Sandia National Laboratories

Albuquerque, New Mexico 87185

OCT 20 1992

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QA: NA

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Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization
Project Office
U. S. Department of Energy
Nevada Operations Office
101 Convention Center Drive
Phase 2, Suite 200
Las Vegas, Nevada 89193-8518

10-20-92

Attention: V. F. Iorii

Subject: September 1992 Monthly Highlights and Status Report

Dear Carl:

Enclosed is the Monthly Highlights and Status Report for the month of September, 1992. If you have any questions, please call Fran Cheek-Martin at FTS 844-7810.

Sincerely,

John T. Holmes for

Thomas E. Blejwas, Manager
YMP Management Department 6302

FCM:6318:pe
Enclosure

DIVISION Quality
CC: Clerk
CC: See Distribution
CC: Lost (YMP)
CC: Brodsky
CC: Jones, S.
CC: Stucker - RW 22
CC: Johnson - W/O
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ENCLOSURE 4

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

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I-333416

October 21, 1992

TWS-EES-13-10-92-040

Mr. Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization Project Office
US Department of Energy
P.O. Box 98608
Las Vegas, NV 89193-8608

Dear Mr. Gertz:

SUBJECT: HIGHLIGHTS OF THE LOS ALAMOS MONTHLY ACTIVITY REPORT—SEPTEMBER 1992

Attached are the highlights of the Los Alamos Monthly Activity Report for September 1992. This internal document describes our technical work in detail; however, the report has not received formal technical or policy review by Los Alamos or the Yucca Mountain Site Characterization Project. Data presented in this document represent work progress, are not referenceable, and are not intended for release from the US Department of Energy. If you have changes to our distribution list, please call me at (505) 667-0916.

Sincerely,

Susan H Klein

Susan H. Klein

SHK/elm

Attachment: a/s

Gertz
Blanchard
cc: Dixon
cc: Dyer
cc: Parri
cc: Arnecka
cc: Brocoum
cc: Jones S.
cc:

10/26/92

Cy w/att:
M. B. Blanchard, YMPO, Las Vegas, NV
T. E. Blejwas, SNL, Albuquerque, NM
W. L. Clarke, LLNL, Livermore, CA
W. R. Dixon, YMPO, Las Vegas, NV
J. R. Dyer, YMPO, Las Vegas, NV
N. Z. Elkins, EES-13/LV, MS J900/527
L. D. Foust, CRWMS, M&O/TRW, Las Vegas, NV
L. R. Hayes, USGS, Denver, CO
V. F. Iorii, YMPO, Las Vegas, NV
M. Martin, M&O/TRW, Las Vegas, NV
M. Voegele, SAIC, Las Vegas, NV
RPC File (2), MS M321
TWS-EES-13-File, MS J521

Cy w/o att.:
J. A. Canepa, EES-13, MS J521
S. H. Klein, IS-11, MS J521
E. P. Springer, EES-13, MS J521
A. R. Pratt, EES-13, MS J521
CRM-4, MS A150

ENCLOSURE 2

Los Alamos
September Highlights

WBS 1.2.3.4.1.3/1 Batch Sorption Studies and Sorption Models
Experiments to measure batch sorption coefficients of neptunium on crushed tuff samples under a variety of pH, pCO_2, and water compositions continued. The reaction between the rock samples and Np-traced solutions was completed, the solution and solid phases were separated by centrifugation, and the amount of Np in the solution samples was determined by liquid scintillation counting.

The milestone report on the influence of particle size and water composition on sorption coefficients is in preparation. Staff detected no experimental artifacts caused by crushing or grinding the tuff samples in the measured sorption coefficients; therefore, previous experiments using particle sizes between 2μm and 75μm should not be biased by the extent of grinding. Most previous batch experiments used a tuff size fraction between 75 and 250μm, which appears to be ideal for minimizing sampling error and sample mineral fractionation caused by excessive grinding.

Publication
Meijer, A., "A Strategy for the Derivation and Use of Sorption Coefficients in Performance Assessment Calculations for the Yucca Mountain Site," in "Proceedings of the DOE/Yucca Mountain Site Characterization Project Radionuclide Adsorption Workshop at Los Alamos National Laboratory September 11-12, 1990," J. Canepa, Comp., Los Alamos National Laboratory report LA-12325-C (August 1992), pp. 9-40.

WBS 1.2.3.4.1.1.A Ground-water Chemistry Model
Staff continued refining the matrix for "most-active ground-water modeling" to categorize ground-waters by compositional variables that affect radionuclide solubility and/or sorption properties. Variables of interest are measured Eh potential, pH, and bicarbonate content. EQ3/6 is being used to simulate different ground-water compositions.

WBS 1.2.3.3.1.2.2 Water Movement Tracer Tests
Over 20 samples from neutron-access boreholes USW N37, N54 and N55 and Midway Valley soil were prepared by Hydro Geo Chem and subsequently analyzed by the University of Rochester and LLNL for chlorine-36 .

WBS 1.2.3.4.1.3 Radionuclide Retardation by Precipitation Processes
Milestone Report 3031, "Actinide(IV) and Actinide(VI) Carbonate Speciation Studies by NMR and PAS Spectroscopies," was completed and submitted for technical review. This paper discusses our multifaceted spectroscopic approach to determining radionuclide speciation, recent results in determining Pu(IV) carbonate speciation by PAS, and carbonate complexation studies in PuO_2^{2+} by ^{13}C NMR spectroscopy.

Np and Pu undersaturation experiments in UE-25p #1 water at 60°C. Np undersaturation experiments have run almost as long as comparable oversaturation experiments; their concentration profiles for pH 6 and 8.5 solutions have virtually reproduced the oversaturation results. The Pu undersaturation experiments are approaching 30 days duration; at all three pH values, the aqueous plutonium concentration is approximately 10^{-7} M.

A talk, "Far-Field Radionuclide Solubility and Speciation Studies for the Yucca Mountain Site Characterization Project," was prepared for the 1993 International High-Level Radioactive Waste Management Conference to be held April 26-30, 1993 in Las Vegas.

WBS: 1.2.3.4.1.4.1/2 Radionuclide Retardation by Dispersive, Diffusive, and Advective Processes

We completed Np transport experiments using crushed-tuff columns and Np batch sorption experiments with tuffs G4-1530 and G4-275 and ground-waters USWH-3, UE-25p #1, and J-13. We also completed batch sorption experiments with Np solutions and pure mineral separates found in the following tuffs: hematite, montmorillonite, clinoptilolite, and quartz. The results of these studies will be reported next month.

A letter report, "Far-Field Transport of Carbon Dioxide: Retardation Mechanisms and Possible Validation Experiments," was prepared by A. Meijer. He described the retardation mechanisms for C-14 at Yucca Mountain, evaluated potential experimental efforts to determine C-14 retardation, and made recommendations for site characterization activities and modeling studies. Three main chemical retardation mechanisms were identified for C-14 as carbon dioxide in Yucca Mountain: equilibration with carbonate species in ground-water, isotope exchange with carbonate minerals, and sorption on non-carbonate minerals. Meijer recommended an experimental protocol and modelling approach.

A milestone report, "Measurement of Unsaturated Hydraulic Conductivity in Yucca Mountain Tuff," was prepared. Experimentally determined hydraulic conductivities were reported on as a function of water content, and the feasibility of applying an innovative unsaturated flow technique (UFA) to transport studies was evaluated.

Publication

Triay, I.R., A. J. Mitchell, and M. A. Ott, "Radionuclide Migration Studies for Validating Sorption Data—Past, Present, and Future," in "Proceedings of the DOE/Yucca Mountain Site Characterization Project Radionuclide Adsorption Workshop at Los Alamos National Laboratory September 11-12, 1990," J. Canepa, Comp., Los Alamos National Laboratory report LA-12325-C (August 1992) , pp. 91-110.

WBS: 1.2.3.2.1.1.1 Mineralogy of Transport Pathways

Milestone 3137, "Geologic evaluation of six nonwelded tuff sites for a surfacebased test facility for the Yucca Mountain Project," was revised and sent to the USGS and SNL for further modification. This report includes data on hydrologic properties (A. Flint, USGS) and mechanical properties (C. Rautman, SNL), as well as the mineralogical and chemical data collected at LANL. The will be submitted for publication early in FY 93.

The first 530 ft of UE-25 UZ-16 were examined at the Sample Management Facility. Fractures containing silica, calcite, clay, zeolites and manganese oxide minerals were requested for further study.

