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SITE
CHARACTERIZATION
PROJECT**

Monthly Status Report

August 1992

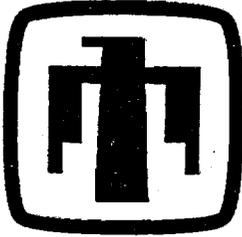
DISCLAIMER

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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PDR WASTE PDR
WM-11

102.8
ENCLOSURE *3*

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11/12/92



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9211240405 921112
PDR WASTE PDR
WM-11

102.8

ENCLOSURE 3



United States Department of the Interior

GEOLOGICAL SURVEY
BOX 25046 M.S. 425
DENVER FEDERAL CENTER
DENVER, COLORADO 80225



*Rec'd with letter dtd
11/12/92*

IN REPLY REFER TO:

August 11, 1992

*Gertz (2)
Lamm
Royer
Ritchey
Ripston
Snyder
Jones S
Sturcken
Wallace }
8/17/92*

WBS: 1.2.9.2
QA: N/A

I-330817

Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization Project Office
U.S. Department of Energy
P.O. Box 98608
Las Vegas, Nevada 89193-8608

SUBJECT: U.S. Geological Survey Yucca Mountain Project Monthly
Summary for July, 1992.

Dear Carl:

In compliance with the revised Yucca Mountain Project monthly reporting procedures, following is the YMP USGS input for July, 1992. If you have any questions, please contact Raye Ritchey at (303)236-0517.

WBS 1.2.3 - SITE INVESTIGATIONS

The surface water runoff monitoring project reports that average July precipitation for the immediate area surrounding Yucca Mountain was .003 inches. Skull Mountain Pass, Rock Valley at Jackass Flats averaged .32 inches and Fortymile Wash from the Narrows to Lathrop Wells averaged .04 inches. Areas of moderate rainfall were Rock Valley at U.S. highway 95 near Amargosa Valley with .97 inches and Stockade Pass above area 12 with 1.06 inches. Runoff was noted in Cane Springs Wash tributary and the Amargosa River at Eagle Mountain. The origin of flow to the Amargosa River for the July 11-13 storms was Ash Meadows.

In support of debris transport studies, preparation began of a 1968-1992 climatic data base for southern Nevada. The data base will allow analysis of recent climatic trends for the area, and enable region-wide winter and summer storm events to be more clearly defined. For example, it has already been determined that in January and February, 1969, two major storms caused extensive flooding in southern Nevada. These data additionally will provide correlations of precipitation and severe runoff events. Debris

102-8

ENCLOSURE 4

movement, due to severe flooding, occurred on July 11, 1992, near Hawthorne, Nevada. The debris, which consisted of fine-grained sand and gravel, was transported and deposited on most of the streets of Hawthorne. South of Hawthorne, debris was deposited in several roadcuts of Nevada State Highway 359. This debris was mostly fine-grained sand and gravel, and the volumes were fairly large. One roadcut filled to depths of about 10 feet over a length of several hundred feet. Moderately heavy debris (boulders up to 2 feet in diameter in a sand and gravel matrix) was deposited over Interstate 80 east of Reno, Nevada, and fine-grained sandy debris was deposited on residential streets and yards in Carson Valley, on July 14. Heavy debris transport occurred in Gray Creek, a tributary of the Truckee River, north of Reno, Nevada. Fine-grained sand, silt, and clay caused municipal water-treatment plants in Reno and Sparks to cease operations for several days.

Staff from the natural infiltration project continued the preliminary analysis of relative changes in moisture profiles using neutron meter counts for a qualitative analysis of wetting fronts that resulted from the above average precipitation during the winter and early spring of 1992. This analysis is providing important information concerning differences in infiltration mechanisms between bedrock and alluvium surficial materials, and between channel, terrace, sideslope, and ridgetop locations. Continued analysis of the moisture profiles in Pagany Wash is being used to estimate evapotranspiration for a mass balance analysis and for comparison with energy budget measurements being made on the surface, and also with a class A evaporation pan. Drilling of neutron access borehole N-63 in Pagany Wash is scheduled to begin the first week of August. This site is located on the alluvium terrace adjacent to N-9, and will extend the existing transect of boreholes, which has provided very important input for 2-dimensional modeling of infiltration, across the wash towards the north slope of the wash.

The surface based boreholes project reports that the total depth of the deep UZ borehole at the end of July was 400 feet. The estimated completion date is March 18, 1993. The drilling has penetrated the Tiva Canyon unit, and is now drilling through the upper lithophysal section of the Topopah Spring unit. Meetings were held with RSN to discuss various aspects of instrumenting UZ-16. A final design for the geophone cable mounts was agreed upon. The USGS agreed to fabricate a prototype mount and deliver it to RSN in about 3 weeks. RSN will take the lead in arranging for fabrication of a sufficient number of mounts to accommodate the 96 geophone units that will be installed in UZ-16.

The prototype infiltration (percolation) testing project reports that the final stage of the ponding test on the large block has been in progress since May 11, 1992. Initially a positive water pressure of around +5.5 cm of water was applied to the top of the block. The flow rate was around 25 cubic cm of water per day in the rock matrix and fracture. Later the water pressure was increased to +7 cm of water. The initial flow rate at the new

pressure increased to around 100 cubic cm of water per day, then decreased to zero. A core was tested to investigate any variations to rock surfaces after cutting and finishing. Preliminary results indicate that there are no significant differences.

In support of gaseous phase chemical investigations, to complete fabrication of the UZ-16 multi-packer string, tests of heat tape used to prevent condensation of gasses were completed. The tests indicated that heat tapes, used in conjunction with aluminum insulation, would prevent condensation. Three tapes will be needed near the surface, two tapes to about 1200 feet, and one tape below 1200 feet. This increased complexity in the packer design required additional testing prior to purchasing materials needed to complete the packers for final leak and pressure testing; however, the packers will be completed by the end of FY 1992, well before UZ-16 is completed.

