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9/13/93*

Department of the Interior
United States Geological Survey
YUCCA MOUNTAIN PROJECT
Monthly Highlights and Status Report
APRIL 1993

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1.2.1 SYSTEMS ENGINEERING

OBJECTIVE

To apply the systems engineering discipline to transform the regulatory requirements into functional needs of the MGDS design, system configuration, and site characterization activities.

WBS No. 1.2.1.6 Configuration Management

OBJECTIVE

To develop and maintain a configuration management system and provide associated support to the CCB.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Procedure HP-209, R0, was modified due to a baseline document change.

Configuration Management Control Guidelines were submitted for review for Document Control, Cost/Schedule Change Control, and Field Change Control. Preparations began to establish the PI QA/Project Training Program.

1.2.3 SITE

OBJECTIVE

To characterize Yucca Mountain and vicinity to identify and technically qualify a possible site for the construction and operation of a mined geologic repository for high-level radioactive waste.

WBS 1.2.3.1 Coordination and Planning

Principal Investigator - L. Hayes

OBJECTIVE

To coordinate and plan the work performed within the site WBS elements.

M&I - Geologic Studies Program 0G3193G1

Summary Account Manager - J. Stuckless

ACTIVITIES AND ACCOMPLISHMENTS

M&I QA Implementation GSP 0G3193G2

Summary Account Manager - J. Stuckless

ACTIVITIES AND ACCOMPLISHMENTS

QA assistance was provided to the trilateration data collection task and the shallow seismic refraction task. Preparation of a map depicting sample locations was coordinated for inclusion in the calcite silica working paper.

Eight GSP technical procedures were processed this month.

Ten Management Agreements were approved and distributed, and record packages were submitted.

M&I - Hydrology Program Management and Administration 0G3193H1

Summary Account Manager - D. Gillies

ACTIVITIES AND ACCOMPLISHMENTS

All 62 USGS and LBL hydrology summary-account schedules were statused as of the end of March using schedule-status, progress, and variance information provided by each summary-account manager. Four accounts showed relatively small negative schedule variances, none of which have any impact on major milestones, and which probably can be made-up by the end of FY93. The largest negative schedule variance (-16 K) is occurring in "Site Potentiometric-Level Evaluation" and is caused by a delay in preparation of the 1990-91 water-level-data report. The primary cause of this delay was the diversion of staff early in FY93 to document the impact of last summer's earthquakes on water levels near Yucca Mountain. Seven summary accounts showed cost variances greater than 25 K, five of which are underruns and two of which are overruns. The five underruns are caused by administrative delays in the execution of pending contracts and in the filling of personnel vacancies. All of the necessary administrative actions have been executed and these cost variances probably will be near zero by the end of FY93. The two overruns have resulted, respectively, from higher than expected costs at the USBR to complete the C-wells testing equipment, and from the lack of funding to support hydrology-program data base development.

G. Allen, DOE Office of the Inspector General, interviewed a number of hydrology-program staff members.

The Saturated-zone/Quaternary hydrology section quality-assurance specialists met twice during April to review and status QA action items that are due in the near future. A comparison of the levels of QA implementation among the various projects also was made.

D. Appel, D. Gillies, M. Chornack, and R. Luckey attended the International High-Level Radioactive Waste Conference.

Hydrology-program management staff began reviewing the FY94 Draft Annual Plan for Site Characterization prepared by the CRWMS/M&O. Comments on the plan will be presented at the YMP Technical Advisory Group meeting on May 14, 1993.

M. Chornack presented the overview of geology, hydrology, and meteorology to four tour groups as a part of the YMP public open-house and tour. Chornack also assisted with the Yucca Mountain field trip for the IHLRWM Conference.

M&I QA Implementation, Hydrology 0G3193H2

Summary Account Manager - W. Causseaux

ACTIVITIES AND ACCOMPLISHMENTS

Ten preliminary draft technical procedures and/or modifications were prepared or changed.

Technical Procedures

S. Frans of HIP currently is processing 46 Hydrologic Procedures and Scientific Notebook Plans.

HIP Technical Procedures - HP-60, R3, HP-178, R1, HP-243, R0, HP-247, R0, and HP-260, R1 were approved

Quality Management Procedures

M. Chornack and M. Ciesnik performed a review of QMP-1.01.

J. Watson, W. Steinkampf, G. Severson, and S. Boucher reviewed QMP-3.15.

W. Steinkampf and M. Ciesnik submitted a proposed revision of QMP-5.05, R3 to the QAO for consideration.

M. Kurzmack and M. Ciesnik performed a QA review of QMP-3.03, R3-M3.

A proposed QMP revision of QMP-4.01, R5, was compiled by W. Causseaux and G. O'Brien of HIP, and P. Reilly and D. O'Leary of GSP, and submitted to the YMPB.

Open Items

M. Pabst provided investigative support to YMP-USGS Branch staff to supply TDIF and data submittal information as a part of the USGS-CAR-92-08 corrective actions, and performed an investigation and prepared a response for USGS-NCR-93-10 (Improper receiving review for a Hewlett Packard procurement).

J. Woolverton submitted a proposed remedial action plan for USGS-NCR-93-13, and USGS-NCR-93-14. Both nonconformances document deficiencies related to improper reports processing.

M. Ciesnik prepared the proposed disposition to NCR-93-12 and submitted it to the QAO for approval.

Audits

M. Pabst attended the entrance meeting for internal audit USGS-93-08.

Management Agreements

The MA between HIP and the USBR for work on Activity 8.3.1.2.3.1.4-5 was approved and distributed, and the records package was submitted to the LRC.

QA Training

Quality Assurance staff members attended training for QMP-4.01, QMP-7.01, QMP-7.04, QMP-3.03, and for prevention of sexual harassment.

Meetings and Travel

QA staff members attended the YMP-USGS Open Items meeting.

Records Management

M. Pabst prepared a TDIF for a data report supporting Activity 1.2.3.3.1.1.2.

Computer Operation & Data Management, Hydrology 0G3193H3

Summary Account Manager - C. Washington

ACTIVITIES AND ACCOMPLISHMENTS

Novell System

Most of this month was spent composing the HIP Newsletter and checking files for viruses. The Central Point Anti-Virus program was installed as a menu item on the Novell system. Clients were instructed to run the program on every diskette before using.

The speed of the Novell LAN increased dramatically because of installation of new cable and running backups after hours directly on the server.

Unix System

The COU conducted extensive tests to check the throughput of telecommunication links. These tests were run as a prelude to testing the telecommunication links to the HRF. The tests in Denver show that the link to the HRF may be too slow for client to client applications. The same tests will be performed from the HRF during the Month of May.

Numerous software packages were updated on the Unix systems.

YMPB, Las Vegas

The offices in Las Vegas have been wired and the clients are able to connect to all of HIP's systems, as well as DOE's Vaxes.

Field Operations Center (FOC)

DOE has not given a definite date for wiring the FOC. The COU will be replacing the existing router in the FOC with a local bridge to assist DOE SAIC/LV in connection with the clients in the FOC. This is being done because the USGS already has a Class "C" license and SAIC/LV would have to apply for one to connect everyone. The use of the USGS license would expedite bringing the FOC online.

Miscellaneous

The COU spent a considerable amount of time completing the DOE IRM Short Range Plan and associated documents.

The COU attended the GERT training, sexual harassment course, procurement integrity workshop, procurement workshop (QMP-4.01 R4) and a Government Computer Conference.

Scientific Reports and Project Documents, Hydrology 0G3193H4 Summary Account Manager - T. Brady

ACTIVITIES AND ACCOMPLISHMENTS

Scientific Reports Processing

J. LaMonaca, HIP-YMPB, currently is processing 89 YMP-HIP scientific publications, 66 YMP-GSP scientific publications, 13 YMP-LBL scientific publications, and 38 abstracts.

Tim Brady completed the HIP review of reports, "*An improved method for quantifying soil macroporosity*", by V. Vermeul, J. Istok, A. Flint, and J. Pikul; "*Past precipitation and air temperature reconstructions*", by A. Smith and R. Forester; "*Ground-water data from wells in Nye and Inyo Counties, Nevada-California*", by M. Ciesnik; "*Ground-water recharge estimates using a geomorphic-distributed parameter simulation model approach, Amargosa River Basin, Nevada and California*", by W. Osterkamp, L. Lane, and C. Savard; "*Water chemistry and ostracode occurrence from springs in Colorado, Kansas, and New Mexico*", by E. Gutentag, J. Downey, R. Forester, K. Conrad, and J. Watson; "*Streamflow and selected precipitation data for Yucca Mountain and vicinity, Nye County, Nevada, water years 1983-1985*", by M. Pabst, D. Beck, P. Glancy, and J. Johnson; and "*Pore-water extraction from unsaturated tuff by triaxial and one-dimensional compression methods, Nevada Test Site, Nevada*", by T. Mower, J. Higgins, I. Yang, and C. Peters.

Tim Brady completed the HIP review of abstracts "*Temporal changes in lacustrine chemistry, a measure of perturbations in the hydrologic cycle*", by R. Forester and A. Smith; "*Paleolimnology and paleohydrology of Lake Manitobu, Canada, based on isotope and*

ostracode stratigraphy", by W. Last, J. Teller, and R. Forester; "*Multi-media reverse time USP imaging over complex structures at Yucca Mountain*", by H. Jaramillo, A. Balch, C. Efemir, and J. Rousseau; "*Volcaniclastic, stream gruds fluctuations, and structural events in the rhyolite of Calico Hill, Nevada*", by D. Buesch and R. Dickerson; and "*Petrofabric analysis and spatial clusters of elongate grains in a pyroclastic flow deposit: Implications for process of flow, deposition, and aggradation of the base*", by D. Buesch and L. Dorcheus.

Study Plan Status

W. Causseaux and T. Brady of HIP attended a Study Plan Coordinator meeting in Las Vegas to discuss implementation of the revised version of AP-1.10Q.

WBS 1.2.3.2 Geology

Principal Investigator - J. Stuckless

OBJECTIVE

To conduct geologic investigations to evaluate the suitability of the surface and subsurface environment for siting a nuclear waste repository.

WBS 1.2.3.2.2 Rock Characteristics

OBJECTIVE

To describe present and expected rock characteristics of the Yucca Mountain site and to develop a three-dimensional model of rock characteristics. (SCP Section 8.3.1.4)

WBS 1.2.3.2.2.1 Geologic Framework of the Yucca Mountain Site

OBJECTIVE

To conduct field studies, including surface and subsurface geophysical surveys and geologic mapping on the surface and in the exploratory shaft facility to characterize the geologic framework of the Yucca Mountain site. (SCP Investigation 8.3.1.4.2)

WBS 1.2.3.2.2.1.1 Vertical and Lateral Distribution of Stratigraphic Units within the Site Area

Principal Investigator - R. Spengler

OBJECTIVE

To determine the vertical and lateral variability and emplacement history of stratigraphic units and lithostratigraphic subunits within the Yucca Mountain site area. (SCP Study 8.3.1.4.2.1)

SCP 8.3.1.4.2.1 Vertical & lateral distribution of stratigraphic units LOE Account 0G32211Z93

Summary Account Manager - R. Spengler

ACTIVITIES AND ACCOMPLISHMENTS

R. Spengler and C. Hunter presented papers at the American Nuclear Society High-Level Radioactive Waste Management Conference.

C. Hunter completed minor corrections and enhancements of preliminary cross sections constructed by USGS of proposed ramp alignments and underground excavations of the ESF. Stable-base mylars were produced and transferred to EG&G.

R. Spengler met with Geomatrix Corp. to view preliminary results of gravity and magnetic data presentations by H. Oliver and D. Ponce.

R. Spengler and C. Hunter attended a DOE-sponsored meeting in preparation for the upcoming NRC Technical Exchange on integration of geophysical investigations.

SCP 8.3.1.4.2.1.1 Surface and subsurface stratigraphic studies of the host rock and surrounding units
0G32211A93

Summary Account Manager - C. Hunter

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGU11AA Conduct lithologic logging/synthesize borehole data

D. Buesch and R. Drake worked on revising the technical procedure GP-20, R0, by applying the procedure to point counts of lithophysae, groundmass colors, and clasts in the middle nonlithophysal and lower lithophysal zones of the Topopah Spring tuff.

A partial core log from drill hole RF-8 was compiled at the request of A. Girdley (YMPO) and C. Brechtel (Agapito and Assoc., for SNL) for planning of NRG-2a, and determining the possible fault and valley-fill geometry of the small valley west of Exile Hill along the ESF north ramp alignment.

3GGU21AA Conduct isotopic sampling/ analysis/ evaluation/ synthesis

Z. Peterman prepared an oral presentation to be given at the American Nuclear Society High Level Radioactive Waste Management (ANS HLRWM) Conference on his paper entitled "Isotopic and trace element variability in altered and unaltered tuffs at Yucca Mountain, Nevada".

3GGU400 Construct isopach and structural contour maps

J. Nelson and R. Dickerson completed and delivered a demonstration model of a computer-interactive stratigraphic synthesis of the subdivided Topopah Spring Member at Yucca Mountain including documentation on creation and interpretation of the synthesis. This relates to milestone 3GGU400M RPT/TDIF: EVALUATE STRATIGRAPHIC MODEL/CENTRAL BLOCK.

Quality Assurance:

Personnel completed all assigned reading requirements and training, including GERT.

Revision of Technical Procedure GP-20, R0, "*Volumetric estimation of lithophysae*" is in progress.

Work Performed but not in Direct Support of the Scheduled Tasks

A summary manuscript entitled "*Three-dimensional lithostratigraphic model at Yucca Mountain, Nevada: A framework for fluid transport modeling and engineering design*" by D.C. Buesch, R.W Spengler, J.E. Nelson, and R.P. Dickerson, was submitted for presentation at the Focus '93: Site Characterization and Model Validation meeting, sponsored by the American Nuclear Society and the American Society of Mechanical Engineers.

D. Buesch was involved in various meetings, discussing rock characteristics section involvement, with the ESF and repository design engineers, status of lithologic and structure logging activities, possible

drilling along the Stagecoach Road Fault, specific geometry and regional context of the Ghost Dance Fault and progress on 3-D lithologic modeling in preparation of the paper to be submitted to the Focus '93 meeting. Buesch further provided geologic support to Project participants with discussions of stratigraphic picks in NRG-2 and clarification of structural and engineering concerns about the Ghost Dance and Bow Ridge Faults, the graben west of Exile Hill, and relation to TBM tunneling efforts.

D. Buesch presented a paper at the ANS HLRWM Conference.

SCP 8.3.1.4.2.1.2 Surface-based geophysical surveys 0G32211B93

Summary Account Manager - C. Hunter

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGU265 Analysis of bids for seismic contract

USGS Headquarters' audits of seismic reflection proposals were completed. Negotiations have continued with potential bidders. Planning discussions also have continued with DOE/M&O staff regarding issues of safety and test interference.

3GGU250A Conduct magnetic/gravity investigation in Yucca Wash

H. Oliver and D.Ponce presented preliminary results of new gravity and ground magnetic data sets obtained in Yucca Wash in September 1992.

Quality Assurance:

H. Oliver outlined suggestions for handling software QA for nine software items not covered under the present system. This memo was forwarded to D. Gockel.

Technical Procedure SP-10, R1, "*Deep seismic reflection study of the tectonic environment*" received final approval and was distributed.

Planning and Operations:

H. Oliver, D. Ponce, and V. Langenheim presented papers at the ANS HLRWM Conference.

Variances

Analysis of bids for seismic contract were completed, but negotiations with potential bidders and planning discussions will continue.

Work Performed but not in Direct Support of the Scheduled Tasks

H. Oliver attended a DOE- sponsored meeting in preparation for the upcoming NRC Technical Exchange on integration of geophysical investigations.

SCP 8.3.1.4.2.1.3 Borehole geophysical surveys 0G32211C93

Summary Account Manager - P. Nelson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

3GGU395 Maintain and expand existing data base.

Data from borehole UZ-6, drilled in 1984, and reported recently in OFR 92-28, were entered into the YMP borehole data base. The core data reported in OFR 92-28 include water content and water potential, as well as stratigraphic information.

3GGU371 Run magnetometer/magnetic susceptibility logs.

Magnetic susceptibility and magnetometer logs were acquired in boreholes UZ-16 and NRG-6 at Yucca Mountain. Caliper and gamma-ray logs also were acquired as subsidiary data. Logs were obtained from bottom of casing to a depth just short of driller's total depth, with no operational problems.

Quality Assurance:

P. Nelson attended the half-day YMP-USGS Procurement Workshop.

Work Performed but not in Direct Support of the Scheduled Tasks

P. Nelson presented a paper entitled "*Estimation of water-filled and air-filled porosity in the unsaturated zone, Yucca Mountain, Nevada*" at the ANS HLRWM Conference.

P. Nelson attended a DOE-sponsored meeting in preparation for the upcoming NRC Technical Exchange or. Geophysics Integration.

WBS 1.2.3.2.2.1.2 Structural Features within the Site Area

Principal Investigator - R. Spengler

OBJECTIVE

To determine the frequency, distribution, characteristics, and relative chronology of structural features within the Yucca Mountain site area. (SCP Study 8.3.1.4.2.2)

SCP 8.3.1.4.2.2 Structural features within the site area LOE Account 0G32212Z93

Summary Account Manager - R. Spengler

ACTIVITIES AND ACCOMPLISHMENTS

C. Hunter, representing GSP on the GAC, completed review of ACSRs for two studies and related activities in support of the Tectonics program. These ACSRs were accepted by the GAC at the April meeting.

R. Spengler directed compilation of lithostratigraphic discriminators in the rocks of the Tiva Canyon Member. Spengler and C. Hunter completed administrative reports on lithostratigraphic criteria and proposed design for road cuts in the Ghost Dance Fault study area.

C. Hunter represented GSP/Rock Characteristics in a pre-requisite review of planned activity in ESF underground mapping.

C. Hunter reviewed two papers relating, respectively, to structured events in the Calico Hills volcanic sequence and to petrofabric analysis of pyroclastic rocks.

SCP 8.3.1.4.2.2.1 Geologic mapping of zonal features in the Paintbrush Tuff 0G32212A93

Summary Account Manager - C. Hunter

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGF183A Conduct struct analysis/mapping-exposed fault zones

A. Braun, L. Martin, R. Blackburn, and R. Linden continued field mapping along the Ghost Dance Fault. Criteria for determining the cooling contacts within the Tiva Canyon Member were defined during the March-April trip. The majority of the work was centered on the Antler

Ridge area with some effort spent to the north and south. The entire April trip was focused on providing data for the Field Identification Summary and the Stratigraphic Column for the study area.

3GGF186A Conduct geologic mapping northeast corner of site area

R. Dickerson, assisted by A. Boulton, completed detailed mapping of several square kilometers in Fortymile Canyon. Dickerson completed three measured sections and collected 12 samples keyed to measured sections of the rhyolite of Calico Hills in Fortymile Wash. It was observed that welded tuffs exist within the rhyolite of Calico Hills, and that not all the vitric rhyolitic rocks are lava flows.

Mapping by D. Buesch and R. Drake of the rhyolite of Calico Hills in upper Paintbrush Canyon shows that the lower part of the section consists of about 160 meters of volcanoclastic rocks deposited by pyroclastic flow and fallout and by fluvial processes. The complex interstratification of these rock types has not been documented previously, nor have the implications for stream-grade fluctuation and structural events in the evolving Calico Hills volcanic field been recognized.

D. Buesch and R. Drake conducted reconnaissance mapping of the rhyolite of Calico Hills exposed along the northern flank of Yucca Mountain and on the north flank of Busted Butte. These sections will be compared to the section exposed in upper Paintbrush Canyon to develop the architectural framework of the Calico Hills volcanic field.

An abstract entitled "*Primary and secondary volcanoclastics, stream grade fluctuation, and structural events in the rhyolite of Calico Hills, Nevada*", by D. Buesch and R. Dickerson, was reviewed and approved for submittal to a meeting sponsored by the International Association of Volcanology and Chemistry of the Earth's Interior.

3GGF200A Conduct mapping of western YM/northern Crater Flats

C. Fridrich conducted mapping in Big Dune Quadrangle in support of SCP 8.3.1.17.4.5, "Detachment Faults". Fridrich accompanied W. Hamilton for three days on a field trip in the Death Valley-Yucca Mountain region.

3GGF201A Conduct sampling/evaluation isotopic/geochem phase 1 & 2

Z. Peterman, J. Paces and K. Ludwig participated in a meeting to plan a strategy for investigating U-series dates of calcites precipitated as fracture fillings along the Ghost Dance Fault. The study will attempt to provide information on the timing of the latest rupture and subsequent vadose water infiltration and carbonate mineralization. Peterman completed a proposal for obtaining additional funding for this specific activity, and submitted it to the USGS-YMPB-TPO.

Z. Peterman assisted F. Singer in the petrographic interpretation of samples of the Tiva Canyon tuff collected from Antler Ridge. Information will be used to quantify lithostratigraphic subunits used in mapping offsets along fault traces associated with the Ghost Dance fault zone.

Z. Peterman attended a meeting of participants of the Ghost Dance fault mapping project to assess the quantification of parameters and criteria used in subunit mapping.

B. Widmann, along with F. Singer, spent a day at Yucca Mountain, photo-documenting field relationships of volcanic rocks outcropping in the Raven Canyon geochemical reference section.

Quality Assurance:

The technical procedure GP-18, "*Petrographic analysis of volcanic rocks*", received technical review and is currently in final signature process.

Planning and Operations:

D. Buesch received 1:2000-scale photographic enlargements of the orthophoto quadrangle that includes part of the upper Paintbrush Canyon area. These photographs will be used in the field to locate stratigraphic sections, and to trace individual beds to determine lateral continuity for stratigraphic and structural frameworks.

D. Buesch reviewed a preliminary manuscript from R. Dickerson that summarizes progress on mapping of the rhyolite of Calico Hills.

D. Buesch attended various meetings discussing observations made by R. Dickerson during a recent field trip, to gather information for presentation of the abstract "*Intraformational deformation in the Calico Hills Formation near Yucca Mountain, Nevada*", by D. Buesch and R. Dickerson at the GSA meeting in Reno in May, and a review by F. Singer (SAIC) of petrographic variation in the Tiva Canyon tuff exposed on Antler Ridge.

Work Performed but not in Direct Support of the Scheduled Tasks

An abstract entitled "*Petrofabric analysis and spatial clusters of elongate grains in a pyroclastic flow deposit: Implications for processes of flow, deposition, and aggradation of the base*", by D. Buesch and L. Dorcheus, Mary Harden Baylor College was reviewed and approved for submittal to a meeting sponsored by the International Association of Volcanology and Chemistry of the Earth's Interior. The abstract is an extension of work by Buesch prior to joining the YMP, but methods and results of this work will apply to site characterization studies.

SCP 8.3.1.4.2.2.2 Surface-fracture network studies 0G32212B93

Summary Account Manager - M. Fahy

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGF100 Compile map of Tiva Canyon data area

M. Fahy continued work on the report and drawings for the Tiva Canyon data submittal. First portions will be submitted for USBR management review during the first ten days of May. Fahy and P. Berger are preparing many graphics to supplement the report. Conclusions from this report include the style of fracturing of bedded tuffs at the base of the Tiva Canyon tuff. Both dilative (permeable) and ductile (impermeable) fracturing occurs in the bedded tuffs. Classifying the bedded tuffs as an aquiclude may not be valid.

3GGF081 Map and analyze Fran Ridge ESF pits area

M. Fahy has mapped approximately 46 percent of the area enclosed by P2001 due to construction misstarts at the tunnel. Fahy will wait to review the budget before continuing mapping.

Quality Assurance:

The process to qualify DIPS software continued. M. Wallendorf (SCC member) requested additional test pit data set listings. Fahy will transmit this information as soon as possible.

Variances:

3GGF100 Compile map of Tiva Canyon data area

A Memorandum of Change to the contract was prepared regarding this deliverable. The report is expected to be submitted to R. Spengler for review by May 14, 1993. This relates to milestone 3GGF100M MAP TIVA CANYON FOR REVIEW.

Work Performed but not in Direct Support of the Scheduled Tasks

USBR staff are working on a safety plan pertinent to tunnel mapping crews as a result of Z. Peterman's input toward scientific-crew safety needs compared to construction-crew safety needs. Investigation with R. Craig and L. Johnson (USGS, Las Vegas) indicated that safety at the detail needed for tunnel mapping is really up to the line supervisors (crew chiefs, PI's, etc.). Not much time has been spent on this due to existing priorities, but OSHA and MSHA regulations have been reviewed, and a Job Safety Analysis (JSA) will be prepared with Johnson's help.

Staff worked in support of the underground mapping project and mapping at the North Ramp Portal. Support of mapping was in the plans, but construction delays have required support in excess of planned levels.

