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United States Geological Survey
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Monthly Highlights and Status Report
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ACRONYM LIST

A&E	architectural and engineering
ABC	American Borate Corporation
ACD	advanced conceptual design
ACM	alternative conceptual model
ACNW	Advisory Committee on Nuclear Waste
ACP	Area Characterization Plan
ACS	American Chemical Society
ACWP	actual cost of work performed
ADP	automated data processing
ADTS	Automated Data Tracking System
AEC	Atomic Energy Commission
AECB	Atomic Energy Control Board
AECL	Atomic Energy of Canada, Ltd.
AEG	Association of Engineering Geologists
AFOS	Automated Field Operating System
AFR	Audit Finding Report
AGU	American Geophysical Union
AIH	American Institute of Hydrology
ALARA	as low as reasonably possible
ALTS	Apache Leap Tuff Site
AMA	Assistant Manager for Administration
AMFM	alternative means of financing and managing
AMP	Administrative Management Procedure
ANS	American Nuclear Society
ANSI	American National Standards Institute
ANSTO	Australian Nuclear Science and Technical Organization
AO	Administrative Officer
AP	Administrative Procedure
APQ	Administrative Procedure Quality
ARR	Area Recommendation Report
ARS	Automated Records System
ASA	American Statistical Association
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASR	Annual Status Report
ASTM	American Soceity for Testing and Materials
ATC	Asynchronous Terminal Concentrator
ATLAS	Alternatives to License Application Strategies
ATS	Activity Tracking System
AVL	Approved Vendors List
BA	Biological Assessment
BAC	budgets at completion
BBC	British Broadcasting Company
BBS	Bulletin Board System
BCWP	budgeted cost for work performed
BCWS	budgeted cost for work scheduled
BDR	Basic Data Recorder

BFD	Basis for Design
BG&H	Bond Gold and Hydrosearch
BGRA	Branch of Geologic Risk Assessment
BIG	Branch of Isotope Geology
BLM	Bureau of Land Management
BP	before present
BPA	blanket purchase agreement
BPO	blanket purchase order
BQA	Branch of Quality Assurance
BRC	below regulatory concern
BRG	Branch of Central Regional Geology
BSP	balanced cross section modeling program
BSR	Bi-annual Status Report
BWIP	Basalt Waste Isolation Project
C/SCR	Cost and Schedule Change Report
C&C	consultation and cooperation
CA	Construction Authorization
CADD	Computer-Aided Drafting and Design
CAE	Computer-Aided Engineering
CAM	Cost Account Manager
CAP	cost account plan
CAR	Corrective Action Report
CASY	Committee for the Advancement of Science in the YMP
CATS	Corrective Action Tracking System
CBI	Controlled Blasting Investigation
CCB	Change Control Board
CCC	Configuration Control Committee
CD	Consultative Draft
CDP	Career Document Profile
CDR	Conceptual Design for the Repository
CFR	Code of Federal Regulations
ChemTrec	Chemical Transportation Emergency Center
CHLW	commercial high-level waste
CIRF	Configuration Identification Request Form
CMR	Branch of Central Mineral Resources
COB	close of business
COCORP	Consortium for Continental Reflection Profiling
COGS	Computer-Oriented Geological Society
COSIM	conditional simulation
CPR	Cost Performance Report
CR	Central Region
CRF	Central Records Facility
CRF	Comment Response Form
CRG	Central Regional Geology
CRGB	Central Regional Geology Branch
CRW	comment resolution workshop
CSCS	Cost Schedule Control System
CSM	Colorado School of Mines
CVO	Cascade Volcanoes Observatory
CY	calendar year
D&E	development and evaluation
DAA	Design Acceptability Analysis

DAS ..... data acquisition system
DCP ..... data collection platform
DDP ..... Director's Decision Plan
DEC ..... Digital Equipment Corporation
DECUS ..... Digital Equipment Corp Users Group
DEIS ..... Draft Environmental Impact Statement
DFC ..... Denver Federal Center
DHLW ..... defense high-level waste
DISA ..... Downhole Instrument Station Apparatus
DOE ..... Department of Energy
DOE/HQ ..... Department of Energy Headquarters
DOE/NV ..... Department of Energy/Nevada Operations Office
DOE/NVO ..... Department of Energy/Nevada Operations Office
DOP ..... Department Operating Procedures
DOT ..... Department of Transportation
DR3M ..... Distributed Routing Rainfall-Runoff Model
DRI ..... Desert Research Institute
DRMS ..... Data Records Management System
DRS ..... document review sheet
DTN ..... document transmittal notice
DTP ..... Detailed Test Plan
DWMD ..... Defense Waste Management Department (REECo)
DWPF ..... Defense Waste Processing Facility
DVNM ..... Death Valley National Monument
EA ..... Environmental Assessment
EAC ..... estimate at completion
EAEG ..... Euroean Association of Exploration Geophysicists
EBS ..... engineered barrier system
ECR ..... Engineering Change Report
EDBH ..... engineered design borehole
EDF ..... Environmental Defense Fund
EEI ..... Edison Electric Institute
EEP ..... Emergency Evaluation Plan
EFAP ..... Environmental Field Assessment Plan
EIA ..... Emergency Information Administration
EIS ..... Environmental Impact Statement
EKES ..... Electonic Keyed-Entry System
EM ..... electromagnetic
EMP ..... electron-microprobe
EPA ..... Environmental Protection Agency
EPRI ..... Electric Power Research Institute
ERDA ..... Energy Research and Development Administration
EROS ..... Earth Resource Observatory System
ERTP ..... Environment Requirements Training Program
ES ..... exploratory shaft
ESF ..... Exploratory Shaft Facility
ESF/DRD ..... Exploratory Shaft Facility Design Requirements Document
ESQAT ..... Earth Science Quality Assurance Team
ESR ..... electron spin resonance
ESSE ..... Early Site Suitability Evaluation
ESTC ..... Exploratory Shaft Test Coordination
ESTP ..... Exploratory Shaft Test Plan

ESTP-C ..... Exploratory Shaft Test Plan Committee
EV ..... earned value
FEHMS ..... Finite Element Heat Mass and Stress
FEIS ..... Final Environmental Impact Statement
FEMA ..... Federal Emergency Management Agency
FFS ..... Federal Financial System
FFS ..... Federal financial system
FID ..... Flame Ionization Detector
FIS ..... Federal interim storage
FITS ..... Facilities Important to Safety
FMMG ..... Fracture Matrix Mesh Generator
FP ..... final procedures
FPC ..... final procurement and construction
FQI ..... Federal Quality Institute
FR ..... Federal Register
FRD ..... Functional Requirement Document
FRHP ..... Fractured Rock Hydrology Program
FSN ..... Fenix and Scisson, Nevada
FSU ..... Florida State University
FTE ..... full-time equivalent
FWP ..... field work proposal
FY ..... fiscal year
G&A ..... Goodson and Associates
GAO ..... Government Accounting Office
GC ..... gas chromatograph
GCM ..... Global Climate Model
GCP ..... Geochronological Procedure
GD ..... Geologic Division
GEOEAS ..... Geostatisical Environmental Software
GETT ..... grants equal to taxes
GID ..... Ground Water Site Investigation
GIS ..... Graphic Information System
GOCO ..... government-owned contractor-operated
GOES ..... Geostatisical Environmental Operational Satellite
GP ..... Geologic Procedure
GPO ..... Government Printing Office
GPP ..... Geophysical Procedure
GPR ..... ground-penetrating radar
GPS ..... global positioning satellite
GQA ..... Graded Quality Assurance
GRESS ..... Gradient Enhanced Software System
GSA ..... Geological Society of America
GSA ..... General Services Administration
GSIS ..... Geoscientific Information System
GTUF ..... G-Tunnel Underground Facility
GW ..... ground water
GWE ..... Gigawatts Electrical
GXP ..... Geochemical Procedure
H&N ..... Holmes and Narver
HIP ..... Hydrologic Investigations Program (formerly NHP)
HLRW ..... high-level radioactive waste
HLW ..... high-level waste

HP ..... Hewlett Packard
HP ..... Hydrologic Procedure
HQ ..... Headquarters
HRF ..... Hydrologic Research Facility
HRMP ..... Hydrology and Radionuclide Migration Program
HSPF ..... Hydrological Simulation Program
IBM ..... International Business Machines
ICG ..... International Geologic Congress
ICN ..... Interim Change Notice
ICWG ..... Interface Control Working Group
IDAS ..... Integrated Data Acquisition System
IDS ..... Information Data System
IFS ..... Iterated Function System
IG ..... Integration Group
IGIS ..... Interactive Graphics Information System
IGT ..... Institute of Gas Technology
IHLWM ..... International High Level Radioactive Waste Management
IMS ..... Information Management System
INEL ..... Idaho National Engineering Laboratory
INSTAAR ..... Institute of Arctic and Alpine Research
INTRAVAL ..... International Transport Code Validation
IR ..... infrared
IRG ..... Interagency Review Group
ISA ..... Instrument Society of America
ISD ..... Information Systems Division
ISO ..... International Standards Organization
IVV ..... Independent Verification and Validation
JGR ..... *Journal of Geologic Research*
LA ..... license application
LACT ..... laser alignment and centering target
LAN ..... local area network
LANL ..... Los Alamos National Laboratory
LBL ..... Lawrence Berkeley Laboratories
LCS ..... Liquid Scintillation Counter
LDRP ..... litigation discovery request procedure
LLNL ..... Lawrence Livermore National Laboratory
LLP ..... Lightning Location & Protection, Inc.
LLW ..... low-level waste
LOE ..... level of effort
LRC ..... Local Records Center
LRE ..... latest revised estimate
LRP ..... long-range planning
LRS ..... Litton Resource System
LSP ..... laser safety plan
LSS ..... Licensing Support System
LWS ..... Lathrop Wells aeromagnetic survey
LV ..... Las Vegas
MADS ..... Meteorological Alert Distribution System
MCL ..... Maximum Contaminant Level
MEDA ..... Meteorological Data Acquisition Network
MGDS ..... Mined Geologic Disposal System
MIC ..... Management Information Center

MISIS ..... Micro Integrated Storm Information System
MLT ..... materials testing laboratory
MMDS ..... Martin Marietta Data Systems
MODFE ..... Modular Finite Element
MOT ..... Management Overview Team
MOU ..... Memorandum of Understanding
MPBA ..... multipurpose borehole activity
MPBH ..... multipurpose borehole
MPM ..... Management Procedure Manual
MPU ..... Manuscript Prep Unit
MRIR ..... Material Receiving and Inspection Report
MRS ..... monitored retrievable storage
MSA ..... major system acquisition
MSHA ..... Mine Safety and Health Administration
MSIS ..... Management System Information Strategy
MSL ..... mean sea level
MT ..... magneto-telluric
M&TE ..... measuring and test equipment
MTU ..... metric tons of uranium
MW ..... mixed waste
NARUC ..... National Association of Regulatory Utility Commissioners
NBS ..... National Bureau of Standards (now NIST)
NCAR ..... National Center for Atmospheric Research
NCR ..... Nonconformance Report
NEA ..... Nuclear Energy Agency
NEPA ..... National Environmental Policy Act
NFS ..... Nuclear Fuel Services
NHP ..... Nuclear Hydrology Program (now HIP)
NIST ..... National Institute of Standards and Technology
NMD ..... National Mapping Division
NMIMT ..... New Mexico Institute of Mining and Technology
NNWSI ..... Nevada Nuclear Waste Storage Investigation
NOAA ..... National Oceanic and Atmospheric Administration
NOO ..... Nevada Operations Office
NPS ..... National Park Service
NRC ..... Nuclear Regulatory Commission
NRP ..... National Research Program
NSTF ..... near-surface test facility
NTC ..... National Training Center
NTS ..... Nevada Test Site
NTSO ..... Nevada Test Site Office
NVO ..... Nevada Operations Office
NWF ..... Nuclear Waste Fund
NWIS ..... Nevada Water Information System
NWIS ..... National Water Information System
NWM ..... Nuclear Waste Management
NWN ..... *Nuclear Waste News*
NWPA ..... Nuclear Waste Policy Act
NWPO ..... Nuclear Waste Projects Office
NWQL ..... National Water Quality Laboratory
NWTRB ..... Nuclear Waste Technical Review Board
OBS ..... organization breakdown structure

OCRWM	Office of Civilian Radioactive Waste Management
OF	Open file
OFR	open-file report
OGR	Office of Geologic Repositories
OMB	Office of Management and Budget
OMR	Office of Mineral Resources
OPCNM	Organ Pipe Cactus National Monument
OPFM	Office of Project and Facilities Management
OPIO	Office of Policy, Integration, and Outreach
ORM	Office of Resource Management
ORNL	Oak Ridge National Laboratory
OSTS	Office of Storage and Transportation Systems
P&S	planning and scheduling
PA	performance assessment
PAC	planning and control
PACE	Performance Assessment Calculation Exercise
PACS	Planning and Control System
PAGEOPH	*Pure and Applied Geophysics*
PAGIS	Performance Assessment of Geological Isolation Systems
PAL	Project Acronym List
PAMP	Performance Assessment Management Plan
PAP	Performance Assessment Plan
PASP	Performance Assessment Strategy Plan
PBEI	prototype blast effects on instrumentation
PBQ&D	Parson, Brinkerhoff, Quade, and Douglas
PBS	pyramid beam splitter
PC	personal computer
PCBI	Prototype Controlled Blasting Investigation
PCCB	Program Change Control Board
PCM	pivoting camera mount
PCSB	Program Cost and Schedule Baseline
PC&TS	Program Coordination and Technical Support
PSA	Participant Data Archives
PDCR	prototype dry coring of rubble
PDHI	prototype drill hole instrumentation
PDM	Problem Definition Memorandum
PDS	Project Decisions Schedule
PEET	prototype excavation effects test
PI	Principal Investigator
PIP	Prototype Investigation Plan
PIR	Precision Infrared Radiometer
PL	Public Law
PMB	Performance Measurement Baseline
PMF	probable maximum flood
PMIS	Program Management Information System
PMP	Program Management Plan
PMR	performance measurement review
PMS	Program Management System
PNL	Pacific Northwest Laboratories
PPWE	prototype pore-water extraction
PQM	Project Quality Management
PRBP	project review briefing package

PRC	Project Records Center
PRDA	Program Research and Development Announcement
PRESS	Project-related Engineering and Scientific Studies
PRMS	Precipitation Runoff Modeling System
PSAR	Preliminary Safety Analysis Report
PSI	pounds per square inch
PTP	Prototype Test Plan
PTS	Petroleum Testing Services
QA/QC	quality assurance/quality control
QA	Quality Assurance
QAG	Quality Assurance Grading
QAGR	Quality Assurance Grading Report
QALA	Quality Assurance Level Assignment
QALAS	Quality Assurance Level Assignment Sheet
QAM	Quality Assurance Manager
QAP	Quality Assurance Program
QAPD	Quality Assurance Program Description
QAPO	Quality Assurance Project Officer
QAPP	Quality Assurance Program Plan
QAR	Quality Assignment Records
QARD	Quality Assurance Requirements Document
QASC	Quality Assurance Support Contractor
QMP	Quality Management Procedure
QMPR	Quality Management Policies and Requirements
QRA	Quality Related Activities
QRB	Quality Review Board
QVC	Quality Verification Check
QWL	quality of work life
R&D	research and development
R&H	receiving and handling
R&LSD	Research and Laboratory Services Division
RALD	right angle laser deflectometer
RAM	responsibility assignment matrix
RASA	Regional Aquifer Study Assessment
RASRA	radial arm strike rail assembly
RCR	Regional Characterization Report
RCRA	Resource Conservation and Recovery Act
REBS	Radiation Energy Balance Systems
REECo	Reynolds Engineering and Electrical Company
RFP	Request for Proposal
RIB	Reference Information Base
RIS	Records Information System
RMF	Records Management Facility
RMNMD	Rocky Mountain National Mapping Division
RMP	Records Management Plan
RMS	Records Management System
ROD	Record of Decision
RPC	Report Package Collection
RQPG	right angle prism goniometer
RRL	reference repository location
RSN	Raytheon Services Nevada
RTISA	request to initiate site activity

RW	radioactive waste
RWMS	Radioactive Waste Management Site
s-p	surface-propagated
SA	study activities
SAGEEP	Symposium on the Application of Geophysics to Engineering and Environmental Problems
SAIC	Science Applications International Corporation
SAR	Safety Analysis Report
SAS	Statistical Analysis System
SBTFRD	Surface-Based Test Facility Requirements Document
SBTP	Surface-Based Test Prioritization
SCA	Site Characterization Analysis
SCC	substantially complete containment
SCI	Software Configuration Items
SCIF	software checklist and indexing form
SCM	Software Configuration Management System
SCP	Site Characterization Plan
SDR	Standard Deficiency Report
SDRD	Subsystems Design Requirement Document
SE	Senior Engineer
SE&D	Systems Engineering and Development
SEM	scanning electron microscopy
SEMP	System Engineering Management Plan
SEPDB	Site and Engineering Properties Data Base
SES	Scientific and Engineering Software
SF	spent fuel
SG	Senior Geologist
SGB	Southern Great Basin
SGBSN	Southern Great Basin Seismic Network
SGR	Seismic Group Recorders
SIP	Scientific Investigation Plan
SIR	Scientific Investigations and Research
SIR	Special Investigative Review
SIT	Site Integration Team
SKB	Swedish Nuclear Fuel and Waste Management Company
SMF	Sample Management Facility
SMS	Sample Management System
SNF	spent nuclear fuel
SNL	Sandia National Laboratories
SNP	Scientific Notebook Plan
SNSN	Southern Nevada Seismic Network
SOBART	Southern Basin and Range Transects
SOC	Sample Overview Committee
SOIR	status of open items report
SOP	Standard Operating Procedure
SP	Seismic Procedure
SP	Study Plan
SPA	Study Plan Assessment
SPE	Society of Petroleum Engineers
SPOC	submersible pressurized outflow cells
SPR	Semi-annual Progress Report
SQA	Software Quality Assurance

SQAP	Software Quality Assurance Plan
SRD	system requirements and description
SRG	strike rail goniometer
SRP	Site Recommendation Report
SSF	software summary forms
SSF	specified software forms
SSR	Site Selection Report
SSSA	Soil Science Society of America
STC	Southern Tracer Complex
SWO	stop-work order
SZ	saturated zone
T&MSS	Technical and Management Support Services
TAR	Technical Assessment Review
TBD	to be determined
TBM	Tunnel Boring Method
TC	Technical Contact
TC	Training Coordinator
TCP	telescoping camera pedestal
TCPAL	Thermocouple Psychrometer Calibration
TDAG	Technical Data Advisory Group
TDB	Technical Data Base
TDD	Test Descriptions Document
TDF	task definition form
TDIF	Technical Data Information Form
TDR	time domain reflectometry
TDS	total dissolved solids
TEF	Test and Evaluation Facility
TIC	Technical Information Center
TM	thematic mapper
TP	Technical Procedure
TPEC	Technical Proposal Evaluation Committee
TPO	Technical Project Officer
TPT	Testing Prioritization Task
TQM	Total Quality Management
TRIG	Technical Review and Integration Group
TRIMS	Technical and Regulatory Information Management System
TRU	Transuranic
TVA	Tennessee Valley Authority
UNE	Underground Nuclear Explosion
UNLV	University of Nevada at Las Vegas
UNR	University of Nevada, Reno
UPS	Uninterrupted Power Supply
URL	underground research laboratory
USBLM	U.S. Bureau of Land Management
USBR	U.S. Department of the Interior Bureau of Reclamation
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UTM	Universal Trans Mercator
UZ	unsaturated zone

UZFRHP ..... Unsaturated Zone Fractured Rock Hydrology Project
UZIG ..... Unsaturated Zone Interest Group
UZSBP ..... Unsaturated Zone Surface-Based Borehole Project
VAR ..... Variance Analysis Report
VARS ..... Video Archival Retrieval System
VLF ..... very low frequency
VOC ..... Validation Oversight Committee
VOG ..... Validation Oversight Group
VSP ..... vertical seismic profiling
WA ..... Western Atlas
WAC ..... Waste Acceptance Criteria
WAS ..... Work Authorization Submission
WBS ..... work breakdown structure
WIPP ..... Waste Isolation Pilot Plant
WIT ..... Working Integration Team
WMSD ..... Waste Management Systems Description
WNRE ..... Whiteshell Nuclear Research Establishment
WORM ..... Write Once Read Many
WP ..... waste package
WP ..... Weapons Program
WPDRD ..... Waste Package Design Requirements Document
WRD ..... Water Resources Division
WRG ..... Western Region Geology
WRI ..... Water Resources Investigations
WRIR ..... Water Resources Investigations Report
WRR ..... Water Resources Research
WSNSO ..... Weather Service Nuclear Support Office
WSP ..... Water Supply Paper
WT ..... water table
WVDP ..... West Valley Demonstration Project
YM ..... Yucca Mountain
YMP ..... Yucca Mountain Project
YMPB ..... Yucca Mountain Project Branch
YMPO ..... Yucca Mountain Project Office

1.2.1 SYSTEMS

OBJECTIVE
To integrate systems with the Geologic Repository Program and to describe the YMP Mined Geologic Disposal System (MGDS); and to evaluate the performance of the natural, engineered barrier, and total systems for meeting regulatory standards.

WBS 1.2.1.2 Systems Engineering

OBJECTIVE
To develop and implement a Systems Engineering Management Plan that will provide DOE/NV with a means of integrating and documenting the technical development of the waste management system requirements; and to ensure that systems engineering techniques are consistently applied during the various phases of the Yucca Mountain Mined Geologic Disposal System life cycle.

WBS 1.2.1.2.6 Yucca Mountain Site Characterization Project (YMP) support to the Management Systems Improvement Strategy (MSIS)
Principal Investigator - L. Hayes

OBJECTIVE
To manage the YMP resources and perform work in support of the MSIS being conducted by the Office of Civilian Radioactive Waste Management (OCRWM).

ACTIVITIES AND ACCOMPLISHMENTS
R. Craig attended a Management Systems Improvement Strategy (MSIS) meeting for the ESF as a core team member March 12-14 in Denver and March 26-28 at Los Alamos.

B. Lewis prepared for and participated in a MSIS Geoscience Expert panel for Performance Issues 1.1 and 1.6 in Denver.

B. Lewis prepared for and participated in a MSIS functional analysis technical expert panel meeting for Performance Issues 1.1 and 1.6 at LANL.

B. Lewis participated in the meeting of the MSIS Physical System Functional Analysis Core Team, March 25-29.

W. Langer participated in the MSIS exercise.

WBS 1.2.1.3 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 1.2.1.3.5 Technical Data Base Input
Principal Investigator - L. Hayes

OBJECTIVE
To provide the hardware, software, personnel, and procedures needed to provide data to the technical base.

ACTIVITIES AND ACCOMPLISHMENTS

A synopsis of a meeting concerning technical data and USGS concerns with the implementation of the Project's requirements was prepared and distributed to all attendees for information and comment.

A second visit by Licensing Support System (LSS) personnel reviewed current and potential records generated by the USGS to support licensing.

The review draft of QMP-8.03, R4 is now out for formal review and comment.

The PDA received two technical data segment packages. Four TDIFs related to the following SCPs were processed and forwarded to the Automated Data Tracking System:

SCP 1.2.3.2.8.4.1	2 TDIFs
SCP 1.2.3.3.1.1.1	1 TDIF
SCP 1.2.3.3.1.1.2	1 TDIF

Attended meetings with EG&G to coordinate the transfer of technical data.

WBS 1.2.1.4 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 1.2.1.4.6 Development and Validation of Flow and Transport Models

Principal Investigator - L. Hayes

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

The first draft of "The effects of wet and dry drilling fluids on *in situ* hydrologic conditions of tuffaceous rock: 2. Core data and neutron logs," by A. Flint, L. Flint, K. Richards, and M. Chornack was completed and is in internal review.

Work began on development of mesh to model imbibition in dry drilled nonwelded borehole from G-Tunnel.

WBS 1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

Principal Investigator - L. Hayes

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

J. Czarnecki attended a follow-up meeting in Las Vegas on developing nominal-condition models of ground-water flow and transport for the flow system of Yucca Mountain and vicinity. In attendance were representatives from LANL, SNL, DOE, and SAIC. The objective of the effort is for SNL to develop a convergent model of ground-water flow and transport by April 30, 1991. To facilitate that effort, Czarnecki provided an IBM compatible diskette with pertinent input and output files for baseline 2-D finite-element simulations of the flow system. Czarnecki also provided pertinent publications to several of the meeting participants.

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 Management and Integration

Principal Investigator - L. Hayes

OBJECTIVE

To manage and integrate the work performed within the site WBS elements.

M&I QA Implementation GD 0G31AAAA

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

GCP-07, R2, Mineral Separation for Geochemistry and Isotopic Analysis, is currently in the signature approval process; and GPP-11, R1, Magnetic Methods, is being prepared for submittal to technical review. Scientific Notebook GCP-24T, R0, Modifications to U-Th-Pb Standard Procedures, is in technical review.

