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

DEC 0 4 1998

OVERNIGHT MAIL

Sandra L. Wastler
High Level Waste & Uranium Recovery
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
2 White Flint North
Rockville, MD 20852

SUBMITTAL OF PARTICIPANTS' MONTHLY PROGRESS REPORT

As you have requested, the U.S. Nuclear Regulatory Commission is on distribution to receive a copy of the Yucca Mountain Site Characterization Project participants' monthly status report on a regular basis. Enclosed is the U.S. Geological Survey Progress Report for October 1998.

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

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

OL&RC:AVG-0411

Enclosure:
Ltr, 11/16/98, Craig to Kozai, w/encl.

NH12
102.8
WM-11

YMP-5

REC 12/7/98

cc w/encl:
L. H. Barrett, DOE/HQ (RW-1) FORS
A. B. Brownstein, DOE/HQ (RW-52) FORS
C. E. Einberg, DOE/HQ (RW-52) FORS
S. H. Hanauer, DOE/HQ (RW-2) FORS
R. A. Milner, DOE/HQ (RW-2) FORS
Samuel Rousso, DOE/HQ (RW-50) FORS
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Washington, DC
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United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Box 25046 M.S. 425
Denver Federal Center
Denver, Colorado 80225

IN REPLY REFER TO:

INFORMATION ONLY

November 16, 1998

Wayne Kozai
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
P.O. Box 30307
Las Vegas, Nevada 89036-0307

SUBJECT: Yucca Mountain Project Branch - U.S. Geological Survey (YMPB-USGS) Progress Report, October, 1998

Attached is the USGS progress report in the required format for the month of October, 1998.

If you have any questions or need further information, please call Raye Ritchey Arnold at (303)236-0516, ext. 282.

Sincerely,

Raye R. Arnold

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

Enclosure:
cc: J. Bresee, DOE/OCRWM-HQ/Forrestal
S. Hanauer, DOE/Forrestal
R. Dyer, DOE, Las Vegas
C. Fox, DOE, Las Vegas
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Enclosure

R. Patterson, DOE, Las Vegas
R. Spence, DOE, Las Vegas
T. Sullivan, DOE, Las Vegas
M. Tynan, DOE, Las Vegas
D. Williams, DOE, Las Vegas
C. Glenn, NRC, Las Vegas (2 copies)
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A. Whiteside, SAIC, Denver

U.S. GEOLOGICAL SURVEY
EXECUTIVE SUMMARY

October 1998

COORDINATION and PLANNING

The U.S. Geological Survey-Yucca Mountain Project Branch currently is processing some 43 documents prepared by USGS authors. Of these listed items, 25 are USGS reports, 12 are journal articles, and six are abstracts. For the month of October, four complete publication packages (one open-file report, two Proceedings, and one WRIR), one supplement to a record package, and one correction to a record package were sent to the Records Coordinator for submittal to the Records Processing Center. Four OSTI packages were sent to DOE. Sixteen QA deficiencies were resolved and sent to the Records Coordinator for submittal to the RPC.

Reports published in October:

Kwicklis, E.M., Thamir, Falah, Healy, R.W., and Hampson, David, 1998, Numerical simulation of air- and water-flow experiments in a block of variably saturated, fractured tuff from Yucca Mountain, Nevada: U.S. Geological Survey Water-Resources Investigations Report 97-4274, 64 p.

Potter, C.J., Day, W.C., San Juan, Carma, Sweetkind, D.S., and Drake, R.M., II, 1998, Pre-construction geologic section along the cross drift through the potential high-level radioactive waste repository, Yucca Mountain, Nye County, Nevada: U.S. Geological Survey Open-File Report 98-530, 24 p., 1 plate, scale 1:6,000.

GEOLOGY

Geologic Framework

Staff developed a description of lithologic units and contacts from USW SD-6 and participated in the technical review of SD-6 contacts. Stratigraphic-studies staff visited the ECRB Cross Drift on November 2 to review stratigraphy throughout the tunnel.

