

Department of the Interior
United States Geological Survey
YUCCA MOUNTAIN PROJECT
Monthly Highlights and Status Report
December 1990

DISCLAIMER

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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
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 Society 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
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
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
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	Eurocan 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	Electronic 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
ESQAT	Earth Science Quality Assurance Team
ESR	electron spin resonance
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
GCM	Global Climate Model
GCP	Geochronological Procedure
GD	Geologic Division
GEOEAS	Geostatistical Environmental Software
GETT	grants equal to taxes
GID	Ground Water Site Investigation
GIS	Graphic Information System
GOCO	government-owned contractor-operated
GOES	Geostatistical 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
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
IFS	Iterated Function Systems
IGT	Institute of Gas Technology
ICWG	Interface Control Working Group
IDAS	Integrated Data Acquisition System
IDS	Information Data System
IFS	Iterated Function System
IG	Integration Group
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
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	<i>Journal of Geologic Research</i>
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
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
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
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	<i>Nuclear Waste News</i>
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
PACS	Planning and Control System
PAGEOPH	<i>Pure and Applied Geophysics</i>
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
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
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
QAGR	Quality Assurance Grading Report
QALA	Quality Assurance Level Assignment
QALAS	Quality Assurance Level Assignment Sheet

QAM	Quality Assurance Manager
QAPO	Quality Assurance Project Officer
QAP	Quality Assurance Program
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
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
SEPBD	Site and Engineering Properties Base Data
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
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
TDD	Test Descriptions Document
TDF	task definition form
TDR	time domain reflectometry
TDS	total dissolved solids
TEF	Test and Evaluation Facility
TIC	Technical Information Center
TM	thematic mapper
TP	Technical Procedure
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
USBR	U.S. Department of the Interior Bureau of Reclamation
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife 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
WRD	Water Resources Division
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 1.2.1.3 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 modification to QMP-8.03, R3, Identification, Control, and Transmittal of Technical Data, was written. A follow-up preliminary draft for QMP-8.03, R4 was prepared.

A meeting was held with H. Nunes, LANL, to discuss the DOE QA Workshop efforts on resolving training/indoctrination issues.

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.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

R. Craig attended (a) the Prototype Management Team Meetings on December 7 and 14; (b) the Sample Overview Committee (SOC) meeting at the Sample Management Facility on December 4 as the USGS representative, where core-sample requests from I. Yang and J. Stuckless were approved by the SOC; (c) the Prioritization Task meeting of Testing Experts as an invited expert on December 12 and 13 in Palo Alto, California; (d) the USGS CASY meeting in Denver on December 11; (e) a Sandia National Laboratories presentation to DOE/YMPO personnel on an alternative ESF prototype testing location near Creede, Colorado (December 10); (f) a briefing (December 17) at the NTS by LLNL defense personnel on downhole video camera equipment they are currently using, as well as a Video Archival Retrieval System (VARS) they use to index some 80,000+ event-

related photographs; and (g) a meeting on the problem of obtaining adequate calibration of NTS contractor geophysical logging tools, requested by P. Nelson (December 10). Participants included personnel from YMPO/DOE, RSN, and SAIC/LV as well as the USGS.

R. Craig gave a presentation on the status of USGS Exploratory Shaft Facility (ESF) testing at the Exploratory Shaft Test Committee meeting December 18.

R. Craig participated in a field trip (December 5) to Yucca Mountain crest to select proposed prototype borehole location near the south end of Yucca Mountain. Other participants on the trip included staff members from DOE/YMPO, RSN, and REECO.

R. Craig presented a briefing on the Exploratory Shaft Alternative Study to interested USGS personnel in Denver on December 11.

A draft of "Assessing the Natural Performance of Felsic Tuffs using the Rb-Sr and Sm-Nd Systems-- A Study of the Altered Zone in the Topopah Spring Member, Paintbrush Tuff, Yucca Mountain, Nevada," by Z. Peterman, R. Spengler, K. Futa, B. Marshall, and S. Mahan was submitted to DOE. The paper is to be published in the proceedings of a Materials Research Society Symposium on "Scientific Basis for Nuclear Waste Management."

A draft of "Comment on 'Geomorphic Assessment of Late Quaternary Volcanism in the Yucca Mountain Area, Southern Nevada: Implications for the Proposed High-Level Radioactive Nuclear Waste Repository'" by J. Whitney and R. Shroba was submitted to DOE for approval on December 6.

The following drafts of papers for the International High Level Radioactive Waste Management Conference to be held in Las Vegas next spring were submitted to and approved by the Project Office:

"Isotopic Discontinuities in Ground Water Beneath Yucca Mountain, Nevada" by J.

Stuckless, J. Whelan, and W. Steinkampf

"Geophysical Borehole Logging in the Unsaturated Zone, Yucca Mountain, Nevada" by U. Schimschal and P. Nelson

"Strontium Isotopes in Carbonate Deposits at Crater Flat, Nevada" by B. Marshall, Z. Peterman, K. Futa, and J. Stuckless

"Distribution of Rubidium, Strontium, and Zirconium in Tuffs from Two Deep Coreholes at Yucca Mountain, Nevada" by R. Spengler and Z. Peterman

" $^{40}\text{Ar}/^{39}\text{Ar}$ Laser Fusion and K-Ar Ages of Quaternary Basaltic Volcanic Centers at Crater Flat, Nevada and Cima, California: The Age of the Youngest Volcanic Activity in the Yucca Mountain Area," by B. Turrin and D. Champion

V. Glanzman attended the CASY meeting on December 11 to discuss status of the CASY Bulletin.

The following Technical Procedures were edited and returned to NHP as requested:

HP-91, R1	Collection and Field Analysis of Surface-Water Samples
HP-183, R2	Investigation into the Chloride Ion Leaching from Fresh Rhyolitic Surfaces
HP-199T, R0	Collection of Aquatic Micro-Organisms
HP-209, R0	Method for Preparing Tracers for Additions to a Water Supply System
HP-210, R0	Method for Crushing Tuff Needed for Tracer Tests

A Quality Assurance Grading Report (QAGR) for J. Stuckless, WBS 1.2.3.6.2.2.1, Characterization

of the Yucca Mountain Quaternary Regional Hydrology, was resubmitted to the Yucca Mountain Project Quality Review Board and gained acceptance. Other QAGRs previously submitted will be resubmitted with the equivalent corrections.

Technical procedure GP-10, R1, "Fracture and Borehole Characteristics Logging From Borehole Video Recordings" was approved and submitted to the QA Office for controlled distribution. GPP-01, R2, "Gravity Methods" is in the signature approval process. GPP-18, R1, "Magnetotelluric Measurements" is in QA review.

The following procedures were edited and returned to the authors for further input:

GP-06, R3	Geodetic Leveling and Trilateration Surveys
GPP-11, R1	Magnetic Methods
GPP-20, R2	Measurement of Subsurface Temperatures

A status check was begun on technical procedures that are shown on the Master List of Technical Procedures as being drafted by the authors for longer than six months.

Assistance was provided to G. Perasso, USGS/NMD, in the following areas: reading assignments follow-ups, tracking of calibration status on instrumentation currently in use, up-dating his technical procedure, preparation of a request to place a new vendor on the Approved Vendor's List, preparation of a notebook used for tracking sub-issues of technical procedures, and preparation for the up-coming January field surveillance.

A YMP Quality Assurance Field Checklist is being prepared for the Geologic Division to assist investigators with meeting all applicable QA requirements prior to starting Yucca Mountain field work.

The Geologic Division was assisted with responses to and/or remedial/investigative actions for SDR-489, SDR-554, AFR-9013-02, AFR-9013-08, EA9001-01,R1, CAR-89-09, CAR-90-04, CAR-91-01, CAR-91-03, NCR-90-30, NCR-90-36, and NCR-90-37. Draft NCR-91-11 was prepared for the GD.

An investigation was conducted to determine the outstanding QA requirements that need to be completed before the USGS can proceed with its activities for study 8.3.1.17.4.2, Study Plan for Evaluating the Location and Recency of Faulting Near Prospective Surface Facilities (i.e., Midway Valley). The scope of the investigation was limited to the management agreement between the USGS and Sandia National Laboratories. It was determined that there are no outstanding QA requirements that would hinder the USGS from participation.

Efforts for Surveillance 91-S04 and Audit 91-01 were coordinated for the GD. The Principal Investigator for Relevel Base Station Network was assisted in preparing for the upcoming field surveillance. The GD was assisted in following up on overdue reading assignments and document Transmittal Notices (DTNs), and in assigning attenders to the Health and Safety training given by the DOE.

Assistance was given to J. Stuckless and his personnel in implementing QMP-3.03, R2 to prepare for the CCC Meeting held December 14.

P. Covington was designated the GD representative for and attended the CCC Meeting on December 4.

T. Lippert attended the ESTC meeting December 18 in Las Vegas.

Planning Documents

The NHP review of the following reports (a) "Preliminary Data on Unsaturated Zone Flows at Yucca Mountain, Nevada," by I. Yang; (b) "Prototype Testing of Instruments for Monitoring Water and Tracer Movement in the Proposed Exploratory Shaft Percolation Test at Yucca Mountain," by J. Marvil, S. Doty, E. Kwicklis, F. Thamir, C. Boughton; (c) "Field Testing the Effectiveness of Removing Sulfur Hexafluoride Traced Drilling Air from a Prototype Borehole near Superior, AZ," by C. Peters, P. Striffler, I. Yang, and J. Fararese; (d) "Proposed Algorithm for Determining the Delta Intercept of a Thermocouple Psychrometer Curve," by M. Kurzmack; (e) "Combined Analytical/Numerical Approaches to Solving Fluid Flow Problems in the Unsaturated Zone at Yucca Mountain," by R. Zimmerman, G. Bodvarsson, E. Kwicklis; (f) "Observations on Gas Composition and Flow at Open Boreholes on Yucca Mountain," by D. Thorstenson, E. Weeks, H. Haas, J. Woodward; (g) "Developing a Conceptual Model of Ground-Water Flow at UE-250-hole Complex, Yucca Mountain," by K. Karasaki, M. Lansfeld, M. Grossenbacher, D. Galloway, and A. Geldon; (h) "Evaluation of Detection, Borehole Coring, and Hydrologic Monitoring Techniques," by M. Chornack and J. Marvil; (i) "Study of Fractured Aperture Distribution and Permeability of Fractures," by S. Kumar, R. Zimmerman, and G. Bodvarsson; and (j) "Method Development and Preliminary Results from a One-Dimensional Test Cell Designed for Extraction of Pore Water from Unsaturated Tuff, Yucca Mountain," by J. Higgins, T. Mower, and I. Yang were completed by T. Brady.

Other participant Study Plan 8.3.1.12.2.1 "Meteorological Monitoring Plan for the Yucca Mountain Project" (9/10/90 version) was reviewed by D. Ambos and determined adequate by T. Brady.

Quality Assurance

V. Glanzman (a) reviewed a draft of QMP-3.10, R2, and forwarded comments to the TPO; (b) attended a question and answer meeting on AP-5.1Q on December 3; and (c) attended a meeting December 19 to discuss procedures for modifications to QMPs.

The Technical Procedure Master List was updated and forwarded to the YMP-USGS QA Office as scheduled. Six records packages were prepared and transmitted for approved technical procedures, Quality Management Procedures and/or modifications, and surveillances.

Operations

V. Glanzman attended the "State of the Project" briefing presented by C. Gertz on December 7.

L. Roadway transmitted November and December accounting reports to WRD; and processed, posted and submitted GD YMP QA Level 1 and capital equipment procurement documents to the QA office, USGS YMP LRC, Procurement and Contracts Office, and WRD Offices as required.

T. Lippert continued coordination of hydrologic testing activities; compiled USBR weekly status reports; and coordinated preparation of the November monthly report of USBR activities.

WBS 1.2.3.2 Geology
Principal Investigator - R. Raup

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

S. Mahan completed a USGS Short Course on Carbonates. The training will be valuable in studies involving carbonates of various origins at Yucca Mountain.

Z. Peterman attended the Geologic Division Science Advisory Committee meeting in Reston, Virginia, on December 18 and 19 and participated in a discussion of the Division's involvement in the Yucca Mountain Project.

Ongoing activities centered on calibration of the EDXRF system using USGS standard rock samples, validation of parts of the trace element data base for drill core samples, EDXRF analyses for the calcite/silica activity, laboratory maintenance, and calibration of the #2 mass spectrometer by multiple analyses of standard EN-1 with data collected from ultra-stable signals at different intensities (check for nonlinearity in the measuring circuits).

Verification of 6- to 8-year-old television fracture data from WT boreholes continued in preparation for publication.

Planning Documents

Quality Assurance

Operations

K. Futa, S. Mahan, B. Marshall, and Z. Peterman completed the one-day safety course for Yucca Mountain presented by DOE/Las Vegas.