Staff from the simulation of the natural hydrogeologic system project performed further 2-dimensional simulations with heterogenous and isotropic rock properties for each of the hydrogeological units. Due to the effect of gas flow, steady state conditions could be reached only by changing the entry value of the various hydrogeological layers to 1. The permeability contrasts at the unit boundaries also created numerical problems. These tests complete the 2-dimensional simulations; further simulations with the 3-D model will be performed in FY 1993.

In support of prototype tracer testing, a week was spent at the Nevada Test Site monitoring the injection of trace gas into the drilling air at UZ-16. The temporary system that is now online is working smoothly. The calculated and measured concentrations of tracer gas in the drilling air are in good agreement. The mass flow controller can be rapidly adjusted to match changes in the volume flow of drilling air. Three sample collection ports have been installed onto the uphole drilling line to check air leakage.

Staff from the site potentiometric-level evaluation project report that investigation continued of the water-level and fluid pressure responses in wells at Yucca Mountain to earthquakes on June 28-29 in southern California and Little Skull Mountain. Preliminary data and analyses were sent to DOE for their use and dissemination. Data compilation of water-level fluctuations caused by the earthquakes, in response to a request from the State of Nevada. Water levels in four zones in two wells continued to be monitored for responses to earthquakes and aftershocks. Data loggers were installed at these sites in order to record maximum water-level responses, which were often off-scale on the analog recorders. Several planned activities were delayed because staff was diverted to responding to information requests regarding the earthquakes.

In support of multiple-well interference testing, the first cross-well survey was completed. The complete section between wells C2 and C3 was imaged from a depth of 1344 feet to 2952 feet. The space from 2046' to 2952' was imaged at 1 meter intervals; from

1344' to 2046' the interval was 2 meters. Work began on reducing and analyzing the data from the cross-well field work. Initial results suggest a complicated wavefield that is indicative of a fractured layer section.

Staff supporting the conceptualization of saturated zone flow models completed analysis of existing data at the UE-25 c-well complex, compiling television and acoustic televiewer logs, in addition to caliper logs, core analyses, tracejector surveys, temperature logs, static tracer tests and heat-pulse surveys into a conceptual geologic model. The geology will be incorporated directly into the preliminary hydrologic models via 3-D discretization of the geology into the model mesh.

Staff supporting surface-based geophysics studies are obtaining new gravity and ground magnetic data along several profiles across Yucca Wash and northern Midway Valley to help locate the trace of the Paintbrush Fault. Activity to collect magnetic and gravity data in investigations to support interpretation of the seismic lines to be run in Yucca Wash as a part of the extensive seismic reflection transect of Yucca Mountain is awaiting approval of Study Plan 8.3.1.4.2.1 by the NRC. Planning for fieldwork supporting the seismic transect, anticipated late in 1992, is underway. Data from this activity will be used to target the location for proposed corehole USW G-5 and will also provide constraints on the interpretation of regional variation in the stratigraphic relationships at Yucca Mountain.

Recent interest by DOE in having the USGS submit a 3-D geologic model has prompted the acquisition of two 3-D geoscientific software packages, Dynamics Graphics and LYNX geosystems, which will be used to generate a 3-D display of the geologic framework of Yucca Mountain. In addition, structural data will be compiled and integrated into a model that describes the structural history of the site. Staff have prepared numerous 3-D illustrations to depict the spatial distribution and total thickness of major ash-flow sheets. Illustrations include members within the Paintbrush Tuff, tuffaceous beds of the Calico Hills, and members within the Crater Flat Tuff. The data consist of drillhole and measured-section locations with respect to all of these members. These data were converted to a grid-mesh that was interpolated to create and graphically edit 2-D surface models into a 3-D display model. These data sets are the first step in the development of the 3-D geologic framework of Yucca Mountain. Digitization began of major faults within the site area; the data set will be integrated into the computer-based 3-D geologic model.

In support of surficial deposits mapping of the Yucca Mountain area, mapping was begun of the 3.75 minute quadrangle #26, which includes extensive surficial deposits along Fortymile Wash from just south of the mouth of Pah Canyon to just north of the mouth of Yucca Wash. Field checking was conducted of surficial deposits in Fortymile Wash and confluent side canyon drainages. Recent natural exposures of surface deposits, including surficial and buried soils

underlying surficial deposits, were noted which are useful in constraining deposit thicknesses and geomorphic/climate history. These exposures were used to relate field surface characteristics to mappable photogeologic characteristics of units. Some of these exposures may be used as sampling sites for soil sedimentology and isotopic analyses for deposit age estimation.

Staff supporting regional paleoflood evaluation continued preparation of a large, high-resolution digital data base for the Amargosa River basin. USGS digital line graph and digital elevation model data (1:100,000) will be used for much of the underlying baseline map information. These data will be combined with aerial reconnaissance information for preliminary mapping of regional paleoflood features. Work is ongoing to delineate drainages and computer basin area measurements for the Amargosa River basin and its second-order sub-basins, which will provide needed data for quantitative analyses of the relationships between precipitation and streamflow runoff, and ultimately will be used to compare modern and past streamflow events that have occurred in the region. The aim of this study is to determine the magnitude and frequency of past runoff from Fortymile Wash and other upper Amargosa River sub-basins adjacent to Yucca Mountain. It is expected that the sedimentary stratigraphy of the Amargosa River basin will provide essential chronological information for the past 10,000 years of streamflow in the region. USGS has not received DOE review and approval of the study plan for this activity, which was submitted to them March 31, 1992.