SCP 8.3.1.4.2.2.4 Geologic mapping of the exploratory shaft and drifts 0G32212D93

Summary Account Manager - S. Beason

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGF006B Map portal/interpret/submit data

Geologic mapping of the North Ramp Portal for the ESF was completed in March 1993. Two acquired TDIFs were submitted to the Data Management Office, relating to the milestone 3GGF006M DATA SUBMISSION PDA: PORTAL MAP/INTERPRETATION. Acquired data will be submitted to the LRC June 15, 1993.

3GGF003B Prepare conventional map - launch chamber

3GGF013B Prepare photogrammetrical map - launch chamber

Mapping of the North Ramp starter tunnel began on April 14, 1993, after the first blast round. Mapping continued through the end of April to station 0+53 including stereophotography, full-periphery mapping, and detailed line surveys. Seven samples were collected of wall rock, mineral infillings, and fault rubble.

At DOE's request, geologists also worked on a plan-view geologic map of the drainage channel above the portal cut. DOE has requested that USBR/USGS combine information gathered by the North Ramp Portal mapping with the geologic data mapped by Geomatrix to produce an overall geologic map of the Exile Hill area.

Work Performed but not in Direct Support of the Scheduled Tasks

USBR staff are working on a JSA and safety plan pertinent to tunnel mapping crews. OSHA and MSHA regulations have been reviewed. The JSA will be prepared with USGS staff assistance.

Mapping of the drainage channel above the portal cut and integration with Exile Hill data are underway at the request of DOE.

SCP 8.3.1.4.2.2.5 Seismic tomography/vertical seismic profiling 0B32212E93

Summary Account Manager - E. Majer

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGF041 Incorporate/integrate VSP model with Rock Characteristics

Personnel from LANL (H. Kalia) and LBL (E. Majer) were accompanied by personnel from Sandia and Morrison-Knudsen, to inspect the excavations in the portal and to determine what seismic imaging measurements could be made on a timely basis to aid in the prediction of the geologic structure ahead of the tunnel face and of stability of the tunnel. A modest seismic imaging program, that could be added to the existing work with minimal interference with the excavations, was recommended. Recommendations were submitted to R. Spengler, including information on tomographic imaging above and off-end of the tunnel and on high-resolution surface-reflection imaging.

3GGF045 Develop and validate interpretational code

E. Majer submitted a progress report on the interpretational codes. USGS had not received it as of May 3, 1993. This relates to milestone 3GG050M PROGRESS REPORT: CODE VALIDATION.

3GGF040 Acquire and analyze VSP data

Preparation for the field VSP work continued. The final programming and calibration of the field system was completed, and preparations were made for shipping the equipment to the Nevada Test Site.

Quality Assurance:

All reading assignments were completed on schedule.

WBS 1.2.3.2.5 Postclosure Tectonics

OBJECTIVE

To supply data on the probability and effects of tectonic initiating events that may alter existing conditions at Yucca Mountain and adversely affect repository performance. (SCP Section 8.3.1.8)

WBS 1.2.3.2.5.3 Changes in Hydrology Due to Tectonic Events

OBJECTIVE

To assess or analyze the possibility that tectonic events could cause changes in existing hydrologic conditions at the Yucca Mountain site. (SCP Investigation 8.3.1.8.3)

WBS 1.2.3.2.5.3.2 Effect of Tectonic Processes and Events on Changes in Water-Table Elevation

Principal Investigator - J. Whitney

OBJECTIVE

To analyze and assess the probability that tectonic initiating events could result in significant changes in the elevation of the water table or potentiometric surface, changes in the hydraulic gradient, the creation of discharge points in the controlled area, or the creation of perched aquifers in the controlled area. (SCP Study 8.3.1.8.3.2)

SCP 8.3.1.8.3.2.5 Effects of faulting on water-table elevation 0G32532E93

Summary Account Manager - C. Fridrich

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTW009 Integrate studies/effects of tectonic processes on water table elevation
An interim report was prepared on the status of this activity.

WBS 1.2.3.2.5.5 Information Required by the Analysis and Assessment Investigations of the Tectonics Program

OBJECTIVE

To collect field data called for by analysis and assessment activities in other tectonics investigations to support analyses of volcanic, igneous intrusion, and folding processes. (SCP Investigation 8.3.1.8.5)

WBS 1.2.3.2.5.5.2 Characterization of Igneous Intrusive Features

Principal Investigator - J. Sass

OBJECTIVE

To gather data concerning the presence of thermal anomalies in the area and data on the geochemical and physical effects of intrusions on the surrounding rock. (SCP Study 8.3.1.8.5.2)

SCP 8.3.1.8.5.2.3 Heat flow at Yucca Mountain and evaluation of regional ambient heat flow and local heat flow anomalies 0G32552C93

Summary Account Manager - J. Sass

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GAT016 Maintain laboratory /Calibrate equipment

Continued tests of high temperature thermal conductivity apparatus.

3GAT045 Evaluate drilling plans and recommendations

An inquiry was made regarding the status of reconfiguration of WT holes to facilitate detailed thermal studies of the unsaturated zone. The response from R. Luckey was that some of these holes may be reconfigured this fiscal year. No response was received regarding plans for geologic core holes or their completion as thermal observation wells.

3GAT018 Prepare interim report

The report is deferred pending resolution of QA software issues.

3GAT012 Collect core samples/ prepare thermal specimens

This task is tied to 3GAT013 for which there has been no opportunity for sampling.

Quality Assurance:

Major comments yet to be resolved regarding QA review of revised GPP-20,R3 center around documentation of software involved in calibration of temperature sondes and calculation of temperatures during logging runs. Arrangements were made to complete QA on project software.

Reviewer comments on Study Plans 8.3.1.8.5.2, Rev. 0 and 8.3.1.15.2.2, Rev 0 have been received and are being responded to.

Continued dialogue with QA specialists on calibration vendors and on calibration of balances, micrometers and vernier calipers.

Maintained and updated QA records and performed reading assignments as required.

Variations:

3GAT012 Collect core samples/prepare thermal conductivity specimens

This activity is tied to 3GAT013 for which there has been no opportunity to do field work to collect samples. Efforts are underway to rectify this situation.

3GAT013 Collect field measurements

No field measurements were carried out; no new holes have been made available and WT holes have not been reconfigured. Outstanding software QA issues prevent acquisition of qualified data.

3GAT018M Interim report Lab/Calibration

Has been deferred pending resolution of QA software issues.

WBS 1.2.3.2.8 Preclosure Tectonics

OBJECTIVE

To develop an understanding of and to characterize the tectonic events and processes that could impact proposed repository structures, systems, or components considered to be important to safety through the operational phase and that could affect the design and operation of certain structures, systems, and components required for exercising the retrieval option. (SCP Section 8.3.1.17)

WBS 1.2.3.2.8.3 Vibratory Ground Motion

OBJECTIVE

To develop a seismic-design basis for repository facilities that are important to safety. Provide other information that will facilitate the assessment of the adequacy of the seismic-design basis and the identification of credible accidents that might be initiated by seismic events and lead to the release of radioactive materials. (SCP Investigation 8.3.1.17.3)

WBS 1.2.3.2.8.3.1 Relevant Earthquake Sources

OBJECTIVE

To identify and characterize those earthquake sources that are relevant to a deterministic seismic hazard analysis of the site (i.e., those sources that could be active) and, if active, could cause severe ground shaking at the site. (SCP Study 8.3.1.17.3.1)

SCP 8.3.1.17.3.1.1 Identify relevant earthquake sources 0G32831A93

Summary Account Manager - S. Pezzopane

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GSS002 Identify (preliminary) relevant Earthquake sources

Compiled information from maps and reports and prepared preliminary data table on the most relevant earthquake sources.

3GSS101A Compile information from existing sources

Compiled information from maps and reports and began examination of data quality and reliability for sources of earthquake information.

Quality Assurance:

Began research for writing technical procedure on identification of relevant earthquake sources.

Planning and Operations:

Met with colleagues to discuss procedures and approach for identification of relevant earthquake sources.

SCP 8.3.1.17.3.1.2 Characterize the 10,000 year cumulative slip earthquake 0G32831B93

Summary Account Manager - J. Whitney

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GSS118A Evaluate and revise deterministic seismic hazard methodology

Began scoping studies and collaborative research to revise seismic hazard methodology.

Planning and Operations:

A meeting was planned to discuss and revise seismic hazard methodology (May 1993 - Menlo Park, CA)

WBS 1.2.3.2.8.3.3 Ground Motion From Regional Earthquakes and Underground Nuclear Explosions

OBJECTIVE

To select or develop ground-motion models that are appropriate for estimating ground motion at the site from earthquakes and UNEs. (SCP Study 8.3.1.17.3.3)

SCP 8.3.1.17.3.3 Ground motion from Regional earthquakes and UNEs 0G32833A93

Summary Account Manager - J. Whitney

ACTIVITIES AND ACCOMPLISHMENTS

Planning and Operations:

A meeting was scheduled to address ground motion methodology, for May 1993, in Menlo Park, CA.

Variances:

3GES010 Develop earthquake ground motion methodology

More time is needed to perform analyses of alternative solutions - key participants were not available to contribute during the scheduled time frame. No impact to the schedule is anticipated.

WBS 1.2.3.2.8.3.4 Effects of Local Site Geology on Surface and Subsurface Motions

OBJECTIVE

Determine and model site and systematic effects on surface and subsurface ground motions resulting from the local site geology. (SCP Study 8.3.1.17.3.4)

SCP 8.3.1.17.3.4.1 Determine site effects from ground motion recording 0G32834A93

Summary Account Manager - J. Whitney

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

- 3GSG101A Gather seismograms from prior studies
Assembled recordings made at UNR portable stations near Yucca Mountain for over 300 earthquakes.
- 3GSG102A Gather geological and geophysical site information
Gathered more detailed velocity and density information beneath Yucca Mountain, especially Midway Valley where surface facilities are proposed.
- 3GSG103A Develop initial standard ground motion model
Started development of a computer program that will use the Little Skull Mountain earthquake sequence to estimate site effects for Yucca Mountain.
- 3GSG250 Conduct seismic field experiment #1
Eight Reftek portable stations were deployed in Midway Valley area for the site effects investigation.

Variances:

- 3GSG104A Compare initial standard model with initial observations
This task has not started yet; initial observations still are being collected. No impact to the schedule is anticipated.

WBS 1.2.3.2.8.4 Preclosure Tectonics Data Collection and Analysis

OBJECTIVE

To provide data and analyses required by other investigations including the assessments of fault displacement and vibratory ground motion that could affect repository design or performance. (SCP Investigation 8.3.1.17.4)

WBS 1.2.3.2.8.4.1 Historical and Current Seismicity

Principal Investigator - J. Brune

OBJECTIVE

To compile information on reported and instrumentally recorded earthquakes that characterize the earthquake potential near Yucca Mountain and to attempt to purge explosion and triggered earthquakes related to weapons testing from existing catalogs of instrumentally determined earthquakes. (SCP Study 8.3.1.17.4.1)

SCP 8.3.1.17.4.1.1 Compile historical earthquake record 0G32841A93

Summary Account Manager - J. Brune

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GSM100 Develop method - Peak ground acceleration

Project participants attended a field trip to Solitario Canyon with D. Keefer, an expert on rock falls. Participants also viewed the area shaken by the southern Utah earthquake of October 1992. Tests were conducted on a computer code that models rock falls in two dimensions.

Variances:

Due to the workload imposed by the Little Skull Mountain earthquake, project personnel have been unable to make significant progress on 3GSM105 "*Compile historical earthquake records*". Milestone 3GSM105M may not be met on schedule.

SCP 8.3.1.17.4.1.2 Monitor current seismicity 0G32841B93

Summary Account Manager - J. Brune

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GSM134A Monitor FY 93 seismicity

Recorded data from SGBSN for all of April, except for approximately 1 hour due to minor problems. Backup recorded on devolocorders; no data was lost. UNR preliminary southern Great Basin seismic event bulletin is now complete through April 30, 1993.

3GSM148A Data analysis Little Skull Mountain Earthquake

A waveform data base was started on optical disk for the Little Skull Mountain earthquake sequence. Using a master event method, all Little Skull Mountain aftershocks from September through December 1992 have been relocated. Focal mechanisms have been determined for over 500 Little Skull Mountain aftershocks.

Quality Assurance:

Successfully completed new seismic instrument calibration procedure for roughly 8 stations; approximately 12 other calibration signals are pending analysis. Internal drafts were finished of revised technical procedures, covering magnitude determination and event location.

WBS 1.2.3.2.8.4.2 Location and Recency of Faulting Near Prospective Surface Facilities

Principal Investigator - J. Whitney

OBJECTIVE

To identify appropriate trench locations to investigate the possible occurrence of late Quaternary surface faulting in the vicinity of planned critical surface facilities; and using surface and trench mapping, locate sites without evidence of significant late Quaternary faulting. (SCP Study 8.3.1.17.4.2)

SCP 8.3.1.17.4.2.1 Identify appropriate trench locations in Midway Valley 0G32842A93

Summary Account Manager - F. Swan

ACTIVITIES AND ACCOMPLISHMENTS

Planning and Operations:

Plans were made to complete fieldwork, including soil descriptions and field inspection of preliminary geologic mapping.

Variances:

Project personnel were unavailable to work on tasks under this activity in April due to attendance at a professional conference and scheduled vacation. No delays in meeting the schedule are anticipated.

Work Performed but not in Direct Support of the Scheduled Tasks

During the March 11, 1993 audit, it was discovered the Geomatrix personnel had not completed sample collection forms for soils described and collected for task 3GFP003 (Audit USGS-93-06 observation no. 5). The information required during sample collection, as outlined in GP-27 and AP-6.26Q, is documented in field notebooks and soil description forms with necessary cross references. Geomatrix was planning to transfer the required information from notebooks and soil description forms to sample description sheets as soon as soil sample collection activities are completed. However, this approach could lead to loss of required information, or time consuming efforts to organize this information at a

later date. A response to this observation has been drafted but not resolved.

SCP 8.3.1.17.4.2.2 Conduct exploratory trenching in Midway Valley 0G32842B93

Summary Account Manager - F. Swan

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GFP021 Clean/modify/relog/study new logs from trench 17

Fieldwork activities were completed, and report preparation for MWV-T4 continued.

3GFP008 Excavate/log/study trenching near proposed ESF

Report preparation continued for the trenching investigations near the proposed ESF. Bedrock faults exposed in the "box cut" of the ESF portal were mapped to determine their locations relative to faults and fractures observed in our trenches (now backfilled) in the construction area.

Planning and Operations:

Geomatrix personnel made preparations to present preliminary results of studies of trench 17 (MWV-T4) and preliminary results of studies in the ESF area at the GSA meeting in Reno, Nevada.

Variances:

3GFP021M Report/TDIF Results of logging from trench 17

Was not completed on 5 April as planned. A professional conference and vacations during the April reporting period caused the delay. The report will be completed in May.

WBS 1.2.3.2.8.4.3 Quaternary Faulting within 100 km of Yucca Mountain

Principal Investigator - J. Whitney

OBJECTIVE

To identify Quaternary faults within 100 km of Yucca Mountain and to characterize those faults capable of future earthquakes with magnitude such that associated ground shaking could impact design or affect performance of the waste facility. (SCP Study 8.3.1.17.4.3)

SCP 8.3.1.17.4.3.2 Evaluate Quaternary faults within 100 km of Yucca Mountain 0G32843B93

Summary Account Manager - L. Anderson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTQ007B Compile map of Quaternary faults within 100 km/study Beatty scarp

Work on map compilation is complete. Accompanying text and tables are being prepared. A draft report on the origin of the Beatty scarp was completed.

3GTQ033B Evaluate faults SW of Yucca Mountain

Initial evaluation of scarps and lineaments in the northern Amargosa Desert area was completed using low-sun-angle aerial photographs. Field study of the Death Valley-Furnace Creek fault zone was conducted. Several areas were identified where detailed geologic mapping could provide specific information on the age and amount of slip for the most recent surface faulting event on the Death Valley-Furnace Creek fault zone.

SCP 8.3.1.17.4.3.4 Evaluate Bare Mountain fault zone 0G32843D93
Summary Account Manager - L. Anderson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTQ065 Conduct detailed Quaternary surficial geologic mapping on the east side of Bare Mountain. Low-sun-angle aerial photographs of the Bare Mountain frontal fault zone were evaluated and analyzed. Based on aerial photograph interpretation, and field verification studies conducted in March, compilation of preliminary surficial geologic map of the Bare Mountain frontal fault zone was begun.

Planning and Operations:

Project personnel led a field trip for DOE support personnel to proposed soil pit sites, and the additional trench sites, so that additional permitting work can begin.

Variations:

Early start for analyzing trenches (activity 3GTQ060) was scheduled for March 1, 1993. Due to lack of archeology clearances for trench BMT-1 (Tarantula Canyon site), excavation currently is planned sometime in July. Trench BMT-2 now is scheduled for excavation on May 12, 1993; therefore, the earliest date for start of trench analysis is May 12, 1993.

WBS 1.2.3.2.8.4.4 Quaternary Faulting within Northeast-Trending Fault Zones
Principal Investigator - J. Whitney

OBJECTIVE

To evaluate the potential for ground motion resulting from future movement on Quaternary left-lateral strike-slip faults located east and south of the site area. (SCP Study 8.3.1.17.4.4)

ACTIVITIES AND ACCOMPLISHMENTS

Participated in revision of QMP-5.01, R5. Provided technical guidance and made recommendations of revisions prepared for technical review. (2 hours)

SCP 8.3.1.17.4.4.1 Evaluate the Rock Valley fault system 0G32844A93
Summary Account Manager - D. O'Leary

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTN011 Work on study plan / Conduct fieldwork Rock Valley fault system
Aerial photo analysis of the Rock Valley Fault Zone continued. Ten days of fieldwork in the Rock Valley area also was conducted to evaluate faults.

3GTN014 Develop interim report

An interim report on the Rock Valley fault system was completed and submitted to YMPB.

WBS 1.2.3.2.8.4.5 Detachment Faults
Principal Investigator - J. Whitney

OBJECTIVE

To provide information pertaining to the distribution, displacement rate, and age of detachment faults proximal to Yucca Mountain; and determine whether they represent a significant earthquake source or conceal a significant earthquake source at depth. (SCP Study 8.3.1.17.4.5)

SCP 8.3.1.17.4.5.1 Evaluate significance of the Miocene-Paleozoic contact 0G32845B93

Summary Account Manager - W. Hamilton

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTD017B Complete map of the Calico Hills / Write report

Several days of field work were spent examining exposures of Paleozoic stratigraphy, that may correlate with exposures in the Calico Hills.

3GTD009B Evaluate Miocene-Paleozoic contact

Principal investigator attended field trip with W. Hamilton to examine detachment faults in the region. Dissimilarities were observed between regional detachment faults and the low angle faults in the Calico Hills.

SCP 8.3.1.17.4.5.2 Evaluate postulated detachment faults in the Beatty-Bare Mountain area 0G32845B93

Summary Account Manager - W. Hamilton

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTD004B Collect field and lab data - Bare Mountain and Yucca Mountain

Project participants attended a field trip led by W. Hamilton to examine both upper and lower plate rocks of the major detachment faults in the region. Sampling sites and strategies and preliminary results of scoping studies were discussed. Work on this task will be combined with 3GTD013B and will begin in earnest this summer (see section C.).

3GTD012B Evaluate and conduct mapping, Bare Mountain and Crater Flat

Geologic mapping was conducted at the south end of Crater Flat (the Will Carr Hills) and at the north end of Bare Mountain. Project personnel also led a field trip to examine structures exposed at the north end of Bare Mountain.

3GTD005B Evaluate extension in Miocene rocks - Bare Mountain and Crater Flat

Preliminary hypotheses pertaining to extensional deformation in the Bare Mountain, Crater Flat, and Death Valley were discussed, and field relations examined, during a field trip.

Variances:

Task 3GTD004B Collect field and lab data - Bare Mountain

This activity will be combined with task 3GTD013B "*Thermobarometry study of lower plate rocks*". These two tasks are interdependent parts of a study of thermobarometry of lower plate rocks. The principal investigator will begin the study in June when other obligations are finished.

SCP 8.3.1.17.4.5.5 Evaluate age of detachment faults 0G32845E93

Summary Account Manager - W. Hamilton

ACTIVITIES AND ACCOMPLISHMENTS

Variances:

3GTD015B Conduct fission track dating

The Principal investigator will begin this task in June when other obligations are finished.

3GTD016 Conduct K-Ar dating of lower plate rocks

Experts in the field have determined that the K-Ar dating technique may not work for this application; therefore, this task may be canceled.

WBS 1.2.3.2.8.4.6 Quaternary Faulting within the Site Area

Principal Investigator - J. Whitney

OBJECTIVE

To evaluate the age and recurrence interval of Quaternary faulting and to analyze the probability of future faulting; to determine which faults moved during the Quaternary; and to assess fault probability on the basis of rates of faulting during the Quaternary. (SCP Study 8.3.1.17.4.6)

SCP 8.3.1.17.4.6 Evaluate Quaternary faulting within the site area LOE Account 0G32846Z93

Summary Account Manager - C. Menges

ACTIVITIES AND ACCOMPLISHMENTS

Considerable time was spent on the following tasks:

Administrative duties required for training and personnel actions for newly hired field assistant; preparing monthly reports; QA tasks - preparation of acquired data TDIF's for trench data; coordinating responses with other WRD personnel pertaining to requests for Quaternary fault data for the ESF seismic hazard analysis; planning and coordination of several support activities such as aerial overflight of Yucca Mountain, possible drilling near Stagecoach Road, and conducting environmental clearance work on geophysical survey sites at Windy Wash fault.

SCP 8.3.1.17.4.6.1 Evaluate Quaternary geology and potential Quaternary faults at Yucca Mountain

0G32846A93

Summary Account Manager - J. Whitney

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GPF026A Complete field mapping / Submit map for review

Work on final drafting of map continued. 1:12,000 scale maps were reduced and merged to fit a 1:24,000 scale topographic base map, and an outline for the accompanying text was drafted.

Variances:

The final map at 1:24,000 scale, along with its accompanying report will not be submitted for USGS review on time. At DOE's request, the principal investigator was called away to work on the erosion topical report. The other co-author was similarly pulled away to work on monthly and semi-annual reports. Despite these and other administrative distractions, the map is nearing completion and should be ready for submittal in mid June.

SCP 8.3.1.17.4.6.2 Evaluate age and recurrence of movement on suspected and known Quaternary faults

0G32846B93

Summary Account Manager - C. Menges

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GPF19P Study faults on west & east sides of Busted Butte

Completed plotting contacts and structures on photographic prints for exposure #4 (equivalent to plotting on trench log). Systematically reevaluated fault event chronology and field measurement of vertical offsets, and identified and measured possible fault slicken lines (slip indicators) on exposure #4.

J. Paces obtained final alpha spectrometry counts on aliquots of HD954 and HD955a from Busted Butte, Wall 1. Regression of present data (N=4 for HD954; N=5 for HD955a) result in preliminary ages of 85 ± 15 Ka for HD954, and 148 ± 7 Ka for HD955a. These dates bracket the last surface displacement event along the Paintbrush Canyon fault.

B. Widmann continued thermoluminescence procedures on samples from Midway Valley and Stagecoach Road. Total bleach and sunlight experiments have been completed on samples TL-01 (Av horizon in Midway Valley Trench 5), TL-02 (Av horizon from Stagecoach Road Trench 1), and TL-05 (uppermost Av horizon in Midway Valley Trench 4), and half of the anomalous fading experiment is complete. Very preliminary calculations indicate ages of 20 Ka, 15 Ka and less than 1 Ka, respectively.

D. Craft prepared mineral separates of an ash-rich soil sample from Stagecoach Road to assess the potential for dating using Ar/Ar techniques. Z. Peterman completed a preliminary evaluation concluding that the horizon has been reworked. Biotite is sparse exhibiting ragged grain boundaries and is interpreted to be an exotic, transported component. However, the deposit also contains abundant, angular, unaltered amphibole, which most likely is a primary component of the ash, and as such, has potential for age determination.

3GPF035A Study trenches excavated on Yucca Mtn. faults

Completed cleaning and flagging contacts and structures on outer wall, north branch of trench 14D. Plotting on trench log is nearing completion. Began cleaning, identifying, and flagging contacts and structures on main south wall, trench 14D with E. Taylor. Original trench log of trench 14D inner wall, north branch was digitized, and a report on the trench log is in progress. Began cleaning, identifying, and flagging contacts and structures on Stagecoach Road trenches (SCR-T1).