SCP 8.3.1.4.2.1.3 Borehole geophysical surveys

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

A paper entitled "Physical properties of ash flow tuff from Yucca Mountain, Nevada," by P. Nelson and L. Anderson was revised after Branch review and submitted to V. Glanzman for DOE and USGS-QA review.

Experimental geochemical logs will be acquired in borehole G-2 during late January-February. AWS will first log the hole in January.

The issue of calibration of AWS logging tools was discussed at a meeting in Las Vegas with representatives from SAIC, DOE, and Raytheon. The USGS was assured of support in this area. A criteria letter is required to initiate further work; then funding must be found. Later it was learned that AWS has commenced calibration work on density tools in air-filled holes at their Houston facility.

Planning Documents

Quality Assurance

Operations

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

R. Spengler responded to editorial review comments and submitted camera-ready manuscript entitled "Distribution of Rubidium, Strontium, and Zirconium in tuff from two deep coreholes at Yucca Mountain, Nevada" by R. Spengler and Z. Peterman to editors at the American Nuclear Society. The paper will appear in the proceedings of the "1991 International High Level Waste Management Conference" to be held in Las Vegas. The paper discusses the first-order variability of above mentioned trace elements and of strontium-isotopic data in USW G-1 and USW G-3. The study identifies several conspicuously high concentrations of strontium and zirconium that are interpreted as being a result of either primary compositional variations or of elemental redistribution resulting from intense smectitic alteration.

R. Spengler participated in a three-day meeting, December 11-13, in San Francisco, addressing test

prioritization at Yucca Mountain.

W. Page continued review and updating of current trace-element data base of tuffs at Yucca Mountain.

R. Spengler and L. Nealey attended meetings with the Chief Geologist and with C. Gertz on the status of the Yucca Mountain.

L. Nealey received approval from the Branch of Central Regional Geology to publish an open-file report that describes a Microsoft Excel workspace for modeling combined assimilation-fractional crystallization in igneous systems.

L. Nealey began preparation of a report on the geology of rhyolite lava flows in the northeastern part of the Yucca Mountain site area. These rocks were originally mapped by R. Christiansen and P. Lipman in the sixties. A question has arisen concerning vent areas for flows, and the impact of dikes and feeders for the flows on the hydraulic regime at the north end of Yucca Mountain. One aspect of future field investigations will focus on the possibility that the steep hydrologic gradient is controlled in large part by these features.

R. Spengler and L. Nealey completed an informal review of a Center for Nuclear Waste Regulatory Analyses report entitled "Evaluation of Computer-Assisted Cross Section Balancing Methods for Analysis of Subsurface Fault Geometry in the Vicinity of Yucca Mountain, Nevada: A Pilot Study," by S. Young and G. Stirewalt (1990). Nealey attended a demonstration of the computer program GeoSec, one of the software packages discussed in the report. The demonstration was conducted by GeoLogic Systems, Inc. of Boulder, the developer of GeoSec. GeoSec allows the construction, restoration, and balancing of structural cross sections in an interactive mode. This and other programs could provide USGS personnel with the ability to use both well and surface geologic data in the construction and interpretation of faults at Yucca Mountain. Structural models generated by such programs could allow us to redesign our field data collection programs in response to specific computer models. The computer models could also be used to redesign or modify the systematic and other drilling programs of the Yucca Mountain Project.

Planning Documents

Quality Assurance

L. Nealey continued revisions on GP-18 after an informal review by SAIC/Golden staff and continued with QA reading assignments.

Operations

R. Spengler revised and submitted PACS input to conform with current funding allocations.

R. Spengler and L. Nealey attended YMP health and safety training course, held in Denver on December 10.

SCP 8.3.1.4.2.2.2 Surface-fracture network studies

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Field work continued on fracture outcrop studies at Yucca Mountain. Planned activities include continuation of field work at Yucca Mountain on fracture studies of uncleared outcrops and reduction and manipulation of fracture data.

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Planning Documents

Quality Assurance

Operations

Project personnel completed the General Health and Safety Training course on December 10th.

SCP 8.3.1.4.2.2.4 Geologic mapping of the exploratory shaft and drifts

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

M. McKeown reviewed the specifications for the test pit excavation presently scheduled for January.

M. McKeown and S. Beason attended the ESTC meeting in Las Vegas.

Planning Documents

Quality Assurance

J. Montgomery continued QA documentation of the analytical plotter software, ORIPROGRAM.

Operations

M. McKeown participated in a FY91 budget and PACS exercise for Underground Geologic Mapping and VSP.

Prototype underground geologic mapping testing at the Fran Ridge Test Pits is still on hold because of the lack of air quality permit and funds.

SCP 8.3.1.4.2.2.5 Seismic tomography/vertical seismic profiling

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Modeling G-4 well log data continued during December using ANI90 (formerly ANRAY90). Modeling parameters have been implemented in 3-D to determine sensitivity to fracture content, saturation, fracture orientation, and density. Previous results using "conventional codes", i.e. codes that implement a bulk parameters approach, indicated that the results were sensitive to crack density and orientation. The latest results confirm this with the added result that 3-D polarization analysis may reduce the ambiguity between crack density and matrix anisotropy.

Planning Documents

Preparations for the comment resolution of Activity 8.3.1.4.2.2.5 to be held on December 11 were suspended due to the postponement of the comment resolution meeting. It is anticipated that the comment resolution meeting will be held in January 1991.

Quality Assurance

Confusion regarding two of our software packages, ANI90 and Beam87 was cleared up. ANI90 is the official name for what used to be called ANRAY90, and Beam87 was somehow confused to be RAY87. There is no RAY87, only Beam87.

Reading assignments were completed by various personnel.

Operations

Further input was given to M. McKeown for FY91 budget and for short and long term schedules.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Planning Documents

Study Plan 8.3.1.8.5.2 (Characterization of igneous intrusive features) - F. Singer completed an initial draft of Sections 1, 4, and 5 (including tables and figures) and submitted the document to R. Keefer (USGS-GD) for review.

Study Plan 8.3.1.15.2.2 (Characterization of the site ambient thermal conditions) - F. Singer completed an initial draft of Sections 1, 4, and 5 (including tables and figures) and submitted the document to R. Keefer (USGS-GD).

Quality Assurance

Operations

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

S. Hartzell and T. Van Dreser surveyed sites for deployment of the portable seismometers in Midway Valley.

J. Gomberg presented a poster at the 1990 AGU in San Francisco titled "Seismicity Detection/Location Threshold and Strain in the Southern Great Basin."

J. Gomberg presented a poster at the USGS annual "Expose Yourself to Science" exhibition titled "The Effect of S-Wave Arrival Times on the Accuracy of Hypocenter Estimation."

The evaluation of data acquisition and telemetry systems proposals for the network upgrade were completed.

Technical procedure SP-15, R0, Compilation and analysis of non-instrumental historical earthquake intensities data, reviewed by SAIC/Golden, was approved November 13, 1990.

Planning Documents

Quality Assurance

Work continued on software development and software QA.

Operations

Operation of the Southern Great Basin Seismographic Network continued. All 16 portable seismometer systems and two broadband seismometers were accepted.

FY89 and FY90 capital equipment procurements are proceeding.

Maintenance contracts on the data acquisition/processing system for the entire SGBSN have expired and cannot be renewed.

Several possible archives have been contacted.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

D. Klein worked with reviewers (Branch and QA) on revisions for technical procedure GP-18, R1, Magnetotelluric Surveys.

Planning Documents

Quality Assurance

Operations

SCP 8.3.1.17.4.3.2 Evaluate Quaternary faults within 100 km of Yucca Mountain

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The air-photo interpretation of Quaternary faulting in the western part of Las Vegas 1° X 2° quadrangle was completed.

Planning Documents

Quality Assurance

Operations

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

D. Muhs analyzed carbonate veins from Trench 14 for uranium series. C. Bush continued work on

the new computer system for alpha counting.

Planning Documents

Quality Assurance

Operations

WBS 1.2.3.2.8.4.7 Subsurface Geometry and Concealed Extensions of Quaternary Faults

Principal Investigator - W. Mooney

OBJECTIVE

To provide data on distribution of mass, magnetic gradients, geoelectric features, and seismic velocities and reflections that will aid in evaluating the continuity and geometry of Quaternary faults where concealed by Holocene and late Pleistocene surficial deposits. (SCP Study 8.3.1.17.4.7)

SCP 8.3.1.17.4.7.1 Evaluate intermediate depth (2 to 3 km) reflection and refraction methods and plan potential application of these methods within the site area

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

J. Evans consulted with B. Crowe (LANL) and others on possible deep drilling to investigate postulated continuing volcanism at Crater Flat.

Planning Documents

Quality Assurance

Operations

SCP 8.3.1.17.4.7.5 Evaluate surface geoelectric methods and plan potential application of these methods within the site area

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Efforts were directed toward continuing the draft work on the electrical traverses in the Yucca Mountain area. The draft versions of maps showing all USGS electrical data have been completed and now cross-sections for unpublished lines on DC-electric surveys are being worked on using the dipole-dipole method. D. McNair was temporarily assigned to this work to help get topographic profiles drawn up for these 26 lines, which he finished the end of December.

Planning Documents

Quality Assurance

Operations

WBS 1.2.3.2.8.4.8 Stress Field within and Proximal to the Site Area

Principal Investigator - H. Swolfs

OBJECTIVE

To provide data on the ambient stress at the site and its immediate vicinity and to evaluate to potential relevance of paleostress data to prediction of future stress orientations. (SCP Study 8.3.1.17.4.8)

SCP 8.3.1.17.4.8.1 Evaluate present stress field within the site area

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Planning Documents

Work on the Study Plan, Stress field within and proximal to the site area, progressed.

Quality Assurance

Operations

WBS 1.2.3.2.8.4.12 Tectonic Models and Synthesis

Principal Investigator - K. Fox, Jr.

OBJECTIVE

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

SCP 8.3.1.17.4.12.1 Evaluate tectonic processes and tectonic stability at the site

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

K. Fox, Jr., attended a demonstration of software designed to produce balanced cross-sections, hosted by GeoLogic, Inc. of Boulder, Colorado. A principal topic of the demonstration was a presentation and discussion of a balanced cross-section of Yucca Mountain. Using data from the Scott and Bonk (1984) map of Yucca Mountain, a balanced cross-section was developed, featuring lithic faults merging with a detachment at 4 km depth. Faults must be lithic to accommodate the roll-over structure in the hanging wall, as mapped by Scott and Bonk (1984).

An interpretive report was prepared describing structure as revealed by reflection seismology along line AV-1 in the central and eastern Amargosa Desert.

Planning Documents

Quality Assurance

Operations

WBS 1.2.3.3 Hydrology
Principal Investigator - D. Gillies

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

On December 14, a frontal passage brought the first snow of the season which fell on the northern end of Yucca Mountain. The storage gage network recorded only a spatial average of .01 inch of moisture. Upper Fortymile Wash received the greatest amount at .07 inch. These measurements are estimates at best because the plastic wedges are not designed to accurately measure frozen precipitation. There was not enough snow on Yucca Mountain to get a ground measurement, most had drifted. However, the mesas of the northern Nevada Test Site received inches of snow.

A meeting of the meteorology working group was held on December 17.

The test of various types of oils to prevent evaporation from the collection gages continued. The oils being tested are vegetable, mineral, and two viscosities of silicone.

The calibration of tipping-bucket raingages continued.

D. Ambos prepared a talk to be given at the January 1991 meeting of the Southern Nevada Chapter of the American Meteorological Society.

Planning Documents

J. Hevesi and A. Flint worked with EG&G to finalize the figures in USGS-YMP Study Plan

8.3.1.2.1.1, Characterization of meteorology for site and regional hydrology. Comment resolution was completed except for two reviewers. These will be completed by January 4, 1991.

D. Ambos completed the USGS review of YMP participant Study Plan 8.3.1.12.2.1, R0, Meteorological monitoring plan for the Yucca Mountain Project.

Quality Assurance

All required QA reading assignments were accomplished.

Operations

The monthly progress report for November was completed.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

D. Beck, D. Bauer, and R. Carmen reflagged planned streamgage sites in and about Yucca Mountain on December 3-5. Reflagging efforts were made to assist and expedite required environmental and cultural surveys by DOE contractors.

D. Beck and D. Bauer reconnoitered and flagged potential streamgage sites in the Upper Fortymile Wash Watershed on December 12 and 13. These sites will also be included in the listing of sites for DOE requiring environmental and cultural surveys.

On December 14, copies of the raw field notes for the regional surface-water monitoring network for the water years 1983-1985 were submitted to the LRC.

On December 19, a preliminary draft of the data report, "Streamflow and Selected Precipitation Data for Yucca Mountain and Vicinity, Nye County, NV, Water Years 1983-85," was submitted to the Nevada District Reports Section for editorial review.