A draft management agreement was prepared for G. Perasso in accordance with YMP-USGS-QMP-4.02, R2, Control of Intra-USGS Acquisitions and submitted to the QA Office for review. The agreement covers calibration services to be provided to the YMP-USGS by the USGS National Mapping Division Branch of Geometronics in Reston, VA.

Two hundred two (202) Hydrogenic Deposit Sample Description Sheets were prepared and submitted to the DOE Sample Management Facility.

An implementation plan for QMP-2.02, R5, USGS Personnel Qualification was prepared for the GD. Informal reviews of the guidance documents for QMPs -2.07, R1 and -2.08, R1 were completed.

The Software Technical Review Report for SEISMIC CMD was rewritten and submitted to the SCM System.

A response was completed as follow-up to the DOE/YMP Quality Assurance Software Workshop discussing USGS implementation concerns and success stories for software quality assurance.

Quality Assurance

J. Barth was active in several USGS QA activities, including review of revised QMP papers, NCR

examination, open-items meetings, technical examination, and calibration requirements. He assisted the QA office with related functions at surveillance and audit activities, training, etc.

The Technical Procedure Master List was updated and forwarded to the YMP-USGS QA Office as scheduled.

The preparation of Quality Assurance Grading Reports has continued with the completion of all but five technical grading reports. Sixteen programmatic grading reports were completed and are being submitted to the Quality Review Board.

Planning and Operations
SAIC/Golden is preparing Position Descriptions, Personnel Resumes, and Contractor Qualification Statements in compliance with implementation requirements of QMP-2.08, R1.

Computer Operation & Data Management, Hydrology 0G31AAAC

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations
The Data Management Unit performed the 91.1 update to the National Water Information System (NWIS) data base software. The state of Washington data for E. Gutentag's project can now be loaded.

B. Kerans and D. Burkhardt attended the training session for NWIS data base administrators. Kerans got the chance to perform as the training person for several sections of the course because of a medical problem with one of the persons on the training staff.

The capabilities of the NWIS data base handling of qualified or unqualified data were outlined in a memo to the YMPB QA office. This covered the various options we have now and what we expect in the updated version for NWIS for the DIS-II hardware.

The Computer Operations Unit has been doing some checking and becoming familiar with the capabilities of the SUN computer and the WRD contract with Data General Computer. The MOTIF and OpenWindows packages are compatible as long as certain other procedures are followed.

The Computer Operations Unit started the process of identifying costs for the telecommunication lines and attach points for the Parfet building. Once these tasks completed, the personnel in the YMPB and QA offices can join the HIP network and access the Prime computer in a direct fashion.

M&I - Geologic Division 0G31AAAE

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Surface and Subsurface Stratigraphic Studies: In support of surface and subsurface stratigraphic studies (SCP 8.3.1.4.2.1), F. Singer completed the initial assembly of ten graphs showing trace element distribution with respect to stratigraphic sequence, alteration, and welded zones from existing drill hole data from the site area. In addition, F. Singer provided assistance to R. Spengler and Z. Peterman in the collection of rock and water samples from the Paleozoic section in the Yucca Mountain site area

for future isotopic analyses.

Quality Assurance
W. Langer participated on the QA Management Assessment Committee for evaluating the FY 1990 QA program of the USGS.

V. Glanzman responded to a request from S. Jones, YMP, for comments on a revision of AP-1.3 on March 26.

V. Glanzman reviewed the concurrence draft of QMP-3.10, R2, and submitted comments to the QA Office on March 28.

V. Glanzman attended a meeting on March 8 to discuss CAR 91-04, and the CAR Board meeting on March 29. She also attended the audit scoping meeting on March 26, and met with A. Handy and T. Higgins on March 27 to discuss Geologic Division activities.

Planning and Operations
V. Glanzman transmitted the manuscript record package for the journal article, "Paleomagnetic Constraints on the Geometry and Timing of Deformation at Yucca Mountain, Nevada," by J. Rosenbaum, M. Hudson, and R. Scott to the LRC on March 8.

V. Glanzman continued editing the 27 Geologic Division papers for the CASY Bulletin on a time available basis; attended the technical data workshop on March 5; and attended the LSS briefing held in Denver on March 12.

W. Langer and V. Glanzman met with M. McKeown and D. Campbell, USBR, on March 13 to discuss geologic structure in the vicinity of the proposed portal locations for the ESF.

L. Roadway transmitted the February accounting report to WRD; and processed, submitted and tracked GD YMP QA Level 1 and GD YMP Capital Equipment procurement documents to the QA Office, USGS YMP LRC, and Procurement and Contracts Office as required.

W. Langer informally reviewed a SNL study plan on future climate modeling and participated in planning efforts to define realignment of YMP geologic functions in the USGS.

M&I - Hydrology Program Management and Administration 0G31AAAG

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
A summary of hydrology-program technical accomplishments was provided for use in a briefing of the Edison Electric Institute.

Amargosa Boreholes Task: S. Keller largely completed inventorying the mining-company lithologic and geophysical logs, except for a large set of digitized geophysical log data which was retrieved from the WRD mainframe on March 27. He continued with the assembly of a complete set of uniform combined lithologic and geophysical logs for all the Amargosa boreholes, using LOGGER software. He contacted the mining-company supervising geologist March 12, and was invited to use the company's facility in Pahrump, Nevada, to examine archived borehole cuttings against J. Anthony's detailed lithologic logs, and to log the cuttings from three new (1990) boreholes. This visit is scheduled for late April. He met with J. Anthony of HCI on March 21 to discuss the nuclear-tool calibration exercise, the existing database of digitized geophysical logs, and the use of a computer optimization program for the

correlation of natural-gamma logs between boreholes.

Quality Assurance

Planning and Operations
Detailed FY91 budgets were finalized for all Hydrology M&I summary accounts. The management and administration account is under funded by 50K.

Input to the FY93 WAS was provided for all hydrology program activities by D. Gillies and B. Lewis.

Substantial progress was made by the administrative unit in reconciliation of the USGS-Federal Financial System expenditure data with the local expenditure system.

Based on detailed FY91 budgets, a listing of federal and contract FTEs by PACS summary account was compiled by D. Gillies for the hydrology program.

M&I - Branch, USBR 0G31AAAI

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
R. Craig attended (a) Prototype Management Team Meetings on March 1, 8, 15, 22, and 29; (b) the Branch staff meeting March 4 in Denver; (c) the Exploratory Studies Facility Committee meeting March 7; (d) the first meeting of a integration group to provide support to the Regulatory and Site Evaluation Division of YMPO, to represent the surface-based testing community; and (e) a meeting and provided input on a Project procedure to cover activities at a drill site March 3.

R. Craig presented material at the ESF Task Force meetings on the status of the geotechnical (engineering geology) input the USBR is providing to RSN for use in siting accesses for the Exploratory Studies Facility (March 8, 15, 22, and 29). In conjunction with this effort, Craig attended a field trip to potential ESF access sites with YMPO and RSN staff, as well as USBR personnel on March 20.

R. Craig provided overviews of the Yucca Mountain geology and hydrology programs as part of the Open House on March 9.

A. Buono briefed a VIP group 3/2/91 at Yucca Mountain, including Under Secretary of Energy J. Tuck and J. Bartlett, Director for the DOE Office of Civilian Radioactive Waste Management on the Geology and Hydrology of the Yucca Mountain Site and the program to answer related site characterization questions. The visit was part of the Yucca Mountain Site Characterization Project Open House, which included more than 300 visitors from the general public.

A. Buono worked with D. Vedder, REECo Health Physics Dept., Environmental Training and arranged for use of half of Test Cell "C" for office and laboratory space in Area 25 of the NTS.

A. Buono gave a 20 minute presentation (3/15/91) on the ground-water hydrology of the Yucca Mountain area to the Inyo County, California, League of Women Voters at the Yucca Mountain Project Information Office in Las Vegas.

A. Buono and K. Grassmeier (YMPO) met with G. Perkins (USFS) to discuss a permit for the existing seismic receiving station on Angels Peak in the Spring Mountains in southern Nevada. Activities on this land, now under the jurisdiction of USFS, requires a new permit to replace the permit obtained in the early 1980s under the USBLM. Also discussed was a permit for the system upgrade that will include

a satellite uplink.

A. Buono visited the UZ-4 borehole site to observe J. Rousseau's work to remove the instrument packages from the borehole.

Quality Assurance
R. Craig met in Denver as part of the USGS Management Assessment Team for the QA Program on March 3 and 4.

Planning and Operations
T. Lippert (a) continued coordination of hydrologic testing activities; (b) reviewed costs-to-date and current budget estimates for hydrologic testing activities; (c) compiled USBR weekly status reports; and (d) coordinated preparation of the February Monthly Report of USBR activities.

Scientific Reports and Project Documents, Hydrology 0G31AAAK

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations
HIP is currently processing 111 YMPB-HIP Scientific Reports and Abstracts and 13 YMPB-LBL Scientific Reports.

The report, "Water levels in periodically measured wells in the Yucca Mountain area, Nevada, 1989," by G. O'Brien, received USGS approval for publication as a USGS Open-File Report on March 21, 1991.

The abstract, "Preliminary simulation showing potential effects of a wetter future climate coupled with a localized increase in hydraulic conductivity on the ground-water flow system of YM and vicinity, Nevada-California," by J. Czarnecki, received USGS approval for presentation/publication at the AGU Spring Meeting in Baltimore, MD.

The abstract, "A geologic hypothesis for the large hydraulic gradient under Yucca Mountain, Nevada," by C. Freidrich, D. Dobson, and W. Dudley, Jr. received USGS approval for presentation/publication at the AGU Spring Meeting in Baltimore, MD.

The abstract, "Correlation integrals of Nevada streamflow," by C. Savard received USGS approval for presentation/publication at the AGU Spring Meeting in Baltimore, MD.

The HIP review of the following reports was completed by T. Brady: (a) "Possible validation of the simulated ground-water flow system near Yucca Mountain with paleohydrologic evidence," by J. Czarnecki; (b) "Strain related water-level and fluid pressure responses in selected wells, Yucca Mountain, Nevada," by D. Galloway, G. Patterson, and J. Gemmell; (c) "Imaging structure at YM using VSP crosswell seismic methods," by E. Majer, J. Peterson, T. Daley, and M. Tura; (d) "Use of a submersible pressure outflow cell for determination of moisture characteristic curves on rock core," by L. Flint and A. Flint; (e) "Potential applications of three-dimensional geoscientific mapping and modeling systems to the Yucca Mountain Project," by A. Turner and J. Downey; (f) "Distinguishing colloidal dissolved silica: analytical separation using colorimetry," by A. Lewis-Russ; (g) "Numerical and laboratory investigations of transient and steady-state flow in a fractured core," by E. Kwicklis, F.

Thamir, R. Healy, and C. Boughton; and (h) "Monitoring gas and water vapor for chemical and isotopic composition at borehole USW UZ-1," by C. Peters, I. Yang, and D. Thorstenson.

The final version of Study Plan 8.3.1.2.2.3 - Percolation in the UZ--Surfaced Based Study, by J. Rousseau and A. Flint was transmitted to YMPO on March 5, 1991.

M&I QA Implementation, Hydrology 0G31AAAM

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance
HIP is currently processing 29 Hydrologic Procedures and six Scientific Notebook Plans.

Technical Procedure HP-97, R1, "Measurement of temperature and relative humidity using a Campbell Scientific Inc. 207 temperature and relative humidity probe," was approved.

Technical Procedure HP-177, R1, "Operation of Setra Model 270 barometric pressure transducer," was approved.

Technical Procedure HP-210, R0, "Method for crushing tuff needed for tracer tests," was approved.

Technical Procedure HP-199-T, R0, "Collection of aquatic micro-organisms," was approved.

W. Causseaux and J. Woolverton attended the scoping meeting for the upcoming DOE Audit scheduled for May 1991.

W. Causseaux and J. Woolverton met with the HIP data management staff to discuss "flagging" of YMPB data in data bases that are subject to final dispositions for non-conformance reports.

W. Causseaux participated in Audit No. USGS-91-05 as the HIP liaison, during the week of March 4, 1991. Causseaux attended the post audit meeting for Audit No. USGS-91-05.

T. Brady attended the Corrective Action Report meeting regarding aerial photographs used by project investigators.

Planning and Operations

WBS 1.2.3.2 Geology
Principal Investigator - W. Langer

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 8.3.1.4.2.1.1 Surface and subsurface stratigraphic studies of the host rock and surrounding units 0G3221A1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Geochemical isotopic sampling and analysis phase 1 (3GGU002A)

Z. Peterman (BIG), R. Spengler (CRG), M. Carr (WRG), and F. Singer (SAIC/Golden) completed a collection trip (March 12 to 15) for Paleozoic carbonates at Bare Mountain and the Striped Hills. Fifty samples were collected to represent the Paleozoic carbonate section at various localities and in various thrust sheets. The trip was multipurpose in that the collection will be used for several YMP studies including rock characterization, calcite/silica, and paleohydrology.

S. Mahan, Z. Peterman, and D. Tromp worked on preparing QA Level 1 samples collected from outcrops near Highway 95 in September from reference sections of the Tram through the Topopah Spring. Coarse crushing, splitting, and acid leaching are about 80 percent complete for the suite.

Subsurface characteristics of faults (3GGUF09M)

R. Snyder attended the March SOC Meeting in Billings, MT and visited the Stillwater Mine to observe the tunnel boring machine (TBM) and how fractures appear on walls of drifts created by the TBM. He reported on the trip at the Semi-annual Project Meeting.

Borehole fracture data (3GGUAF5M)

R. Snyder prepared and presented borehole fracture data for 16 water table holes at the Semi-annual Project Meeting, March 25.

Quality Assurance

Planning and Operations
Geochemical isotopic sampling and analysis phase 1 (3GGU002A)

Procurement of a solid-source, multicollector mass spectrometer continues to move forward. The specifications had to be reviewed by Information Systems Division as part of a new policy to scrutinize any equipment purchase to determine what portion might be ADP equipment. Z. Peterman met with ISD to discuss and review the various components of the mass spectrometer. Among the $350K worth of electronic components, only the PC in the digital acquisition system is ADP equipment.

The isotope laboratory has been cleaned and reoccupied following construction. Calibration checks for Sr have been completed and analytical work is being resumed.

S. Mahan updated the EN-1 standards files and transported the data to a new graphics program for easier evaluation in determining long-term stability of the #1 6-inch mass spectrometer. She also started a computer file for analyses of SRM-987, the primary calibration standard.

The Kevex X-ray fluorescence unit developed a problem of intermittent shutdown. The Kevex engineer was called in on the service contract, but was unable to solve the problem. B. Marshall and S. Mahan removed the X-ray tube and the high-voltage power supply and returned it to the Kevex plant in San Carlos, California. The unit is expected to be down for at least three weeks.

SCP 8.3.1.4.2.1.3 Borehole geophysical surveys 0G3221C1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Monitor calibration of logging tools 1991 (3GGU322)

R. Schimschal wrote the following open-file reports: (1) Borehole corrections for normal resistivity logs at Yucca Mountain, Nevada, and (2) Spectral gamma-ray borehole corrections for the Yucca Mountain Project. These reports document the encoding of algorithms for the purposes designated by the titles.

In addition, R. Schimschal has completed and previously documented work on compensation of existing density logs acquired in air-filled boreholes.

Compute density, porosity, water saturation of logs (3GGU331)

R. Schimschal wrote the following open-file report: Porosity and water saturation calculations at Yucca Mountain, Nevada.

This report concerns a trial computation of porosity and water saturation in borehole H-1.

Before analysis of existing data can continue, a replacement for R. Schimschal must be found who is knowledgeable concerning core and log data.

Quality Assurance

Planning and Operations

Compute density, porosity, water saturation of logs (3GGU331)

R. Schimschal left the USGS for a permanent job at the Bureau of Reclamation. Before departing, he wrote the three open-file reports cited above. J. Mikesell and P. Nelson reviewed the open-file reports and spent several days discussing R. Schimschal's work with him before he left.

Work Performed but not in Direct Support of the Scheduled Tasks

P. Nelson participated in a one-day review of activities under Study 8.3.1.4.2.1 (Rock Characteristics), chaired by R. Spengler.

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 8.3.1.4.2.2.1 Geologic mapping of zonal features in the Paintbrush Tuff 0G3221G1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Phase 1, geologic map NE corner of site (3GGF125)

March 14 and 15, D. Nealey conducted two days of field work at Yucca Mountain. He sampled lava flows of the Fortymile Canyon Rhyolites near Yucca Wash, concentrating on the flows of the Rhyolite of Pinnacles Ridge and a dike of Pinnacles Ridge Rhyolite. The dike consists of an intrusive tuff breccia, an intrusive tuff, and a vitrophyre. The vitrophyric core of the dike is an echelon feature that extends for several hundred meters along a north-south zone. It intrudes the Tiva Canyon Member of the Paintbrush Tuff. The dike is one of the only mapped feeders for the Fortymile Canyon Rhyolites.

SEM, XRF, XRD analysis of samples (3GGF181A)

March 12, D. Nealey conducted field work in northern Arizona. He sampled obsidian deposits for their use in geochemical studies of silicic rocks from Yucca Mountain. Obsidian is usually a homogeneous rock substance that can be used as a geochemical standard. Therefore, these northern Arizona obsidians will be used as blind samples in geochemical studies of silicic rocks from Yucca Mountain. The compositions of the obsidians will be monitored to insure that analyses of Yucca Mountain samples remain within analytical precision.

R. Spengler and Z. Peterman participated in a field trip to collect representative samples of the Paleozoic section in the vicinity of Yucca Mountain (March 12-15).

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

R. Spengler (a) was interviewed about the state of the QA program by the QA annual review committee (March 5); (b) participated in a meeting to explore ways to properly implement AP 5.1Q (March 5); (c) organized and sent requested stratigraphic information to J. Fernandez, SNL (March 6); (d) met with H. Oliver and W. Mooney on future geophysical work at Yucca Mountain; (e) organized and prepared for a mid-year technical review of work currently funded by the rock characteristics program (March 18-20) (the review was held March 25 and attended by L. Hayes and W. Dudley); and (f) provided suggestions for revising viewgraphs for the USGS presentation to Edison Electric Institute (March 29).

D. Nealey evaluated computer programs for generating technical slides for oral presentations. A Hewlett Packard film recorder was attached to a computer and three sets of slides were produced for use in talks.

D. Nealey participated in a project review meeting and described geologic mapping of Fortymile Canyon Rhyolites.

SCP 8.3.1.4.2.2.2 Surface-fracture network studies 0G3221H1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Conduct field work (K) on uncleared outcrops (3GGF100A)

C. Throckmorton continued field work on fracture outcrop studies at Fran Ridge. Two field localities were completed; several future locations were selected. Most of the previously studied localities were visited in order to photograph features of interest. Criteria are being developed to distinguish cooling joints from tectonic sets in each unit studied.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

C. Throckmorton met with W. Langer and W. Dudley to provide input to the management staff on potential problems regarding the realignment of YMP-USGS geologic functions.

C. Throckmorton coordinated a field trip to the NTS with M. Chornack and E. Ervin in order to train WRD participants in the techniques for studying surface fractures.

SCP 8.3.1.4.2.2.4 Geologic mapping of the exploratory shaft and drifts 0G3221J1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Conduct (BuRec) field studies (3GGF012B)

Siting reconnaissance began.

Drift mapping technical procedure (no activity ID)

Drift mapping is being reevaluated relative to size and mining method changes.

Shaft mapping technical procedure (3GGFB11M)

Shaft mapping is being reevaluated relative to size and mining method changes.

Quality Assurance

Planning and Operations

Excavate test pit (3GGF006B)

Specifications for work have been advertised; work will begin May 1, 1991.

SCP 8.3.1.4.2.2.5 Seismic tomography/vertical seismic profiling 0B3221A1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Testing and validation of ANRAY90 3-D code

ANRAY90 first phase of testing was completed by checking results with synthetic results.

A paper for CASY was revised, figures were redone, and it was submitted to the USGS for final review.

Model NTS VSP data (Area 10 data)

Well log data was obtained from the USGS to model Yucca Mountain data.

Quality Assurance

Planning and Operations

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 1.2.3.2.5.5 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 - K. Fox, Jr.

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 0G3255B1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations

Study plan development (3GAT002)

J. Sass continued the development of SP 8.3.1.8.5.2.3, "Heat Flow at Yucca Mountain and Evaluation of Regional Ambient Heat Flow and Local Heat Flow Anomalies."

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 1.2.3.2.8.4 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 - K. Shedlock

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 8.3.1.17.4.1.2 Monitor current seismicity 0G3284HA

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Monitor current seismicity (3GSM108A)
Existing network continues to operate and routine processing is performed on a daily basis.

Catalog of 87090 seismic events (3GSM115A)
An open-file report on 87-89 seismicity was prepared and is in internal review. The 1990 catalog is almost complete and ready for review.

Monitor 1991 seismic events (3GSM109A)
See activity 3GSM108A.

Catalog of 1990 seismic events (3GSM116A)
A catalog is almost complete and ready for review.

Quality Assurance
Prepare notebook for portable seismic arrays (3GSM119A)
A scientific notebook has been prepared and approved.

Planning and Operations
Test and install network upgrade (3GSM118A)
First phase of testing of portable recorder (characterization of system noise, response, linearity, channel cross talk) was completed, and a final report of results is in preparation.

All 16 accelerometers for portable array were received. The final installment of seismometers for permanent array was received.

System calibration methods are under development.

Development of software to perform automatic event association (identifying earthquakes recorded at different node processors as the same event) is well underway.

A criteria letter and supporting information was submitted to the GD Coordinator for NTS support services for FY91 (installation of new network).

The location of the first US National Seismograph Network site was finalized and plans for site installation (tentatively in June) are underway.

New work facilities at Test Cell "C" were confirmed and preparations to move are underway.

Work Performed but not in Direct Support of the Scheduled Tasks
J. Gomberg attended QA Management Review committee meetings and wrote a contribution to the report being prepared.

K. Shedlock prepared for and attended meetings pertaining to USGS YMP reorganization.

J. Gomberg attended a two day workshop in Denver on the International Seismologic Observing Period. The purpose of the workshop was to discuss seismic network processing goals and procedures with the goal of standardizing these world-wide. Status reports from seismic networks throughout the world were presented and software and hardware demonstrations were given.

WBS 1.2.3.2.8.4.3 Quaternary Faulting within 100 km of Yucca Mountain
Principal Investigator - K. Fox, Jr.

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 8.3.1.17.4.3.1 Conduct and evaluate deep geophysical surveys in an east-west transect crossing the Furnace Creek fault zone, Yucca Mountain, and the Walker Lane 0G3284J1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations
Geophysics integrating activities reviews (3GTQ005J)
V. Langenheim completed the first draft of the geophysics part of SP 8.3.1.17.4.3; it is now in review.

Work Performed but not in Direct Support of the Scheduled Tasks
H. Oliver met with R. Spengler regarding SP 8.3.1.4.2.1 and edited the geophysics sections.

The drawing of the five plates for 25 dipole-dipole lines continued; the first drafts of two plates are ready and are being proofed.

The technical review of the report on the 1986 magnetotelluric experiment (including depth-resistivity sections) has not been completed and returned yet. This has caused some delay.

WBS 1.2.3.2.8.4.4 Quaternary Faulting within Northeast-Trending Fault Zones
Principal Investigator - K. Fox, Jr.

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)

SCP 8.3.1.17.4.4.1 Evaluate the Rock Valley fault system 0G3284O1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations
Develop study plan (3GTF01A)
J. Yount completed a draft of SP 8.3.1.17.4.4, "Quaternary Faulting Proximal to the Site Within Northeast-Trending Fault Zones." The draft is in USGS technical review with K. Fox.

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 8.3.1.17.4.6.1 Evaluate Quaternary geology and potential Quaternary faults at Yucca Mountain 0G3284C1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Prepare strip maps of faults zones (3GPF03A)
K. Fox and J. Whitney conducted field work on the geologic strip map of the Solitario Canyon and Fatigue-Windy Wash fault systems.

Field check photogeologic maps scarps/lineaments (3GPF02A)
M. O'Neil and others conducted ground-truth investigations of the Yucca Mountain photogeologic lineament map.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks
J. Whitney collected legal field data on Quaternary faulting at Yucca Mountain.

WBS 1.2.3.2.8.4.10 Geodetic Leveling
Principal Investigator - K. Fox, Jr.

OBJECTIVE

To evaluate possible historical and contemporary vertical displacements across potentially significant Quaternary faults within 100 km of Yucca Mountain; to characterize the historical rate of uplift and subsidence in the Yucca Mountain region; and to 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, Yucca Mountain and vicinity 0G3284W1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Relevel network and resurvey quadrilaterals (3GTM005J)

The releveling has been satisfactory - except for the weather and various other problems that have been beyond our control. We have completed approximately 40 percent of this activity. The five original quadrilaterals will have their "0" points (low points) surveyed by GPS techniques. This will allow us to establish a reference for further surveys. Actual baseline measurements will not be made this year.