3GPF032A Scarp degradation and evolution north Windy Wash

Examined, in the field, potential sites for cosmogenic isotope dating and sampling along sections of northern Windy Wash, northern Solitario Canyon, and Stagecoach Road faults. Located areas for detailed mapping and measurement of bedrock fault scarps on northern Windy Wash fault.

Quality Assurance:

Prepared and submitted acquired data TDIFs for trench 14D trench log (inner wall, north branch). Prepared procedure for field measurement of fault scarp morphology; awaiting technical review by USBR staff. Completed and submitted criteria letter for initiating planned geophysical surveys on the Windy Wash fault. Work in progress on completing required QA procedures for operating and calibrating seismic refraction equipment.

3GPF19P Study faults on west & east sides of Busted Butte

B. Widmann made revisions to Technical Procedure GCP-29,R0 "*Thermoluminescence dating*", and resubmitted the revised version for additional review.

Planning and Operations:

Consulted with DOE and USGS staff on procedures for initiating drilling and coring through surficial deposits, to bedrock on the downthrown block of the Stagecoach Road fault near trench SCR-T1. Identified and flagged sites for four new trenches on Solitario Canyon fault. Site information passed on to DOE field test coordinators for processing, and notification of environmental survey personnel. Consulted with DOE officials for use of Raytheon surveying personnel to measure fault scarp profiles. Located and flagged field sites for geophysical surveys (6 lines total). Field sites were visited with field crews for environmental clearance surveys.

Variances:

Work still behind schedule in completing trench 14D trench logs and reports (3GPF036M). Primary log has been completed (TDIF submitted and trench log digitized), but report has been delayed until around early June. Logging of remaining walls of trench 14D in progress. Variance due to unanticipated work on ESF seismic design in March and April. The backlog of trench logging activities, and administrative duties, also have delayed the completion of (3GPF035M). These tasks will be completed as time is available. No serious impacts to the overall study are anticipated.

Work Performed but not in Direct Support of the Scheduled Tasks

At the request of DOE, principal investigator was required to work on technical assessment of ESF seismic design, including meeting attendance, and compilation of preliminary data on Quaternary faults in the site area for probabilistic seismic hazard analysis (5 days spent). Principal investigator spent 1 day working on aerial overflight request. Principal investigator spent 2 days examining trenches across surface ruptures of the 1992 Landers earthquake.

WBS 1.2.3.2.8.4.10 Geodetic Leveling

Principal Investigator - J. Whitney

OBJECTIVE

Evaluate possible historical and contemporary vertical displacements across potentially significant Quaternary faults within 100 km of Yucca Mountain. Characterize the historical rate of uplift and subsidence in the Yucca Mountain region, and evaluate the possible existence of tectonic boundaries that separate domains with differing rates of uplift and subsidence. (SCP Study 8.3.1.17.4.10).

SCP 8.3.1.17.4.10.1 Relevel base station network 0G3284AA93

Summary Account Manager - G. Perasso

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTM007J Continue to relevel network and resurvey quadrilaterals

Field operations for releveling of the base-station network were completed. A summary report and data for 1992/1993 field work will be available sometime in May.

SCP 8.3.1.17.4.10.2 GPS Base - station survey 0G3284AB93

Summary Account Manager - J. Whitney

ACTIVITIES AND ACCOMPLISHMENTS

Quality Assurance:

The technical procedure for the GPS base station survey was completed and approved.

WBS 1.2.3.2.8.4.12 Tectonic Models and Synthesis

Principal Investigator - J. Whitney

OBJECTIVE

To synthesize data relevant to tectonics; and to develop a model or range of models that establishes the causal relationship between application of tectonic forces and formation of structures observed at Yucca Mountain and vicinity; link observed rates of formation of those structures with regional rates of crustal strain; forecast changes in tectonic setting and the manner in which those changes will affect both the regional crustal strain rate and tectonic stability in the Yucca Mountain region; and estimate the effect of those changes on rate and nature of crustal strain at Yucca Mountain and vicinity and the future rate of tectonic processes at Yucca Mountain. (SCP Study 8.3.1.17.4.12)

SCP 8.3.1.17.4.12.1 Evaluate tectonic processes and tectonic stability at the site 0G3284CA93

Summary Account Manager - W. Hamilton

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTE072 Compile geologic map of the Death Valley area

The geologic map of the Death Valley area is undergoing revision and redrafting, to comply with all USGS map standards. Study Plan 8.3.1.17.4.12 was revised following internal USGS review, and submitted for QA review.

3GTE08JA Integration of tectonic data

A field trip was conducted to examine field relations and discuss tectonic models and concepts in the Yucca Mountain/ Death Valley region. Participants examined well exposed detachment faults, and recent faulting in the Death Valley area, and made comparisons with postulated structures at Bare Mountain and southern Crater Flat.

SCP 8.3.1.17.4.12.2 Evaluate tectonic models 0G3284CB93

Summary Account Manager - W. Hamilton

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GTE045 Evaluate Tectonic models

A field trip to Death Valley and Bare Mountain was conducted, with W. Hamilton and other Tectonics Section personnel, in order to evaluate geological data pertaining to acceptance or rejection, modification of refinement of tectonic models.

WBS 1.2.3.3 Hydrology

Principal Investigator - D. Appel

OBJECTIVE

To conduct hydrologic investigations to evaluate the suitability of the surface and subsurface environment for siting a nuclear waste repository.

WBS 1.2.3.3.1 Geohydrology

OBJECTIVE

To provide information about geohydrologic characteristics, processes, and conditions, both favorable and potentially adverse, to support resolution of the performance and design issues through the development of a credible geohydrologic model of Yucca Mountain and vicinity. (SCP Section 8.3.1.2)

WBS 1.2.3.3.1.1 Description of the Regional Hydrologic System

OBJECTIVE

To develop a conceptual model of the regional hydrologic system to assist in assessing the site's suitability to contain and isolate waste. (SCP Investigation 8.3.1.2.1)

WBS 1.2.3.3.1.1.1 Precipitation and Meteorological Monitoring for Regional Hydrology

Principal Investigator - A. Flint

OBJECTIVE

To characterize the area surrounding Yucca Mountain in terms of precipitation and other meteorological data and their relationship to surface runoff and infiltration; and to provide input into rainfall-runoff model development for the Fortymile Wash drainage basin. (SCP Study 8.3.1.2.1.1)

SCP 8.3.1.2.1.1.1 Precipitation and meteorological monitoring 0G33111A93

Summary Account Manager - A. Flint

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GMM035 Collect/analyze synoptic weather/reg/site met data

Data collection continued in April. Site data from the five weather stations were downloaded and reviewed weekly. Satellite and weather chart data were archived on tape backup every third day. Precipitation-wise, the month was dry; no precipitation was recorded. The synoptic weather pattern kept the southern Nevada region under high pressure with dry frontal passages occurring every four days on the average. The only measurable precipitation (.02 inch) fell at the HRF on April 5; none was recorded at Yucca Mountain. With each frontal passage, only accompanying windiness was observed. The precipitation pattern was restricted to the Great Northwest, northern Great Basin, and the Rockies. Historic precipitation/temperature records were received in digital format for 31 regional cooperative stations in southern Nevada and California. Also, complete station records were received for 12 Bureau of Land Management (BLM) RAWS stations. These historic records were received from the Western Region Climate Center in Reno, Nevada. Most of these records include all available data from the station's activation through 1992. Weather at Yucca Mountain continued to be monitored by the video surveillance system.

3GMM038 Prepare technical report FY92 synoptic/reg/site met data

Work continued to perform geostatistical analyses on site precipitation data. The effort is to characterize storms, by season, in terms of spatial and temporal variability. A similar analysis of regional precipitation data is planned to begin next month. The digital elevation model will be used also to improve isohyetal mapping on the regional scale. See March report for details on this work.

Work Performed but not in Direct Support of the Scheduled Tasks

Work was done in support of the UZ Natural Infiltration Program. Soil moisture data were collected using a neutron probe. (hrs 9)

D. Ambos reviewed the technical publication: "Meteorological, discharge, and water-quality data from two basins in central Nevada" by P. McKinley and T. Oliver. (hrs 4)

Time was spent supporting tours and the HRF. (hrs 16)

WBS 1.2.3.3.1.1.2 Runoff and Streamflow

Principal Investigator - D. Beck

OBJECTIVE

To collect basic data on surface-water runoff at, and peripheral to, Yucca Mountain and its hydrologic flow system; to use the streamflow data to describe the runoff characteristics of the area and assess the response of runoff to precipitation; to assess the potential for flood hazards and related fluvial-debris hazards to the Yucca Mountain Project; and to provide basic data and interpretations of surface-water runoff to investigations that evaluate the amounts and processes of infiltration and ground-water recharge at Yucca Mountain and surrounding areas. (SCP Study 8.3.1.2.1.2)

SCP 8.3.1.2.1.2.1 Surface-water runoff monitoring 0G33112A93

Summary Account Manager - T. Kane

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GRSO30A Complete FY 83-85 data report

Quality Assurance review of manuscript was completed, and the manuscript was sent to DOE for final approval.

3GRSO31A Complete reduction of FY 86-89 data and preparation of report

Activity should read " FY 86-90 " data and preparation of report. Progress continues on this activity which is thirty percent complete.

3GRSO25A Reduce FY 92 runoff data and prepare report

This activity is to be rescheduled into 1994 FY. The current objective is to finish the 1986-1990 data report. The winter storms of Jan.-Feb. impacted the time frame for accomplishing most activities forcing a rescheduling of priorities.

3GRSO31M RPT/TDIF streamflow and precipitation data FY 86-90

Activity is tied to 3GRSO31A, and has been rescheduled for completion.

3GRSO25M RPT/TDIF streamflow and precipitation data FY 92

Activity is tied to 3GRSO25A, and will be resubmitted as a package including the 91-93 water year.

3GRSO23A Collect FY 93 runoff and streamflow activity

The month of April was relatively dry. No runoff was noted at any of the streamgage network sites, except for the Amargosa River at Tecopa, 10251300, and Amargosa River at Eagle Mtn. These sites averaged 0.63 cfs, during the first week of April. The end of the month Eagle Mtn. had ceased flowing, while Tecopa had established a base flow of 0.19 cfs. Precipitation averaged .08 inches for the network sites surrounding Yucca Mtn. Off the test site the regional network averaged .35 inches.

Quality Assurance:

3GRSO23A Collect FY 93 runoff and streamflow activity

Quality assurance activities conducted by C. Martinez this month included: work on TDIFs and reading assignments, updating HP, QMP, and AP procedures (40 hrs), and attendance of QA training in Denver.

Planning and Operations:

3GRSO28A Apply for site prerequisite survey

G. Ryder (DOE) and C. Newberry (DOE) were contacted, and assurance was received from them that site permits will be received in the next few days.

Variances:

3GRSO28A Apply for Site Prerequisite Survey

Activity delayed until May 31, 1993 pending environmental clearances by DOE for the three new sites located on Yucca Mountain. This delay will cause activity # 3GRSO17A to be pushed back for one month as well.

3GRSO30A Complete FY 83-85 data report

This activity is delayed with no indication of when report will be released from DOE. Estimate September 30, 1993.

3GRSO31A Complete reduction FY 86-91 data and prepare rpt.

Activity should read "FY 86-90" and rescheduled to finish September 30, 1993. Winter storms impacted all activities; an effort to finish this report has been given top priority.

3GRSO25A REDUCE FY 92 runoff data and prepare report.

This activity is to be rescheduled to 1994 water year. It will be packaged with the 91-93 data report.

3GRSO30M RPT/TDIF: Streamflow and precipitation FY83-85

This activity is tied to 3GRSO30A. The report was released to DOE May 3, 1993. Estimate September 30, 1993 for approval.

3GRSO17A Install 3 additional gages on Yucca Mtn.

This activity is tied to 3GRSO28A, which is site permit authorization. Scheduling for installation will occur only when permits are obtained. Reschedule one month to June 3, 1993.

3GRSO31M RPT/TDIF: Streamflow and precipitation data FY 86-91

Activity should read "data FY 86-90" and is tied to 3GRSO31A. Progress continues and the activity is rescheduled for completion September 30, 1993.

3GRSO25M RPT/TDIF: Streamflow and precipitation data FY 92

This activity is tied to 3GRSO25A and has been rescheduled to 94 FY as a package which includes 91-93 water years.

Work Performed but not in Direct Support of the Scheduled Tasks

T. Kane prepared for the regional project review held in house at USGS Sub-District level. (48 hours)

T. Kane, attended regional project review held in Carson City, and made a presentation on surface-water monitoring activities on-going at the NTS. (48 hours)

C. Martinez, W. Nylund attended a course in "Streamflow Hydraulics" at the NTC, Denver.

WBS 1.2.3.3.1.1.3 Regional Ground-Water Flow System

Principal Investigator - J. Czarnecki

OBJECTIVE

To define the potentiometric distribution hydraulic properties, and recharge and discharge for the regional ground-water flow system to determine the magnitude and direction of ground-water flow. (SCP Study 8.3.1.2.1.3)

SCP 8.3.1.2.1.3 Regional ground water flow system LOE Account 0G33113Z93

Summary Account Manager - J. Czarnecki

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

J. Czarnecki conducted tests of four thermistors in a programmed water bath, at the USGS HRF in area 25.

COLLECT FY93 MOISTURE DATA

Project staff collected ground-water levels in UE-29 a#1, UE-29 a#2, and UE-29 UZN #91; took readings from rain wedges at UE-29 UZN #91 and #92; and collected neutron moisture logs from UE-29 UZN #91 and #92. Data collection frequency was decreased from previous months, which documented ground-water recharge from rainfall/runoff events in the Fortymile Wash watershed.

Quality Assurance:

M. Ciesnik performed an informal technical review of QMP 5.05, R3 "*Preparation of scientific notebooks*" and prepared a revised version with W. Steinkampf reflecting requirements in the QARD.

M. Ciesnik reviewed modification M3 to QMP 3.03, R3 "*Software quality assurance*" and sent comments to the QA office. He also performed a technical review of QMP-1.01.

M. Ciesnik prepared a disposition to NCR 12-93 and submitted it to the QA office. Ciesnik also: 1) participated in the monthly open-items meeting at the QA office; 2) participated in a meeting devoted to QA issues of data processing within YMP; 3) attended training on QMP 4.01 and 7.01; 4) reviewed TDIFs submitted to the QA office during the past year; 5) reviewed controlled documents (QMPs and APs) against updated lists prepared by the QA office; and 6) completed reading assignments of QMPs 4.01, 7.01, and 5.05.

Planning and Operations:

The training session on "sexual harassment" was attended by J. Czarnecki and M. Ciesnik.

J. Czarnecki and C. Savard represented the HIP Saturated Zone section during the Yucca Mountain Open House Public Tours at the HRF.

M. Ciesnik performed the various maintenance tasks on a project Compaq 386/20 microcomputer.

SCP 8.3.1.2.1.3.2 Regional potentiometric level distribution and hydrogeologic framework studies

0G33113B93

Summary Account Manager - J. Czarnecki

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GRG054 Revise water level data report

A TDIF for a report entitled "*Ground-water altitudes and well data, Nye and Inyo Counties, Nevada-California*" was submitted. Processing continues at USGS Central Region for USGS Director's approval.

3GRG011A Test small diameter wells

A bailed water sample was obtained from a 1 1/4" diameter piezometer in a dual-piezometer borehole (ST-2) south of the Tidewater Hills area of the Amargosa Desert. Attempts to obtain a sample from the deep piezometer (2000' deep) in ST-2 resulted in dewatering the well to a depth of 500'; subsequent pumping one week later resulted in no water being produced. A sample was obtained from well ST-1 after approximately 8 hours of pumping a 2" diameter steel-cased piezometer using a pump jack whose pump was set at about 220' below the top of the casing. The pump was set in a third hole (NA-10) to a depth of 700' using a portable tripod equipped with a traveling block and winch. Pumping lasted about 40 minutes at a rate of 7 liters/minute at which point the piezometer would yield no more water; subsequent pumping the next day yielded no more water. Additional pumping will be tried one week following the last pumping.

3GRG062 Continue preparation of report: Hydrostratigraphy of the Amargosa Desert

J. Czarnecki modified a purchase order to have 30,000' of additional geophysical logs digitized for boreholes constructed in the Amargosa Desert as part of an exploration program of a mining company. These logs will be part of a report entitled "*Lithologic and geophysical logs from U.S. Borax & Chemical Corporation Exploration Boreholes, Amargosa Desert, Nevada-California*" being prepared by S. Keller (SAIC).

3GRG068 Survey water wells in Amargosa Desert FY93

G. Buchanan and J. Czarnecki visited several wells in the northwest Amargosa Desert being monitored by LAC Bullfrog Mine (Beatty, NV). LAC personnel were visited and water-level records for 12 monitoring wells obtained. LAC records indicated that elevation surveys were made for all 12 wells. Quarterly water-level data from these 12 wells were obtained from P. Christianson (National Park Service). Measurements are planned by USGS-HIP project staff to corroborate values obtained by LAC personnel. Plans are in process to obtain water samples from various LAC wells and from the underground workings of the LAC Bullfrog Mine. G. Buchanan measured depths to water, in several wells in the southern Amargosa Desert.

Planning and Operations:

3GRG068 Survey water wells in Amargosa Desert FY93

J. Czarnecki discussed the status of permits to access well sites in Nevada with J. Mur (BLM), B. Jacobs (SAIC LV) and G. Ryder (SAIC LV). BLM has approved access to the requested sites and test pumping of deep piezometers at these sites.

SCP 8.3.1.2.1.3.3 Fortymile Wash recharge study 0G33113C93

Summary Account Manager - C. Savard

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GRG021B Write/revise Fortymile recharge data report

C. Savard applied preliminary corrections to depth-to-water measurements for Fortymile Canyon wells. He established a land surface elevation reference for three Fortymile Canyon wells and

graphed hydrographs from the three wells. Hydrographs for UE-29 UZN-91 and UE-29 a#2 respond similarly indicating that the two wells may tap the same hydrogeologic unit. The hydrograph from UE-29a#1 indicated water-levels several feet higher.

3GRG023B Evaluate southern Nevada & California streamflow

C. Savard began making preliminary arrangements for a seminar at USGS headquarters on applications of chaos theory to hydrology, and implications for Yucca Mountain hydrology.

3GRG026 Conduct ponding and infiltration tests

C. Savard began writing and bench testing a program to control the water level in infiltration tanks and model streamflow hydrographs during storm events.

3GRG020 Prepare interim status report

C. Savard began drafting the report.

Work Performed but not in Direct Support of the Scheduled Tasks

C. Savard attended a workshop on the use of chlorine isotopes in hydrologic studies. The traces may be used to date recharge events, the work for which is proposed to be done during the Fortymile Wash study to document recharge history. C. Savard presented data collected during 1992-93 showing recharge in Fortymile Canyon from streamflow events. An interpretation of the data is that recharge is episodic and event driven in Fortymile Canyon for shallow (~25 m) depths to water. (Estimated hours spent: 24)

WBS 1.2.3.3.1.1.4 Regional Hydrologic System Synthesis and Modeling

Principal Investigator - J. Czarnecki

OBJECTIVE

To synthesize hydrologic, geologic, hydrochemical, and geophysical data into a model and make a qualitative analysis of how the system is functioning; and to represent quantitative observations of hydrologic data pertaining to the ground-water flow system in a comprehensive flow model. (SCP Study 8.3.1.2.1.4)

SCP 8.3.1.2.1.4 Regional hydrologic system synthesis and modeling LOE Account 0G33114Z93

Summary Account Manager - J. Czarnecki

ACTIVITIES AND ACCOMPLISHMENTS

SCP 8.3.1.2.1.4.2 Subregional two-dimensional areal hydrologic modeling 0G33114B93

Summary Account Manager - J. Czarnecki

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GRM028A Draft report on preliminary simulation of large hydraulic gradient

J. Czarnecki continued to run simulations which examined the removal of the barrier to ground-water flow responsible for representing the large-hydraulic gradient north of Yucca Mountain on the NHPSUN computer. Initial hydraulic head was set to 20,000 yr 15x-increased-recharge conditions. Mass balances were typically 5 to 6 orders of magnitude smaller than the maximum specified fluxes within the model indicating excellent mass balance.

Work Performed but not in Direct Support of the Scheduled Tasks

J. Czarnecki met with B. Nelson and E. Paleogos (INTERA) to discuss interfacing Czarnecki's 2D finite-element model domain and hydrogeologic property designations, with a 2D boundary-element model

being developed for performance assessment by the M&O. Czarnecki provided Paleogos with a map of the nodal locations and node numbers, and a key to going from local coordinates to Central Nevada coordinates. (hrs 8)

SCP 8.3.1.2.1.4.4 Regional three-dimensional hydrologic modeling 0G33114D93

Summary Account Manager - J. Downey

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GFH022C Refine 3D hydrogeologic model

C. Faunt began plotting horizon data in three-dimensions. This data will be examined to find problems in the data before gridding. Some problems with the software upgrade were encountered but were addressed by Intergraph staff, and Faunt began using CPS-3 to plot 3-D horizon data.

The paper on structural analysis is completed; final maps and figures are being prepared. A rough draft is being reviewed by K. Turner, and comments are being incorporated into the manuscript. The report is being updated by incorporating earthquake epicenter data and statistical analyses.

K. Turner continued review of map and text developed for "*Hydrogeology of Death Valley Region, Nevada and California*", by C. Faunt and F. D'Agnese.

C. Faunt presented "*Development of a three-dimensional hydrogeological framework model for the Death Valley region, southern Nevada and California*", at The Hydro GIS Conference (Application of Geographic Information Systems in Hydrology and Water Resources Management) in Vienna, Austria. While attending the meeting, Faunt and Turner talked with representatives of different GIS vendors. They also met with international GIS researchers specializing in hydrogeology.

F. D'Agnese gave a poster presentation at IHLRWM Conference, in Las Vegas, Nevada, titled "*Characterizing the hydrogeologic framework of the Death Valley region, Nevada and California*".

3GRM041A Generate model input arrays

F. D'Agnese finalized preliminary vegetation maps and worked on report for Regional Veg Mapping Death Valley Region. A field trip was conducted to field check resulting density and land cover classes. Field check indicated that the land cover classes were quite accurate in most areas relating vegetation density to vegetation. Some classes were difficult to interpret in high density phreatophyte areas; however, since these are small areas, manual correction of classes should not be difficult. A final map and report are projected for summer.

K. Turner continued to complete draft report on the Amargosa Desert vegetation mapping originally conducted by L. DeMarco. Land cover classes were correlated with regional vegetation mapping conducted by F. D'Agnese.

K. Turner, F. D'Agnese, C. Faunt and E. Gutentag reviewed progress on regional and Amargosa vegetation maps, and outlined scheduled for completion of work for this summer.

F. D'Agnese revised water balance accounting for Death Valley Region based on earlier investigations (numerical models and water resource studies), and data from Nevada State Engineer supplied by D. LaCamera. Results to date indicate that the transient effects of discontinuous pumping in Pahrump and Amargosa Valleys may have greatly affected regional water levels.

F. D'Agnese continued conducting analysis of present-day discharge areas. Areas are being mapped for 3D model arrays. Areas include discharge from free-water, bare soils, wetlands/marshes, and phreatophyte areas. Comparisons were made with historical estimates by Rush, Harril, Maxey and Eakin, Malmberg, etc., and with published models.

F. D'Agnese continued working with B. Meier (Intergraph) to develop a 2.5 dimensional terrain model of the study area to be used in visualization of the 3-dimensional model, YMP tour demonstrations, and presentations.

C. Faunt continued preliminary development of code to translate ARC data into an ASCII format that would be readable by Intergraph's ASCII Loader software.

F. D'Agnese continued work on regional potentiometric surface map. Field checking of springs with water table map was conducted from April 21 to May 3. Map revisions continued through the month. The map also is being compared to other published maps and topographic data. D'Agnese discovered some software bugs in CPS-3 and arranged to have those bugs rectified, with help from Radian Corp. (Austin, Texas).

F. D'Agnese continued developing layers for preliminary model (including two BCF layers, a recharge layer and a spring discharge layer) using GIS data base.

Methods on distributing hydraulic conductivity were reviewed including random analysis, stochastic conditional simulation, Bayesian statistics and deterministic methods. Methods using GSLIB, developed at Stanford University, were reviewed and evaluated.

F. D'Agnese continued preparing report on the Hydrogeology (Conceptual and Numerical Models) of the Death Valley Region. The chapter on previous work and site description was completed.

F. D'Agnese continued analysis of regional spring discharge; including analyzing spring discharge, temperature and chemistry to determine if spring was, indeed, a regional discharge component. Additional spring localities in the northern portion of Death Valley were located and added. This activity in conjunction with the past discharge activity will direct future sampling trips for faunal, isotope and chemical characterization of ground-water as well as aid in the characterization of major regional flow-paths.