In support of past discharge studies, well VH-1 in Crater Flat was pumped for water chemistry samples. Of 36,600 gallons pumped during 5 hours 36 minutes of operation, 20 gallons per minute or 19 percent was diverted to the microorganism collector. The nets will be checked for microorganisms during the first week of August. At a field trip to Franklin Lake Playa, water samples for Sr 87/86 were collected from 17 wells using a Kemmerer bottle to collect water samples from known well depths. Results from these well samples will be compared to those from the springs collected north of Franklin Lake in Carson Slough.

Staff from the calcite silica project determined $d^{13}C$ and $d^{18}O$ values from the following locations: 14 samples from site 106; 6 samples from the paludal deposits from site 199; 22 samples of vein and pedogenic calcrete from trenches CFS-E, CF-1, CF-2, and 8; 3 samples of Cenozoic limestone from the Tonopah RR locale in Ash Meadows; 3 trench 14 vein calcites plus 5 samples of the slope parallel calcrete exposed at the base of the south wall of trench 14; and 1 sample from Nevares spring deposits in Death Valley.

To support the development of a geomorphic map of Yucca Mountain, staff surveyed ground control points on the west-facing hillslope of Yucca Crest. Control points were used to orient aerial photographs in an analytical stereo plotter. Once oriented, the photographs were used to measure a Digital Elevation Model (DEM) of

the hillslope. A 2m spaced DEM was measured on bedrock, channel, and dated colluvial boulder flow exposures on the west-facing hillslope of Yucca Crest. The elevation difference between each DEM node and a planar surface calculated on the upper surface of the boulder fields, will be used to estimate the volume of material eroded since the boulder fields were stabilized. The calculated volume, along with the estimated ages of the flows, will be used to estimate a long-term erosion rate for the area.

Staff supporting the evaluation of Quaternary geology and potential faults at Yucca Mountain compiled field mapping at 1:12,000 scale. Fault locations and observed fault attributes were plotted on overlays for the 1:12,000 scale orthophotos. Staff also conducted field work to the north and south of mapping along the Solitario Canyon fault, and examined trenches 10a and 10b.

The Little Skull Mountain earthquake of June 29, 1992, $M = 5.6$, is the largest recorded earthquake within the boundaries of the Nevada Test Site; several large underground nuclear explosions have had larger body wave magnitudes. Because the earthquake was near the proposed repository at Yucca Mountain, it is of particular importance and interest. Aftershock recording equipment was installed around the epicenter within a couple of days by the USGS, Branch of Geologic Risk Assessment, and the University of Nevada, Reno, Seismological Lab. Thousands of aftershocks have been recorded and are providing a wealth of data for outlining the fault plane of the fault (or faults) which slipped. Several aspects of the earthquake occurrence are unique. The time of the earthquake was apparently in part determined by the occurrence of the $M = 7.4$ Landers earthquake, which triggered a considerable amount of activity throughout the western U.S. The Little Skull Mountain earthquake caused considerable damage to the Field Operations Center for the Yucca Mountain Project -- the first earthquake known to have caused significant damage on the Nevada Test Site. The earthquake occurred within the relatively dense Southern Great Basin Seismic Network. A very sensitive 4-station micro-earthquake array was in operation near the proposed repository site and continued to operate through both the Landers and Little Skull Mountain earthquakes (and up to the present). This array provides important information on the microseismicity in the immediate vicinity of the proposed repository, but also gives a continuous record of the activity at Little Skull Mountain before and after the Landers and Little Skull Mountain earthquakes. The earthquake provided an important opportunity to study rockfalls caused by the earthquakes. The earthquake dislodged numerous large boulders from the crest of Little Skull Mountain, and further study of these boulders, and others possibly dislodged by earlier earthquakes, may provide important data on seismicity in the region, and on the erosional effects of earthquake shaking. Some constraints may be placed on the ground motion expected at Yucca Mountain based on the ground acceleration that would be necessary to topple precarious rocks observed near the proposed repository site.

In support of the evaluation of tectonic processes, W. Hamilton

examined surface deformation caused by the June 28, Landers, California, earthquake to determine whether similar features, indicative of paleoearthquakes, might be recognizable near Yucca Mountain. The Landers earthquake was the largest strike-slip event in the Basin Range province in 135 years; it produced right-lateral strike-slip offsets as great as 5 m along north- to northwest-striking faults, with variable subordinate extensional components. Despite the size and extent of the structural breaks, surface deformation of alluvial and colluvial deposits was surprisingly difficult to see, and Hamilton concluded that the surficial effects will soon be obliterated. Hamilton noted that there is no direct analogy between the faults displaced by the Landers earthquake and faults in the Yucca Mountain region because, unlike Landers, conspicuous major bedrock strike-slip faults are not present near Yucca Mountain, nor is the regional geology or fault-related topography analogous. Hamilton concluded that the Landers geology provides no support for conjectures that major young strike-slip faults are present but unrecognized near Yucca Mountain.

Sincerely,

Larry R. Hayes

for Larry R. Hayes
Technical Project Officer
Yucca Mountain Project
U.S. Geological Survey

cc: D. Appel, USGS/Denver
J. Blakey, USGS/CR
T. Blejwas, SNL/Albuquerque
R. Bullock, RSN/Las Vegas
D. Campbell, USBR/Denver
J. Canepa, LANL/Los Alamos
T. Chaney, USGS/Denver
T. Conomos, USGS/WR
J. Cook, USGS/SR
R. Craig, USGS/Las Vegas
J. Docka, Weston/Washington D.C.
R. Dyer, DOE/YMPO/Las Vegas
L. Ducret, USGS/Denver
W. Dudley, USGS/Denver
D. Faust, TESS, Las Vegas
D. Gillies, USGS/Denver
R. Hirsch, USGS/Reston
V. Iorii, DOE/YMPO/Las Vegas
C. Johnson, TESS/Las Vegas
K. Krupka/PNL
R. Lowder, MACTEC/Las Vegas
R. Pritchett, REECO/Las Vegas
R. Ritchey, USGS/Denver
E. Roseboom, USGS/Reston
D. Russ, USGS/
J. Sauer, USGS/NR
V. Schneider, USGS/Reston
M. Siegel, SNL, Albuquerque
A. Simmons, DOE/YMPO/Las Vegas
R. St. Clair, TESS, Las Vegas
T. Statton, TESS, Las Vegas
J. Stuckless, USGS/Denver
K. Taylor, Washington, D.C. (U.S. Senate)
N. Trask, USGS/Reston
J. Verden, TESS, Las Vegas
B. Viani, LLNL/
J. Weeks, USGS/Denver
R. Wesson, USGS/
YMP-USGS Local Records Center File 1.1.02