Excavation of the ECRB Cross Drift halted on October 14 at Station 26+81. The tunnel boring machine (TBM) will remain in the tunnel at the heading, awaiting possible future exploration. In the interim, mapping will proceed as far up the trailing gear as visibility of the tunnel walls through the various equipment associated with the TBM will allow. The main splay of the Solitario Canyon fault (SCF) was encountered between Stations 25+84 and 25+87. Intensely fractured rock associated with the footwall of the SCF extends nearly to Station 25+30. Intensely fractured materials in the hanging wall extended to approximately station 26+00. The underground mapping team completed characterization of the Cross Drift as follows:

Full-periphery geologic mapping was completed to Station 25+00
Detailed line surveys were completed along the left wall of the drift to Station 25+25
RQD evaluations were completed to Station 25+00
Q and RMR evaluations were completed to Station 23+90.

The fracture studies/structural group provided support to several studies. In support to isotopic age studies, USGS and LANL personnel conducted a field trip into the Cross Drift on October 5 and 6 to select sampling locations for chlorine-36 analyses. The major objective of those samples is to test the accuracy of predictions made by LANL, USGS and LBNL staff about the distribution of that radionuclide in the drift, including occurrence of bomb-pulse ^{36}Cl. The sample-reconnaissance trip focused solely on the selection

of sites from fractured and faulted portions of the tunnel, as far as the trailing gear of the TBM at Station 26+00. In response to one of the comments of the Chlorine-36 Peer Review, staff developed a reproducible protocol for selecting sample locations. Application of those criteria has resulted in identification of 63 locations to be sampled out to Station 26+00. USGS staff consulted with U.S. Bureau of Reclamation personnel regarding interpretations shown on a post-construction cross-section along the Cross-Drift alignment. In regard to fault-zone studies, staff spent two days in the field examining fault zones in the vicinity of the central block of Yucca Mountain and at Jet Ridge. Much of the time was spent evaluating the amount of outcrop available for study at specific fault zones and what attributes of fault zones were available for study in the field. Subsequent discussions with QA staff explored necessary modifications to technical procedures to cover data collected from fault zones. In structural support to TSPA/VA and LA, staff finalized for review cross sections, depictions of subsurface geologic structure, and the text for the 1:50,000-scale geologic map compilation for the SZ Site Area. Those maps, sections, and text were submitted for USGS peer review on October 7. Staff conducted one week of technical field reviews for the 1:50,000-scale geologic map compilation for the SZ Site Area and began to address reviewers' comments.

In unscheduled work, staff co-led the Friends of the Pleistocene Field trip, and in other work, completed final edits to a draft version of a USGS open-file report on the cross-block drift. Other staff worked on edits for a draft version of a USGS open-file report on the Fran Ridge pavement study.

HYDROLOGY

Unsaturated-Zone Hydrology

Borehole data from NRG-7a, UZ #4, UZ #5, UZ-7a, and SD-12 were transferred to Denver, converted to engineering units, and archived on a routine basis throughout the month. Sensor readings were checked daily for unusual occurrences, and statistical outliers were flagged. A monthly backup of data was performed. Staff performed an additional review of YAP12.3Q. Mass-flow controllers and barometers were checked for other staff. Data collected during the period from April 1 to September 30 (1998) were reviewed and assembled in a data package. That data package was sent for technical review. Supporting material, such as calibration records, shelter reports, and electronic diagnostic test results, are being assembled as a records package. Problems with air conditioning occurred at sites 3 (NRG-7a) and 6 (UZ-7a). Problems with UPS units occurred at two sites. The UPS batteries were replaced at site 5 (UZ #4 and #5). Some 27 trips were made to field sites for correcting generator, chiller, UPS, and data-collection problems. Large-instrument UPS units at UZ #4 and #5, UZ-7a, and SD-12 currently are in by-pass mode. Staff are working with Site electricians to identify and remove batteries with defects. Battery failures apparently prevent the UPS units from starting correctly. Staff continued revisions and data checks on F. Thamir's report, *Drilling, logging, and testing information from borehole USW UZ-14, Yucca Mountain, Nevada*. Staff provided continued assistance in resolving problems with macros in lithostratigraphic applications.