The positioning of the six "0" points (from this activity and 3GTM006J) will allow us to plan for future baseline measurements. The individual baseline measurements will not be observed this year. We have experienced very unusual weather conditions during March (extreme winds coupled with significant amounts of rain and snow). We have also had two Temporary Field Assistants resign. This has required six additional days of required QA training.

As of March 25, we have had 23 nonproductive days due to weather, resignations, QA training, sick leave, equipment failure (dropped level rod), and vehicle problems. This down time represents 26% of our original 85 days of estimated leveling. Additional funding is needed in order to complete the leveling activity.

Survey new quadrilateral, Stagecoach Road Fault (3GTM006J)

The "0" point of this quadrilateral will be determined at the same time as the five original quadrilaterals. During mid-March, K. Fox and J. Whitney (Geologic Division) identified the four corners of this new quadrilateral. This quadrilateral is identified as STAGE.

Quality Assurance

Relevel network and resurvey quadrilaterals (3GTM005J)

Additional QA training has been required for our Temporary Field Assistant.

A third revision of our technical procedures is in the approval (signature) stage - anticipated approval date is March 26. This revision was undertaken in order to allow the use of GPS survey procedures and techniques.

Planning and Operations

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 0G3311E1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Monitor rain wedge gages (3GMM19A)

The network consists of 93 rain wedges placed on Yucca Mountain. The network is read following each storm.

Evaluate geostatistical/feature based design of network (3GMM24A)

Geostatistical analysis was used to krig and cokrig rainfall from individual storms. The experimental and model semivariograms were used to estimate variances which in turn were used to estimate the locations needed for precipitation monitoring stations. Feature-based sampling requirements are being integrated into the geostatistical network.

Evaluate tipping bucket data (3GMM22A)

Precipitation data from each tipping bucket were evaluated to determine length, intensity, and total rainfall for each storm event. Presently there are eight locations which have tipping rain gages. Six of these sites also have heated snow gages. Data from the tipping buckets were compared with rain wedge data to determine relative accuracy of the wedge data. Wedges are installed at each tipping-bucket location.

Monitor stations and tipping bucket gages (3GMM01A)

Data were routinely collected via data logger at each weather station and tipping bucket gage.

Quality Assurance

Develop technical procedures (3GMM08A)

Technical procedures are being evaluated and modified when necessary to accomplish high quality data collection and implement the QA program.

Conduct technical procedure training (3GMM26A)

Technical procedure training is accomplished as required to fully implement the QA program.

Planning and Operations

Study plan submittal (YMPO) (3GRP001M)

Study Plan 8.3.1.2.1.1, "Characterization of the Meteorology for Regional Hydrology" was submitted for USGS review in April 1990. The comments were reviewed and changes were made to the SP in May 1990. The SP was submitted to DOE in June and comment resolution was completed in January 1991, following some revisions.

Procure GOES satellite equipment (3GMM14A)

Technical specifications were prepared, reviewed and submitted; the equipment was ordered, received, and inspected.

Procure lightning (NTS) equipment (3GMM31A)

Technical specifications were prepared, reviewed and submitted; the equipment and software was ordered, received, and inspected. A dedicated telephone circuit to the Weather Service Nuclear Support Office (DOE) was installed.

Acquire meteorological data, regional sources (3GMM04A)

Precipitation data were routinely collected from Nellis Air Force Base, National Weather Service, Cooperatives, and the Nevada Site Climatologist for approximately five cooperative stations in California. Precipitation data is also obtained from the Nevada Test Site climatology network of 15 raingages. These data are received monthly.

Procure replacements parts, meteorological stations and gages (3GMM27A)

Replacement parts were procured, inspected and installed as necessary.

Calibrate and install tipping bucket gages (3GMM21A)

Two tipping-bucket rain gages were calibrated and installed. The design of the network continued (activity 3GMM24A).

Tabulate data for rain gages and meteorological stations (3GMM32A)

Data were down-loaded from the data loggers and archived in ASCII format.

Install lightning equipment (3GMM28A)

The hardware and software system was received earlier than expected.

Install GOES network equipment (3GMM29A)

Early receipt of the equipment enabled an early installation.

Procure Compaq-286/E (3GMM39A)

Procurement of a new computer is being delayed because of lack of funding. No milestones should be affected at this time.

Procure Compaq-286/E (3GMM41A)

Procurement of a new computer is being delayed because of lack of funding. No milestones

should be affected at this time.

Work Performed but not in Direct Support of the Scheduled Tasks
An estimated four hours were spent on retrieving precipitation from two gages set up by the UZ Hydrochemistry Study and geochemical analyses will be performed.

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 0G3311F1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Reduce FY83-85 data and prepare report (3GRS004A)
The final draft of the FY83-85 report was edited and typed by the Nevada District Reports Section.

Collect FY91 runoff and streamflow data (3GRS001A)
The gages and equipment associated with the Regional streamflow network were operated and maintained. Runoff was documented within the network and occurred in late February. Field estimates of peak-flow were made at Topopah Wash on Jackass Flats and at Amargosa River below Beatty. Flows were rated as minor, as discharge estimates at both sites were less than 15 cfs.

Prototype test hydrological monitoring equipment (3GRS003A)
This activity is delayed pending the completion of environmental and cultural field studies.

Quality Assurance
Revise technical procedures for streamflow data collection (3GRS009A)
Technical procedures HP-40, -43, -44, -45, -100, -114, -115, -116, -117, -166, and -169 were revised; colleague review was completed on HP-40, -43, -44, -45, -114, -115, -116, -117, and -169; and the revision to HP-115 was approved by the YMPB. Initial drafts of the Scientific Notebook Plan for Rattlesnake Ridge and the Hydrologic Procedure for the balance-beam manometer system were completed.

Planning and Operations
Reconnoiter new gage sites (3GRS013A)
Three additional Fortymile Wash gage sites, two Yucca Mountain sites, two regional sites, and fourteen other proposed sites for stream gages in washes on Yucca Mountain were reconnoitered and flagged.

Install and test prototype telemetry equipment (3GRS005A)

An ALERT radio path and signal strength test was conducted for selected streamgage sites.

Install three Fortymile Wash gages (3GRS015A)

Shelters to house streamgaging instrumentation at three upper Fortymile Wash sites were installed.

This activity is delayed because of unavailability of personnel to construct the gages. No impact on milestones is anticipated.

Apply for permits (3GRS014A)

The plans and locations for three additional Fortymile Wash gages, two Yucca Mountain gages, and two regional gages for environmental and cultural field surveys and access permits were submitted to the YMPB.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 250 hours were spent in pre-audit preparation and post-audit follow-up on findings and other relate matters for USGS-91-05 Audit.

An estimated 200 hours were spent on the duplication of data for storage in Carson City; the preparation of the 1983-85 data package for submittal to the LRC; and the preparation of the 1986-90 data package for submittal to the LRC.

Approximately 400 hours were spent on classroom training, reading assignments, coordination and training assignment preparation, and record keeping of controlled documents.

Approximately 240 hours were spent on purchase, calibration, tracking, and records of equipment.

SCP 8.3.1.2.1.2.2 Transport of debris by severe runoff 0G3311G1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Collect FY91 debris transport data (3GRS001B)

Nevada weather was observed and documented to assess the likelihood of flooding and debris transport on a daily and continuing basis.

Newly published literature was scanned and read to stay abreast of the changing technology in debris transport. Select articles were copied for inclusion in the Nevada District YMP technical library.

Staff attended the Fifth Federal Interagency Sedimentation Conference in Las Vegas to assimilate new concepts in debris movement and new technology for sampling and investigating debris movement.

An unusual appearing debris flow that originated from Copper Canyon along the northwest side of Walker Lake was discovered and briefly reconnoitered. The flow appeared to be a viscous mudflow with minimum transport of coarse-grained clasts. It was photographed, described, and sampled for particle-size distribution. The source area still needs to be investigated and deposits need to be more thoroughly examined and documented.

The riparian terrain along the highways between Carson City and Beatty, Nevada (US 50 and 95) was reconnoitered for signs of recent (FY90 and FY91) debris movement. None was noted

other than the Copper Canyon site.

The landscape between Reno and Las Vegas were reconnoitered from airliners on several trips for evidence of recent flooding and debris movement. The areas where evidence of recent flooding and debris transport were observed (all FY90 flooding) and also areas where future debris-movement evidence might be expected were photographed.

Scientific investigations in the field were coordinated with W. Osterkamp, who is working on potential for ground-water recharge by streamflow, regarding evidence contained in the streambed of Fortymile Wash. The streambed consists of all sizes of debris - most would be hazardous when in motion. It was agreed that the characteristics of many deposits show evidence of numerous debris flows, but ages of these flows were not determinable during this visit. More work needs to be done on those deposits as part of this activity and as part of paleoflood investigations.

Convert scientific notebook procedure to SOPS (3GRS009B)

No activity is possible until more field work is done through the Scientific Notebook Plan. Conversion requires additional data and experience.

Quality Assurance

Collect FY91 debris transport data (3GRS001B)

Staff prepared for and participated in the internal USGS QA audit 91-05 for this activity and other associated activities.

Grade (QA) for debris transport by severe runoff (3GRS010B)

Study-level QA grading was completed as part of the Streamflow and Runoff Study Plan (8.3.1.2.1.2) in January. A lower-level, detailed grading package may need to be prepared.

Planning and Operations

Work authorization (G035)

The status of work authorization is unknown at this time, but should be forthcoming soon on the basis of the completion of QA grading. Some work is progressing under authorization of ongoing monitoring.

Work Performed but not in Direct Support of the Scheduled Tasks

Numerous unanticipated and unplanned tasks have arisen during the last several years and months--particularly during March 1991. They include, but are not limited to, responses to review comments of study plans and the SCP; preparations for QA audits; participation in QA audits; subsequent corrections of audit findings; continually increasing time requirements to prepare monthly and semi-annual progress reports; preparing, processing, and studying QA documents; technical coordination and interchanges of information with other YMP scientific investigators; searching for replacements for the YMP PI for three separate study activities; etc. These major impacts and energy drains cause serious delays and impacts on the production of technical products and thereby ultimately delay or derail deliverables. However, the erratic, unpredictable, and diffuse nature of these work-plan changes are inherently difficult to quantitatively or economically assess on a daily or monthly basis.

An estimated eight hours were spent on audit preparation.

An estimated eight hours were spent in participation in the USGS internal audit in Las Vegas, February 25-27.

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 8.3.1.2.1.3.2 Regional potentiometric level distribution and hydrogeologic framework studies 0G3311B1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Locate (QA preparation) piezometers (3GRG001)

Additional piezometers were located and a report entitled "Hydrogeologic inferences from drillers' logs and from gravity and resistivity surveys in the Amargosa Desert, Southern Nevada" by W. Oatfield and J. Czarnecki was published as USGS Open-File Report 89-234 and will be published by the *Journal of Hydrology* any month now. Oatfield revised the galley proofs per *Journal of Hydrology* comments and mailed them to the journal.

Reduction of existing regional water level data (3GRG008)

W. Oatfield finished creating update files with new location information for both GWSI data bases (#1 and #2). B. Kerans loaded the supplied information for data base #1. Oatfield also obtained a sitelist of R. La Camera's ground-water network from the USGS Carson City office. UE-25 WT-13 on Yucca Mountain has the wrong site ID.

W. Oatfield constructed a table of wells that are currently being or are planned to be monitored by either Bond Gold or USGS Carson City.

Construction of piezometers in mining company holes (3GRG014A)

J. Czarnecki provided comments to A. Buono on a letter requesting Project funding for testing and instrumenting three mineral exploration holes planned for the Amargosa Desert this spring.

Locating additional piezometer sites (3GRG002)

The regional potentiometric-level network was expanded with the addition of the three piezometers described in 3GRG014A.

Procure equipment for small diameter well (3GRG013A)

Local vendors have been contacted by J. Czarnecki regarding compatibility of specific conductance meters and probes with Campbell Scientific dataloggers.

Process existing geophysical log data from the Amargosa Desert (3GRG006)

S. Keller (SAIC/Golden) is collecting all available logs and processing them into a uniform format for analysis. He met with J. Anthony, now in private consulting, to discuss the status of this effort prior to Anthony's departure from the project.

Conduct prototype equipment testing in small diameter wells (3GRG007)

To date no testing has been done pending the acquisition of final pieces of equipment. W. Oatfield is determining costs and availability of winches for attachment to the tripod that was constructed for raising and lowering equipment in the small diameter wells. Testing is expected to occur in late Spring '91.

Quality Assurance

Grade potentiometric level activities (3GRG017A)

A grading package was prepared by W. Causseaux and reviewed by J. Czarnecki. The package was forwarded to DOE for approval. M. Ciesnik reviewed requirements for the preparation of Graded QA packages. Graded QA packages were prepared for studies 8.3.1.2.1.3, 8.3.1.2.1.4, and 8.3.1.2.3.2.

Planning and Operations

Construction of piezometers in mining company holes (3GRG014A)

Piezometers were constructed during December in three mining-company boreholes in the western Amargosa Valley. The holes range in depth from 1,700 to 2,200 feet. J. Czarnecki and M. Carr compiled a wish list of activities that PIs within YMP supplied with regard to participation in the construction of three planned oil wells to be drilled in the Amargosa Desert in April 1991.

Procure equipment for small diameter well (3GRG013A)

Local vendors have been contacted by J. Czarnecki regarding compatibility of specific conductance meters and probes with Campbell Scientific dataloggers.

Process existing geophysical log data from the Amargosa Desert (3GRG006)

W. Oatfield and S. Keller retrieved geophysical well logs and notes pertaining to mining company drillholes in the Amargosa Desert from Building 810.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 80 hours were spent on the following tasks:

M. Ciesnik participated in the activities assessing the compliance with SQA compliance by HIP.

M. Ciesnik drafted answers to NCR-9109 related to water samples collected on 10/16/90 from three wells in Crater Flat and Beatty Wash. NCR-9109 triggered a series of extensive discussions on the ability to segregate data within existing data bases (WATSTOR, GWSI, etc.) which are used by HIP scientists. During one meeting, a consensus was reached as how to handle "unqualified data" in the future. Details of these discussions are summarized in a memo from N. Stuthmann (USGS Computer Operations and Data Management Unit) to the Acting QA Manager of the USGS-YMPB.

W. Oatfield performed file maintenance and backups on files contained on his Compaq 386 computer. He also returned old records to P. McKinley for additional report documentation.

M. Ciesnik withdrew two software codes (GDAT2.PAS and CI2.F77) from the Software Configuration Management system. These codes were originally introduced to the system based on confusing requirements contained in QMP-3.03, R2.

M. Ciesnik participated in the Configuration Control Committee monthly meeting of the SCM, where the following topics were discussed: the status of QMP-3.03 and QMP-3.14; and DOE Workshop on Software QA.

M. Ciesnik reviewed a list of currently approved and used APs and requested missing ones from SAIC/LV.

SCP 8.3.1.2.1.3.3 Fortymile Wash recharge study 0G3311C1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare poster on streamflow behavior (3GRG104A)

The poster "Correlation Integral Analysis of South Twin River streamflow, central Nevada: Preliminary application of chaos theory" by C. Savard was prepared and presented on December 7, 1990, at the American Geophysical Union meeting in San Francisco. The abstract for the poster was published in EOS, v. 71, no. 43, p. 1341.

Write report on channel loss (3GRG105A)

Field measurements of channel geometry in Fortymile Wash and tributaries were collected.

Quality Assurance

Grade recharge study activities (3GRG113A)

A study-level grading package for 8.3.1.2.1.3 was prepared for, submitted to, and approved by the QRB in January.

Planning and Operations

Analyze existing data on Fortymile Wash recharge (3GRG103A)

"Hydrologic and drill-hole data for test wells UE-29a#1 and UE-29a#2, Fortymile Canyon, Nevada Test Site" by R. Wadell, USGS OFR 84-142, was reviewed.

Locate FM streamgages (3GRG023)

SP 8.3.1.2.1.2, R0, "Characterization of the Yucca Mountain regional surface-water runoff and streamflow" was reviewed. It was determined whether stream gages planned for the Fortymile Wash watershed will adequately define streamflow losses at the current level of funding.

Procure equipment for infiltration tests (3GRG108A)

Stock tank distributors were visited in Las Vegas to determine if they carry big enough (10-30 ft. diameter) tanks without bottoms for use in ponding tests.

Coordinate with UZ infiltration tests (3GRG020)

Joint prototype UZ infiltration testing with A. Flint was discussed.

This activity is delayed in study plan approval; it should not cause any delay in deliverables.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 80 hours were spent on the following tasks:

The abstract "Correlation Integral Analysis of South Twin River streamflow, central Nevada: Preliminary application of chaos theory" by C. Savard was submitted to the American Geophysical Union for presentation at the Spring 1991 meeting. This is a continuation of the scoping work done in activity 3GRG104A.

Field assistance was provided to the Regional surface-water runoff and streamflow study, 8.3.1.2.1.2, by visiting Fortymile Wash and its tributaries and determining that no runoff had occurred during precipitation events.

SCP 8.3.1.2.1.3.4 Evapotranspiration studies 0G3311D1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Write report, vertical multilevel sampler, Franklin Lake Playa (3GRG204A)

A porter session was given at the AGU Fall '89 meeting in San Francisco. The title of the poster was "Hydrochemical stratification at Franklin Lake playa, Inyo County, California" by J. Czarnecki, L. Kroitoru, M. Magaritz, and D. Ronen. A draft paper of the work presented in this poster is being prepared.

Assess old and possible new data and sampling (3GRG040)

This activity has been placed on hold until the project chief (J. Czarnecki) can be freed to work on this paper. An abstract and accompanying talk entitled "Hydrochemistry at Franklin Lake playa, Inyo County, California" by J. Czarnecki and W. Oatfield was presented at the AGU Fall '86 meeting.

Analyze Franklin Lake hydrochemical data (3GRG206A)

This activity has been placed on hold until the project chief (J. Czarnecki) can be freed to work on it. Results from this effort will feed G006.

Test Bowen ratio station equipment (3GRG203A)

J. Czarnecki returned a net radiometer to the manufacturer for cleaning and recalibration.

Quality Assurance

Grade evapotranspiration activities (3GRG211A)

This activity was accomplished by submission of a blanket grading package for the entire Regional Hydrology Studies.

Planning and Operations

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 8.3.1.2.1.4.2 Subregional two-dimensional areal hydrologic modeling 0G3311I1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare and present paper on recharge mechanism and climate change (3GRM04A)

J. Czarnecki prepared and delivered an invited talk at the Geological Society of America National Meeting in Dallas in October 1990. The talk was entitled "Possible effects of a wetter climate on the ground-water flow system of Yucca Mountain and vicinity, Nevada-California." About 200 people were in attendance during the talk. A companion abstract was published in the proceedings of the meeting.

Procure, install, and test software for laser (3GRM07A)

J. Czarnecki is engaged in testing software for plotting high resolution images on project laser printers.

Obtain, compile, and test MODFE 2D/3D computer code (3GRM00A)

J. Czarnecki obtained a version of the MODFE (Modular Finite Element) code from L. Torak (USGS Georgia) assembled to solve problems involving transient, vertical leakage. The code is being tested on problems related to abrupt increases in hydraulic conductivity in the vicinity of the large hydraulic gradient north of Yucca Mountain. W. Oatfield assisted by producing hard-copy plots of vector diagrams at various time steps throughout a given simulation.

J. Czarnecki tested various approaches for automatic time stepping control, using a non-linear finite-element ground-water flow model which uses vertical leakance functions to accommodate evapotranspiration. The criteria for time-step control is based on maximum head change within each time step.

This activity is delayed because of diversion of the PI to unscheduled work.

Prepare and present paper on uncertainty in upgradient boundary conditions (3GRM06A)

J. Czarnecki presented a paper entitled "From where and by what flow paths does ground water beneath Yucca Mountain, Nevada originate?" at the AGU meeting in December 1990, to an audience of about 150 persons. Czarnecki, W. Steinkampf, and L. Kroitoru (Weston, Washington D.C.) compiled hydrologic and hydrochemical data and analyses to support the paper. Significant input was provided by W. Oatfield in contouring potentiometric data and posting locations of measurement points. A dry-run brown-bag presentation was given by Czarnecki to a group of about 40 HIP and GD staff.

Grid new finite element mesh for the subregional 2-D model (3GRM02A)

This effort has not begun due to the lack of available personnel and diversion of the PI to unscheduled work. M. Ciesnik has been identified as a likely person to assist in this effort.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 80 hours was spent in the following tasks:

J. Czarnecki developed conceptual models related to increased recharge under wetter climatic conditions and localized an increase in hydraulic conductivity in the vicinity of the large hydraulic gradient north and west of the design repository area. He also prepared an abstract entitled "Preliminary Simulations Showing Potential Effects of a Wetter Future Climate Coupled with a Localized Increase in Hydraulic Conductivity on the Ground-Water Flow System of Yucca Mountain and Vicinity, Nevada-California" for publication in EOS and presentation at the AGU Spring meeting in Baltimore, May 28-June 1, 1991.

J. Czarnecki reviewed an abstract by L. Kuiper (LANL) entitled "Water-Table Rise due to Dike Intrusion Beneath Yucca Mountain" and assisted him in getting the abstract approved through the USGS Central Region. The abstract will be included in a special session at the Spring AGU meeting entitled "The Potential of Tectonism and Volcanism for Producing Significant Excursions of the Water Table," of which Czarnecki is co-chairman.

J. Czarnecki attended a meeting of the NWTRB intended to allow PIs and project staff an

opportunity to state problems with the workability of the QA Program. Czarnecki discussed the following: (a) the situation existing since 1986 of being able to construct piezometers and not measure water levels; (b) the problem facing the program regarding qualifying old data, and the logic of expending large amounts of time and effort on qualifying fairly certain data such as potentiometric levels (which are used in models of ground-water flow) when the largest uncertainties will be with "educated guesses" for boundary conditions, such as specified recharge; (c) the problems associated with repeated modifications to simple, well established procedures (in this case, piezometer construction), and what is likely to happen when complex, poorly established procedures are written, used, and audited; and (d) the way in which the QMP regarding software quality assurance has gone full circle since the writing of SOP 03-02, and requires the user to interpret the requirements of NUREG-0856. Comments from all PIs were well received and recorded for transmission to DOE/LV.

M. Ciesnik installed the Lahey Fortran 77 compiler on the project Compaq 386/20 and became familiar with various functional options offered by this software. This powerful compiler will be used for compiling modeling software.

M. Ciesnik wrote a computer program in Fortran 77 for calculating aquifer transmissivity from specific capacity data based on the modified Regula Falsi method which was published in a paper by J. Czarnecki and R. Craig (1985) entitled "A program to calculate aquifer transmissivity from specific-capacity data for programmable calculators."

J. Czarnecki met separately with J. Stuckless and E. Taylor regarding the need to characterize paludal sediments and their ages in an area in the central Amargosa Desert. A field trip is tentatively scheduled following the HLNWM meeting in Las Vegas (April 28-May 3).

J. Czarnecki revised a paper entitled "Possible validation of the simulated ground-water flow system near Yucca Mountain with paleohydrologic evidence" and forwarded it for inclusion in a USGS Bulletin on scientific activities within the USGS Yucca Mountain Project.

J. Czarnecki researched and processed a requisition request for IBM compatible 386/25 microcomputers. He also brought in his own personal 386/25 microcomputer for testing on the YMP LAN.

J. Czarnecki prepared a personal resume per requirements of QMP-2.02, and revised his current position description to more accurately reflect duties being performed.

J. Czarnecki attended a CASY seminar by D. Noble (Mackay School of Mines, U. of Nevada) on Volcanism and Tectonism of Southern Nevada.

SCP 8.3.1.2.1.4.4 Regional three-dimensional hydrologic modeling 0G3311K1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare existing data for model input (3GRM11A)

Scanning of Geologic Maps is about 5% complete. The Bare Mountain Quad, 1/100,000 scale, is 95% scanned and is in machine readable form. Fault maps for the 3-degree area centered on Yucca Mountain is about 75% scanned. This work item should be completed in late April. Work has been slow because of equipment problems and availability of personnel and space.

P. Sinton rewrote the report on the preliminary 3-D model of the ground water flow system at

and near Yucca Mountain. The report is a major source of existing data to be processed for model input.

The planned finish date shows a delay because (a) the magnitude of the task was substantially underestimated, considering that about 40 maps must be scanned; (b) budget reductions in FY91 and anticipated in FY92 have significantly restricted personnel and equipment available for this task; and (c) the rewrite of the preliminary 3-D model report was not anticipated.

Develop prototype 3-D model (3GRM12A)

A model grid of the area to be covered by the 3-D regional model was developed.