Planning Documents

Quality Assurance

Operations

Verbal approval was received from DOE for installing three proposed streamflow gages in the Upper Fortymile Wash Watershed and one for the Amargosa River below Beatty. Approval of the sites was based on completion of environmental and cultural surveys, and land access permits.

Permission has not been received as yet for the two proposed sites along the lower Amargosa River near Eagle Mountain and Tecopa.

SCP 8.3.1.2.1.2.2 Transport of debris by severe runoff

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Vigilance for rainfall and severe runoff was continued during December.

Current literature on flooding and severe debris movement were scanned and articles appropriate to this investigation were duplicated for addition to the library. Select articles were studied in detail.

In early December, P. Glancy and P. Telis reconnoitered the lower Amargosa River drainage and southern Death Valley for possible debris movement associated with flooding alleged to have occurred during late September. No evidence of recent serious debris movement was noted.

Planning Documents

The study plan for this activity is still undergoing DOE review.

Quality Assurance

No quality-assurance activities took place in December except completion of QA reading assignments.

Operations

Effort was expended on the orientation of P. Telis to YMP operations and procedures. Telis is the new Activity Chief of the "Future Surface Hydrology" activity in the Nevada District. This orientation included a field visit to the Yucca Mountain region during early December.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Planning Documents

Quality Assurance

M. Ciesnik (a) attended the question and answer session, organized by the USGS QA office, on application of AP-5.1Q in the YMP; (b) reviewed USGS-QMPs -3.04, -8.03, and -17.01 in order to plan the process of qualification of past data required by the project; (c) processed NCR 91-09 related to water samples collected in three wells in Crater Flat and Beatty Wash, filed by W. Outfield; and (d) performed a technical review of the HP-183, R2, "Investigation into the chloride

ion leaching from fresh rhyolitic tuff surfaces."

W. Oatfield processed reading assignment paperwork for QMP-12.01, R5.

Operations

Installation of 2-inch steel piezometer pipe was performed in three mining-company-supplied geologic exploration boreholes in the western Amargosa Valley. These holes range in depth from 1,700 ft to 2,200 ft and will provide better three dimensional definition of potentiometric and hydrogeologic data down-gradient from Yucca Mountain.

J. Czarnecki processed requisitions for an additional 2,002 ft of 2-inch steel pipe and logistical support for transportation and installation in a 2,000 ft deep drillhole under construction in the Amargosa Desert by a commercial mining company. He also prepared a requisition for a replacement weight for a 1,000 ft electric well sounder.

M. Cicsnik initiated the purchase of additional Bernoulli diskettes for storage of project computer files.

W. Oatfield noted a location-entry error in the USGS-NWIS database for a deep borehole (NA-6) in the north-central Amargosa Desert. He performed checks of areas around 10 well sites in both the NHP and Carson City NWIS databases to avoid double entry of data. He also coded data for the creation of five additional well sites in the NHP-NWIS database #1.

W. Oatfield provided P. McKinley with data references for hydrochemistry of wells UE-25p#1 and FL-1 (Franklin Lake playa). He also provided the methodology used for alkalinity determination.

W. Oatfield assisted in the update of the NHP-NWIS database.

SCP 8.3.1.2.1.3.3 Fortymile Wash recharge study

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

C. Savard presented a poster at the American Geophysical Union meeting in San Francisco entitled "Correlation integral analysis of South Twin River streamflow, central Nevada: Preliminary application of chaos theory". The poster (and abstract published in EOS) discussed the method and results of scoping work on applying chaos theory to characterizing Nevada streamflow. The poster and author will travel to Denver in the first part of 1991 to share results of this work with NHP and other USGS staff.

A preliminary correlation integral was computed for Steptoe Creek in east-central Nevada for comparison to the South Twin River correlation integral analysis. The results were similar with a stepping in the correlation integral at small radii and indication of a high (greater than 5) fractal dimension of a possible strange attractor.

A program to compute Lyapunov exponents from experimental time series data is being converted to run on NHP computers. The program was originally published in the physics literature. Lyapunov exponents measure the divergence or convergence of nearby orbits in phase space. A positive exponent indicates that the system is exhibiting chaotic behavior.

No streamflow was observed in Fortymile Wash.

C. Savard updated a bibliography on chaos and strange attractors with articles on correlation integral methodology and applications.

Planning Documents

Quality Assurance

Operations

Small carrying cases with padding were obtained from NTS salvage yard with the assistance of the Teamsters assigned to the USGS Core Library. The cases can be used to transport instruments without damage or be used as temporary shelters for instruments during field deployment.

Estimates of the volume of water needed for planned infiltration tests in Fortymile Wash were computed based on the expected range of infiltration rates and the different sizes of infiltration tanks.

SCP 8.3.1.2.1.3.4 Evapotranspiration studies

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Planning Documents

Quality Assurance

M. Ciesnik compiled a list of types of data from USGS Open-File Report 90-356 (Geohydrology and evapotranspiration at Franklin Lake Playa, Inyo County, California) that will be subject to qualification under the QA program.

Operations

J. Czarnecki sent copies of a newly released USGS Open-File Report (USGS OFR 90-356) entitled "Geohydrology and evapotranspiration at Franklin Lake Playa, Inyo County, California" to 21 different persons.

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

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 8.3.1.2.1.4.1 Conceptualization of regional hydrologic flow models

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

J. Czarnecki presented a paper entitled "From where and by what flow paths does ground water beneath Yucca Mountain, Nevada originate?" at the American Geophysical Union Meeting to an

audience of about 150 persons. Czarnecki also helped man the YMPO booth on Site Characterization activities at Yucca Mountain.

J. Czarnecki performed colleague reviews of two papers entitled "Precipitation estimation in mountainous terrain using multivariate geostatistics: 1. Structural analysis" by J. Hevesi, J. Istok and A. Flint and "Precipitation estimation in mountainous terrain using multivariate geostatistics: 2. Isohyetal maps" by J. Hevesi, A. Flint, and J. Istok.

J. Czarnecki attended a CASY colloquium entitled "Coupling of Geothermal and Ground-Water Flow Systems." The following speakers presented material on coupled systems: C. Williams (USGS/Menlo Park); W. Dudley (USGS/Denver); and J. Sass (USGS/Flagstaff).

J. Czarnecki attended a meeting of the Committee for the Advancement of Science in the Yucca Mountain Project, at which: (a) P. Warner (SAIC/Golden) asked that CASY advocate the use of CD ROM (WORM-Write Once Read Many) storage media; (b) T. Brady (USGS/Denver) gave an update of the preparation of the USGS Bulletin on studies of the YMP; and (c) future plans for colloquium were discussed.

Planning Documents

Quality Assurance

J. Czarnecki began a technical review of USGS QMP-3.03, R3 on Software Quality Assurance.

M. Ciesnik met with W. Causseaux and D. Gillies to discuss the review process of QMP-3.03, R3, and coordinated the assignment of technical reviewers; he also performed a technical review of the QMP.

M. Ciesnik assisted the SAIC/Golden auditor with an internal audit of the NWIS database system used by the Hydrology Program's personnel. He also provided assistance during the NHP surveillance 91-S04 on compliance with QMP-3.03, R2.

Operations

J. Czarnecki obtained air photos and satellite imagery from J. Lorenz (REECo) for use in providing potentiometric data for the DOE YMP booth on Site Characterization activities.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The EG&G group has agreed to help prepare some of the necessary maps of the surficial materials.

M. Chornack has started working on defining the subsurface distribution of some of the tuff units on Yucca Mountain. This information will help to determine the appropriate way to account for the deep alluvium/tuff interaction.

Planning Documents

USGS-YMP-SP 8.3.1.2.2.1 is awaiting DOE approval.

Quality Assurance

All QA related reading assignments were accomplished as required.

Operations

SCP 8.3.1.2.2.1.2 Evaluation of natural infiltration

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Work continued on (a) writing the paper "Temperature Effects on a Hand-Held Neutron Moisture Meter"; (b) collecting data from the radiation instrumentation in Jackass Flats; (c) geostatistical analysis of precipitation data to determine spacial distribution of individual storm events; (d) monitoring the moisture in the shallow unsaturated zone through the neutron logging program; (e) monitoring the class A evaporation pan in Jackass Flats in order to determine potential evaporation rates; (f) writing the research paper on the calibration of tipping-bucket rain gages; (g) monitoring instrument string, which was designed to monitor unsaturated conditions in alluvium, in a drill hole in Topopah Wash near Test Cell "C"; and (h) closely monitoring propane consumption at the heated snow gages on and around Yucca Mountain.

Calibrations were performed on all Campbell Pacific Nuclear, hand held neutron moisture meters and three of the four presently fielded Sierra Misco tipping bucket rain gages.

The literature search began for information on computer modeling of rainfall-runoff relationships. Runoff is one of the quantities in the water budget equation.

The collection of class A evaporation pan data from other agencies' operating pans in the southern Nevada and southeastern California areas began.

Work was initiated with EG&G in order to acquire maps generated from digital elevation models.

Planning Documents

USGS-YMP-SP 8.3.1.2.2.1 is awaiting DOE approval.

Quality Assurance

All QA related reading assignments were accomplished as required.

Operations

Five 21X dataloggers were received from Campbell Scientific after recalibration and one CR10 datalogger, after repair.

SCP 8.3.1.2.2.1.3 Evaluation of artificial infiltration

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Preparations began for a field test of the automated, time domain reflectometry station. This system uses time domain reflectometry to determine the water content in the top 50 cm of the soil. Each automated platform will sample up to 12 sites within a 10 meter radius.

Planning Documents

Comments were signed off for USGS-YMP-SP 8.3.1.2.2.1; awaiting DOE approval.

Quality Assurance

All QA related reading assignments were accomplished as required.

Operations

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Liquid saturation procedure testing on core samples from Apache Leap prototype drilling site continued. Some samples were placed in relative humidity ovens to be dried at several relative humidities to determine the water content at which the pores have emptied and the water begins to leave the structure of the minerals. This is important to identify, because physical properties can be influenced from this resultant change in structure.

Development of a SPOC system to solve problems encountered and automate data collection continued. The load cells were successfully calibrated and the SPOC system is presently in use.

An evaluation of mathematical models, reported in the soil science literature, for relative permeability that require moisture retention characteristic data continued for use on tuff.

Simulations of imbibition of water into rock core using the TOUGH code are being conducted to evaluate the appropriate formulations of moisture retention characteristic data and relative permeability functions and to determine sensitivities to various physical parameters. This will also

aid in the identification of appropriateness of different methods of measurement for the same parameter.

D. Soeder is constructing a gas permeameter to determine gas permeability of rock core.

The Matrix-Property working group met once in December.

Planning Documents

The Matrix-property study plan is awaiting approval by DOE.

Quality Assurance

All QA related reading assignments were completed as required.

Operations

SCP 8.3.1.2.2.3.2 Site vertical-boreholes studies

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

J. Kume submitted a report on GTUF concerning a chapter on temperature and thermistor sensor use in prototype testing.

C. Cope reduced and analyzed long term drift data from the third month of pressure transducer calibration. All transducers are well within tolerance, however one transducer is marginal, and happens to be the same transducer that had an originally high current excitation value. This anomalously high current excitation value could be a good first indicator for a transducer that may be rejected as one that does not perform within tolerance or in a stable manner over a long time period.

C. Cope reduced and analyzed temperature hysteresis data in pressure sensors. This data suggests that temperature hysteresis occurs, but a more extensive test will be performed in January. If temperature hysteresis is a characteristic that is large enough to affect the error bars in the original equation, it will be included into the calibration method.

M. Kurzmack worked on the HRF DAS program for data collection from HRF holes and met with S. Breshears to plan electronic rack for HRF holes.

C. Loskot spent considerable time and effort learning the sysgraphics program and began data reduction runs on calibrated psychrometrics D1-D6.

W. Thordarson completed the thermodynamic processes part of G-tunnel report and calculated the flux density of water vapor through tuff.

G. LeCain continued to review air permeability test methods for fractured rock.

G. LeCain attended the Test Prioritization Task Force meeting in Palo Alto, California, on December 12 and 13. This meeting interrupted the field testing going on at the ALTS, Arizona.

The paper, "The use of forward- and back-scattered P-, S-, and converted seismic waves in cross-borehole imaging," by A. Balch, P. Chang, G. Hofland and K. Ranzinger, has been accepted, with revisions, for publication in the referred journal, "Geophysical Prospecting." This article contains

much of the material that was given at the European Society of Exploration Geophysicists meeting in June.

H. Jaramillo is in the process of generating a complete data set from his simplified physical VSP fault model. Data (multiple component, multi mode) acquisition is nearly completed.

