Department of Energy
Washington, DC 20585

SEP 1 0 1992

Mr. Joseph J. Holonich, Director
Repository Licensing and Quality Assurance
Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Holonich:

The enclosed Yucca Mountain Site Characterization Project participant monthly status reports are forwarded for your information. If you have any questions on the enclosed reports, please contact Priscilla Bunton at (202) 586-8365.

Linda J. Desell, Chief
Regulatory Integration Branch
Office of Civilian Radioactive
Waste Management

Enclosures: as stated
(1) Lawrence Livermore National Laboratory Yucca Mountain Project Status Report, July 1992
(2) Los Alamos Monthly Activity Report, July 1992
(3) Sandia National Laboratories Yucca Mountain Project Status Report, July 1992

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cc:w/o encl.
C. Gertz, YMPO
cc: w/encl.
K. Hooks, NRC
R. Loux, State of Nevada
T. J. Hickey, Nevada Legislative Commission
M. Baughman, Lincoln County, NV
J. Bingham, Clark County, NV
B. Raper, Nye County, NV
P. Niedzielski-Eichner, Nye County, NV
G. Derby, Lander County, NV
P. Goicoechea, Eureka, NV
C. Schank, Churchill County, NV
F. Mariani, White Pine County, NV
V. Poe, Mineral County, NV
E. Wright, Lincoln County, NV
J. Pitts, Lincoln County, NV
R. Williams, Lander County, NV
J. Hayes, Esmeralda County, NV
M. Hayes, Esmeralda County, NV
B. Mettam, Inyo County, CA

rec'd with ltr 9/10/92

Sandia National Laboratories

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Monthly Status Report

July 1992

DISCLAIMER

Quality assurance checks on data contained in this report have been performed only to determine that the data have been obtained and documented properly. The SNL Project Department cautions that any information is preliminary and subject to change as further analyses are performed or as an enlarged and perhaps more representative data base is accumulated. These data and interpretations should be used accordingly. Milestones have not been baselined and are included only to show status.

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Sandia National Laboratories

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Monthly Status Report

July 1992

Sections At-A-Glance

WBS Elements Without Reportable Activity This Period

1.2.1.2.1	System Requirements and Description
1.2.1.2.2	System Studies
1.2.1.2.5	Configuration Management Plans and Procedures Control
1.2.1.2.6	Yucca Mountain Site Characterization Project (YMP) Support to the Management Systems Improvement Strategy (MSIS)
1.2.1.3.5	Technical Data Base Input
1.2.1.4.3.4	Seal Performance Requirements and Analyses
1.2.1.4.8	Performance Confirmation
1.2.3.2.8.4.6	Quaternary Faulting Within the Site Area
1.2.4.2.1.1.1	Excavation Investigations
1.2.4.2.1.1.3	In Situ Mechanical Properties
1.2.5.2.2	Site Characterization Program
1.2.5.2.3	Regulatory Review
1.2.5.2.6	Semi-Annual Progress Reports

Highlights

SNL staff sends the Site and Engineering Properties Data Base data file tables to EG&G for transfer to the GENESIS data base.

See 1.2.1.3.1 Site and Engineering Properties Data Base on page 2

SNL staff presents an analysis of the 'three-bucket approach' at a U.S. DOE/NRC technical exchange meeting and submitts to the DOE a comparison of the approach to 1985 EPA standards.

See 1.2.1.4.1 Total System Performance Assessment on page 4

SNL staff prepares for independent review the report on relative performance assessment of unsaturated surficial deposits as an item important to waste isolation.

See 1.2.1.4.3.2 Preclosure Radiological Safety Analyses on page 5

SNL staff submits study plan revision based on Project Office and DOE HQ comments.

See 1.2.3.2.2.2.1 Systematic Acquisition of Site-Specific Subsurface Information on page 10

The Topopah Spring welded tuff anisotropy report is published.

See 1.2.3.2.7.1.3 Laboratory Determination of Mechanical Properties of Intact Rock on page 13

SNL distributes four YMP documents:

- PRSA for underground facilities' accident conditions at the potential site
- PRSA for the exploratory studies facilities
- approaches to support performance assessment *hydrologic and chemical transport*
- TSPA-1991

See 1.2.9.1.1 Management on page 26

SNL staff processed all backlogged SCP activity records.

See 1.2.9.1.4 Records Management on page 27

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July 1992

WBS 1.2.1.3.1 Site and Engineering Properties Data Base (SEPDB)

- A data cartridge containing all remaining SEPDB data file tables required for transfer to the GENESIS data base was sent to Edgerton, Germeshausen and Grier Corp. (EG&G) on July 15, 1992.

WBS 1.2.1.4.1 Total System Performance Assessment

- SNL staff presented "An Analysis of the Three-Bucket Approach" at a U.S. Department of Energy/Nuclear Regulatory Commission (U.S. DOE/NRC) technical exchange meeting on July 22, 1992.
- SNL staff also completed "A Comparison of the 1985 EPA Standard With the 'Three Bucket Approach' " for the DOE to submit as input to the EPA revision of 40 CFR Part 191.
- SNL distributed SAND91-2795, "TSPA 1991: An Initial Total-System Performance Assessment for Yucca Mountain," by R. Barnard, M. Wilson, and H. Dockery (SNL), J. Gauthier (SPECTRA), P. Kaplan, R. Eaton, and F. Bingham (SNL), and T. Robey (SPECTRA).

WBS 1.2.1.4.3.2 Preclosure Radiological Safety Analyses

- The relative performance assessment of unsaturated surficial deposits as an item important to waste isolation report is ready for independent review. Development of the report on items important to safety continues.
- SNL distributed the following reports:
  - SAND88-7061, "Preclosure Radiological Safety Analysis for Accident Conditions of the Potential Yucca Mountain Repository: Underground Facilities," by C. Ma, R. Sit, S. Zavoshy, and L. Jardine (BNI);
  - SAND89-7002, "Preclosure Radiological Safety Analysis for the Exploratory Shaft Facilities," by C. Ma, D. Miller, and L. Jardine (BNI);

Executive Summary
July 1992
Continued

WBS 1.2.1.4.4.1 Pre-Waste-Emplacement Ground-Water Travel Time

SNL distributed the following reports:

- SAND89-7018, "Conceptual, Experimental, and Computational Approaches to Support Performance Assessment of Hydrology and Chemical Transport at Yucca Mountain," by T. Narasimhan and J. Wang (LBL); and

WBS 1.2.3.2.7.1.3 Laboratory Determination of Mechanical Properties of Intact Rock

- SAND91-0894, "Anistropy of Topopah Spring Member Welded Tuff," by R. Martin, R. Price, P. Boyd, and R. Haupt, was published in July 1992.

WBS 1.2.3.2.2.2.1 Systematic Acquisition of Site-Specific Subsurface Information

- SNL staff revised the Systematic Acquisition of Site-Specific Subsurface Information Study Plan based on results of a comment resolution meeting held on July 1, 1992 with reviewers from both the Project Office and DOE Headquarters.

WBS 1.2.9.1.4 Records Management

- SNL staff processed all backlog records associated with SCP activities for forwarding to the Central Records Facility.

1.2.1 SYSTEMS

The objective of the Systems element is to provide the focal point for the Yucca Mountain Site Characterization Project (YMP) activities concerned with the integrated perspective of the entire radioactive waste disposal system. The Systems element is comprised of four individual tasks: Systems Management and Integration (1.2.1.1), Systems Engineering (1.2.1.2), Technical Data Base Management (1.2.1.3), and Total System Performance Assessment (1.2.1.4).

1.2.1.1 MANAGEMENT AND INTEGRATION

Status Report on Ongoing Activities

Staff continued to support the project Integrated Test Evaluation effort. Meetings involving Sandia National Laboratories (SNL) staff took place on July 1 and 2, 1992 in Las Vegas, NV.

1.2.1.2.4 SYSTEMS ENGINEERING IMPLEMENTATION

Significant Meetings Attended

SNL staff attended the 2nd International Symposium of the National Council on Systems Engineering in Seattle, WA on July 27 through 29, 1992. R. Sandoval (SNL) presented the conference paper "Functional Analysis of a Nuclear Waste Repository System" (SAND91-2759C), by F. Schelling and R. Sandoval (SNL).