WBS 1.2.3.1 Surface-based Testing

ESF Testing. Continued field construction and testing activities as defined by TPP 92-07, "Fran Ridge Test Pit Mapping," and its associated JP 92-7. The DRC JP 92-7 field implementation record package is being assembled for submittal to the local records center. Staff developed a Technical Data Information Form with USGS management for the mapping data to be collected at the Fran Ridge site.

1.2.3.2.3.1.A Postclosure Tectonics

Lathrop Wells volcanic center. A large trench was constructed on the north side of the center. The scoria mound beneath the Ql4 lava, an older scoria unit (Qs7) below the scoria mound, and a sequence of primary and reworked pyroclastic surge deposits were exposed on the south end of this trench. On the north end, the base of the Ql7 lava, which lies on a thin interval of flow clinker and minor scoria, was exposed.

Trace-element data were evaluated for the Black cone and the Lathrop Wells cone. The data for both cones show that they were formed by separate magma batches. Each magma batch cannot be related to other magma batches by processes of fractional crystallization.

A three-day meeting was held with the Nuclear Waste Technical Review Board. Talks were presented by the YMP, State of Nevada, NRC, USGS, and external consultants for the first two days. A field trip to the Lathrop Wells volcanic center and Crater Flat was conducted on the third day.

WBS 1.2.1.4.6 Caisson Experiment

An extended summary on the design of the caisson experiment was submitted to the High-Level Waste Conference.

WBS 1.2.3.1.1 Test Management and Integration

Staff met with the principal investigators to define FY93 work scope and milestones based on preliminary FY93 budget splits. A meeting was held with YMP/International principal investigators and DOE/YMP staff to discuss FY92 accomplishments and FY93 plans.

WBS: 1.2.3.2.1.1.2 Mineralogy, Petrology, and Rock Chemistry of Transport Pathways

D. Vaniman and S. Levy reviewed the draft YMPO topical report on calcite-silica studies at Trench 14 and Busted Butte and provided additional text and data tables for the report.

Publications

Bish, D. and J. Aronson, "Paleogeothermal and paleohydrologic conditions in silicic tuff from Yucca Mountain, Nevada," YMP policy review completed, submitted to *Clays and Clay Minerals.*

Levy, S., "Natural gels in the Yucca Mountain area, Nevada, USA," YMP policy review completed, accepted by *Applied Clay Science.*

WBS 1.2.1.4.7 Performance Assessment

G. Zyvoloski met with W. Nelson of INTERA to discuss ground-water modeling capabilities within YMP. They also discussed future code development of the LANL code FEHMN.

TABLE OF CONTENTS

TABLE OF CONTENTS, Continued

EXECUTIVE SUMMARY
SEPTEMBER 1992

WBS 1.2.1.4.1 Total System Performance Assessment

- SNL staff hosted a meeting to discuss the current understanding of near-field performance assessment (PA) in the U.S. and abroad. Guests presented data gathered on international treatments of near-field PA modeling for a survey paper being prepared for the Swedish Nuclear Power Inspectorate. SNL staff discussed PA modeling currently underway for the WIPP and the YMP.

WBS 1.2.1.4.3.1 Postclosure Repository Design Analysis

- SNL published SAND91-1493, "Equivalent Energy Density Concept: A Preliminary Re-examination of a Technique for Equating Thermal Loads," by E. Ryder.

WBS 1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

- Calculations to estimate the effects on repository performance of surficial water use in the controlled zone outside the repository, as described in ESF PA No. 12 and PDM72-32, completed technical review.

WBS 1.2.1.4.9 Development and Verification of Flow and Transport Codes

- SNL published SAND91-2416, "LLUVIA-II: A Program for Two-Dimensional Transient Flow Through Partially Saturated Porous Media," by R. Eaton and P. Hopkins.

WBS 1.2.4.2.1.1.2 In Situ Thermomechanical Properties

- SNL staff drafted the report on thermal effects on instrumentation in support of the ESF thermomechanical experiments. The report lists test instrumentation requirements and environments, matches this list with available off-the-shelf instruments, identifies test instruments to be developed, and details promising new technologies.

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 continue to interact regularly with the Project Office staff in Las Vegas, NV and other participant personnel on interface and integration issues.

1.2.1.2.1 SYSTEM REQUIREMENTS AND DESCRIPTION

Major Activities Upcoming Next Three Months

Staff will participate in the U.S. Department of Energy (DOE) review of the Mined Geologic Disposal System (MGDS) Requirements Document.

1.2.1.2.5 CONFIGURATION MANAGEMENT PLANS AND PROCEDURES CONTROL

Status Report on Ongoing Activities

Staff initiated efforts to develop and implement an internal information management system. Staff also addressed several impact evaluations and affected document notices. In conjunction with the Management and Operations (M&O) contractor and other participants, staff continued to close out inactive or completed Interface Memoranda of Understanding (IMOU). Several YMP Change Requests (CRs) were submitted for Change Control Board (CCB) disposition.

1.2.1.3.1 SITE AND ENGINEERING PROPERTIES DATA BASE

Status Report on Ongoing Activities

SNL has received the verification reports from the Edgerton, Germeshausen, & Grier Corp. (EG&G) GENESIS database staff. All verifications were completed satisfactorily. The transition job log was closed out and sent to the records center accompanied by a letter from R. Orzel to A. Simmons, dated September 30, 1992, stating that the transition is complete and that all data submittals and product requests should now be addressed to the EG&G GENESIS database in Las Vegas, NV.

Major Activities Upcoming Next Three Months

None. WBS 1.2.1.3.1 is closed and no longer exists.

1.2.1.3.2 INTERACTIVE GRAPHICS INFORMATION SYSTEM

Status Report on Ongoing Activities

Work continued to develop conversion techniques that translate the existing CALMA gridded terrain models of the thermal/mechanical units into contour maps to be used in ARC/INFO. ARCVIEW techniques are being explored and view files developed for various subjects of interest.

Major Activities Upcoming Next Three Months

ARC/INFO and ARCVIEW training will be provided to additional personnel. The additional licenses for ARCVIEW will be installed and a training program will be developed to instruct users on the basics of building ARCVIEW maps at their workstations or personal computer (PC).

Staff will work with the GENESIS network to develop techniques to transfer data and to begin replacing the existing data with new data as it is qualified under a quality assurance (QA) procedure.

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 396 for P. Gottlieb - Repository Expansion Areas
- Job 397 for D. L. Eley - Convert GTMs to ARC/ INFO

1.2.1.3.3 REFERENCE INFORMATION BASE

Status Report on Ongoing Activities

Staff worked to define and initiate actions to transfer this work to the M&O for FY93.

Major Activities Upcoming Next Three Months

The transition of responsibility for this WBS element to the M&O will be completed.

Pending CCB disposition, Rev. 7 of the Reference Information Base (RIB) will be prepared for Project distribution.

1.2.1.3.4 TECHNICAL DATA BASE MANAGEMENT COMPUTER SUPPORT

Status Report on Ongoing Activities

Staff began developing system standards for workstation file structures and configurations.

The Legatto auto-backup system is still being tested and debugged.

Major Activities Upcoming Next Three Months

Staff will continue to set up new and existing workstations and PCs and participate in networking efforts.

The new Exabyte drive will be installed, tested, and replaced as needed. If the new drive does not solve the existing problems, other systems for automatic backups over the network will be investigated.

Staff will continue investigating providing dependable color printing on the network and performing routine backups, software installation, preventive maintenance and system monitoring on all machines.

1.2.1.3.5 TECHNICAL DATA BASE INPUT

Major Accomplishments

Technical database input has been suspended until October 1, 1992 due to the transition of the SEPDB to EG&G's GENESIS database.

1.2.1.4.1 TOTAL SYSTEM PERFORMANCE ASSESSMENT

A paper entitled "Convective Instability of Moist Gas in a Porous Medium," by Y. Zhang, N. Lu, and B. Ross, was written for the conference and is currently in SNL technical review. It was also prepared for submission to the *International Journal of Heat and Mass Transfer.*

Significant Meetings Attended

G. Barr attended a short course on "Volcanic Geology and Mineral Deposits" held by the MacKay School of Mines in Reno, NV on September 21-26, 1992. The course emphasis was a review of the available observations on economic mineralization accompanying caldera formation. The information will be used to help refine scenarios for natural resource occurrence in the human intrusion event trees.

SNL Yucca Mountain Site Characterization Project (YMP) staff hosted a meeting in Albuquerque, NM on September 28-29, 1992, to discuss the current understanding of near-field performance assessment (PA) in the United States and abroad. M. Apted (Intera) and K. Andersson (Karinta-Konsult, Sweden) presented information obtained for a survey paper they are writing under the auspices of the Swedish Nuclear Power Inspectorate (SKI) on international treatments of near-field PA modeling. SNL staff discussed the PA modeling currently underway for both the Waste Isolation Pilot Plant (WIPP) and the YMP.