J. Baer has been correcting bugs in several programs in the IDAS System Maintenance Subsystem.

A. Greengard, J. Baer, and R. Getzen met with J. Rousseau and M. Kurzmack on December 6 to discuss requirements and techniques for transferring IDAS data to the Denver Data Base. Ongoing discussions between Baer, Kurzmack, and Getzen regarding plans for archiving and transferring IDAS data should result in a consensus on hardware, software, formats, and procedures within another six weeks.

J. Baer has been writing programs to test new Keithley 182 Nanovoltmeter; testing was delayed by defective GPIB11V controller, but should be complete by January 12.

J. Baer and A. Sims attended DECUS (Digital Equipment Corp Users Group) symposium in mid-December, primarily to learn techniques for interpreting RSX Crash Dumps, diagnostic output from fatal computer failures. Other things learned at DECUS: (a) PDP-11/73 will be retired from DEC line in 1992; (b) DLV11J and DLVJ1 controllers can only be used for low-speed (<1200 baud) communications between PDPs and EKES, UPS, or external dataloggers; (c) DECnet can be configured to support virtual (remote) device drivers; and (d) existing DMV11s can be operated at higher speeds (56kb) by changing cabinet kits.

One solution for archiving and transferring IDAS data to Denver is use of VMS-DECnet to transfer data from ARC-1 to a PC-LAN optical disk system. This requires replacing ARC-2 with a MicroVAX, which can run Phase-V VMS-DECnet. The PDP-11/73s run Phase-IV RMS-DECnet, which is not compatible with PC-based LANs. This looks like a viable technique, and use of a MicroVAX for ARC-2 has other operational advantages, primarily improved security and data protection. FY91 costs are estimated at \$20,000, including DECnet and system software; future hardware cost increases would be negligible, as the cost of a spare MicroVAX would be offset by salvage cost of the PDP that can be used at a field site. ISD has approved use of their MicroVAX at Denver Federal Center for software development; if no other problems are discovered, a procurement strategy should be in place by mid-February.

Planning Documents

The technical procedure draft for VSP acquisition at Yucca Mountain is still in progress.

Quality Assurance

M. Kurzmack received approval from D. Gillies to have E. Kwicklis review TCPCAL, PTCAL and THMCAL by the end of January.

G. LeCain completed QA reading assignments and updated the QMP as assigned.

A. Greengard has completed a new revision of HP-141 procedure for General IDAS Operation, but will not release this revision until the completion of the "IDAS Set-Up Example." After concluding that IDAS Manuals would not be self-explanatory without a realistic data-acquisition example, R. Getzen and Greengard began composing and describing an "IDAS Set-Up Example." This example will describe and explain all the data-entry steps required for creating and operating a new IDAS field site for typical Deep-UZ measurements. This document, which should be ready for review in late January, will include approximately 30 tables and 60 illustrations.

A. Sims has completed a first draft of HP-144, Procedures for Installation, Testing and Handling of DEC Computers and Equipment, and R. Getzen is reviewing it. A final draft of HP-144 may be complete by late January.

Initial drawings of the packer system components have been completed and are being checked by A. Benavidez.

Operations

J. Rousseau and R. Getzen met with W. Wilson and P. Phillips (NTS Safety Officer) in Las Vegas to resolve differences over safety criteria requirements for the IDAS instrument shelters. Rousseau will visit Getzen in Menlo Park in early January to finalize procurement documents and design criteria for the new IDAS instrument shelters.

J. Kume submitted a final draft of the criteria letter for the HRF holes to NHP and YMP for approval. The copy was approved by L. Hayes and sent to C. Gertz.

J. Kume prepared handouts and overhead slides for an internal project staff meeting concerning the upcoming HRF holes instrumentation. Kume held a staff meeting attended by J. Rousseau, K. Thomas, M. Kurzmack, C. Loskot, C. Cope, G. Okoren, and D. Winegarden to inform them about the involvement each had in accomplishing the HRF hole instrumentation activity.

J. Rousseau, J. Kume, K. Thomas, C. Cope, M. Kurzmack, C. Loskot, W. Thordarson, and G. LeCain attended a speech by C. Gertz, DOE, on the "State of the Project."

J. Rousseau, J. Kume, and K. Thomas met with an ASCO salesman concerning the future purchase of solenoid valves.

J. Kume prepared a sole source justification for Tensolite Company to build a DISA cable and prepared a requisition to purchase 5,000 feet of DISA cable.

J. Kume consulted with B. Garms, Raytheon, concerning the construction of the casing/screen basket and protective pipe assembly for the HRF holes.

C. Cope prepared for a trip to NTS in January by studying the user's manual for the Ruska piston gage. The gage was shipped to the calibration lab in December and will be used in pressure transducer calibrations. Many constants were calculated that will be used with the piston gage, such as: local gravity, buoyancy, elastic deformation, and nitrogen densities at specified pressures.

C. Loskot (a) arranged trip and went with J. Rousseau to Albuquerque, New Mexico, to visit Thunder Scientific to check out their Model 9000 humidity generator, which is build specifically for caliuration; (b) arranged and attended a meeting between Rousseau, M. Kurzmack, and A. Bissal from ABCO in Boulder, concerning the M3 dewpoint hygrometers; (c) wrote a letter, along with Rousseau, to L. Hayes, through B. Lewis and D. Gillies, about the purchase of a humidity generator, including a comparison chart of five instruments from four companies; and (d) reviewed the UZ-6 report.

The field site at Bergen Park is awaiting landowner's permission to drill the seismic boreholes.

Problems have been encountered in adapting the Vseis package to the RS/6000 computer. Certain differences between IBM Unix and the standard Unix prevent the package from compiling and executing. The irony here is that the principle benefit of Unix is supposed to be machine independent software, but IBM appears to have created a machine dependent Unix operating

system. This defeats the whole Unix idea.

A. Balch, J. Rousseau, K. Thomas, J. Henderson, and N. Reinhardt met with D. Anderson in personnel to develop a hiring strategy to replace J. Kovats. Appropriate position descriptions and position announcements will be written to ensure a smooth selection and hiring process. Continued monitoring by A. Sims and S. Breshears shows no new problems with batteries since generators were shut down in late September.

REECO technicians have been preparing "as built" electrical diagrams for EKES systems. R. Getzen will incorporate this information into HP-140, Procedure for Entry and Identification.

R. Getzen has been working with EG&G Special Projects on the redesign of microwave communications system (effort presently about 7 weeks behind schedule). Discussions with T. Brown indicate that a procurement and testing strategy and requirements document should be complete about January 20.

R. Getzen and J. Rousseau have been working with DOE on redesign of prototype instrument shelter to improve performance, reduce cost, and create an easily reproducible unit; hope to resolve impasse with DOE Health and Safety by obtaining a simulated (calculated) FM corner test for a proposed transportainer-based shelter. Initial contact has been made with fire-safety engineering consultants; Getzen and Rousseau will contact vendors in January.

J. Boernge completed preliminary layout design and component fitting of interval pipe and packer assembly for the downhole instrument. Solenoids, additional electrical connectors, and pipe fittings were received.

The field support trailer will be delivered to the vendor for construction of the data acquisition shelter in mid-January.

J. Boernge and G. LeCain held design and fabrication status meetings.

A. Greengard attended a Denver Data Base (DDB) staff meeting on December 6 to discuss interface requirements between IDAS and the DDB, and the presentation by C. Gertz to YMP staff on December 7.

The graphics package DrawPerfect will be used for all technical procedure drawings. It has been demonstrated to be fully compatible with WordPerfect; drawings can be imported successfully into WordPerfect files. Using DrawPerfect will eliminate the necessity for cutting and pasting figures manually into procedures.

M. Kurzmack will do installation work to replace ARC-2 with a Microvax and use TCP-IP as a protocol to transfer data files to Novell Netware 2.15 network on a PC. Preliminary identification was made of the Woolongong WIN/TCP as the software package to use for file transfer. Quotes obtained on the Microvax and WIN/TCP.

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 8.3.1.2.2.4.1 Intact-fracture test in the exploratory shaft facility

ACTIVITIES AND ACCOMPLISHMENTS

The set-up for the Big Block Air K permeability tests had to be redone; nine out of nineteen holes have been completed; one injection packer and five monitoring packers have been installed.

An Ethernet cable was installed in the lab and office areas. Several pieces of lab equipment were repaired.

Technical Activities

Work continued in the use of image digitization and processing to look at moire fringes and in the characterization of a simple geometrical object consisting of convex and concave surfaces by using projection moire.

Dr. Cardenas started work using Fast-Fourier Analysis approach to topographical mapping.

Laboratory notebooks were reviewed for Sampling Methods Prototype Test for submittal to LRC.

Review comments from Colorado District on an ANS paper (received December 19) were addressed and submitted to the NHP Reports Section (December 20) for final typing before sending to ANS.

G. Severson worked on some of the figures for the preliminary report (letter report) on sampling methods test. A draft OFR is now in preparation. The present draft will be edited and submitted to C. Boughton and NHP Staff for internal review.

G. Severson attended C. Gertz's "State of the Project" address December 7 and R. Craig's meeting concerning ESF excavation alternatives on December 11.

G. Severson spoke with V. Deason (INEL/EG&G) concerning his work with diffraction Moire. Their work has primarily been "inplane" deformations and not "out-of-plane" or topographical.

The draft of the preliminary technical procedure for collecting rock cores with radial fractures is with the co-author for review.

Planning Documents

Quality Assurance

The QA manual was updated twice.

Operations

G. Severson met with R. Bigelow (Branch of Geochemistry) to discuss connecting to their multiconnect box on the DFC backbone. S. Anderton and Severson ran two coaxial cables from the Branch of Geochemistry computer room to room F1600, our office space area. M. Brodie made the

coaxial cable segments in the office space area and checked out each segment and only one connector needed to be replaced.

The AIR digital barometer and Edwards/Datametrix mass flow pressure transducers (company calibrations) were received.

S. Anderton and G. Severson cleaned up the vacuum pump they picked from CASU. Some plumbing changes need to be made and an exhaust filter put on it before it can be used routinely in the lab. This pump will also be used as a backup pump for the vacuum oven and the vacuum saturation table.

G. Severson attended FRHP meeting on December 14.

Shelving was put together in Building 810 to be used in the laboratory for rock samples, etc.

Installations Unltd. completed work on the inserts for the laboratory bench tops on December 20; the equipment was put back into place.

Due to the closure of G-Tunnel, projected axial sampling is temporarily suspended and due to the spending freeze, procurement of needed equipment is temporarily delayed.

SCP 8.3.1.2.2.4.2 Percolation tests in the exploratory shaft facility

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Permeability measurements were made on a fractured core (sample 13b) at various matric potentials. For the drying curve, it was found that liquid flows through the fractured, welded tuff sample remained high (several hundred cubic centimeters per hour) until the matric potential at the core boundaries was reduced from -10.16 to -13.33 centimeters, at which time flow dropped to below 1.0 cubic centimeter per hour. For the wetting curve, flow rates remained small until unequal positive pressures were applied to the core boundaries.

The data from the above test were processed and along with transient imbibition data from tests performed on the same core, were analyzed 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. This paper will be presented in Tucson, Arizona on January 9 during Workshop V on Flow and Transport Through Unsaturated Fractured Rock, co-sponsored by the University of Arizona and the Nuclear Regulatory Commission.

Transient and steady-state air-permeability measurements were completed by S. Anderton and F. Thamir on the large block of welded tuff (54.3 cm long X 29.7 cm wide X 80.6 cm high) to be tested with water in the coming months. The air permeability data will be used to estimate the properties of the block prior to the beginning of tests using water, and will also be analyzed to identify connected pathways through the block.

F. Thamir established a second data collection station using a Keithley model 706 scanner and a Hewlett-Packard 3456a multimeter. This will permit multiple experiments to be run simultaneously.

M. Brodie installed the thin ethernet line to connect the laboratory in Building 20 to the backbone. He also assisted F. Thamir with some interface problems that were occurring with the scanner and completed the installation of computer hardware required for thermocouple psychrometer

calibration.

Planning Documents

Quality Assurance

Staff read OMPs, as assigned.

Operations

SCP 8.3.1.2.2.4.7 Perched-water test in the exploratory shaft facility

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The search continued for commercially available sampling, testing, and monitoring systems for use in perched-water testing in ESF.

The first draft of the road log for the GSA field trip entitled "A Hydrogeologic Overview of the Regional Flow System in Relation to Yucca Mountain, Nevada" was completed and text was written for selected stops.

M. Chornack (a) attended the TPTF meeting in Palo Alto, California, on December 11-13; (b) participated in trip to N-tunnel and T-tunnel on the NTS to observe how different mining methods affect fracture exposure and mappability; (c) began preliminary work for characterization of surficial materials at Yucca Mountain; and (d) reviewed borehole lithology section of report entitled "Geohydrology of Shallow Neutron Access Boreholes, Yucca Mountain, Nye County, Nevada" and made selected changes to that section of the report.