United States Department of the Interior



GEOLOGICAL SURVEY
BOX 25046 M.S. 425
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

SEP 18

1 44 PII '00

IN REPLY REFER TO:

Handwritten signatures and notes:
K. B. (12)
L. J. ...
D. ...
A. ...
R. ...
S. ...
Crawley
9/18/92 Wallace

WBS: 1.2.9.2
QA: N/A

September 16, 1992

I-332035 2.1

Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization Project Office
U.S. Department of Energy
P.O. Box 98608
Las Vegas, Nevada 89193-8608

SUBJECT: U.S. Geological Survey Yucca Mountain Project Monthly Summary for August, 1992.

Dear Carl:

In compliance with the revised Yucca Mountain Project monthly reporting procedures, following is the YMP USGS input for August, 1992. If you have any questions, please contact Raye Ritchey at (303)236-0517.

WBS 1.2.3 - SITE INVESTIGATIONS

The precipitation and meteorological monitoring project reports that a new satellite data ingest system (from MARTA Systems, Inc.) was installed, which will enable the collection of more types of imagery more frequently, looping or animation of data over time, and zooming and panning of data. Higher resolution data are now available for analyzing storm development and movement near Yucca Mountain.

Staff supporting the subregional 2-D areal hydrologic model made scoping calculations regarding the potential precipitation of calcite resulting from elevated saturated zone temperatures following waste emplacement; temperature data was provided by LLNL. Calcite was shown to precipitate at about 90 degrees C, the upper range of the simulated temperatures in the saturated zone caused by waste emplacement. Discussions indicated that precipitation could occur at much lower temperatures. Precipitation could cause reduced permeability in the saturated zone and a rise in the water table.

ENCLOSURE 5

In support of studies of surficial materials, geophysical logging was tested in N54 and N55; Gamma-Gamma logging and Neutron logging were performed. Data were collected by the two source methods; it seems that all electronics and instrumentation in the geophysical logging van are in working condition. Two watersheds, Split Wash and Pagany Wash, were studied in detail. These washes were divided into several soil units based on areal photos. Field spot check of the soil units is in progress. The soil units will be evaluated to find out the similarity or differences between them that may affect the hydrologic properties of surficial materials.

The natural infiltration project reports that comparison of moisture profiles obtained from the neutron logging program continued with the addition of profiles obtained from the scheduled logging of all boreholes in August. As expected, a general decrease in the moisture content for all surficial materials (to a depth of approximately 2 meters) was observed. The decrease in moisture content at most locations is predominantly due to evapotranspiration; downward vertical flow is assumed to be insignificant relative to evapotranspiration because no significant changes in moisture profiles were observed below the wetting front. Neutron access holes N-33 and N-34 were completed in Drill Hole Wash.

In support of matrix hydrologic properties testing, additional thin sections of fluorescent-dye impregnated tuff have been made up at the HRF for petrographic observation. Samples of Calico Hills tuff were heated and made into thin sections. This was to see if heating caused visible changes in flowpaths related to the increase in permeability seen as identical samples were exposed to higher temperatures. Analyses of other samples from the unsaturated zone are ongoing. Physical property measurements on the first batch of new neutron core samples were nearly complete by the end of August.

Staff from the surface based borehole project prepared an addendum to the criteria letter for drilling, testing, and instrumenting UZ-16. The addendum spells out details for the vertical seismic profiling (VSP) surveys, which include a first level reconnaissance survey, followed by a production survey, and if required, a data in-fill survey. Information on VSP field data collection includes seismic source lines, seismic sourcing systems, and seismic data recording systems.

In support of prototype pore water extraction testing, tracer gas injection and monitoring were conducted at UZ-16. The volume flow of drilling air is measured and calculated, and the appropriate concentration of tracer gas is added to the drilling air by adjusting the mass flow controller. The mass flow controller can be rapidly adjusted to match changes in the volume flow of drilling air. Concentrations of trace gas in the drilling samples will be analyzed using the gas chromatograph.

In support of regional hydrochemical characterization, staff met with the National Park Service (NPS) at Death Valley National

Monument (DVNM) to clarify YMP objectives relative to, and planned activities for, proposed data and sample collection at springs within the monument. A collection permit was obtained from DVNM, and scoping samples were collected for selected isotope determinations from Nevares Spring and Virgin Spring. Analytical data from the samples will be used to determine the feasibility or suitability of the sites for YMP purposes, and may provide some insight to the nature of the regional flow system.

Study plan 8.3.1.2.3.3, Site Saturated Zone Synthesis and Modeling, was formally transmitted to DOE/YMPO for concurrence.

The surface based geophysics project reports that the collection and reduction of gravity and magnetic data in Yucca Wash has been divided into two parts. The first part consists of obtaining five E-W detailed profiles across the Midway Valley area to help locate the surface of the buried Paintbrush and/or other faults on the east side of Yucca Mountain. The other part is to obtain data along five E-W and one N-S line in Yucca Wash, to the north of Midway Valley. The proposed lines in Yucca Wash are generally shorter, but the topography is rougher, ranging up to 500 feet along individual lines. The deeper seismic reflections are expected to be helpful in describing the Tertiary/Paleozoic contact and the nature of deep faults below Yucca Mountain.

