraulic and tracer testing. Staff from the USGS worked with the Test Coordination Office in development of draft cross-hole test plans, expected to be completed in November. Staff from the USGS group also worked with Baski, Inc., manufacturer of most of the testing equipment being used at the ATC, in oversight of manufacturing of equipment for the cross-hole testing.

Water samples were collected prior to and during the 48-hour open-hole pump test at the ATC. Those water samples have been submitted to the National Water Quality Laboratory (NWQL) for analysis as part of USGS isotopic and hydrochemical support to studies at the ATC. Work continued on development of test-planning documents for ATC isotopic and hydrochemical investigations.

In work on hydrochronology of the Yucca Mountain flow system, contracts for carbon (^{14}C) dating were prepared and awarded. Existing samples were prioritized and have been requested from the Sample Management Facility.

Multiple aspects of work on modeling of the Death Valley regional flow system (DVRFS) continued. Planning and workscope preparation, as well as training in use of ArcGIS software, dominated activity in modeling data-base efforts. Additional efforts evaluated applicability of ArcGIS 8 to DVRFS work. In specific data-base work, revisions continued to flags in the DVRFS water-level data base. Interaction continued with the water-use group in regard to determination of well depths for township/range/section (TRS) and model-grid coordinate systems. Routines and programs were developed to extract water levels by flag and to plot hydrographs in mass for the DVRFS. (Hydrographs provide TRS and model ROW/COLUMN coordinates for each well. The routine also determines the X and Y model-cell center-point offsets.) Additional routines were developed to plot stacked bar charts of ground-water pumpage data from the DVRFS water-use data base. Pumpage can be summed and plotted by hydrographic area (or by TRS) and stacked by defined usage. Development of automated routines to generate model-input data sets from DVRFS water-level and water-use data bases began.

Progress and refinement of the hydrogeologic framework model (HFM) produced a preliminary HFM for the transient-flow model. That HFM currently is being examined for geologic validity. Review of cross-section data and repair of problematic areas on the cross sections continued. Presentations (posters) were constructed to present results of

flow modeling and HFM improvements to the UGTA (the NTS underground test area) kick-off meeting on October 10. Several staff members participated in that meeting. Staff also participated in a DVRFS modeling meeting held in Tucson October 15—19. An abstract covering HFM work was prepared and submitted to the Nevada Water Resources Association (NWRA) on October 26. A presentation of the HFM used in the steady-state flow modeling is expected to be made at the NWRA's February 27—28 meeting in Las Vegas. Editorial suggestions from geologic staff were completed regarding the initial set of gridded surfaces for each hydrogeologic unit for the new 3-D framework model. Those suggestions were based on geologic data on unit extent and on consistency with subsurface data and interpretations. Grids were modified accordingly.

The following reports concerning hydrogeologic facies maps of the Death Valley region are either in review or carry completed technical reviews. The reports have been sent to R. Waddell at HSI GeoTrans for comment, and, with any necessary revisions, will be submitted for DOE concurrence:

Sweetkind, D.S., and White, D.K., 2001, *Facies analysis of Late Proterozoic through Lower Cambrian clastic rocks of the Death Valley regional ground-water system and surrounding areas, Nevada and California*: U.S. Geological Survey Open-File Report 01-351, 13 p. [Status: has USGS Director's approval; awaiting comments from R. Waddell; to be submitted shortly for DOE concurrence]

Sweetkind, D.S., Fridrich, C.J., and Taylor, E., *Facies analysis of Tertiary basin-filling rocks of the Death Valley regional ground-water system and surrounding areas, Nevada and California*: draft manuscript, intended as a U.S. Geological Survey open-file report. [Status: submitted for USGS Director's approval; awaiting comments from R. Waddell; to be submitted for DOE concurrence]

Drake, R.M., II, and Sweetkind, D.S., *Hydrogeologic facies maps of six Tertiary volcanic units in the southwestern Nevada volcanic field, Nevada and California*: draft manuscript, intended as a U.S. Geological Survey open-file report. [Status: in review]

On-going efforts in ground-water flow modeling also continued. Work continued throughout the month on revisions to the flow-model report. That report has been re-written in response to review comments, figures and tables have been updated, and the report is in final stages of preparation for submittal to the USGS Director's Office for approval.