3GFH009C Continue testing with chemical models

Chemical data were sorted by lithology and basic statistics were run for each lithologic group. Because the results did not appear to be reasonable, the process was reviewed and a problem was found with the ARC data. This was corrected, the data were re-sorted according to lithology, and basic statistics were re-run.

Piper plots were made for each lithologic group in ROCKWARE, and the data set was analyzed in SAS, using the method of Cluster analysis. Two data sets were used, the original and a log transformed version. Each of these were preclustered. The two preclustered data sets were then clustered, using three different clustering methods, which resulted in six tree diagrams. These

diagrams were interpreted, and the clusters were plotted and contoured.

Preliminary piper plots of data were made. These initial results for cluster analysis appear to be reasonable.

3GFH014C Evaluate GIS methods

F. D'Agnese and C. Faunt continued a paper on the use of GIS for numerical ground-water modeling. Issues being tested involve input array generation, calibration, and modeling workflow.

Planning and Operations:

3GFH022C Refine 3D hydrogeologic model

C. Faunt and K. Turner (while abroad in Europe) met with representatives of the British Geological Survey, and visited Sellafield, the British Waste Disposal Site. They discussed Britain's plans and characterization programs for nuclear waste disposal.

At the IHLRWM Conference, F. D'Agnese met with M. Wilkins (Business Development Manager, Intergraph Corporation) to discuss Intergraph's plans to provide the 3D modeling activity with a workstation and software for visualization of the regional hydrogeologic framework model.

WBS 1.2.3.3.1.2 Unsaturated Zone Hydrology

OBJECTIVE

To develop a model of the unsaturated zone hydrologic system at Yucca Mountain that will assist in assessing the suitability of the site to contain and isolate waste. (SCP Investigation 8.3.1.2.2)

WBS 1.2.3.3.1.2.1 Unsaturated Zone Infiltration

Principal Investigator - A. Flint

OBJECTIVE

To determine the effective hydraulic conductivity, storage properties, and transport properties pertinent to unsaturated zone infiltration as functions of moisture content or potential; and to determine the present and to estimate the future spatial distribution of infiltration rate over the repository block at Yucca Mountain. (SCP Study 8.3.1.2.2.1)

SCP 8.3.1.2.2.1 Unsaturated zone infiltration LOE Account 0G33121Z93

Summary Account Manager - A. Flint

ACTIVITIES AND ACCOMPLISHMENTS

Support Project Operations, FY93

Activities included preparation of monthly PACS. W. Guertal, D. Hudson, and L. Hofmann were involved in a public tour. D. Hudson was involved with an all day tour of Area 25 for the participants of the Cl^{36} Workshop. A. Flint, L. Flint, W. Davies, J. Hevesi, L. Hofmann, W. Guertal, and D. Hudson were involved with preparing, organizing and running the all day technical tour for the annual HLWC, and nine 1-hour small group tours of the HRF.

W. Guertal attended GET training renewal. D. Hudson attended QA document training. QA reading assignments were completed. A draft of a technical procedure for determining calcium carbonate content was prepared and sent to Denver for pre-QA review. HP-263 was revised and sent to Denver for re-typing and technical review.

A. Flint, L. Flint, W. Guertal, D. Hudson, M.N. Nash, and M.H. Nash attended the C1³⁶ Workshop. A. Flint and L. Flint prepared and presented a presentation for the NWTRB Meeting in Reno, Nevada. A. Flint, L. Flint, J. Hevesi, W. Guertal, D. Hudson, and J. Gonzales attended IHLRWM Conference.

Neutron Moisture Monitoring FY93
All neutron holes were logged this month.

SCP 8.3.1.2.2.1.1 Characterization of hydrologic properties of surficial materials 0G33121A93
Summary Account Manager - A. Flint

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUI012 Collect/analyze consolidated/unconsolidated materials

Three transects of tensiometers (60 tensiometers total) were installed in WT-2 wash. The tensiometers were installed at two depths (15 and 30 cm) at each of the sampling locations, and are being read at selected time intervals (approximately twice a week). Grab samples were taken at each location. These samples will be used for soil moisture potential and water content measurements.

The monthly surficial moisture sampling project is continuing. Although the surface samples (upper 5 cm) were dry (20 to 60 bars), tensiometers placed at 30 cm indicate that this depth is still moist (0.5 to 1 bar). In order to investigate this difference, samples were taken at 5 cm increments, to a depth of 30 cm, at 5 sampling locations. Gravimetric moisture content and soil moisture potential were determined for each of the samples. Unique moisture gradients were associated with each of the varying surficial materials. This sampling sequence will be repeated in the future.

3GUI015A Develop preliminary geohydro/surficial/infil/runoff map

Specific map unit descriptions for each of the geomorphic surfaces are being evaluated. As soon as the new GIS software arrives, the preliminary surficial geomorphic map of the repository region will be digitized.

3GUI010 Prepare interim status report

The interim status report was begun.

SCP 8.3.1.2.2.1.2 Evaluation of natural infiltration 0G33121B93
Summary Account Manager - A. Flint

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUI305 Conduct water balance studies FY93

Tensiometers are installed and working properly on the crest of Yucca Mountain at N-27 and N71, in WT-2 Wash at N-54 and N-55, and in Pagany Wash at N-14. The soil water potential at 30 cm is monitored at approximately weekly intervals at each of these locations. Soil samples were collected at each of these locations in 5 cm increments, from the surface to 30 cm, to measure the profiles of water content and water potential. Transects of tensiometers at 30 and 15 cm were installed across WT-2 wash to study the correlations between slope, aspect, radiation load, soil texture, depth to bedrock, and vegetation with the near surface boundary conditions of water content and water potential for use in small scale watershed models. Bowen

ratio data were collected.

3GUI307 Develop small scale watershed model

Preliminary work setting up the GIS workstation was begun, to start digitizing properties and measurements, for use in watershed models. Software procurement is slowing this process.

3GUI310 Evaluate shallow/deep infiltration process FY93

Processed core data and neutron probe logs were compared for WT-2 wash at the N-53, N-54, N-55 cross-section. N-53 data show increased, and more variable, water contents through the alluvium and into the bedrock; N-54 data show little changes in water content in the alluvium below 2 m, and the saturation profiles suggest a long term drying trend below the surface alluvial pulses; and N-55 data show water content changes to approximately 6 m through the alluvium and into the bedrock, and also suggest a drying trend of the profile through the welded columnar unit. This data supports the model of deep infiltration occurring through the shallow alluvium covering on the slopes of washes rather than in the deep alluvium at the bottom of washes. UZ-16 core data of saturation, volumetric water content, porosity, and bulk density suggest a low permeability confining layer below the Calico Hills-Prow Pass contact that maintains the water table level below the piezometric surface.

3GUI050 Prepare report historical neutron hole data

All historical neutron probe data are entered into a functional Paradox data base. The process of verifying the data will begin soon. Preparation of the report is contingent on the data being verified.

3GUI300 Prepare interim status report

This is in preparation and should be completed on schedule.

SCP 8.3.1.2.2.1.3 Evaluation of artificial infiltration 0G33121C93

Summary Account Manager - A. Flint

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUI636 Conduct infiltrometer study/prepare OFR

Began preparation of a manuscript which describes the operation and performance of the ring infiltrometers and water storage system. A rough first draft of the manuscript has been completed. Work is progressing on the manuscript's diagrams and figures.

A survey of potential field sites for infiltrometer measurements has been completed. The sites that were chosen should represent the greatest range in infiltration rates found throughout the study region. As soon as QA procedures are in place, infiltrometer measurements will begin.

3GUI640 Conduct prototype ponding/SPRS/LPRS study-finalize methods

Neutron monitoring at N-85 continues. The periodic readings show that internal drainage is proceeding, but at a very slow rate. Weekly readings will be taken during the rest of the study year.

Bulk density samples were collected at selected probe locations at N-85. Particle size analysis, moisture content, and moisture potential will be determined for these samples.

3GUI630 Prepare interim status report

The interim status report was begun.

WBS 1.2.3.3.1.2.3 Percolation in the Unsaturated Zone - Surface Based Study

Principal Investigator - J. Rousseau

OBJECTIVE

To determine the present *in situ* hydrologic properties of the unsaturated zone hydrogeologic units and structural features; to determine the present vertical and lateral variation of percolation flux through the hydrogeologic units and structural features; to investigate the relationships between present flux and past climatic conditions; and to determine the effective hydraulic conductivity, storage properties, and transport properties as functions of moisture content or potential. (SCP Study 8.3.1.2.2.3)

SCP 8.3.1.2.2.3 Percolation in the unsaturated zone, surface-based study LOE Account 0G33123Z93

Summary Account Manager - M. Chornack

ACTIVITIES AND ACCOMPLISHMENTS

Support Project Operations

Permeameter procedure (USGS-HP-266, R0) is in review. There was a modification to HP-229 to make the humidity sensor generic. HP-229 is now R2.

The Rotronics humidity sensor in one of the relative humidity ovens went bad and was sent back for repairs.

HRF Tours

4/1 DOE Inspector General's office
4/7 Mineral Co. officials
4/24 Public Tour
4/26 IHLRWC general tour (3 buses)
NRC tour

D. Hudson attended the High Level Waste Conference technical field trip conference. Hudson also attended a chlorine-36 workshop and visited with J. Fabryka-Martin on site.

HRF Borehole monitoring and sensor recalibrations

Continued monitoring of HRF boreholes; prepared monthly PACs status reports for month of March 1993; prepared 8th semiannual progress report for the period of October 1, 1992 - March 31, 1993; prepared modifications and contract addendum for the Insulated Instrument Shelter procurement; and attended pre-award survey at R/P International in Cincinnati, Ohio (meeting was attended by J. Rousseau, J. Kume, and J. Foster, Contracting Officer, USGS, Central Region).

J. Rousseau met with RSN engineers to discuss various approaches for geophone instrumentation of UZ-16 (VSP-2). Tentative schedule for instrumenting, and conducting the first field VSP survey at UZ-16, also was discussed.

A. Balch prepared a briefing for the upcoming NRC presentation in June, and the dry run in Las Vegas scheduled for May 7, 1993.

J. Rousseau participated in a dry run in preparation for NWTRB presentations; and made a presentation to the NWTRB in Reno, Nevada. The title of presentation was "*A Features-based*

drilling approach for deep percolation studies at Yucca Mountain, Nevada". Rousseau also attended the HLRWMC in Las Vegas, Nevada.

All Denver based staff attended a half-day class on "sexual harassment" in the work place.

Select Denver based staff attended training on QMP 4.01, QMP 7.01, QMP 7.04.

J. Rousseau and G. LeCain prepared annual USGS performance appraisals.

Staff vacated office and shop space in Building 56. Equipment located in the facility was moved to the NTS.

Prepared interim status reports for air-k testing, vertical seismic profiling, integrated data acquisition system, and surface based borehole accounts.

J. Rousseau hosted a special tour of the HRF calibration laboratory in conjunction with the HLRWMC tour of the Yucca Mountain site.

R. Hommel prepared a preliminary draft of a technical procedure for maintaining the calibration status of the two pressure humidity generator.

Received delivery of 200 geophone cable brackets that will be used to instrument UZ-16 (VSP-2).

Submitted purchase requisition for core velocity measurements (UZ-16); assisted QA office with specification requirements needed to certify recommended vendor. Vendor was certified and awarded the order.

Continued working with the Central Region procurement and contracting division on acquiring 100 pressure transducers. Order was originally submitted in November '92. Execution of order continues to be hampered by requirements to demonstrate the need for sole-sourcing of this item.

Prepared purchase requisitions for teflon tubing, electrical cable, and fiberglass pipe for instrumenting UZ-16, UZ-14 and the existing shallow UZ boreholes.

Continued with development of a standardized stemming plan for VSP and hydro-instrumented boreholes using RockWare Software package.

Submitted paperwork requesting hire of a computer programmer to replace positions vacated with termination of IDAS. B. DeHaan was hired and began work.

Fabrication of the second and third cable reel racks for hydro-instrumentation of the UZ boreholes was completed.

Completed prototype fabrication of a mounting bracket that will be needed for hydro-instrumentation of existing shallow UZ boreholes. Intent is to fabricate all mounting brackets using local (USGS) machine shop support.

Reviewed modification of QMP 3.03.

Finished work on ICONVERT for HDAS conversion. Section for HRFDAS conversion was split off to a separate program called HCONVERT, which can be classified as peripheral.

Continued working on IDISPLAY program. The sections for clearing curves, controlling gap size, and numeric entry of y scale values were completed.

Reviewed bids on computer order. Orders for UPSs, and software for printing graphics in protected mode, have been received.

Attended presentation on DOS 6. Evaluation is that there are not enough new features to make it worthwhile to upgrade.

Air-K Testing

G. LeCain attended a half-day workshop on the new QA procurement policies, and a half-day workshop on sexual harassment in the work place.

SCP 8.3.1.2.2.3.1 Matrix hydrologic-properties testing 0G33123A93

Summary Account Manager - D. Soeder

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUP005A Measure rock properties/state variables FY93

Final dry weights of the UZ-16 core from 1408-1685 feet were determined, and allowed for the calculation of core saturations to aid in the interpretation of water level and bailing information obtained during the final drilling cycles.

3GUP025A Determine matrix permeability FY93

Saturated permeability data interpretation has been completed on 23 runs of samples from the Prow transect. Additional lab personnel have been added to the technical staff, and are being trained, so the remaining permeability samples from the prow will be completed soon. In addition, J. Istok is finalizing a BASIC program to do interactive data analysis on the flow data to calculate permeabilities, which will greatly speed up the process.

3GUP031A Determine moisture characteristic curves FY93

Moisture characteristic curve measurements in the chilled-mirror CX-2 psychrometer are continuing on samples of fine soil (<2 mm size fraction) and coarse fragments (> 9.5 mm size fraction) as well as mixtures composed of varying percentages of the coarse and fine fractions. REECO has gotten its temperature calibration standard approved by YMP and is awaiting its return to the REECO lab.

SCP 8.3.1.2.2.3.2a Surface-based boreholes studies 0G33123B93

Summary Account Manager - J. Rousseau

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUP053A Drill UZ boreholes

Drilling of UZ-14 commenced on April 15, 1993.

Planning and Operations:

3GUP050A Prepare interim status report

Prepared interim status report on Surface-based borehole studies.

SCP 8.3.1.2.2.3.2b Vertical seismic profiling 0G33123C93

Summary Account Manager - J. Rousseau

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUP081B Conduct VSP prototype field test and analysis

Additional crosshole seismic data were acquired at the CSM Experimental Mine. The crosshole data have been enhanced significantly by computer processing. From an inversion point of view, the enhanced data quality is marginal. Plans to replace the hydrophone receiver with a wall locking geophone have been delayed due to a malfunction in the geophone. Delays in this activity will not affect the VSP data acquisition schedule at Yucca Mountain. Crosshole work is not planned at Yucca Mountain during FY93.

Planning and Operations:

3GUP084B Provide velocity measurements UZ-16 core

PBT Laboratory has been certified as an approved vendor by the QA office, a contract for core velocity measurement, was awarded to PBT Laboratory.

Variances:

3GUP081B Conduct VSP prototype field test and analysis

This activity remains behind schedule due to difficulty in acquiring field data and instrument problems. These delays will not affect the Yucca Mountain VSP schedule.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 200)

Started work on the presentation for the NRC geophysics integration technical exchange; dry run planned for May 7, 1993, for presentation June 8, 1993.

Revised abstract of paper for Fall SEG and submitted for final review and approval

Additional reprocessing of the Yucca Mountain model data continues. Analysis of some of the pre-stack images suggests some of the registry problems described earlier may be due to a changing source waveform. That is, as the source is moved from location to location on the surface, its wave shape or "signature" changes, which in turn affects the signature of the reflection image. This is a problem which may arise in the field also. Attempts are being made to correct the problem by modifying the imaging condition. Attempts also may be made to compensate for the effect by signature deconvolution.

SCP 8.3.1.2.2.3.2c Integrated data acquisition system 0G33123D93

Summary Account Manager - J. Rousseau

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUP072C Develop, test, review, and integrate software

The transition from the PDP based system to a simpler PC based system is continuing. The new system performs four main functions - data acquisition, data transfer to Denver, data translation,

and data display and analysis. The data acquisition function is performed by three programs: HDAS, SETHDAS, and HBASE. These programs are written and will be tested in May. The data transfer is accomplished using a commercial program called PCANYWHERE. This has been used for the last 18 months for transferring HRF borehole data. The data translation program called ICONVERT has been written and will be used to convert from the HDAS output file format to a data base structure suitable for display. Work is continuing on IDISPLAY, the program to graphically display the data. The majority of the PC based system has been written and is ready to be tested on the HRF boreholes.

The PC based system initially is being implemented as a minimal system for data acquisition. The complex alarm and communication system originally planned for IDAS is not in the initial implementation. Some of this will be implemented if we are able to maintain communication with the shelters using radio modems, but the focus will be on data collection and transferring the data back to the HRF building. There are no plans for handling data from external sources such as data loggers. HDAS and ICONVERT are being developed and fully documented under QMP-3.03. The rest of the programs are considered to be peripheral.

3GUP076C Evaluate prototype data from HRF boreholes

Evaluation of data from the HRF boreholes continued throughout the reporting period. Sensors in these boreholes have been operating for over 18 months and continue to provide reliable data. The new PC based data acquisition system is ready to be tested on the HRF boreholes in May. This installation is similar to that which will be used in the field shelters. One computer will be used only for data acquisition and the data will be transferred to another computer, or, in this case, the HRF Novell network where it can be transferred to Denver.

3GUP071C Prepare for instrumenting UZ borehole

This activity is nearly unchanged under the PC based system. The first instrument shelter already has been procured and is being evaluated for any modifications that may have to be made for the PC based system. These appear to be minimal. Evaluation of the radio modems, which were purchased for the PDP based system, indicates that they work reliably at 9600 baud. A systems analyst with a strong electrical engineering background has been hired.

Planning and Operations:

3GUP070C Prepare interim status report

Work has begun on preparing the interim status report.

SCP 8.3.1.2.2.3.2d Air-permeability and gaseous-tracer testing 0G33123E93

Summary Account Manager - G. LeCain

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUP031D Prepare/test/write report for UZ-16 air-k

The third axle was installed on the field support trailer and the boom supports were reinforced with additional steel. In addition, many of the welds required rewelding. The next step is to send the trailer for safety inspections of all load bearing welds, and the boom will be load-tested at 10,000 lbs. The unit will be ready to begin field testing June 14, 1993.

Variances:

3GUP032D Prepare/test/write reports for UZ air-k testing

The testing of UZ-16 is behind schedule because the borehole was not completed until the end of March. In addition, the testing has been delayed due to USBR budgeting and scheduling

problems. The USGS decided that the only possibility of completing the equipment was for the PI to assume all responsibilities for construction and testing of the equipment. The PI has scheduled the equipment to be completed and ready for field use on June 14, 1993.

WBS 1.2.3.3.1.2.4 Percolation in the Unsaturated Zone - ESF Study

Principal Investigator - M. Chornack

OBJECTIVE

To conduct hydrologic tests in the ESF to supplement and complement the surface-based hydrologic information needed to characterize the Yucca Mountain site; to provide phenomenological information for analyzing fluid flow and the potential for radionuclide transport through unsaturated fractured tuff; and to provide information about water flow through unsaturated fractured tuffs. (SCP Study 8.3.1.2.2.4)

SCP 8.3.1.2.2.4 Percolation in the unsaturated zone, ESF study LOE Account 0G33124Z93

ACTIVITIES AND ACCOMPLISHMENTS

FRHG staff attended a "Sexual harassment" class; FRHG staff members attended a procurement workshop; attended the HLRWM conference in Las Vegas; and the FRHP meeting.

F. Thamir visited the WIPP site in Carlsbad, New Mexico as a USGS representative to the ESF IDS group, and began writing a technical procedure on calibrating pressure transducers.

Refurbishment (new electrical wiring, re-sealing potential air entry points, etc) of the glove box for use in the imbibition experiments (obtained from USGS surplus in Bldg 810) was completed, and an area set up for this station.

A preliminary controlled property inventory was completed prior to J. Brooks' review scheduled for May 7, 1993.

G. Severson checked and tested 7 XT personal computers in the laboratory. Three that were classified as "obsolete", and therefore available for cannibalization, were checked and stripped of the few components that were serviceable. These three computers will be excessed in May.

Electronics Expo at the Denver Convention Center was attended by three staff members.

B. Britain completed his baseline medical examination and remainder of new employee QA orientation training in April, and began working on a draft technical procedure for calibrating thermocouple psychrometers.

Technical review of USGS-QMP-3.15, R1, "*Application of graded quality assurance*" was completed and submitted to W. Causseaux, and the QMP-5.05, R3 reading assignment was reviewed.

Prepared March PACS reports.

Prepared and processed a number of purchase requests.

Cleaned filters in dust collection unit in Bldg 20 laboratory.

S. Anderton continued supporting the percolation test and the Block E experiments as well as the tests on sample 13B. The thermocouple psychrometers used in the Block E experiment are still being recalibrated to check for drift during the experiment. This was started in March and continues into May.

Samples were cored from trimmings from the Block E sample for imbibition tests, including setting up a drill for wet coring in the laboratory.

SCP 8.3.1.2.2.4.1 Intact fractures testing in the ESF 0G33124B93

Summary Account Manager - G. Severson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUS015J Complete journal paper: detailed moire

This draft is still being written and will be submitted to the HIP reports section for formal technical review in the near future.

3GUS020J Design and conduct tests

Consideration was given to the design of the tests to be conducted under this activity. The air permeability manifold was torn down and the mass flowmeters sent in for calibration prior to use by the intact fracture test and the percolation test. A material is being sought for use as a "blank" that would have essentially a zero permeability. The actual start of testing under this activity is dependent on the completion of activity 3GUS028J.

3GUS024J Complete OFR on projection moire

Progress toward this "final report" continues. A draft of this OFR will be submitted for review after activity 3GUS015J is completed, which should be sometime in May 1993.

3GUS028J Design/fabricate vessel

Most of the pieces for the low-pressure vessel have been completed. One radius on one of the drawings still considered an o ring seal (original seal), rather than a poly pak seal that was finally decided upon. This one piece remains to be machined. The material for this piece was received in April. Fabrication of the LVDT mounting brackets for displacement measurements has not been completed. Some of the plumbing hardware has been received but, a considerable number of items still need to be obtained.

A preliminary design was decided upon for the test stand for the low-pressure vessel. This was submitted to a machine shop for estimates of cost and time involved for fabrication.

3GUS022J Select analog site-fracture sampling-evaluate/develop axial fractures

The "north test pit" (test pit #1) at Fran Ridge, Yucca Mountain, Nevada has been inspected and could be used as a possible sampling site. However, discussions concerning the mapping work (USBR) to be done in this pit still indicate that this work will probably not be completed during FY93 due to funding constraints.

Planning and Operations:

3GUS018J Prepare Interim Status Report

A draft of the Interim Status Report was started mid-April. This report shall be finished by May 8, 1993.

SCP 8.3.1.2.2.4.2 Percolation testing in the ESF 0G33124B93

Summary Account Manager - F. Thamir

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUS034B Prepare analytical report on imbibition experiments

Preliminary results from an experiment that was repeated last month indicated that water flow rate through a fractured sample, under unsaturated conditions, is significantly affected by what appeared to be bacterial and algae growth. After the biological growth was observed, the flow rate under similar conditions became less than half the initial flow rate, when the water did not have noticeable biological growth. Also, the flow rate fluctuated and became unpredictable after the biological growth was observed. A similar experiment will be repeated to study this effect in more detail. Bacteria does occur in the unsaturated zone; however, the types and concentrations in the Yucca Mountain region have not been studied thoroughly.

3GUS033B Prepare prototype percolation test report

The paper entitled "*Laboratory study of water infiltration into a block of welded tuff*", by F. Thamir, E. Kwicklis, and S. Anderton was presented at the 1993 IHLRWM Conference in Las Vegas, Nevada and published in the Conference Proceedings. The information in this paper will become a significant part of the percolation test report.

3GUS035B plan and design ESF percolation test

Work on the new revision to the ESF Percolation Test Study Plan, SP-8.3.1.2.2.4.2, continues.

3GUS036B prepare interim status report

Work on this report was started.

SCP 8.3.1.2.2.4.7 Perched water tests in the ESF 0G33124G93

Summary Account Manager - M. Chornack

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUSO12G Begin monitoring ESF for perched water

Monitoring for perched water following the drilling of shot holes, and after each blast round in the ESF, is being conducted by USBR personnel in conjunction with underground mapping.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 16)

Revised Table 1 in technical procedure HP-260 "*Hydrologic testing, monitoring, and sampling perched-water zones in the Exploratory Studies Facility*".