1.2.1.3.1 SITE AND ENGINEERING PROPERTIES DATA BASE (SEPDB)

Status Report on Ongoing Activities

A data cartridge containing all files required to transfer the remaining data tables to GENESIS was sent to Edgerton, Germeshausen and Grier Corp. (EG&G) on July 15, 1992. The tables contained bulk chemistry, bottom hole coordinates, core information, curve fit, flood data (predicted and measured), drill hole coordinates, lithologic units, matrix potential, permeability, water production, paleomagnetic, precipitation, sample locations, spent fuel radioactivity, sonic velocity, mineralogy (surface samples), storage coefficient, thermal expansion, stratigraphic, and water level data. The tables are included in the job file at SNL and will be closed out when SNL receives identical verification reports from EG&G.

Major Activities Upcoming Next Three Months

Data entry will be completed for any critical new submittals.

Technical Data Information Forms (TDIFs) will be developed for data submittals that existed prior to the inception of the Automated Technical Data Tracking (ATDT) system.

The transition of the Site and Engineering Properties Data Base (SEPDB) to the GENESIS database will continue.

1.2.1.3.2 INTERACTIVE GRAPHICS INFORMATION SYSTEM

Status Report on Ongoing Activities

A temporary copy of Arc/View was installed on the internal network for evaluation. Staff tested the functionality of the software and successfully operated the software over the network on Sun workstations, personal computers (PCs), and Macintosh units. Several new coverages and the master Arc/View file were ordered from the Yucca Mountain Project Office (YMPO) technical database.

The initial version of the Planning and Control System (PACS) video was completed. Development of videos on computer models and Yucca Mountain geology continued.

The following CALMA thermal/mechanical model jobs have been completed:

- Job 385 for W. F. Chambers - FEM of Yucca Mountain Cross Section
- Job 393 for T. H. Robey - Profile Through USW N54-N55
- Job 394 for M. E. Fewell - Locate Proposed Test Pits

Major Activities Upcoming Next Three Months

System setups and user interfaces for Arc/Info and Arc/View software will be developed and additional personnel will be trained.

Staff will continue working with the Project Technical Data Base (TDB) or GENESIS (at EG&G) to obtain additional data, such as contours at a higher resolution and files containing graphics, to display symbols similar to the maps produced at the TDB or GENESIS.

The following CALMA jobs are in progress:

- Job 386 for H. A. Dockery - Drill Holes/Section
- Job 391 for M. J. Esp - Section Through Ramps/ Drift
- Job 395 for W. F. Chambers - Site Seismic Test Holes

1.2.1.3.3 REFERENCE INFORMATION BASE

Major Accomplishments

The latest revisions of Version 4 of the Reference Information Base (RIB), approved by the YMP Change Control Board (CCB), were distributed by Project Document Control. These include revisions 5 and 6 of RIB Version 4.

1.2.1.3.4 TECHNICAL DATA BASE MANAGEMENT COMPUTER SUPPORT

Status Report on Ongoing Activities

Staff continued to load Personal Computer Network File Server (PCNFS) software on PCs, install communications boards, and set up network files to bring all PCs into operation on the Local Area Network (LAN).

Staff installed and tested a cross-terminal emulation program for PCs. Staff also tested a new bubble-jet color printer, scanner, and copier for possible use on the network. Network interface is not currently available for these entities, but investigation continues to determine if networking will be possible.

A new network printer for black-and-white printing was installed. Breakdowns continued with the Tektronix color printers.

The Legato autobackup system is still having trouble recognizing the size of the tape. Another drive is being sent from Exabyte to determine the condition of tape drive heads.

Major Activities Upcoming Next Three Months

Staff will continue setups for new and existing workstations and PCs. Staff will participate in the SNL Division-wide effort to provide a network for the Division.

The new Exabyte drive will be installed, tested, and replaced if necessary. If problems are not solved with the new drive, other possible systems for automatic backups over the network will be investigated.

Staff will continue to investigate possible providers of dependable color printing on the network.

Routine backups, preventive maintenance, and system monitoring will be performed on all machines.

1.2.1.4.1 TOTAL SYSTEM PERFORMANCE ASSESSMENT

Major Accomplishments

Staff made a presentation entitled "An Analysis of the Three-Bucket Approach" at a U.S. Department of Energy/Nuclear Regulatory Commission (DOE/NRC) technical exchange meeting on July 22, 1992 in Bethesda, MD.

"A Comparison of the 1985 EPA Standard with the 'Three Bucket Approach'" was completed by M. Wilson. The document was prepared for transmittal to the Environmental Protection Agency (EPA) as part of the DOE's input to the EPA on the revision of 40 CFR Part 191.

Significant Meetings Attended

A class on Expert Judgment, taught by S. Hora of the University of Hawaii, was presented on July 6, 1992. In addition to SNL staff, attendees included staff from the Yucca Mountain Project Office (YMPO), Science Applications International Corporation (SAIC), and the Management and Operation (M&O).

SNL staff attended the Engineered Barrier System (EBS) Performance Assessment (PA) meeting in Las Vegas, NV on July 15, 1992.

SNL staff attended a second-cycle Total System Performance Assessment (TSPA) planning meeting July 21, 1992 in Vienna, VA, at the TRW offices. Representatives of INTERA, TRW, and YMPO were also present.

Staff attended a Lead Organizer's planning meeting for the International High Level Radioactive Waste Management Conference. The format for the conference was discussed, along with potential topics for the workshops and plenary sessions.

SNL staff met with staff from M&O/Woodward-Clyde to discuss how the work reported on scenario selection associated with basaltic volcanism (SAND91-1653) might be used to help resolve NRC comments on the study plan related to basaltic volcanism issues.

SNL hosted the Hydrology Integration working group meeting on July 28, 1992. Staff from Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), the United States Geological Survey (USGS), YMPO, and the M&O were present to discuss, among other topics, the result of saturated-zone modeling effort underway at SNL.

Status Report on Ongoing Activities

"A Semianalytical Method of Path Line Computation for Transient Finite-Difference Models" (SAND92-7035), by Ning Lu (Disposal Safety Inc.), is currently in technical review at SNL. It will be submitted to Water Resources Research.

Staff have been developing source-term inventories (using the ORIGEN database) that reflect the changes in isotopic compositions due to reactor type, amount of burnup, and length of decay since discharge from the reactors. These data will be used to evaluate the importance of using such detailed source terms in TSPA calculations, compared with the averaged source term of 60% PWR (@33,000 MWd burnup)/ 40% BWR (@27,500 MWd burnup). Results will be presented in a memo or report.

1.2.1.4.3.1 POSTCLOSURE REPOSITORY DESIGN ANALYSIS

Status Report on Ongoing Activities

SAND91-1493, "Equivalent Energy Density Concept: A Preliminary Reexamination of a Technique for Equating Thermal Loads," by E. Ryder, is being prepared for printing. SAND91-1493 documents the results of a study that addresses the thermal design problem of bounding-induced thermomechanical responses over expected ranges of waste stream characteristics (age and burnup).

1.2.1.4.3.2 PRECLOSURE RADIOLOGICAL SAFETY ANALYSES

Status Report on Ongoing Activities

A report on the relative performance assessment of unsaturated surficial deposits as an item important to waste isolation has been drafted and is ready for independent review. Development of a report on items important to safety continues and is expected to be completed this fiscal year.

1.2.1.4.4.1 PRE-WASTE-EMPLACEMENT GROUND-WATER TRAVEL TIME

Major Accomplishments

In preparation for continued efforts in the analysis of site and analog data a request was made to install ARCVIEW. ARCVIEW is a software package that allows easy access and interactive graphical manipulation of data that have been formatted for ARCINFO. The ARCVIEW installation was successful. Efforts are now underway to tailor the installation to specific needs and to add as much information to the data base as possible.