Status Report on Ongoing Activities

SNL staff continued work on the radionuclide-source-terms report that discusses the changes in radionuclide inventory that occur due to decay and burnup. In association with this work, the ORIGEN database program, NWTSP, has been installed on the LAN18 SPARC9. This program has been used to generate some of the radionuclide data sets used in the calculations reported in the paper.

SNL staff continued to organize the near-field PA sessions for the International High-Level Radioactive Waste Symposium.

SLTR90-2002, "Progress Report on the Construction of Event Trees in Support of Scenario Development: Tectonism," completed its technical review and most of its management review.

The text for the first internal SNL draft of SAND92-2186, "Scenario Construction for Nominal Flow in Yucca Mountain and Vicinity," is nearly complete. SNL staff is arranging for the drafting of numerous figures for the final report, which will be submitted to the Project Office for review by the end of January.

SNL staff have been working on development of a simple dose-calculation model for the TRANS module of TOSPAC, based on information from the U.S. Nuclear Regulatory Commission (NRC), the International Commission on Radiological Protection (ICRP), and SKI reports. The model calculates the dose received from ingesting water taken from any specific location in a TOSPAC flow column or tube. The model is extremely simple; however, it is expected to be useful for scoping calculations and first-order checks on calculations performed by others.

Several extended summaries by Sandia National Laboratories (SNL) authors were submitted to the 1993 International High-Level Radioactive Waste Management Conference. The summaries submitted included "Sensitivity Analyses for Total-System Performance Assessment," by M. Wilson; "Implications of Stability Analysis for Heat Transfer at Yucca Mountain," by B. Ross, Y. Zhang, and N.I Lu; "Scenario Development and Performance Assessment—Questions for Near-Field Modelers," by G. Barr and R. Barnard; and "A Working Definition of Scenario and Method of Scenario Construction," by G. Barr and E. Dunn.

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, has been published. SAND91-1493 documents the results of a study that addresses the thermal design problem of bounding the induced thermomechanical responses over expected ranges of waste-stream characteristics (age and burnup). (Design Activities 1.11.6)

An extended summary of the results of a far-field thermal study was submitted for presentation at the 1993 International High-Level Radioactive Waste Management Conference. The study focuses on an evaluation of a range of design-basis areal power densities given a consistent set of modeling assumptions. Captured in the three-dimensional model are an accounting for variations in yearly average waste characteristics and a detailed repository geometry. (Design Activity 1.11.6)

1.2.1.4.3.2 PRECLOSURE RADIOLOGICAL SAFETY ANALYSES

Status Report on Ongoing Activities

A report on the assessment of the relative performance of unconsolidated surficial deposits as an item important to waste isolation has been completed and is in final line review. A report on the impacts of exploratory studies facility (ESF) design changes on items important to safety is in preparation and will be submitted for review shortly.

Major Activities Upcoming Next Three Months

The two reports described above will be completed and provided to the YMP Assessment Team.

1.2.1.4.4.1 PRE-WASTE-EMPLACEMENT GROUND-WATER TRAVEL TIME

Status Report on Ongoing Activities

SNL staff submitted several extended summaries for the 1993 International High-Level Radioactive Waste Management Conference, including: "A Technical Basis for the Evaluation of the Geohydrology Disqualifying Condition in 10 CFR Part 960," by P. Kaplan, A. Van Luik, and J. Boak; "Use of the Mixed Finite Element Approach in Performance Assessment," by T. Robey; and "Recent Developments in Stochastic Modeling and Upscaling of Hydrologic Properties in Tuff," by C. Rautman and T. Robey.

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. The document will be completed when referenceable information on the proposed location of the repository horizon is obtained.

The porosity data from the PA database have been used to generate a three-dimensional geostatistical simulation. A three-dimensional parameter file has been created for the Sequential Gaussian Simulator (SGSIM). The three-dimensional cross-section is of the arroyo containing UZ-7 and UZ-16, which is the east-west cross section for the INTRAVAL study. SGSIM has been modified to allow the program GAM2 to compute the variogram for the simulation. Also, VMODEL from the GSLIB collection has been implemented to produce the variogram model. SGSIM, GAM2, and VMODEL have been integrated to run automatically, using a common parameter file with a script shell. A PV-WAVE graphics program, VARIOGRAM, has been written to prompt for the simulation variogram and model variogram files and display the results in a two-dimensional plot.

Programs have been written to process data files and compute correlations between the variables to generate correlated random variables. The correlation parameters are written to files that are then read by the geostatistical properties. This eliminates the time-consuming process of recomputing the correlations by hand every time data are added or modified. Stability in the computation of the boundary conditions has been improved, and the median computed pressures for each element edge on the boundary is used.

There have been several internal meetings to organize a performance-assessment database for the INTRAVAL study and a new iteration of the total-system performance assessment (TSPA). The PA data group held their first weekly meeting on September 14. The initial effort has been directed at entering porosity, bulk-density, and particle-density data. Efforts to use the INTRAVAL data from Yucca Mountain drill holes and data from Apache Leap in Arizona have concentrated on porosity and conductivity values useful to analysts.

Converges for ARC/INFO have built for topography, geology, hydrology, and surface-based testing. Access is being built so users can display and query the data using ARC/VIEW.

The database design and methodology have been developed for reformatting data from the SEPDB into ARC/INFO. QA procedures and data-tracking procedures have also been established. The existing drill-hole data received from EG&G have been integrated with data from the SEPDB.

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 and hence are not addressed.

Significant Meetings Attended

On September 16, 1992, M. Siegel and E. Springer (Los Alamos National Laboratory [LANL]) met with faculty at the University of Nevada, Las Vegas (UNLV) to plan collaborative research in support of the caisson test and reactive transport model experimentation activities. UNLV faculty will provide analytical support for the caisson test and a test bed for additional large-scale (3-5 m) column tests.

M. Siegel attended a meeting of the YMP Geochemical Integration Team (GIT) in Las Vegas, NV on September 17, 1992 and participated in a GIT teleconference on September 30, 1992.

Status Report on Ongoing Activities

Unsaturated flow through single fractures:

Work continued on a journal article reporting the results of the full-field instability experiments; the first draft should be completed in October. Data collected from the single-finger experiments is being prepared for submission to the Data Records Management System (DRMS). Two extended summaries were submitted to the 1993 International High-Level Radioactive Waste Management Conference. The first summary describes results from single-finger experiments performed in an initially dry analog fracture. The second summary describes preliminary experimental results exploring wetting front instability in a partially saturated analog fracture. An additional extended summary of our research in modeling gravity-driven fingering using modified percolation theory was submitted to the 1993 International High-Level Radioactive Waste Management Conference.

Modifications to improve light level stability in the Rotating Test Stand (RTS 1) continued. The photoelectric cell was installed and testing is underway. The test cell is being thoroughly cleaned and refurbished in preparation for continued experimentation.

Collaborative experiments in flow and transport through saturated fractures were begun this past summer with LANL staff. Experiments were conducted in a 6-x-6-inch fracture in welded Bandelier tuff. The results of these experiments have been summarized and submitted to the 1993 International High-Level Radioactive Waste Management Conference.

Fracture matrix interaction:

An extended summary was submitted for the 1993 International High-Level Radioactive Waste Management Conference. This summary describes studies that have been performed to understand and detail the influence of matrix suction on the character of the wetted structure in horizontal fractures.

Studies to understand the influence of matrix imbibition on fracture percolation in thin two-dimensional systems cut normal to the plane of the fracture continued. Efforts this month included the construction of a flow chamber to hold fractured test media (tuff slabs and sintered glass plates), acquainting SNL staff with the Siemen's Polytron real-time X-ray imaging equipment (available through a cooperative agreement with the University of New Mexico [UNM]), and developing software to download images from the Polytron. An extended summary for the 1993 International High-Level Radioactive Waste Management Conference and an abstract for the 1992 American Geophysical Union (AGU) Fall conferences were submitted.

Gravity-driven fingering in porous media:

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

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

In support of studies designed to improve understanding of processes governing rock-property scaling and variability, an automated gas permeameter test system is being constructed. SNL staff await the arrival of several permeameter components; however, construction of the test stand and other parts of the system have been initiated. Efforts have also continued on the development of software to drive the test system. An extended summary that describes the automated permeameter test system and scoping studies to be

conducted was written and submitted to the 1993 International High-Level Radioactive Waste Management Conference.