The computer code (SNODIF2) was developed to validate or interpret existing isotope data from the project area to determine climatic conditions from recharge. The computer code was tested.

Quality Assurance

Software QA for 3-D model (3GRM13A)

Per meeting with the YMP-USGS software QA group, software QA for the 3-D model will be done as the last phase of the model study and only for final model runs. All other steps are considered model development and do not need QA.

Grade QA for regional 3-D modeling (3GRM08A)

QA grading has not started yet because synthesis and modeling activities have been assigned a lower priority than data-collection activities.

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

Technical review of a Kansas District report on EM-34 electromagnetic ground-conductivity surveys of the Amargosa Desert to help determine hydrogeologic and structural features potentially important to the 3-D ground-water modeling began.

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 potentia; 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 8.3.1.2.2.1.1 Characterization of hydrologic properties of surficial materials 0G3312Z1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Collect samples and lab analysis (3GUI007)

Soil samples collected on and around Yucca Mountain were analyzed for particle size.

Collect rock outcrop samples and perform lab analysis (3GUI001)

Rock outcrop samples were collected from a transect in Solitario Canyon and analyzed for bulk density, porosity, and saturated hydraulic permeability.

Tabulate rock outcrop and soils data (3GUI002)

Some of the data collected in activities 3GUI001 and 3GUI007 have been tabulated.

Analyze spatial variability soil physical properties (3GUI004)

Several semivariograms have been calculated for soil texture from the samples collected in activity 3GUI007. These variograms will be used to help design a data collection procedure.

Develop technical procedures (3GUI008A)

Development of technical procedures would be premature at this point, as the prototype studies have not been completed.

Quality Assurance

Conduct technical procedure training (3GUI023A)

No technical procedures currently exist for surficial materials analysis; therefore, no training has been conducted.

Planning and Operations

Evaluate various GIS techniques (3GUI006)

PC ARC/INFO has been installed on an IBM 386 computer in the map room at the HRF. This system is compatible with the EG&G ARC/INFO data base.

SCP 8.3.1.2.2.1.2 Evaluation of natural infiltration 0G331211

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Log neutron moisture meter (3GUI300)

All neutron holes were logged in FY90.

Procure/install soil heat-flux instruments (3GUI380)

Several heat flux instruments were purchased and tested in the laboratory.

Installation of the soil heat-flux instruments has been delayed until field ET sites are selected for instrumentation. No milestones should be affected at this time.

Log neutron moisture meter (3GUI301)

All neutron holes are currently being logged on a monthly to bimonthly schedule. Increased logging in Pagany Wash occurred due to high rainfall measurements.

Test shallow borehole instruments Topopah Wash (3GUI320)

Borehole instruments continued to be monitored in Topopah Wash.

Collect soil samples to support ET studies (3GUI330)
Soil samples were collected to measure water content in support of the ET studies and to help calibrate the field TDR system.

Develop large- and small-scale water balance models (3GUI360)
Preliminary modeling has been initiated using Pagany Wash data as a case study.

Evaluate moisture profile spatial variability (3GUI323)
Lack of personnel and time have delayed the start of this activity. No milestones should be affected at this time.

Tabulate neutron meter moisture data (3GUI350)
Due to the lack of proper neutron moisture meter calibration equations, the data that will be submitted to the data base are not yet available. Calibration boreholes have been requested through DOE and, once drilled, will be used to generate the proper calibration equation. Impacts on milestones are unknown at this time.

Develop technical procedures (3GUI381)
Development of technical procedures would be premature at this point, as the prototype studies have not been completed.

Test/evaluate soil heat-flux instruments (3GUI317)
This activity is delayed due to lack of completion of activity 3GUI380. No milestones should be affected at this time.

Quality Assurance
Conduct technical procedure training (3GUI383)
All employees required to implement any technical procedures have been trained.

Planning and Operations
Procure TDR (3GUI393)
Several TDR units have been purchased and are in storage at the HRF.

SCP 8.3.1.2.2.1.3 Evaluation of artificial infiltration 0G331221

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
R&D methods for artificial infiltration (3GUI616)
Estimation of infiltration rates at the proposed small plot infiltration site near Test Cell "C" were made using a one dimensional model. The model input parameters were obtained from the work done in activity 3GUI619.

Analyze (lab) samples for infiltration plot (3GUI619)
Six soil horizons were sampled from the proposed small plot infiltration site near Test Cell "C" and tested for bulk density, particle size analysis, and gravimetric water content.

Quality Assurance

Planning and Operations

Evaluate instrument infiltration/ponding experiment at Jackass Flat (3GUI617)

Due to lack of personnel, this activity has been postponed. All associated milestones will be shifted equal to the delay of starting the activity.

Procure support equipment for precipitation network (3GUI688)

Due to lack of adequate funding and delay in activity 3GUI617, the procurement of the equipment necessary to monitor the central plot has been postponed. The delay in procurement of the support equipment should no cause delays in major milestones at this time.

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 8.3.1.2.2.3.1 Matrix hydrologic-properties testing 0G3312U1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare report on preliminary permeability and water retention (3GUP016A)

Director's approval was received for "Preliminary permeability and moisture retention data from non-welded and bedded tuff, Yucca Mountain area, Nye County, Nevada" by L. Flint and A. Flint. The report is currently in printing.

Analyze permeability and water retention (3GUP002A)

Preliminary analysis was made on a single core sample and a paper was presented at Workshop V on "Flow and Transport through Unsaturated Fractured Rock," January 1991 in Tucson, Arizona. The paper entitled "Characterization of Rock Hydrologic Properties using Model Verification," by A. Flint, K. Richards, and L. Flint, is awaiting Director's approval for publication as NUREG.

Evaluate sample handling process (3GUP001A)

Evaluation of moisture loss due to packaging is being continued with the procurement of a canner. Other packaging (LEXAN, ProteCore) has been evaluated. Sample transfer procedures (at drill rig, in laboratory) are yet to be developed.

Finalize geostatistical code development (3GUP004A)

Code has been completed and documentation is in preparation.

Continue sensor evaluations and calibrations (3GUP015A)

Tensiometer/transducer system has been successfully calibrated and applied to ceramic porous media. Heat dissipation probes were evaluated and found unsatisfactory. Development was undertaken to redesign specifications to our specific requirements. Probes are currently being calibrated at the distributor.

Develop core analysis for hydraulic properties (3GUP024A)

Staff visited the Institute of Gas Technology and they performed research and development under contract with the USGS. It was concluded that they could not supply our needs for core analysis with their standard procedures. We have since built an air/water permeameter (saturated) for evaluation and observed a demonstration by a manufacturer's representative of a gas pycnometer to determine bulk density, porosity, and grain density. Materials Testing Lab conducted an evaluation of methods to measure porosity.

Prepare imbibition article (3GUP017A)

The draft of the paper entitled "Application of imbibition experiments to the evaluation of measurement scale in welded and nonwelded tuff," by A. Flint, L. Flint, and K. Richards, has been completed and is currently in USGS technical review.

Evaluate water retention method to estimate relative permeability (3GUP021A)

Worked on the development of the SPOC system to collect sorption and desorption moisture characteristic data. An automated system is currently being developed.

Collect outcrop samples and develop borehole sampling techniques (3GUP027A)

A transect of outcrop samples were collected and some laboratory analyses have been completed.

Evaluate imbibition methods to estimate UZ permeability (3GUP50A)

This activity is delayed because it was determined that the influence of the oven drying technique used has an appreciable effect on imbibition. Relative humidity oven drying techniques are being evaluated and must be completed before this activity can start.

Analyze core from NTS prototype drillholes (3GUP028A)

NTS prototype drillholes were delayed.

Complete technical procedures (3GUP005A)

Prototype development is still underway on all methods.

Conduct and complete technical procedures training (3GUP023A)

No technical procedures have been completed or approved.

Quality Assurance

Planning and Operations

Procure lab supplies (3GUP008A)

Some supplies have been ordered as needed.

Procurement of lab supplies are delayed by budget uncertainty and procurement moratorium during the first half of FY91.

Procure compaq 386 (3GUP011A)

The Compaq 386 was received in February 1991.

Procure lab supplies (3GUP009A)

Lab supplies are continuing to be procured as needed and as funding permits.

Review (OCRWM) study plan (3GUP110)

The document is still at DOE in review.

Review (NRC) study plan (3GUP120)
The document is still at DOE in review.

SCP 8.3.1.2.2.3.2a Surface-based boreholes studies 0G3312V1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Construct test DISA (3GUP028E)
A prototype assembly was constructed, evaluated, and leak tested.

Conduct marketing survey for humidity generator (3GUP048E)
A market survey for a two-pressure humidity generator was conducted. The unit will be used to calibrate chilled mirror hygrometers.

Purchase electronic diagnostic equipment for lab (3GUP063E)
Approximately half of the electronic equipment needed to perform diagnostic checks of the electronic data acquisition systems in the laboratory and at field sites has been ordered and received.

Test and evaluate gas sampling system (3GUP044E)
Preliminary testing of a gas sampling system was conducted in the HRF calibration laboratory. Additional testing will be conducted when the HRF boreholes are instrumented and the gas sampling racks have been constructed.

Order flowmeters/controllers design/build multi-station (3GUP041E)
Flowmeters, hygrometers, and flow controllers for the first gas sampling rack have been ordered. Miscellaneous hardware (tubing, quick connect fittings, bulkhead connectors, metering valves, solenoids) is being identified and will be ordered in the near future. A schematic diagram of the system has been developed.

Colleen, Stan deadweight school (3GUP33E)
Two staff members attended the deadweight testing course at Ruska Instruments in Houston, Texas.

Modify DISA (3GUP029E)
Preliminary modifications to the prototype DISA assembly were made following earlier leak testing. Additional modifications probably will be identified during instrumentation of the HRF boreholes.

Design HRF stemming package (3GUP024E)
Preliminary designs for the HRF borehole stemming program have been prepared and reviewed. NTS contractors are finalizing these designs.

Place order for humidity generator (3GUP049E)
The order for the two-pressure humidity generator has been prepared and forwarded to REECo for procurement.

Fabricate thermistors (3GUP010E)
Approximately half of the thermistor mounts for the HRF borehole program have been fabricated.

Install deadweight tester (3GUP034E)

The Ruska deadweight tester has been installed at the HRF calibration laboratory. The unit is now operational and has been used to recalibrate the DPI 140s transfer standard (pressure).

Calibrate pressure transducers (3GUP001E)

Approximately 40% of the calibration work on pressure transducers for the HRF borehole program has been completed.

Calibrate thermistors (3GUP011E)

Approximately 40% of the calibration work on thermistors for the HRF borehole program has been completed.

Calibrate thermocouple psychrometers (3GUP006E)

Approximately 40% of the calibration work on thermocouple psychrometers for the HRF borehole program has been completed.

Finalize/submit pressure transducer technical procedure (3GUP002E)

The pressure transducer calibration procedure has been submitted to the project chief for review.

Finalize/submit thermistor technical procedure (3GUP012E)

The thermistor calibration procedure is under final revision by the principal author.

Finalize/submit thermocouple psychrometer technical procedure (3GUP007E)

The thermocouple psychrometer technical procedure is under final revision by the principal author.

Solve SCN problem (3GUP013E)

Thermistors for resolving problems with the SCN primary temperature standards cell have been calibrated. Approximately 20% of this research effort is complete.

Software development for gas sampling system (3GUP045E)

Software development is impossible to do until all equipment for assembling a gas sampling rack is delivered and the gas sampling rack is constructed. Also need instrumented boreholes to conduct tests of the software and the associated hardware system. The estimated new start is 9/1/91.

WRI reports (thermistor calibration/long lead tests) (3GUP069E)

This activity is on hold pending the results of SCN evaluation. The estimated new start is 8/1/91.

WRI report (thermocouple psychrometer calibration) (3GUP071E)

This activity is on hold pending finalization of TCP technical procedure. The estimated new start is 8/1/91.

Design, build, test water injection apparatus #3 (3GUP039E)

This activity is on hold because of a lack of available staff. The estimated new start is 9/1/91.

On-going development work on Denver data base (3GUP059E)

The estimated new start of this activity is 11/1/91, following completion of software development for gas sampling. There is insufficient staff at this time due to the Denver data base.

WRI report (gas sampling) (3GUP073E)

This activity is on hold pending the completion of the gas sampling rack, instrumentation of HRF boreholes, testing of methodology, and development of software. The estimated new start is 1/1/92.

Retest DISA (3GUP030E)

The final evaluation of DISA has been rescheduled following the completion of HRF borehole instrumentation and after evaluation on *in-situ* pressure transducer recalibration methodology and gas sampling methodology. The estimated new start is 2/1/92.

Test and evaluate electronic diagnostic equipment (3GUP064E)

There is insufficient staff to complete this work and additional equipment is needed. The estimated new start is 9/1/91.

Design/develop software for multi-station apparatus (3GUP46E)

See 3GUP044E and 3GUP045E. The estimated new start is 9/1/91.

Quality Assurance

Graded QA (3GUP053E)

The study-level package was submitted and approved by the QRB in January. The lower-level grading package with details of application of QA criteria at the operational level was not completed. A lot of time was spent in September and October 1990 to accomplish this work. The lack of a sound graded QA plan for YMP precluded accomplishing operational-level graded QA. Program requirements still need to be defined. It is impossible to know when this will happen. It is estimated that is will take two months to complete the grading at the operational level.

Submit graded QA (3GUP054E)

See 3GUP053E--complete two months after receiving guidance on how to proceed.

Defend QA program (3GUP055E)

See 3GUP053E and 3GUP054E.

QA program approval (3GUP056E)

See 3GUP053E, 3GUP054E, and 3GUP055E.

Planning and Operations

Order pressure transducers (HRF) (3GUP000E)

Pressure transducers were ordered for the HRF borehole program. The units were delivered in February 1991.

Order thermistor parts (3GUP008E)

Parts to assemble thermistors for the HRF borehole program were ordered and have been received.

DOE backs HRF boreholes? (3GUP016E)

DOE agreed (informally, but not in writing) to proceed with the HRF borehole program.

Prepare AC order (3GUP036E)

The order for the AC power conditioning equipment to provide clean, regulated power to the HRF calibration laboratory was placed.

Purchase electronic diagnostic equipment for lab (3GUP063E)

Approximately half of the electronic equipment needed to perform diagnostic checks of the electronic data acquisition systems in the laboratory and at field sites has been ordered and received.

Order flowmeters/controllers design/build multi-station (3GUP041E)

Flowmeters, hygrometers, and flow controllers for the first gas sampling rack have been ordered. Miscellaneous hardware (tubing, quick connect fittings, bulkhead connectors, metering valves, solenoids) is being identified and will be ordered in the near future. A schematic diagram of the system has been developed.

Order deadweight tester (3GUP032E)

The precision, primary standards deadweight tester was ordered and delivered to the HRF calibration laboratory.

Order thermistors (3GUP009E)

Thermistors for the HRF borehole program have been ordered and delivered.

Write criteria letter coordinating with NTS contractors (3GUP017E)

A criteria letter for the HRF borehole program was written, reviewed, approved, and submitted to DOE. Two planning meetings were held and the criteria letter was approved for issuance of a work package by DOE contractors.

Order thermocouple psychrometers (3GUP005E)

Thermocouple psychrometers for the HRF borehole program have been ordered and delivered.

Order AC power system (3GUP037E)

The AC power conditioning system for the HRF calibration laboratory was ordered.

Place order for humidity generator (3GUP049E)

The order for the two-pressure humidity generator has been prepared and forwarded to REECo for procurement.

Fabricate thermistors (3GUP010E)

Approximately half of the thermistor mounts for the HRF borehole program have been fabricated.

Recalibrate lab electronics (3GUP015E)

The electronic equipment for calibration of the HRF borehole sensors have been recalibrated.

Order solenoids (3GUP027E)

Solenoid valves for the HRF borehole program have been ordered. The delivery date is April 26, 1991.

Construct 15 DISA units (3GUP031E)

Approximately half of the DISA assemblies for the HRF borehole program have been constructed. 15 units are needed.

Order materials: electric cable, teflon, grout, etc. (3GUP025E)

Miscellaneous materials for the HRF borehole program have been ordered.

Install AC power (3GUP038E)

The HRF calibration laboratory's AC power conditioning system has been installed.

Construct DAS rack for HRF boreholes (3GUP026E)
Approximately 20% of the DAS rack for the HRF borehole program has been assembled; and waiting on parts to be manufactured by the REECo machine shop.

Process criteria letter (3GUP018E)
The criteria letter for the HRF borehole program has been processed.

Order dewpoint hygrometer (3GUP052E)
The dewpoint hygrometer order (four units) has been prepared and forwarded to REECo for procurement.

Install humidity generator in HRF (3GUP050E)
The equipment order was sent to REECo 4/1/91. There is an eight month lead time to manufacture, so the estimated installation at HRF is 1/1/92.

Mobilize (3GUP019E)
The new start of this activity is 5/1/91 due to extensive delays in approving funds for the HRF borehole program and reviewing the environmental aspect of the proposed work.

Work Performed but not in Direct Support of the Scheduled Tasks
An estimated 600 hours were spent in assistance with the development of SQA--reviews, workshop attendance, preparation of memorandum, assistance with rewriting, etc.

An estimated 40 hours were spent on the annual QA management assessment committee development.

SCP 8.3.1.2.2.3.2b Vertical seismic profiling 0G331231

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Give paper at SEG (3GUP042B)
The report "The use of forward and back scattered P-, S- and converted seismic waves in cross-borehole imaging," by A. Balch, H. Chang, G. Hofland, K. Ranzinger, and G. Erdimir, has been written, reviewed and submitted for final approval. The paper will be presented at the annual meeting of the Society of Exploration Geophysicists September 1991.

Clean-up/improve wave separation program (3GUP027B)
Major improvements to the earlier version of the wave-mode separation program, originally developed by K. Ranzinger, have been made; additional improvements may or may not be forthcoming in the future. The need for additional improvements is still being investigated.

Relocate data processing software and data to IBM (3GUP012B)
Data processing software, formerly resident on the Gould mainframe computer at CSM has been successfully transferred to the IBM RS/6000 work station computer system at CSM.

Relocate data processing software and data to Cray (3GUP015B)
Data processing software, formerly resident on CSU's Cyber computers has been successfully transported to Florida State University's Cray computer system. The USGS has entered a time sharing arrangement with FSU for use of their Cray computer facilities. The arrangement is working very well. The transfer of the software is 90% complete.

Acquire 3-D VSP modeling package for IBM RS/6000 (3GUP018B)

Inquiries into purchasing an IBM RS/6000 compatible 3-D VSP modeling package (AIMS equivalent) will be approximately $20K - primarily to modify the existing code to make it compatible with the IBM RS/6000 operating system. Insufficient funds at this time preclude further work on this item. Approximately 30% of the acquisition effort has been expended in identifying prospective vendors for an AIMS equivalent software package.

Install V-seis software on RS/6000 (3GUP038B)

Inquiries into the availability of V-SEIS software to run on the IBM6000 system indicate the current supplier of this software is not interested in modifying it to run on the IBM work station system. Approximately 30% of the up front acquisition effort has been expended in evaluating acquisition of this software. Lack of vendor interest suggests that further efforts will probably not be worthwhile. A Cray version (see 3GUP039B) is being looked into.

The software cannot be installed until it is purchased. See 3GUP018B.

Conduct simplified 2D fault physical model experiment (3GUP023B)

Approximately 50% of this work has been completed. This activity is on schedule.

Write technical procedure for field VSP data acquisition/submit (3GUP031B)

Approximately 30% of the field VSP data acquisition technical procedure has been developed.

Acquire 3D-3 component physical model VSP data (3GUP021B)

Approximately 30% of the work on this activity has been completed. The activity is on schedule and is proceeding smoothly.

Design/build and use absorbing boundary model (3GUP026B)

The initial design of an absorbing boundary model has been completed. Lack of staff precludes continuance of this activity at this time. It will be restarted as staffing permits.

The construction and use of an absorbing-boundary model is suspended due to the lack of staff.

Manuscript of SEG paper for review (3GUP043B)

See also 3GUP042B. Technical review of this manuscript has been completed. The activity is 100% complete.

Process 3D-3C model data/reconcile with physical mode (3GUP022B)

3D-3C model data (see 3GUP021B) are being processed in conjunction with data acquisition. The effort is approximately 10% complete.

Select downhole dry hole source (3GUP036B)

TOMEX technology is being evaluated as an alternative to the use of downhole dry source for x-hole, tomographic data acquisition during drilling of satellite boreholes at the UZ9 borehole complex. The effort is approximately 20% complete.

Process/image data from simple fault model experiment (3GUP024B)

Data collected under 3GUP023B are being processed as these are acquired, using a simplified 2D fault physical model. The effort is approximately 20% complete.

Develop RS/6000 wave mode separator/reverse time (3GUP013B)

The RS/6000 version of the wave mode separator and reverse time migration algorithms have been developed and successfully implemented. The effort is 100% complete.

Develop Cray procedure of wave mode separation/reverse time (3GUP016B)

Cray versions of the wave mode separator and reverse time migration algorithms are approximately 50% complete.

Conduct 2D Yucca Mountain VSP experiment (3GUP025B)

This activity is being delayed pending the results of 3GUP023B. The estimated start is 10/1/91.

Manuscript of SEG paper and geophysics approved (3GUP044B)

See 3GUP44MB and 3GUP043B. Approval date cannot be provided.

Test deconvolution procedures on VSP model data (3GUP028B)

This activity is delayed due to a lack of sufficient staff. The estimated new start is 10/1/91.

Quality Assurance

Write technical procedure for instr VSP borehole/submit (3GUP029B)

Approximately 10% of this effort is complete.

Planning and Operations

Respond to comments cemented geophones/comment (3GUP040B)

This issue was resolved at the Study Plan Comment Resolution closeout in January 1991.

Install "cross-window terminal" (3GUP011B)

The description and specifications for the "X-windows" terminal have been developed. The purchase order will be placed within the next 30 days. The activity is estimated at 30% complete.

Installation is delayed by procurement of equipment which was suspended until final FY91 budgets were developed.

Acquire 3-D VSP modeling package for IBM RS/6000 (3GUP018B)

Inquiries into purchasing an IBM RS/6000 compatible 3-D VSP modeling package (AIMS equivalent) will be approximately $20K - primarily to modify the existing code to make it compatible with the IBM RS/6000 operating system. Insufficient funds at this time preclude further work on this item. Approximately 30% of the acquisition effort has been expended in identifying prospective vendors for an AIMS equivalent software package.

The purchase of the IBM RS/6000 compatible 3-D VSP modeling package has been suspended until the end of FY91, due to lack of funds (20K).

Install V-seis software on RS/6000 (3GUP038B)

Inquiries into the availability of V-SEIS software to run on the IBM6000 system indicate the current supplier of this software is not interested in modifying it to run on the IBM work station system. Approximately 30% of the up front acquisition effort has been expended in evaluating acquisition of this software. Lack of vendor interest suggests that further efforts will probably not be worthwhile. A Cray version (see 3GUP039B) is being looked into.

The software cannot be installed until it is purchased. See 3GUP018B.

Acquire/test/process real earth cross borehole data, Idaho Springs (3GUO041B)

Approximately 20% of the coordination work for this activity has been completed. The site for this investigation has been changed from Idaho Springs to Bergen Park, Colorado.

Acquire 3-D computer VSP modeling data/process (3GUP019B)
The start of this activity is delayed because of dependance on 3GUP018B.

Modify study plan for cross-hole work/submit ICN (3GUP033B)
There is no action on this item. An ICN will be submitted after the study plan is approved. The study plan has been forwarded to DOE HQ for final approval. A new start date cannot be estimated at this time.

Purchase additional lab equipment for 3D-3C physical model (3GUP020B)
There is no action on this item. The new start date, pending the availability of funds, is 6/1/91.

SCP 8.3.1.2.2.3.2c Integrated Data Acquisition System 0G331241

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

System generation (3GUP021C)
System generation of PDP 11/73 ARC1 and ARC2 development is complete.

Market research/RFP (3GUP115C)
Market research for the replacement of the GEMLink transmitters has been completed. A draft request for proposals has been written and reviewed internally.

Shelter/UPS/HVAC/power and systems, redesign specs (3GUP011C)
Sixty percent of the redesign of the new instrument shelters is complete. Specifications of HVAC, UPS, support systems are being developed. Estimated completion is 6/1/91.

Status and calibrate (3GUP121C)
Seventy percent of this activity is complete. Work was done in conjunction with 3GUP115C as part of the market research for replacement of the GEMLink transmitters. Work will be finalized following evaluation of the replacement units. See 2GUP215C.

PI review ds (JE) (3GUP024C)
Ten percent of the PI review of software, high level specification design has been completed.

Comm test design (3GUP017C)
See 3GUP015C and 3GUP115C. Approximately 70% of the design specifications for the testing of the GEMLink replacements have been developed.