SAND89-7018, "Conceptual, Experimental and Computational Approaches to Support Performance Assessment of Hydrology and Chemical Transport at Yucca Mountain," by T. Narasimhan and J. Wang, was printed and distributed this month.

Significant Meetings Attended

SNL hosted the organizational meeting on July 10, 1992 for the INTRAVAL study group at SNL. A proposed outline for integrating the INTRAVAL data, geostatistical simulator, and the two-dimensional flow codes was presented to the participants in the study group.

SNL staff attended the July 14th, 1992 meeting on future directions in performance assessment and contributed some input regarding the INTRAVAL studies in relation to future performance assessment. Staff also attended the annual Society for Industrial and Applied Mathematicians (SIAM) meeting July 20 through 23, 1992 to get information on recent research in nonsymmetric preconditioners for linear-equation solvers.

Status Report on Ongoing Activities

Geostatistical simulation of porosity between USW-N54 and USW-N55 for the Yucca Mountain INTRAVAL Test Case has been successfully demonstrated. In addition, an adaptive grid routine has been written to adjust to each geostatistical simulation in preparation for modeling the flow field between the two holes. Current efforts are centered on generating a model for the characteristic curves for the INTRAVAL Test Case.

A two-dimensional model of Solitario Canyon was run by workers at LBL. The model uses different layers having different porosity and permeability values. The run was used to check if rock property contrast would affect the performance of the model. An outline of the report to document the boundary-condition study was submitted this month.

The authors of SAND88-7054, "Processes, Mechanisms, Parameters and Modeling Approaches for Partially Saturated Flow in Soil and Rock Media," are addressing review comments.

SAND92-0461, "Pre-Waste-Emplacement Ground-Water Travel Time Sensitivity and Uncertainty Analyses For Yucca Mountain, Nevada," by P. Kaplan, has been reviewed by the Project Office and returned with minor comments that will be addressed.

The geostatistical-simulation program and documentation were obtained and a two-dimensional cross-section of the first INTRAVAL problem was generated. The two-dimensional cross section generated above is being used to debug the geostatistical adaptive grid generator (GAG), which was written last month to take output from the geostatistical simulator and produce grids and input files for the flow simulator. The initial algorithm obtained was found to be unstable for fine grids, but modification to the algorithm makes GAG much more robust and produces better girds.

Subroutines are being added to GAG to produce the input files for both flow codes (NORIA and DUAL). Possible problems with sparse data and curve fitting are being investigated. The use of an incomplete gamma function as an alternative to the van Genuchten curve is being investigated.

1.2.1.4.6 DEVELOPMENT AND VALIDATION OF FLOW AND TRANSPORT MODELS

All activities addressed in this monthly status report support SCP Section 8.3.5.12.2.1.1. Activities supporting SCP Section 8.3.5.12.2.2.2 are not scheduled for FY92.

Status Report on Ongoing Activities

Unsaturated flow through single fractures

Analysis of data from full-field infiltration instability experiments continued and notebooks covering the experiments were submitted to the SNL Data Records Management System (DRMS). Completion of the analysis and writing a journal article reporting results are scheduled for August. Scoping experiments to investigate the effects of initial moisture content of gravity-driven fingering in nonhorizontal fractures also continued.

Large fractures within blocks of welded Bandelier tuff were extracted from an outcrop near Los Alamos, NM and transported to SNL. Several of these have been cut for use in experiments to measure saturated permeability and solute transport in single fractures. In collaboration with P. Riemus of Los Alamos National Laboratory (LANL), an experimental apparatus has been constructed in the SNL lab and preliminary permeability measurements of one of these fractures made. The two sides of the fracture have also been profiled using a laser profilometer. An interesting preliminary result is the substantial reduction in the fracture permeability as a function of time. In August, fracture profiles will be analyzed and permeability data interpreted. In addition to this effort, an experiment to demonstrate gravity-driven fingering in large natural fractures in tuff was performed using dyed water and one of the fractured blocks from the welded Bandelier. As predicted from laboratory research in analog roughened glass fractures, fingers developed and moved through the vertically oriented fracture, bypassing over 50 percent of the fracture cross-sectional area. Additional demonstration experiments are planned for this August.

Fracture matrix interaction

Experiments continued to understand and describe the wetted structure in horizontal fractures. These experiments are necessary to build defensible models for interblock connection for use within larger-scale effective media models. Experiments this month focused on dynamic aspects of the wetting process and the influence of film flow in finely rough fracture surfaces.

Scoping studies continued aimed at understanding the influence of matrix imbibition on fracture percolation in thin two-dimensional systems cut normal to the plane of the fracture. Imaged moisture content fields were digitized and analyzed. Based on these results, modifications are being made to the experiment and data analysis procedures.

Gravity-driven fingering in porous media

Measurement continued of the hydraulic properties of the seven similar sands used in fingering experiments conducted two years ago. Properties are being measured within the slab chamber used in the fingering experiments. Full-field saturation measurement techniques developed at SNL are being used.

Field, lab, and numerical experimentation to determine scaling laws for effective-media properties in heterogeneous media

An automated gas-permeameter test system was designed this month. All primary components of the system were selected and purchased. The test system is composed of a computer-driven, two-dimensional translation system and automated electronic gas permeameter. LABTECH, a commercial data acquisition package, has also been evaluated for its capabilities to control positioning of the permeameter probe, to operate the gas permeameter, and to acquire and store the desired data. The gas permeameter is designed for both field and laboratory applications, while the translation system will be used only in the laboratory.

Development of experimental capabilities

A Phillips MG161 x-ray generator and tube head has been identified as the unit of choice for the laboratory program. Efforts have also been made to address safety concerns and to acquire associated equipment required to operate and maintain the unit safely.

Studies aimed at evaluating the precision and accuracy of x-ray absorption and transmitted light as full-field moisture content monitoring techniques were completed. The associated data were submitted to the SNL DRMS. A journal article documenting the results will be completed soon.

Tensiometer and dye concentration sensors continued to be developed for use in automated laboratory experiments.

Reactive transport model development

Experiments to determine the effect that trace surface coatings and admixed grains have on the surface properties of natural materials continued during July. The amount of carbonate coating the surfaces of grains in the quartz sand that will be used in the caisson experiment was estimated. Chemical and x-ray analysis of the limonite that will be used in the caisson experiment showed it to be very heterogeneous. Therefore, the reactive layer should be well-mixed before emplacement. Initial bench-scale column experiments to estimate the pH in the caisson under unsaturated-flow conditions were completed. Lithium and boron adsorption experiments were carried out with a mixture of limonite and sand in order to evaluate their potential as poorly-sorbing tracers for the caisson experiment. Both elements exhibit low but measurable amounts of sorption in both the mixture and pure sand over the pH range expected for the caisson. Isotherm experiments to determine the linear range of sorption are currently being conducted.

Major Activities Upcoming Next Three Months

The automated gas-permeameter test system will be built and tested.

A suite of tests aimed at studying the influence of matrix imbibition on fracture percolation in thin, two-dimensional systems cut normal to the plane of the fracture will be conducted.

Detailed studies will continue of sorption of B, I, Li, and Ni by mixtures of sand and goethite and by materials (samplers, plastic laboratory ware) to be used in caisson or in supporting laboratory studies. Design calculations will continue for caisson experiment fill and instrument caisson, and surface potentiometric titration of sand, geothite and zeolite will also continue.

Other Items to Report

A lab tour was given on July 28, 1992 to the Hydrology Integration Team by V. Tidwell and R. Glass.

1.2.1.4.7 SUPPORTING CALCULATIONS FOR POSTCLOSURE PERFORMANCE ANALYSES

Status Report on Ongoing Activities

Calculations to estimate the effects on repository performance of surficial water use in the controlled zone, but outside the repository, which are presented in the Exploratory Studies Facility (ESF) Performance Assessment (PA) Analysis No. 12, and the Problem Definition Memo (PDM) describing these calculations, PDM 72-32, were completed and have completed technical review. The results of the analyses were presented at the ESF status meeting and at the Technical Integration Group (TIG). Exploratory Studies Facility Design Requirements (ESF DR) Appendix I will be revised to include the analysis results.