Ongoing studies of percolation flux across the repository horizon continued. Installation of heat-dissipation (HD) probes in the Cross Drift was completed. One hundred HD probes now are installed in 2-m drill holes at 25-m intervals from Cross Drift Stations 0+50 to 25+25. No more HD probes will be installed because excavation of the Cross Drift has been stopped, and the TBM obstructs installation of more probes further into the Cross Drift. Water potential was monitored in all those drill holes. Initial analysis of the measured water potentials in the Cross Drift indicated that the rock mass is wetter (that is, the potentials are higher) and that the moisture is more uniformly distributed than expected. Measured potentials in the Cross Drift range between –0.2 and –0.5 bars. To validate these unexpected values, HD probes have been installed at shallower depths to see if drying of the rock mass due to surface evaporation can be detected. Heat-dissipation probes also have been installed with sand instead of silica flour to determine if the silica flour is retaining water from the installation process. Laboratory measurements also are being conducted to validate these measurements. Arrangements are being made to complete drilling and coring of 50 boreholes at 50-m intervals from Cross Drift Stations 0+50 to 25+00. The boreholes are to be 2 m deep except for 6-m boreholes at Stations 5+00, 10+00, 15+00, 20+00, and 25+00. No boreholes will be drilled past Station 25+00 because excavation of the Cross Drift has been stopped, and the TBM obstructs drilling additional boreholes into the Cross Drift near the heading. Physical and hydrologic properties (initial water

content, porosity, bulk density, and water content after drying at 60°C and 65% relative humidity) were measured on core obtained from boreholes located from Cross Drift Stations 0+50 m to 8+00 m. Further core processing has been delayed because of uncertainty in funding for that work and the possibility that the core processing may be postponed in the planning process.

Moisture-related studies continued during the period. In ESF monitoring work, data are being collected, reviewed, and assembled for the data package. Monitoring of temperature, relative humidity, and barometric pressure continued in the ESF Main Drift, niches, and Alcove #7. Data are being collected from 51 HD probes in Alcove #7. Eight surface-based probes monitored the soil moisture potential in and adjacent to the Ghost Dance fault. Collection of dust samples continued in Alcove #7. Twenty-one HD probes monitored the rock water potential in Niche #1. Final preparations are being made to restart the Alcove #1 drip-infiltration experiment. The drip-collection trays have been washed, and all needed items for the water-chemistry program have been ordered. A new tarp has been installed over the infiltration drip lines, and plans are being made for the tracer-injection system. Water applications are expected to resume on November 16. Monitoring of the alcove with 21 HD probes and eight sets of time-domain reflectometry probes continued. Temperature, relative humidity, and barometric pressure currently are being measured in the alcove. Eight HD probes monitored changes in the water potential of the surface soil/rock interface. Moisture was also monitored in the Cross Drift using nine temperature and relative humidity stations. Five of those stations also record wind speed. Some 106 HD probes recorded soil moisture potential 2 m into the rock wall. Those probes are placed every 25 m in the Cross Drift. Fifty HQ-sized drill holes are being neutron-logged periodically to monitor tunnel-wall dry-out.

In air-permeability work, the Northern Ghost Dance Fault Testing data package has been completed and submitted for technical review. That data package contains all required information and supporting documents including scientific notebook and calibration documents for all field equipment used, and the package meets all YMP QA requirements. Analysis of the Ghost Dance Fault pneumatic and tracer testing, and report preparation, continued. USGS scientists successfully developed both an equivalent-continuum model and a discrete-fracture model that replicate the field-test pressure and tracer-transport responses.

Isotopic analysis contributed to several activities. USGS staff presented results of strontium and uranium analysis on the Single Heater Test water at the quarterly thermal test workshop held at LLNL.