Caisson test:

Batch and flow-through tests are being conducted to determine the extent of tracer sorption (nickel, boron, bromine, and lithium) by the ceramic cups samplers that will be used in the caisson. Sorption ratios of approximately 70, 0, and 0 were measured for nickel, bromide, and boron, respectively, in batch experiments. The initial results of the flow experiments were consistent with the batch sorption studies. The differences between the pH measured by electrodes placed in in-line flow-through cells and the pH measured in open containers were evaluated as a function of eluted pore volumes to determine whether in-line pH monitors are required in the caisson experiment. Under unsaturated conditions, the pH of the in-line and open-vessel samplers differed by only 0.1 - 0.15 pH units after two pore volumes had been eluted from the column. The experiments will be continued for longer time periods during October. Ni sorption on four plastics used for sample collection, storage, and sorption experiments is being investigated as a function of solution headspace and pH. Investigation results will be used to guide the choice of sample storage vials for the caisson and to estimate the stability of collected solutions that are stored for later chemical analysis. Initial results suggest that moderate sorption occurs over 2- to 9-day periods in containers with large headspace. Sorption studies at lower headspace under more acidic conditions are underway.

A summary entitled "Characterization of Materials for a Reactive Transport Model Validation Experiment," by M. Sieg ard, W. Cheng, and C. Reynolds (SNL), a ao (Howard University) was submitted to the 19. national High-Level Radioactive Waste Ma nent Conference.

Reactive t ort model development:

A first draft user's manual for the LEHGC code was comp by G. Yeh of Pennsylvania State University. ts have been initiated to implement the LEHG(oled reaction-transport computer code on the Cor tional and Computer Sciences and Mathemat nter's nCUBE, which has 1024 processors he initial modifications to the code, the geochemic uilibrium calculations will be performed in parallel ne transport calculations will be performed on gle node. The potential benefits of this effort incl wer costs for central processing unit (CPU) tim s real time spent per simulation, and increasec and complexity of acceptable problems. An abstra tled "Efforts to Verify and Validate the Lagrangia erian Model of Hydrogeochemical Transport (GC)," by P. Hopkins and M. Siegel (SNL), and eh (Pennsylvania State University), was subm r presentation at the 1992 Fall Annual Meeting of GU.

Major Activ Upcoming Next Three Months

Detailed stu s will continue of sorption of B, Br, Li, and Ni by s and by materials (samplers, plastic laboratory w e) to be used in caisson or in supporting laboratory s ies. The caisson will be filled and instrumente sotherm experiments to determine the linear range sorption of tracers will continue. Surface potent tric titration of sand will continue. The LEHGC coc l be implemented on massively parallel arcn ture.

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 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. A report describing this analysis is being drafted.

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 performance assessment of impacts of drill hole NRG6 on waste isolation was completed.

A performance assessment of impacts of the drill hole NRG2-NRG5 on waste isolation was completed.

A performance assessment impact of a communication tower on waste isolation was completed.

The classification analyses performed by RSN for work package 1A were reviewed as part of the waste package 1A design verification. SNL staff participated in a working group to improve the surface-based testing job and the test-planning process.

Major Activities Upcoming Next Three Months

The documents describing the PA 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

Major Accomplishments

M. J. Martinez, R. R. Eaton, and R. C. Dykhuizen submitted an abstract entitled "Effective Conductivity for Unsaturated Flow in Periodically Fractured Porous Media" for presentation at the fall meeting of the American Geophysical Union.

Significant Meetings Attended

R. Eaton participated in a one-week course on "Multiphase Flow and Heat Transfer" during the week of September 28, 1992.

Status Report on Ongoing Activities

The PC version of TOSPAC is essentially complete; however, work is continuing on the OUTPLOT module. The three-dimensional plots generated by the INGRAF graphics package are inadequate. Therefore, completion of the three-dimensional plots for TOSPAC will not occur until the new version of INGRAF is developed and received.

A computer code based on the method-of-lines was written to solve a set of coupled partial differential equations, provided by W. Cheng (6115), describing the diffusion of CO_2 into unsaturated soil. Results are currently being examined.

A proposal has been written to study the applicability of one-dimensional flows for TSPA. Numerous studies have been made in which staff addressed the questions of the significance of two-dimensional problem characteristics and the conditions for which they can be incorporated into one-dimensional investigations through concepts such as effective material properties and properly applied boundary conditions. If this proposal is approved, staff will review the work previously completed in this area, add to it where necessary, and stress how these studies apply to TSPA.

Modeling of thermal effects associated with heat-generating wastes at Yucca Mountain is currently being studied. The results will be used for developing thermal-effects models for the TSPA.

Software QA:

The effort to document the climatology codes has been completed and is currently in review.

Work is continuing to qualify the JAC2D and MERLIN II codes. JAC2D should be qualified by the end of September and MERLIN II will be qualified shortly thereafter.

The test problems for TOSPAC were rerun and verified to satisfy Corrective Action Request 92-1, generated during the SNL internal audit. Several discrepancies in the results from the test problems run using Version 1.0 were identified: the mass-balance calculations in DYNAMICS did not produce the same numbers, the composite-capacitance plot did not extend to the higher negative pressures shown in the user's guide, and the groundwater travel time plot did not include the travel time produced using the composite velocity shown in the user's guide. Each of these discrepancies was caused by subsequent improvements in TOSPAC. A memo documenting these problems will be written and included in the software documentation required by Section 6.4 of the quality-assurance procedure for software, QAIP 3-2.

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

SNL staff participated in the Sample Overview Committee (SOC) meeting on September 10, 1992 in Area 25 at the Nevada Test Site (NTS). Various core requests were acted upon, and the first 500 feet of core from drill hole UZ-16 were made available for viewing.

No samples were logged in or out of the Samples Library this month. Due to personnel changes and other activities, the inventory of the Samples Library has not yet been accomplished.

Major Activities Upcoming Next Three Months

The Samples Library will be inventoried prior to the impending physical relocation of the majority of the Waste Management Center.

1.2.3.2.2.2.1 SYSTEMATIC ACQUISITION OF SITE-SPECIFIC SUBSURFACE INFORMATION

Status Report on Ongoing Activities

SNL staff and the United States Geological Survey (USGS) co-investigators field-checked several problems identified in the data from the two-dimensional "grid" convering the basal portion of the Tiva Canyon Member of the Paintbrush Tuff in Solitario Canyon on the west side of Yucca Mountain. Permeability and sorptivity measurements were completed during the month by a USGS contractor. An extended summary of the field and laboratory data, entitled "Influence of Deterministic Geologic Trends on Spatial Variability of Hydrologic Properties in Volcanic Tuff," by C. A. Rautman (SNL), J. D. Istok (Oregon State University), A. L. Flint (USGS), L. E. Flint (Raytheon Services Nevada), and M. P. Chornack (USGS), was prepared. The extended summary was submitted to the 1993 International High-Level Radioactive Waste Management Conference. If selected, a full-length paper will be prepared and submitted for participant and Project Office review. (SCP Activity 8.3.1.4.3.1.1 and 8.3.1.2.2.3.1)

SNL staff reviewed portions of a draft LANL report, tentatively entitled "Geologic Evaluation of Six Nonwelded Tuff Sites in the Vicinity of Yucca Mountain, Nevada for a Surface-Based Test Facility for the Yucca Mountain Project." Investigators from SNL and the USGS are contributing data and text sections on hydrologic properties to this collaborative publication. (SCP Activity 8.3.1.4.3.1.1)

No additional progress was made during the month on the outcrop studies of the Bandelier Tuff, a natural analogue for some of the nonwelded tuffs at Yucca Mountain. Laboratory measurements on samples from the final two transects were halted by an equipment malfunction and staff vacations. Work will resume in early October. (SCP Activity 8.3.1.4.3.1.1)

In-situ measurement of important hydrologic properties in the Bandelier Tuff was deferred pending repair by

the vendor of a commercial field permeameter being evaluated for expanded use in investigating nonwelded tuffs at Yucca Mountain. This work will resume in October, assuming the equipment problems can be resolved . (SCP Activity 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. The air permeameter will be tested upon completion of repairs and, if feasible, used to collect permeability data from several promising locations. 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 natures. A full-length paper may be prepared for the 1993 International High-Level Radioactive Waste Management Conference. (SCP Activity 8.3.1.4.3.1.1)