Planning Documents

Quality Assurance

Operations

The December 1990 Monthly Report was prepared and submitted.

SCP 8.3.1.2.2.4.9 Multipurpose-borehole testing near the exploratory shafts

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The search continued for commercially available sampling, testing, and monitoring systems for use in perched-water testing in ESF.

The first draft of the road log for the GSA field trip entitled "A Hydrogeologic Overview of the Regional Flow System in Relation to Yucca Mountain, Nevada" was completed and text was written for selected stops.

M. Chornack (a) attended the TPTF meeting in Palo Alto, California, on December 11-13; (b) participated in trip to N-tunnel and T-tunnel on the NTS to observe how different mining methods affect fracture exposure and mappability; (c) began preliminary work for characterization of surficial materials at Yucca Mountain; and (d) reviewed borehole lithology section of report entitled "Geohydrology of Shallow Neutron Access Boreholes, Yucca Mountain, Nye County, Nevada" and

made selected changes to that section of the report.

Continued to search for commercially available sampling testing, and monitoring systems for use in perched-water testing in ESF.

Planning Documents

Quality Assurance

Operations

The December 1990 Monthly Report was prepared and submitted.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

I. Yang attended the CASY colloquium "Coupling of Geothermal and Ground-Water Flows Systems" on December 11, and "Geochemical Aspects of the Alligator Rivers Analogue Project" presented by Dr. R. Edis of the Australian Nuclear Science and Technical Organization (ANSTO) on December 3, 1990 at the Denver Federal Center.

I. Yang attended the meeting on ESF Alternative Study presented by R. Craig of the USGS at the Denver Federal Center.

C. Peters completed draft of short paper "Field testing the effectiveness of pumping to remove Sulfur Hexafluoride Trace Drilling Air from a prototype borehole near Superior, Arizona," for inclusion in NUREG proceedings of Tucson, Arizona, workshop January 7-10, 1991, and revised it per colleague review.

C. Peters and P. Striffler planned poster presentation for the Tucson workshop.

C. Peters began the preparation of a proposal for additional Apache Leap, Arizona, work.

P. Striffler prepared the equipment required for the UZ1 field trip scheduled for January 1991.

J. Ferarese analyzed several squeezed samples for CO₂ on the gas chromatograph.

J. Ferarese completed the laboratory experiment to determine if using large (2.1 liter) aluminum cylinders to collect gas samples for ¹³/₁₂C isotope analysis could obtain accurate and reproducible data. It has been determined that this is a viable method, and will be added to the appropriate HPs.

Planning Documents

P. Striffler prepared the gas sampling results of the prototype hole at Apache Leap, Arizona.

Quality Assurance

I. Yang completed Quality Assurance reading assignments on QMP-12.01, R5 and AP-1.10Q, R2.

W. Shaw completed Quality Assurance reading assignments on HP-176, R1; HP-184, R1; HP-190T, R0; HP-192, R1; HP-193T, R0; HP-194, R0; HP-195, R0.

C. Peters and P. Striffler completed all Quality Assurance reading assignments.

C. Peters and W. Shaw met to determine the data books required for data management.

J. Ferarese updated the summary sheets and calibrated the gas chromatograph for CO₂ and CH₄ analysis.

Operations

C. Peters began planning the UZ1 field trip scheduled in January 1991; purchased Tedlar Bags needed for the testing field trip; and continued discussions with REECO YMP Procurement concerning the capital equipment purchases.

Project members attended six hours of project meetings.

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 rock

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

A talk titled "Lubrication Theory Analysis of the Permeability of Rough-Walled Fractures," by R. Zimmerman, S. Kumar, and G. Bodvarsson, was delivered by Zimmerman at the Fall Annual Meeting of the American Geophysical Union in San Francisco.

The paper "Lubrication Theory Analysis of the Permeability of Rough-Walled Fractures," by R. Zimmerman, S. Kumar, and G. Bodvarsson, was sent to USGS/YMP QA officer J. Lamonaca for approval for publication in the Proceedings of the 2nd International High-Level Radioactive Waste Management Conference (Las Vegas, 28 April- 2 May, 1991).

R. Zimmerman and G. Bodvarsson submitted a reply to the written comment by J. Parlange et al., on their paper "An Approximate Solution to One-Dimensional Absorption in Unsaturated Porous Media" (Water Resources Research, 1989).

C. Boughton participated in a field trip related to the Calico Hills work on December 5. Construction methods and fracture detail in N and P Tunnels at the NTS were viewed.

C. Boughton attended the Exploratory Shaft Test Coordination meeting held in Las Vegas on December 18.

E. Kwicklis and F. Thamir met several times during the month to discuss material and to write a paper to be presented at the workshop on fracture flow to be held in Tucson, Arizona, in January, 1991.

E. Kwicklis and R. Healy debugged FRAC-2PW.F77, a code which generates two-phase relative permeability, saturation and matric potential relationship for a variable aperture fracture and then used the code to generate those 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 was examined. These curves were then incorporated into the TOUGH code and used to simulate transient imbibition into a fractured welded core. Results were included in the 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 will be presented at Workshop V on Flow and Transport in Unsaturated, Fractured Rock to be held in Tucson, Arizona, January 7-10, 1991.

C. Mallon met with P. McKinley to discuss using Lotus 1-2-3 to do data correlations for approximation of missing air temperature and soil temperature data. Data from fourteen of P. McKinley's data files were transferred into a Lotus 1-2-3 compatible format for use in computing a regression analysis.

Planning Documents

No response has been received by DOE to the Study Plan for Conceptual and Numerical Modeling in Unsaturated, Fractured Rock which was submitted to DOE for review in September.

Quality Assurance

A status check with NHP Quality Assurance personnel indicated that HP-201, R0 entitled, "Method for the Construction and Use of a Mariotte Reservoir" is still in the process of being written.

Reading assignments were completed by various personnel.

C. Mallon continued to participate in the committee to revise Software Quality Assurance QMP-3.03, R3. Formal reviews have been requested by L. Hayes for finalization of the QMP revision by mid-January.

C. Boughton attended a Configuration Control Committee meeting as NHP representative on December 14. During the meeting she volunteered to participate in the revision of QMP-3.14. A recommendation was also made by the committee that the CIRF for NWIS should be withdrawn as it appears to have been inappropriately accepted into the system.

C. Mallon attended a question and answer session on AP-5.1Q, "Control and Transfer of Technical Data on the Yucca Mountain Project.

C. Mallon completed SQA documentation for RADSOL.F77, including a USGS User's Manual, obtaining a copy of the source code, and filling out a SRS, SDD, SVR, SSF, and SAD. She also completed SQA documentation for FLUME.F77 (v.1, 2, 3) including running test problems and filling out SVRs for each version. CIRFs for RADSOL.F77 and ANNIE were approved at the December 14 CCC meeting and an SAD for NWIS was submitted for approval.

C. Boughton, E. Kwicklis, and C. Mallon completed reading assignments and replaced pages in

controlled documents as required. YMP-USGS Controlled Document Configuration Reports were also checked against actual controlled documents in possession.

Operations

G. Bodvarsson and R. Zimmerman met with B. Lewis of the USGS NHP on December 20 to discuss the budget and workscope for FY91.

C. Boughton has been involved in ongoing meetings and telephone follow-ups regarding staff exposure to fumes of unknown origin and composition emanating from the floor drains in the fractured rock hydrology laboratory on October 17.

C. Boughton completed mid-year reviews for all USGS staff.

Communication with LBL regarding ongoing activities was maintained.

Budgetary uncertainty continues to affect the progress of the project.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

A seminar presentation entitled "Geochemical Aspects of the Alligator Rivers Analogue Project" was given by Dr. R. Edis (ANSTO) on December 3 and was attended by I. Yang, A. Lewis-Russ, J. Kume, and M. Whitfield. Dr. Edis presented data for some geochemical studies of radionuclide migration in Australia.

The Sample Overview Committee was held at the Sample Management Facility on December 4 and a field trip to Yucca Mountain on December 5 to look at potential prototype drilling sites.

A CASY technical symposium was held on December 11 in the Bureau of Reclamation's Auditorium. The theme for the four talks presented was "Coupling of Geothermal and Ground-Water Flow Systems." UZ attendees were J. Rousseau, J. Kume, I. Yang, C. Cope, M. Chornack, E. Kwicklis, and M. Whitfield.

Responses to the UZ Hydrology peer review comments for which USGS primary responsibility was assigned were submitted by W. Dudley via memorandum to C. Newbury (DOE) on December 13.

The monthly Exploratory Shaft Test Coordination meeting was held in Las Vegas on December 18

and was attended by G. Shideler (GD), T. Lippert (USBR), M. McKcown (USBR), S. Beason (USBR), R. Craig (YMPB), C. Boughton (NHP), and M. Whitfield (NHP).

Planning Documents

The technical reviews and resolution of review comments for Study Plan 8.3.1.2.2.9 (UZ Modeling and Synthesis) have been completed and the first submittal to DOE will be made in January 1991.

Quality Assurance

Reading assignments and revisions to APs and QMPs were distributed to UZ investigators for reading.

A listing of all controlled YMP USGS QMPs was provided to UZ investigators on December 26 to check against and see if their QA manual has all of the QMPs transmitted by the QA office.

Operations

A meeting of the Branch TPO, QA Manager and staff, and NHP project investigators was held on December 3. The purpose of the meeting was to provide a forum, to answer questions regarding the implementation of AP-5.1Q, R1 (Control and Transfer of Technical Data on the Yucca Mountain Project). UZ attenders were B. Lewis, C. Mallon and M. Whitfield.

A presentation entitled "State of the Project" was made by C. Gertz at the Denver Federal Center on December 7. It was attended by most of the NHP investigators.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

A coarse three-dimensional model of the unsaturated zone at Yucca Mountain is being designed. A. Flint of USGS met with G. Bodvarsson to discuss the development of the three-dimensional model.

Planning Documents

G. Bodvarsson and R. Zimmerman met with B. Lewis of USGS-NHP on December 20 to discuss the budget and workscope for 1991, and the comments made by technical reviewer G. Bodvarsson on the study plan for their activity.

Quality Assurance

Reading assignments were completed by various personnel.

Operations

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 Cross-Hole Testing

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

G. LeCain completed setup and programming of a second portable PC for use in field testing.

G. LeCain and C. Warren conducted gas injection testing at the University of Arizona ALTS. The testing was limited to single-hole injection tests run at variable injection rates and pressures; the goal was to determine if injection rates influence calculated permeabilities.

G. LeCain lost part of the injection packer string down one of the ALTS holes. A hook was lowered and attached to the packers, but problems with the power generator made lifting impossible. The hook was left attached and plans made to return and retrieve the packers when the generator can be repaired.

Most field equipment was removed from ALTS and transferred to the USBR in Phoenix, from there it will be shipped to the HRF in Nevada.

Planning Documents

Quality Assurance

G. LeCain completed QA reading assignments and updated the QMP manual as assigned.

Operations

G. LeCain and C. Warren began preparations to return to ALTS to recover the packers.

USBR Arizona Projects Office personnel provided support for removal of equipment at the Apache Leap Test Site the week of December 17.

Prototype Dry Coring of Rubble

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

C. Peters installed the Data Acquisition system for load frame operation in Building 20; worked on the blasting reports with J. Kotherslatte; and began statistical analysis of Holmes & Narver and the U.S. Bureau of Reclamation coring work.

M. Beasley was trained using the SATEC 600K load frame to squeeze pore water from four nonwelded rock cores from G-tunnel. Core moisture contents averaged $\pm 32\%$. Average water yield was ± 39.0 ml and average gas yield was ± 16.0 ml. Beasley will compress two additional cores prior to years end.

Planning Documents

Quality Assurance

C. Peters and P. Striffler completed all Quality Assurance reading assignments.

C. Peters and W. Shaw met to determine the data books required for data management.

Operations

C. Peters prioritized G-tunnel rock for coring and squeezing.

M. Beasley started to organize SMF forms and Bureau of Reclamation coring forms into book format.

USBR issued a requisition for consulting services for final assembly of components for the second-generation (high-pressure) extraction cell.

Prototype Pore-Water Extraction

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

J. Higgins made revisions to a technical paper after USGS review. The paper was put in camera-ready form and sent to the publisher. The paper is titled "Pore-water Extraction from Unsaturated Tuffs using One-Dimensional Compression" and will be published by the American Nuclear Society.

M. Beasley was trained using SATEC 600K load frame to squeeze pore water from four nonwelded rock cores from G-tunnel. Core moisture contents averaged about 32%. Average water yield was about 39.0 ml and average gas yield was about 16.0 ml. Beasley will compress two additional cores prior to years end.

Nondestructive testing was performed on critical test-vessel components to detect the presence of micro-cracks; all components passed.

Planning Documents

M. Beasley reviewed Hydrochemistry Exploratory Shaft and Site Study Plans and examined Optimal Rubble, Dry Coring and Pore Water Extraction Detail Test Plans.