In support of surface fracture network studies, three data stations (tracelines) were collected in Solitario Canyon in the bedded tuffs immediately above Topopah rounded-step outcrops and topographically south of UZ-6. An additional traceline was collected across the location of the minor fault at NRG-1 core, east side of Exile Hill. These data will be incorporated into the local 3-D fracture model composed of the NRG-1 core, surface data stations, and the cleared pavement topographically above the NRG-1 corehole.

Work began on the Fran Ridge pit deepening and pavement clearing and is expected to be complete by September 11.

In support of the analysis of stratigraphy-sedimentology of marsh, lacustrine & playa deposits, an 18-mile traverse was made of the Spring Mountains at high elevations looking for cold climate features that would indicate the presence of glaciers during the past. Some ground patterns were found above the tree line that indicate the past presence of perennial snow or glaciers. More work will be conducted to verify findings.

Staff supporting calcite silica studies completed arrangements for detailed sampling of trench 14D, the long trench east of Exile Hill, and of sand ramp calcretes and fault-filling calcretes at Busted Butte. Relationships between fault events and cross-cutting mineralization at these trenches and exposures has recently been mapped in detail, providing the opportunity to date faulting events and to determine the stable isotope systematics of age-constrained pedogenic calcrete samples.

The existing Southern Great Basin Seismic Network (SGBSN) continued to record aftershocks of the Little Skull Mountain earthquake. The current rate of seismicity in the southern Great Basin (late August) is about one magnitude 1 or greater earthquake per two hours.

In support of Midway Valley studies, all soil pits have been excavated and most have been logged. Information from soil pits was used to correlate alluvial fan deposits in Midway Valley. Soil descriptions also were used to verify age designations for the surficial map units.

Field reconnaissance of Quaternary faults within 100 km of Yucca Mountain was completed.

In support of the evaluation of age and recurrence of movement on Quaternary faults at Yucca Mountain, existing trench TR-8 was deepened and the walls cleaned of debris; auxiliary trench T8a was excavated.

Field work was conducted for reconnaissance of the three fault zones in the Rock Valley Fault system; emphasis was placed on the location of major northeast trending fault traces in alluvium and evidence for strike slip style of deformation. Fault styles were appraised in blocks separated by northeast striking faults.

The isotope and geochemistry support group processed a series of twelve whole rock samples for Sr isotopic analysis in support of the mapping of zonal features. Samples consisted of unaltered welded and nonwelded units collected in outcrops from the geochemical reference section in Raven Canyon. Analyses of these units will be compared to compositions of the same units collected from drill core beneath Yucca Mountain to help assess the chemical variations induced by water/rock interactions occurring beneath the paleo water table. In support of Quaternary faulting studies, analytical scoping studies were initiated on one of the carbonate-rich layers exposed just below the present surface of the Busted Butte sand ramps at the Bow Ridge fault. Recent examination of excavated exposures suggests that this is a particularly important horizon because it is not cut by the most recent fracturing associated with faulting.

Sincerely,

Larry R. Hayes

for Larry R. Hayes
Technical Project Officer
Yucca Mountain Project
U.S. Geological Survey

cc: D. Appel, USGS/Denver
J. Blakey, USGS/CR
T. Blejwas, SNL/Albuquerque
R. Bullock, RSN/Las Vegas
D. Campbell, USBR/Denver
J. Canepa, LANL/Los Alamos
T. Chaney, USGS/Denver
T. Conomos, USGS/WR
J. Cook, USGS/SR
R. Craig, USGS/Las Vegas
J. Docka, Weston/Washington D.C.
R. Dyer, DOE/YMPO/Las Vegas
L. Ducret, USGS/Denver
W. Dudley, USGS/Denver
D. Faust, TESS, Las Vegas
D. Gillies, USGS/Denver
R. Hirsch, USGS/Reston
V. Iorii, DOE/YMPO/Las Vegas
C. Johnson, TESS/Las Vegas
K. Krupka/PNL
R. Lowder, MACTEC/Las Vegas
R. Pritchett, REECO/Las Vegas
R. Ritchey, USGS/Denver
E. Roseboom, USGS/Reston
D. Russ, USGS/
J. Sauer, USGS/NR
V. Schneider, USGS/Reston
M. Siegel, SNL, Albuquerque
A. Simmons, DOE/YMPO/Las Vegas
R. St. Clair, TESS, Las Vegas
T. Statton, TESS, Las Vegas
J. Stuckless, USGS/Denver
K. Taylor, Washington, D.C. (U.S. Senate)
N. Trask, USGS/Reston
J. Verden, TESS, Las Vegas
B. Viani, LLNL/
J. Weeks, USGS/Denver
R. Wesson, USGS/
YMP-USGS Local Records Center File 1.1.02



EG&G ENERGY MEASUREMENTS

Santa Barbara Operations

EG&G ENERGY MEASUREMENTS, INC., 101 CONVENTION CENTER DRIVE, LAS VEGAS, NEVADA 89109

TEL: (702)794-7463

I-331546

9/2

September 4, 1992
LV92-RAG-134
WBS 1.2.5.4.7
NQA

Wendy Dixon, Director
Project & Operations Control Division
Department of Energy
Yucca Mountain Site Characterization
Project Office
P. O. Box 98608
Las Vegas, NV 89193-8608

PROGRESS REPORT - AUGUST 1992

Attached is the August 1992 progress report on biological studies and support activities conducted by EG&G/EM for the Yucca Mountain Project. Please contact me (293-7762) or Kent Ostler (794-7474) if you have questions regarding this report.

EG&G Energy Measurements, Inc.