Issues/Potential Problems Needing Resolution and Potential Impacts

A Project-level meeting had been scheduled for late September to review and revise the schedule and location of holes composing the integrated drilling program, of which the Systematic Drilling Program (SCP Activity 8.3.1.4.3.1.1) is part. The meeting was abruptly canceled because of other fiscal-year-end activities. Such a meeting is sorely needed. The overall drilling schedule has not been significantly changed in several years, yet scoping studies and other activities, including the ongoing shallow neutron drilling program, have produced abundant new data that may alter 1988-vintage plans. Some hole locations have changed unofficially, and testing concepts for various drill holes have evolved considerably. (SCP Activity 8.3.1.4.3.1.1)

1.2.3.2.2.2.2 THREE-DIMENSIONAL ROCK CHARACTERISTICS MODELS

Status Report on Ongoing Activities

Work continues on the geostatistical simulations related to the previously reported INTRAVAL exercise on the N-54/N-55 cross section. The computational process has been partially automated through the use of UNIX scripts. The N-54/N-55 cross section was extended approximately 6500 feet to the north and a simulation was generated to examine the effects of extrapolating significantly beyond the range of correlation and the available conditioning data. As expected, the excellent lateral continuing of the nonwelded Paintbrush Tuff (PTn) observed in previous simulations deteriorated significantly when the simulation extended beyond the range of correlation from the last known data point. The laterally continuous PTn interval degenerated as a coherent layer, and was replaced by other layers at different stratigraphic levels that continued for approximately the range of correlation. These layers, too, degenerated and were replaced by new ones. The important point is that, geostatistically, the simulation is correct and indistinguishable from the real world. The proportion of high-porosity nonwelded material in any vertical section is essentially the same throughout the extended cross section. In visual appearance, porosity is correlated laterally to approximately the same degree throughout the profile. Yet even a casual observer would object that the simulation does not reflect what is known about stratigraphic units at Yucca Mountain. It is obvious that there is additional information (soft data) available that is not being incorporated into the simulation. SNL staff are investigating methods to incorporate that soft (and ill-defined) information into the rigorous simulation process. (SCP Activity 8.3.1.4.3.2.1 and WBS element 1.2.1.4)

Geostatistical evaluation of the two-dimensional, Tiva Canyon shardy base grid was largely deferred during the month, pending field checking of some apparently anomalous results. This work was accomplished (see Section 1.2.3.2.2.2.1), and evaluation had resumed at the month end. A paper was prepared for the 1993 International High-Level Radioactive Waste Management Conference. (SCP Activity 8.3.1.4.3.2.1)

No additional activity occurred during September regarding the development of Lynx models. SNL staff involved in the next round of TSPA activities would

benefit from having the capabilities of the Lynx Geotechnical Modeling System (GMS) readily available. However, staff resources cannot support these other activities as they should be supported. (SCP Activities 8.3.1.4.3.2.1 and 8.3.1.4.2.3.1)

Major Activities Upcoming Next Three Months

Work will continue on developing the integrated simulation software and on modeling the INTRAVAL data.

Discussions with SNL staff assigned to the TSPA exercise have identified a potential new modeling effort. This effort would use indicator simulation to generate stochastic images of stratigraphy, rather than of material properties within a stratigraphy. The approach, although quite ill-defined at present, could resolve some issues of "knowing more and more about less and less" that can complicate modeling of material properties on the repository scale. An approach of generating stratigraphy stochastically would address a much higher first-order effect of variability, because variability of material properties would (at least initially) be treated at a very superficial level. However, given the lack of detailed site characterization data at present and the difficulty of incorporating soft data (discussed above), the approach might provide some significant insights into uncertainty at minimal additional cost. The techniques and data required already exist; it would be a matter of defining a test problem and reformulating the information to match the new objective. Additional discussions with SNL performance assessment staff will attempt to determine the feasibility of proceeding with this approach during October. (SCP Activity 8.3.1.4.3.2.1)

Issues/Potential Problems Needing Resolution and Potential Impacts

Staff assigned to this WBS element are being very thinly stretched. Additional resources should be committed for all activities now in progress to be adequately covered. Development of the Lynx GMS modeling capabilities is being hindered by the current lack of resources. This inability to develop Lynx models has adverse impacts on the new TSPA exercises, causing staff assigned to performance assessment to reinvent the wheel and develop new computer routines that essentially duplicate some capabilities of the Lynx system. (SCP Activity 8.3.1.4.3.2.1)

1.2.3.2.7.1.1 LABORATORY THERMAL PROPERTIES

Status Report on Ongoing Activities

The C-Matic LT (low temperature) system has been calibrated using the moisture containment cell for maintaining sample saturation. The C-Matic LT instrument will be used for measuring thermal conductivity at temperatures from 20 to 100°C. The LT passed calibration at 75 and 50°C, but failed at 25°C. This was the first calibration of the LT performed with the moisture containment cell. The guarding was high, as the guard differential was set for the expected resistance of the reference samples without the moisture containment cell. This may explain the low conductivity values obtained during the verification. Heat sink compound was not used between the interfaces of the moisture containment cell and the samples because it may be absorbed into the rock pores after it is applied between testing cycles. A suitable medium is being sought to reduce the interface resistance. (SCP Activity 8.3.1.15.1.1.3)

A revision to TP-207, "Calibration of Temperature Sensors Used for Thermal Properties Testing," to extend the calibration range of the transfer thermocouples to as low as 0°C, is being written. (SCP Activity 8.3.1.15.1.1.3)

A preliminary draft of TP-215 for calibrating the Lawson Thermocouple and A/D board has been written. These internal systems perform the same functions for the Thermal Conductivity Analyzer (TCA) that the reference thermocouple, electronic ice reference, and data acquisition unit perform for the C-Matic LT. The TCA will be used for thermal conductivity measurements made at or above 110°C. (SCP Activity 8.3.1.15.1.1.3)

Revision 01 to EP-0041, "Saturation Effects on Thermal Conductivity," has been issued. This revision modifies the sample descriptions, adds requirements for the data acquisition system, and updates the references. (SCP Activity 8.3.1.15.1.1.3)

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, the data acquisition software is verified and approved, and the relevant procedures revised. (SCP Activity 8.3.1.15.1.1.3)

1.2.3.2.7.1.2 LABORATORY THERMAL EXPANSION TESTING

Status Report on Ongoing Activities

A series of five verification runs of the dilatometer with the saturation test apparatus (STA) has been completed using 4-inch borosilicate glass. The sample was heated and cooled at a rate of $\leq$ 1°C/min. Water was drained from the STA when the sample reached ~100°C (on heat up) and the sample then was allowed to soak at 125°C for 10 hours. Afterwards, the sample was heated to 325°C and then allowed to cool to ambient. The maximum difference between the expected expansion and the measured expansion was -6.82%.

A series of calibration and verification runs using the same parameters with a 1-inch borosilicate glass sample will be conducted after a sample holder is fabricated to accommodate the shorter sample length. (SCP Activity 8.3.1.15.1.2.1)

A draft of EP-0042, "Effects of Sample Size on Thermal Expansion," has been written. Minor changes to the draft of TP-203, "Measurement of Thermal Expansion of Geologic Samples Using a Push Rod Dilatometer," are being made. (SCP Activity 8.3.1.15.1.2.1)

Major Activities Upcoming Next Three Months

A scoping study on the effects of sample size on thermal expansion will be initiated after the accuracy and reproducibility of the test data is established, instrument calibration is completed, data acquisition software is verified and approved, and relevant procedures are issued. (SCP Activity 8.3.1.15.1.2.1)

1.2.3.2.7.1.3 LABORATORY DETERMINATION OF MECHANICAL PROPERTIES OF INTACT ROCK

Status Report on Ongoing Activities

New England Research, Inc. (NER) is conducting a study of time-dependent deformation involving high-temperature experiments at creep and low strain rate conditions. The first in a series of constant stress (creep) experiments was initiated; however, a problem in the displacement gages has forced a temporary shutdown of this test. The measurement problem is being investigated and the test should be restarted this month. (SCP Activity 8.3.1.15.1.3.2)

R. Price (SNL) visited with the staff at NER in White River Junction, VT from August 31 to September 3, 1992 to discuss progress on the testing of samples of Topopah Spring Member tuff. In addition, a number of reports that are in process were discussed. These technical documents are being co-authored by NER and SNL personnel.

SAND92-0119, entitled "Experimental Comparison of Laboratory Techniques in Determining Bulk Properties of Tuffaceous Rocks," and SAND92-0847, entitled "The Effect of Frequency on Young's Modulus and Seismic Wave Attenuation in Tuff," have been technically and editorially reviewed. The documents are being revised in response to the resulting comments. (SCP Activity 8.3.1.15.1.3.2)

Two summaries of technical issues were prepared and submitted for consideration by the organizing staffs for two national meetings. "The Influence of Strain Rate and Sample Inhomogeneity on the Moduli and Strength of Welded Tuff" was submitted to the 34th U.S. Symposium on Rock Mechanics (June 27-30, 1993 at the University of Wisconsin-Madison), and "Characterization of Porosity in Support of Mechanical Property Analysis" was submitted to the 1993 International High-Level Radioactive Waste Management Conference (April 26-30, 1993 at Las Vegas, NV).