Work in unsaturated-zone hydrochemistry continued. Preparation of the draft report on correction of perched water ^{14}C ages (by P. Glynn of USGS-National Research Program) continued. A paper titled *Isotopic evidence for the origin of low-temperature calcite and opal exposed in an underground laboratory at Yucca Mountain, Nevada* was presented by B. Marshall at the Geological Society of America annual meeting in Toronto on October 29, reporting strontium work. Strontium analysis also continued of SD-12 whole-rock samples and pore-water salts. Eight WT-24 water samples were prepared for tritium analysis and counted for tritium concentration, and the data were reduced; similar work was done on eight water samples from WT-24 and SD-6. Pore water was extracted by centrifuge methods from four WT-24 core samples with moisture contents between 10 and 20 percent. The extracted pore water will be analyzed for major ions. Pore water also was extracted from six SD-6 and two WT-24 core samples by vacuum distillation. That extracted pore water will be analyzed for tritium, D/H, and $^{18}O/^{16}O$ isotopes. Two SD-6 and four WT-24 water samples were analyzed for anions; six SD-6, one SD-9, and ten WT-24 water samples were analyzed for silica; and two SD-6, one SD-9, and nine WT-24 water samples were analyzed for alkalinity. Pore water collected from two WT-24 core samples using high-pressure one-dimensional compression will be analyzed for carbon isotopes. Pore water was extracted by centrifuge methods from six SD-6 core samples. Those pore-water samples will be analyzed for major ions and stable isotopes. Dissolved CO_2 and pore water were extracted from six ESF core samples using distillation methods. Extracted CO_2 will be analyzed for carbon isotopes, and the extracted pore water will be analyzed for tritium. Water samples analyzed for tritium and for major-ion chemistry during October were recorded in the respective data bases. Water collection by centrifuge, compression and distillation during October was recorded in the water-collection database. The liquid-scintillation counter was calibrated.

Saturated-Zone Hydrology

The USGS will contribute to the Level 3 LANL milestone on hydraulic and tracer testing in the Prow Pass interval in the C-hole wells. Planning was accomplished for a joint meeting to be held in Denver on November 10. Revisions were made to the hydraulic-testing planning documents during October and will be presented at that meeting. The tracer-test analysis currently is in progress, and the conservative tracer part will be written after completion of that analysis. The USGS supported LANL in the Prow Pass reactive tracer testing at the C-hole complex, providing as-needed support on equipment and data-acquisition software. While the reactive tracer test of LANL proceeded, the conservative tracer tests that the USGS had initiated from c#3 to c#2 and from c#1 to c#2 also progressed concurrently. Samples of water from the pumped well (c#2), taken at four-hour intervals, are being transported once a week from the C-holes to UNLV in Las Vegas for analysis. Analysis of those c#2 samples continued for iodide and 2,4,5 trifluorobenzoic acid, the tracers that were injected into c#3 on June 17, and for 2,3,4,5 tetrafluorobenzoic acid, the tracer injected into c#1 on July 31.

Routine water-level measurements were conducted in numerous boreholes, including USW H-3 (upper and lower intervals) and USW H-1 on October 6; UE-25 J-11 and USW H-4 (lower interval) on October 7; USW VH-1 and USBLM on October 8; UE-25 WT#4 on October 13; UE-25 WT#16 on October 14; UE-25 WT#15, USW WT-2, UE-25 p#1, and UE-25 WT#13 on October 15; USW H-1 (tubes 1, 2, 3, and 4) on October 19; UE-25 J-13, UE-25 J-12, UE-25 WT#12, and USW H-5 (upper and lower intervals) on October 20; UE-25 WT#17 and UE-25 WT#3 on October 21; USW H-6 (upper and lower intervals), USW WT-7, and USW WT-10 on October 22; USW H-4 (lower interval) on October 26; and USW WT-24 on October 27. (All boreholes were measured with Chain 3 except UE-25 WT#3, UE-25 WT#17, and USW WT-24. Those boreholes were measured with the multiconductor cable unit.) Data were retrieved from USW G-2 and UE-25 WT#6 through October 28. Level 4 milestone **SPH37KM4 [Memo to TPO: July to September 1998 periodic water-level data to RPC]** was completed ahead of schedule and reported to the TPO on October 7.