Preliminary efforts for a model validation exercise have been initiated in collaboration with WBS 1.2.1.4.6. Preliminary calculations are being performed and a PDM, describing calculations to be made in conjunction with the caisson sand experiments, is being written.

A review of controls on the Phase II Neutron Boreholes and U.S. Geological Survey (USGS) activities in the Quaternary Fault site area was completed.

A performance assessment of impacts of the soil and rock properties Phase II test pits and Fran Ridge test pits on repository performance was completed.

Infiltration and waste isolation implications of "To Be Determined" (TBD) and "To Be Verified" (TBV) statements for ESF Work Package 1A were evaluated.

Opinions regarding the Classification Analysis of the Systems in the North Portal Package 1A were documented and transmitted to RSN.

Major Activities Upcoming Next Three Months

The documents describing the performance assessment plan for the ESF Title II design support will be completed. The plan described in the document will be developed and implemented.

1.2.1.4.9 *DEVELOPMENT AND VERIFICATION OF FLOW AND TRANSPORT CODES*

Significant Meetings Attended

SNL staff presented a paper entitled "Some Modeling Issues in Nuclear Waste Isolation" at the Environmental Studies workshop at the University of Minnesota on July 5 through 10, 1992. The meeting was sponsored by the Institute for Mathematics and its Applications with the objective of providing an interdisciplinary forum for joint exploration of recent advances in environment sudies. The talk discussed mathematical challenges associated with modeling transport in unsaturated fractured porous materials and presented some modeling examples.

Status Report on Ongoing Activities

Code Development (Subactivity 1.6.2.1.2)

Staff participated in a scoping meeting to outline studies to be incorporated into the 1993 total systems performance analysis report. Staff contribution to this report will include results of matrix/fracture vapor flow studies and a summary of the importance of dimensionality.

Staff are serving on a Yucca Mountain Project analysis review team. In accordance with requirements set forth in DOP 2-4, they are reviewing the Problem Definition Memo and resulting analyses of Fewell and Sobolik; this work estimates the extent of migration of surficially applied water near the perimeter of the potential repository.

A statement-of-work was prepared for letting a contract to S-CUBED to investigate vapor flow through the fractured materials at Yucca Mountain in collaboration with staff. The investigation proposes to consider effects of barometric pumping, the so-called "Bernoulli effect," and diurnal fluctuations on moisture transport.

Software QA (No SCP activity)

Revisions for QAIP3-2, Rev 2 were completed. This revision addresses recent internal audit findings and comments.

The documentation effort for the climatology codes is continuing.

All Quality Assurance (QA) codes, except NORIA-SP and TOSPAC, have been set up in the software configuration management system on sass459. The NORIA-SP qualification documentation is being reviewed and should be completed in early August.

Responses to internal audit findings DR92-01, DR92-02, and DR92-03 are being investigated.

1.2.3 SITE INVESTIGATIONS

The objective of the Site Investigation element is to determine repository site suitability in terms of DOE siting guidelines (10 CFR 960), Nuclear Regulatory Commission (NRC) criteria (10 CFR 60), and Environmental Protection Agency (EPA) standards (40 CFR 191).

1.2.3.1 SITE MANAGEMENT AND INTEGRATION

Status Report on Ongoing Activities

During the Sample Overview Committee (SOC) meeting on July 7, 1992 in Area 25, an outstanding specimen removal request from North Carolina A&M University was considered and approved subject to a review of the remaining core by Lawrence Livermore National Laboratory (LLNL) to ensure adequate material for additional analyses. The samples would be used to study diffusivity of CO_2 and other radionuclides through Topopah Spring tuff.

Review of the draft Selection of Preferred Initial ESF Access (SPIA) Task Force report was completed and the final report was issued by the Project Office. The task force concluded that there were no overriding technical reasons for selecting either the northern or southern ramps as the preferred initial access to the ESF, and that programmatic factors, such as schedule, should guide the selection.

1.2.3.2.2.2.1 SYSTEMATIC ACQUISITION OF SITE-SPECIFIC SUBSURFACE INFORMATION

Significant Meetings Attended

Staff participated in a Project-wide geophysical logging workshop in Denver, CO on July 16, 1992. Personnel from Schlumberger presented the capabilities of several new geophysical tools, particularly those using new neutron-logging and high-resolution electrical borehole imaging techniques. Personnel from Subsurface Imaging, Inc. presented the capabilities of a new digitally recorded TV log. Indications are that new down-hole tools are available that can provide very high resolution images (direct visual or indirect) of the borehole and the adjacent rocks. Project personnel presented several informal talks on existing geophysical logging activities and the anticipated requirements for logging during site characterization.

Status Report on Ongoing Activities

A comment resolution meeting was held July 1, 1992 with SNL personnel responsible for the Systematic Acquisition of Site-Specific Subsurface Information study and reviewers from both the Project Office and U.S. Department of Energy Headquarters (DOE/HQ). The Study Plan was revised to resolve minor outstanding comments from the comment resolution meeting, and the revised draft was retransmitted to the Project Office on July 22, 1992.

Draft text and figures were prepared for inclusion in a LANL report that compares several potential sites for a "surface-based test facility" or "prototype Exploratory Studies Facility." LANL has prepared information regarding the general geology, mineralogy/petrology, and geochemistry of several sites in bedded and other nonwelded tuffs. The new additions summarize information on hydrologic properties obtained at or near these potential sites as part of the outcrop sampling studies conducted by this WBS element. (SCP 8.3.1.4.3.1.1)

Three vertical sample transects have been collected through the Quaternary Bandelier tuff in the Jemez Mountains of northern New Mexico. Hydrologic property determinations are in process. The Bandelier tuff is of interest as a natural analog to some of the tuffs at Yucca Mountain because nonwelded, vitric tuffs that are poorly exposed at Yucca Mountain are widely exposed in the canyons surrounding the Jemez Mountains. Sampling results have been somewhat disappointing in that these materials are extremely friable and do not sample well despite the excellent outcrops. The materials collected thus far are either more welded than desired or have been "strengthened" by extensive vapor-phase alteration. Alternative sampling techniques are being investigated as time permits, as is the potential for in-situ measurement of important hydrologic properties. (SCP 8.3.1.4.3.1.1)

Major Activities Upcoming Next Three Months

Evaluation of data from the surface transects, including natural analogs, will continue intermittently to obtain samples needed to resolve questions or to confirm existing findings. The air permeameter will be tested upon completion of repairs and used to collect permeability data from several promising locations if feasible. Emphasis will be placed on attempting to obtain field measurements from rock types that could not be cored for laboratory analysis because of their excessively friable nature. (SCP 8.3.1.4.3.1.1)

1.2.3.2.2.2.2 THREE-DIMENSIONAL ROCK CHARACTERISTICS MODELS

Status Report on Ongoing Activities

The Stanford Center for Reservoir Forecasting (SCRF), which is partially funded by this WBS element, has delivered a new version and users' manual for the geostatistical software subroutine library, GSLIB version 1.2. The users' manual and software on diskette are scheduled to be published by Oxford University Press sometime late in 1992 or early 1993. SCRF participants (including the Yucca Mountain Site Characterization Project) receive products of this industrial research consortium significantly in advance of public availability.

Staff have begun work on adapting geostatistical simulation subroutines into work being performed under the Ground-Water Travel Time activity for an INTRAVAL exercise. Preliminary simulations of porosity in the cross section between neutron drill holes N-54 and N-55 that include the basal Tiva Canyon Member and underlying bedded tuff interval have been produced using Gaussian simulation techniques. Initial indications are that the simulations are richly detailed and preserve the "flavor" of small-scale spatial variability identified by field scoping studies of this interval. (SCP 8.3.1.4.3.2.1 and WBS element 1.2.1.4)

In addition, an adaptive grid algorithm has been coded and incorporated into the simulation program to create block-scale grids that minimize the variance of the detailed simulation cells within each large block. Averaging of material properties within such coherent blocks should yield more reasonable estimates of block-scale effective properties than averages computed for more heterogeneous blocks. This method of developing block-scale effective properties is likely to be of particular utility in modeling properties, such as permeability, that do not average arithmetically. Several alternative averaging algorithms, other than the straightforward geometric mean, are under consideration for use in computing block-scale models of conductivity. (SCP 8.3.1.4.3.2.1 and WBS element 1.2.1.4.1)

Major Activities Upcoming Next Three Months

Work will continue on modeling the INTRAVAL data. The preliminary spatial model used to date will be refined, and the simulation code will be modified to

provide more extensive evaluation and "reasonableness checks" of the individual simulations. Modeling will expand to permeability-type data as soon as practical. The resulting models will be input to preliminary flow calculations as soon as feasible.