Major Activities Upcoming Next Three Months

SAND92-1810, "Unconfined Compression Experiments on Topopah Spring Member Tuff at 22°C and a Strain Rate of $10^{-9}s^{-1}$: Data Report," has been drafted, is being revised following a meeting of the authors, and will begin technical and editorial review in October. (SCP Activity 8.3.1.15.1.3.2)

The logbook covering a series of six experiments run at a nominal axial strain rate of 10^{-9} s^{-1} is being reviewed and will be submitted to the DRMS in October. (SCP Activity 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

The time-dependent mechanical properties of fractures are being investigated to address long-term stability issues within the potential repository. This month a triaxial creep (constant stress) experiment was started. A sample (right-circular cylinder, diameter of ~2.125 in. and length-to-diameter ratio of 3:1) was prepared with the fracture oriented ~35° to the sample axis. The confining pressure and the initial axial stress difference were both 10 MPa, which gave a ratio of shear-to-normal stress on the surface of ~0.36. The value for fully established sliding would be in the range of 0.6 to 0.7. When no shear displacement was measured after approximately a week at this stress difference, the axial stress was increased by 2 MPa. This stepping sequence has been continued each week until the differential stress became ~21 MPa, when time-dependent slipping began. The sample is at room temperature and vented to the atmosphere. (SCP Activity 8.3.1.15.1.4.2)

Gypsum cement replicas of rough, natural fractures in the welded Topopah Spring Member tuff have been made and are being tested under a range of test conditions. The first two experiments have been performed on replicas of a tensile fracture. The cyclic shear tests were done at a constant normal stress of 2 MPa. The first experiment was started in the mated condition and the second was started with an initial offset of 1 mm. The stress-slip and dilation-slip curves all show some hysteresis and permanent changes. This is consistent with apparent surface damage accumulation. (SCP Activity 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 staff, and Headquarters personnel, and the review comments were received in May. The Fracture Properties Working Group (W. Olsson, S. Brown, and R. Price) met twice in September to discuss the appropriate responses to the comments. The study plan is in the process of being revised. (SCP Activities 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2)

Work is continuing on the development of a computer program to model the dilation, normal stiffness, and shear stiffness of single fractures in rock. (SCP Activity 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 two months. (SCP Activities 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2)

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

1.2.3.2.8.3.3 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, is in internal SNL technical and managerial review. M. Walck and D. Gibson performed technical reviews.

Planning for FY93 and out-year WBSs was performed by D. Gibson and M. Walck.

1.2.3.2.8.4.2 LOCATION AND RECENCY OF FAULTING NEAR PROSPECTIVE SURFACE FACILITIES

Status Report on Ongoing Activities

Work by Geomatrix Consultants continued to log soil pits and trenches in the Midway Valley.

The preliminary results of trench mapping, surficial geologic mapping, and soil pit disruptions were presented to the NRC during a site visit on September 17 and 18, 1992. The fieldtrip was attended by approximately 50 persons including members from the the Nuclear Waste Technical Review Board (NWTRB), the State of Nevada, and surrounding Nevada counties.

1.2.3.2.8.4.6 QUATERNARY FAULTING WITHIN THE SITE AREA

Status Report on Ongoing Activities

A draft progress report, "Geologic Mapping Within the Yucca Wash and Northwestern Fortymile Wash Drainage Basins, Nye County, Nevada," by J. Gibson (SNL) was submitted to the USGS in Denver, CO for informal review. This report includes a description of mapping units, faults that transect this area, and copies of preliminary maps at a scale of 1:12,000.

1.2.3.6.2.1.6 FUTURE REGIONAL CLIMATE/ ENVIRONMENTS

Status Report on Ongoing Activities

Further analysis of the present climate simulation runs of MM4BAT driven by a general circulation model (GCM) continues. This analysis will focus on evaluation of the spatial and seasonal characterisitics of the model and observation-based surface climatology over the Yucca Mountain region.

Considerable effort is being expended to obtain and validate high-quality data sets of evapotranspiration and soil moisture. These observed data sets of surface hydrologic variables are difficult to come by, but are needed for a more detailed examination of the surface hydrologic budget (soil moisture, evaporation, infiltration, runoff) produced by the BATS component of the MM4BAT. The purpose of these examinations are to both characterize the behavior of the regional climate model (RCM) and to fine tune its forecasts.

A test run of MM4BAT was completed for the software documentation purpose. The software evaluation reports for pre- and post-processing software have been completed.

Major Activities Upcoming Next Three Months

The software evaluation report for the regional climate model, MM4BAT, will be completed.

The DOP 2-4 requirements for the Phase I Analysis will be addressed.

The QA audit of the National Center for Atmospheric Research (NCAR) is scheduled for the week of October 26, 1992.

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. In cooperation with Lawrence Livermore National Laboratory (LLNL) and LANL, a plan has been developed 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 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. In the past month, SNL staff provided input to working groups. These groups developed a plan that identified the major issues related to thermal loading and proposed actions to move toward a decision on thermal loading for repository design.

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 were transmitted to M&O.

Major Activities Upcoming Next Three Months

SNL will participate in the development of a plan for addressing the thermal loading of the repository. Specific actions for FY93 will be identified and thermal goal working groups will begin review of the thermal goals.

1.2.4.2.1.1.2 IN SITU THERMOMECHANICAL PROPERTIES

Status Report on Ongoing Activities

SNL staff drafted the report on thermal effects on instrumentation, which will support the ESF thermomechanical experiments. The report lists test instrumentation requirements and environments, matches this list with available off-the-shelf instruments, and identifies test instruments that will have to be developed. New technologies that show promise for developing needed instruments are detailed.

1.2.4.2.1.1.4 IN SITU DESIGN VERIFICATION

Status Report on Ongoing Activities

Proposed resolutions for all the comments received on Study Plan 8.3.1.15.1.8, "In Situ Design Verification," have been formulated. The study plan has also been revised to reflect the new ESF configuration and the current mining method to be used to construct the ESF.

1.2.4.2.1.2 ROCK MASS ANALYSIS

Status Report on Ongoing Activities

A series of experiments designed to study the effects of a nonstandard loading condition on frictional properties has been conducted at the University of Colorado (CU). Replicas of fractures in rock samples have been tested for normal stiffness and shear deformation properties. SAND92-1853, "Effect of Boundary Conditions on the Strength and Deformability of Replicas of Natural Fractures in Welded Tuff: Data Report," detailing the experiment techniques and the resulting data has been drafted and is in SNL review. The analysis of the data will be reported in a separate SAND document, currently being drafted, that will enter SNL review in October.

Laboratory work continued on the experiments involving small polycarbonate models. Two identical experiments were performed in which a layered polycarbonate model with a centrally located hole was axially loaded from 0.0 MPa to 6.4 MPa to 0.0 MPa. Nine images of the Moiré fringe patterns in each loading direction were taken. The new light source was used and displacement gages were installed to monitor deformation of the hole. Analysis of the data will be conducted in October to determine the joint slip and hole closure as a function of load. This data will be used to verify computer models developed in WBS 1.2.4.2.3.1. Also as part of this laboratory work, a detailed experiment on the frictional properties of the Lexan polycarbonate sheets used for the above experiment was performed. The slip rate, normal load, and surface finished were varied. This data will be analyzed in October.

Major Activities Upcoming Next Three Months

A new study will be initiated in October to study the surface characteristics of natural fractures and relate these to the frictional data gathered on replicas of the surfaces. The majority of the experimental work will be carried out by a CU graduate student in the Geomechanics Department laboratory at SNL.

1.2.4.2.3.1 CERTIFICATION OF DESIGN METHODS

Status Report on Ongoing Activities

JAC2D, SNL's primary thermomechanical finite-element code, is in the final stages of being certified for quality affecting work. During this month, verification problems were defined, ran, and compared with theoretical or past results. Excellent comparisons with theoretical and other results were obtained. The test problems all involved highly nonlinear phenomena such as large deformation of a beam, hollow tube crushing, and pressure and thermal loading of elastic-plastic spheres. JAC2D is in the last phases of obtaining QA certification and is anticipated to be certified by the end of September. The next step will be to obtain certification with the SNL jointed rock models. We anticipate that this can be done very quickly since the base version of JAC2D will already be certified.