Definition of Denver engineering data base (3GUP018C)
The Denver engineering data base has been 70% developed. Requirements of design will be completed following delivery and testing of the GEMLink replacements.

Scrn typo (3GUP031C)
This activity has been completed.

Quality Assurance

Write HP-144 (NS) (3GUP064C)
Fifty percent of this HP is written. The draft version is being circulated for internal (informal) review.

The finish date was delayed so that work can be completed. There is no impact on milestones.

Review and revise HPs 135, 141, 142, 143, 150, 151 (3GUP137C)

HPs 141 and 151 have been formally reviewed. Revisions are being made. HPs 142 and 143 need to be revised to accommodate the changeover of ARC2 from the PDP 11/73 to the MICROVAX system. HP 135 is written and is ready for formal review. HP 150 is in the outline stage only.

Review, revise, and approve HP-137 (RG) (3GUP057C)

This procedure is being revised in conjunction with the redesign and specification development for the new instrument shelters. The procedure is 60% complete. See 3GUP011C.

Training (3GUP038C)

Seventy percent of this activity is complete. Cross-training was conducted on five technical procedures. Additional cross-training will be conducted following the revisions of HPs 135, 143, and 150.

Review, revise, and approve HP-144 (3GUP065C)

A first draft of HP-144 has been written and is in the internal (informal) review process.

Write HP-133 (AG) (3GUP039C)

A first draft of HP-133 has been written and is in internal review.

Write HP-153 (3GUP055C)

The draft of HP-153 is approximately 10% complete.

Write HP-154 (3GUP059C)

The draft of HP-154 is approximately 10% complete.

Planning and Operations

Proposals and procurement (3GUP015C)

Preliminary discussions with potential vendors of the GEMLink replacement systems have been held. The procurement document is in final preparation.

Updates (NS), RSC, DECNET, ST, and GPIB (3GUP037C)

Updated of RSX, DECNET, and ST have been installed. This will be an ongoing activity whenever updates of subsystem components are released by various vendors and manufacturers of IDAS equipment.

Investigate archive media (3DUP019C)

Various options for a permanent archiving media have been investigated. The activity is on hold until RMC rules on acceptable optical disk technology. The completion date cannot be estimated.

Proposals and procurement for shelters (3GUP012C)

Approximately 10% of the procurement package for the replacement instrument shelters has been developed. There is no change in dates.

There is ongoing activity with the following items: 3GUP137C, 3GUP057C, 3GUP011C, 3GUP121C, 3GUP038C, 3GUP024C, 3GUP015C, 3GUP017C, 3GUP037C, 3GUP065C, 3GUP018C, 3GUP022C, 3GUP039C, 3GUP055C, 3GUP019C, 3GUP059C, and 3GUP012C. Estimated completion dates have slipped. See new planned finish dates.

None of the following activities have started: 3GUP058C, 3GUP025C, 3GUP032C, 3GUP033C,

3GUP040C, 3GUP215C, 3GUP026C, 3GUP056C, 3GUP023C, through 3GUP068C. The project schedule is undergoing top to bottom revision. A new schedule will be available on May 1, 1991.

SCP 8.3.1.2.2.3.2d Air-permeability and gaseous-tracer testing 0G331251

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Complete assembly 8" packer (3GUP002D)

The USBR has finished 70% of the 8" packer assembly. Items remaining to be completed are (a) slots for supporting the system over the borehole; (b) nylon tubing for inflation; and (c) sections to join the interval pipe. The planned finish date is pushed back to 6/3/91.

When the FY91 budget for packer-assembly construction was reduced and the number of systems to be built in FY91 was reduced, the schedule for the construction of the 8" packer assembly was extended. There is no impact on major milestones associated with the UZ borehole testing program.

Review/develop cross-hole/single-hole air injection (3GUP011D)

G. LeCain continues to work on development of single and cross-hole test methods. Some methods were tested at the ALTS March 1-8. Pressure transducers were placed in the Peters/Yang gas sampling system and used to calculate tuff permeabilities. Both single hole and cross-hole tests were done.

This activity is extended because cross-hole prototype air-K testing at the Apache Leap site and large-diameter, single-hole developmental testing must be completed first. Cross-hole prototype testing is scheduled to continue through September 1991. Large-diameter, developmental testing is not yet scheduled.

Redesign packer system for use in 12" hole (3GUP001D)

The adaption of 8-inch packer design for use in 12-inch diameter holes is proceeding on schedule; design is taking into account the greater weight of the 12-inch system.

Complete construction of first support trailer (3GUP003D)

The first support trailer is 30% complete. The unit consists of a trailer with an office. Remaining to be completed are the boom, equipment cover, and installation of reel, winch and the controls. No work was done in March and the finish is pushed back to 10/4/91.

The schedule is extended as per 3GUP002D.

Quality Assurance

QA drawings/assemble/test instruments, packer trailer (3GUP010D)

The USBR has finished 30% of the QA drawing/assembly procedures and testing of the Air K system. USBR has added a part time draftsman to do the QA drawings.

Purchase all measurement and data storage equipment (3GUP020D)

A study-level graded QA package was submitted to and approved by the QRB in January. A lower-level grading package with details of application of QA criteria at the operational level was not completed. This will not be possible until QA requirements and procedures for lower-level grading are better defined.

Complete QA for 8" packer assembly and support trailer (3GUP004D)

The USBR has completed 10% of the QA for the 8" packer assembly and support trailer. The USBR has added a draftsman to do QA drawings.

This activity is delayed because the completion of the QA drawings and field-assembly procedures is somewhat dependent on the assembly of the 8" packer system, which has been delayed.

Planning and Operations

Purchase all measurement and data storage equipment (3GUP020D)

The measurement and data-storage equipment for the Air-K testing system were purchased as funding allowed.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 120 hours were spent on the following tasks:

Pressure transducers were installed in the Yang/Peters packer system and drawdown/recovery test were conducted during the February 26 - March 9 ALTS gas sampling. Eight successful single hole tests and three cross-hole tests were conducted.

G. LeCain has spent most of the remaining time in March analyzing this data. These tests should be very valuable in selecting test methods and analysis for use in single holes at the Yucca Mountain site.

WBS 1.2.3.3.1.2.4 Percolation in the Unsaturated Zone - ESF Study

Principal Investigator - B. Lewis

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 8.3.1.2.2.4.1a Prototype testing of intact fractures 0G3312N1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare Moire journal paper (3GUS016A)

Dr. J. Cardenas-Garcia is preparing a paper regarding proof of concepts for the application of Moire projection to produce high resolution imagery of the roughness of fracture planes to be submitted to *Applied Optics Journal*; the proposed title is "Moire Topography." This paper is expected to be transmitted to the USGS in mid-April for review.

Preparation for a USGS-sponsored symposium in Denver last month and a search for a manufacturer of an imaging board to replace the Epix equipment previously ordered (but was never delivered) has delayed submittal of this paper.

Prepare letter report: Moire bench marking (3GUS003A)

The preparation of this interim report is coincident with the Moire journal paper (3GUS016A) and is anticipated to be submitted in mid-April. This letter (internal) report precedes the journal paper concerning the bench marking and therefore is a prerequisite to the journal paper.

Continue Moire projection; method development (3GUS005A)

Work continues to progress using image digitization and processing to look at Moire fringes. Characterization of a simple geometrical object consisting of convex and concave surfaces using projection Moire is ongoing. Fast-Fourier transforms continued to be used to analyze the collected data. A study using a stereo imaging approach is progressing well.

A 2-mm diameter, stainless steel ball bearing was pressed into an aluminum block producing a dent approximately 1 mm deep. Fifty "points" were generated using the Moire projection techniques (i.e., a 40 micron accuracy). The bench marking effort now places an accuracy in the tens of microns when objects are reproduced digitally. The imaging board ordered this month will greatly improve the ability to handle all the data collected by the high resolution video camera.

Write technical procedure; Moire calibration (3GUS007A)

This activity has not been started. This will follow submittal of the Moire journal paper (3GUS016A) and the Moire bench marking paper (3GUS003A).

Prepare journal paper; equipment bench mark (3GUS023A)

This paper will be prepared subsequent to the completion of the Moire bench marking letter report (3GUS003A). The journal paper has not been started.

Quality Assurance

Complete procedure; radial fracture sampling (3GUS017A)

The co-authors draft of the technical procedure was completed and submitted to the Project Chief and co-author review on March 1. The authors met on March 11 to discuss the Project Chief's review comments. The Project Chief's comments were addressed; the draft was revised and returned to the co-author on March 15 to draw several figures and add more detail to the procedure. The draft is anticipated to be submitted to the USGS-HIP Reports Section in early April.

Several figures need to be added to the procedure for clarification (two are completed) and more detail added to the procedure based on internal reviews.

Planning and Operations

Procure high cost, non-capital equipment (3GUS021A)

Due to funding constraints, most purchases have been delayed. The RLC bridge necessary for electrical resistivity measurements was delivered in January 1991. Two DC power supplies needed for laboratory work were ordered in March and one was delivered late in the month. IBM-compatible PCs were ordered for the laboratory in March 1991. None are available in the laboratory for tests to be started in the month of April. The funds available to the laboratory for purchasing equipment are now known with greater certainty and most of the remaining high-cost equipment for FY91 will be purchased during April 1991.

Procurement of lab equipment was delayed by funding uncertainty early in FY91.

Commit capital for equipment (3GUS012A)

Delivery problems were encountered with the Epix imaging board ordered during FY90 for the Moire projection work conducted by Dr. J. Cardenas-Garcia. A lower capability, "loaner" board was returned to the manufacturer and an imaging board from a different manufacturer was ordered in March 1991. Additional capital equipment orders will be placed when the funds for these items become available.

Calibrate instruments (3GUS019A)

All the laboratory instruments were calibrated or are currently in for calibration, that needed to be calibrated or will be available for calibration this fiscal year. There are still transducers for tests to be conducted during FY91 that will be calibrated as needed.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 30 hours were spent on the use of gamma source to detect water content and wetting front in laboratory hydraulic studies:

Some time was involved in following up on requisition for the ratemeter. Delivery was held up due to manufacturer quality control problems. The instrument was modified at our request to operate on AC. The problem was resolved by deciding to further modify the AC circuit in-house. The ratemeter was received March 15.

Staff met with the Branch of Isotope Geology staff and conducted some preliminary work with gamma radiation sources. Two Cesium 137 sources (a 50 micro Curie and a 5.5 micro Curie) were used with rock slabs of welded and nonwelded tuff to check out the ratemeter and to see if these sources would generate enough counts to be above the background. Preliminary scoping calculations indicated a source strength of approximately 30 micro Curies or greater would be necessary.

The vacuum plumbing is almost completely replaced. There were previous problems with corrosion. The stainless steel plumbing failed due to the highly corrosive nature of the pore water extracted. Water chemistry results still have not been entirely analyzed. (approximately 10 hours)

A statement of need, technical specifications, and functional specifications for imaging board Moire projection work was prepared prior to submitting the requisition request. (approximately 3 hours)

The follow-up continued with the USGS Space & Facilities Management Office regarding connection to emergency power generators at Building 20. (approximately 2 hours)

The large block (Percolation Test) pedestal and enclosure design were discussed with S. Anderton. Drawings were reviewed for completeness and accuracy before cost estimates were requested from machine shops. (approximately 4 hours)

The laboratory slab saw was cleaned and prepared for use. (approximately 5 hours)

The pressure transducer calibration station was moved and the pressure manifold was mounted to the wall. (approximately 2 hours)

Staff completed their Federal Personnel Resumes as described in QMP-2.02, R5 and submitted them to the Project Chief. The controlled copy of the QMP manual was updated and a QA reading assignment was completed. (approximately 5 hours)

SCP 8.3.1.2.2.4.2a Prototype infiltration (percolation) testing 0G3312O1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare paper, mariotte and aperture work (3GUS018B)

The Mariotte paper is completed and was submitted to the American Nuclear Society on 12/30/90. The paper will be presented at the Second International High Level Radioactive Waste Management Conference on 5/1/91. The paper discussed disadvantages of the Mariotte

reservoir system caused by fluctuations in barometric pressure and temperature when the water flow rate is small and offers an alternative.

The aperture work will be incorporated with activity 3GUS006B. This change will not cause delays in the schedule or this milestone since the Mariotte paper was completed and delivered.

Develop technical procedure, fx location, air k (3GUS008B)

The fracture (fx) location procedure has been developed and written. This procedure will be used to locate fractures in small fractured rock samples and eventually in the ESF tests. Fractures need to be identified for mapping and instrumentation purposes. The air permeability procedure is currently being developed.

Continue ongoing flow test in small block (3GUS025B)

A flow test on one fractured welded tuff block (16 cm long X 12.7 cm wide X 16.2 cm high) was finished 8/31/90. No measurable water flow was observed through the fracture and was later attributed to clays coating the fracture plane. A second test on a fractured welded tuff sample (D= 4.13 cm, L= 7.35 cm) was finished 1/18/91. The fracture surface of this sample did not have clay minerals. The results of the second test were presented in a paper during the Unsaturated Zone Flow and Transport Workshop at the University of Arizona in January 1991.

Conduct imbibition tests on core (3GUS031B)

Tests with nonwelded tuff, sealed and unsealed, are complete; tests on welded tuff are continuing. These tests were designed to study the effects of air entrapment on the water-imbibition process and final water saturation into rock samples. In nonwelded tuff the effect seemed to be very small.

The activity finish date is delayed to allow sufficient time to complete tests on welded tuff. Milestone S32M will not be impacted.

Analyze data from large block tests (3GUS006B)

The fracture map of the block is complete. Air permeability measurements using miniature packers are complete and part of the data has been processed. The permeability measurements are needed to get an estimate of the fracture permeabilities before water ponding starts.

Prepare report, imbibition tests (3GUS032B)

The draft of this report has been started. Part of the data was analyzed and presented in the paper mentioned in 3GUS025B.

Calibrate resistivity instrumentation (3GUS023B)

The new start for this activity is 6/1/91. Equipment required for this part was not received until late February 1991.

Develop resistivity procedure (3GUS024B)

This activity is delayed; see 3GUS023B.

<u>Quality Assurance</u>

Calibrate instrumentation (3GUS011B)

Equipment is periodically sent for calibration, as required, to QA approved vendors; other equipment is calibrated in-house.

Train staff on QA (3GUS021B)

Training is done as scheduled and as needed.

Planning and Operations

Procure equipment and supplies (3GUS012B)

Technical specifications are prepared and requisitions are submitted as needed.

Initiate contract at core labs (3GUS030B)

Initiation is delayed until June 1991 due to funding constraints. This delay will not affect the ongoing activities since the data that will be gathered from this contract will be used in the analysis (3GUS028B).

WBS 1.2.3.3.1.2.6 Gaseous-Phase Movement in the Unsaturated Zone

Principal Investigator - E. Weeks

OBJECTIVE

To describe the pre-waste-emplacement 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 0G3312W1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Collect UZ borehole air flow and chemical data (3GGP01A)

Gas samples were collected in November 1990 from boreholes USW UZ-6, USW UZ-6s, and the following neutron access boreholes: N-93, N-94, and N-95.

Analyze gas samples UZ boreholes for geochemistry (3GGP03A)

Samples collected under 3GGP01A were analyzed in the gas chromatograph for geochemical data.

Tabulate/analyze air flow and chemical data (3GGP05A)

Geochemical data collected under 3GGP03A are currently being tabulated and analyzed.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 16 hours was spent in preparation of the GSA field trip on the hydrogeology of the Yucca Mountain area.

WBS 1.2.3.3.1.2.7 Unsaturated Zone Hydrochemistry

Principal Investigator - I. 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 8.3.1.2.2.7.1 Gaseous-phase chemical investigations 0G3312X1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Collect gas samples from existing UZ boreholes (3GUH012B)

From UZ-1 borehole at the NTS: UZ-1 borehole was drilled in 1983 to a depth of about 1,200 feet, and completed with 15 sampling stations, including gas probes insulated from each other by silica flour and cement grout. Sixteen ^{14}C gas samples were collected in stainless cylinders containing 5A molecular sieve; fifteen ^{13}C samples of gas in aluminum cylinders, fifteen ^{13}C gas samples in Tedlar bags, and fifteen ^{13}C gas samples in flow-through glass containers were collected for carbon-isotope analyses; fifteen water-vapor samples were also collected for tritium, oxygen-18 and deuterium analyses. 264 gas samples were collected by syringe and analyzed on-site for *in-situ* CO_2 concentration.

From UZP-5 hole at Apache Leap, Arizona: UZP-5 hole was drilled in 1990 to a depth of 220 feet, and remained open. Three packer systems were installed down-hole to isolate four stations for gas sampling. Three ^{14}C gas samples were collected from each zone in stainless-steel cylinders as mentioned above for $^{14}CO_2$ analysis; and two ^{13}C gas samples from each zone were collected in aluminum cylinders, and another two ^{13}C gas samples were collected from soil zone at 1-meter depth away from the UZP-5 hole for carbon-isotope analyses. 550 gas samples were collected by syringe and analyzed on-site for *in-situ* CO_2 concentration.

Analyze UZ gas samples (3GUH003B)

UZ-1 gas samples: Sixteen ^{14}C samples were degassed from the molecular sieve and sent to the Geochron Laboratory in Cambridge, MA, for ^{14}C activity measurements; forty-five ^{13}C gas samples were processed in the laboratory vacuum-line system to separate CO_2 from air, and sent to the Isotope Laboratory of the Geologic Division at the USGS, Denver Federal Center, for carbon-13 analyses; fifteen water-vapor samples for ^{3}H analysis, and fifteen water-vapor samples for δD and $\delta\,^{18}O$ analyses were sent to the USGS, Reston Laboratory.

UZP-5 gas samples: All gas samples remain to be processed.

Tabulate data for gas-sample analyses (3GUH006B)

Gas-sample field-collection data were tabulated for UZ-1 and UZP-5, while chemical data have not been received from an outside laboratory.

Quality Assurance

Planning and Operations

Procure laboratory and field supplies (3GUH001B)

Two tanks of standard SF_6 gas and two regulators were procured for gas chromatograph (GC) calibration. Other supplies for the GC such as syringes, a three-way stopcock for use with the syringe, and various nuts and bolts were also ordered and received.

Procure/outfit mobile sampling laboratory (3GUH014B)

Three manufacturers of the mobilab were identified: ENG Mobile System, Inc., in California, Advanced Technology in Oregon, and REECo at NTS. The plan is to order a 16- to 18-foot long and 7.5-foot wide mobilab--currently waiting specifications for the mobilab and will send to the vendors for a quotation.

SCP 8.3.1.2.2.7.2 Aqueous-phase chemical investigations 0G3312Y1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Extract/analyze water samples from boreholes (3GUH110A)

UZ #4, UZ #5, and UZ #6 cores were received from the Sample Management Facility in January 1991. Plan to squeeze and distill pore water from those cores in April 1991.

Quality Assurance

Planning and Operations

Procure laboratory and field supplies (3GUH007A)

The following laboratory supplies were ordered: (a) 20-ml volume polyvials coated with teflon for super low diffusion to be used for ^{3}H counting and oxalic acid standard for synthesizing benzene to be used as ^{14}C counting standard for the liquid scintillation counter; (b) a Cardy compact pH meter for pore water pH measurements; (c) a guard column required to maintain integrity of ion column in the ion chromatograph and a service contract with Dionex Corp. for maintenance of the ion chromatograph; and (d) a deionization tank exchange unit to maintain deionized-water supply for the laboratory use.

WBS 1.2.3.3.1.2.8 Fluid Flow in Unsaturated Zone Fractured Rock

Principal Investigator - C. Boughton

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 rocks 0G3312T1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Debug simulation program (3GUF004)

As far as is known, the flow algorithms in VSFRACW and VSFRACD are now fully operational and can calculate relative permeability relations to water and air, water and air saturations, and fractional wetted areas as functions of matric potential in single, variable aperture fractures given a knowledge of the spatial distribution of apertures within that fracture.

Complete program for particle tracking (3GUF017)

The particle tracking algorithm in the numerical codes VSFRACW and VSFRACD has been tested and is believed to be fully operational.

Model parameter estimation sensitivity analysis (3GUF023)

VSFRACW was used to generate hypothetical relative permeability, saturation and matric potential relations for a 125 micron aperture fracture. The influence of assumed variance in the natural logarithm of aperture on both saturated hydraulic aperture and on the relative permeability, saturation and matric potential relations were examined. These curves were then incorporated into the TOUGH code and used to simulate transient imbibition into a fractured

welded core. Additional numerical analysis with TOUGH code to refine the model of the imbibition experiment suggested that permeability of the welded tuff matrix is strongly anisotropic, with matrix permeability parallel to the fracture two orders of magnitude greater than matrix permeability transverse to the fracture. Visual examination of the rock fabric supported this possibility. Additional matrix imbibition experiments utilizing unfractured cores taken perpendicular and parallel to the original core are being performed to verify this hypothesis. Results are included in a paper entitled "Numerical and Laboratory Investigations of Transient and Steady-State Flow in a Fractured Core," by E. Kwicklis, F. Thamir, R. Healy, C. Boughton and S. Anderton. The paper was presented at Workshop V on Flow and Transport in Unsaturated, Fractured Rock held in Tucson, Arizona, January 7-10, 1991, and will be published in a Nuclear Regulatory Commission Report (NUREG) which will contain the proceedings from that meeting.

Revise air encapsulation and infiltration papers (3GUF021)

These papers are in the editorial queue awaiting press releases and data conversion tables and have not yet been subject to technical review. Revisions to date have been of an editorial nature.

Bounding simulations (3GUF006)

An analysis of the influence of matric block size on the attenuation of movement of an infiltrating pulse of water has been planned. The analysis will involve looking at the depth of water penetration as a function of the mean and variance of the block size distribution and will compare the results of numerical and semi-analytical methods. The motivation for this work is to determine the relative importance of identifying block size during site characterization.

Scoping calculations (3GUF005)

Several numerical simulations were run using a modified version of the VS2DT code that simulates gas flow. Simulations sought to examine the effect that fractures may have on the recovery of gaseous tracers injected into the partially welded tuff units at the Apache Leap site as part of the prototype (dry) drilling activity. Simulations have focused on the effect that pumping rates, delay times between drilling and sampling, and fracture/matrix permeability ratios exert on the total mass of tracer recovered, and on tracer concentration, relative to input concentration, of the pumped air. Simulated results are being used to support hypothesis concerning optimal pumping rates for gaseous tracer recovery currently being developed by the UZ Hydrochemistry Study. A summary of modeling results was provided to C. Peters on November 21, 1990.

Additional scoping calculations were run using TOUGH and the FMMG (Fracture-Matrix Mesh Generator) Code to compute the relative permeability versus matric potential relation for a simple fracture network (nine fractures), where each fracture was assumed to possess identical properties. This case will be used as a base case against which future simulations assuming variable fracture properties will be compared. The motivation for this work is to examine how flow may become concentrated along specific pathways through a network of fractures and how the locations of these pathways may depend on matric potential. These calculations are also being used to compute the relative conductivity versus matric potential relations for the hypothetical block of rock being simulated.

Quality Assurance

Participate in CCC for software QA (3GUF019)

C. Boughton continued to participate in the CCC as HIP representative as required by the YMP QA Program.

Review QMP-3.03, R4 (3GUF007)

No work has yet been performed under this activity ID because this revision of QMP-3.03 has not yet been made available for review. The impact of this delay is not known.

Planning and Operations

Develop study plan (3GUF000)

Study Plan 8.3.1.2.2.8, "Fluid Flow in Unsaturated Rock," was completed and sent to DOE for review.

Respond to study plan comments (3GUF001)

No work has yet been performed under this activity ID because the authors of the study plan have not yet received comments from the reviewers. The potential impact is that the authors of the study plan will be asked to respond to the review comments within an unreasonable time frame once they are received.

SCP 8.3.1.2.2.8.1 Development of conceptual and numerical models of fluid flow in unsaturated, fractured rocks 0B3312T1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare/publish final WRR paper on absorption (3GUF001L)

A paper entitled "Absorption of Water Into Porous Blocks of Various Shapes and Sizes," by R. Zimmerman, et al. appeared in *Water Resources Research*, November 1990.

Analyze lubrication theory (ongoing) (3GUF004L)

A paper entitled "Lubrication Theory Analysis of the Permeability of Rough-Walled Fractures," by R. Zimmerman, S. Kumar, and G. Bodvarsson, has been prepared for presentation at the Second International High-Level Radioactive Waste Management Conference in Las Vegas, April 29, 1991 (ANS Conference).

Prepare/publish final Brooks-Corey in tpm (3GUF015L)

Page proofs for the paper "A Simple Approximate Solution for Absorption in a Brooks-Corey Medium," by R. Zimmerman and G. Bodvarsson, have been corrected and sent to the publisher of *Fluid Dynamics Research*.