Modeling activities using the Lynx Geotechnical Modeling System will continue. SNL staff and USGS personnel will meet to define the parameters that will constitute the basic underpinnings of a jointly developed geologic model for the site. (SCP 8.3.1.4.3.2.1 and 8.3.1.4.2.3.1)

Work should resume on the geostatistical description of material properties obtained for the two-dimensional surface transect of the shardy base microstratigraphic unit of the Tiva Canyon Member (see WBS 1.2.3.2.2.2.1). (SCP 8.3.1.4.3.2.1)

1.2.3.2.7.1.1 LABORATORY THERMAL PROPERTIES

Status Report on Ongoing Activities

Preparation of SAND88-2820, "The Density and Porosity of Tuffaceous Units at Yucca Mountain, Nevada," has been initiated by staff. This report will update and formalize the statistical analyses used to support the rock physical properties values currently in the RIB. (SCP 8.3.1.15.1.1.1)

Overhaul of the C-Matic LT, a low-temperature thermoconductivity measuring instrument, has been completed. The C-Matic LT instrument will be used for measuring thermal conductivity at temperatures from 20 to 100°C. (SCP 8.3.1.15.1.1.3)

An Interim Change Notice (ICN) is being developed to address the calibration of the thermocouple and analog/digital boards that are used in the thermal conductivity analyzer. (SCP 8.3.1.15.1.1.3)

Geologic sample G2-01349.8, identified in Experiment Procedure (EP)-41 as a test sample for the saturation effects scoping study, is brittle and highly fractured. It is unlikely that the sample would survive the saturation/conductivity testing/drying cycles that constitute the study. Additional samples have been sent to Holometrix as replacement candidates. Once the replacement sample is identified and machined, an ICN to EP-41 will be issued.

Major Activities Upcoming Next Three Months

The scoping study on the effects of saturation on thermal conductivity will begin after the C-Matic LT instrument is calibrated and the data acquisition software is approved. (SCP 8.3.1.15.1.1.3)

Other Items to Report

SNL YMP DRMS data set 51/L01A-2/9/90 has been reorganized to ensure completeness and facilitate retrievability of information. This data set contains the data, quality assurance (QA) documentation, and supporting information resulting from the development of Technical Procedures (TPs) for thermal conductivity testing.

1.2.3.2.7.1.2 LABORATORY THERMAL EXPANSION TESTING

Status Report on Ongoing Activities

SAND88-1581, "Linear-Thermal-Expansion Data for Tuffs From the Unsaturated Zone at Yucca Mountain, Nevada," is being printed and will be issued soon. (SCP 8.3.1.15.1.2.1)

A Eurotherm controller/powerpack unit has been assembled and integrated into the dilatometer apparatus to control the temperature of the linear variable differential transformer (LVDT) chamber. A series of calibration runs using this apparatus has been initiated. TP-203 and the dilatometer control program are undergoing minor changes; both are near completion. (SCP 8.3.1.15.1.2.1)

Major Activities Upcoming Next Three Months

Once the accuracy and reproducibility of test data is established and the relevant procedures are approved, a scoping study on the effects of sample size on thermal expansion will be initiated. (SCP 8.3.1.15.1.2.1)

1.2.3.2.7.1.3 LABORATORY DETERMINATION OF MECHANICAL PROPERTIES OF INTACT ROCK

Major Accomplishments

SAND91-0894, "Anisotropy of Topopah Spring Member Welded Tuff," by R. Martin, R. Price, P. Boyd, and R. Haupt, was published in July 1992. (SCP 8.3.1.15.1.3.2)

Status Report on Ongoing Activities

New England Research, Inc. (NER) is conducting a study involving high-temperature experiments at creep and low strain rate conditions. Preparation for the series of six constant stress (creep) experiments are complete and the experiments have been initiated. Six samples of TSw2 will be tested at a pore pressure of 4.5 MPa, a confining pressure of 5 MPa, and a constant differential stress of 80 MPa. Initially, the experiments will be performed at room temperature and then at 250°C. Each test will each take about four months to complete. (SCP 8.3.1.15.1.3.2)

R. Price (SNL) is a member of the American Society for Testing and Materials/Institute for Standards Research (ASTM/ISR) Steering Committee for the Interlaboratory Testing Program for Rock Properties. The testing portion of Phase I has been completed, the results have been summarized in a draft report, and a presentation of the results was made by the chairman of the committee on July 21, 1992 at the National Academy of Sciences (NAS) in Washington, D.C. The presentation was made to representatives of the program sponsors and to interested NAS staff. Several other committee members also attended to support the chairman and to answer questions resulting from the presentation.

SAND92-0119, entitled "Experimental Comparison of Laboratory Techniques in Determining Bulk Properties of Tuffaceous Rocks," continues in the technical and editorial review processes. (SCP 8.3.1.15.1.3.2)

Major Activities Upcoming Next Three Months

R. Price (SNL) will be going to NER in White River Junction, VT in late August and early September to discuss progress on the series of experiments designed to investigate the time-dependent deformation of the welded Topopah Spring Member tuff.

SAND92-0847, entitled "Modulus Dispersion and Attenuation in Tuff," is being drafted and will begin the review process in the next two months. (SCP 8.3.1.15.1.3.2)

1.2.3.2.7.1.4 LABORATORY DETERMINATION OF THE MECHANICAL PROPERTIES OF FRACTURES

Status Report on Ongoing Activities

An investigation has been initiated to use fracture roughness data to predict dilation and permeability of a fracture during shear deformation of the surfaces. (SCP 8.3.1.15.1.4.2)

Study Plan 8.3.1.15.1.4, "Laboratory Determination of the Mechanical Properties of Fractures," has been reviewed by other Project participants, Project Office personnel, and DOE Headquarters personnel. The Fracture Properties Working Group (W. Olsson, S. Brown, and R. Price) met on July 17, 1992 to discuss the appropriate responses to the comments. A revision of the study plan will be written in the next two to three months. (SCP 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2)

Replicas of rough, natural fractures in the welded Topopah Spring Member tuff have been made and will be tested under a range of test conditions. A rubber mold is made of the rough fracture surface and the replicas are cast in gypsum cement. (SCP 8.3.1.15.1.4.2)

A sample (right-circular cylinder, diameter of approximately 2.125 in., and length-to-diameter ratio of 3:1) is being prepared to test under creep (constant stress) conditions for several weeks to several months. The timeframe for the experiment will be determined as the test progresses. (SCP 8.3.1.15.1.4.2)

Major Activities Upcoming Next Three Months

A revised version of Study Plan 8.3.1.15.1.4, "Laboratory Determination of the Mechanical Properties of Fractures," will be submitted to the Project Office in the next three months. (SCP 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2)

A journal article summarizing the topography data collected on 17 natural joints and the analysis of the data using a simple mathematical model is being drafted and will be submitted for review in the next three months. (SCP 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2)

1.2.3.2.6.3.3 GROUND MOTION FROM REGIONAL EARTHQUAKES AND UNDERGROUND NUCLEAR EXPLOSIONS

Status Report on Ongoing Activities

SAND92-0956, "A Statistical Analysis of Ground Motion Resulting From Underground Nuclear Explosions in the Yucca Mountain Region," by B. Rutherford (SNL), is in internal SNL technical and managerial review. Technical reviews are being performed by M. Malek and D. Gibson.