Last month, SNL reported that they were able to reconcile differences between two separate implementations of the orthogonal jointed rock model. This month, SNL has begun to update the implementations to be compatible with the latest release of the JAC2D finite-element code, which is about to receive QA certification. Once the implementations are complete, the jointed rock model will be verified and JAC2D, with the jointed model, will be certified for quality affecting work. A SAND report will be written to cover the certification effort. This report will document the baseline behavior of the continuum joint model so that subsequent modifications to the model or implementations into later versions of JAC2D or other codes will be easier. In addition to the work on the orthogonal joint set model, SNL has also been working on improving and documenting the single joint set model. This model is significantly simpler than the orthogonal joint set version, yet can be very valuable for problems that are dominated by one joint set.

SNL's work to combine finite-element and boundary-element technology continues to yield mixed results. Good results have been obtained when all the boundary-element boundaries are coupled to finite elements. When this condition is not met, i.e., no finite elements are used, the iterative equation solver does not converge. SNL is pursuing the possibility that certain properties of the coefficient matrix of the equations that are necessary for the particular class of iterative (Krylov) solvers to work are not present in problems involving only boundary elements. In related work, Geologic Research, Inc. has submitted their final report on their work, entitled "A Two-Dimensional Boundary Element Method for Transient Problems in Thermoelasticity," by Y. Tian.

The final editorial changes to the JAC3D manual are being made this month. We expect this document to go to the printer in October.

Major Activities Upcoming Next Three Months

SNL will begin the initial work to examine the feasibility of developing computationally fast discrete deformable block codes. These codes will differ from what is commercially available in that they will be designed primarily to solve static thermomechanical problems (commercial codes primarily address dynamic problems). We are currently examining a one-dimensional formulation to explore the feasibility of some new concepts developed at the University of California at Berkeley.

1.2.4.2.3.2 DESIGN ANALYSIS

Status Report on Ongoing Activities

SAND92-0589, "Yucca Mountain Site Characterization Project: New Three-Dimensional Far-Field Repository Field Thermomechanical Calculations," by Hardy et al., has been submitted for internal SNL technical review. This report documents the work completed for Problem Definition Memo (PDM) 75-25. The analyses defined in the PDM were intended to provide information on the temperatures, stresses, and strains expected in the vicinity of ESF openings that may become part of the repository. The "new repository design" was used in the analysis, with thermal loadings of 57 and 80 kW/acre. (SCP Section 8.3.2.4.1.1)

Structural processing of the thermal results obtained as part of the SNL support to the M&O's systems study on repository thermal management has begun. Structural calculations will be completed using the compliant joint model option of the finite element code JAC. Initial efforts will focus on design-basis areal power densities (APDs) of 57, 80, and 100 kW/acre assuming rock quality designations (RQDs) of categories 1, 3, and 5 (Hardy and Bauer, 1991), with additional calculations completed as appropriate. A summary of the thermal and structural results obtained from this study will be submitted to the 1993 International High-Level Radioactive Waste Management Conference.

Documentation of a study comparing the predictions of near-field thermal response using approximations of smeared two-dimensional heat sources and discrete three-dimensional representations continued. It was the purpose of this study to provide a preliminary evaluation of the adequacy of smeared source approximations in two-dimensional thermal modeling. Local APDs of 20, 25, 34, 57, 80, and 114 kW/acre were examined.

1.2.4.6.1 SEAL DESIGN AND DESIGN REQUIREMENTS

Major Accomplishments

Work continued on the review of available technologies to seal underground openings in the following areas.

- The review of the Defense Nuclear Agency (DNA) sealing activities continued. Numerous documents were reviewed including construction, containment data, containment evaluation, and concrete and grout reports and photographs of SNL stemming plugs in G-Tunnel.
- A case history was prepared that focused on the backfilling operations for the Bullfrog Mine.
- A meeting was held with DNA representatives on the operations associated with weapons testing.
- Preparation of the available technologies report continued. The report is approximately 40% written.

Documentation of the computer code, SHAFTSEAL, was prepared for SNL by IT Corporation in accordance with SNL DOP 3-2. This documentation included updating a user's manual and completing QA forms on the software package. The user's manual will undergo technical review starting in October. A rough draft of a journal article also was prepared on the structural analysis of repository seals in an underground repository, including computation of the interface stress development as the cementitious seal cures. These computations were made using the SHAFTSEAL code.

Geochemistry evaluations continued as part of the backfill strategy development work. These evaluations considered alterations of the mineralogy of the Topopah Spring tuff and the Calico Hills tuff. Several areas were numerically analyzed, including the effects of temperature, water composition, and moisture content. Other areas investigated include the thermal and chemical stability of clays and the optimum clay ratio.

1.2.4.6.2 SEALING TESTING

Major Accomplishments

Draft report SAND92-0960, "Initial Field Testing Definition of Subsurface Sealing and Backfilling Tests in Unsaturated Tuff," by J. A. Fernandez, J. B. Case, and J. Tyburski, was modified based on SNL management review. It was transmitted to the DOE at the end of the month.

To support the backfill strategy development, numerous hydrologic water flow calculations were performed. All water flow scenarios involved water entering a drift through a saturated fault zone. The drift was assumed to be backfilled with a variety of backfill materials. The drift was also inclined. Other variables in the analysis included:

- the hydraulic conductivity of the fractured, bulk rock;
- the fault zone hydraulic conductivities;
- two steady-state water flow boundary conditions; and
- two transient water flow boundary conditions.

To enhance the understanding of the water flow in the backfill, simple analytical solutions were performed. This work is currently being documented.

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

Status Report on Ongoing Activities

SNL staff continue to support public tours of Yucca Mountain.

R. Orzel (Department 6351) represented SNL on the public tour conducted at Yucca Mountain on September 26, 1992. These tours are conducted monthly as part of the DOE public outreach program. A representative from each of the YMP participants is requested to staff the exhibits at the Field Operation Center (FOC) and answer questions that the public might have about the displays.

1.2.5.2.2 SITE CHARACTERIZATION PROGRAM

Status Report on Ongoing Activities

Staff continued to support Technical Integration Group (TIG) meetings, which are used to resolve concerns related to planned and ongoing investigations at Yucca Mountain.

1.2.5.2.3 REGULATORY REVIEW

SNL staff supported the DOE effort to supply technical material for the Environmental Protection Agency (EPA) to consider in revising the standard governing repositories for spent fuel and high-level waste. This support took the form of participation at a meeting at DOE Headquarters and a presentation at the National Academy of Sciences (NAS). The Headquarters meeting, on September 22, produced guidance for the presentation. The presentation, on September 23, was for a special NAS board on radioactive waste, which, on behalf of the EPA, was examining the DOE suggestions for revising the standard. The presentation explained the suggestions for removing difficulties in estimating the probabilities and consequences of human intrusion into a repository.

1.2.5.2.5 STUDY PLAN COORDINATION

Status Report on Ongoing Activities

Study Plan 8.3.1.17.4.4, "Quaternary Strike-Slip Faulting Proximal to the Site Within Northeast-Trending Fault Zones," written by USGS staff, was reviewed by D. Borns (SNL) on September 14, 1992.

Study Plan 8.3.1.17.3.5 R O, "Ground Motion at the Site from Controlling Seismic Events," written by USGS staff, was received by SNL for comment verification, September 1, 1992.

Study Plan 8.3.1.2.3.3 R O, "Site Saturated-Zone System Synthesis and Modeling," written by USGS staff, was received by SNL for comment verification, September 25, 1992.

1.2.5.2.6 SEMI-ANNUAL PROGRESS REPORTS

Status Report on Ongoing Activities

The coordination and preparation process has begun for the seventh Semi-Annual Technical Progress Report.

Major Activities Upcoming Next Three Months

Sandia will complete and submit the Semi-Annual Technical Progress Report and work with the Project Office to finalize this report.

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

Two SAND reports were printed and distributed in September 1992:

- SAND91-1493, "Equivalent Energy Density Concept: A Preliminary Reexamination of a Technique for Equating Thermal Loads," by E. Ryder (SNL). (WBS 1.2.1.4.3.1)

- SAND91-2416, "LLUVIA-II: A Program for Two-Dimensional, Transient Flow Through Partially Saturated Porous Media," by R. Eaton and P. Hopkins (SNL). (WBS 1.2.1.4.9)

Significant Meetings Attended

Staff attended the Information Resource Management (IRM) Council meeting in Las Vegas, NV.

Status Report on Ongoing Activities

The property inventory is continuing and the SNL Project Assets Management Tracking System is being updated as applicable for Nuclear Waste Fund (NWF) property.