Complete lubrication theory paper (3GUF017L)

The paper entitled "Lubrication Theory Analysis of the Permeability of Rough-Walled Fractures," by R. Zimmerman, S. Kumar, and G. Bodvarsson, has been revised in accordance with USGS review comments and sent to the *International Journal of Rock Mechanics*.

Prepare/present fractals ANS (3GUF022L) and Prepare fractal analysis report (3GUF012L)

These activities will be completed May 3, 1991, after the ANS meeting in Las Vegas.

Prepare/publish final cylinder asperity papers (3GUF009L) and Validate size/shape effects, mod. dual porous model (3GUF019L)

There was no activity on these activities during March.

Quality Assurance

Planning and Operations

WBS 1.2.3.3.1.2.9 Site Unsaturated Zone Modeling and Synthesis
Principal Investigator - B. Lewis
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 0G3312C1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance
Prepare for audit (3GUM07A)

Staff began checking QA related items/documents (i.e., SQA requirements, procurements, personnel qualifications, and related travel) for applicable inclusion in a possible upcoming audit.

The date for the DOE/YMPO audit was moved up by approximately two months.

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks
An estimated 72 hours were spent on the following activities:

A site modeling meeting between nine UZ investigators and the Computer Operations and Data Management Unit was held on March 5, 1991, to provide attendees with background on future data storage and archiving needs.

Six UZ investigators attended the USGS Yucca Mountain Project colloquium held on March 19, 1991. Dr. D. Noble from the Mackay School of Mines gave a slide presentation talk entitled "New observations on the Volcanic, Tectonic, and Hydrothermal Evolution of the Southwestern Nevada Volcanic Field and Areas to the West." Emphasis was on volcanic units, distribution of mineral deposits, structure of calderas, faulting and uplift.

A hydrologic instrument probe housing pressure transducers, thermistors, and psychrometers, that has been downhole in USW UZ-4 for two years, was removed March 26, 1991, for inspection, which included collecting specimens for bacterial analysis.

An open-house tour of the HRF was held on March 2, 1991, with six UZ investigators providing hydrologic testing information to the public via instrument steps, posters, and answers to questions.

The following revised APs and QMPs were distributed for reading: AP-1.10Q, AP-3.3Q, QMP-2.07, R1, QMP-2.08, R1, QMP-16.01, R3, M1, and QMP-16.03, R2, M1.

SCP 8.3.1.2.2.9.2 Selection, development, and testing of hydrologic-modeling computer codes 0B3312D1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Test decoupled TOUGH hydrological simulation (3GUM13A)

G. Bodvarsson traveled to Las Vegas and Denver to meet with DOE and USGS unsaturated zone principal investigators regarding the site-scale model.

Further data reports on Yucca Mountain wells were collected. A magnetic tape with stratigraphic data was obtained from E. Ervin. A letter was sent to SNL requesting a copy of their SEP data base.

A map with the extensions of three types of infiltration areas--crests, slopes, and alluvium--was obtained from L. Flint during her visit to LBL on March 18, 1991.

A preliminary areal grid has been developed based on the location of the existing, and most of the proposed, wells; the main tectonic features; the outcrops of the main geological formations; and the infiltration data.

A criterion was developed (analytically) to assess the range of validity of the effective continuum approximation for fractured/porous media. Computer simulations to validate this criterion have commenced.

Quality Assurance

Perform software QA on decoupled TOUGH (3GUM16A)

G. Bodvarsson met with C. Boughton and SAIC personnel regarding software QA of various LBL codes.

Review QMP-3.03, R4 (3GUM15A)

R. Zimmerman reviewed QMP-3.03, R4 on software QA after receiving it in December, 1990.

Planning and Operations

Revise and resolve study plan comments (3GUM10A)

G. Bodvarsson performed a comprehensive technical review of SP 8.3.1.2.2.9 on site-scale UZ modeling and synthesis, and assisted USGS study plan authors with the resolution of comments and the revision of the study plan.

WBS 1.2.3.3.1.2.10 Prototype Hydrologic Tests that Support Multiple Site Characterization Activities

Principal Investigator - B. Lewis

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 Drill-Hole Instrumentation 0G3312H1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Write GTUF report (3GUT001B)

The GTUF report on Prototype Drill-Hole Instrumentation is approximately 30% complete. Several chapters of this report have been written.

There is currently insufficient staff available to work on this activity. It has been on a hold status since 1/2/91. The new planned finish date of the first draft is 8/1/91.

Quality Assurance

Planning and Operations

Prototype Cross-Hole Testing 0G3312I1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Conduct ALTS Arizona (3GUT001C)

Cross-hole pneumatic testing was conducted in December 1990 at ALTS using the small-diameter testing system.

Pressure transducers were placed in the UZ hydrochemistry gas sampling assembly and used to conduct cross-hole pneumatic tests at the Apache Leap site. The system worked well and three successful cross-hole tests were conducted.

The ALTS testing started late because of scheduling conflicts with the University of Arizona, which operates the ALTS. Due to change in the PI, problems in locating connecting fractures and additional questions raised during earlier testing, the ALTS testing program has been extended to October 1991, with additional testing campaigns in May and September 1991.

Reduce and examine ALTS data (3GUT002C)

G. LeCain reduced and examined all the December 1990 and March 1991 ALTS pneumatic-testing data.

Because the field testing at ALTS has been extended, the data reduction and examination will be extended.

Analyze ALTS data by numerous methods/comparisons (3GUT003C)

G. LeCain analyzed all the December 1990 and March 1991 ALTS pneumatic-testing data by several methods. The data are very good and gave consistent reasonable results.

Because the field testing at ALTS has been extended, the data analysis will be extended. This will result in a corresponding delay in preparation of the data report on testing and methods (3GUT005C) and in completion of milestone T05M. However, there are no long-term, higher-level impacts because results of prototype cross-hole testing will be available to support the start of ESF and new surface-based activities.

Quality Assurance

Planning and Operations

Prototype Tracer Testing 0G3312J1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Produce WRI report on aqueous tracer tests (3GUT003D)

This report is titled "Borate Adsorption by some volcanic tuffs: Evaluation of borate as a potential tracer for estimated flow at Yucca Mountain" by A. Lewis-Russ and I. Yang. The paper was drafted and sent for colleague review by USGS scientists. The paper is due back to the authors for response to review comments.

The submittal of the WRI report on aqueous tracers is delayed because additional time is needed to respond to colleague review.

Design tracer gas sorption experiments (3GUT004D)

Due to the resignation of an employee working on this project, the experiments are being postponed until the new hire arrives. It is expected that the new hire will arrive in May 1991. This activity could be delayed until June 1, 1991. The delay may not impact the UZ hydrochemistry studies because the site drilling programs are also delayed.

Quality Assurance

Develop and complete technical procedures (3GUT005D)

Two technical procedures for aqueous-phase tracers were written. One is HP-209 "Method for preparing tracers for addition to a water supply system," and the other is HP-210 "Method for crushing tuffs needed for tracer tests." HP-209 went through technical review and is currently under QA review. HP-210 was approved.

Planning and Operations

Procure laboratory and field supplies (3GUT008D)

Laboratory supplies for Borate Tracer studies and field supplies for gaseous tracer studies at Apache Leap, Arizona, were procured and received. Supplies for laboratory tracer gas sorption studies have not started due to the resignation of an employee.

Prototype Dry Coring of Rubble 0G3312L1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare a report on the effect/technique using nonwelded (3GUT003F)

The outline for the report has been developed and initial statistical analyses of dry coring physical characteristics have been completed.

Prepare a report on the effect/technique using welded (3GUT014F)

The outline for the report has been developed and initial statistical analyses of dry coring physical characteristics have been completed.

Test effect of block technique/gas used and coring technique (3GUT001F)

Analysis of physical characteristics is 80% complete. Water and gas samples have been removed from 80% of these cores. Water and gas analyses have been completed on 20% of these samples.

Test effects of seal methods (3GUT001E)

One hundred six cores have been sealed by eight different methods and weighed monthly for the last six months. Preliminary results indicate differential moisture loss from cores sealed by different methods.

The finish of this activity is being delayed nine months to allow for the collection of sufficient data for meaningful interpretation, but will not impact any planned milestones/deliverables.

Reduce data for effect of coring nonwelded tuff (3GUT002F)

Sufficient water chemistry results have not yet been obtained to start this activity. We expect to begin the activity in the next month. The delayed start of this activity will delay completion, but will have no impact on any planned milestones/deliverables.

Quality Assurance

Planning and Operations

Procure lab and field supplies (3GUT008F)

Supplies for coring have been procured. Supplies for core preparation are 70% complete and supplies for water extraction are 50% complete.

Work Performed but not in Direct Support of the Scheduled Tasks

The need for dry coring of rubble is questionable due to the change of ESF construction method from drill and blast to tunnel-boring machines. However, the dry coring information will still be of use to analyze effects on cores removed from boreholes in the ESF and surface-based work. High tritium contents found in the G-Tunnel rock and the contamination potential to our labs and lab equipment will reduce the number of pore-water analyses from G-Tunnel core. It may be possible to substitute Apache Leap core for some parts of this study.

Prototype Pore-Water Extraction 0G3312M1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare symposium paper on 1-D compression (3GUT013G)

The paper has been completed and submitted to the symposium for publication. A draft of a WRI/data report has been prepared and is nearly ready for colleague review.

Reduce data pore water chem vs. comp and chemical analysis (3GUT003G)

Data for nonwelded expression is 90% collected and 60% reduced. Data for welded expression has not yet begun.

Extract and analyze pore water using high pressure cell (3GUT001G)

The construction of the high pressure cell is 95% complete. Unexpected delays due to safety considerations and fitting of inner and outer sample sleeves have prevented the start of high pressure 1-D compression. Those problems have been 90% worked out and shakedown of the cell is expected to begin in the next month.

Quality Assurance

Write technical procedure for 1-D compression (3GUT005G)

Procedure development is about 80% complete. The first draft of the technical procedure is 50% written.

Planning and Operations

Procure lab supplies (3GUT008G)

Lab supplies for core preparation are 70% purchased. Purchase of supplies for pore water expression is 30% completed. Materials and machining procurements for cell construction are 70% complete. Data acquisition system is 50% complete.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 100 hours has been spent on the hiring of a consultant to complete the construction of the high pressure 1-D cell, the ordering of steel sheeting to wrap the cell for safety, and the building of a model to test the effects of compression on the lubricant which allows removal of the sampling sleeve. All are tasks which were not foreseen, but which were necessary to the completion of the high pressure 1-D cell and are 90% complete.

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 - R. Luckey

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 8.3.1.2.3.1.2 Site potentiometric-level evaluation 0G3313E1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare 1989 water-level data report (3GWF041B)

Data collection ended December 31, 1989.

Periodic (manual) measurements have been processed to water levels. The report "Water-levels in periodically measured wells in the Yucca Mountain area, Nevada 1989" by G. O'Brien was prepared and reviewed. The report received USGS Director's approval on March 20, 1991, and was sent to DOE for concurrence on January 28, 1991.

Continuous (automated) measurements have been processed to water levels. The report "Water levels in continuously measured wells in the Yucca Mountain area, Nevada, 1989" by D. Lobmeyer and R. Luckey is in draft stage.

Analysis of water-level trends (3GWF220A)

Preliminary evaluation was made on what data may be used in analysis.

The presentation "Strain-related water-level fluctuations" was made at the TPO meeting on March 20, 1990.

Two transducers were placed in neutron access hole UE-25 UZN #5 to monitor the phase lag of barometric fluctuations through the shallow unsaturated zone. This information may be helpful in interpreting barometrically induced water-level fluctuations in wells not cased below the water table.

Anticipated completion of this task and milestone Z412 (Analysis of water-level fluctuations at Yucca Mountain) is delayed three months. Manpower originally intended for this task was diverted to processing water-level data and determining if "water-level excursions" are real.

Collect 1990 water-level data (3GWF003A)
Data collection ended December 31, 1990.

Reduce 1990 water-level data (3GWF023A)
Periodic (manual) measurements processed to water levels.

Continuous (automated) measurements inspection for convertible periods of record has begun.

Prepare 1990 water-level data report (3GWF042A)
The format and outline for the report were prepared.

Study accuracy and precision of water-level data (3GWF118A)
Preliminary evaluation of data is about 25% complete.

The draft outline for the report is complete.

Collect 1990 water-level data (3GWF004B)
Data collection began January 1, 1991. Routine tasks completed this month include: (a) monitored three wells (on a quarterly basis); (b) monitored 17 zones in 16 wells (on a monthly basis); (c) monitored 19 zones in 12 wells (on a hourly basis); (d) obtained continuous analog data on two zones of one well (included in count of hourly sites); (e) obtained real-time data on eight zones in five wells using satellite data-collection platforms (included in count of hourly sites); (f) evaluated the status of the network at the end of each month and made recommendations for instruments that should be watched, calibrated, or replaced; and (g) monitored real-time data on a daily basis, looking for water-level excursions.

Special tasks completed this month: (a) calibrated transducers at wells USW WT-11, USW H-4 (upper), and USW H-4 (lower); (b) replaced transducers at wells USW G-3, USW H-6 (upper), and USW H-6 (lower); (c) installed a data collection platform to collect real-time data at well USW H-6; and (d) were onsite during two different water-level excursions at well USW G-3.

Quality Assurance

Reduce 1990 water-level data (3GWF023A)
QA checks were completed for about one-half of the periodic water levels.

Graded QA for potentiometric levels task (3GWF163A)
The grading report was prepared and forwarded to the Quality Assurance Review Board on January 18, 1991, and was approved February 4, 1991.

Collect 1990 water-level data (3GWF004B)

The response for NCR 91-12 (Use of existing software prior to completion of QA documents) was accepted by the QA office.

Planning and Operations

Analysis of water-level trends (3GWF220A)

G. O'Brien began procurement of a 386 computer with a math coprocessor to analyze water-level fluctuations.

Prepare 1990 water-level data report (3GWF042A)

Preliminary assignments of some duties in the report preparation were made.

Collect 1990 water-level data (3GWF004B)

D. Burkhardt completed the "Data Base Administrator" course so he could maintain the data base for continuous data.

A replace vehicle was obtained to house the multiconductor cable. Logging equipment was mounted in the new vehicle.

An all project meeting was held on March 14. This meeting covered all tasks, but is listed here because more time was spent on this than any other task.

Backlog records (3GWF200A)

No work was performed on this task due to a lack of manpower and because it is a lower priority.

Work Performed but not in Direct Support of the Scheduled Tasks

R. Luckey met with N. Trask and a management team for QA on March 5. He discussed his perceptions of the strengths and weaknesses of the current QA program. (approximately 3 hours)

R. Luckey and E. Ervin attended a joint USGS, DOE, and NRC meeting on March 5 to discuss sharing of data among project participants. The meeting was a first step at striking a balance between project requirements to share information and USGS requirements of thorough review before release of information. (approximately 8 hours)

R. Luckey and E. Ervin attended the NWTRB meeting March 6 and 7 in Denver as spectators. They were most interested in the presentation of a saturated zone conceptual model by J. Robertson, but attended other sessions for general information. (approximately 24 hours)

R. Luckey met with J. Caldwell and K. Martin (DOE representatives) on March 13 to discuss data issues in the Yucca Mountain Project. (approximately 1 hour)

Preparation of the monthly report in the new format took approximately 4 hours.

SCP 8.3.1.2.3.1.3 Analysis of single- and multiple-well hydraulic-stress tests 0G3313F1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Prepare C-holes hydrogeology report (3GWF030)

A. Geldon has rewritten this report in response to technical review and submitted it for supervisory and management review.

Determine hydraulic properties 2 (3GWF051A)

Available data from previously completed hydraulic stress tests at C-holes and H-holes were evaluated for determination of aquifer properties.

Determine hydraulic properties 3 (3GWF052A)

Hydraulic properties have been determined for UE-25C#1 using the final data set obtained before packer removal. Peak dynamic strain has been determined for USW H1 in response to an UNE in November, 1990.

Monitor earth tide, barometric, seismic, and UNE responses at selected network wells (3GWF036A)

Strip charts have been set up at UE-25B#1 and at USW H4 to monitor for UNEs and earthquakes.

G. Patterson prepared a technical presentation for the March 22, 1991, TPO meeting in Las Vegas dealing with strain-related water-level fluctuations.

Analyze stress tests of UE25c wells (3GEF032)

Hydraulic-pressure responses of the C-Holes to stress from UNEs, earthquakes, earthtides, and barometric changes were analyzed to determine aquifer properties and refine the conceptual model of saturated-zone hydrology.

Analyze flow tests of UE25-c wells (3GEF031)

Data from preliminary pump tests at the C-Holes were reanalyzed using analytical methods developed specifically for fracture-flow regimes, including dual-porosity methods. Results were used to determine the method that best describes the details of flow at the C-Holes. This method will be described in the report on intraborehole flow and stress test (P891).

Prepare intraborehole flow and stress test report (3GWF032A)

G. Patterson began preparing this report and anticipates a timely completion.

Quality Assurance

Prepare scientific notebook for earth tide, barometric, and seismic monitoring (3GWF130A)

The scientific notebook procedure for monitoring hydraulic response of saturated zone to earthtides, barometric changes, earthquakes, and UNEs is about 30% complete.

Planning and Operations

Monitor the C-holes for earth tide, barometric seismic effects (3GWF035A)

This activity had been put on hold because the packers and tubing were removed from the C-holes in November, 1990, to clear the way for TV logs, Caliper logs, and Cross-hole Seismic Tomography. The cross-hole tomography was subsequently delayed because of funding shortfalls at LBL. Plans are now underway to purchase a light-weight packer that can be installed with a cable hoist and allow continued monitoring at the C-holes without impeding access to the borehole for other work. The planned finish of this activity is not in jeopardy at this time.

SCP 8.3.1.2.3.1.4 Multiple-well interference testing 0G3313G1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Update modules to the well test analysis program (3GWF146A)

No new modules were added to the hydraulic-test-analysis program, but several existing

modules were tested using old pump test data. When problems with the program are identified, the program is corrected.

Log temperature in the C-holes (3GEF144A)

An attempt was made to run the logs, but the computer that is dedicated to interfacing with the logging truck electronics blew its power supply. The computer is being repaired and the logs will be run as soon as possible.

The temperature logging has been delayed until some time later in FY91 due to equipment problems. This should have no schedule impact on any activity.

Quality Assurance

Planning and Operations

Update SCP to include additional C-hole (3GWF105A)

Details of the additional C-hole are being discussed between the USGS, LANL, REECo, and RSN. When all of the information such as exact location, drilling angle, depth of penetration, and mode of drilling are determined, an official ICN to the SCP will be written. The ICN cannot be prepared until all design and location details have been worked out with LANL, REECo, and RSN.

Begin procedure to have power lines run to the C-hole site (3GWF142A)

J. Gemmell has been in phone contact with D. Royer (DOE) to discuss the electrical needs and procedure for having power run to the site. Costs are being compared for running generators versus permanent lines.

Work Performed but not in Direct Support of the Scheduled Tasks

J. Gemmell and G. Patterson have reviewed vendor proposals for supplying the packers for the multi-well testing tool. Three vendors submitted bids and two were selected as being in the acceptable range. Those vendors have been notified and solicited for their "best and final offers" which will then be reviewed and a selection made.

J. Gemmell and G. Patterson are also involved in discussion with Druck Manufacturing to finalize the design requirements for the transducers that will be used for the testing tool.

Both of the above activities are directly related to task 3GWF140A (Construct 2,3 packer strings) and took approximately 80 hours.

SCP 8.3.1.2.3.1.5 Testing of the C-hole sites with conservative tracers 0G3313H1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Construct models to assist tracer selection (3GWF154A)

A. Geldon and G. Patterson are selecting codes to use for the preliminary models. General hydraulic parameters and preliminary fracture distributions have been determined for use in these simulations.

Develop techniques for analyzing solute transport at the C-holes (3GWF154A)

Several different methods for tracer test analysis are being assessed and several will be tested using hypothetical data sets.

Quality Assurance

Grade QA for conservative tracer testing (3GWF155A)

This activity is completed.

Planning and Operations

Update SCP to include additional C-hole (3GWF106A)

Details of the additional C-hole are being discussed between the USGS, LANL, REECo, and RSN. When all of the information such as exact location, drilling angle, depth of penetration, and mode of drilling are determined, an official ICN to the SCP will be written. The ICN cannot be prepared until all design and location details have been worked out with LANL, REECo, and RSN.

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 0G3313J1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Revise HP-23 (3GWH013A)

Augmented/corrected/edited part of the text of HP-23, R1, on collection and field analysis of ground-water samples from the saturated zone.

Quality Assurance

Grade QA for activity (3GWH012A)

A study-level grading package was prepared, submitted to and approved by the QRB in February. Detailed, lower-level grading packages still need to be prepared.

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 450 hours were spent on the following tasks:

Familiarization with the ion chromatograph system installed in August 1990 continued. A replacement cation micromembrane suppressor was installed and a replacement microcomputer and system software was installed and tested for system control.

Review of the technical procedure for analyses of selected anions using ion chromatography began.

The test application at the NTS of an *in-situ* tool for pumping tests and hydrochemical data collection was investigated by DRI and USGS/LV personnel. Tool performance was judged to be unsatisfactory by DRI investigators for hydrochemical characterization; a USGS/LV investigator indicated that the tool perhaps could be used in some USGS Weapons Program support work.

A technical review of the summary and abstracts that derived from the USGS "Fractures, Hydrology, and Yucca Mountain" symposium held on September 13 and 14 in Lakewood, CO, was provided.

PACS input was prepared.

Staff participated in a briefing of DOE/LV personnel on HIP activities.

A list of primary study objectives through June '92 and attendant personnel requirements were prepared for USGS/YMP supervisory staff review and discussion.

The results of ^3H analyses of ambient air samples from the USGS Area 25 HRF were conveyed to and discussed with EPA/EMSL staff.

Staff met with members of the NWTRB to discuss the impacts of the Project QA programs on the technical program.

Staff participated in a series of Project-level workshops to address the implementation of QA in the YMP and in presentations of the results of the workshops to C. Gertz, M. Blanchard, and additional DOE/LV staff; J. Bartlett and D. Horton (DOE/OCRWM); and members of the NWTRB.

Staff participated as a technical auditor in USGS audit 90-01 of Quaternary Regional Hydrology (Past Discharge and Analog Recharge). Pre-audit activities included training in numerous technical procedures and QMP-18.01, R5.

Staff participated in USGS QA Branch workshops to address problems in the preparation and review of QMPs and changes thereto; and to address implementation of AP-5.1Q.

A draft QA plan for support work to be done by the Environmental Research Center at UNLV was reviewed.

SCP 8.3.1.2.3.2.2 Hydrochemical characterization of water in the upper part of the saturated zone 0G3313K1

Technical Activities

Sample mining company holes (3GWH005A)

USGS/NTS staff were advised regarding the collection of ground-water samples from two wells in west-central Crater Flat. The holes were drilled by a mining company in an attempt to obtain sufficient water for mining operations.

The planned finish is delayed because no mining-company holes have become available for sampling.

Sample weapons program (ERTDB) GCB holes (3GWH006A)

No work was performed on this activity because construction of the GCP boreholes has not yet begun, DRI has not established sampling equipment to be used, and the sampling equipment has not been purchased. The impact on the study is nil, unless construction of boreholes is delayed into FY93.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 55 hours were spent on the following tasks:

The feasibility of using ^{85}Kr as a means of identifying the presence of drilling fluid in gaseous and aqueous samples to be collected in the course of planned activities were investigated. The search for laboratories capable of ^{85}Kr analyses of gaseous and aqueous samples began. Identification of methods for collection of requisite gaseous samples began.

Staff coordinated, with DOE/LV and AECL, personnel, budget and plans for equipment tests at the AECL WNRE Borehole Investigations Test Facility and the AECL Lac du Bonnet site area.

SCP 8.3.1.2.3.2.3 Regional hydrochemical characterization 0G3313L1

Technical Activities

Collect regional samples (3GWH010)

Samples from a stock-watering well site northwest of Yucca Mountain were collected and submitted for analyses in order to provide a preliminary estimate of water chemistry to be expected in the Timber Mountain area north of Crater Flat.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 130 hours were spent on the following tasks:

Hydrochemical data along selected ground-water flowpaths were compiled and examined to support the presentation of a paper at the Fall 1990 meeting of the AGU.

Attempts at identifying/locating field equipment to be used in collection of regional and site ground-water samples and *in-situ* hydrochemical data continued.

Staff participated in meetings with DOE and USGS staff to discuss the plans for the NAS field trip and with the USGS TPO and staff to discuss the results of the UZ technical exchange with the NRC.

A preliminary agreement with the USGS Weapons Program support staff regarding the entry of historic USGS/WP data, currently in hard-copy form in Lakewood, into both USGS/WP and USGS/YMP data bases was reached. Final agreement should be reached in April 1991, in order for this work to be done this fiscal year.

Staff participated in the disposition of USGS-NCR-91-10 regarding samples collected from UE25-P#1 in 1990.