1.2.3.2.6.4.2 LOCATION AND RECENCY OF FAULTING NEAR PROSPECTIVE SURFACE FACILITIES

Status Report on Ongoing Activities

Work by Geomatrix Consultants continued on logging soil pits and trenches in Midway Valley. Safety concerns that may require shoring or a configuration change have delayed entry into the trenches.

1.2.3.6.2.1.6 FUTURE REGIONAL CLIMATE/ ENVIRONMENTS

Status Report on Ongoing Activities

Analysis continued of higher-order statistics of model-produced precipitation and temperature fields at various locations throughout the U.S. Among the statistics being analyzed are standard deviations, autocorrelations, precipitation intensity distribution functions, average interval of dry and wet periods, and frequency of occurrence of extreme events. Variability in simulated precipitation and temperature affects surface hydrology. A more detailed examination of the surface hydrologic budget (soil moisture, evaporation, infiltration, runoff) produced by the Biosphere Atmospheric Transfer Scheme (BATS) component of the MM4BAT code is also ongoing. In particular, staff are examining the seasonal patterns of simulated surface hydrologic budgets and comparing these patterns with the available observations. The analysis is currently being conducted for various basins in the U.S. to understand the general behavior of the model hydrologic component. After the overall model evaluation is complete, a detailed validation analysis for a smaller region encompassing Yucca Mountain will be performed.

The Phase I Report, "Simulation of the Arid Climate of the Southern Great Basin Using a Regional Climate Model," has been submitted to the Bulletin of the American Meteorological Society for peer review.

The QA software evaluation of the regional climate model (RCM) is ongoing. The evaluation of pre- and post-processing software is complete and the software evaluation reports are being prepared. The flow chart of MM4BAT has been developed and the subroutines with no formal documentation have been identified. Development of a test run for the RCM has been started.

Major Activities Upcoming Next Three Months

A multiyear regional climate run for the western U.S., using boundary conditions provided by CCM1 at finer resolution (T420), will be completed.

Software evaluation reports for computer codes associated with the regional climate modeling will be completed.

The Department Operating Procedure (DOP) 2-4 requirements for the Phase I Analysis will be addressed.

1.2.4 REPOSITORY INVESTIGATIONS

The objectives of the Repository element are to design a repository compatible with the host rock that meets the engineered barrier performance objectives of 10 CFR 60 and 40 CFR 191; to develop the required instrumentation and equipment for the repository; to obtain the necessary geoengineering data through laboratory and field tests; and to identify repository operation, closure, and decommissioning requirements.

1.2.4.1.1 REPOSITORY MANAGEMENT AND INTEGRATION

Status Report on Ongoing Activities

Several integration efforts are ongoing. A plan has been developed in cooperation with LLNL and LANL to address the issue of consolidation of thermal tests in the ESF. A list of tests that could be consolidated has been developed and initial discussions between LLNL, SNL, and LANL have been completed. A thermal design working group has been formed with key staff from SNL, LLNL, and the Management and Operations contractor (M&O). The initial focus of this group will be to revise the current Site Characterization Plan (SCP) thermal design goals for the repository. Once this is completed, issues, such as the range of thermal loading to be studied during Advanced Conceptual Design (ACD), can be addressed.

Initial design analyses to address a range of thermal loading for both in-drift and in-borehole emplacement schemes have been completed and will be consolidated with M&O waste-stream studies. Thermal structural calculations of near-drift response for a range of thermal loadings have been initiated and preliminary results will be transmitted to the M&O in August.

Networks for all SNL activities in 1.2.4 for the Mission 2001 exercise were reviewed and integrated into the Project Long-Range Plan (LRP). SNL staff worked with the M&O to identify and correct interface and logic problems in the networks.

Major Activities Upcoming Next Three Months

Several Project-wide meetings are planned to focus on the thermal loading question and lay out a long-range plan for final resolution of the issues. The first step will focus on revision of the SCP thermal goals.

Issues/Potential Problems Needing Resolution

The annotated outline for the Phase I report for the M&O's systems study on thermal loading strategies was reviewed and numerous comments on content and design strategies were provided. The July 17 version of the outline contains many of the concerns identified by us in the study proposal. Staff are losing faith that real teaming with the M&O will occur.

1.2.4.2.1.1.2 IN SITU THERMOMECHANICAL PROPERTIES

Status Report on Ongoing Activities

Staff continued writing the report on a study of thermal effects on instrumentation, which will make recommendations for ESF thermal tests. The study lists test instrumentation requirements and environments, matches this list with available off-the-shelf instrumentation, and details new technologies that may be able to fill gaps where no commercial instrumentation is available.

1.2.4.2.1.1.4 IN SITU DESIGN VERIFICATION

Status Report on Ongoing Activities

Comments received on Study Plan 8.3.1.15.1.8, In Situ Design Verification, are being reviewed and resolved.

1.2.4.2.1.2 ROCK MASS ANALYSIS

Status Report on Ongoing Activities

Work on the laboratory experiments involving loading layered polycarbonate plate models continued. SNL staff worked on developing new software to more accurately interpret Moiré fringes. Some work involved better affixing the Moiré master to the sample end cap to prevent it from rotating during the experiment. New experiments have not been performed, because a necessary monochromatic light has not been received.

The EFS support analyses are delayed while software QA is completed for a number of computer programs. There are four programs required:

- FASTQ (finite-element mesh generation)
- BLOT (display and plotting of finite-element results)
- COYOTE II (finite-element thermal analyses), and
- JAC2D (finite-element solid mechanics analyses).

QA work for FASTQ is completed. BLOT and COYOTE II are in the final stages of obtaining approval. QA work for JAC2D has not begun. Staff has taken steps to insure that the work on BLOT and COYOTE II will be finished next month so that the thermal analysis portion of the work can be performed. Steps have also been taken to accelerate the QA work for JAC2D. Analysis staff will be working closely with QA staff to expedite this work.

As part of the ESF support activities, staff has performed a comparison of the various failure criteria for jointed rock. The more well-known failure criteria have been reviewed and their applicability to rock structures of the types expected to be found in Yucca Mountain has been discussed. This work is contained in SLTR92-002, "Review of Failure Criteria for Use in the Yucca Mountain Site Characterization Project," by J. Holland, which is in peer review.

The University of Colorado has been performing experiments to study the effects of nonstandard loading conditions on the frictional properties of joints. This month, work has been done on analyzing the data and preparing a SAND report.

Major Activities Upcoming Next Three Months

The report "Fracture Analysis and Rock Quality Designation (RQD) Estimation for the Yucca Mountain Site Characterization Project," by M. Lin and M. Hardy (Agapito & Associates) and S. Bauer (SNL), SAND92-0449, is being printed and should be distributed in August. SAND92-0450, "Rock Mass Mechanical Property Estimates for the Yucca Mountain Site Characterization Project," by M. Lin and M. Hardy (Agapito & Associates) and S. Bauer (SNL), has completed management review and is being prepared to be sent to the Project Office. Some delay in getting this report published is anticipated because some work needs to be done to assure that the data in the report to be placed in the RIB has the proper traceability.

1.2.4.2.3.1 CERTIFICATION OF DESIGN METHODS

Status Report on Ongoing Activities

SNL staff continue to check and verify available jointed rock continuum models. Some small discrepancies between the various models were identified and corrected. In some test cases, identical results between the older scalar versions of the model and the newer scalar version are now being obtained. Larger problems to test the models in more complicated stress states are being run. A flatjack opening problem is currently running. Next month, the benchmark problem will be run. A SAND report on this work will serve to document the baseline behavior of the continuum joint model. The document will be especially important when this joint model is quality checked.

Testing of a combined finite-element and boundary-element technology continued. During the next two months, this work will focus on the feasibility of this coupling. The effort will concentrate on using an explicit iterative equation solver. Large-scale problems become feasible when the equations are solved explicity (i.e., without forming the stiffness matrix). Work to verify that the coding of the new iterative solver in JAC2D is correct has been performed. GeoLogic, Inc. personnel provided the boundary-element portion of this work and will be using direct solution methods to solve the coupled finite-element - boundary-element equations. By using a direct solution approach, GeoLogic, Inc. personnel may be better able to isolate whether the current problems are due to the element formulations, the coupling formulation, or the equation solver.