Quality Assurance

M. Beasley began working on consolidation of procedures for the HP on Pore Water Extraction by Uniaxial Compression.

Operations

J. Higgins attended two project coordination meetings and worked on a personal computer system to trouble shoot printing problems. The problems were solved.

M. Beasley requisitioned a Cardy C-1 Compact pH meter for use in pore water extraction prototype testing. The previous pH meter developed a noncorrectable drift problem; but can be returned to the company for free repair.

J. Prizio and H. Hoff installed and tested a Data Acquisition System for pore-water extraction testing on the USGS's 600-kip load frame.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The data loggers on the continuous water-level network were dumped and data was processed twice this month. Transducers were calibrated at the following wells: USW H-3 (upper), USW G-3, UE-25 WT #6, and UE-25 WT #13. All instrument calibrations are up to date.

Periodic measurements were made once on the water-level network this month. Well UE-25 WT #18 was added to the network and Well USW H-3 was temporarily converted from continuous to periodic network this month. This probably will last until about mid January.

The packer at Well USW H-3 was removed December 12 to clear a transducer that was blocking the access tube. The blockage prevented measuring the water level in the lower zone of the well. Upon removal, it was discovered that the plug at the bottom of the access tube had not been removed when the packer was installed. This means that there was very little, if any, communication between the access tube and the lower zone of the well. Additionally, the packer did not appear to be fully seated and may not have effectively isolated the upper and lower zones of the well. The packer was refurbished but could not be put back in the same place due to hole conditions. The packer was finally seated at about 1061 meters below land surface (about 53 meters above its previous position).

Thirty-six feet of water-level access tubing were added to Well UE-25 WT #18 on December 17. This put the tubing to a depth of 609 meters. With the additional tubing, the water level was measured at about 607 meters below land surface.

A multiconductor cable unit was calibrated without its usual weight on December 5 and 6. The calculated correction factor was somewhat different than had been observed in the past. The unit will be calibrated again in January with its usual weight as a check.

The computer used to service data collection platforms has been determined to be defective but could not be released for repair without a replacement. A replacement has been borrowed from another activity and is being tested to see that it will work on the platforms. A permanent backup is being procured through normal USGS procurement channels.

Editorial review of the draft report "Water levels in continuously monitored wells in the Yucca Mountain area, Nevada, 1985-88" by R. Luckey, D. Lobmeyer, and D. Burkhardt was completed December 17. It is expected to take 4-6 more weeks to revise the report following this review.

Editorial review of the draft report "Water levels in Periodically Measured Wells in the Yucca Mountain Area, Nevada, 1989" by G. O'Brien was completed December 12. It is expected to take 4-5 more weeks to revise the report following this review.

Data-collection platforms at USW G-3, USW H-4, USW H-5, and USW WT-11 are operating well. Backup data was collected from the platforms and transmitted directly to the Prime computer. The backup data was spot checked against the data coming through the satellite to verify that the transmission system was operating properly.

An apparent water-level anomaly was observed via the data collection platform at USW G-3 on December 13; however, it was discovered too late to get onsite during the anomaly.

D. Lobmeyer continued preparation of text for the draft report "Water levels in continuously monitored wells in the Yucca Mountain area, Nevada, 1989." The text is now approximately 60 percent complete.

R. Luckey attended a meeting of the Testing Prioritization Task Force in Palo Alto, California, December 12 and 13 to give information about the saturated-zone flow system.

All packers used to isolate water-level monitoring wells into separate zones will be tested. The test will initially determine if the plug was removed when the packer was installed. Conclusive testing will include removing, inspecting, rebuilding, and replacing all packers.

R. Luckey is planning a trip to the NTS to review status of water-level network and meet with project personnel and to Las Vegas to continue work with Testing Prioritization Task Force.

A trip is planned (a) to NTS by M. Boucher to collect logbooks and other records so appropriate records can be placed in records center; (b) to NTS by E. Ervin to test use of lap top computer to program data collection platforms and transfer data from platforms to Prime computer; and (c) by G. O'Brien to do special instrumentation related to water-level monitoring and help fill in vacant position of field technician.

Planning Documents

Study Plan 8.3.1.2.3.1.1-6, R0, "Characterization of the Site Saturated-Zone Ground Water Flow System" was resubmitted to YMPO on May 18. To date, it has not yet been formally approved by DOE.

Quality Assurance

NCRs 91-03 and -07, were issued last month for using barometers that had been calibrated by a non-certified calibration facility. The calibration facility was audited this month and it was recommended that they be certified. When they are certified, data collected with these barometers should be usable.

M. Boucher participated in the revision and implementation of QMP-2.07 and -2.08.

R. Luckey participated in the revision and implementation of QMP-2.02 and received QMP-3.03 for formal review.

R. Luckey and M. Boucher participated in a meeting on AP-5.1Q. They discussed concerns that they have relating to timely data submittal for the water-level network.

Operations

G. Otto submitted his resignation as a contractor field technician to take a USGS position in the Weapons Program. He had several years experience in water-level monitoring and will be sorely missed.

The entire Denver staff attended presentation by C. Gertz on December 7 on the "State of the Project."

D. Baldwin began planning an internal training course on use of data collection platforms to collect water-level data. The course will be given at NTS in early February.

R. Luckey completed annual work plan for G. O'Brien. R. Luckey still has one work plan to complete as soon as possible.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Hydraulic pressure and water level data from UE-25 C#1 collected during 1990 was analyzed for barometric and earth tide responses.

The graphical well test analysis program continued to be tested by analyzing existing data sets from c-hole well tests. Problems with the program are being documented and corrected.

Writing of the c-hole intraborehole flow and hydraulic stress test report continued.

The c-hole hydrogeology report still awaits re-typing.

Monitoring continued at three shallow neutron holes instrumented with a differential transducer to monitor gas pressure. This data is being collected to help develop the method for obtaining pneumatic diffusivity from gas pressure measurements.

Two additional neutron holes and one unsaturated zone borehole were instrumented with a differential transducer to monitor gas pressure.

Criteria letter work to remove the packers and tubing from the c-holes was completed 11/28/90. A downhole television log was completed at C3, and caliper logs were run on all three c-holes on December 11. A bundle of cable was encountered at about 2800 feet in C3 causing the termination of the TV and caliper logs. The removal of the cable will be attempted and then arrangements will be made to complete the logging. Completion of the logs is critical because of the question of the existence of faults in the lower part of C3.

Plans are now underway to instrument UE-25b #1 and USW H-4 with small packers, transducers, and strip charts to monitor for seismic, barometric, and earth tide responses. This work will be completed in early January, 1991. Before monitoring begins at b1, we must ensure that the plug at the bottom of the packer access tube was removed after installation of the packer. This was not done at USW H-3 and the record for the below zone of b1 is similar to that of H-3. Because of the problems discovered at H3, the data for the below zone is now suspect. All interpretations and reference to the H3 below data has been removed from the CASY paper "Strain-related water-level and fluid pressure responses in selected wells, Yucca Mountain," by D. Galloway, G. Patterson, and J. Gemmill.

Planning Documents

There were no responses required for comments to the statutory SCP.

The study plan awaits DOE approval.

Quality Assurance

No activity on software QA pending final resolution of QMP-3.03 and the availability of personnel.

J. Gemmell and G. Patterson completed all required QA readings.

Operations

No recruitment activity was initiated for the GS-7 hydro-tech position. This position is required to address software QA.

D. Galloway's replacement has been selected and will be on board February 11, 1991.

G. Patterson, J. Gemmell, and A. Geldon completed mandatory safety training December 10.

SCP 8.3.1.2.3.1.4 Multiple-well interference testing

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The graphical well test analysis program continued to be tested by analyzing existing data sets from c-hole well tests. Problems with the program are being documented and corrected.

Because of the elimination of LBL funding for c-hole hydraulic work in FY 91, the cross-hole seismic tomography will not be completed this year. This will cause drastic delays in planning the c-hole hydraulic and tracer testing and severely limit the results of preliminary modeling to aid this planning.

Construction of the two "prototype" packer strings has not begun. Several problems continue to plague the procurement of packers to install into the system. A negotiated contract procedure has been initiated by which all vendors submitting bids originally will be allowed to re-bid. Those bids will then be rated by a committee consisting of G. Patterson, J. Gemmel, and J. Sharman (USBR).

G. Patterson and K. Karasaki (LBL) have continued setting up preliminary models of the c-hole complex to test various conceptual models and help design the packer testing program. This activity will also be hindered by the lack of funding for LBL.

The purchase of two pumps to use with the packer system has been initiated.

Carry-over from 1st quarter: The joint DOE/AECL proposal has been approved by DOE and awaits final approval from AECL.

J. Sharman attended design coordination meetings with the USGS for the Saturated Zone Packer System.

Planning Documents

There were no responses required for comments to the statutory SCP.

The study plan awaits DOE approval.

Quality Assurance

There has been no activity on software QA pending final resolution of QMP-3.03 and the availability of personnel.

There have been no packer string QA activities due to ongoing design of the equipment.

There has been no QA activity relative to the c-hole hydraulic testing because of packer string design delays.

J. Gemmell and G. Patterson completed all required QA readings.

USBR continued design drawings for the Saturated Zone Packer System.

The 26-conductor #20 gage cable was received and inspected. The cable did not meet requirements due to varying lengths (from 200' to 1000') found on the rolls and will be returned to the vendor.

Operations

Plans are underway to test several different types of transducers and barometers along with the CR7 data logger at one of the recently opened c-holes.

J. Sharman, J. Gemmel, and G. Patterson reviewed the Request for Proposal and the evaluation criteria for a negotiated procurement of a dual mandrel packer. The solicitation will be sent out early January.

J. Sharman provided the USBR machine shop with a design for the instrumentation casing to evaluate cost of construction and is pursuing companies for sealing materials and electrical connectors for field electrical connections.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Planning Documents

W. Steinkampf began consideration of Project and DOE/HQ review comments on SP-8.3.1.2.3.2, R0.

Quality Assurance

W. Steinkampf participated as technical auditor in USGS audit 90-01; attended a USGS QA Branch workshop to address problems in the preparation and review of quality-management procedures and changes thereto; placed a hold tag (per NCR-90-10) on analytical data for samples from Well UE25-p#1; and attended a QA Branch workshop to address implementation of AP-5.1Q.

Operations

W. Steinkampf participated in the presentation of the recommendation of the DOE/NRC QA Workshop to the Project Chief (YMP), D. Horton (QA/YMP), M. Blanchard (YMP), and additional Project staff on December 6 in Las Vegas; prepared overheads for a future presentation of workshop results to OCRWM staff; prepared a preliminary list of tasks to be accomplished within the next 12-18 months, and attendant personnel requirements, for supervisory review and discussion; completed review of extended abstracts for a USGS Bulletin on fractures and hydrology; began familiarization with spreadsheet software (Microsoft Excel); and prepared input to PACS.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The new water-level information from well UE-25 WT #18 was compared with data from surrounding wells and was plotted on the preliminary revised potentiometric-surface map being compiled by E. Ervin. The water level from WT #18 does not appear to be within the steep-gradient zone to the north of the proposed repository block.

E. Ervin started evaluating several computer codes for the generation of semivariograms of hydraulic conductivity for stochastic modeling of the saturated-zone-flow system at the site.

E. Ervin attended a planning meeting with D. Galloway, A. Riggs and M. Chornack concerning the October 1991 GSA field trip of the regional ground-water flow system in the vicinity of Yucca Mountain.

E. Ervin received a beta test version of the flow and transport computer code MAFIC (to which the FRACMAN code is linked) from I. Miller of Golder Associates, Inc. of Redmond, Washington. She is in the process of loading the MAFIC code on the SUN workstation and will attempt to recompile the code to run under the SUN operation system.

A trip to the Nevada Test Site planned by E. Ervin for January 5-8 to deliver and setup COMPAQ laptop computer to D. Baldwin in order to download water-level data from the data collection platforms and to finish road log for the 1991 GSA field trip with M. Chornack.

Planning Documents

E. Ervin completed colleague review and comment resolution with the authors of Study Plan 8.3.1.5.2.2, Characterization of the Future Regional Hydrology due to Climate Changes.

Quality Assurance

E. Ervin read OMP-17.01, R4, Records Management and AP 1.10Q, R2, Preparation and review of SCP study plans.

Operations

SCP 8.3.1.2.3.3.2 Development of fracture network model

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Verification runs on the hydrologic inversion technique are being conducted. For a simple case it was verified that the technique yields the correct transmissivity and storativity values.

K. Karasaki attended American Geophysical Union Fall Meeting held in San Francisco from December 3-7.

The paper titled "Method Development and Strategy for the Characterization of Complexly Faulted and Fractured Rhyolytic Tuffs, Yucca Mountain, Nevada, USA," was revised incorporating, USGS colleague review comments.