WBS 1.2.3.3.1.3.3 Saturated Zone Hydrologic System Synthesis and Modeling
Principal Investigator - R. Luckey
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 0G3313A1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Evaluate and procure computer hardware and software (3GWM013A)

E. Ervin obtained a copy of FRACMAN and MAFIC software from Golder and Associates, Seattle, Washington and asked W. Dershowitz of Golder to put these two codes on the project's SUN workstation.

E. Ervin discussed the potential of using the TOUGH code from LBL for some of the preliminary flow modeling during the hypothesis testing stage. Use of this code would aid in coordination of modeling efforts between the unsaturated-zone and saturated-zone projects. Ervin is planning to be trained on the TOUGH code at LBL by G. Bodvarsson this summer.

Synthesis of potentiometric surface map (3GWM005A)

Work began on 1988 potentiometric-surface map, data points were contoured and the results were discussed with R. Luckey.

E. Ervin investigated the feasibility of producing a geologic map at the potentiometric surface. She met with R. Spengler to discuss time and effort involved and what data is already available.

Planned completion date is delayed several months because of other priorities. The potentiometric surface map report is planned to be in review by the planned finish.

Preliminary hypothesis testing phase 1 (3GWM009A)

E. Ervin went with A. Flint, M. Chornack, and L. Flint to EG&G, Las Vegas, met with E. Ezra, and discussed EG&G's role in and equipment for Geographic Information Systems for the project.

E. Ervin met with G. Bodvarsson, B. Lewis, A. Flint, N. Stuthmann, and E. Kwicklis to hear about the unsaturated-zone site model being done by Bodvarsson and to coordinate modeling efforts in the unsaturated and saturated zones.

E. Ervin began compiling data needed to build a 3-D geologic model for Yucca Mountain. Initial plans are to put the data in the Dynamic Graphics GSIS.

Anticipated completion data is delayed two months because of other commitments such as preparation for a GSA field trip to Yucca Mountain.

Quality Assurance

Graded (QA) model conceptualization activities (3GWM012A)

R. Luckey and E. Ervin met with the QRB in Las Vegas to discuss graded QA for SP 8.3.1.2.3.3. The application package was withdrawn from the QRB by the USGS to make changes per QRB comments.

The graded QA package was revised and resubmitted to the QRB late in February.

The TPO made this a high priority in January, so the schedule was accelerated.

Planning and Operations

Evaluate and procure computer hardware and software (3GWM013A)

A 386 computer with 4 MB RAM, 90 MB disk drive and a math coprocessor was ordered.

The finish date was delayed because the activity was redefined to include evaluation of modeling codes.

Review (DOE) study plan 8.3.1.2.3.3.1 (3GWM001A) and Revise and resolve (USGS) study plan comments (3GWM002A)

The study plan was sent to DOE 9/4/90 and was due back 1/8/91. The study plan has not come back from DOE review and, thus, no work on 3GWM002A has been done. Milestone G024 (Work Authorization) is impacted by this delay.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 45 hours were spent on preparation, coordination, and writing by E. Ervin of her portions of the 1991 Geological Society of America field trip guide on the regional hydrology of Yucca Mountain and vicinity.

E. Ervin and R. Luckey attended a meeting on the sharing of data among Project participants. At the meeting were USGS, DOE, and NRC representatives. (approximately 8 hours)

E. Ervin and R. Luckey attended a meeting of the NWTRB held in Denver on the results of the Calico Hills Task Force and revised ESF plan. Of particular interest was the presentation on the viability of the saturated zone as a barrier to radionuclide migration given by J. Robertson.

SCP 8.3.1.2.3.3.2 Development of fracture network model 0G3313B1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Oversight of preliminary modeling I (3GWM001B)

E. Ervin began investigating sources of existing fracture data for Yucca Mountain and vicinity, including fracture-pavement data collected by C. Barton and additional fracture data from TV logs at the UE25 C-hole complex. A public domain INGRES data base is being considered for holding the data.

Quality Assurance

Grade (QA) USGS fracture-network model activity (3GWM004B)

R. Luckey and E. Ervin met with the QRB in Las Vegas to discuss graded QA for SP 8.3.1.2.3.3. The application package was withdrawn by the USGS from the committee to make changes per their comments.

The graded QA package was revised and resubmitted to the QRB late in February.

The TPO made this a high priority in January, so the schedule was accelerated.

Planning and Operations

Oversight of preliminary modeling I (3GWM001B)

E. Ervin discussed with K. Karasaki the status of the LBL fracture network model and additional data needs including the planned outcrop mapping of the fractures in the Crater Flat Tuffs.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated eight hours were spent on coordination and preparation by E. Ervin of fracture mapping in the Crater Flat Tuffs for input to LBL's fracture-network model. Discussions were held with R. Spengler and C. Throckmorton (GD) to meet data needs for both divisions and LBL.

SCP 8.3.1.2.3.3.2 Development of fracture network model 0B3313C1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Develop preliminary model I (3GWM002C)

A conjugate gradient solver with incomplete Cholesky reconditioning was evaluated for use in the fracture network flow and solute transport code TRINET.

Two minor bugs in the transport option in TRINET were discovered and corrected.

A collaboration on improving TRINET has started with a French scientist.

A paper entitled "Preliminary Terminated Slug Tests," by K. Karasaki, was completed and sent to the American Society of Civil Engineers, Hydraulics Division, for presentation at the 1991 International Symposium on Ground Water.

An abstract entitled "Modeling of Flow and Transport in Fracture Networks," by K. Karasaki, A. Davey, J. Peterson, K. Hestir, and J. Long was revised incorporating USGS reviewers' comments and sent back to CASY.

Compute 3-D fracture distribution from boreholes (3GWM001C)

After computing strike and dip of tuff units and fractures observed in the C-Holes, a fracture network was generated for borehole data and then compared to a synthetic fracture network generated with the LBL fracture-mesh generator. Through these comparisons, the borehole bias study continues at LBL.

Quality Assurance

Grade QA for fracture-network model (3GWM006C)

A detailed, lower-level grading package for site saturated-zone modeling was prepared by R. Luckey and E. Ervin and submitted to the QRB for review.

Planning and Operations

WBS 1.2.3.3.2 Preclosure Hydrology

OBJECTIVE
To examine hydrologic conditions, including flooding, availability of water supply, and characteristics within and above the repository horizon; and to determine whether engineering measures that require excessive cost, or technology beyond that which is reasonably available, will be needed during construction or operation of the repository. (SCP Section 8.3.1.16)

WBS 1.2.3.3.2.1 Flood Recurrence Intervals and Levels at Potential Locations of Surface Facilities
Principal Investigator - P. Glancy

OBJECTIVE
To assess the flood and debris hazards at and near the potential repository surface facilities locations to allow adequate design of facilities to prevent or reduce hazards to an acceptable level. (SCP Study 8.3.1.16.1.1)

SCP 8.3.1.16.1.1.1 Site flood and debris hazards studies 0G3321A1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities
Incorporate FY90 data in data base (3GFR005)

Much progress has been made in the processing of FY90 flood data. Some final tasks still need attention. They should be completed and transmitted to the LRC by the end of June, if too many other unplanned interferences do not occur. Some field data have not yet been collected that still may be attainable. Numerous bureaucratic and administrative chores since September 1990, have prevented the completion of field data-collection tasks. Some additional data may be attained during the FY91 data collection period if FY91 runoff is light and FY90 data can still be collected.

The finish date is delayed because some debris-movement data for FY90 remains to be collected.

Collect, analyze, evaluate FY91 flood data, ongoing (3GFR001)

Runoff and flooding during FY91 has been light thus far. There is no way to predict what may happen during the remainder of the year that will govern the data-collection activity.

Nevada weather was observed and documented to assess the likelihood of flooding and debris transport on a daily and continuing basis.

Newly published literature was scanned and read to stay abreast of the changing technology in debris transport. Select articles were copied for inclusion in the Nevada District YMP technical library.

Staff attended the Fifth Federal Interagency Sedimentation Conference in Las Vegas to assimilate new concepts in debris movement and new technology for sampling and investigating debris movement.

An unusual appearing debris flow that originated from Copper Canyon along the northwest side of Walker Lake was discovered and briefly reconnoitered. The flow appeared to be a viscous mudflow with minimum transport of coarse-grained clasts. It was photographed, described, and sampled for particle-size distribution. The source area still needs to be investigated and deposits need to be more thoroughly examined and documented.

The riparian terrain along the highways between Carson City and Beatty, Nevada (US 50 and 95) were reconnoitered for signs of recent (FY90 and FY91) debris movement. None was noted other than the Copper Canyon site.

The landscape between Reno and Las Vegas were reconnoitered from airliners on several trips for evidence of recent flooding and debris movement. The areas where evidence of recent flooding and debris transport were observed (all FY90 flooding) and areas where future debris-movement evidence might be expected were photographed.

Scientific investigations in the field were coordinated with W. Osterkamp, who is working on potential for ground-water recharge by streamflow, regarding evidence contained in streambed of Fortymile Wash. The streambed consists of all sizes of debris - most would be hazardous when in motion. It was agreed that the characteristics of many deposits show evidence of numerous debris flows, but ages of these flows were not determinable during this visit. More work needs to be done on those deposits as part of this activity and as part of paleoflood investigations.

The finish date is likely to be delayed because of the delay in incorporating FY90 data into the data base (3GFR005).

Develop analytical schemes for the flooding process (3GFR009)

Literature scanning continues on an ongoing basis to seek up-to-date technology on flood analysis. No other progress has been made, or is required yet, because data collection is ongoing and the amount and types of data collected will control progress on this task. This task will continue at a mild, but uneven pace throughout the duration of the YMP.

Review of available flood-analysis techniques, ongoing (3GFR010)

This activity, ongoing for the duration of the YMP, is geared largely, at this stage of pre-project activity, to literature scanning, sorting, and assembling of newly developing techniques. As with 3GFR009, the review and selection precess of techniques depends to a large extent on the accumulation of usable streamflow data and the nature of the data collected.

Compute PMF for Yucca Mountain drainage (3GFR003)

This activity has not yet started because USBR has been awaiting clarification of location and configuration of surface facilities from the ESF alternatives study. QA certification of PMF software will begin in April in preparation for computation of PMF flow rates. The original planned finish date is still feasible.

Prepare technical procedures on flood inundation (3GFR011)

This activity has not yet started by USBR because of overall uncertainties in the program during the first half of FY91. Refinement of the USBR procedure to satisfy YMP QA requirements will begin in April. The original planned finish date is still feasible.

<u>Quality Assurance</u>

Revise technical procedures for flood data collection (3GFR012)

All technical procedures for streamflow and runoff monitoring are being revised to meet changing QA requirements and reviews. Work is proceeding sporadically in the Las Vegas Office, Nevada District, under guidance of M. Pabst, QA specialist. Progress is being made, but the intense pressure of many YMP QA tasks is delaying completion of the revisions. These procedures are all approved and still usable in their current state.

The finish date is delayed because of demands of other QA tasks, such as records management.

There is no impact on the technical work because the technical procedures are useable in their present form.

Collect, analyze, evaluate FY91 flood data, ongoing (3GFR001)
Staff prepared for and participated in the internal USGS QA audit 91-05 for this activity and other associated activities.

Grade (QA) for site flood and debris hazards (3GFR015)
A study-level grading report (G123321) was completed and approved by the QRB in January 1991. A lower-level, detailed grading package may need to be prepared.

Planning and Operations
Develop analytical schemes for the flooding process (3GFR009)
Literature scanning continues on an ongoing basis to seek up-to-date technology on flood analysis. No other progress has been made, or is required yet, because data collection is ongoing and the amount and types of data collected will control progress on this task. This task will continue at a mild, but uneven pace throughout the duration of the YMP.

Review of available flood-analysis techniques, ongoing (3GFR010)
This activity, ongoing for the duration of the YMP, is geared largely, at this stage of pre-project activity, to literature scanning, sorting, and assembling of newly developing techniques. As with 3GFR009, the review and selection precess of techniques depends to a large extent on the accumulation of usable streamflow data and the nature of the data collected.

Prepare administrative report; FY90 flooding (3GFR006)
Preparation of this brief report will not begin until the bulk of the data are processed and submitted to the LRC, which should be reasonably soon.

Work Performed but not in Direct Support of the Scheduled Tasks
Numerous unanticipated and unplanned tasks have arisen during the last several years and months--particularly during March 1991. They include, but are not limited to, responses to review comments of study plans and the SCP; preparations for QA audits; participation in QA audits; subsequent corrections of audit findings; continually increasing time requirements to prepare monthly and semi-annual progress reports; preparing, processing, and studying QA documents; technical coordination and interchanges of information with other YMP scientific investigators; searching for replacements for the YMP PI for three separate study activities; etc. These major impacts and energy drains cause serious delays and impacts on the production of technical products and thereby ultimately delay or derail deliverables. However, the erratic, unpredictable, and diffuse nature of these work-plan changes are inherently difficult to quantitatively or economically assess on a daily or monthly basis.

Approximately 20 hours were spent in preparation for and participation in the USGS internal audit in Las Vegas, February 25-27.

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 1.2.3.6.2.1.4 Paleoenvironmental History of Yucca Mountain
Principal Investigator - J. Whitney

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 8.3.1.5.1.4.2 Surficial deposits mapping of Yucca Mountain area 0G3621I1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks
J. Whitney worked on the "Erosion rates" manuscript with C. Harrington, LANL.

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 - J. Stuckless

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 8.3.1.5.2.1.1 Regional paleoflood evaluation 0G3622A1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Research paleoflood analysis methods (3GQH006A)

Literature review is an ongoing process of this study that will continue to the end of the activity. Articles describing techniques pertinent to the activity are included in our YMP technical library.

Revise Coyote Wash report (3GQH005A)

This report is over 95% complete, but editorial deficiencies need correction. It has been approved by DOE. USGS editors have noted some deficiencies that need correction. However, time has been unavailable to address the deficiencies because of other high-priority tasks.

Quality Assurance

Grade (QA) paleoflood activities (3GQH009A)

QA grading cannot be done until technical procedures and/or a QA investigative strategy is complete. QA procedures are stalled because of a lack of time to address the problem and until DOE review of the study plan has been completed.

Planning and Operations

Study plan submitted to YMP (G038)

The study plan was submitted to YMP-HIP in mid-September 1990. It was submitted to DOE on September 25, 1990. It was allegedly transmitted to reviewers selected by DOE on January 31, 1991.

Update/review (DOE) study plan (3GQH001A)

Evaluation and resolution of DOE comments on the study plan revision for paleoflood studies cannot begin until comments are received from DOE. The study plan was transmitted to DOE-selected reviewers on 1-31-91.

Develop technical procedures (3GQH007A)

Technical procedures and technical consultation on this talk have not been addressed for two reasons: there has been no time to write them; and until DOE review is complete and the general strategy for the investigation is approved, it is probably premature to prepare scientific procedures.

Work Performed but not in Direct Support of the Scheduled Tasks

Numerous unanticipated and unplanned tasks have arisen during the last several years and months--particularly during March 1991. They include, but are not limited to, responses to review comments of study plans and the SCP; preparations for QA audits; participation in QA audits; subsequent corrections of audit findings; continually increasing time requirements to prepare monthly and semi-annual progress reports; preparing, processing, and studying QA documents; technical coordination and interchanges of information with other YMP scientific investigators; searching for replacements for the YMP PI for three separate study activities; etc. These major impacts and energy drains cause serious delays and impacts on the production of technical products and thereby ultimately delay or derail deliverables. However, the erratic, unpredictable, and diffuse nature of these work-plan changes are inherently difficult to quantitatively or economically assess on a daily or monthly basis.

SCP 8.3.1.5.2.1.3 Evaluation of past discharge areas 0G3622B1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Determine discharge mechanism in hydrologic units (3GQH034A)

Data interpretation was conducted by K. Kolm, who is evaluating the data model for input.

A report was prepared that uses the parameters from discharge mechanism activity:

Kolm, K. and Downey, J., in U.S. Geological Survey review, Conceptual model of the future ground-water flow system, southwestern Nevada and Death Valley, California: U.S. Geological Survey Bulletin XXX.

Reduce vegetation and statistical analyze data (3GQH006)

Field plant transects have been completed, but the statistical analysis and map preparation have been delayed. The statistical data are being finalized by J. Emerick.

Statistical analysis of vegetation data and map preparation is delayed by an unanticipated loss of staff.

Analyze soil samples, chemical spectrometer (3GQH001)

A new technical strategy was developed to directly relate soil chemistry to remotely-sensed spectral responses. Chemical spectrometer data is scheduled to be collected in June 1991 by K. Kolm, F. D'Agnese, and C. Faunt as a part of their field activities.

Copy/scan geologic maps (3GQH040)

Techniques for the scanning of geologic maps were developed and tested. Primary scanning of geologic maps began.

This activity is space and labor intensive; as of this time, the equipment consists of one light table and a maximum use of five days a month at the USGS GIS lab.

The intention is to increase production of copying geologic maps this summer with student help.

Input maps to arc-info/spans (3GQH041)

Data on depth of basement, soils, surface elevation, fracture systems, faults, and lineaments were entered into SPANS for the Amargosa Desert.

Plan and conduct field trip to wet and dry playas (3GQH014)

Samples from 33 dry playas were collected from three states; eight in New Mexico, six in Nevada, and 19 in California.

Wet playas could not be sampled in January and February because they were too wet due to excessive precipitation. Wet playas will be sampled during July and August after they have dried out some.

Conduct field trip to modern springs (3GQH015)

Samples were collected from three springs in Nevada and five springs in the Death Valley area.

Analyze flora and fauna for wet and dry playas (3GQH026)

R. Forester (GD) is analyzing flora and fauna samples collected from dry playas in January. The work is expected to be on schedule for the samples collected for dry playas.

Quality Assurance

Analyze soil samples, chemical spectrometer (3GQH001)

A management agreement is being prepared with the GD Branch of Geochemistry to analyze collected field samples.

After the departure of R. Talbot to the Bureau of Reclamation, the preliminary spectral response data collected by Talbot was not found to be adequately QA'd.

Planning and Operations

Determine discharge mechanism in hydrologic units (3GQH034A)

The accuracy of the parameters needed to run 3-D models is being evaluated.

Input maps to arc-info/spans (3GQH041)

Staff for this activity is the same as activity 3GQH040. We had anticipated converting existing job slots for this activity, but funding restrictions eliminated the jobs.

Plan and conduct field trip to wet and dry playas (3GQH014)

Samples from wet playas will be collected in late summer.

Work Performed but not in Direct Support of the Scheduled Tasks

An estimated 32 hours were spent on responses to AFR-1901-01 through 06 and preparation and revision of the Management Agreement between the USGS Yucca Mountain Project and the USGS GD Branch of Geochemistry Laboratory.

SCP 8.3.1.5.2.1.4a Analog recharge sites 0G3622C1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Conduct chloride leaching test (3GQH013C)

T. Oliver has started a leaching experiment which should continue until June 1, 1991. P. McKinley has been working on literature review and evaluating mass transport methods. McKinley contacted Z. Peterman, R. Zielinski, G. Foord, and L. Jackson about dissolution and ion diffusion in glass as a means of ion mass transport. Oliver finished an experiment to determine the effects of tuff leaching on the pH of the leaching solution.

This work has been delayed due to the time required in to secure qualified laboratory. A management agreement should be in place by April 1, 1991, which will allow experimentation to start. Two months is the minimum time for one leach total leaching as presently conceived. The summer field session will start the first of June, which will stop further leaching work until the end of the field work in the fall. This will cause a delay in the completion of the chloride-ion method of determining recharge.

Prepare data report on Kawich: FY85-90 (3GQH015C)

Data is in preliminary form. NWIS, ADAPS contains the data. The data has not been checked for errors. C. Mallon is working a correlation of analog weather data with other local weather stations.

Prepare data report on Stewart Creek: FY85-90 (3GQH016C)

Data is in preliminary form. NWIS, ADAPS contains the data. The data has not been checked for errors. C. Mallon is working a correlation of analog weather data with other local weather stations. T. Oliver evaluated the use of Radsol as compared to actual solar radiation for short

time periods.

Prepare technical procedure/scientific notebook for ET (3GQH025C)

J. Emerick has the first draft complete of the scientific notebook plan Measurement of Evaporation using Bowen ratio methods. This plan has been given to S. Frans for typing and logging into the review system.

The proposed schedule was too optimistic. The new finish date is by June 1, 1991, which is the proposed beginning of field work. If this date is met, there will be no negative impact on the program.

Collect hydrologic data from remote sites (3GQH011C)

M. Salamon worked on the satellite transmission from a remote site. The data has been coming in with some errors but has been recoverable.

Prototype testing of ET equipment (3GQH023C)

Prototype testing will not take place due to the lack of time. Some field testing was accomplished during the summer of 1990, but it was not completed because of the lack of funds and the delay in release of funds designated for capital equipment. The ET equipment will be deployed to the field in June without further testing. The impact of this will be that field work ma be hampered by unexpected problems that would have been worked out during prototype testing.

Quality Assurance

Prepare technical procedure/scientific notebook for ET (3GQH025C)

J. Emerick has the first draft complete of the scientific notebook plan Measurement of Evaporation using Bowen ratio methods. This plan has been given to S. Frans for typing and logging into the review system.

Procure additional ET equipment (3GQH021C)

The purchase of a net radiometer which will replace damaged equipment is in process. This is pending QA certification of the vendor for calibration.

Collect hydrologic data from remote sites (3GQH011C)

Revisions have been made to HP-91, HP-97, HP-183, and HP-198.

Grade QA analog recharge (3GQHB01)

This task has been completed.

Planning and Operations

Procure additional ET equipment (3GQH021C)

The purchase of a net radiometer which will replace damaged equipment is in process. This is pending QA certification of the vendor for calibration.

Work Performed but not in Direct Support of the Scheduled Tasks

Preparation of resume in accordance with DOE QMP-2.02, R5 (P. McKinley) including meetings, reading, and writing. (approximately 3 hours)

Corrections were finished on the report "Chemical analysis of water from selected wells and springs in the Yucca Mountain area, Nevada and southeastern California." (approximately 20 hours)

Group discussion with DOE and NRC representatives on data collected by USGS-YMP for DOE.

(approximately 3 hours)

Management agreement between the Geologic Division and Water Resources Division. (approximately 3 hours)

Huffman Laboratory certification as a vendor for chemical analysis. (approximately 4 hours)

P. McKinley was interviewed by DOE on data collected by the USGS for DOE. (approximately 1 hour)

Data and information requests by I. Friedman (GD) and E. Pendell (GD). (approximately 4 hours)

Lecture by D. Noble from the University of Nevada, Reno. (approximately 3 hours)

Work on the response to SDR 489. (approximately 2 hours)

Monthly status reports -- implementation of the new reporting system, reading, discussing the request, and writing the report. (approximately 8 hours)

SCP 8.3.1.5.2.1.4b Geochemistry of arid-zone infiltration 0G3622E1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Design equipment installation (3GQH009C)

Over ninety percent of the monitoring equipment has been received from suppliers, allowing design of installation to proceed near schedule. Minor modifications will follow field installation.

The finish date has been delayed. Difficulties surrounding obtaining approved calibration sources for some field installations have delayed actual installation of equipment. This, in turn, has delayed development of some of these installations. This may be a continuing problem.

Analyze chemistry and geochronology (3GQH005C)

Analysis has been primarily that of the contractors (University of New Mexico and New Mexico Tech). Geomorphology studies are complete, awaiting the final report. Chlorine 36 studies have begun and preliminary results are in general agreement with the geomorphology.

Install hydrologic monitoring equipment (3GQH010C)

This activity has not begun because calibration, prior to installation, has run into some delays. The most critical delay is the lack of approved calibration sources for some equipment, notably soil moisture monitoring equipment and soil heat-flux plates. These problems are currently being addressed by QA and project staff. Delays beyond six months are not currently anticipated.

Monitor hydrology (3GQH002C)

This activity requires 3GQH010C to be completed prior to initiation, and is therefore also delayed. Delays beyond eight months are not currently anticipated.

Quality Assurance

Grade QA geochemistry of arid-zone infiltration (3GQHB11)

A study/activity-level grading package was submitted to DOE on 12-5-90 and approved by the Quality Review Board on 12-7-90.

Prepare technical procedure/scientific notebook (3GQH008C)

This activity has progressed to submission of the scientific notebook to the QA group for comments/approval.

Planning and Operations

SCP 8.3.1.5.2.1.5 Studies of calcite and opaline silica vein deposits 0G3621D1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Analyze stable isotopes - deposits of known origin (3GQH0048)

J. Whelan continued stable isotope work on drill core samples recently obtained from the SMF. D. Vaniman and B. Carlos, from Los Alamos, visited J. Whelan and took some subsamples for mineralogic and chemical analysis (as prescribed in the recently executed MOU between the USGS and LANL).