SCP 8.3.1.2.2.4.8 Hydrochemistry tests in the ESF 0G33124H93

Summary Account Manager - A. Yang

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUS403 Research gas-sampling system

The task requires a gas sampling system using a commercial product called "SEAMIST". A requisition has been prepared for a Commerce Business Daily advertisement in March, 1993. The contract may not be awarded for five months.

Variances:

3GUS403 Research gas-sampling system

The work on this task is behind schedule because of funding for SEAMIST procurement. The

milestone, 3GUS403M Status Report on Gas Sampling, cannot be provided due to lack of equipment. The slippage in this task will impact the FY94 baseline schedule.

WBS 1.2.3.3.1.2.6 Gaseous-Phase Movement in the Unsaturated Zone

Principal Investigator - M. Chornack

OBJECTIVE

To describe the pre-waste-emplacment gas-flow field; to identify structural controls on fluid flow; to determine conductive and dispersive properties of the unsaturated zone for gas flow; and to model the transport of water and tracers in the gas phase. (SCP Study 8.3.1.2.2.6)

SCP 8.3.1.2.2.6.1 Gaseous-phase circulation study 0G33126A93

Summary Account Manager - M. Chornack

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GGP06B Plan tracer tests in selected UZ boreholes.

The Dyna calibrator, which will be used to provide standards for the tracer tests, was calibrated. Carbon dioxide samples were collected and analyzed for the Hilte holes. A preliminary map of the Hilte hole locations was prepared. A letter was sent to K. Stetzenboch, the UNLV consultant on tracer gases for the state of Nevada, describing the testing it is felt is necessary to adequately assess the gas tracers that have been included on the permit application. Have attempted to set up a meeting, to discuss this work with Stetzenboch, without success.

3GGP02B Collect UZ borehole data - FY93.

Inserted propeller anemometer into UZ16 open borehole to conduct a total depth flow survey. Obtained flow readings to 250'. Propeller broke off and was lost to the well. Methods are being developed to allow completion of the UZ16 flow survey.

3GGP04B Tabulate and analyze gas samples.

UZ6, 6s, 13, and neutron access borehole gas samples are being processed at SMU for carbon 14 and 13/12 analysis.

3GGP01B Prepare interim status report.

Preparation of the interim status report was begun; expected completion date is set for the second week of May.

Planning and Operations:

3GGP08B Plan modeling and gas flow interference tests.

Gas flow and chemistry data collected from UZ6, UZ6s, and the neutron access borehole are being analyzed for utilization in the 3D gas flow and transport model.

WBS 1.2.3.3.1.2.7 Unsaturated Zone Hydrochemistry

Principal Investigator - A. Yang

OBJECTIVE

To understand the gas transport mechanism, direction, flux, and travel time within the unsaturated zone; to design and implement methods for extracting pore fluids from the tuff; to provide independent evidence of flow direction, flux, and travel time of water in the unsaturated zone; to determine the extent of the water-rock interaction; and

to model geochemical evolution of ground-water in the unsaturated zone. (SCP Study 8.3.1.2.2.7)

SCP 8.3.1.2.2.7 Unsaturated-zone hydrochemistry LOE Account 0G33127Z93

Summary Account Manager - A. Yang

ACTIVITIES AND ACCOMPLISHMENTS

Conduct information seminars on model for project staff

One seminar was held in April to work with the reaction path modeling program, PHREEQE.

Procure, test borehole sampling system (12" hole)

The packer system has been constructed and is awaiting testing.

Contract for Seamist was advertised in Commercial Business Daily. The contract is expected to be awarded in approximately five months. Peters checked on progress.

Prepare hydrologic procedures, FY93

Ratray wrote a technical procedure on operation of a dynaclibrator.

Support project operations, FY93

J. Higgins completed QA reading assignments AP-6.4Q, R2-ICN2.

K. Scofield and M. Beasley completed QA reading assignments.

M. Beasley and P. Striffler attended a training class on sexual harassment.

M. Beasley picked up the Chevy cube van after engine repair.

All project personnel prepared PACS reports, J. Higgins coordinated the report preparation and C. Peters reviewed and edited the report.

G. Ratray picked up computer hardware for A. Yang and G. Ratray.

G. Ratray prepared paperwork for purchase of HFC 134a and regulator from Scott Specialty Gasses.

J. Ferarese attended a 3-day safety class.

Analytical balances were calibrated per QMP 12.01.

Responses to NCR 93-05 were discussed with QA specialists. Samples in question and cross-checked samples have been prepared and sent to NWQL for isotope analysis.

The renovation of the UZ hydrochemistry lab in Bldg 56 has been scheduled for July 1, 1993. Prior to this date, the entire lab will need to be moved to a location suitable for continuation of operations. The potential for moving next door into the old paleohydrology lab has been discussed.

P. Striffler acted as UZ hydrochemistry representative for public tour of the HRF.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUH011 Eval existing export models gaseous C-14 export

Initial estimates of the difficulty of performing these tasks were far too optimistic. The work done to date has shown that calculation of the partitioning of carbon-13 and carbon-14 between the gaseous, aqueous, and solid phases, even in a 1-D transport model, is not something that can be accomplished simply by incorporating a simple set of chemical equations into a transport model, nor by simple modifications of existing geochemical modeling codes.

3GUH012 Prepare, analyze and tabulate data

Ten water vapor samples from borehole UZ1 were analyzed for tritium.

3GUH013 Oversee drilling/collect gas and water vapor

Continued oversight of trace gas injection at boreholes UZ14 and NRG holes.

J. Ferarese trained field personnel on operation of sulfur-hexafluoride, carbon-dioxide, and methane analysis by gas chromatography using newly installed data acquisition system.

Collected gas samples from several UZ, NRG and UZN boreholes that were naturally blowing air. The gas samples were analyzed for carbon dioxide and methane concentrations using the FID on the gas chromatograph.

Conducted tracer gas injection and monitoring at UZ-14 and NRG-5. Trace gas (SF₆) was injected manually using the mass flow controller. Core samples of drilling air were collected at least twice a day or whenever there was a significant change in the volume of drilling air being injected. The concentrations of the trace gas in the drilling air was analyzed using the ECD on the gas chromatograph.

Collected SF₆, CO₂, CH₄, C₁₄, C_{13/12} samples from UZ16 borehole.

Pumped approximately 2.5 million scf air out of UZ16 using HAZVAC.

3GUH017 Modify/develop selected geochem codes

See 3GUH011 above.

Variations:

3GUH011 Eval existing export models gaseous C-14 export, and 3GUH017 Modify/develop selected geochem codes

The adequate modeling capabilities will require a fully coupled transport and geochemical model (such as PHREEQE). Generation of such a reaction-transport model will require a cooperative effort with one, or perhaps several, NRP researchers. No such effort is currently in progress, and thus attempts to schedule progress on this problem is simply not possible. P. Montazer, a private consultant, had contacted A. Yang to do the gas-phase modeling. Montazer's consulting firm is currently doing some work for the Yucca Mountain Project under subcontract to REECO. This is a potential alternative to complete the task.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent 224)

The FID (flame ionization detector) which analyzes for carbon dioxide and methane was set up in the mobile lab and optimized. (8 hrs)

Discussed packer handling system construction work with REECo truck shop (Mercury, Nevada) and USBR design engineer. As soon as all equipment is in (crane, hoist, winch, etc.) the USBR engineer and REECO truck shop personnel will complete the construction of the system. (8 hrs)

A video and caliper log of UZ16 were obtained and viewed to determine packer locations so that internal tubing bundles can be prepared. (8 hrs)

C. Peters and A. Yang attended the IHLRWM Conference. (80 hrs.)

Investigated the analytical behavior of the potential tracer gas, HFC 134a (a SUVA product), on a gas chromatograph. Pumped gas samples from ten different depths at UZ1 and checked the samples for evidence of Freon or SUVA gasses. (16 hrs.)

Continued testing the adsorption of CO₂ onto partially saturated crushed tuff. Tested a modified sample flask for vacuum integrity. Cut gypsum cement core to a size that will fit into the modified sample flask. Tested deionized water for pH, conductivity, and CO₂ concentrations. (24 hrs)

Made pre-travel arrangements and held discussions with REECo and Caltrol representatives regarding hookup and placement of USGS trailer, computer, and other tracer injection equipment, including the procurement of necessary gasses and regulators. G. Rattray provided onsite assistance while Caltrol calibrated and tested the automated tracer injection equipment. Rattray worked with Caltrol personnel to write program codes allowing computer to operate auto-injection equipment and to calculate and store drilling data. Rattray attended a meeting with Caltrol, DOE, REECo, and RSN personnel to discuss who will be responsible for calibrating and servicing the auto-injection equipment. (80 hrs)

Transported all available packer equipment to NTS in preparation for gas sampling at borehole UZ-16. Submitted flatbed trailer to REECo shops for modifications to support packer installation and withdrawal. Trailer modifications have begun, currently waiting on winch, traction hoist, and gantry boom.

SCP 8.3.1.2.2.7.2 Aqueous-phase chemical investigations 0G33127B93

Summary Account Manager - A. Yang

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUH035A Prepare report on effects of core sealing

This report was presented at the IHLRWM Conference during the week of April 26, 1993 and was published in the Proceedings' volume. This task is complete.

3GUH030A Export, prepare, extract and analyze core

Analytical request forms for analysis of sixty-four water samples from distillation and core-squeezing operations have been completed. The samples have been delivered to the NWQL where they will be analyzed for stable isotopes.

Transferred drying oven and supplies to Building 20 lab in preparation for cutting UZ-16 core. Prepared balance in Building 20 lab for QA qualification.

Additional UZ-16 core was transported to Denver Federal Center from Mercury.

Inventoried 8 boxes of UZ16 core received April 13, 1993. Inspected 33 UZ-16 core samples, prepared 28 samples for compression tests, and determined moisture content and volume of water available in each core.

Ten UZN-55 core samples were distilled. The extracted pore water will be analyzed for tritium, O18/16 and D/H.

3GUH032A Design aqueous tracer container size/prep solutn
Raytheon is responsible for designing the containers and tracer injection system. USGS will provide needed information. This task is expected to be on schedule.

Planning and Operations:

3GUH029A Prepare interim status report
A. Yang and J. Higgins prepared the interim status report and submitted it to M. Chornack. A meeting on status will be held in mid May.

Variances:

3GUH039A Prep/review journal art: press vs pore H2O chem
Start of work on this paper will be delayed due to the lack of project personnel to complete chemical modeling, data analysis, and squeezing experiments on time. Personnel that are involved in this task are busy with gaseous-phase activities. The schedule for completion of this task may be impacted if additional positions are not filled.

WBS 1.2.3.3.1.2.8 Fluid Flow in Unsaturated Zone Fractured Rock

Principal Investigator - L. Anna
LBL Principal Investigator - G. Bodvarsson

OBJECTIVE

To develop and validate conceptual and numerical models describing gas flow and liquid water and solute movement in unsaturated, fractured rock at the laboratory and sub-REV scales. (SCP Study 8.3.1.2.2.8)

SCP 8.3.1.2.2.8.1 Development of conceptual and numerical models of fluid flow in unsaturated, fractured rock 0G33128A93

Summary Account Manager - L. Anna/E. Kwicklis

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUF026 Model imbibition experiments
The experiment is in the final stages of data collection. A report is in progress and should be finished this month.

3GUF020 Conduct scoping and bounding calculations
Continued to develop techniques to calculate fracture porosity from measured total porosity and acoustic properties of rock. Continued to search Yucca Mountain literature for total porosity and acoustic properties of rock data. Liquid water flux rates are being calculated from water

saturation and water potential profiles from four surface based borehole data. Because the initial phase of this work was successful, it is planned to investigate other surface based boreholes for similar information.

3GUF022 Model large block percolation experiment

Data collection for the large block percolation experiment was terminated in January. Transformation of the large volume of data as input into the numerical model has begun. Formulation of the modeling strategy has begun, experimenting with model runs using hypothetical data.

3GUF027 Adapt fracture network model to UZ flow.

A contract with Golder Associates was finalized to help and advise the USGS adapt a fracture network model to UZ flow. Initial discussions began between the USGS and Golder to define strategies and goals. Golder's FracMan code has been adapted to the USGS computer systems. As part of the conceptual design of this activity, data and information about fracture orientation, dip, frequency, density, orientation and flow rates in differential stress regimes, and fracture characterization at different scales will continue to be compiled. This information will be in the formulation of the fracture network model.

3GUF021 Perform Num. Experiments/Model Fracture Network.

July 1993 start.

Variances:

3GUF026 Model Imbibition Experiments.

This activity has been delayed because the imbibition experiment has been changed. Changes include a new non-fractured sample and continuous data collection instead of periodic collection. This change of technique will give more meaningful information when comparing numerical simulation. Also, the large block percolation experiment had syphoned manpower and computer systems support from the imbibition test; however, data collection from that activity is now complete.

SCP 8.3.1.2.2.8.1L Development of conceptual and numerical models of fluid flow in unsaturated, fractured rock 0B33128A93

Summary Account Manager - G. Bodvarsson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUF418L Complete and publish paper in RWMNFC journal

No work performed. The paper "*Accuracy and efficiency of a semi-analytical dual-porosity simulator...*", by R. Zimmerman, G. Chen, G. Bodvarsson, and E. Kwicklis, has been completed, and is in the hands of the journal editor.

3GUF217L Complete semi-analytical methods report

Writing of the report/user's guide for the semi-analytical dual-porosity code continued. The guide includes appendices on numerical solution to the Richards equation, and discussion of sorptive lengths and imbibition equilibration times for matrix blocks.

Work Performed but not in Direct Support of the Scheduled Tasks

R. Zimmerman attended the 4th IHLRWM Conference in Las Vegas, and delivered a paper entitled "*An inverse procedure for estimating the unsaturated hydraulic conductivities for volcanic tuffs*," co-authored by G. Bodvarsson of LBL and A. Flint and L. Flint of USGS.

Staff members completed various QA reading assignments.

WBS 1.2.3.3.1.2.9 Site Unsaturated Zone Modeling and Synthesis

Principal Investigator - E. Kwicklis

LBL Principal Investigator - G. Bodvarsson

OBJECTIVE

To develop conceptual and numerical models for the site unsaturated zone hydrogeologic system; to apply the models to predict the system response to changing external and internal conditions; to evaluate the accuracy of the models using stochastic modeling, conventional statistical analyses, and sensitivity analyses; and to integrate data and analyses to synthesize a comprehensive qualitative and quantitative description of the site unsaturated-zone hydrogeologic system under present as well as probable, or possible, future conditions. (SCP Study 8.3.1.2.2.9)

SCP 8.3.1.2.2.9.1 Conceptualization of the unsaturated-zone hydrogeologic system 0G33129A93

Summary Account Manager - E. Kwicklis

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUM002A Develop conceptual models of UZ - FY93

A summary of recent work (see reports for March and February) entitled "*Estimation of unsaturated zone liquid water flux at boreholes UZ #4, UZ #5, UZ #7 and UZ #13, Yucca Mountain, Nevada, from saturation and water potential profiles*" by E. Kwicklis, A. Flint and R. Healy was forwarded to the technical program committee of the Focus'93 conference for possible inclusion in the symposium.

Preparation of the interim status report was initiated.

3GUM028A Conduct hypothesis tests/2-d cross-sectional models

No work was conducted under this activity because of the time spent preparing for presentations to the Nuclear Waste Technical Review Board (NWTRB) or attending the IHLRWM Conference.

Variances:

3GUM028A Conduct hypothesis tests/2-d cross-sectional models

This activity is slightly behind because much of March was spent modeling the hydrologic effects of thermal loads related to the emplacement of radioactive waste at Yucca Mountain (results were presented at the CASY Symposium March 24-25, Denver) and most of March was spent preparing a presentation to the NWTRB. This activity is expected to resume in May.

Work Performed but not in Direct Support of the Scheduled Tasks

Approximately 32 hours was spent attending the IHLRWM Conference.

SCP 8.3.1.2.2.9.2L Selection, development, and testing of hydrologic-modeling computer codes
0B33129B93

Summary Account Manager - G. Bodvarsson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUM016L Complete decoupled TOUGH testing

The decoupled TOUGH code has been tested against the original TOUGH code for a series of problems and has given accurate results in all cases. This completes the task.

Work Performed but not in Direct Support of the Scheduled Tasks

G. Bodvarsson participated in a "dry run" for the NWTRB meeting.

G. Bodvarsson participated in the NWTRB meeting in Reno, and presented an overview of how the site-scale model will address issues related to infiltration and future climate changes.

Staff members completed various QA reading assignments.

SCP 8.3.1.2.2.9.3L Simulation of the hydrogeologic system 0B33129C93

Summary Account Manager - G. Bodvarsson

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUM32L Complete report moisture flow

Work continued on the writing of chapters for the report, which gives a detailed description of the development of the 3-dimensional numerical grid.

3GUM15L Collect/incorporate new data into moisture-flow model

New moisture tension data were received from A. Flint and L. Flint and these will be analyzed and incorporated into the site-scale model. Various reports were received and reviewed.

Work Performed but not in Direct Support of the Scheduled Tasks

G. Bodvarsson participated in a "dry run" for the NWTRB meeting.

G. Bodvarsson participated in the NWTRB meeting in Reno, and presented an overview of how the site-scale model will address issues related to infiltration and future climate changes.

G. Bodvarsson attended the 4th IHLRWM Conference in Las Vegas and delivered a paper titled "*Studies of the role of fault zones on fluid flow using the site-scale numerical model of Yucca Mountain,*" coauthored by C. Wittwer and G. Chen.

Staff members completed various QA reading assignments.

WBS 1.2.3.3.1.2.10 Prototype Hydrologic Tests that Support Multiple Site Characterization Activities

Principal Investigator - M. Chornack

OBJECTIVE

To perform prototype hydrologic tests to minimize costly stand-by times; to develop QA procedures; to determine feasibility of the proposed tests; to train new personnel; to help increase likelihood of success of the tests; and to test new instruments, equipment, and procedures.

Prototype Cross-Hole Testing 0G3312AC93

Summary Account Manager - G. LeCain

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUT004 Prep open file report on ALTS testing & analysis

First draft of the Apache Leap Tuff Site prototype testing open-file report was completed. The report is presently undergoing in-house review.

Prototype Tracer Testing 0G3312AD93

Summary Account Manager - A. Yang

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUT016D Prepare WRI report on gaseous tracer tests

Continued research of adsorption literature and adsorption geochemical codes contained in the computer program MINTEQA2.

Prototype Pore-Water Extraction 0G3312AG93

Summary Account Manager - A. Yang

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GUT050G Evaluate & analyze chem and compress techniques

J. Higgins discussed core available for testing and analysis with M. Beasley. The purpose of the discussion was to determine which core should be tested first to allow data to be collected that will help complete this task.

Very little progress was made on this task this month because M. Beasley and C. Peters were busy with aqueous and gaseous investigations tasks and J. Higgins was assisting A. Yang in preparing interim status reports for "Aqueous, gaseous, and ESF investigations".

3GUT052G Prepare OFR on pore-water chem vs press data

No progress was made on this task this month because C. Peters was busy with aqueous and gaseous phase investigations and J. Higgins was assisting A. Yang in preparing interim status reports.

3GUT053G Prepare journal paper on dev of 1-D compression

J. Higgins wrote a draft of section on the design of the high-pressure one-dimensional compression cell.

Variances:

Progress on all tasks has been adversely affected this month due to a shortage of personnel. It is expected that the schedules will continue to slip unless more help is obtained. Some relief should be

realized in May, June, and July when J. Higgins increases his time commitment to the USGS assignment agreement. However, this will not completely solve the problem.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 10)

M. Beasley picked up and inspected a first generation one-dimensional compression cell at the USGS machine shop after repairs to the inner corpus ring. (2 hrs)

M. Beasley set up compression test for photo session. (3 hrs)

J. Higgins made edits to WRIR and prepared the news release and WRISC Abstract. The WRIR was sent to USGS Region for approval and is being prepared to be sent to headquarters. (4 hrs)

J. Higgins discussed, with F. Travers, USBR, repairs required for the load frame in the USBR vibration lab. An estimate of time required by Travers for repair work was made and given to A. Yang. Yang will investigate where funds can be acquired and how they should be transferred to USBR. (1 hr)

WBS 1.2.3.3.1.3 Saturated Zone Hydrology

OBJECTIVE

To develop a model of the saturated zone hydrologic system of Yucca Mountain that will assist in assessing the suitability of the site to contain and isolate waste. (SCP Investigation 8.3.1.2.3)

WBS 1.2.3.3.1.3.1 Site Saturated Zone Ground-Water Flow System

Principal Investigator - M. Umari

OBJECTIVE

To determine the hydrogeologic nature of the Solitario Canyon fault in the saturated zone; to determine the time and spatial variation of the potentiometric surface; to determine the character, magnitude, and causes of water-level fluctuations; to estimate elastic and hydraulic properties; to determine transport properties of the saturated zone; to evaluate the relation between hydraulic properties and fracture characteristics; to characterize chemical and physical properties of the saturated zone that affect radionuclide retardation; and to conduct single-and-multiple well tracer tests using conservative and reactive tracers to determine hydrologic, chemical, and physical properties in the saturated zone. (SCP Study 8.3.1.2.3.1)

SCP 8.3.1.2.3.1 Site saturated-zone ground-water flow system LOE Account 0G33131Z93

Summary Account Manager - R. Luckey

ACTIVITIES AND ACCOMPLISHMENTS

Support Project Operations

(A) Site potentiometric-level evaluation (8.3.1.2.3.1.2)

P. Tucci performed routine project operational tasks, including scheduling and coordinating field operations to maintain the water-level monitoring network, overseeing project budget and spending items, preparing personnel actions, attending section meetings, meeting with project personnel, and other miscellaneous administrative and operational tasks for the site potentiometric levels project.

M. Boucher lent QA support to various activities, evaluating QA and organizing QA support for other groups of activities.

P. Tucci prepared and submitted the Interim Status Report for the TPO, fulfilling the milestone, "Interim Status Report" in PACS.

Field personnel performed required maintenance and repairs on steel tapes and multiconductor cable unit used to obtain water-level measurements.

M. Boucher compiled and submitted water-level data for wells J-11, J-12, J-13, VH-1, WT-15, p #1, and WT-13 to the Nevada District for their environmental monitoring program.

M. Boucher prepared TDIFs for information used in G. O'Brien's earthquake reports.

M. Boucher compiled and submitted manual water-level measurements for wells p #1 and WT-13, for 1988-92, to the Nevada District per request from J. Johnson.

P. Tucci and M. Boucher attended training classes on "sexual harassment" and "procurement". R. Valentin and T. Campbell attended First Aid/CPR training, and Campbell attended GET 1.5 refresher class.

D. Baldwin supervised contractor work to free several hundred feet of steel tape stuck in well USW WT-7.

(B) Saturated-zone fractured-rock hydrology (8.3.1.2.3.1.3)

M. Umari prepared the monthly PACS report for March 1993, tracked spending under accounts 4889-12001, -12002, -12005, and -12006, and transferred \$2,580 by Standard Voucher to K. Kipp of NRP to provide 8 days of support in using his HST (heat & solute transport) code to construct cross-sectional models for the c-hole complex.

Plan and schedule project operations

J. Gemmell met in Las Vegas with representatives from RSN, REECo, and SAIC (M&TSS) to try and finalize plans for AC power and pump support at the c-hole complex. The decision was made to use an existing mobile AC power system in the form of a trailer equipped with two 300 kw generators with all the switching, busing, breakers, sensors, and power distribution systems already in place. As far as pump support, REECo was instructed to purchase a new variable-speed controller, because the existing one will not be adequate for the c-hole testing needs.

Prepare procurement documents

The procurement paperwork to have a software engineering company write a computer program for the National Instruments Data Acquisition system (to be used during the c-hole testing activities), which had been initiated in March 1993, had to be modified to include blank forms for, and reference to, Software QA.

Participate in training

M. Umari, G. Patterson, J. Earle, J. Darnell, and J. Gemmell attended a training class on "sexual harassment", and a workshop on Procurement QA.

Prepare for and attend technical and administrative meetings

M. Umari and G. Patterson met with E. Ervin (USGS) and P. Wallman (Golder Associates) to discuss the development of a FracMan model of the c-hole complex. Wallman later presented a brown bag seminar on the use of FracMan in Sweden.