Major Activities Upcoming Next Three Months

A request to dispose of nonfunctioning and surplus NWF property will be submitted to the YMP.

1.2.9.1.4 RECORDS MANAGEMENT

Significant Meetings Attended

Staff attended the Nuclear Information and Records Management Association (NIRMA) meeting in San Francisco, CA. Local Records Center (LRC) staff met to discuss the programming needs related to development of a computer capability to build a tracking mechanism for record packages during the indexing process.

Status Report on Ongoing Activities

Replacement personnel have been selected for the Technical Reports and Study Plan Support position and the records-processing position.

A complete inventory of the SNL LRC has been initiated to meet the requirements of DOE Order 1324.2A for both SNL and the Office of Civilian Radioactive Waste Management (OCRWM). The inventory will take place in early October with resulting data being submitted to the OCRWM and the SNL Recorded Information Management Office.

Procurement record packages are in the final stages o cleanup and tables of contents are being prepared. These packages are records that were completed prio to 1990. Surrogate records have been sent to the Central Records Facility (CRF) in lieu of the actual records, as the actual records contain SNL proprietary information.

Approximately one-third of the SAND reports (the report plus reviews and comments, drafts, etc.) for 1988 and 1989 have been verified against OCRWM microfilm to ensure legibility and completeness. Each associated microfilm roll number for a report has been indexed into the Records Management System (RMS) system and each verified page has been marked to indicate this verification. Upon approval of appropriate SNL personnel, hardcopies of microfilmed records will be destroyed.

QAIP 17-2 has been revised and is in the final stage of preparation prior to circulation for review and comment. Included in the revision is the definition of "qualified data" as required by the corrective actions associated with the closure of DOE/YMP CAR-YM-92-59. Corrections were also made to identified TDIFs that had previously incorrectly classified some data as "qualified data" for CAR-YM-92-59.

Major Activities Upcoming Next Three Months

The DOE Site-Specific records inventory will be completed as requested by the OCRWM and in compliance with DOE Order 1324.2A and the results will be submitted to the YMP.

All Desk Guidances will be completed and submitted for approval.

A Records Management Total Quality Team will be initiated to review the Record Series and the Master List of File Codes and to reverse records packaging processes to simplify work and enhance the organization of project or topic files. Records staff will work with the Records Management Total Quality Team to review the technical data record packaging process to determine if improved processing is possible to reduce redundancy, eliminate duplication of effort, and improve protection of data.

All technical data that was submitted to the Project Data Archive (PDA) will be reviewed to ensure that records were appropriately identified and forwarded to the YMP CRF.

Issues/Potential Problems Needing Resolution and Potential Impacts

Staff needs to: develop a process to verify OCRWM YMP microfilm prior to destruction of dual storage hardcopies; ensure, through frame-by-frame comparison with the hardcopy, that OCRWM microfilm contains legible and complete copies of all SNL submitted QA records prior to destruction of the hardcopies; obtain assurance that the National Archives and Records Administration (NARA) has approved of the use of the OCRWM microfilm as the permanent record prior to this process; and determine and obtain appropriate staffing to establish this verification process on a real-time basis for old and current microfilm. Potential Impact: Extensive reduction in cabinet and shelf space currently utilized for storage of relatively inactive records. Space savings would ensure that expansion of the LRC would not be necessary in the near future.

The SNL Records Coordinator will work with the DOE/YMP Technical Data Manager to determine whether "Project Assessment" activities should be required to meet AP-5.1Q, AP-6.2Q, and other relevant Project requirements or whether the resulting reports and supporting materials should be processed only as Project records.

Other Items to Report

The PDA staff now have access to a PostScript printer to allow printing capabilities from the Project-controlled Automated Technical Data Tracking (ATDT) system. Some software remains to be acquired to complete the operational capabilities of the printer.

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

Status Report on Ongoing Activities

The revised manager and trainee orientation manuals were distributed to the managers and Technical Project Officer (TPO) for review and comment. Copies of the Project and Control System (PACS) videotape, "What is Going On?," were distributed to all participants for use as an introduction to PACS. The procedure abstracts to be used in training have been reviewed, revised, and finalized. Prototype lesson plans have been developed for global, refresher, and classroom training for four to six procedures. A lesson plan for Geology for Non-Geologists has also been developed. Training records are still being verified for accuracy with respect to dates in database vis a vis hardcopies.

Major Activities Upcoming Next Three Months

The geology for non-geologist course will be conducted, training record verification will be completed, Job Effectiveness Training (JET) will be implemented after TPO and managers approval, and staff will develop Hydrology and Contaminate Transport courses.

1.2.9.2 PROJECT CONTROL

Major Accomplishments

PACS monthly status and costs were transmitted on September 4, 1992, (five days early).

PACS software has been modified and tested to support the end-of-the-fiscal-year closing.

Significant Meetings Attended

Staff attended the YMP Project Control Steering Committee meeting in Denver, CO and the PACS meeting in Las Vegas, NV.

Status Report on Ongoing Activities

New PACS files are being created for all LOEs to be merged with the new WBS structure data files. PACS software modifications in support of the new fiscal year are continuing. Current efforts include the automated generation of timesheets and task leader list (responsibility assignment matrix). The installation of on-line access to PACS budget and cost data is continuing. Work continued on the SNL WBS Dictionary.

The NOVELL server computer for the PACS staff has been received, and the hardware tested. The network software is being installed, and the network versions of applications software (DBASE, FOXPRO, LOTUS 123, and Freelance) are being installed.

Modifications and testing of INFORMIX software is continuing with the addition of some of the remaining reports to the QA Deficiency tracking database.

Several errors in the INFORMIX software, designated as highly critical, have been corrected. Work has began on the generic records management software database design in the AIMS system.

Major Activities Upcoming Next Three Months

The conversion of the PACS to the new fiscal year will take place during October. This will include installation of new software to combine data from the Procurements tracking database with the budget planning database. The automated generation of timesheets and task leader list for the YMP will be completed.

The Novell network will be brought on-line for PACS staff. The SNL WBS Dictionary will be completed and submitted to the YMP. The PACS data downloaded through the Workstation software will be reviewed and

corrected as necessary for FY93. A Configuration Management System Plan and implementation procedures will be developed.

The generic records management database design effort will continue for the AIMS.

1.2.9.3 QUALITY ASSURANCE PROGRAM

Major Accomplishments

Responses were generated and submitted for the three Corrective Action Requests (CARs) issued as a result of the YMP DOE QA Audit #YMP-92-22 performed in August.

Responses were completed to comments generated by the Project Office in Revision 1 to the SNL Quality Assurance Program Description (QAPD) for the Yucca Mountain Project.

A new SNL QA staff member, Donald Wrobel, has joined the QA organization.

Status Report on Ongoing Activities

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

Routine QA review of procurement documents continues. September in-depth reviews resulted in issuance of CAR 92-11 to correct lack of required consultant training. This action will align the contract with QAGR/CSR requirements and strengthen the SNL/contractor understanding with YMP QA Program requirements.

Providing assistance to the Training Program development effort continues: a draft Orientation Manual for SNL YMP activities is receiving critical review and an effort was undertaken to compare and assess procedure usage versus training assignments.

Work Agreements (an SNL document that specifies interface agreements and provides work direction) have been drafted and are being reviewed or issued for SNL YMP work activities. This effort is a result of major SNL organization changes and some extensive simplifications in administrative procedures.

Major Activities Upcoming Next Three Months

One subcontractor audit is scheduled for the next quarter. The audit of the National Center for Atmospheric Research (NCAR) is currently scheduled for the last week of October.

Two surveillances are scheduled for the next quarter. Areas to be reviewed include WBS activities 1.2.1.4.4.1 and 1.2.4.2.2.2.2.

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
CR84	Rock Failure Update	Submitted to CCB
CR85	Soil Properties Update	Submitted to CCB
CR86	Groundwater Chemistry	Submitted to CCB
CR87	Saturation Level Update	Submitted to CCB
CR88	Saturated Hydraulic Conductivity	Submitted to CCB
CR89	Reference Boundary Update	Submitted to CCB
CR90	Thermal Analysis Update	Submitted to CCB
CR91	UNE Seismicity Update	Submitted to CCB

3. INFORMATION ENTERED INTO THE RIB

None.

*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

Participant	Description of Data

None.

2. DATA FORMALLY SUBMITTED TO THE TECHNICAL DATA BASE

Participant	Description of Data	SNL Data Auth. No.

None.

3. DATA FORMALLY ENTERED INTO THE TECHNICAL DATA BASE

Participant	Description of Data	SNL Data Auth. No.

None.