Through October 30, total depth of borehole USW WT-24 remained at 2,834 ft below land surface (bls). Further work awaited funding for completion into the lower volcanic aquifer. No drilling activity occurred during October. Measurement of the water level in WT-24 was conducted on October 27. Work began on the interpretive report describing hydraulic testing on the perched water body in WT-24; that report is expected to enter review during November. Drilling activity at USW SD-6 also was stalled during October, as operations awaited arrangement by the M&O of a contractor to attempt to fish the drill bit and several joints of drill pipe out of the borehole. Total depth remained at 2,541 ft bls, and no testing occurred in SD-6 during the reporting period. Other staff continued work to synthesize existing isotopic and hydrochemical data of water from SZ wells.

The USGS provided support to SZ flow-model abstractions. Staff discussed involvement in the SZ Testing/Abstraction Workshop with W. Arnold of SNL during a meeting of the SZ modeling team on October 19.

CLIMATE and PALEOHYDROLOGY

In work in support of studies of fracture and cavity calcite, USGS and UNLV personnel jointly collected 21 samples for fluid-inclusion and isotopic studies from the Cross Drift. Supplementary collecting trips are likely, pending additional funding.

In studies of calcite and opal, staff collected 20 samples of secondary hydrogenic mineralization from the Cross Drift between Stations 25 and 8 during the last two days of September. Deposits of calcite and opal mainly were collected from lithophysal cavities. Samples were brought back to the laboratory in Denver where they were logged into the HD sample-tracking system. In addition, samples were photographed, briefly described, and sectioned for petrographic and fluid-inclusion chips. Samples also will be subsampled for isotope and geochronological studies in the next several months.

Staff collected literature relating to development of uranium-transport models. Previously collected data indicate that the natural isotopes of uranium are fractionated by chemical processes within the Yucca Mountain unsaturated zone from small activity ratios in surface deposits to larger activity ratios at depth and in saturated-zone water. Therefore, the two isotopes must be treated as independent parameters that have different reaction properties. Efforts will continue in November to establish a simple model of mass balances that assesses the sensitivity of the volume of flux along a flow path to the resulting $^{234}U/^{238}U$ activity ratio.

SPECIAL STUDIES

Staff began the process of taking geochemical and mineralogical data and description from Chapter 6 of the Site Description and integrating that material into Chapter 3 where it supports description of the surficial and site geology. The PI attended mandatory training on preparation of the WDLA; additional staff will participate in a WDLA workshop (and training) in November.

The USGS technical lead conducted a review of Site Characterization Progress Report #19 and the Documentation of Program Change (DPC, Revision 1). The review was conducted at the request of the USGS TPO as part of the M&O/USGS Management Review of the two documents. A total of 18 comments were submitted on electronic comment forms. Eleven of the comments were on PR #19, and the remainder were on the DPC. Much of the review effort was expended on verifying correct incorporation of USGS input to the two documents. Work began on verifying all reference citations in the DPC, which involved supplying section and/or page numbers for the documents cited.

WATER-RESOURCES MONITORING

Staff obtained periodic water-level measurements from the site-characterization program and compiled data on ground-water levels for six sites for the period April through June 1998. Data on ground-water levels and discharges collected and compiled for monitoring sites during the period July through September 1998 were reviewed. Staff prepared and delivered to DOE and TRW/SAIC on October 30 a letter report on fourth-quarter FY1998 water-resources monitoring in completion of Level 3 milestone **SSH14HM3 [Letter Report: 4th Quarter FY98]**.

Ground-water levels were measured at 34 sites, and ground-water discharge was measured at one flowing well. Staff checked and filed ground-water data collected during September. Basic information for seven monitoring sites (such as latitude and longitude) was checked and refined.

Discussions continued with USGS-NV District managers concerning personnel assignments and reorganization of the Nevada District. Additional discussions related to FY1999 monitoring activities and funding continued with USGS-NV District, USGS-YMPB and TRW/SAIC officials. Staff responded to USGS-NV District Chief review comments pertaining to the summary monitoring report for calendar year 1997 (FY1998 milestone SSH13NM3) and forwarded that report to USGS-YMPB on October 28 for QA and policy reviews and approval.