For Thomas P. O'Farrell, Manager
Environmental Studies Project
611 Avenue H
Boulder City, NV 89005

mak

Enclosure

cc: G. Ryder, DOE/YMP
D. Sorensen, SAIC
P. Niles, SAIC

DIXON
DIVISION
cc: (10741) w/o
cc: Gertz
cc: Durr / Schuck
cc: Ryder / Best
cc: Mc Carr - SAIC
cc: Braxley
cc: Gandy / Phillips
cc: Simmons / Jones

REC'D IN YMP

9/5/92

ENCLOSURE 1

**YUCCA MOUNTAIN PROJECT
BIOLOGICAL RESOURCES PROGRAM
MONTHLY PROGRESS REPORT
AUGUST 1992**

Summary of Work Accomplished During Report Period

EG&G Energy Measurements (EG&G/EM) conducted work for the Biological Resources task (WBS 1.2.5.4.7) for the Project Office. Activities included conducting preactivity surveys; continuing site characterization effects studies, support studies for the radiological monitoring program, desert tortoise studies, and habitat reclamation studies; development of work instructions and study designs for new studies; and responding to requests for biological support by Project Office.

Monitoring and Mitigation

- EG&G/EM received requests to conduct preactivity surveys for:
 - 1) A proposed pavement study site adjacent to the North Portal Facility (#92-026).
 - 2) Seismic monitoring stations for University Nevada, Reno (#92-028b).
 - 3) Surface excavation at Lathrop Wells cinder cone (#92-029b).
 - 4) Rock Valley tortoise relocation sites (#92-027b).

- Seven preactivity surveys were conducted during August:
 - 1) Road to ESF topsoil and rock storage sites (#92-015b).
 - 2) Drill Hole NRG-6 (#92-019b).
 - 3) Proposed pavement study adjacent to North Portal Facility Pad (#92-026).
 - 4) ESF borrow pit No. 1 (#92-023b).
 - 5) Land near broken waterline between Wells J-11 and J-12 (no request #, emergency request).
 - 6) Neutron borehole N62 (#92-018b). This site was incorrectly staked and the area had to be resurveyed.
 - 7) Surface excavation at Lathrop Wells cinder cone (#92-029b).

- Two preactivity survey reports were submitted to Project Office for:
 - 1) ESF topsoil and rock storage site, access road, and the North Portal Facility Pad (#92-015b).
 - 2) Hazardous waste accumulation area (#92-021b).

- Resurveys were completed for neutron boreholes N33 and N34 (#92-018b), Fran Ridge Test Pit Excavation (#92-012b), and Quaternary Fault study site in Solitario Canyon (#92-010b).
- Reclamation inventories were conducted for the ESF topsoil and rock storage site, North Portal Facility Pad, the powder magazine road (#92-015b), and surface excavation at Lathrop Wells cinder cone (#92-029b). Site-specific reclamation stipulations were submitted to the Project Office for the North Portal Facility Pad (#92-015b) and ESF topsoil and storage sites and access road (#92-015b).
- A post-activity survey was conducted at Well JF-3 (#91-020d).
- EG&G/EM provided a biologist on-site to monitor land disturbance during removal of a REECo truck that was stuck on the road to the Busted Butte pavement study (#92-007b). A biologist was provided for 2.5 days to survey proposed seismic monitoring stations for University Nevada, Reno seismologists. Trench MWVT-5a was checked for desert tortoises daily as required by the land access approval (#92-009b). An EG&G/EM biologist also met with REECo and DRI personnel to identify and flag the access road to the ESF borrow pit No. 1 (#92-023b).

Habitat Reclamation

- Three plant succession study plots were established. Plant cover and density and seedling density were measured on each plot. Thirty-seven more study plots were selected for use in the plant succession studies.
- The hydromulcher was repaired. A chemical stabilizer was applied to the remaining non-stabilized part of the Trench MWVT-5a topsoil stockpile, the topsoil stockpile at Trench MWVT-6, and topsoil stockpiles at the six rock and soil test pits in the North Portal Facility area.

Site Characterization Effects Program

- Plant biomass samples were collected on 23 ecological study plots (ESFs) to measure annual vegetation production. Samples now have been collected on all 48 ESPs. This task now is completed except for weighing samples and entering the data into the computer database.
- Small mammals were trapped, marked, released on eight ESPs to estimate population abundance, survival, and recruitment. Based on numbers of captures, populations remain abundant and reproductive success appears to be good. One more trapping session in September is planned for this calendar year.

- Samples of selected shrub species were collected to determine which invertebrate species or groups are associated with particular shrubs. Those invertebrate species or groups that have more specific plant-host relationships are more likely to be impacted by potential ecosystem or plant community change. Plant and soil/litter samples also were collected on selected ESPs at different distances from disturbances to monitor the potential effect disturbances on invertebrate communities. These samples were collected both during the day and night to assess invertebrates with different activity periods. Most of the night collections were canceled because Area 25 was repeatedly closed because of other NTS activities.
- Spotted bat surveys were conducted for one night. The survey was conducted approximately 20 miles north of Yucca Mountain in habitat more typical of that reported for the spotted bat. At approximately 21:17 hours, the first suspected spotted bat vocalization was heard. Vocalizations were heard on five other occasions during the night and were recorded on a digital audio tape recorder. The tapes were taken to the calibration lab for the Department of Computers and Electrical Engineering at UNLV for analysis on an oscilloscope. The frequency analysis confirmed that the vocalizations were likely from the spotted bat. The frequencies matched those previously published in the scientific literature. These results validate the methods and survey efforts used in the vicinity of Yucca Mountain that failed to detect the presence of the spotted bat.
- Traffic counts were recorded each week at 12 locations. Eight of the counters were rotated to different locations each week. Four counters are left at permanent locations. Fugitive dust samples were collected from the 48 ESPs and weighed.
- Soil moisture and temperature and weather data were collected once at the 48 ESPs.