Do operational tasks

Work at the Raymond Quarry site, which will be used to prototype the c-holes-bound packer string: J. Gemmell, J. Earle, and J. Darnnell went to the Raymond site to correct a problem with well SW-2 that was leading to incorrect communication between the downhole transducers and the data logger at the surface. The problem turned out to be partly due to a leak in the casing of a downhole electric-motor-driven valve that opens and closes the transducer reference line. The other part of the problem seemed to be associated with the data logger, because the communication problems totally disappeared when the transducers were connected to LBL's data acquisition system.

Oversee LBL's effort to complete analysis of seismic profile

A. Geldon travelled to LBL to work with E. Majer on interpreting the results from the cross-hole tomographic survey done between wells UE-25 c#2, and UE-25 c#3 in June 1992. Geldon lent his extensive geologic and geophysical knowledge of the site to the process of making geohydrologic sense out of the gathered seismic data.

Convert Scientific Notebook to Technical Procedure

The SN for the field simulation of the c-hole testing, which was approved in February 1993, may have to be modified to reflect a slight change in temperature calibration requirement. The SN will probably be used for the initial stages of the actual testing at the c-holes (tests are planned to start in July 1993), and as such, the conversion to a technical procedure is not imminent.

Develop software QA for analysis programs

All, except one, of the software applications are in the developmental stages in the SZFRHP, and are exempt from full software QA stipulations according to the ACSR YMP-USGS-ACS-G1233131-1, R0. The only exception is the program for automated data acquisition that is being contracted out to a software engineering design firm. This program will be entered into the software QA process upon receipt from the vendor.

Begin 1993 Water-level data collection

Routine tasks completed in this reporting period: monitored 18 zones in 17 wells on a monthly basis; monitored 17 zones in 12 wells on an hourly basis; obtained continuous analog data from 4 zones in two wells (included in count of hourly sites above) in order to monitor water-level responses to earthquakes and UNEs; obtained real-time data on 18 zones in 12 wells using DCP's (included in count of hourly sites above); evaluated status of network at end of each month; and monitored real-time data on a daily basis, looking for water-level excursions and equipment malfunctions.

Special tasks completed in this reporting period: calibrated transducers at the following wells - G-2, p #1, H-5 (both zones), H-3 (upper zone), and H-4 (both zones); and replaced transducers at the following wells - G-2, and H-5.

Other equipment calibrated this month: data logger; barometer (operational check); and chart recorder in well UE-25p #1; and reinstalled and calibrated DCP and earthquake-monitoring equipment in well USW H-5.

Approximately 700' of steel tape from Chain #1 were freed from well USW WT-7.

Transducers, DCP, and earthquake-monitoring equipment were reinstalled, and the site brought back on line into the continuously monitored network.

Water-level measurements were obtained in well UZ-16 on April 6. Water levels appeared to be stable, at a depth of about 1,605' below the top of casing.

Reduce 1992 Transducer calibrations

Work was done on calibrations for wells WT-2 and WT-3 in order to convert the transducer data to water levels.

SCP 8.3.1.2.3.1.2 Site potentiometric-level evaluation 0G33131B93

Summary Account Manager - P. Tucci

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWF064A Complete 1990-91 water-level report:

Transducer data (1990-91) for well UE-25 c#1 were converted to water levels for analysis and inclusion in the report.

R. Luckey informally reviewed existing draft and format of the report, and passed review comments to P. Tucci.

Continued revising and editing previous drafts of the report.

3GWF025A Reduce 1992 water-level data:

Reduction of all 1992 periodic water-level data has been completed, and checked. Calibrations for steel tapes and the multiconductor cable unit, done in 1992, were compiled and the data are being prepared for submittal to LRC.

Variances:

Work on the 1990-91 water-level data report is still behind schedule. In addition to causes of delays listed in the March monthly report, other project duties have delayed the review and evaluation of the data by G. O'Brien and P. Tucci. This review and evaluation must be done before the sections on the hourly water-level measurements can be completed. The report will be lengthy, because it includes 2 years of data for both the periodic and continuous networks, and colleague review of the report will also be lengthy. It is anticipated that an additional 2 months will be required to complete the report. Anticipated completion date is July 30, 1993. This delay will cause a delay in the start of the 1992 data report; however, the format and much of the text for the 1992 report will be exactly the same as the 1990-91 report, and it is anticipated that the time required to complete the 1992 report will be shorter than originally planned. The completion date for the 1992 report remains the same as originally planned (October 31, 1993). No other impacts, due to the delay in completion of the 1990-91 report, are anticipated.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 196 hours.)

G. O'Brien worked on revisions to QMP 5.01. (16 hrs); and on final revisions to HP-60. (8 hrs); and compiled information for TDIF for 1992 earthquake reports. (8 hrs)

G. O'Brien prepared monthly report on status of continuous-monitoring network and quarterly report of status of periodic measurements (16 hrs); and prepared new procedures for using newly acquired SETRA barometers that will be used to replace existing YSI barometers (8 hrs);

G. O'Brien wrote a memorandum documenting the work performed by contractors during the rehabilitation of well H-5, and prepared for a presentation of that work to SZ PI's. (8 hrs)

G.. O'Brien assisted field personnel in getting the DCP and earthquake-monitoring system at H-5 back on line (40 hrs); and worked on problems with Astromed chart recorders used to monitor water levels for earthquake responses. (8 hrs)

G. O'Brien attended "procurement" and "sexual harassment" training classes. (4 hrs)

P. Tucci prepared for and taught a class on "Introduction to ground-water flow modeling" at the Iowa District Office for the Central Region. (80 hrs)

Status of approved reports or reports awaiting approval (not previously discussed):

The text of the approved report "*Water levels in continuously monitored wells in the Yucca Mountain area, Nevada, 1985-88*" was submitted to the Colorado District for final formatting and processing. Work has begun on preparation of camera-ready copies of illustrations by the Colorado District.

The report, "*Earthquake-induced water-level fluctuations at Yucca Mountain, June, 1992*", by G. O'Brien received USGS Director's approval on March 3, 1993, and the report was revised per review comments, and sent to Colorado District for final processing for publication.

SCP 8.3.1.2.3.1.3 Analysis of single- and multiple-well hydraulic-stress tests 0G33131C93

Summary Account Manager - M. Umari

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWF010D Complete Intraborehole Flow & Stress Test Report

A. Geldon completed a manuscript for the report. The manuscript will now have to be typed and prepared for colleague review. The projected completion date of the report at this time is July 1, 1993 (date at which the report, having received colleague review, would be sent simultaneously for WRD Region / Head Quarters review, and for DOE concurrence).

3GWF008D Monitor/Analyze Strain-Related Pressure Response

No progress. Awaiting placement of the multi-zone packer system in the c-holes, to conduct strain-related pressure monitoring during "down" times in the cross-hole testing.

3GWF004D Write Journal Article on the Reanalysis of Past c-hole Aquifer Tests

A. Geldon has been assigned this task. The plan is to use his "*Intraborehole Flow and Stress Test*" report as a basis for this article which will be submitted for publication in the Proceedings of a GSA meeting.

3GWF001D Prepare Interim Status Report

An outline of the report was prepared.

SCP 8.3.1.2.3.1.4 Multiple-well interference testing 0G33131D93

Summary Account Manager - M. Umari

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWF007F Complete Design Memoranda - 5-zone Packer String

The final agreement with the USBR, in the form of a task agreement (TA), stipulates that the USBR will document its design of the packer string system by design memoranda (DM). These DM would also include instructions on assembly of the string prior to field deployment. The final review and revision process of these DM are not due to be completed until end of May 1993.

J. Bowen, USBR, continued to work on these DM.

3GWF030F Expand Packer Strings to 5-Zones

The work under this activity is being carried out jointly by the SZFRHP/ HIP/ USGS-YMP, and the USBR.

After delivery of the packers from Tam Inc. in March 1993, 1/4-inch diameter holes, drilled through the outer protective rubber down to the reinforcing steel bands of the packers, was noticed for the first time (drilled, apparently for equilibration of pressure on both sides of the protective rubber). These holes had been drilled after the final inspection in Houston, and therefore, a letter was requested from Tam documenting this change. In April 1993, a letter was received from Tam discussing this change.

The effort to solder electric connectors to the multi-conductor cable segments that go through the packers, and water-proofing these connections, continued, and is currently 50% complete.

Work continued to make "extension cords" of various lengths. These are segments of multi-conductor cable that do not go through the packers, which are interchangeable and are used between packers and from the top packer to land surface and then to the data acquisition trailer.

A 30 day test of the integrity of the water-proofed, soldered, connections between the electric connectors and multi-conductor cable, was started. A sample connection was placed in a hydraulic pressure cell under 800 psi of pressure.

The remaining "test sections" were assembled and are ready to have the USBR machine shop weld protective "fins" to them. The "test sections" are sections of 2 7/8" pipe with an adjustable "sliding sleeve" (for controlling hydraulic connection with a particular test zone during the testing) in line with it, and a transducer and thermistor attached to it. These "test sections" can be connected to the 2 7/8" drill pipe provided at the c-holes by REECo to form the multi-zone packer string.

The AC power line to the downhole pump has to pass through the top of the pump shroud. This pass-through has to be water/pressure tight. The decision was made to have this section of the power line be a rubber cable, because the water/pressure-tight seal can then be accomplished fairly easily using some form of rubber-gasket. This rubber section of the cable then can be attached to the rest of the cable, which is a metallicly-armored cable.

3GWF014F Develop Techniques for (and Begin) Analysis of X-Hole Test Results

Using the USGS HST (heat and solute transport) 3-D code, written by K. Kipp, USGS/WRD NRP, to develop a 3-dimensional porous-medium-equivalent model of the c-hole complex (the model can be used for cross-hole test design, and analysis of the eventual cross-hole test results): M. Umari, G. Patterson, and A. Geldon collaborated on this effort. A grid was constructed for a cross-sectional HST model between UE25c#1 and UE25c#3, and geohydrologic parameters (hydraulic conductivities and porosities) were associated with seven different horizontal zones. A top boundary condition was established that represents the water table. North-end, south-end,

and bottom constant-head boundary conditions were established to cause a flow regime similar to the one observed during the December 1992 heat-pulse intraborehole flow surveys at the c-holes. The input file for the model was constructed to embody all this information in preparation for a first run.

Using the software package FracMan (by Golder Associates) to develop a 3-dimensional fracture-network model for the c-holes (the model can be used for cross-hole test design, and analysis of the eventual cross-hole test results): E. Ervin is doing this work in cooperation with the SZFRHP. M. Umari and G. Patterson met with Ervin (USGS) and P. Wallman (Golder Associates) to discuss the development of the FracMan model for the c-hole complex. Wallman requested data on previously-conducted aquifer tests at the c-hole complex from A. Geldon, along with Geldon's synthesis of all available information on the complex. Geldon has already provided some of that information, and will continue the effort in May 1993. Wallman later presented a brown bag seminar on the use of FracMan in Sweden.

3GWF006F Prepare Interim Status Report
An outline of the report was prepared.

SCP 8.3.1.2.3.1.5 Testing of the C-hole sites with conservative tracers 0G33131E93
Summary Account Manager - M. Umari

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWF169A Continue Development of Techniques for Analysis of Tracer Test Results

The following two bullets are repeats of bullets presented under the monthly report for Summary Account number 8.3.1.2.3.1.4, because the two computer modeling activities discussed in the bullets serve activities under accounts 8312314 and 8312315 (the present account) at the same time:

Using the USGS HST (heat and solute transport) 3-D code, written by K. Kipp, USGS/WRD NRP, to develop a 3-dimensional porous-medium-equivalent model of the c-hole complex (the model can be used for tracer test design and for analysis of the eventual tracer test results): M. Umari, G. Patterson, and A. Geldon collaborated on this effort. A grid was constructed for a cross-sectional HST model between UE25c#1 and UE25c#3, and geohydrologic parameters (hydraulic conductivities and porosities) were associated with seven different horizontal zones. A top boundary condition was established that represents the water table. North-end, south-end, and bottom constant-head boundary conditions were established to cause a flow regime similar to the one observed during the December 1992 heat-pulse intraborehole flow surveys at the c-holes. The input file for the model was constructed to embody all this information in preparation for a first run.

Using the software package FracMan (by Golder Associates) to develop a 3-dimensional fracture-network model for the c-holes (the model can be used for tracer test design and for analysis of the eventual tracer test results): E. Ervin is doing this work in cooperation with the SZFRHP. M. Umari and G. Patterson met with Ervin (USGS) and P. Wallman (Golder Associates) to discuss the development of the FracMan model for the c-hole complex. Wallman requested data on previously-conducted aquifer tests at the c-hole complex from A. Geldon, along with Geldon's synthesis of all available information on the complex. Geldon has already provided some of that information, and will continue the effort in May 1993. Wallman later presented a brown bag seminar on the use of FracMan in Sweden.

3GWF170A Complete Tracer Injection System

A tracer mixing tank will be required at the surface during the tracer tests at the c-holes. \$5,000 has been earmarked for this purpose in FY93, and the Isotope Geology Machine Shop is the most likely candidate to do the work.

The completion date for the construction of the tank has been delayed from April 1, 1993 to September 30, 1993.

The downhole tracer injection system requires, in addition to the components already purchased from Baker, 1.66" O.D. pipe to deliver the tracer from land surface to the downhole system. This pipe will be requested from NTS contractors through a criteria letter.

3GWF168A Prepare Interim Status Report

An outline was prepared for the report.

WBS 1.2.3.3.1.3.2 Saturated Zone Hydrochemistry

Principal Investigator - W. Steinkampf

OBJECTIVE

To describe spatial variations in chemical composition of ground-water; to identify chemical and physical processes that influence ground-water chemistry; to use hydrochemical data to aid in the identification and/or quantification of ground-water travel times; flow paths; fluxes to, from, and within the saturated zone; and climatic conditions during past periods of recharge. (SCP Study 8.3.1.2.3.2)

SCP 8.3.1.2.3.2.1 Assessment of saturated-zone hydrochemical data availability and needs 0G33132A93

Summary Account Manager - W. Steinkampf

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWH001A Assessment of extant data, phase II

D. Perfect retrieved lithologic data from ARC. The data were sorted by general lithologic type, and basic statistics were calculated for each type. Because the results did not appear to be reasonable, the process was reviewed and a problem was found with the ARC data. This was corrected and the data were re-sorted according to lithology and basic statistics were re-calculated. Piper plots also were made for each lithologic group using ROCKWARE. The data set was then analyzed in SAS using the method of cluster analysis. Two data sets were used, the original and a log-transformed version. Each of these were pre-clustered. The two pre-clustered data sets were then clustered using three different clustering methods, yielding six tree diagrams. These diagrams were then interpreted and the clusters were plotted and contoured. Preliminary Piper plots have also been made. These initial results for cluster analysis appear to be reasonable.

B. Steinkampf discussed the status of the YMP data-compilation effort with R. LaCamera (USGS/LV) of the Survey hydrologic support group associated with the USDOE Weapons Program. The LV staff interest derives from a desire to maintain a base of hydrochemical information relevant to the NTS that is as complete as is possible. Tentative plans call for LV staff to examine the YMP-compiled data set to determine if it contains information not present in LV files.

Planning and Operations:

3GWH00A - Prepare interim status report

Guidance for report preparation was received from R. Luckey.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 32)

D. Perfect participated, with paleohydrology-study staff, on a sampling and data-collection trip to spring and well sites in the region north, west, and southwest of Yucca Mountain and the NTS.

SCP 8.3.1.2.3.2.2 Hydrochemical characterization of water in the upper part of the saturated zone

0G33132B93

Summary Account Manager - W. Steinkampf

Technical Activities:

3GWH006B Develop mobile lab and downhole collection equipment

B. Steinkampf received information from equipment manufacturers for consideration of inclusion in the planned laboratory. Decisions will be based on cost and safety assessments made by study staff.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours: 34)

B. Steinkampf discussed responsibilities, procedures, qualifications, and materials requisite to collection of perched-water samples in the ESF with R. Whitfield, M. Chornak, R. Craig, and L. Ducret (USGS/HIP) and D. Boak and J. Berry (LANL). (4 hrs)

B. Steinkampf participated in a meeting of the YMP quality integration group in Las Vegas. (8 hrs)

B. Steinkampf participated in the monthly teleconference of the YMP geochemistry integration team. (2 hrs)

B. Steinkampf and M. Ciesnik revised YMP-USGS-QMP-5.05, R3 SN to reflect the intent of QARD Supplement III. The suggested revision was delivered to the HIP QA Implementation Group for processing and transmittal to the QA office.

B. Steinkampf began examination of a revised draft of the proposed American National Standard ANSI/ASQC E4 - Quality System Requirements for Environmental Programs at the request of one of the authors, to re-examine the possibility of changing his vote of disapproval to one of acceptance.

B. Steinkampf attended procurement-document and radiation-safety training in Lakewood. (8 hrs)

SCP 8.3.1.2.3.2.3 Regional hydrochemical characterization 0G33132C93

Summary Account Manager - W. Steinkampf

Technical Activities:

3GWH905A Select sample sites - FY93

B. Steinkampf discussed with National Park Service Staff (NPS) from Ft. Collins and Death Valley National Monument both scheduling of sample and data collection at selected springs within the monument, and prior efforts in March. The surmised (by DVNM staff) seasonal nature of discharge at one spring (Keane Wonder) suggests the need for at least two sampling efforts at this site.

3GWH910 Collect/analyze/evaluate regional samples - FY93

B. Steinkampf and T. Oliver assembled requisite information for the establishment of data storage addresses for the DVNM sites sampled. The current content of the YMP-USGS hydrochemistry data base (not that assembled in activity 8312321) to ascertain if addresses (similar or identical) currently exist. Two similar latitude/longitude identifiers were found and will be examined to determine if they refer to two of the six sites visited in March. Samples were transported to Lakewood by UZ-hydrochemistry study staff, and will be delivered to the USGS NWQL.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 68)

B. Steinkampf met with T. Chaney and M. Mustard (USGS/QA) to discuss the USGS QA matrix and plans for implementation of requirements identified as "not met" in the matrix.

B. Steinkampf met with W. Causseaux to discuss the USGS QA matrix, planned and suggested revisions of selected USGS quality-implementing procedures, and the status of procedures currently under revision.

B. Steinkampf met with R. Luckey, R. Lichty, and T. Oliver to discuss preliminary plans for utilization of part of Oliver's time by the SZ hydrochemistry study.

B. Steinkampf participated in a meeting of the YMP quality integration group in Las Vegas. (8 hrs)

B. Steinkampf reviewed draft QMP 3.15, R1.

B. Steinkampf attended the spring semi-annual meeting of the ASME Committee for Nuclear Quality Assurance; participated in meetings of work group and SCNWM and was elected to membership of SCNWM.

B. Steinkampf formally reviewed YMP-USGS-QMP-3.15, R1 (DRAFT) "*Application of graded quality assurance*".

B. Steinkampf and M. Ciesnik revised YMP-USGS-QMP-5.05, R3 SN to reflect the intent of QARD Supplement III. The suggested revision was delivered to the HIP QA implementation group for processing and transmittal to the QA office.

WBS 1.2.3.3.1.3.3 Saturated Zone Hydrologic System Synthesis and Modeling

Principal Investigator - E. Ervin

LBL Principal Investigator - K. Karasaki

OBJECTIVE

To synthesize available data to develop a conceptual model; to make a qualitative analysis of how the system is functioning; to develop and evaluate porous-media and fracture-network methods for simulating ground-water flow and solute transport; and to estimate ground-water flow direction and magnitude for input to ground-water travel time calculations. (SCP Study 8.3.1.2.3.3)

SCP 8.3.1.2.3.3.1 Conceptualization of saturated zone flow models within the boundaries of the accessible environment 0G?3133A93

Summary Account Manager - E. Ervin

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWM10AA collect outcrop samples - hydrologic properties

E. Ervin and M. Chornack discussed potential locations for collecting outcrop samples of the Crater Flat Tuff. Samples would consist of one-inch cores drilled with a hand carried corer, such as those collected by A. Flint and C. Rautman for rocks of the unsaturated zone.

Planning and Operations:

3GWM000 prepare interim status report

E. Ervin met with R. Luckey to discuss format for the Interim Status Report.

Work Performed but not in Direct Support of the Scheduled Tasks

(Estimated hours spent: 32)

The report entitled "*Revised potentiometric-surface map for Yucca Mountain and vicinity, Nevada*", by E. Ervin, R. Luckey and D. Burkhardt is in final camera-ready format; the figures are almost finished being drafted by the Publications and Graphics Units of the USGS' Colorado District. A base map negative for the main plate of the report, showing the revised potentiometric contours, was ordered from the USGS' Mapping Division.

E. Ervin presented a talk entitled: "*Summary of revised potentiometric-surface map, Yucca Mountain and vicinity, Nevada*" at the 4th IHLRWM Conference in Las Vegas, Nevada.

SCP 8.3.1.2.3.3.2 Development of fracture network model 0G33133B93

Summary Account Manager - E. Ervin

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWM013B Complete fracture mapping/prep rpt: Crater Flat

E. Ervin completed plotting fracture data, collected from outcrops east of Little Skull Mountain and Raven Canyon in the Bullfrog Member of the Crater Flat Tuff, in rose diagrams and stereonets in preparation for a report (Milestone 3GWM013M).

3GWM005B Develop conceptual model fracture network FY93

P. Wallmann of Golder and Associates came to Denver to work with E. Ervin to develop a strategy for FracMan model development at the UE-25 c-Hole complex, examine data collected during previous aquifer tests, and evaluate other data available for the multiple-well complex. Another working session is planned for the end of May or beginning of June to continue this effort.

Quality Assurance:

3GWM013B Complete fracture mapping/prep rpt: Crater Flat

E. Ervin made the minor corrections noted by L. Anna during his independent review of the fracture data collected by Ervin and M. Chornack.

Planning and Operations:

3GWM004B Prepare interim status report

E. Ervin met with R. Luckey to discuss the format of the Interim Status Report, in addition to discussing the progress of LBL work on the fracture-network model with K. Karasaki for the report.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWM18CA Study outcrop fracture bias and prepare report

Fracture bias was studied based on simulated 2- and 3-dimensional random fields. Gaussian random fields with known co-variance function were generated by the turning bands methods.

3GWM21CA Complete TRINET users manual

An algorithm in TRINET to minimize numerical dispersion in the back-tracking process was modified to ensure the accuracy of the concentration profile.

3GWM23CA Study prediction error and design test

K. Karasaki attended the IHLRWM Conference and presented a paper titled "*Flow and Transport in Hierarchically Fractured S*".

A cluster annealing algorithm that combines variable aperture worked successfully, and converged much faster than a single element on-off annealing on a synthetic case.

Work Performed but not in Direct Support of the Scheduled Tasks

Staff members completed various QA reading assignments.

WBS 1.2.3.6 Climatology and Meteorology

OBJECTIVE

To collect and analyze climatic, paleoclimatic, future climatic, and Quaternary hydrologic data to evaluate the suitability of the site.

WBS 1.2.3.6.2 Climatology

OBJECTIVE

To characterize the present, paleo-regional, local climate, and hydrologic conditions at Yucca Mountain, and to determine the magnitude and likely effects that future changes in climate will have on repository performance.

WBS 1.2.3.6.2.1 Change in Climatic Conditions

OBJECTIVE

To provide a baseline for determining the changes in climate that potentially affect the waste isolation capabilities of the site. (SCP Investigation 8.3.1.5.1)

WBS 1.2.3.6.2.1.1 Modern Regional Climate

Principal Investigator - B. Parks

OBJECTIVE

To develop a synoptic characterization of the modern regional climate to provide a baseline and a background for the interpretation of climatic variation. (SCP Study 8.3.1.5.1.1)

SCP 8.3.1.5.1.1.1 Synoptic characterization of regional climate 0G36211A93

Summary Account Manager - R. Forester

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GCR014 Conduct stable/radiogenic isotope anal of precipitation

S. Mahan completed analyses of several precipitation samples gathered from February storms at Yucca Mountain. $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of 0.70919, 0.71179 and 0.71174 are within the range of other precipitation events even though these storms were spawned by El Nino conditions unlike much of the previously acquired precipitation.

Variances:

Completion of Study Plan has been delayed due to field work and leave taken by key personnel.

WBS 1.2.3.6.2.1.2 Paleoclimate Study of Lake, Playa, and Marsh Deposits

Principal Investigator - B. Parks

OBJECTIVE

To establish the nature, timing duration, and amplitude of paleoclimate changes based on paleontologic, stratigraphic-sedimentologic, chemical, and mineralogic analyses of lacustrine sediments in or near southern Nevada; and provide a chronologic frame work for this paleoclimatic information. (SCP Study 8.3.1.5.1.2)

SCP 8.3.1.5.1.2 Paleoclimate study of lakes, playas, and marshes LOE Account 0G36212Z93

Summary Account Manager - B. Parks

ACTIVITIES AND ACCOMPLISHMENTS

Prepared schedules for tasks assigned to this activity. Provided status reports of planned activities and prepared variance analysis reports. Performed administrative duties and managed personnel.