Revisions to the site-scale hydrogeologic framework model (HFM) continued. New cross sections developed for the Nye County boreholes by R. Spengler (USGS) and others were incorporated along with new regional-scale cross sections and mapping. The hydrogeologic framework also was updated to be consistent with the regional framework model. A preliminary version of the framework has been completed, and the related AMR is being updated for review. Grids were generated for new figures in the AMR revision and are being completed. A data request from LANL for the most current

version of the framework model was fulfilled. It was determined that revision of the site-scale HFM would not require a "test plan," since no field work or data-collection activities are involved. The saturated-zone technical work plans are being revised to describe accurately the investigations intended for FY2002.

In work supporting closure of DR-118, investigations to date have identified one additional user with three non-baselined pieces of software. The completed response to the deficiency report was submitted on October 3. Additional action will supplement a preliminary data package with an explanation of the deficient condition regarding use of non-baselined software. The completed response was accepted on October 11.

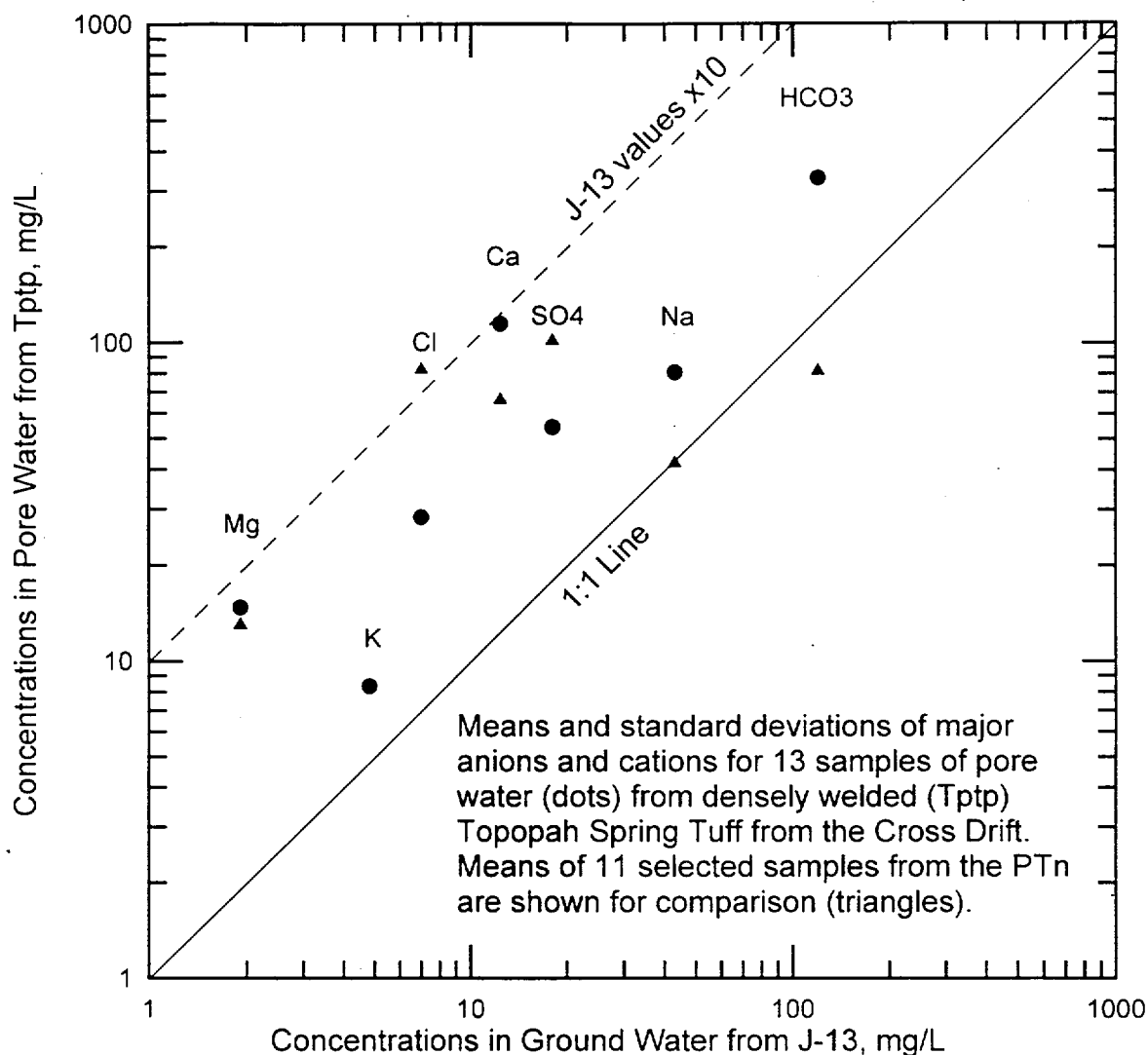
UNSATURATED-ZONE STUDIES

In additional work on deferred activities, the USGS monitored pressure, temperature, and water potential at stations located in boreholes UE-25 UZ #4, UE-25 UZ #5, and USW NRG-7a.