Radiological Monitoring Program

- The two remaining radiomarked quail were located two to three times this month. One is in Forty-Mile Wash near Well J-13; the other is near the subdock in Drill Hole Wash.
- Small mammals were trapped, marked, and released at NF37 and NF59 to monitor effects of radiological monitoring collections on population abundance and recruitment. It appears that the April collection had very little effect on population abundance or recruitment. A second collection in October will likely be made.
- EG&G/EM (R. Green) assisted the SAIC Radiological Monitoring group (J. Follette) in locating the deer forage collection plots. Latitude and longitude readings were made at each plot using a Global Positioning System.

Desert Tortoise Program

- Most of the radiomarked tortoises (84-88) were located twice each week. The four tortoises scheduled to be located once each week were located. Two unmarked tortoises were found and radiomarked while conducting a preactivity survey on the east side of Fran Ridge for a borrow pit. A third unmarked tortoise was found and radiomarked on top of Yucca Mountain. This tortoise had some potential symptoms of Upper Respiratory Disease Syndrome (URDS). This is not a confirmed case of URDS. The tortoise is being monitored.
- Two tortoises were found dead. No indications of human involvement were observed for either death. One was a radiomarked tortoise (52 mm maximum carapace length) whose burrow collapsed on it. Eighty percent of carapace was covered with dirt and a 4 cm rock was resting on the back half of the carapace. A female tortoise with a transmitter also was found dead. This tortoise was found above ground. No apparent cause of death could be determined.
- Tortoise # 423 (relocated from Midway Valley) was located 3-4 times each week. It has remained in an area approximately 2.4 km east of its original release site for the last seven weeks.
- Tortoise nests previously located were checked each week to see whether predators have disturbed them. No evidence was found of predation. Fences were constructed around three nests to catch hatchling tortoises. Eggs in all three nests have hatched. Eight hatchlings have been found; seven were fitted with radiotransmitters. Three of the hatchlings fitted with transmitters have died. Cause of death is unknown.
- The July monthly report on tortoise relocation efforts and a draft cover letter to U. S. Fish and Wildlife Service were submitted to Project Office.
- Surveys were conducted to monitor abundance of ravens in the Yucca Mountain area and in a control area northwest of Crater Flats.

Support Items

- The July monthly report of Yucca Mountain Site Characterization Project activities and accomplishments was sent to the Project Office. Weekly reports of activities also were submitted to Project Office and SAIC.
- EG&G/EM participated in the planning and budgeting process for FY93. This included attending meetings and providing input to Project Office for different FY93 budget scenarios.
- EG&G/EM (R. Green) participated in an integration meeting to help identify environmental requirements for planned project activities during the next several years.

- **The revision of the Terrestrial Ecosystems Environmental Field Activity Plan was submitted to PDD for final approval signature.**
- **Representatives of EG&G/EM attended the annual YMP safety meeting. EG&G/EM received an award for no lost time accidents.**
- **EG&G/EM provided input to and editorial comments on the YMP Annual Site Environmental Report. Input and comments were submitted to SAIC (D. Powers).**
- **EG&G/EM provided biological expertise for the Native American Tour on August 29.**

EG&G ENERGY MEASUREMENTS
Santa Barbara Operations

EG&G ENERGY MEASUREMENTS, INC., 101 CONVENTION CENTER DRIVE, LAS VEGAS, NEVADA 89109

TEL (702)794-7463

Submitted to
Project Office
Date 5

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October 7, 1992
LV93-RAG-002
WBS 1.2.13.4.
NQA

I-333897

(2)

Wendy Dixon, Director
Project and Operations Control Division
Yucca Mountain Project Office
DOE Field Office, Nevada
P. O. Box 98518
Las Vegas, NV 89193-8518

PROGRESS REPORT - SEPTEMBER 1992

Attached is the September 1992 progress report on biological studies and support activities conducted by EG&G/EM for the Yucca Mountain Project. Please contact me (293-7762) or Kent Ostler (794-7474) if you have questions regarding this report.

10/7/92

EG&G Energy Measurements, Inc.

Thomas P. O'Farrell

Thomas P. O'Farrell, Manager
Environmental Studies Project
611 Avenue H
Boulder City, NV 89005

mak

Enclosure

cc: G. Ryder, DOE/YMP
D. Sorensen, SAIC
P. Niles, SAIC

DIXON
RECORD
SOURCE
Dixon
Ryder
Schuck / Harri
Dyer / Brodsky
Gander / Ammons
S. Jones
Hamilton - Ray
McCann - SAIC
Gertz - W/A

10/9/92

ENCLOSURE 2

**YUCCA MOUNTAIN PROJECT
BIOLOGICAL RESOURCES PROGRAM
MONTHLY PROGRESS REPORT
SEPTEMBER 1992**

Summary of Work Accomplished During Report Period

EG&G Energy Measurements (EG&G/EM) conducted work for the Biological Resources task (WBS 1.2.13.4) for the Project Office. Activities included conducting preactivity surveys; continuing site characterization effects studies, support studies for the radiological monitoring program, desert tortoise studies, and habitat reclamation studies; development of work instructions and study designs for new studies; and responding to requests for biological support by Project Office.

Monitoring and Mitigation

- EG&G/EM conducted preactivity surveys during September for:

- 1) ESF borrow pit No. 1 (#92-023b).
- 2) 8" water line from J-13 well to the North Portal area (#92-015b).
- 3) Explosives and cap storage pads (#92-015b).
- 4) Radiological Monitoring Station NF104 and access road (#92-006).

The survey for the 8" waterline was not completed because additional areas had to be flagged before they could be surveyed.

- Reclamation inventories were completed for:

- 1) ESF borrow pit No. 1 (#92-023b).
- 2) 8" water line from J-13 well to the North Portal area (#92-015b).
- 3) Trenches A1, A2, and MWVT-3 (#92-009b).