USGS Level 3 Milestone Report

October 1, 1998 - October 31, 1998

Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comments
Letter Report: 4th Qtr FY98 **Milestone Number:** SSH14HM3	10/30/98	10/29/98	10/29/98	

YMP PLANNING AND CONTROL SYSTEM (PACS

MONTHLY COST/FTE REPORT

Participant U.S. Geological Surve
Date Prepared 11/10/98 03:23 PM

Fiscal Month/Year October 31, 1998

	CURRENT MONTH END						FISCAL YEAR		
WBS ELEMENT	ACTUAL COSTS	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS	APPROVED BUDGET	APPROVED FUNDS	CUMMULATIVE COSTS
1.2.1	44	1026	244	0	0	0	0	0	44
1.2.3	640	10918	2847	0	0	0	0	0	640
1.2.5	40	232	707	0	0	0	0	0	40
1.2.8	23	656	0	0	0	0	0	0	23
1.2.9	42	472	332	0	0	0	0	0	42
1.2.12	10	352	0	0	0	0	0	0	10
1.2.15	120	1196	422	0	0	0	0	0	120
	919	14852	4552	0	0	0	0	0	919

USGS Level 4 Milestone Report

October 1, 1998 - October 31,
Sorted by Baseline Date

Deliverable	Due Date	Expected Date	Completed Date	Comment
Cross-Drift Q Stratigraphic Picks to TDB **Milestone** SPG470M4	10/15/98	11/30/98		
FY99 milestone (from FY98/outyears schedule) delivered in October				
Water-Level Altitude Data from the Periodic Network 10/1/97 through 6/30/98 **Milestone** SPH37KM4	10/30/98	10/30/98	10/9/98	Not in FY99 planning
Late FY98 milestones delivered in October				
Memo to TPO: Analy Cond for Input to Site Scale Mdl **Milestone** SPH253M4	9/30/98	9/30/98	10/2/98	
Memo to TPO: Analy Boundary Conds Oct-Jul 98 **Milestone** SPH225M4	9/30/98	9/30/98	10/2/98	
Memo to TPO: Chem/Iso Analy on Wtr Samples WT-17 **Milestone** SPC34CM4	9/15/97	9/30/98	10/8/98	