A minor bug was discovered and corrected during verification runs of the transport option of TRINET on 3-dimensional fracture networks.

Planning Documents

Quality Assurance

Reading assignments were completed by various personnel.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Vigilance was maintained for rainfall and runoff during the month.

Continued processing of data from numerous 1990 floods dominated technical work.

Current literature on flooding and related hazards was scanned and appropriate articles were duplicated for addition to the library.

P. Glancy and P. Telis reconnoitered areas where runoff was reported during late September, 1990. An estimate of peak flow was made for Amargosa River at California Highway 127 crossing about 6 miles North of Death Valley Junction. September runoff was inseparable from earlier runoff elsewhere on the Amargosa River and in Death Valley.

Data compilations and analysis for recent regional flooding will continue during the foreseeable future.

Planning Documents

All study plans are undergoing some stage of review.

Quality Assurance

No work was done on quality assurance this month, except completion of QA reading assignments.

Operations

A substantial effort was expended on orientation of P. Telis to YMP operations and procedures. Telis is the new Activity Chief of the "Future Surface Hydrology" activity in the Nevada District.

P. Glancy visited NTS and Yucca Mountain during early December with P. Telis as part of her field orientation to surface-water activities of YMP. During this visit Glancy met with A. Flint and D. Ambos to further inform them of 1990 runoff events and emphasize a need for backup meteorological information on 1990 storms to fulfill the objectives of relating runoff to storm activity.

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 8.3.1.5.1.4.1 Modeling of soil properties in the Yucca Mountain region

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The revision of the manuscript on Kyle Canyon soils was completed after Branch approval and Geologic Names Unit edit. It is being prepared for submittal to DOE approval and journal review.

Planning Documents

Quality Assurance

Operations

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The available newly published literature was scanned to stay abreast with changing technology in paleoflooding. Important and useful articles were copied and included in our YMP library.

Continued documentation and processing of data from numerous 1990 floods dominated technical work.

Data accumulation and analysis for recent regional flooding will continue during the foreseeable future.

Planning Documents

The study plan for this activity is still undergoing DOE review.

Quality Assurance

No QA activities took place in December, except the completion of QA reading assignments.

Operations

A substantial effort was expended on orientation of P. Telis to YMP operations and procedures. Telis is the new Activity Chief of the "Future Surface Hydrology" activity in the Nevada District. This included field orientation in the Yucca Mountain region during early December.

SCP 8.3.1.5.2.1.3 Evaluation of past discharge areas

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Preparation was made for January field trips to collect material from wet and dry playas. Modern Springs will be collected when the wet and dry playas activity is complete.

Planning Documents

Quality Assurance

E. Gutentag attended safety training for work at the NTS.

A response to NCR 91-06 was issued.

The past discharge activity was audited (Audit USGS 91-01).

Scientific Notebook HP-199T was prepared for the collection of aquatic microorganisms.

Operations

E. Gutentag completed work plans for Past Discharge employees.

R. Forester and D. Adam attended the project planning meeting.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

J. Stuckless received DOE approval for two manuscripts for talks to be presented at the ANS meeting on High-Level Nuclear Waste.

B. Marshall received Director's and DOE approvals for a paper titled "Strontium isotopes in carbonate deposits at Crater Flat, Nevada" to be presented at the ANS meeting. Coauthors are Z. Peterman, K. Futa, and J. Stuckless.

All necessary technical procedures for work in Trench 14 after deepening have been completed. Training to those procedures has also been completed. Environmental training and safety training have been completed by all those who expect to work in the field.

J. Whelan has finished preliminary analyses of drill core samples obtained from Los Alamos through the recently executed MOU. Because the core is not qualified, the work is scoping in nature. These results do not duplicate the tight linear trends for isotopic composition with depth noted by Kaiser and Szabo, but do show a general tendency of increasing $\delta^{18}\text{O}$ with depth. δD values do not show a good trend with depth, but rather show a more bimodal distribution.

Z. Peterman continued analysis of carbonate samples from the Crater Flats area and of water and carbonate samples from the Ruby Mountains which may be an analog to the deposits in the Las Vegas Valley.

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.

J. Stuckless attended a meeting of the SOC and presented a request for 206 samples. A few samples were shipped to the USGS before Christmas, and the remaining samples should be shipped in mid January.

J. Wilson assembled localities of wet and dry playa sites. Many of these sites will be visited and collected next month.

J. Conrad completed locality diagrams for an open-file report on opaline-silica vein paleontology.

Planning Documents

Quality Assurance

Operations

All of the isotope laboratories are working at reduced capacity or shut down temporarily by installation of a new air handling system in the chemistry wing of Building 21. Construction was scheduled for September through November, but has now been extended through December.

E. Taylor's temporary appointment has expired and the Geologic Division has decided not to renew her appointment; attempts to transfer her to WRD are in progress.

D. Adam, R. Forester, and C. Carter attended the DOE safety meeting in Denver.

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

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

Planning Documents

Study Plan 8.3.1.5.2.2 (Effects of climate on hydrology) - S. Keller assisted in finalizing author/reviewer concurrence in preparation for NHP QA review.

Quality Assurance

Operations

SCP 8.3.1.5.2.2.3 Synthesis of effects of possible future recharge due to climate changes on hydrologic characteristics of the Yucca Mountain saturated zone

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

The development of the SNODIF2 program for isotine diffusion through snow pack continued.

A major rewrite of the Sinton 3-D Modeling report continued.

A 3-D model concept was developed in the subregional study area and a finite difference grid and layers were laid.

A. Turner made a presentation concerning 3-D GIS activities to the TPO meeting in Las Vegas. Discussions followed concerning possible expanded roles for GIS within the YMP, coordination with DOE contractors, etc.

A. Turner and K. Kolm conducted field investigations and video recording in the Amargosa Desert and Death Valley regions to support the development of a proposed videotape presentation describing the use of 3-D GIS in the YMP. Three days were spent in the Amargosa and Death Valley areas, recording video images of vegetation communities, springs and spring deposits, cultural and historical sites (Harmony Borax Works, etc.), and critical geological sites and overviews.

A. Turner and K. Kolm visited several dune fields in southern Nevada and southeastern California to evaluate probable ranges of infiltration conditions. Dune fields visited included those in Death Valley and those near Kelso, California. Field reconnaissance of Joshua Tree National Monument allowed the evaluation of recharge potential in uplifted granitic basement rocks.

A. Turner and K. Kolm visited Image Data Corporation, Pasadena, California, to discuss the

specifications of the simulated "fly-over" video of the Death Valley and Amargosa region. Image Data Corporation has special expertise and equipment to produce flight simulator images, and has offered to supply a two-minute video-tape master of such a flight line according to our specifications. The appropriate digital data have been supplied to them. It is estimated that about 30 hours of computation time on specialized parallel computers will be required to make this video.

A. Turner and K. Kolm visited Professor J. Harbaugh at Stanford University to discuss his methods of integrating 3-D visualizations with geological models.

A. Turner and K. Kolm visited Dynamic Graphics Inc. at Alameda, California, to review their progress in building a 3-D geologic model of the Yucca Mountain block. A new 21-layer model was reviewed, minor data corrections made, and a copy was returned to Denver for viewing on the GIS Lab workstation in Building 25. The implementation of fault data was also reviewed, along with future work plans.

A. Turner and K. Kolm made a poster presentation on the use of 3-D GIS at the AGU Fall Meeting in San Francisco.

A. Turner, E. Ervin, and J. Downey completed the corrections to the manuscript submitted to the ANS Conference in Las Vegas in April-May 1991. The manuscript was forwarded to the region for review.

A. Turner briefed C. Gertz during his visit to Denver on the video tape program concept and demonstrated the new Dynamic Graphics 3-D Yucca Mountain model. Gertz expressed strong interest and support for the video tape, and support for continued 3-D modeling.

Planning Documents

Quality Assurance

Operations

Additional computer support and space for work areas are needed. The lack of work space will slow any modeling effort in the future and the lack of support personnel will, in addition, limit the work that can be done in the near future.

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 1.2.5.2.2 Site Characterization Program

Principal Investigator - W. Wilson, III

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

D. Hoxie was committed almost completely full time to activities in support of the Test Prioritization Task (TPT). As a TPT Core Team member, Hoxie attended TPT meetings during the weeks of December 10 and 17, and participated in the EPRI High-Level Waste Performance Assessment workshop in Washington, D.C., December 4-6.

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

S. Keller assisted W. Causseaux in the updating of the Primavera NHP study-plan schedules.

Post-YMP-Submittal Study Plans

Study Plan 8.3.1.2.1.1 (Meteorology for regional hydrology) - S. Keller continued to track author/reviewer concurrence in response to DOE review.

Study Plan 8.3.1.2.2.6 (Unsaturated-zone gaseous-phase movement) - S. Keller transmitted final page changes (as approved in DOE audit review) to the Project Office. The DOE audit review is now complete, and the study plan is now awaiting final approval at the Project Office.

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. LaCamera

OBJECTIVE

To provide water resources environmental field activity planning documents, field data and analyses, and topical reports describing the results of field data analyses.

ACTIVITIES AND ACCOMPLISHMENTS

Technical Activities

A status report for the water-resources monitoring program was prepared for DOE. The report summarized activities for the period November 13 to December 4, 1990.

Suggested revisions (to accommodate DOE and NPS concerns) for the document detailing the ground-water level and springflow monitoring program were delivered to G. Doyle and G. Fasano on December 5. R. LaCamera, Doyle, Fasano, and E. McCann (SAIC/Las Vegas) met in Las Vegas during the week of December 10 to discuss DOE's modifications to the document and content of an accompanying cover letter for forwarding to the NPS. DOE plans on mailing the monitoring program to NPS before December 31.

R. LaCamera met with J. McDaniel (REECo/Las Vegas) to obtain information on DOE's wells J-11 and J-12 during the week of December 10. Clarification of initial construction specifications for a monitoring well to be built south of well J-12, and cost-cutting alternatives, were also discussed that week in a meeting with U. Clanton (DOE), R. Long (DOE), G. Doyle, and G. Fasano. Additional information on well construction which was requested was supplied to Long on December 21.

Release of data collected as part of the site-characterization studies to NPS was discussed with USGS, YMPB personnel on the phone. A meeting in Las Vegas during the week of January 14 is planned to discuss data-release plans for the Environmental and Site-Characterization Programs.

Results of water-quality analyses for samples collected in the Amargosa Desert, Ash Meadows, and Furnace Creek areas during August, 1990 were reviewed.

Status of a quality-assurance grading package was discussed with M. Dussman (SAIC/Las Vegas) and G. Fasano in Las Vegas on December 14. It was determined that the grading package should be approved by the USGS, Yucca Mountain Project Branch QA Manager and TPO. Accounting, funding, and reporting of work performed in fiscal year 1991 were also discussed in a meeting with SAIC personnel.

Staffing needs and status of the water-resources monitoring program were discussed with USGS, Nevada District managers. Recruitment of necessary personnel is in progress.

Procedures and/or policies which might permit a more rapid release of ground-water level data are being explored, particularly with respect to data collected as part of the site-characterization studies.

1.2.6 EXPLORATORY SHAFT (ES) FACILITY

OBJECTIVE

To provide access to a selected underground tuff horizon and surrounding strata in the unsaturated zone; provide the ability to safely and effectively acquire geotechnical data from the selected underground tuff horizon and surrounding strata; and demonstrate the constructibility of a large diameter shaft and underground openings (drifts and waste package emplacement holes) in the selected horizon.

WBS 1.2.6.3 Surface Facilities

OBJECTIVE

To design and develop the Exploratory Shaft surface facilities buildings.

WBS 1.2.6.3.1 Exploratory Shaft Facility Buildings and Surface Facilities

Principal Investigator - D. Campbell

OBJECTIVE

To design and construct Exploratory Shaft Facility (ESF) buildings.

ACTIVITIES AND ACCOMPLISHMENTS

M. McKeown continued coordinating with J. Grenia (FSN) and reviewing the Study Plan for the soil/rock investigations.

The USBR QA Office and soil laboratories are evaluating laboratory QA requirements and changes in procedures necessary to meet YMP requirements. The MOU between the USGS/USBR and DOE needs to be in place before funds are expected.

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 NHP personnel for QMP-17.01, R4, YMP-USGS Records Management.

First Reminder Notices were distributed to participants who were late in submitting completed reading assignment forms for QMP-4.02, R2; QMP-12.01, R5; and AP-5.1Q, R1. The Training Specialist also provided overdue reading assignment information to the TPO QA Advisor.

A revised reading assignment reminder system was completed and an explanation letter regarding the new system was distributed to appropriate YMP-USGS personnel.

Orientation video tape assignments and reading assignments were distributed to personnel according to management's requests.