Determination of chemical and isotopic composition of UZ pore water continued. Water samples were extracted by ultracentrifugation from core obtained from the ECRB and from borehole USW SD-9. The water was analyzed by ion chromatograph (IC) and inductively coupled plasma mass spectrometry (ICPMS). The analytical results are consistent with earlier analyses of pore water from the densely welded, crystal-poor member of the Topopah Spring Tuff. A cross check on cation analyses was performed on three samples using both IC and ICPMS, and work continued on improvement of precision in alkalinity measurements.

As part of the Technical Update Impact evaluation conducted by BSC (October 23—25, 2001), the USGS provided input to the white paper on "Unsaturated-Zone Flow and Transport" regarding new pore-water geochemistry. Thirteen analyses of pore water from the crystal-poor member of the Topopah Spring Tuff were illustrated with means and standard deviations relative to representative analyses of water from UE-25 J-13 and to a mean of selected analyses of pore-water compositions from the PTn (see figure, next page). Where multiple samples of water were obtained from a single core, the analyses indicated significant compositional variation at the meter scale or finer. Apparently, those variations in pore-water composition are not erased or homogenized by molecular or mechanical dispersion. This observation, if validated by additional work, has important implications for the potential efficacy of matrix diffusion as a retardation mechanism for radionuclide transport in the unsaturated zone.

Development of test plans for isotope support to Thermal Testing continued during the month. Samples of core from the new borehole were delayed due to problems with the drilling rig. Presentation of preliminary results of pore-water chemistry from ECRB cores was underway for the workshop to be held in early November. A spreadsheet summary of volumes of water generated during the heating phase of the Drift-Scale Test was compiled, forming the basis for another presentation at the November workshop.



Construction of a test plan for U-series work in delineation of UZ flow zones was initiated using a previously completed plan (Moisture Monitoring in the ECRB) as a guide. Activities have been outlined, and supporting QA information is being assembled. The completed plan is expected to be ready for review in early November.

In work on deferred activities, efforts on validation of surficial carbonate sources continued, with on-going work on compilation of carbon, oxygen, and strontium isotopic data packages.

Work on geochemical characterization of ESF dust produced a letter report on chemical analyses of dust samples (described in the August status report). That report was modified slightly per customer requests and was submitted to the RPC. It is now available on the RIS web under MOL.20011004.0233 and MOL.20011004.0234.

In on-going analytical efforts, analyses for soluble anion and cations were completed and reported by the USGS Crustal Imaging and Characterization Team on October 22. Sufficient material remained available from the initial dust collection to conduct those analyses. The procedure leached 2 grams of sample in 40 ml of deionized water for 1 minute, then allowed setting for 1 hour, followed by filtering on a 0.45 micron filter. Quality control was provided by submittal of an anion standard from Environmental Resource Associates certified for Br, Cl, F, N (as nitrate), P, and S (as sulfate). Three splits of the standard were submitted blindly along with the unknowns, and the results were satisfactory within the performance-acceptance limits. The elements Cl, F, N, S, Br, Ca, K, Mg, Na, Si, and P were reported at the parts per million (ppm) level (relative to the solid). All other elements were reported at the parts per billion (ppb) level. The concentrations of soluble anions are Cl, 181 ± 56 ppm; F, 14.5 ± 9.4 ppm; NO_3 , 418 ± 351 ppm; SO_4 , 816 ± 472 ppm; and Br, 29 ± 14 ppm. No correlation was found between location of samples and concentrations of any of the elements. A correlation between Cl/Br ratios and Br content indicate that construction water was a significant contributor to the soluble Cl and Br load of the dust. This contribution also was suggested by analyses of bulk dust samples. Soluble cations of particular interest to the Waste Package Department are As, 96 ± 36 ppb and Pb, 1.2 ± 0.7 ppb. Those lower (parts per billion) concentrations contrast with the bulk dust analyses of 8.1 ± 2.2 ppm of As, and 32 ± 4 ppm of Pb which indicate that these elements largely are immobilized in the silicate phases of the dust (and the source rock).