U.S. GEOLOGICAL SURVEY
ESTIMATED COSTS FOR October 1, 1998 October 31, 1998
11/10/98 3:13:13 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
0G1CM81	Conduct Engineering Assurance Activiti	38,040.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,040.99
81912019U1	Engineering Assurance FY99	38,040.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,040.99
	Personnel Qualifications - Deferred	3,040.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3,040.45
0G1CM82	Support Line Org. Doc. Issues/Backlog	2,848.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,848.00
81912019UX	Support Line Organization, Docume	5,888.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5,888.45
81912019		43,929.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43,929.44
1.2.1		43,929.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43,929.44
0G33124M89	Conduct Air-K & Hydrochemistry Testing	61,970.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61,970.80
0G33124M8F	Characterize Seepage into Alcoves I	14,137.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14,137.61
0G33124M86	Characterize Seepage into Alcoves II	1,745.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,745.00
0G33127M82	Conduct Isotopic & Hydrochemical Anal	16,160.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16,160.87
0G36221M81	Conduct Fluid Inclusion Studies	4,410.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,410.70
0G36221M83	Cond Frac Mineral Dtg & Iso Analy - ES	32,242.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32,242.01
81912025U1	Moisture Monitoring & Fault Fractur	130,666.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130,666.99
0G36221M85	Water Flux Thru Repository Block	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912025UX	Geochronology of Fracture Minerals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912025		130,666.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130,666.99
0G33131M82	Cond. Hydraulic & Tracer Testing of Pro	39,941.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39,941.23
0G33132M81	Cond Isotopic & Hydrochemical Studies	8,582.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,582.48
0G3XXXM81	Oversee Nye County Drilling Program	8,326.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,326.21
81912029U1	SZ Data Analysis for SR FY99	56,849.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56,849.92
81912029		56,849.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56,849.92
	Comp. Geo. Interpretations - Cross Sect	2,141.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,141.00
	Reduce Uncertainty - Recharge Work	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Ground Water Flow Modeling	409.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	409.14
	Reduce Uncertainty - Hydrochemical Flo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Hydrogeologic Framework Model	8,057.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,057.21
	Comp. Geo. Interpretations - Hydrostruc	2,374.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,374.42
	Comp. Geo. Interpretations - Geologic	7,394.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7,394.23
	Comp. Geo. Interpretations - Amargosa	2,510.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,510.79
0G33133M82	Conduct LA SZ Flow Model Sensitivity A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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0G33133M83	Refine Geologic Framework Model	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33133M84	Develop Regional SZ Model	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912031U1	Regional and Site Scale Saturated Z	22,886.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22,886.79
0G33132M82	Iso & Hhdrochem Studies SZ Water (WT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33133M87	Reduce Uncertain Flux Values to Calibr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33133M8A	Refine Regional Hydrogeologic Framew	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912031UX	SZ Modeling & Hydrochem Studies (	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912031		22,886.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22,886.79
0G32212M87	Conduct Geologic Mapping of the ECRB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912050U2	Geologic Testing in the ECRB FY99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33124M88	Eval Percolation Flux Across Repository	3,559.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3,559.90
0G33124M89	Conduct Moisture Monitoring in the ESF	17,091.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17,091.00
0G36221M84	Cond E-W X-Drift Frac Min Dtng & Isoto	21,218.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21,218.10
81912050U3	Moisture Monitoring & Infiltration St	41,869.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41,869.00
0G32212F85	Conduct Geologic Mapping of the ECRB	75,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75,000.00
81912050UX	Geologic Mapping of the ECRB (Def	75,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75,000.00
81912050		116,869.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	116,869.00
0G32211M83	Complete Stratigraphic Descriptions UZ-	571.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	571.33
0G32211M85	Correlate Lithostratigraphy & Geophysic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G32212M81	Provide Structural Support to Isotopic A	3,970.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3,970.15
0G32212M82	Conduct Fracture Syn in Sup of Reposit	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G32212M83	Conduct Spatial Analysis of Fracture Int	361.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	361.00
0G32212M84	Provide Geo Sup to LBNL Geophys Inve	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G32212M85	Evaluate Short Trace Length Fract. Distr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G32212M86	Char. Structure of Alcove - X-Drift Infil. E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G32212M88	Conduct Fault Zone Studies	936.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	936.56
0G32212M89	Provide Structural Support to TSPA/VA	29,844.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29,844.78
0G395M81	Provide USGS Support to 3-D Model: G	17,445.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17,445.82
0G395M82	Provide USGS Support to 3-D Model: St	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912210U1	Geologic Studies FY99	53,129.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53,129.64
0G32211M82	Conduct Stratigraphic Descriptions	8,854.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,854.32
81912210UX	Stratigraphic Description of SD6WT	8,854.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,854.32

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81912210		61,983.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	61,983.96
0G33124M8F	Characterize Seepage into Alcoves I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33124M8G	Characterize Seepage into Alcoves II	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33127M82	Cond Iso/Hydrochem Studies of UZ & P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912215U1	Moisture Monitoring & Fault Fractur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Paleodischarge/Paleoclimate - Deferred	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912215UX	Paleodischarge/Paleoclimate (Deferr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912215		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33132M81	Cond Isotopic & Hydrochemical Studies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G3XXXM82	Oversee Nye County Drilling Program	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81912245U1	SZ Data Analysis for SR/LA FY99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33127M83	Iso & Hydrochem Studies of UZ Water a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G33131M8G	SZ Hydrologic Testing	8,955.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,955.01
81912245UX	SZ Testing & UZ Hydrochemistry (D	8,955.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,955.01
81912245		8,955.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,955.01
0G398M89	Support Preparation of the WDLA	26,262.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26,262.49
81916105U1	Support for Preparation of the WDL	26,262.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26,262.49
0G32836M81	Rvw Impacts of New Data on Volcanic &	15,736.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15,736.67
0G33129M81	Provide Updated UZ Model Abstractions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G331XXM81	Provide Support to Flow & Transport Mo	3,942.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3,942.01
81916105U2	Review of Literature and Special Stu	19,678.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19,678.68
0G398MA1	Support Peer Reviews	4,933.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4,933.31
0G398MA1	Support Semiannual Progress Reports	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G398MA1	Support Topical Rpts; NWTRB, ACNW,	5,781.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5,781.12
0G398MA1	Support Closeout Activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0G398MA1	Supports KTIs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81916105U3	Technical Interactions and Special P	10,714.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10,714.43
81916105		56,655.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56,655.60
0G33127M81	Conduct Chem. & Isotopic Analyses Drif	9,256.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9,256.98
81916107U1	Isotope Support for Thermal Testing	9,256.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9,256.98
81916107		9,256.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9,256.98