SCP 8.3.1.5.1.2.2 Analysis of stratigraphy-sedimentology of marsh, lacustrine, and playa deposits 0G36211B93

Summary Account Manager - R. Forester

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GCL013B Collect cores

Seven cores averaging 10 meters in length were obtained from playas near Pahrump, Nevada and Stuart Playa with personnel from the DRI, Reno, Nevada. Initial sediment descriptions and inventories for those cores were prepared. Ostracode samples and associated field data were collected from those same playas.

3GCL016B Paleontological preparation/assessment

Prepared a written summary of field work conducted by DRI, and other study activities.

Prepared six samples collected during the southern Nevada coring trip for calcareous microfossils and other materials.

3GCLO14B Stratigraphic analysis

Summary of findings from field trip taken in January has been completed. Review continues in the USGS. This document will satisfy the stratigraphic analysis described in this work element.

Variances:

The milestone 3GCL013M will be delayed because the coring expected to be completed in January-February, 1993, will not be completed until late May. This is because the extreme amount of precipitation in southern Nevada has precluded getting a coring rig into the lakes and playas to be sampled. The coring trip was completed at the end of April, about 3 months later than planned.

Work Performed but not in Direct Support of the Scheduled Tasks

R. Forester presented a Keynote Address titled "*Temporal changes in lacustrine chemistry, a measure of perturbations in the hydrological cycle*" with A. Smith (Kent State University) to the Sixth International Paleolimnology Symposium in Canberra, Australia.

R. Forester participated in the Inter-INQUA meetings and a pre-conference field trip to the volcanic maars in Victoria, Australia.

R. Forester conferred with colleagues at Australian National University to exchange ideas, technology, and scientific findings, and to learn about current Australian research in paleoclimate and Quaternary paleontology.

WBS 1.2.3.6.2.1.3 Climatic Implications of Terrestrial Paleoecology

Principal Investigator - B. Parks

OBJECTIVE

To determine aspects of past vegetation change; and use vegetation records to provide quantitative estimates of changes in climatic variables for the southern Great Basin. (SCP Study 8.3.1.5.1.3)

SCP 8.3.1.5.1.3.1 Analysis of pack rat middens 0G36213A93

Summary Account Manager - P. Wigand

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GCL110 Management oversight/scientific coordination

A field trip to southern Nevada was completed with participation from the DRI, University of Nevada, Reno, the USGS, and University of Arizona. DRI collected pack-rat midden samples, fossils from Pleistocene and Holocene deposits, and cores from playas and marsh deposits.

Variances:

Because field work was delayed due to weather, the status report (milestone 3GCL110M) will be delayed until the middle of June. This will have no effect on the overall products of this activity.

WBS 1.2.3.6.2.1.4 Paleoenvironmental History of Yucca Mountain

Principal Investigator - B. Parks

OBJECTIVE

To evaluate the paleoenvironmental record at Yucca Mountain and surroundings in light of inferred paleoclimate history of the southern Great Basin; to model soil properties in the Yucca Mountain region; to map surficial deposits; and to reconstruct the eolian history of the region. (SCP Study 8.3.1.5.1.4)

SCP 8.3.1.5.1.4.2 Surficial deposits mapping of Yucca Mountain area 0G36214B93

Summary Account Manager - S. Lundstrom

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GCH035A Airphoto/fieldcheck/sampling/analysis n. 1/3 YM

Continued airphoto interpretation and field checking of deposits. Analyses are being entered onto map products.

Variances:

Milestone 3GCH039M has been completed by the PI and is in the hands of his supervisor for review.

SCP 8.3.1.5.1.4.3 Eolian history of the Yucca Mountain region 0G36214C93

Summary Account Manager - J. Whitney

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GCH162C Write report on lead isotopic composition

Completed.

3GCH163C Collect samples for isotope analyses

K. Futa continued Sr analyses of fine-grained playa deposits from the northern NTS and northern Death Valley. S. Mahan analyzed 20 samples for Sr isotopic compositions. Preliminary results suggest that playas in the Death Valley region (Cottonball and Mesquite Flat) contain $^{87}\text{Sr}/^{86}\text{Sr}$ typically between 0.714 and 0.716 which is consistent with Death Valley waters (0.715 to 0.719). Other results include Timpahute Range (0.710), Soda Mountains area (0.710), and Stewart Valley (0.711 to 0.714). A memo summarizing the results was written to Z. Peterman and E. Gutentag.

WBS 1.2.3.6.2.2 Effects of Future Climatic Conditions on Hydrologic Characteristics

OBJECTIVE

To determine the relations between climatic conditions and hydrologic characteristics in the vicinity of Yucca Mountain during and since the Quaternary; and to predict future hydrologic response to possible future climatic conditions. (SCP Investigation 8.3.1.5.2)

WBS 1.2.3.6.2.2.1 Quaternary Regional Hydrology

Principal Investigator - R. Luckey

OBJECTIVE

To investigate the hydraulic characteristics of paleoflood events and to compare them with modern flooding and related geomorphic processes; to determine past infiltration and percolation history at Yucca Mountain through isotopic and chemical analysis of water from the unsaturated zone; to determine past hydrologic conditions in the regional discharge area; to estimate the conditions and rates of infiltration and ground-water recharge during the

Quaternary; and to determine the ages, distribution, origin, and paleohydrologic significance of calcite and opaline silica deposits along faults and fractures. (SCP Study 8.3.1.5.2.1)

SCP 8.3.1.5.2.1 Quaternary regional hydrology LOE Account 0G36221Z93

Summary Account Manager - R. Luckey

ACTIVITIES AND ACCOMPLISHMENTS

Collect hydrologic data FY93

Continue data collection at the Stewart Creek and Kawich Creek Analog Recharge sites. The data collection system consists of 2 stream-flow sites, 4 meteorological sites, and 6-8 water quality sites. On a daily basis, T. Oliver checks the NWIS data base for DCP data and performed weekly data pulls from the LRGS to fill missing data.

In addition: J. Ashby and H. Klieforth retrieved some weather and surface water data from the Stewart Creek site; T. Oliver entered this data into the NWIS data base; and Oliver organized the TDIFs, referencing accumulated data for the Analog Project, in preparation for submitting the data to the CRF and/or to schedule the data for submission.

Support project operations

During this reporting period, the PI responsible for this study planned, scheduled and monitored routine project operations, prepared routine procurement documents, monitored rate of spending, and held or participated in routine administrative meetings.

In addition: E. Gutentag conducted a field collection trip to the Death Valley flow system area in Nevada and California, and requested and received assistance from Air Force personnel in sampling areas on the Nellis Air Force Base Bombing Range.

During the reporting period, the QA specialists involved in this study monitored all project activities for QA compliance, tracked all open items, and attended QMP training sessions and bi-weekly USGS-HIP SZ QA meetings. Special tasks and items included:

USGS-NCR-93-09: The QA office has accepted the submitted response including proposed actions to address lack of QMP-3.04 required approvals and reviews for a GSP generated scientific report. This item is now awaiting QA verification.

USGS-NCR-93-12: M. Ciesnik has submitted a response including remedial actions, and actions to prevent recurrence, to the QA office addressing the issue of a requisition request not being prepared for the purchase of calibration services for 21X Data Loggers for SCP Activity 8.3.1.5.2.1.4b. Awaiting acceptance by the QA Office.

USGS-AFR-92-07: The contract with the New Mexico Institute of Mining and Technology (NMIT) for Activity 8.3.1.5.2.1.4b is being modified as part of actions to be completed for this AFR. This action is based on changed QA requirements for the activity as reflected in a submitted ACSR. The contract is being modified by administrative personnel. There is no change in status on this issue.

J. Watson and T. Oliver calibrated several digital thermometers using HP-59, R0; and Watson performed a technical review of QMP-3.15, R1.

J. Watson attended the following special meetings, training, talks, etc.: - USGS QA Open Items/Data Issues meeting.

SCP 8.3.1.5.2.1.1 Regional paleoflood evaluation 0G36221A93

Summary Account Manager - D. Grasso

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GQH010A Prepare prelim summary of YM paleoflood studies

Flood-flow and related precipitation data for the Yucca Mountain/Upper Amargosa River watershed were reduced, analyzed, and compiled into tables for the preliminary summary of Yucca Mountain paleoflood studies. These data, which span the time period 1962 to 1983, will be compiled into regional computer maps showing the seasonal (winter vs summer) relationship between modern-day precipitation and runoff in the area. Early results show that less than five percent of the total volume of rain received by the watershed actually runs off as surface water--the remainder is presumably lost to either evapotranspiration or water table recharge. Additionally, a method was devised to correlate the results of these hydrologic analyses with that from previous evaluations of the 100-year and 500-year flood within the region. The importance of this procedure is that it provides a means for evaluating the probable long-term paleoflood record in the region, while enabling estimates to be made of flood-flow discharges from un-gaged tributary streams in the Yucca Mountain/Upper Amargosa River watershed. Maps and tables that show the results of this work will be compiled for the preliminary report within the next two months.

3GQH015A Prepare interim status report

An interim status report stating the accomplishments (Oct92-Mar93) and planned accomplishments (Apr93-Sep30) for this activity was prepared according to guidelines established by HIP, YMPB, and submitted on schedule.

SCP 8.3.1.5.2.1.3 Evaluation of past discharge areas 0G36221C93

Summary Account Manager - E. Gutentag

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GQH11 Complete report on methods of channel geometry

Report has received YMP review and Director's approval. T. Brady expects DOE concurrence in May.

3GQH003 Vegetation mapping Phase II

F. D'Agnese finalized preliminary vegetation maps and worked on report for Regional Veg Mapping Death Valley Region. A field trip was conducted to field check resulting density and land cover classes, which indicated that the land cover classes were quite accurate in most areas relating vegetation density to vegetation. Some classes were difficult to interpret in high density phreatophyte areas. However, since these are small areas, manual correction of classes should not be difficult. A final map and report are projected for summer.

K. Turner continued to complete draft report on the Amargosa Desert vegetation mapping originally conducted by L. DeMarco. Land cover classes were correlated with regional vegetation mapping conducted by D'Agnese.

K. Turner, F. D'Agnese, C. Faunt and E. Gutentag reviewed progress on regional and Amargosa vegetation maps and outlined schedule for completion of work for this summer.

3GQH021 Collect/prepare/analyze faunal/water/soil outcrop

A field trip was conducted where 14 sites were collected from the Death Valley flow system. In addition 28 springs and wells were collected for Sr 86/87 ratios in areas where balanced complete water analyses are recorded.

Samples were collected from Central and South Three Lakes Playa, Indian Springs Playa, North Indian Springs Playa, Desert Dry Lake, Lower Dog Bone Lake, and North Dog Bone Lake.

3GQH025 Analyze water and lithologic samples NWQL/GSP/GD

Water samples collected in early March were analyzed by the NWQL and the results received. GSP has completed the SR 86/87 analyses.

Z. Peterman prepared an oral presentation to be given at the ANS HLRWM meeting in Las Vegas on his paper entitled "*Isotopic evidence of complex ground-water flow at Yucca Mountain, Nevada, USA*".

J. Paces prepared an oral presentation to be given at the ANS HLRWM meeting in Las Vegas on his paper entitled "*Late Quaternary history and uranium isotopic compositions of ground water discharge deposits, Crater Flat, Nevada*". The young ages (19 to 45 Ka) presented in this paper have been criticized as representing minimum ages reflecting physical or chemical modifications of older deposits that have been exposed at the surface. Therefore, time was spent addressing various mixing models and other modification processes and their effects on U-series dates. These results provide additional support for the interpretations of young ground water discharge which were expressed in the paper. In addition, investigations in obtaining 14C dates from rhizoliths from these deposits was initiated, and samples were submitted to T. McConnaughey for determination of total, inorganic and organic carbon.

J. Paces investigated the possibility of obtaining water samples from seeps in N-Tunnel at Rainier Mesa. $^{234}\text{U}/^{238}\text{U}$ determinations of vadose water samples are important for modeling the kinetics of U isotopic fractionation between ground water and wall rocks.

K. Futa continued analyses of multiple aliquots of a rhizolith sample, HD1066, obtained from fine-grained paludal deposits in the Pahrump Valley. Ultimately, resulting age determinations will be used to validate U-series dating techniques.

K. Futa and S. Mahan completed Sr isotopic analysis of a sample of ostracodes collected from the spring deposits in Crater Flat. The resulting value of 0.71325 ± 0.00005 is within the range of previously analyzed spring carbonates from the same site.

B. Widmann completed chemistry on 24 water samples for Sr isotopic analyses, including samples collected by S. Mahan and E. Gutentag from the northern Mojave Desert, Amargosa Farms area, Bullfrog Hills and southern Death Valley in March of 1993, and precipitation samples from the Yucca Mountain vicinity. Water samples were analyzed by S. Mahan for Sr isotopic compositions. Water from the Amargosa Valley contains $^{87}\text{Sr}/^{86}\text{Sr}$ values which increase to the south and west ranging from 0.711 to 0.712 near Lathrop Wells, to 0.712 to 0.713 further south, and up to 0.718 near some of the "bedrock highs" near the Funeral Mountains. Waters from Sullivan Spring (Bullfrog Hills), Resting Spring (Resting Spring Range), and Chappo Spring (near Shoshone, California) have $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of 0.71129, 0.71173, and 0.71178, respectively, while springs from Death Valley reflected a much more radiogenic component (Triangle Spring = 0.71836; Saratoga Spring = 0.71662). These radiogenic waters may reflect partial equilibration with Cambrian and older shales and metamorphic rocks underlying some

of the ranges such as Ibex Hills and Resting Spring Range. Water samples were submitted to K. Ludwig for $^{234}\text{U}/^{238}\text{U}$ analyses.

B. Widmann researched potential springs and wells for obtaining additional water samples, during future collecting trips, which will fill gaps in the hydrogeochemical data base. Potential sampling sites include localities in Pahute Mesa, Spring Mountains, Black Mountains, Pahrump Valley, and the Pintwater Range.

K. Ludwig prepared an oral presentation to be given at the ANS HLRWM meeting in Las Vegas on his paper entitled " $^{234}\text{U}/^{238}\text{U}$ as a ground-water tracer, SW Nevada - SE California".

B. Marshall completed a two week training class in ground-water concepts and modeling given through the WRD.

3GQH037 Determine Discharge Mechanism in Hydrologic Units

Report outline on present regional discharge was revised by E. Gutentag, C. Faunt, and F. D'Agnese.

F. D'Agnese and C. Faunt continued analysis of present-day discharge areas. Areas are being mapped for 3D model arrays. Areas include discharge from free-water, bare soils, wetlands/marshes, and phreatophyte areas. Comparisons were made with historical estimates by Rush, Harril, Maxey and Eakin, Malmberg, etc. Also comparisons were made with published models.

F. D'Agnese revised analysis of regional spring discharge based on data from late April field trip. This included analyzing spring discharge, temperature and chemistry to determine if spring was, indeed, a regional discharge component. Additional spring localities along the Amargosa River and at Carson Slough have been located. This activity will help direct future sampling trips for faunal, isotope and chemical characterization of ground-water in the area, as well as offer insight into spring fluxes in regional 3D modeling.

3GQH002 Prepare interim status report

This report will be completed on May 7, 1993.

Planning and Operations:

3GQH021 Collect/prepare/analyze faunal/water/soil outcrop

Additional sites are to be collected in June at the North Bombing Range of Nellis Air Force Base. This trip will be coordinated with the Air Force.

SCP 8.3.1.5.2.1.4a Analog recharge sites 0G36221D93

Summary Account Manager - R. Lichty

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GQH12CA Prepare data reports FY92

P. McKinley worked up the surface water records for Kawich and Stewart basin.

T. Oliver developed tables for the surface water discharge for inclusion in the data report.

3GQH14CA Test PRMS model

B. Lichty utilized data from the April 1992 snow surveys in Kawich Creek watershed in a detailed configuration of PRMS hydrologic response units to compare and evaluate observed and modeled estimates of snowpack water equivalents. PRMS estimates of water equivalents were too low in all comparisons, indicating the need of a winter season precipitation adjustment factor and/or retarded melt timing. Continued testing and parameter adjustments to reduce the discrepancies are being evaluated.

Planning and Operations:

3GQH10CA prepare interim status report

B. Lichty compiled information summarizing progress on activities through March 1993 and described work to be accomplished during the remainder of the fiscal year.

SCP 8.3.1.5.2.1.4b Geochemistry of arid-zone infiltration 0G36221E93

Summary Account Manager - A. Riggs

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GQH003D Collect Watershed Inputs and Meteorological Data

Arrangements finally were made to calibrate the soil moisture probes, and the probes were delivered to the calibrator. The bulk of the remaining equipment purchase, construction, assembly, wiring, and calibration for watershed monitoring at all five sites was completed. Meteorological monitoring continued uninterrupted during this period except for one day when the data logger and all instrumentation were removed and replaced with newly calibrated data logger and instrumentation.

3GQH005D Conduct Misc Site Characterization Activities

Performed quarterly precipitation collection at the Oliver Knoll and Organ Pipe Cactus National Monument sites. Collection was successful and uneventful.

3GQH007D Analyze/Interpret CI-36 and Precipitation Data

22 soil samples were prepared for ion chromatograph analysis. 50 samples were measured on the ion chromatograph. 56 soil water samples and one rain water sample were analyzed for deuterium. The top and bottom of a boulder from a debris flow channel, two boulder samples from the Qf2 surface and one sample from the Qt1 surface were analyzed for B, U, and major elements.

Quality Assurance:

3GQH000M Report/TDIF: Meteorological Data FY91-92

A draft of the report has been completed and submitted for internal review and formatting guidance. Because of the crush of the reviewer's other duties, the report will not be returned for review prior to scheduled travel; therefore, the report will not be completed before the end of June.

3GQH003D Collect Watershed Inputs and Meteorological Data

A response has been submitted to a NCR issued in response to a perceived failure to comply with QMP 4.01 (Q). Read QMPs 4.01, R4; 4.01, R4, M1; 7.01, R5; and decontrolled "Long-term meteorological data collection" SNP (NWM-USGS-HP-211T, R0).

Planning and Operations:

3GQH000M Interim Status Report
Completed and accepted by section chief.

Variances:

As noted above in 3GQH001D, the Meteorological Data FY91-92 report will not be completed until the end of June due to reviewer time constraints and May travel schedule. This should not cause any long-term problems. The problem should not recur in the future because report format development will be finished and generation of future reports should be straightforward.

Work Performed but not in Direct Support of the Scheduled Tasks

Met with DOE Inspector General representative: 2 hours

SCP 8.3.1.5.2.1.5 Studies of calcite and opaline silica vein deposits 0G36221F93

Summary Account Manager - J. Whelan

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GQH833A Prep isotope composition/fluid inclusion history.

B. Marshall prepared an oral presentation to be given at the HLRWM Conference in Las Vegas for his paper entitled "*Sr isotopic evidence for a higher water table at Yucca Mountain*".

R. Zartman prepared an oral presentation to be given at the HLRWM Conference in Las Vegas for his paper entitled "*Lead isotopic compositions of Paleozoic and Late Proterozoic marine carbonate rocks in the vicinity of Yucca Mountain, Nevada*".

J. Paces continued testing of U and Th isotopic analysis, including loading and software techniques, on the Finnigan MAT mass spectrometer. U and Th isotopic compositions of spikes were determined. In addition, tests of the ion counter were conducted with the Finnigan engineer. The counter was recalibrated and it was determined that counter behavior is satisfactory.

K. Futa, along with E. Taylor and S. Lundstrom, collected 23 soil samples from 4 locations at Yucca Mountain for ⁹⁰Sr determinations. Sites were selected to obtain profiles through soils of different ages and pedogenic characteristics. If measurable ⁹⁰Sr concentrations are observed, results will be used to model the chemical behavior and rates of mobility Sr in the pedogenic environment.

K. Futa completed Sr chemistry on 2 drill-core calcites from USW G-2.

D. Craft and A. Walker completed preparation of 22 soil and rock samples from the Amargosa Desert, Funeral and Spring Mountains for geochemical and Sr isotopic compositions. Analyses will be used for evaluating the total carbonate system.

3GQH816B Collect specimens from cores and field sites

T. McConnaughey and J. Whelan spent 5 days at and around the NTS measuring concentrations of soil gas CO₂ and collecting soil profiles and soil gas profiles for measurement of the stable isotopic compositions of H₂O and CO₂. Permanent soil gas sampling probe arrays were monitored at Fran Ridge, Exile Hill, Fortymile Wash, Pagany Wash, the southern flank of Rainier Mesa (road cut on Holmes Road), and at the US Ecology low-level waste disposal site near Beatty, and a permanent site was installed on the top of Rainier Mesa. Approximately one

hundred and twenty-five samples of soil, soil gases, and soil carbonate were collected during this trip. Five samples of soil carbonate precipitating around remnant root material were collected from the Rainier Mesa/Holmes Rd. site for isotope studies including, hopefully, ¹⁴C age determinations of both the organic and carbonate fractions.

J. Whelan received approximately twenty samples of precipitation from five sites in the Yucca Mountain area collected by D. Ambos in support of 8.3.1.5.1.1, "*Characterization of modern regional climate*". Arrangements were made with T. Kane (WRD) to receive samples from five sites monitored by the Nevada District; these sites are Rainier Mesa (Stockade Pass), Pahute Mesa (Rattlesnake Wash), Fortymile Wash (near confluence with E. Cat Canyon), Beatty, and Stateline, Nevada. These more regionally distributed sites complement the coverage in the immediate vicinity of Yucca Mountain.

J. Whelan examined approximately 3500' of core from drill holes UE 12 T#7, N#14, and P#2; and UE 19 W#1. These holes were collared on Rainier and Pahute Mesas and were going to be sampled for calcite. Unfortunately, even though calcrete fracture fillings can be found at the surface in these areas, virtually none was observed in the core. When an understanding is reached of why calcite does not occur in these areas, a better understanding of why it is found in such relative abundance at Yucca Mountain also will be reached.

J. Whelan examined drill cores NRG-2 and -6 and the lower ~400' of UZ-16 and requested 23 samples from the SOC.

3GQH832A Prep mineralogic/petrologic description of specimens.

R. Moscati performed petrologic description and sampling for 23 samples from drill cores VH-1 & 2 and UZ-16. J. Whelan performed petrologic description and sampling for 21 samples from drill cores VH-1 and UZN-35.

J. Whelan and R. Moscati logged in and photo-documented 91 samples from drill core and from the March field work.

Quality Assurance:

3GQH833A Prep isotope composition/fluid inclusion history.

S. Mahan, along with D. Craft completed calibration requirements for Sr analysis on the Finnigan MAT 262. Appropriate calibration files were submitted to the QA office.

Work Performed but not in Direct Support of the Scheduled Tasks

R. Moscati packed and moved into storage old, non-YMP materials to make room for the ever expanding collection of YMP samples. YMP samples are now stored in J. Whelan's office as well as in the "Yucca Mountain Room".

R. Moscati completed a one-week course in Isotope Hydrology and a one day First Aid/CPR course.

J. Whelan and R. Moscati attended a "sexual harassment" training class.

J. Whelan and R. Zartman attended the HLRWM Conference in Las Vegas, with Zartman presenting a paper on "*Lead isotopic composition of Paleozoic and Late Proterozoic marine carbonate rocks in the vicinity of Yucca Mountain*".

J. Whelan committed to organizing a session for the 1994 HLRWM around the Paleoclimate site characterization studies being done for and by the USGS. Anyone interested in presenting their

paleoclimate-related work next year can contact Whelen.

WBS 1.2.3.7 Resource Potential

Principal Investigator - Z. Peterman

OBJECTIVE

To determine present and future resource potentials at the repository site and surrounding area. To determine the likelihood of inadvertent human intrusion into a mined geologic disposal system. To determine the possible consequences of interference. (SCP Program 8.3.1.9)

WBS 1.2.3.7.2 Present and Future Value of Resources

Principal Investigator - Z. Peterman

OBJECTIVE

To evaluate the natural resource potential and its future economic importance at Yucca Mountain. (SCP Investigation 8.3.1.9.2)

WBS 1.2.3.7.2.1 Natural Resource Assessment

Principal Investigator - C. Hunter

OBJECTIVE

To identify and assess the natural resource potential at the proposed repository site at Yucca Mountain. (SCP Study 8.3.1.9.2.1)

SCP 8.3.1.9.2.1.1 Geochemistry assess of Yucca Mountain 0G3721A93

Summary Account Manager - Z. Peterman

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GNR003B Compile radiometric age data, known mineral occurrences

Collection of geological and mineral resources information from published and unpublished sources continued. J. Bergquist continued preparation of a map (anticipated scale is 1:250,000) to show the relationship of mines, geology, and ages of mineralization surrounding the Yucca Mountain region. Base geologic map is more detailed than the one used for the Administrative Report generated in 1991, and is in a digital format. Bergquist began writing the milestone report due May 14, 1993.