Work has continued on crushing and leaching of Cl-validation core from the ESF. To date, 29 leachates (including blanks and duplicates) have been prepared and submitted to the Center for Accelerator Mass Spectrometry (CAMS) at Lawrence Livermore National Laboratory (LLNL) for ^{36}Cl analyses. Additional replication is provided by leachates supplied by the USGS to Los Alamos National Laboratory, where independent extractions of chlorine are performed prior to ^{36}Cl analysis at LLNL. Nineteen crushed samples await leaching in Denver, and the final eight cores are being crushed at the Sample Management Facility. The CAMS reports that mass-spectrometric analyses were conducted on October 26 of both LANL and USGS leachates. The samples are reported to have run satisfactorily. The results, however, will not be reduced until the week of November 12.

USGS staff participated in the development of a white paper describing the significance of new data collected since the preparation of the Science and Engineering Report and the Preliminary Site Suitability Evaluation.

Investigations of the thermal history of Yucca Mountain as recorded in fluid inclusions continued with preparation of additional samples. Approximately 18 samples were digested in buffered acetic acid to remove calcite, then filtered, dried, and passed through heavy liquids to concentrate the fluorite mineral component. Approximately 24 fluorite separates then were handpicked for U-Th-He dating and thermal analysis (to be conducted by the California Institute of Technology), $^{235}\text{U}/^{207}\text{Pb}$ geochronology (to be performed by the Royal Ontario Museum), and $\delta^{87}\text{Sr}$ determinations.

In related unscheduled work, additional efforts were directed at presentation of results of chemical and isotopic investigations. Revisions were completed to a manuscript titled *Paragenetic relations and evidence for secondary mineral formation in unsaturated-zone tuffs at Yucca Mountain, Nevada* (now titled *Physical and stable isotope evidence for formation of secondary calcite and silica in the unsaturated zone, Yucca Mountain, Nevada*) by J. Whelan, J. Paces, and Z. Peterman. The revised version was accepted by technical reviewers and prepared for submission for USGS Director's approval. Several presentations, including *Temperature, timing, and unsaturated-zone origin of secondary calcite and silica at Yucca Mountain, Nevada* (by J. Whelan, L. Neymark, B. Marshall, and J. Paces); *Simulations of the thermal history of the unsaturated-zone at Yucca Mountain, Nevada* (by B. Marshall and J. Whelan); and *Vapor-phase garnet at Yucca Mountain, Nevada: Geochemistry and oxygen-isotope thermometry* (by R. Moscati, C. Johnson, and J. Whelan), were prepared for the annual meeting of the Geological Society of America to be held Nov. 4—8 in Boston.

WATER-RESOURCES MONITORING

Ground-water levels were measured at 34 sites, and ground-water discharge was measured at one flowing well. Ground-water data collected during October were checked and filed. The Trend Analysis Report was prepared and submitted for supervisory review prior to colleague review.

In on-going work, data on ground-water levels and discharges collected and compiled for monitoring sites during July through September 2001 were reviewed. A letter report describing water levels and related measurements was prepared and delivered to DOE on October 29, in completion of Level 4 milestone SAGSW250M4 [**Letter Report: 4th Quarter FY01 Water-Level Monitoring**].

USGS Milestone Report
October 1, 2001 - October 31, 2001
Sorted by Baseline Date

Level: 4

Deliverable	Due Date	Expected Date	Completed Date
SAGSZ905M4 Chemical/Petrographic Data to TDB/RPC	10/26/01	11/9/01	
SAGSM00M4 Review Draft: Volcanic Hazards Analyses	10/30/01	11/30/01	
SAGSW250M Letter Report: 4th Qtr FY01	10/31/01	10/30/01	10/30/01

YMP PLANNING AND CONTROL SYSTEM (PACS)