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0G33131H81	Conduct Water-Level Monitoring	7,277.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7,277.45
81917027U1	Long-Term PC Monitoring FY99	7,277.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7,277.45
81917027		7,277.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7,277.45
	Unfunded Work	91,667.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91,667.74
0G31H81	Support Scientific Programs Mgmt & Int	9,794.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9,794.75
0G31H82	Manage Nevada Operations/Earth Scien	40,391.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40,391.25
81919090U1	USGS SP&I FY99	141,853.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	141,853.74
0G39BHA1C	Provide Site Investigations Technical Su	27,103.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27,103.51
81919090U3	USGS Site Investigations Technical	27,103.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27,103.51
0G39BHA2C	Support QA Compliance, Implementatio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81919090U4	QA Compliance, Implementation, an	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81919090		168,957.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	168,957.25
	1.2.3	640,358.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	640,358.95
0G54XX	Provide Support to Performance Assess	903.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	903.77
81912220U1	USGS Support to Performance Asse	903.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	903.77
81912220		903.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	903.77
0G535H81	Provide Technical Data Coordination	38,790.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,790.52
81912470U1	Technical Data Management FY99	38,790.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,790.52
81912470		38,790.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38,790.52
	1.2.5	39,694.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39,694.29
0G825H81	Implement Federal Safety & Occupation	6,840.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,840.05
81919121U1	Federal Occupational Safety & Healt	6,840.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,840.05
0G847H81	Conduct Water Resources Studies	15,808.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15,808.00
81919121U2	Water Resources FY99	15,808.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15,808.00
81919121		22,648.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22,648.05
	1.2.8	22,648.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22,648.05
0G912H81	Provide TPO Office Support	14,295.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14,295.88
81919135U1	USGS Project Management FY99	14,295.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14,295.88
0G922H81	Conduct Project Control Activities	27,740.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27,740.32
81919135U2	USGS Project Control FY99	27,740.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27,740.32
81919135		42,036.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42,036.20

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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
1.2.9		42,036.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42,036.20
0GC522H81	Conduct Satellite Records Operations	10,272.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10,272.38
81919197U1	USGS Satellite Records Operations	10,272.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10,272.38
81919197		10,272.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10,272.38
1.2.12		10,272.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10,272.38
0GF23H81	Provide Support/Personnel Services	18,827.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18,827.12
0GF23H85	Provide Procurement & Property Manag	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0GF23H86	Provide Computer Support	13,614.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13,614.56
81919110U1	Personnel, Procurement, Property S	32,441.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32,441.68
0GF23H82	Provide Facilities Management (space)	65,333.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65,333.33
0GF23H83	Provide Facilities Management (comput	13,666.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13,666.67
0GF23H84	Provide Facilities Management (other)	2,500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,500.00
81919110U2	Facilities Management (USGS)	81,500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81,500.00
0GF3H81	Provide USGS Training Support	6,082.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,082.08
81919111U1	USGS Training Support	6,082.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,082.08
81919110		120,023.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	120,023.76
1.2.15		120,023.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	120,023.76
1.2 OPERATING		918,963.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	918,963.07
CAPITAL EQUIPMENT		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRAND TOTAL		918,963.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	918,963.07
FTEs														
FEDERAL		86.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CONTRACT		29.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL		115.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	