Analyze U-series from S Canyon and W Wash samples (3GQH360)

D. Muhs continued U-series work on mineral separations of calcite from the Crater Flats localities as well as microsamples from blocks from Trench 14 that have been studied petrographically by D. Vaniman and others at LANL.

Conduct workshop and sampling trip near Yucca Mountain (3GQH001B)

Z. Peterman and co-workers completed a sample collecting trip for Paleozoic carbonates around the Test Site and Bare Mountain. The samples will be used to look for evidence of interaction with fluids in a variety of Tectonic settings and at the gold mine at Bare Mountain.

Samples from the February collection trip arrived and have been logged in. Paper work for all previously collected samples has been completed and sent to the SMF.

Quality Assurance

Planning and Operations

The XRF unit in Building 21 is down for repairs and will be out of service for at least two weeks.

The uncertainty of the future direction or even the existence of the project and consequent discussions has greatly reduced productivity of project personnel during the past month. Hopefully as we reach resolution is reached, morale and productivity will be revived.

Work Performed but not in Direct Support of the Scheduled Tasks

J. Stuckless gave two lectures on radioactive waste disposal at Amherst College. One lecture, for geology students, focused on geologic aspects; the other lecture was more general and had a college-wide audience.

WBS 1.2.3.6.2.2.2 Future Regional Hydrology due to Climate Changes

Principal Investigator - J. Stuckless

OBJECTIVE

To characterize the impacts of potential future climate changes on the regional and site surface-water system, the site unsaturated zone hydrology, and the regional and site saturated zone hydrology. (SCP Study 8.3.1.5.2.2)

SCP 8.3.1.5.2.2.1 Analysis of future surface hydrology due to climate changes 0G3622F1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Quality Assurance

Planning and Operations

Develop study plan (3GFH001A)

The study plan on future hydrologic conditions due to climate change was revised following technical review. The first submittal to DOE for review was made on January 16, 1991.

Follow-up and revise study plan (8315221) (3GFH010A)

This activity is delayed because DOE review comments have not yet been received. The overall schedule could be delayed.

Work Performed but not in Direct Support of the Scheduled Tasks

The PACS schedule and work scope were reviewed and revised in response to FY91 budget reductions. (approximately 12 hours)

Time was also spent on YMP Health and Safety Training (approximately 11 hours), Project orientation and file transfer (approximately 16 hours), and QA reading assignments (approximately 16 hours).

SCP 8.3.1.5.2.2.3 Evaluation of possible future changes in climate and regional geologic framework on regional saturated-zone hydrology

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

GSIS development maps and data sets 1 (3GFH001C)

Staff (a) started scanning geologic data/maps and data reduction; (b) conducted evaluation and debugging of SPANS-GSIS software; (c) reviewed and revised several reports and papers on 3-D conceptual models of future regional saturated zone; and (d) completed the development of the computer program SNODIF2 for evaluation of isotopic content of meteoric and recharge water to determine climatic conditions.

Progress on the GSIS development is delayed because of lack of personnel and data base support/equipment. Because of insufficient resources, plans have been revised to concentrate only on GSIS development necessary to facilitate regional 3-D modeling of the saturated zone.

GSIS development maps and data sets 2 (3GFH002C)

Phase two of GSIS development is delayed because of lack of personnel and data base support/equipment. The planned start is revised to 4-1-91.

Quality Assurance

Develop QA software for GSIS; phase 1 (3GFH015C)

Inquiries were made to the QA Office and the Software Configuration Control Committee to ascertain the QA documentation requirements for the GSIS software.

Develop QA software for GSIS; phase 2 (3GFH017C)

The QA Office and the Software Configuration Control Committee ruled that the GSIS

software is exempt from the documentation requirements of QMP-3.03 because the software is a licensed and proprietary, commercial-grade software package. Therefore, no software QA documentation needs to be developed.

Planning and Operations

Prepare draft study plan for YMPO (3GTFH019C)

The study plan draft was prepared, technically reviewed, revised, and submitted to DOE January 16, 1991.

Study plan submittal was delayed because additional time was needed to respond to technical review.

Review (DOE) of study plan (3GFH020C)

DOE review of the study plan began in late January.

DOE review of the study plan is delayed because of late submittal by the USGS.

Update revision of study plan (3GFH021C)

The revision of the study plan has not started because review comments have not been received from DOE. Start date is unknown.

GSIS development maps and data sets 1 (3GFH001C)

Staff ordered and received a 0.6 GB Intergraph mass-storage device for the GSIS data base system.

WBS 1.2.3.7 Resource Potential

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; and 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

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 - J. Bergquist

OBJECTIVE

To identify and assess the mineral and energy resource potential at the proposed repository site at Yucca Mountain; to conduct a geochemical sampling program for precious, base, strategic metals, energy resources, and industrial minerals; and to assess the potential for geothermal energy and hydrocarbon resources and the potential for undiscovered resources and future exploration. (SCP Study 8.3.1.9.2.1)

SCP 8.3.1.9.2.1.5 Mineral and energy assessment of the site, comparison to known mineralized areas, and the potential for undiscovered resources and future exploration 0G3721E1

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Collect data on geology and geochemical data (3GNR001B)

Worked on collection of geochemical and geological data from literature and data bases at the USGS.

Collect data on geology and geophysical data (3GNR001C)

Worked on collection of geophysical data from published sources, including maps, computerized files. Compilation of geophysical work ongoing or planned under other YMP Activities to see how Mineral Resources geophysical work interfaces with it.

Collect data on geology and mineral resources (3GNR001A)

Worked on collection of geological and mineral resource information from published sources. Began preparation of map to show relationship of mines and geology surrounding the region of Yucca Mountain. Anticipated scale is 1:250,000.

Collect data on geology and hydrocarbon (3GNR001D)

Planned acquisition of Amstrat logs for evaluation. Worked on compilation of existing data from published and unpublished sources.

Quality Assurance

Planning and Operations

Work Performed but not in Direct Support of the Scheduled Tasks

QMPs and APQs and revisions thereto were received, read, certified, and filed.

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 socioeconomics 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.

WBS 1.2.5.2 Licensing

OBJECTIVE
To support DOE by providing Project coordination and support of NRC interactions by providing input related to site aspects of proposed NRC regulation changes, and evaluate the impact of the regulation changes on the site activities, strategies, and plans; to support DOE/HQ in the development of site technical position papers by synthesizing site and site performance assessment technical information into Project positions; to develop draft position papers which support these positions; to perform technical evaluation of site data and related reports, technical reports, and conclusions, and draft position papers; to coordinate study plan review; to support the preparation of the semi-annual progress report for site investigations and assessments; and to coordinate and perform technical reviews of the site characterization program.

WBS 1.2.5.2.1 NRC Interaction Support
Principal Investigator - L. Hayes

OBJECTIVE
To support DOE interactions on the site program with NRC by providing information, coordination, and support within the Project.

ACTIVITIES AND ACCOMPLISHMENTS
P. Nelson attended a meeting with other YMP PIs and representatives from NRC and DOE regarding the release of data.

J. Czarnecki attended a briefing for the NWTRB in Denver and provided a statement on model uncertainty following a presentation by J. Robertson (Hydrogeologic Inc.) on the saturated zone.

WBS 1.2.5.2.2 Site Characterization Program
Principal Investigator - W. Dudley, Jr.

OBJECTIVE
To support the DOE in the completion of the Site Characterization Plan; to provide ongoing technical planning and support of site characterization activities; and to integrate results into site characterization activities and programs as appropriate, monitor each site program, and serve as the interface between the principal investigator and the DOE/HQ.

ACTIVITIES AND ACCOMPLISHMENTS
Comments on the SCP were received from the State of Nevada and draft responses were prepared and submitted:

196 unsaturated zone SCP comments were distributed to investigators on March 7 and 143 completed responses were received by March 31.

C. Boughton spent approximately 24 hours responding to the State of Nevada's comments on the SCP.

Approximately 40 hours were devoted by the surface based borehole project to preparing response to the State of Nevada comments in March.

P. Nelson responded to State of Nevada comments on the SCP.

R. Spengler responded to and submitted responses to SCP comments made by the State of

Nevada.

G. LeCain spent two hours on SCP comment responses to the State of Nevada dealing with Air-K testing.

J. Sass answered a State of Nevada comment on the SCP, concerning the applicability of temperature logging during drilling.

Approximately 32 hours were spent by mineral resources staff on comment response to the State of Nevada.

W. Langer participated in the Integration Group (IG) effort for response development and review for the State of Nevada comment package on the SCP and coordinated responses for the geologic/geophysical comments.

Staff from the SZ hydrochemistry project responded to NRC comments on parts of the SCP relevant to study 8.3.1.2.3.2 and began response to the State of Nevada comments on parts of the SCP relevant to study 8.3.1.2.3.2.

J. Czarnecki provided responses to State of Nevada comments on the characterization of the regional ground-water flow system.

The regional paleoflood evaluation study spent approximately eight hours on response to the State of Nevada review comments on the SCP.

Responses were prepared to about 12 State of Nevada comments on surface-water studies described in the statutory SCP in March.

Nine responses were prepared by site flood and debris hazards study to State of Nevada review comments on the SCP.

Hydrology M&I staff assisted in the SCP comment resolution process. Approximately 32 hours were devoted to this task.

WBS 1.2.5.2.5 Study Plan Coordination
Principal Investigator - L. Hayes

OBJECTIVE
To coordinate the preparation review and revision of SCP Study Plans.

ACTIVITIES AND ACCOMPLISHMENTS
Additional information was needed to resolve traceability of personal and written communications in Study Plan 8.3.1.2.2.3.1; this was provided.

Approximately 40 hours were devoted to final comment resolution of the study plan on Surface Based Studies - Percolation in the Unsaturated Zone in January 1991.

Comment resolution, SP 8.3.1.9.2.1.

Staff responded to Project and HQ editorial, management-integration, quality, and technical review comments on SP 8.3.1.2.3.2, R0.

J. Czarnecki provided responses to DOE HQ comments on SP 8.3.1.2.1.4, "Regional Hydrology System Synthesis and Modeling."

Nine comments, consisting of over six pages of text, were received from the State of Nevada on Study Plan 8.3.1.16.1.1. Over seven pages of text were generated by the PI in response to these comments in March.

S. Keller transmitted a HIP study plan status report to W. Causseaux March 27. Since the February 26 SAIC/Golden status report, the following has been learned about study plans that are in the DOE approval process: SP 8.3.1.2.1.1 was approved by DOE March 13; SP 8.3.1.2.2.1 (Unsaturated-zone infiltration) was transmitted from OCRWM to NRC March 1; and SP 8.3.1.2.3.1 (Site saturated-zone ground-water flow) was transmitted from OCRWM to NRC March 7.

Study Plan 8.3.1.2.1.4 (Regional hydrologic system synthesis and modeling) - S. Keller assisted J. Czarnecki with author responses to DOE comments, which were received by the author March 8.

Study Plan 8.3.1.2.3.2 (Saturated-zone hydrochemistry) - S. Keller assisted B. Steinkampf in the completion (March 25) of author responses to DOE review comments. Author responses will be transmitted to the reviewers in advance of the comment resolution workshop, tentatively scheduled for late April.

WBS 1.2.5.2.6 Semi-Annual Progress Reports
Principal Investigator - L. Hayes

OBJECTIVE
To provide support to DOE/HQ for the development and preparation of the Site Characterization Semiannual Progress Reports.

ACTIVITIES AND ACCOMPLISHMENTS
Input was prepared for the Technical Status Report for September 1990 through March 1991.

WBS 1.2.5.4 Environment

OBJECTIVE
To identify data requirements; to collect required environmental field data; and to prepare topical data reports.

WBS 1.2.5.4.8 Water Resources
Principal Investigator - R. La Camera

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
A status report for the water-resources monitoring program was prepared for DOE. The report summarized activities for the period February 4 through March 4, 1991.

L. Hayes, R. Ritchey, W. Carswell, W. Scott, D. Beck, and R. La Camera attended a mid-year technical and financial review of the monitoring program in Las Vegas on March 13. The review was requested by DOE, with W. Dixon, K. Grassmeier, M. Dussman, and G. Fasano attending. Dixon requested a

follow-up meeting to update DOE on the status of a Quality Assurance Grading package, technical procedures, and work planned for the balance of the fiscal year. This meeting was held on March 29 with the status of QA requirements and work plans for the balance of the fiscal year agreed upon.

R. La Camera, in consultation with D. Beck, prepared estimated costs and work plans for fiscal years 1992 to 2001, a revised work plan for 1992 (based on projected reductions in funding for that year), and a work plan and budget for the remainder of the 1991 fiscal year.

M. Pabst and G. Fasano modified the Quality Assurance Grading package to reflect removal of the water-resources monitoring program from the QAL. The package was reviewed and approved by R. La Camera, and forwarded to the USGS-YMPB for review and/or approval.

R. La Camera reviewed existing YMP technical procedures relevant to the water-resources monitoring program, and identified procedures requiring modification or preparation in consultation with M. Pabst. Pabst identified training requirements for personnel involved with the monitoring program, and developed a tentative schedule for meeting training requirements.

Estimated costs for work elements not initially associated with the water-resources monitoring program (eg. developing/testing of a well to be drilled south of well J-12 and adding water-level access to Army well #1) will be prepared as additional information on responsibilities, tasks, and timing become available.

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 1.2.9.1 Management and Integration

OBJECTIVE
To provide overall management of the Yucca Mountain Project including: technical integration and interaction with other OCRWM Program elements.

WBS 1.2.9.1.1 Management
Principal Investigator - L. Hayes

OBJECTIVE
To provide overall management of the Yucca Mountain Project including budgeting and financial analysis, progress reporting, support to HQ management activities, training, and overall Project integration.

ACTIVITIES AND ACCOMPLISHMENTS
Reading assignments were distributed to assigned YMP-USGS personnel for QMPs -2.07, R1 and -2.08, R1. A highlight sheet for the QMP-2.08, R1 reading assignment was prepared. Arrangements were made for question and answer sessions for both QMPs.

Orientation video tapes and reading assignments were distributed to personnel per management's requests. Participants requiring unescorted access to Yucca Mountain were scheduled for DOE's General Employee Training.

Per a request from C. Rehkop, DOE Training Officer, review comments were prepared regarding the draft DOE Training Management Plan. Additionally, an article for a DOE training newsletter was prepared and submitted to Ms. Rehkop.

During the 03/25/91 DOE Surveillance, the Training Coordinator provided instruction information regarding SDRs 135, 143, 145, and 331.

Monitoring open instruction assignments continues through the Open Items Committee. The emphasis on this type of follow-up has been effective in nearly eliminating overdue assignments and reducing the number of open assignments.

Site security clearance was arranged for a USBR driver to transport equipment from Phoenix to Mercury for C. Peters.

WBS 1.2.9.1.4 Records Management
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
Records/Record Packages prepared and submitted to the CRF: 17 QA packages consisting of 3,154 pages; four cited reference packages with a total of 1,820 pages and three maps; and one manuscript package, OFR 90-354 by M. Whitfield, containing 2,662 pages (total pages 7,636).

This month 425 individual QA documents and 12 packages were received into the LRC; 30 Fix-its were issued and 15 were returned; 33 rolls of develocorder film and three magnetic tapes were picked up at the Earthquake Center; 241 rolls of develocorder film were sent to Security Archives; and one new journal article, by J. Rosenbaum, was received in the LRC.

The Records Coordinator attended two records management "Training Requirements Focus Group" meetings in Las Vegas. The task to identify training requirements for records management in upper-tier Project documents was completed.

P. Warner is preparing a transition plan for the identification and collection of Geologic Division records and technical data materials.

A "Surrogate Record" form has been prepared for use by LRC, SQA, Data Management, and other personnel to adequately document the location of records which will not be submitted to the CRF (e.g., QMP-2.07 Instruction records).

The following controlled documents were distributed:

QMP-2.07, R1	YMP-USGS Instruction
QMP-2.08, R1	Non-Federal Contractor Personnel Qualification
QMP-16.01,R3-M1	Control of Corrective Action Reports
QMP-16.03,R2-M1	Trend Analysis
GP-06, R3	Geodetic Leveling and Quadrilateral Surveys

HP-91, R3	Collection and Field Analysis of Surface-Water Samples
HP-97, R1	Measurement of Temperature and Relative Humidity Using a CSI 207 Temperature and Relative Humidity Probe
HP-210, R0	Method for Cursing Tuff Needed for Tracer Tests

The YMP-USGS Controlled Document Configuration Report is 99% complete.

WBS 1.2.9.2 Project Control
Principal Investigator - L. Hayes

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

ACTIVITIES AND ACCOMPLISHMENTS
The Las Vegas activities schedule was revised to match the USGS schedule for PACS input.

Several comparison runs were made on the schedules using different scenarios for changing the drilling schedule interfaces from 3 to 4 rig and back to 3 rig.

Several members of the scheduling department attended a meeting to determine requirements for the Local Records Center. A report was written on the outcome of this meeting and sent to the Water Resources Division of the USGS.

Minor changes continue to be made on the schedules to improve the cosmetic appearance of the printed networks and to make the logic easier to understand.

Programs were written and existing programs were updated to assist in the WAS submittal. Existing programs and datafiles were modified to accommodate the new range of years. New programs were written to generate flat ASCII files of the data which could be transferred electronically to the VAX in Las Vegas. This direct transfer of WAS data had not been done before this year's submittal.

Maintenance was performed on the computer used by S. Reisler at the Parfet building. Problems with the clock and with the BIOS were corrected. A serial port was installed in order to use the 9600 BAUD modem to connect with the VAX in Las Vegas.

The SAIC/Golden actual cost distribution, estimated cost distribution, FTE report, and the USGS cost report for February were compiled. The February actual costs for the USGS were sent to Las Vegas for input into the PACS system. The compilation of the USGS monthly status report for February was completed and the report was edited and submitted to DOE.

Budget information, BO explanations, and projected capital equipment was compiled through FY 1997 for the FY 1993 Work Authorization Submission (WAS) exercise.

All information for the Performance Measurement Baseline (PMB) and the WAS was collected, compiled and submitted to T&MSS by the respective due dates.

S. Barnes submitted monthly cost estimates and FTE usage reports to the USGS and met with N. Stuthmann on March 20 to furnish an update for USBR FY92 Information Resources Short-Range Plan.

All of the FY88 capital equipment procurements being done by USBR have been completed.

WBS 1.2.9.3 Quality Assurance

OBJECTIVE
To establish and implement a Yucca Mountain quality assurance program.

WBS 1.2.9.3.1 Quality Assurance Program Development

Principal Investigator - T. Chaney

OBJECTIVE
To establish and maintain the QA program descriptions.

ACTIVITIES AND ACCOMPLISHMENTS
QMP-8.03, R4 was submitted for Division Review. Concurrence drafts were prepared and distributed to the reviewers for QMP-3.04, R4 and QMP-3.10, R2. A draft of QMP-16.04, R0, Quality Deficiency Reports was completed.

One modification to QMP-3.03, R2 and an ICN to the QAPP-01, R5 were prepared and submitted to the QA Office for approval. QMP-5.03, R6 is currently in QA Review.

Comments received for QMP-3.03, R3 are being addressed by the Software Quality Assurance committee. QMP-3.14, R4 is also being handled by this committee, with plans to incorporate it into the new revision of QMP-3.03.

Met with Nevada District personnel to prepare for the environmental monitoring task moving under the YMP-USGS QA program. Assisted in the preparation of a graded QA package for the environmental monitoring activity.

Work continued on implementation of QMP-2.02 Federal Personnel Qualifications. The final process for collecting resumes was worked out, the initial package prepared, and qualification resumes forwarded to USGS Personnel Office, Reston, Virginia, for verification.

The QA Manager attended a follow-up meeting to the QA integration workshop in Denver and reported on an action item to identify licensing requirements for technical products.

D. Appel left the position of QA Manager to become Chief, Hydrologic Investigation Program. T. Chaney will be Acting QA Manager until the position is filled permanently.

A meeting was held on March 26 with C. Warren, MACTEC, and T. Higgins, SAIC, to discuss the scope of the next DOE audit of USGS scheduled for the week of May 20.

The following technical procedures were approved:

GP-06, R3	Geodetic Leveling and Trilateration Surveys
HP-91, R3	Collection and Field Analysis of Surface-Water Samples
HP-97, R1	Measurement of Temperature and Relative Humidity Using a Campbell Scientific, Inc. 207 Temperature and Relative Humidity Probe
HP-210, R0	Method for Crushing Tuff Needed for Tracer Tests

The following technical procedures were edited and returned to HIP as requested:

HP-183, R2	Investigation into the Chloride Ion Leaching from Fresh Rhyolitic Tuff Surfaces
HP-211T, R0	Long-Term Meteorological Data Collection
HP-212T, R0	Method for Locating Fractures within Welded Tuff Using a Miniature Packer System
HP-213T, R0	Long-Term Hydrological Data Collection
HP-214T, R0	Measurement of Evapotranspiration Using Bowen Ratio Methods
HP-215T, R0	Measurement of Evapotranspiration Using Eddy Correlation Methods

On March 6, 1991, a copy of USBR's yearly Management Assessment Report for the YMP-USBR Quality Assurance Program was transmitted to the USGS QA Office.

J. Kinney provided Quality Assurance Program indoctrination to USBR Materials Engineering Branch personnel on March 19.

WBS 1.2.9.3.2 Quality Assurance - Audits and Surveillances
Principal Investigator - T. Chaney

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

ACTIVITIES AND ACCOMPLISHMENTS
DOE conducted a surveillance of USGS in Denver during the week of 03/25/91. DOE verified corrective actions for several SDRs (135, 143, 145, 331, 489, and 556), and checked the implementation of QMPs -2.02, -2.07, and -2.08.

Audit USGS-91-05 covering five HIP activities in Nevada was conducted 02/25/91 through 03/08/91.

Audit Plan USGS-91-09 for Radiation and Energy Balance Systems, Inc., was submitted.

Audit USGS-91-08 of LI-Cor, Inc., was conducted and the report submitted to the QA office. NCR-90-33 was closed as a result of this audit.

Audit USGS-91-07, of the Soil Test Laboratory at CSU, was conducted. Several areas of concern were identified and follow-up actions are being taken.

The Audit Report USGS-91-06 for Hewlett-Packard Instruments was submitted.
Special Investigative Reviews were performed for deficiency documents AFR-9103-05 and NCR-91-08.

Annual vendor evaluation reports USGS-91-E02, QA Balance Services and USGS-91-E03, Campbell

Scientific, Inc. were completed. Reports for 3 Special Investigative Reviews were completed and the subject deficiencies closed.

Review of procurement records for USGS-NCR-90-09 and DOE/YMP SDR 135 continues. Approximately 530 requisitions and related procurement or receiving records have been reviewed. The majority of procurement packages were acceptable and record transmittals were prepared as required by QMP-17.01. Several new Nonconformance Reports were generated to document deficiencies noted with inadequate/ missing reviews or documentation.

The Open Items Committee met on a bi-weekly basis in March. The number of open items decreased during the month of March indicating progress toward resolution.

The quarterly issue of the Approved Vendors List (AVL) was prepared.

USBR submitted a Surveillance Response for Observation No. 1 from Surveillance USGS-91-S10 to the USGS QA Office on March 21, 1991.

WBS 1.2.9.3.3 Quality Assurance - Quality Engineering
Principal Investigator - T. Chaney

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

ACTIVITIES AND ACCOMPLISHMENTS
The SCM Librarian has received, reviewed, and/or processed 106 items in accordance with QMP-3.14. This includes updating the Configuration Status Log, the SCM Document Tracking database, and the Directory of Users. Technical Contacts have been notified upon the receipt of SQA Documentation and upon SCM Baselining of Software Products. An Agenda and Minutes were prepared and distributed for the 03/28/91 meeting of the CCC. A CCC Review Plan and Report was completed for each of the four CCC Reviews conducted at that meeting.

A Supplemental Response was prepared on behalf of the TPO for NCR-91-13. The response included an evaluation of discrepancies between the SQAP and SQA QMPs (-3.03 and -3.14). A Supplemental Response was prepared on behalf of the TPO for NCR-91-12, which involves YMP use of "Existing Software" for which SQA Documentation is incomplete. The response included a summary of investigative actions completed to determine the scope of the problem and an evaluation of responses received as a result of the investigative actions.

A memorandum was prepared regarding SQA guidance for purchased software. Comments were prepared regarding changes to Section 19 of the QARD and input was provided regarding the reviews of SQA documentation.

WBS 1.2.9.3.4 Quality Assurance - Quality Overview
Principal Investigator - T. Chaney

OBJECTIVE
To provide reviews, analysis, and interpretations of QA requirements and application of QA to technical and scientific disciplines.

ACTIVITIES AND ACCOMPLISHMENTS

The February Open Items and Trend Analysis Report was written. The format for this report was significantly changed.

Nine technical procedures and/or scientific notebook plans were reviewed.

Assisted in the preparation of the 1990 Management assessment of the USGS QA program. The first draft of the report is in review.