The basic theory for coupling the finite-element - boundary-element methods is presented in SLTR92-7001, which is currently in review.

A new set of posttest analyses of the layered polycarbonate experiment performed in 124212 was begun. Staff now has a better idea of how to model the frictional interfaces, which should improve the agreement between experiment and analysis results.

Staff have begun to migrate analysis codes that have usually been run on mainframe machines over to the LAN. It is anticipated that this move will save significant expense. The UDEC code was ported over to the SUN LAN this month and checked out. Staff will move over other analysis codes, such as JAC2D, JAC3D, COYOTE, FASTQ, and BLOT.

1.2.4.2.3.2 DESIGN ANALYSIS

Status Report on Ongoing Activities

Work continued on PDM 75-25, "New Three-Dimensional Far-Field Repository Thermomechanical Calculations." The defined analyses are intended to determine the temperatures, stresses, and strains expected in the vicinity of ESF openings that may become part of the repository. The "new repository design" is being used in the analysis, with thermal loadings of 57 and 80 kW/acre. Results from the first phase (thermal calculations) have been completed and are being documented. The definition of mechanical calculations examining the performance of drift intersections has been initiated.

A series of thermal analyses were run in support of the M&O's systems study on the thermal management of the potential repository. The analyses examined the near-field thermal effects of two emplacement options, two waste package concepts, two drift shapes and sizes, and eight local areal power densities (LAPDs) in limited combination. Phase I of these calculations, which examines the near-feld thermal response to LAPDs of 20, 24.2, 57, 69.1, 80, 100, 114, and 138.2 kW/acre for an SCP-type vertical emplacement layout and 57, 80, 100, and 114 kW/acre for an in-drift emplacement scheme, has been completed. Selected results of these analyses will be used in mechanical calculations that are currently being defined.

Work on a study comparing the predictions of near-field thermal response using approximations of smeared two-dimensional heat sources and discrete three-dimensional representations continued. The "smearing" of heat sources required in the two-dimensional thermal modeling of the potential repository results in a diffusion of the source that may cause an underprediction of near-field thermal response. The purpose of this study is to provide a preliminary evaluation of this aspect of two-dimensional thermal modeling. LAPDs of 20, 25, 34, 57, 80, and 114 kW/acre are being examined.

1.2.4.6.1 SEAL DESIGN AND DESIGN REQUIREMENTS

Status Report on Ongoing Activities

Work continued on the review of available technologies to seal underground openings. The primary activities include:

- contacting LLNL, LANL, Defense Nuclear Agency (DNA), and Raytheon Services of Nevada (RSN) personnel to assess the available documentation on sealing-related activities used in the weapons testing programs;
- surveying the available documentation;
- obtaining information, such as construction summaries, concrete and grout technology data, and containment reports, which may be important for the repository sealing program; and
- developing a case history of bulkhead technology used at an inactive mine in Colorado.

Additional activities performed include:

- developing temperature and stress change histories at repository seal and borehole seal locations and
- initiating geochemical modeling of backfill.

Preliminary temperature and stress change histories were developed assuming various loading conditions, i.e., 20 kw/acre 30-year-old waste, 20 kw/acre 60-year-old waste, 57 kw/acre 30-year-old waste, and 80 kw/acre 30-year-old waste. A preliminary definition of the geochemical environment was completed, based on the review of experimental studies on the hydrothermal alteration of the Yucca Mountain tuff units.

1.2.4.6.2 SEALING TESTING

Status Report on Ongoing Activities

The draft report SAND92-0960, "Field Testing Definition of Subsurface Sealing and Backfilling Tests in Unsaturated Tuff," by J. Fernandez, J. Case, and J. Tyburski, completed internal SNL technical review and the report was submitted for graphic and text changes. The report will be submitted to SNL management review in early August.

To support the backfill strategy development, hydrologic and gaseous flow analyses were initiated. The hydrologic analyses are intended to determine the lateral extent of water flow in a drift from a discrete, water-producing zone. The source of water inflow and the hydrologic properties of the backfill and the host rock are considered variables in the analyses. Several computer runs have been completed considering these variables and an associated modified permeability zone around the opening. Initial preliminary results show that (1) for a continuous inflow into a drift, a qualitative assessment of water flow can be made prior to the runs; however, the computer runs provide an indication of the extent of the lateral flow; and (2) for a periodic inflow of water, a qualitative assessment is more difficult to make.

The objective of the gaseous flow analyses is to determine the lateral migration of gaseous flow through backfill. The effort this month focused on development of an analytical solution evaluating the effectiveness in limiting gas flow along drifts of backfill (or seals) occupying the entire drift cross section. The analytical solution indicates that if seals can be constructed such that their gas permeability is on the same order as the gas permeability of the host rock, they can be very effective in limiting the flow of gas along the drifts. These preliminary results are independent of the driving pressure gradient and assume that the driving pressure gradient for gas flow is parallel to the axis of the drifts.

Documentation of the computer program SHAFT.SEAL was initiated. The following tasks were completed:

- review of the applicable SNL procedures associated with software development and use;
- generation of verification problems to evaluate the effectiveness and correctness of the software code;

- development of an annotated outline for the report; and

- completion of approximately 50% of the report.

An activity associated with the documentation of the SHAFT. SEAL code is the development of an annotated outline for a journal article evaluating the structural analysis of repository seals.

1.2.5 REGULATORY AND INSTITUTIONAL

The objective of the Regulatory and Institutional element is to (1) conduct all activities involving licensing, environmental compliance, communication, and liaison with the State of Nevada, affected Indian tribes, and the public and (2) administer the grants mandated by the Nuclear Waste Policy Act (NWPA) of 1982.

1.2.5.1 MANAGEMENT AND INTEGRATION

Major Activities Upcoming Next Three Months

SNL staff participated in the public tour conducted at Yucca Mountain on July 17, 1992. These tours are conducted monthly as part of the DOE public outreach program. Representatives from each YMP participant are present to answer questions from the public about the exhibits at the Field Operation Center (FOC).

1.2.5.2.1 NRC AND NWTRB INTERACTION SUPPORT

Significant Meetings Attended

SNL staff participated in a discussion of technical data management on July 14, 1992 in Las Vegas, NV in response to a Nuclear Regulatory Commission (NRC) request.

1.2.5.2.5 STUDY PLAN COORDINATION

Status Report on Ongoing Activities

In response to the comment resolution meeting held July 1, 1992, a revised draft of Study Plan 8.3.1.4.3.1.1, "Systematic Acquisition of Site-Specific Subsurface Deformation - Systematic Drilling Program," by C. Rautman (SNL) was submitted to the YMPO on July 22, 1992. (SCP 8.3.1.4.3.1.1)

Study Plan 8.3.1.5.2.1, Revision 2, "Characterization of the Yucca Mountain Quaternary Regional Hydrology," written by the United States Geological Survey (USGS) staff, was transmitted to G. Barr for verification on July 23, 1992. (No SCP Activity)

1.2.6 EXPLORATORY SHAFT INVESTIGATIONS

The objective of the Exploratory Shaft element is to develop, design, construct, operate, maintain, and decommission the exploratory shafts required for site characterization and to plan and implement the in situ testing program.

1.2.6.1.1 EXPLORATORY SHAFT MANAGEMENT, PLANNING, AND TECHNICAL ASSESSMENT

Significant Meetings Attended

Staff participated as testing program experts in the 90% Management Review of the Title II Design North Portal Area Design Package 1A.

Status Report on Ongoing Activities

Staff provided input to the decision report on the need for a prototype in situ test facility that was issued this month.

1.2.9 PROJECT MANAGEMENT

The objective of the Project Management element is to schedule, budget, perform, control, coordinate, and report Project management, Project control, and quality assurance work. This includes identifying and defining interfaces among Project elements and integrating those elements.