B. Widmann calculated latitude and longitude coordinates for samples collected in March, 1993, from Bare Mountain. Sample tracking sheets were updated and organized. D. Craft completed coring of outcrop samples of Paleozoic carbonates in order to obtain least-altered whole rock aliquots for geochemical and isotopic characterization.

Quality Assurance:

J. Bergquist completed reading assignments and training as required.

Work Performed but not in Direct Support of the Scheduled Tasks

At the request of DOE/M&O, J. Bergquist began revisions of the original USGS Administrative Report to DOE, Yucca Mountain Project, 1991, on mineral occurrences near Yucca Mountain, with plans to submit the report as an OFR.

Summary Account Manager - Z. Peterman

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GNR002A Evaluate hydrocarbons in Railroad Valley analog

J. Grow completed 80 percent of a draft OFR summarizing the sonic logs for Railroad Valley. It will be ready for review by May 15, 1993.

3GNR004C Analyze source rock data Amargosa Valley

J. Grow and staff prepared the geophysical logs from the Felderhoff 25-1 and 5-1 wells for an OFR on "*Lithologies and geophysical logs*", by W. Carr, S. Keller, and J. Grow. The OFR on the Felderhoff wells is expected to be ready for review by the end of May.

Work Performed but not in Direct Support of the Scheduled Tasks

C. Barker and J. Grow prepared for the upcoming GSA meetings in Reno, Nevada, to be held May 19-21, 1993. Barker is a co-author with J. Cole, A. Harris, and M. Lanphere on a paper entitled "*The case for pre-middle Cretaceous extensional faulting in northern Yucca Flat, south-western Nevada.*" Grow is second author with B. Perry on "*Structure and timing of deformation in the central Pancake Range, Nye County, Nevada,*" and with C. Potter and J. Miller on "*Controls on cross-sectional geometry of extensional basins, east-central Nevada — a seismic stratigraphic approach*". All of these papers are GSA publications.

1.2.5 REGULATORY AND INSTITUTIONAL

OBJECTIVE

To support the Department of Energy (DOE)/HQ in the development of the site-related aspects of compliance with Nuclear Regulatory commission agreements, requirements, and policies, environmental and permitting requirements, and related DOE orders, and the development of site-related regulatory documentation; to plan and conduct environmental field investigations and transportation studies related to environmental compliance, permitting and repository design; to plan and conduct socioeconomic studies to assess the regional socioeconomic action studies; to coordinate Project activities with the community and state and local governments; and to plan and implement a public communication plan.

ACTIVITIES AND ACCOMPLISHMENTS

Hydrology program management staff previewed presentations prepared by investigators for the NWTRB meeting scheduled for April 21 and 22, 1993. Staff provided suggestions to the presenters regarding how best to focus and integrate the presentations on unsaturated-zone infiltration, percolation, and flow through fractured rock. D. Appel, D. Gillies, M. Chornack, and R. Luckey attended the NWTRB meeting in Reno, Nevada. The principal topic of the meeting was resolution of difficult issues, such as the impact of possible future climatic change on water infiltration and percolation at Yucca Mountain. Preliminary fault parameters were compiled for the NWTRB preliminary ESF assessment. Several conversations took place with NRC to scope possible alternative methodologies.

WBS 1.2.5.2 Licensing

OBJECTIVE

To review, analyze and interpret regulatory requirements to provide licensing guidance to the Project; to integrate licensing concerns and the needs of the Project; and to define licensing strategies.

WBS 1.2.5.2.2 Site Characterization Program

Principal Investigator - W. Dudley, Jr.

OBJECTIVE

To provide ongoing regulatory planning and evaluation of the site characterization program; and integrate regulatory evaluations into the site program.

ACTIVITIES AND ACCOMPLISHMENTS

The PI was contacted to obtain author/reviewer concurrence on comment resolution for Study Plan 8.3.1.2.2.9, R0 "*Unsaturated-zone modeling and syntheses*". One reviewer has not come to concurrence on the author/reviewer comment resolution.

NRC Interactions (NRC, NWTRB, ACNW)

Prepared a presentation for a full board meeting of the NWTRB, requiring an organizational meeting with DOE, a dry run presentation and the final presentation in Reno. Title of presentation: "*A features-based drilling approach for deep percolation studies at Yucca Mountain, Nevada*".

Approximately 80 hours was spent in preparing for or giving the presentation to the NWTRB, in Reno, at a session that examined the process in place for resolving complex issues. The presentation entitled "*Modeling flow in unsaturated zone fractured rocks*" was prepared and given by E. Kwicklis. This time was charged to a separate account set aside for this purpose.

Additions and revisions for 8th Semi-annual Progress Report were completed.

Z. Peterman participated in a review of the DOE/USGS International Program on March 23, 1993 (3 hrs).

Work Performed but not in Direct Support of the Scheduled Tasks

Z. Peterman participated in an investigation of the YMP by the Inspector General. (2 hrs)

B. Marshall attended a CCC meeting (software QA) (4 hrs); and a meeting of the committee charged with revision of QMP 3.03 (software). (2 hrs)

B. Marshall, S. Mahan, K. Futa, J. Paces, and D. Craft attended a training class on "sexual harassment". (3.5 hrs)

J. Paces worked on revisions to QMP 8.01 to incorporate procedures for nonconforming samples. (16 hrs)

S. Mahan trained and assisted F. Hills to run Sr on the NBS #2 6" mass spectrometer. The project involves using Sr isotopic compositions as a tracer for Paradox Basin brine water flow paths.

Z. Peterman, B. Marshall, S. Mahan, K. Futa, J. Paces and B. Widmann attended GERT training in

Denver. (2 hrs)

J. Paces completed a technical review of a manuscript entitled, "*Geology, geochemistry, and geochronology of the central Giants Range batholith, northeastern Minnesota*", by T. Boerboom and R.E. Zartman. (10 hrs)

J. Paces compiled, wrote and distributed the March monthly report of work accomplished by the Isotope and Geochemistry Group. (10 hrs) In addition, he completed (along with help from S. Mahan and Z. Peterman) the IGG biannual report. (12 hrs)

B. Widmann attended training for certification in CPR and First Aid, March 25, 1993.

WBS 1.2.5.3 Technical Data Base Management

OBJECTIVE

To manage, maintain, and accumulate technical data and information produced by site characterization, design development, and performance assessment activities for the Project.

WBS 1.2.5.3.5 Technical Data Base Input

Principal Investigator - L. Hayes

OBJECTIVE

To provide the hardware, software, personnel, and procedures needed to provide data to the technical data base and to report the acquisition and development of data to the ATDT.

ACTIVITIES AND ACCOMPLISHMENTS

Thirty-five data submittals were received in the PDA.

The new Dataman data base was inaugurated, which will initially consist of tracking information for data received by the PDA since November 1, 1992.

An inventory of all USGS data received by the former SEPDB technical data base has been received.

Sixteen new TDIFs (3 for HIP, 13 for GSP) were created for the backlog publications.

I. Standard data base maintenance

Routine jobs were performed throughout the month, including the retrieval of the water quality data from the WRD NWQL, entering the data into the Water Quality (QW) subsystem of the WRD/HIP NWIS data base. The maintenance and cleanup of the satellite transmission (SATIN) and automated data processing system (ADAPS) logs and directories were accomplished on schedule. Both ADAPS and SATIN are also subsystems within the HIP NWIS database. Backup of all the NWIS database subsystem files was performed and the backup tape sent to the LRC for storage in their fire proof vault.

The procedures for emergency maintenance and verification of the NWIS files were performed, following a PRIME disk crash in April. All data was recovered and accounted for.

II. Satellite transmissions

D. Burkhardt completed work on converting the H-6 water levels. All water level conversions for 1990-1991 are now completed. Burkhardt also worked on collecting data, calculating water levels, and calculating regressions for the C-2 and C-3 wells. Burkhardt recommended further review of this particular data to the hydrologists, to check for possible problems.

A lower zone was added to the H-5 data collection platform (DCP). Burkhardt worked with personnel in WRD in Reston, and in Colorado, and accomplished the programming necessary to accommodate this addition.

D. Burkhardt has started work on the water level conversions for 1992. Wells WT-2 and WT-3 have currently been completed.

There were some questions on the preferred antenna directions for some of the DCPs. Burkhardt went into the WRD Platform Assignment Scheduling System (PASS) and used the program to calculate the proper directions and azimuths for the DCPs in question.

D. Burkhardt reviewed some water-level data, double-checking the data for H-6 and some other wells, at the request of the Project Investigator.

D. Burkhardt also spent time coordinating the daily values tables for the 1989 water level report. These tables were complicated by the fact that part of the year were manual entries of water levels, and the other part of the year was entered automatically, using the newly established DCPs.

III. Data logger data

D. Burkhardt continued his assistance to A. Riggs as he received new data from his CR21X data logger. With the proper device delivery and conversion system (DECODES) formats set, Riggs may now transfer his data from the floppy disks to the PRIME, run the DECODES programs to properly format the data, and then input the data directly into the WRD ADAPS. Burkhardt also is researching a possible method for Alan to use the ADAPS ratings applications on his meteorological data. The type of application required has not been used before, and, if possible, will take some innovative work within the ADAPS system.

IV. User assistance

D. Burkhardt entered several manual water level measurements into the WRD GWIS for well UE-25p #1 and UE-25 WT #13. Burkhardt also performed several regressions for a data transmittal at the request of SZ personnel.

W. Oatfield worked with C. Savard to establish proper site file entries for some of his water quality samples. Once this was accomplished, Oatfield established a procedure for reclaiming the older water quality sample analysis and inputting them into the proper WRD QW file. This process will be used to enter older HIP water quality samples, where possible.

W. Oatfield also oriented T. Oliver to doing site entry through the GWSI programs, and the mandatory entries and policy procedures involved in naming and establishing a proper USGS site. Oatfield also showed Oliver how to use the programs involved in converting Lat/Longs to state plane coordinates.

W. Oatfield also is working on organizing J. Czarnecki's current and previous water quality data and sites for entry into the QW system directly from the NWQL.

V. Software installation

D. Burkhardt proceeded with testing of the ported ADAPS software for the DG UNIX environment. Burkhardt compared water level calculations between the current PRIME system and the ported system. The programs produced similar results. Burkhardt is currently in an iterative testing mode, working with the programmer to insure software quality.

D. Burkhardt obtained a series of WRD supplied ARC/INFO amls, for use with the GIS software, and installed them, and installed a new SCSI disk on his SUN workstation, increasing space for his GIS work and increasing his knowledge of the UNIX systems.

B. Kerans worked with the COU in defining the Short Range Plan for 1994 for data management needs.

VI. Software quality assurance

B. Kerans attended the regular software CCC meeting. In addition, Kerans attended the Software Advisory Committee meeting, as an observer from the CCC.

VII. Data administration

W. Oatfield contacted both the Nevada and California BLM Branches of Cadastral Survey after discovering that there were no official surveys around several of the areas where B. Steinkampf and C. Savard are working. Nevada has sent Oatfield some protractors for their areas and he is waiting for the same from California. Oatfield will use these to try and establish sites with information as close to the proper USGS Nevada and California formats as possible for entry into the data bases. Oatfield has done several "exploratory" pulls on sites from the Nevada and California data bases to confirm the procedures in use.

VIII. Training

The Unit has spent time working on the outlines and contents for a Data Base Management Workshop which is scheduled in order to work with HIP investigators to inform them of the data base applications available, and plan for further data handling coordination.

D. Burkhardt, W. Oatfield, and B. Kerans attended the training class on "sexual harassment".

B. Kerans attended training on procurement requirements.

WBS 1.2.5.4 Performance Assessment

OBJECTIVE

To conduct investigations and develop mathematical models examining the performance of the MGDS in the preclosure and postclosure phases; to verify, validate, benchmark, and document codes for assessing the performance of the overall waste isolation system; and to analyze the performance of the total system and subsystems.

WBS 1.2.5.4.4 Site Performance Assessment

Principal Investigator - A. Flint

OBJECTIVE

To integrate physical process submodels and data into computational models for prediction of performance of the site (including uncertainties); and assess whether the site will meet requirements for ground-water travel time in 10 CFR 60.113(a) (2). (SCP Sections 8.2.2 and 8.3.5)

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GPA004 Develop 1-D and 2-D matrix models

The 1-D flow code is still being modified to incorporate a dual porosity fracture network. Fracture properties are being set initially to a uniform property to test the mesh. Once the fracture properties are established from activity 3GPA008 and fracture densities are estimated from UZ-16 a modified mesh will be created and new properties assigned.

A 2-D geostatistically based hydrologic properties model for the Shardy Base microstratigraphic unit of the Tiva Canyon was completed and presented at the IHLNW Conference. A modified version is currently in USGS review to be submitted to the journal Ground Water.

3GPA008 Analyze fracture/fault fill and develop model

Water retention curves from the fault fill in Trench 14 are being determined using the CX-2. A rock core with fracture filling has been sliced in thin layers to determine alteration from the fracture into the bulk rock away from the fracture. The thin slices are being used to determine porosity, bulk density, grain density and water characteristic curves. Similar whole rock cores are being used to measure imbibition properties of the fracture coating and the unaltered rock core.

WBS 1.2.5.4.6 Development and Validation of Flow and Transport Models

Principal Investigator - A. Flint

OBJECTIVE

To develop and validate the calculational models that (1) are used primarily in assessments of performance for the resolution of Issues 1.1, 1.2, 1.3, 1.6, 1.8, and 1.9; (2) describe fluid flow or the transport of energy/or radionuclides; and (3) are not used exclusively in the resolution of a single issue; and to follow applicable quality-assurance procedures.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GVF003 Develop and refine data for INTRAVAL program

Hydrologic properties from UZ-16 core are being analyzed in the hydrology laboratory. These values are the data that are being estimated by the modelers in the INTRAVAL program. An update data set will be sent in May. This data will include unit contacts, water levels and any core measurements to date.

3GVF007 Develop and test hydraulic functional relations

Characteristic curves are being determined for 40 samples of welded and nonwelded tuffs. The van Genuchten function is being tested to determine differences in the assumptions used in fitting the equation. There are up to 5 fitting parameters or as little as two and the data will be fit using all combinations. These data and results will be presented to the group currently testing the hot repository concept for use in their modeling exercises.

WBS 1.2.5.4.7 Supporting Calculations for Postclosure Performance Analyses

Principal Investigator - A. Flint

OBJECTIVE

To provide documentation and results of calculations used in analyses of postclosure performance that support design efforts, contribute to the resolution of Issue 1.3, and indirectly support activities carried out under other performance assessment WBS elements.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

3GPC007 Measure thermal effects on rock properties

Water characteristic curves are being determined for core samples that were heated to different temperatures. The Topopah Spring unit was not apparently altered by the high temperature. The Calico Hills unit is not complete.

1.2.9 PROJECT MANAGEMENT

OBJECTIVE

To provide overall management of the Yucca Mountain Project including: project control, quality assurance, technical integration, and interaction with other OCRWM Program demands on Project management activities.

WBS 1.2.9.2 Project Control

OBJECTIVE

To provide Project and participant management support in the areas of budgeting, cost and schedule planning and control; develop and maintain an integrated project management system; to implement performance measurement; to support the change control system; and to establish WBS and support project control processes.

WBS 1.2.9.2.2 Participant Project Control

Principal Investigator - R. Ritchey

OBJECTIVE

To develop, maintain, integrate, control and report the participant cost and schedule plans, and to participate in change control.

ACTIVITIES AND ACCOMPLISHMENTS

A new Summary Account was developed to track UZ-14 efforts. A baseline schedule for Quality Assurance was developed to track the modification and revision of Quality Management Procedures. Status to the USGS schedules was input, earned value was calculated, and the information uploaded to Las Vegas. The Monthly Worker Monitoring Program reports were submitted for the months of February and March for quarterly review. DOE Project Control System Guidelines training for DOE Notice 4700.5 was attended.

1.2.11 QUALITY ASSURANCE

OBJECTIVE

Includes work scope related to the development and maintenance of project participants assurance programs, consisting of all those planned and systematic actions, necessary to provide adequate confidence that the information to obtain a license for siting, constructing and operating a geologic repository and monitored

retrievable storage facility will be met and complies with Federal regulations.

WBS 1.2.11.1 Quality Assurance Coordination and Planning
Principal Investigator - T. Chaney

OBJECTIVE

To coordinate and support the activities that are performed within the Quality Assurance WBS element.

ACTIVITIES AND ACCOMPLISHMENTS

Three Activity Controls Specification Reports (ACSRs) were reviewed during the Grading Acceptance Committee Meeting. Two of the ACSRs were approved.

WBS 1.2.11.2 Quality Assurance Program Development

OBJECTIVE

To establish and maintain the QA program documents.

ACTIVITIES AND ACCOMPLISHMENTS

A Draft Matrix for the DOE QARD has been completed. This process identified 15 existing QMPs requiring revision, four new QMPs to be developed, and seven QMPs requiring modification.

A schedule was prepared to track each team working on software, samples, data, and technical procedure preparation.

Modification QMP-4.01,R4-M1, Procurement Document Control was approved.

The March Open Items and Trend Analysis Reports were written and issued.

1.2.11.3 Quality Assurance Verification

OBJECTIVE

To verify the QA program through periodic audits and surveillances of Project activities.

WBS 1.2.11.3.1 Quality Assurance Verification - Audits

Principal Investigator - T. Chaney

OBJECTIVE

To verify the QA program through periodic audits of Project activities.

ACTIVITIES AND ACCOMPLISHMENTS

An audit report for Audit USGS-93-06, of six technical activities was written including one audit finding and six audit observations.

Evaluations of vendors IFR, Inc.; Ruska Instruments; PBT Inc.; and Setra Systems, Inc. were conducted for inclusion on the Approved Suppliers List. Vendor evaluations for three other suppliers were also started, including Sierra Instruments, Inc.; Fluke Technical Center of Fremont, CA; and Paroscientific, Inc.

Audit Plan USGS-93-09, BQA was submitted.

Internal programmatic Audit USGS-93-08 was planned and performed. The audit yielded three Audit Finding Reports, four Observations and numerous recommendations. While the report is pending finalization and issuance, it will recommend the closure of the following deficiency documents: AFR-9110-06; CARs -90-03, -91-01, -91-03, -91-05, -91-10; and NCRs -92-09, -92-26, -92-35, -92-36, -92-38.

WBS 1.2.11.3.2 Quality Assurance Verification - Surveillances

OBJECTIVE

To verify the YMP USGS QA program through periodic audits and surveillances of Project activities.

ACTIVITIES AND ACCOMPLISHMENTS

Field Surveillance USGS-93-S03, on Activity 8.3.1.2.2.6.1 (UZ-6) was planned and conducted with satisfactory results.

WBS 1.2.11.5 Quality Assurance - Quality Engineering

Principal Investigator - L. Hayes

OBJECTIVE

To provide quality engineering support to the project through reviews of documentation and assistance with QA training.

ACTIVITIES AND ACCOMPLISHMENTS

Support continued for the FY92 Management Assessment.

Assistance was given in completing the Transition Plan for transitioning WBS #1.2.3.2.6.2 activities from the USGS to SNL.

Approximately 60 Software Documents were received, reviewed, and/or processed by the SCM Coordinator.

A listing of quality-affecting software was prepared on behalf of the YMP Branch Information Resources Management Representative for transmittal to the M&O contractor as requested.

1.2.12 INFORMATION MANAGEMENT

OBJECTIVE

Includes work scope related to the project-level establishment of systems to facilitate organization, storage, and retrieval of information/documents.

1.2.12.2 Records Management

OBJECTIVE

To provide a YMP Records Management System that will meet the requirements of: DOE/RW-0214, Quality Assurance Requirements Document for the Civilian Radioactive Waste Management Program; DOE/RW-0194P, Records Management Policies and Requirements; ANSI/ASME NQA-1, Quality Assurance Requirements for Nuclear Facilities (Requirement 17 and 17S-1, Quality Assurance Records), and the Licensing Support System (LSS).

WBS 1.2.12.2.2 Local Records Center Operation

Principal Investigator - L. Hayes

OBJECTIVE

To provide a Yucca Mountain Project Records Management System that will meet the requirements of: DOE-NNWSI, Quality Assurance Plan, DOE-NNWSI/88-9; DOE-OCRWM Records Management Policies and Requirements, DOE/RW-0194; and the Licensing Support System (LSS); and to establish and operate all local records centers.

ACTIVITIES AND ACCOMPLISHMENTS

Three hundred six individual records and 98 criteria packages were received into the LRC. One was received late, and 45 packages required corrective actions.

Records transmitted to the CRF from the LRC included 53 individual records and 87 criteria packages (1,595 pages), two publication packages (438 pages), five data packages (125 pages), nine backlog publications (1470 pages), and 51 cited references (570 pages).

WBS 1.2.12.2.5 Document Control

OBJECTIVE

To provide a Yucca Mountain Project Records Management System that will meet the requirements of: DOE/RW-0241, Quality Assurance Requirements Document for the Civilian Radioactive Waste Management Program; DOE/RW-0194P, Records Management and Requirements, ANSI/ASME, NQA-1, Quality Assurance Requirements for Nuclear Facilities (Requirement 17 and 17-S1, Quality Assurance Records), and the Licensing Support System (LSS).

ACTIVITIES AND ACCOMPLISHMENTS

Seven Technical Procedures were distributed. Two Activity Control Specification Reports were distributed. All 35 Scientific Notebook Plans were placed on uncontrolled status.

1.2.13 ENVIRONMENT, SAFETY, AND HEALTH

OBJECTIVE

Includes work scope related to environmental compliance, monitoring, and safety and health.

WBS 1.2.13.4 Environmental Field Programs

OBJECTIVE

To identify data requirements; to collect required environmental field data; and to prepare topical data reports.

WBS 1.2.13.4.7 Water Resources

Principal Investigator - R. LaCamera

OBJECTIVE

To provide water resources environmental field activity planning documents, field data and analyses, and topical reports describing the results of field data analyses.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities:

3GWR021 Conduct Ground-Water Monitoring FY93

Ground-water levels were measured at 26 sites. Discharge was measured at one flowing well. Ground-water data collected during March were checked and filed. Calibrated electric water-level tapes for depths to water less than 500'.

3GWR033 Environmental Program Support, FY93

Prepared and delivered status report for March to DOE and HIP. Status report regarding MV-1 (Army 1 well) and AD-6 (Cooks West Well) was provided to DOE/YMP. Discussed present and future computer needs with Nevada District computer section and DOE/Weston. Computer specifications were developed and supplied to DOE/Weston staff.

3GWR034 Evaluate Ground-Water Quality Monitoring Requirements

Reviewed analytical data, updated data base, and provided DOE with provisional water-quality analysis.

3GWR035 Prepare Water-Resources Report Through FY92

Prepared tabular and graphical summaries using existing data bases and available data. Updated data base. Met with staff of Nevada State Engineer's office to acquire water-use and water-level data.

3GWR026 Prepare Groundwater Monitoring Report 2nd Quarter FY93

Report was prepared and delivered to DOE on April 26.

D. LaCamera has been selected as the Nevada District Coordinator for level I water-quality training. About three weeks of LaCamera's time will be scheduled during the month of May to fulfill prerequisite training requirements. LaCamera also participated in National Field Quality Assurance Program.

Variances:

3GWR021 Conduct Ground-Water Monitoring FY93

Water-level data were not collected at MV-1 or AD-6. MV-1 was not measured because it does not have an access tube to allow water-level measurements. AD-6 is currently the owner's only pumping well and the owner feels that a water-level measurement may affect operation of the well. Nearby well AD-5 is currently measured and provides monitoring data for the area. Instrumentation at Tracer well was stolen between March 24 and April 21, 1993. About one month of data is irretrievably missing for that period. Additional data will be unobtainable until instrumentation is replaced (sometime in May).

1.2.15 SUPPORT SERVICES

OBJECTIVE

Includes work scope related to project-level general administrative and project support activities.

WBS 1.2.15.3 Yucca Mountain Site Characterization Project Support for the Training Mission

Principal Investigator - L. Hayes

OBJECTIVE

To manage the resources and perform work in support of the YMP training mission developed and implemented by the Yucca Mountain Site Characterization Project Office and YMP participants.

ACTIVITIES AND ACCOMPLISHMENTS

YMP-USGS personnel were scheduled and classroom announcements were distributed for five classroom sessions. Additional reading assignments with highlight sheets were distributed for four QMPs. Reading assignments were distributed for five technical procedures.