MONTHLY COST/FTE REPORT

Participant U.S. Geological Survey
Date Prepared 11/15/2001 09:36 AM

Fiscal Month/Year October 31, 2001

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CURRENT MONTH END

FISCAL YEAR

WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.21.5.T	7	0	17	0	0	0	140	0	7
1.2.22.1.3	11	158	0	0	0	0	20	0	11
1.2.22.2.1	7	148	0	0	4	0	153	0	7
1.2.22.2.2	7	223	0	0	0	0	89	0	7
1.2.22.4.6	27	576	40	0	121	0	539	0	27
1.2.22.4.D	7	126	0	0	6	0	190	0	7
1.2.22.4.E	7	53	97	0	109	0	361	0	7
1.2.22.4.I	16	166	168	0	73	0	214	0	16
1.2.22.4.S	71	663	259	0	132	0	977	0	71
1.2.22.4.U	198	1924	1735	0	812	0	2739	0	198
1.2.22.6.2	6	126	0	0	0	0	118	0	6
1.2.22.6.3	151	1250	2359	0	1087	0	2269	0	151
1.2.22.6.4	31	125	163	0	155	0	301	0	31
1.2.22.6.6	38	645	0	0	0	0	745	0	38
1.2.22.6.T	81	857	0	0	0	0	656	0	81
1.2.22.7.1	114	654	708	0	281	0	1568	0	114
	779	7694	5546	0	2780	0	11079	0	779

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	OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
4889-47011 Deferred - Surface Base Boreholes Close	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.50
8191215TUM Deferred - Testing & Analysis	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.50
12215T USGS Test Coord/Supp for Site Activ	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.50
1.2.21.5.T	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.50
1.2.21.5	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.50
1.2.21	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.50
4889-59011 Support to Technical Update Document	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.77
81912213UA Support to Technical Update Docume	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.77
122213 Progress Reports	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.77
1.2.22.1.3	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.77
1.2.22.1	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.77
4889-55011 Deterministic Seismic Hazards Analysis	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.65
81912221UA Science Support to Deterministic Seis	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.65
122221 Description of the Site for LA	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.65
1.2.22.2.1	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.65
4889-55021 Natural Analog Studies	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.11
81912222UA USGS Support to Site Description	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.11
122222 Yucca Mountain Site Description	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.11
1.2.22.2.2	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.11
1.2.22.2	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.76
4889-56011 Nye County EWDP Borehole Lithostratigr	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.59
4889-56012 Hydrostratigraphic Cross Section, Nye Co	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.93
81912246UA Lithostratigraphic Support to Nye Co.	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.51
4889-56021 Isotope/Hydrochemical Support to Nye Co	15.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.43
4889-56111 Deferred - Isotopic/Hydrochemical Suppor	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.16
81912246UB Isotope/Hydrochemical Support to Ny	16.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.59
122246 Technical Support	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.11

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	OCT EST	NOV EST	DEC EST	JAN EST	FEB EST	MAR EST	APR EST	MAY EST	JUN EST	JUL EST	AUG EST	SEP EST	TOTAL
1.2.22.4.6	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.11
4889-56031 Buried Basaltic Eruptive Centers	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.04
8191224DUA Science Support to Disruptive Events	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.04
12224D Disruptive Events Modeling Report	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.04
1.2.22.4.D	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.04
4889-56041 Geochem/Physical Characterization of ES	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.51
4889-56061 Deferred - Effects of Water-Rock Interacti	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
8191224EUA Effects of Water-Rock Interaction on	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.51
4889-56051 Core Characterization Tstg - Thermal Con	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.17
4889-56052 Support to Soil Characterization Tests	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
4889-56062 Deferred - Thermal Conductivity	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
8191224EUB Nevada Operations Support to EBS	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.17
12224E EBS Dgrdtn Flow & Trnsprt PMR - LA	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.68
1.2.22.4.E	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.68
4889-56071 Map Proposed Repository Expansion	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.60
4889-56072 Support Review/Revision GFM 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
8191224IUA Science Support to ISM PMR	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.60
12224I Integrated Site Model PMR - LA	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.60
1.2.22.4.I	15.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.60
4889-56081 Cross-Hole Hydraulic & Tracer Testing AT	41.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.13
4889-56082 Revise Site-Scale HFM	5.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.91
4889-56113 Deferred - Water Level AMR	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.68
8191224SUA SZ Investigations	52.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.72
4889-56091 Isotopic/Hydrochemical Support to the AT	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.28
4889-56092 Hydrochronology of the Yucca Mountain F	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.28
4889-56112 Deferred - Monitor Isotopic/Hydrochemical	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.95
8191224SUB SZ Isotope Hydrology	16.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.50
4889-56101 Liaison Support to Saturated Zone Studie	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.16