1.2.9.1.1 MANAGEMENT

Major Accomplishments

Four SAND reports were printed and distributed in July 1992:

- SAND88-7061, "Preclosure Radiological Safety Analysis for Accident Conditions of the Potential Yucca Mountain Repository: Underground Facilities," by C. Ma, R. Sit, S. Zavoshy, and L. Jardine (Bechtel National Incorporated);
- SAND89-7002, "Preclosure Radiological Safety Analysis for the Exploratory Shaft Facilities," by C. Ma, D. Miller, and L. Jardine (Bechtel National Incorporated);
- SAND89-7018, "Conceptual, Experimental, and Computational Approaches to Support Performance Assessment of Hydrology and Chemical Transport at Yucca Mountain," by T. Narasimhan and J. Wang (LBL); and
- SAND91-2795, "TSPA 1991: An Initial Total-System Performance Assessment for Yucca Mountain," by R. Barnard, M. Wilson, H. Dockery (SNL) and J. Gauthier (SPECTRA), and P. Kaplan, R. Eaton, and F. Bingham (SNL), and T. Robey (SPECTRA).

One record package was submitted in July 1992:

- SAND91-0894, "Anisotropy of Topopah Spring Member Welded Tuff," by R. Price (SNL), and R. Martin, P. Boyd, and R. Haupt (New England Research).

Significant Meetings Attended

SNL's TPO attended the Project Manager and TPO meeting held in Las Vegas, NV on July 24, 1992.

Major Activities Upcoming Next Three Months

SNL's TPO will attend the seminar on "New Avenues in Crisis Management" that will be held on August 5, 1992 in Las Vegas, NV.

1.2.9.1.4 RECORDS MANAGEMENT

Major Accomplishments

Local Records Center (LRC) staff completed processing all backlog records associated with SCP activities. These records have either been forwarded to the Central Records Facility (CRF) or have been verified as being duplicates of previously processed records on microfilm.

Significant Meetings Attended

LRC staff attended the DOE/YMP Information Resources Management (IRM) meeting in Las Vegas, NV on July 21, 1992. In conjunction with the IRM meeting, LRC staff also attended the DOE/YMP Records Coordinators Meeting in Las Vegas, NV on July 22 and 23, 1992.

Status Report on Ongoing Activities

Training was completed for selected LRC staff on database searching the Records Information System (RIS) and the Appended Records Information System (ARIS). Training of selected LRC staff was also completed on packaging technical report records, training records, and controlled document records. Development of supplemental modules for the on-the-job-training (OJT) program for LRC staff continued. Work to revise the Master List of File codes continued. Sorting and packaging of backlog records related to PDMs, Design Investigation Memos (DIMs), Interaction Task Memos (ITMs), and Procurement continued. A reorganization of the DRMS filing system was initiated.

Major Activities Upcoming Next Three Months

A revision to the Master List of File Codes will be issued.

1.2.9.1.5 YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP) SUPPORT FOR THE TRAINING MISSION

Significant Meetings Attended

Staff met at SNL with Carol Rehkop (YMP/DOE) and Regina McCarthy (T&MSS) on July 16, 1992 for the annual on-site evaluation. Staff made a presentation on Sandia's Training for Optimal Performance by Staff (TOPS) and discussed many areas of the training effort.

Status Report on Ongoing Activities

Staff is currently working on the following:

- development of a procedure abstract for each procedure
- development of a Job Effectiveness Training survey
- development of new manager and staff orientation manual material
- review of all active training records to ensure their complete accuracy
- development of a new qualified trainer list

Major Activities Upcoming Next Three Months

Staff will make a presentation to the SNL YMP Technical Project Officer, Project Manager, and Department Managers on August 10, 1992 on training initiatives.

The Project Office will conduct an Instructor Training course at Sandia.

1.2.9.2 PROJECT CONTROL

Major Accomplishments

All clean-up work on Mission 2001 was completed. The Controlled Document System (CDS) coding in INFORMIX has been completed, except for final work on Reports. The system is currently being tested before the data in the database is converted and translated to the INFORMIX database system. The SNL Monthly status report was successfully transmitted to the YMP "Reports" account electronically during July.

Significant Meetings Attended

The Propect Control Steering Committee (PCSC) met in Albuquerque, NM on July 10, 1992. PACS staff attended Primavera training in Las Vegas, NV on July 20 and 21, 1992. SNL personnel attended the Information Resources Management Council Meeting and met with the PACS Workstation software support staff in an effort to resolve problems encountered with the Workstation software.

Status Report on Ongoing Activities

Work in progressing on the implementation plan to transition to the new WBS.

Financial staff recalculated the FY93 budget to include FY93 SNL rates and adjusted budgets to meet YMP guidance. A crosswalk from the FY92 to the FY93 WBS structure is under development.

Work has begun in defining a personnel database within the INFORMIX database system.

Major Activities Upcoming Next Three Months

Staff will attend Parade training in Las Vegas, NV on August 12 through 14, 1992 and the PCSC meeting on August 27, 1992. The WBS crosswalk will be completed and the SNL financial system restructured to accommodate the FY93 WBS structure. The SNL FY93 financial data will be updated on September 1, 1992, as necessary to match the FY93 WBS structure. Capital equipment status will be reconciled with DOE/YMP and reprogramming requests will be initiated as needed. The SNL WBS Dictionary will be revised to match the FY93 WBS structure. The Basis of Estimate information for the Mission 2001 exercise and close-out information on the ICE process will be submitted to YMP. Installation of the NOVELL server upgrade has been delayed, pending the arrival of the new computer equipment. Planning activities to support the conversion of the SNL financial reporting system to the new work breakdown structure are in progress.

1.2.9.3 QUALITY ASSURANCE PROGRAM

Major Accomplishments

Internal surveillance of WBS 1.2.1.4.3.4, Seal Performance Requirements and Analyses, was initiated during this month.

Status Report on Ongoing Activities

The procedure-streamlining process continues. The improvement and simplification of SNL QAIPs will continue, as will activity on the development of a new computer-network-based QA matrix.

Major Activities Upcoming Next Three Months

The YMP DOE QA Audit of SNL YMP Criteria elements 3, 5, 6, 17, 19, and 20 is scheduled to begin August 24, 1992.

One subcontractor audit is scheduled for the next quarter. The audit of NCAR (National Center for Atmospheric Research) was rescheduled for September.

Three surveillances are scheduled for the next quarter. Areas to be reviewed include QA program element 20 for WBS activities 1.2.1.4.3.4, 1.2.4.6.1, 1.2.4.6.1.2, 1.2.1.4.4.1, and 1.2.4.2.2.2.2.

Other Items to Report

YMP QA Division personnel performed a surveillance of SNL's compliance with technical data management procedures of YMP on July 23, 1992.

One Work Agreement was processed this month.

APPENDIX A: REFERENCE INFORMATION BASE

1. REFERENCE INFORMATION BASE (RIB) CHANGE REQUESTS SUBMITTED*

RIBCR	Subject	Participant	Status

None.

2. INFORMATION BEING PROCESSED AS RIB CHANGE DEVELOPMENT FILES FOR CONSIDERATION AS INPUT TO THE RIB*

RIBCR	Subject	Status
CR58	Volcanic Features	Under Development
CR63	Estimated Water Usage	Review Complete
CR80	Water Application Rates	Under Development
CR83	Radiological Monitoring	Under Development

3. INFORMATION ENTERED INTO THE RIB

- CR71, Item 2.1.4, Rev. 0, Potential Transportation Routes
- CR81, Item 1.1.6, Rev. 0, Thermal/Mechanical Surfaces
- CR82, Item 1.2.12, Rev. 1, Topographic Maps

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*Candidate information is identified by RIB Change Requests, which are prepared in accordance with Revision 0 of Yucca Mountain Project Administrative Procedure AP-5.3Q, "Information Flow Into the Reference Information Base," which is implemented at SNL as Department Operating Procedure (DOP) DOP 3-8.

APPENDIX B: TECHNICAL DATA BASE INPUT

1. CANDIDATE DATA FOR THE TECHNICAL DATA BASE

   None.

2. DATA FORMALLY SUBMITTED TO THE TECHNICAL DATA BASE

   None.

3. DATA FORMALLY ENTERED INTO THE TECHNICAL DATA BASE

   None.