The Training Coordinator facilitated A. King's (T&MSS) presentation of the mandatory DOE NTS Orientation and Health and Safety Training in Denver on 12/10/90. The Training Coordinator continued to work with J. Stuckless and R. Spengler, USGS, to ensure that Midway Valley/Trench 14 participants will have completed mandatory DOE NTS training by 1/18/91.

The YMP-USGS training database was updated to reflect all instruction completions in December.

The Training Coordinator worked with M. Boucher, Foothills, and J. Whitney, USGS, to make changes to the QMP-2.07, R1 preliminary draft for presentation to T. Chaney, USGS.

Several meetings were held with the TPO QA Advisor, the Training Coordinator, and personnel from the Geologic Division, Nuclear Hydrology Program, and Quality Assurance to discuss the newly proposed instruction assignment system. The new tracking system was presented to management and agreed upon; the system will go into effect after 01/01/91. Supervisors within each organization and/or office will be responsible for assuring participants complete instruction assignments on time, prior to elevating problems to the TPO.

The QA Advisor to the TPO worked with the Training Coordinator to address indoctrination and orientation issues raised by Audit Findings 01 and 02 from Audit 90-13.

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

Two USBR-QMP-17.01, R1 Preliminary Draft versions were prepared for the USBR QA Program.

A disposition for NCR-91-01 and a supplementary response for SDR 559 was prepared.

The records management review of QMP-3.10, R1, "Verification of Scientific Investigations" and QMP-3.03, R3, "Software Quality Assurance" and an informal review of the DOE/YMP Records Management Plan, R1, was completed.

The YMP-USGS Authorized Personnel List was prepared for L. Hayes' submittal in accordance with QMP-17.03, R0.

Three published report packages (OFR 89-595, OFR 89-234, OFR 89-133, PRO 90-0165 totalling 6,627 pages of which 192 were oversized maps and logs), twenty packages of records/record packages (4,376 pages), and four cited reference packages (24 references totaling 1,210 pages) were submitted to the CRF with a total of 12,213 pages.

USGS Surveillance 91-S06 was conducted of the records management and document control activities.

Meetings were held regarding the status of previously identified Improvement/Enhancements to the Records Database System. Programming, testing, and implementation of about 75% of these improvements have been completed.

The LRC completed all processing and CRF submittal activities for those Study Plans associated with closure of NCR-90-27.

The following approved modifications to Quality Management Procedures were distributed:

QMP-3.04,R3-M1	Software Configuration Management System
QMP-17.01,R4-M2	YMP-USGS Records Management

Technical procedure GP-13, R1, "Fracture Logging from Acoustic Televiewer Images" was distributed.

The 1990 annual Controlled Documents Configuration Report was transmitted to all holders of YMP-USGS controlled documents.

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 schedule exercise for comparing the master file from Las Vegas with the master file of the USGS scope of work is approximately 70% completed.

All efforts are being directed at setting the schedules for the reduced budget constraints and the PACS system. This requires a lot of movement of activities within each schedule to bring the activities which are to be completed within the proper time frame.

A major problem, which has been worked out, is the use of the I.C.C. network system on the computers which has proven to be quite user unfriendly, and also to get the menu-driven batch program for plotting and printing from the Novell system to the I.C.C. system. Improvements and modifications were made to software and hardware for the computers used to support project scheduling activity at the Parfet building. This involved fine-tuning the remote terminals and configuring Primavera for a network environment.

The SAIC/Golden actual cost distribution, estimated cost distribution, FTE report, and the USGS cost report for November were compiled. The November 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 November was completed and the report was edited and submitted to DOE.

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 - D. Appel

OBJECTIVE

To establish and maintain the QA program descriptions.

ACTIVITIES AND ACCOMPLISHMENTS

QMP-2.02, R4 will not be distributed due to changing Project guidance. QMP-2.02, R5, prepared in response to this new guidance is being reviewed by USGS management in Reston.

A revision to QMP-3.10, R2 was submitted for Division Review with comments due back by 12/26/90.

Comments have been received from both Divisions for the revisions to QMPs -18.01 and -18.02; however, QMP-18.01 is being revised further to incorporate the new modification and will be resubmitted for Division Review.

QMP-3.14, R4 was prepared in accordance with the recent modification and was submitted for Division Review.

Review comments have been received from the Records Coordinator, TPO support and GD for the following QMPs: QMP-3.07, R4; -4.01, R4; and -7.01, R4. However, because of the scope of some of these comments the authors have not incorporated and resolved all comments. In response to a resolution to CAR-91-02, a workshop was conducted on 12/19/90. The purpose of this workshop was to identify the causes of the CAR (involving the failure to incorporate modifications to QMPs within the required four month time frame). The workshop was attended by representatives from YMP-USGS QA and TPO Offices, NHP and GD. Results of the workshop included the revision to QMP-5.03 to allow modifications to be reviewed separately from the procedure and after review and concurrence, permit the modifications to remain effective indefinitely rather than for a period of four months. The revision draft for QMP-5.03 is being prepared and is scheduled for completion by 01/21/91.

Comments from Division Review of QMP-3.03, R3 is due by 1/11/91. QMPs -2.07 and -2.08 are still in preparation.

Draft QMP-3.10, R2, Verification of Scientific Investigations, was sent out for Division Review.

Modifications were prepared, approved and distributed for QMP-3.04, R3 and QMP-17.01, R4. Modifications are being prepared for QMP-18.01, R5 and QMP-15.01, R4.

Interim change notices to the YMP-USGS-QAPP-01, R5 are being prepared for the changed requirements concerning QA Levels and the revision of personnel proficiency requirements.

J. Kinney was selected to be USBR-YMP Quality Assurance Manager.

On December 19, J. Kinney and M. McKeown submitted completed software QA documentation for "Oriprogram" to Software Configuration Management Librarian for subsequent processing.

USBR submitted YMP-USBR-QMP-1.01, R1 (Organization Description) to the USGS QA Office for approval on December 20.

WBS 1.2.9.3.2 Quality Assurance - Audits and Surveillances

Principal Investigator - D. Appel

OBJECTIVE

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

ACTIVITIES AND ACCOMPLISHMENTS

A meeting was held between personnel of the USGS QA Office, SAIC/Golden QA Support, and the U.S. Bureau of Reclamation (USBR) to reevaluate the USBR's proposed corrective actions and implementation schedule for AFRs and Observations initiated during the USBR Audit USGS-90-07.

The responses to AFRs and Observations from internal Audit USGS-90-13 were accepted.

The response to USGS-AFR-9014-01 on Sverdrup Technologies was accepted and the audit was subsequently closed.

Audit USGS-91-01 on the implementation of select YMP-USGS QMPs and APQs for two NHP activities was conducted and a draft Audit Report was distributed that included six draft Audit Finding Reports (AFRs) and two draft Audit Observations.

Audit Report USGS-91-02, for vendor Yellow Springs, Inc., was submitted with a recommendation for their acceptance as a YMP-USGS approved vendor.

The YMP-USGS TPO QA Advisor coordinated with the DOE/YMP Audit Team Leader in assessing the responses to Corrective Action Reports (CARs) HQ-91-008 and HQ-91-011. Both CARs had been initiated during the DOE/YMP "Gold Star" Audit 90-I-01.

The Report for surveillance USGS-91-S01 was completed and submitted. This surveillance successfully closed NCRs -90-25 and -90-28 with one Observation and NCR-91-10 resulting.

Surveillance USGS-91-S03 on the implementation of AP-1.10Q, Preparation, Review, and Approval of SCP Study Plans, and QMP-3.07, USGS Review Procedure was planned, conducted, and documented in a Surveillance Report. One Nonconformance Report was written as a result of this surveillance.

Surveillance USGS-91-S04 on the implementation of QMP-3.03, Software Quality Assurance, and QMP-3.14, Software Configuration Management System was planned, conducted, and documented in a Surveillance Report. Two Nonconformance Reports were written as a result of this surveillance.

Surveillance USGS-91-S05 of the implementation and effectiveness of vendor selection and approval requirements and maintenance of the Approved Vendors List (AVL) was conducted and the Surveillance Report was issued. Related to this surveillance, NCR record packages were later reviewed to identify deficiencies for annotation and resubmittal to satisfy AFR-9013-05.

- The Report for surveillance USGS-91-S06 on the implementation of QMP-6.01, R5, Document Control; and QMP-17.03, R0, YMP-USGS Local Records Center was submitted.

The response to USGS-NCR-90-33 was accepted.

A new Quality Deficiency Report form was prepared in anticipation of a meeting on the possible revision of the Nonconformance Report System. This deficiency report form is expected to replace the various forms now used for documenting the deficiencies determined by several procedures.

Surveillance Report for Surveillance No. USBR-S-90-02 (Comparison of USBR-YMP Purchase Requests and Issued Purchase Orders) was approved on December 27.

WBS 1.2.9.3.3 Quality Assurance - Quality Engineering

Principal Investigator - D. Appel

OBJECTIVE

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

ACTIVITIES AND ACCOMPLISHMENTS

A general QA Staff Meeting held jointly with the USGS QA Office was held and well attended. The agenda items discussed included the status and anticipated changes in the YMP-USGS QA Program, such as updating the YMP-USGS Quality Assurance Program Plan (QAPP-01, R5) to address the requirements stemming from the newly approved DOE/OCRWM Quality Assurance Requirements Document (QARD), revising implementing instructions based on changes in the upper tier documents and as a result of the DOE QA Workshops, and assuring that technical personnel participated in the preparation and review cycles for all of the documents. The meeting also involved discussions on software, corrective action and trending, audits/surveillances, personnel qualifications, training, grading, data management, etc.

An implementation initiation follow-up session on AP-5.1Q (data management) was held to answer questions that YMP-USGS personnel had concerning the implementation.

The TPO QA Advisor worked with B. Reilly, SAIC/LV, to ensure that USGS input and slides of FY90 accomplishments would be included in the C. Gertz (DOE YMP Manager) presentation on 12/07/90.

Meetings were attended to discuss implementing QMP-2.02 (YMP-USGS personnel qualification). A revision to the draft "highlight" sheet was prepared and forwarded to the QA Manager for consideration. The sensitive issue of annual proficiency evaluations has been omitted from the DOE/YMP QARD which causes a similar revision to the QMP.

The TPO QA Advisor worked with the USGS QA Office, on reviewing procurement records for USGS-NCR-90-09 and DOE/YMP SDR 135. The Open Items Committee continued meeting on a bi-weekly basis with primary emphasis being on discussing and resolving open items considered complex or difficult to resolve. Some of the action items worked on during December included: External Items SDR 135 (USGS FY89 and FY90 procurements), SDR 489 (calibration details in technical procedures), 557 & 558 (requirements for LRC and Record Sources), SDR 559 (illegible copies of notebooks and aerial photographs); Internal Items AFRs 9007-01 through -04 (USBR QA program), AFRs 9013-01, -02 and Observation 1 (orientation, indoctrination and/or training), AFR 9013-08 and Observation 6 (data management), USGS CAR 90-01 (interface controls), CAR 90-04

(untimely responses or actions for open items), CAR 91-01 (graded QA program), CAR 91-03 (use of unapproved vendors); NCRs 90-09 (procurement), NCR 90-27 (LRC submittal of Study Plan packages to the CRF), NCR 90-29 (fire-proof safes in the LRC), NCR 90-31 (submittal of final procurement documents to SAIC T&MSS), 90-35 (TPO/QA review of publications), NCR 90-37 (calibration requirements), and NCR 91-01 (accession numbering on USGS publications). Other miscellaneous actions included tracking YMP-USGS readiness for tasks associated with the "Midway Valley" work slated to begin in January 1991, coordination and follow-up of instruction assignments with the Training Specialist, resolving overdue document control notices, follow-up of potentially overdue calibrations, limited involvement with internal audit USGS-91-01 (covering two technical NHP activities) and internal surveillances USGS-91-S03 (covering Study Plans), 91-S04 (Software), 91-S05 (Approved Vendors List), and 91-S06 (QA Records and Document Control).

Approximately 53 software items were received, reviewed, and/or processed by the SCM Librarian 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 Baselineing of Software Products.

An Agenda and Minutes were distributed for a December CCC meeting. Nine reviews were conducted for the month of December. Proper documentation of three of these reviews has required research to resolve concerns about an alternate application of change control. A CCC Review Plan and CCC Review Report was reviewed and baselined for each review.

A preliminary draft of QMP-3.14, R4 has been initiated on behalf of its revision committee. A formal review of QMP-3.03, R3 has been initiated.

WBS 1.2.9.3.4 Quality Assurance - Quality Overview

Principal Investigator - D. Appel

OBJECTIVE

To provide reviews, analysis, and interpretations of QA requirements and application of QA to technical and scientific disciplines.

ACTIVITIES AND ACCOMPLISHMENTS

The November Open Items and Trend Analysis Report was submitted.