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8191224SUD USGS Liaison to SZ Studies	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.16
12224S SZ Flow & Trnsprt PMR - LA	71.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.39
1.2.22.4.S	71.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.39
4889-54011 Deferred - UZ Flow & Transport PMR - S	32.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.89
4889-56131 Alcove 8/Niche 3 Infiltration	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.92
4889-56132 Bulkhead Moisture Monitoring	26.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.64
4889-56133 Moisture Monitoring ESF & X-Drift	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.54
4889-56134 Support to UZ In-Situ Processes 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
8191224UUA UZ Moisture Studies	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.99
4889-56141 U-Series Delineation of UZ Flow Zones	12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.58
4889-56142 Fluid Inclusions & Thermal History of Yuc	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.57
4889-56143 Complete Chlorine 36 Validation	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.76
4889-56144 Chemical & Isotopic Composition of Pore	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.76
4889-56171 Deferred - Surficial Carbonate Source Vali	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.48
4889-56172 Deferred - Pore Water Geochemistry	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.51
4889-56173 Deferred - Cl-36 Validation in the ESF	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
4889-56174 Deferred - Age Ca/Opal Frac/Cav Coating	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.11
8191224UUB UZ Isotope Hydrology	54.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.77
4889-56151 Submission of Data from Alcove 8/Niche	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.88
4889-56152 Phase II Lithophysal Study (USBR)	40.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.17
4889-56175 Deferred - Supplemental Surface Fracture	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
4889-56176 Deferred - Lithophysal Study in the ECRB	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
4889-56177 Deferred - 3D Fracture Network Depiction	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
8191224UUC Mapping (USBR)	43.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.05
4889-56121 Isotope Support for Thermal Testing	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.59
8191224UUE Drift-Scale Test ESF	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.59
4889-56161 USGS Liaison to Unsaturated Zone	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.57
8191224UUF USGS Liaison to UZ Studies	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.57

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12224U UZ Flow & Trnsprt PMR - LA	198.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.97
1.2.22.4.U	198.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	197.97
1.2.22.4	325.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	325.78
4889-57011 Federal Occupational Health/Safety	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.35
81912262UB Environmental Safety & Health	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.35
4889-57021 Deferred Funding - Water Resources	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
81912262UQ Water Resources	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
122262 Environment, Safety & Health Implem	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.35
1.2.22.6.2	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.35
4889-57031 Technical Data Management	44.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.28
4889-57032 Data Verification	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.96
4889-57033 USGS Publications Support	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.21
4889-57034 QAIS Support	20.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.54
4889-57035 Data Checking	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.64
81912263UA Technical Support	93.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.62
4889-57041 Computer/Network Support	23.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.08
81912263UB USGS Commputer Support	23.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.08
4889-57071 Records Support	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.01
81912263UC Records	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.01
4889-57051 Regulatory Product Integrity	28.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.50
81912263UD Regulatory Product Integrity	28.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.50
4889-57061 Closure of DR105	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
4889-57062 Closure of DR118	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
81912263UE Closure of Deficiencies	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
122263 Technical & Regulatory Information M	151.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.21
1.2.22.6.3	151.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.21
4889-57081 Program Planning & Performance	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.78

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81912264UB Project Control	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.78
122264 Baseline Control	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.78
1.2.22.6.4	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.78
4889-57091 USGS Technical Project Officer	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.54
4889-57092 USGS Support to Chief Science Office	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.23
81912266UA USGS Technical Project Officer	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.77
122266 Technical Management and Operatio	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.77
1.2.22.6.6	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.77
4889-57101 USGS Liaison to Testing	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.57
8191226TUA USGS Liaison to Testing	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.57
4889-57111 Shaft Design Support (USBR)	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.16
4889-57112 Rock Mechanics Testing in the ECRB	24.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.41
4889-57113 Waste Handling Building Support	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.39
8191226TUB USBR Testing Activities in Support of	78.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.95
12226T Testing and Monitoring Activities	80.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.52
1.2.22.6.T	80.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.52
1.2.22.6	306.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.63
4889-58011 Support & Personnel Services	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.77
4889-58012 Procurement & Property Management	29.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.09
4889-58013 Facilities Management - Space	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
4889-58014 Facilities Management - Computers/Phon	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
4889-58015 Facilities Management - Other	58.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.47
81912271UA Support & Personnel Services	105.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	105.33
4889-58021 Training Support	9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.08
81912271UC Training	9.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.08
122271 Administration	114.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.41
1.2.22.7.1	114.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.41
1.2.22.7	114.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	114.41

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1.2.22	771.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	771.35
1.2 OPERATING	777.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	777.85
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	777.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	777.85
FTEs													
FEDERAL	42.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT	35.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL	77.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	