- Preactivity survey reports were submitted to Project Office for:

- 1) NRG-1 pavement studies (#92-026b).
- 2) Neutron borehole N-62 (#92-018b).
- 3) Neutron boreholes N-57, -58, -59, and -61 in Abandon Wash (#92-018b).
- 4) Trenches A1, A2, and MWVT-3 (#92-009b).
- 5) UE-25 NRG-6 (#92-019b).

- Site-specific reclamation stipulations were submitted to Project Office for:
 - 1) North portal pad (#92-015b).
 - 2) NRG-1 pavement studies (#92-026b).
 - 3) Access road for the powder magazine (#92-015b).
 - 4) UE-25 NRG-6 (#92-019b).

- Resurveys were conducted for the quaternary faults study (Stagecoach Road trenches) (#92-010b), soil and rock property test pits (#92-008b), and the Forty-Mile Wash borrow area. Tortoises near the quaternary faults study site also were monitored during the construction of the Stagecoach Road trenches and the soil and rock properties test pits.

- A resurvey of UE-25 NRG-6 was conducted on the morning of September 28 because Project Office informed EG&G/EM that construction would begin on the 28th. EG&G/EM was informed later in the day that construction at this site would not begin before October 19. Because the Land Access Agreement states that the area must be surveyed within 5 days of construction, this area will have to be surveyed again.

- A casual access survey was conducted for 0.5 miles of unapproved road in Crater Flats (no request #). Verbal approval for access was given. An emergency preactivity survey was conducted for driving a front-end loader down the north slope of Highway Ridge (ridge leading to the top of Yucca Mountain). The loader was needed to remove a USGS field vehicle that was stuck in the bottom of the wash. EG&G/EM biologists were present to ensure that no tortoises were harmed.

- An EG&G/EM biologist attended a meeting with the Bureau of Land Management (BLM) in Barstow, California to discuss the stream flow monitoring study that will be conducted on BLM land in Inyo County, California. G. Ryder (DOE/YMP), B. Jacobs (SAIC), A. Hughes (EG&G/EM), and T. Egan (BLM) discussed the project activities, the sensitive plant and animal species that may be affected, and the type of information that should be included in the environmental assessment.

Habitat Reclamation

- Six study plots were established for the disturbed habitat plant succession study. Plant cover and density and seedling density were measured on five plots.

- Topsoil stockpiles in Midway Valley were stabilized with a soil sealant.

Site Characterization Effects Program

- Reptile populations were trapped, marked, and released on nine ecological study plots (ESPs) to monitor abundance, survival, and recruitment.
- Small mammals were trapped, marked, and released on eight ESPs to estimate population abundance, survival, and recruitment. Based on numbers of captures, populations remain abundant and reproductive success appears to be good.
- Perennial shrub density was measured on 29 ESPs. Measurements still need to be made on 19 ESPs.
- Samples of selected shrub species were collected to determine which invertebrate species or groups are associated with particular shrubs. Those invertebrate species or groups that have more specific plant-host relationships are more likely to be impacted by potential ecosystem or plant community change.
- Traffic counts were recorded each week at 12 locations. Eight of the counters were rotated to different locations each week. Four counters are left at permanent locations. Fugitive dust samples were collected from the 48 ESPs and weighed.
- Soil moisture and temperature and weather data were collected once at the 48 ESPs. Verification was completed of weather data in the computer database.

Radiological Monitoring Program

- The two remaining radiomarked quail were located once this month. One is in Forty-Mile Wash near Well J-13; the other is near the subdock in Drill Hole Wash. Preparation was started for quail trapping and collection in October.
- Predator scent-station surveys were conducted at Yucca Mountain and in Crater Flats.
- Small mammal trapping location NF14 was moved to NF103 near the North Portal and NF5 was moved to NF107 near the South Portal site. NF5 and NF14 will no longer be used. These changes were made as part of ESF Alternative 30. Collections will be made from the new locations in October.

Desert Tortoise Program

- Most of the radiomarked tortoises were located twice each week. The tortoises scheduled to be located weekly or biweekly were located. Six new tortoises (excluding hatchlings) were found and marked with radio transmitters. Four were marked only with numbers. Eight tortoises that were found could not be marked because they were in burrows. Six tortoises previously radiomarked that could not be located were found. These tortoises had either lost their radio transmitters or had a dead transmitter. New transmitters were attached to all six.

- One adult tortoise was found dead. The tortoise appeared to have been preyed on by a mammalian predator.
- Tortoise # 423 (relocated from Midway Valley) was located 2-3 times each week. It has remained in an area approximately 2.4 km east of its original release site for the last seven weeks.
- Fences were erected around six tortoise nests to help capture hatchling tortoises. Twenty hatchlings were found and radiomarked in September. Twenty-nine hatchlings have been found, and 27 of these were radiomarked in August and September. Nine of the 27 hatchlings are known to have died, and seven cannot be found either because of transmitter failure or being carried away by predators. Eleven radiomarked hatchling tortoises are being monitored twice per week.
- The annual effort to weigh, measure, and replace transmitters on radiomarked tortoises was started. This task has been completed for 70 tortoises. Twenty-three have not been processed. These will be completed before tortoises start hibernating.

Support Items

- The August monthly report of Yucca Mountain Site Characterization Project activities and accomplishments was sent to the Project Office. Weekly reports of activities also were submitted to Project Office and SAIC.
- EG&G/EM continued to participate in the planning and budgeting process for FY93. The first draft was completed of the Project Management Plan for the Terrestrial Ecosystems Program.
- EG&G/EM provided biological expertise for a Public Outreach Tour on September 26.
- EG&G/EM attended a meeting with Project Office (G. Ryder) on biological support for the neutron borehole studies.
- A description and base budget needs for the Terrestrial Ecosystem Program were presented to YMP Division directors and to USGS & Los Alamos National Lab principal investigators.



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CHARACTERIZATION
PROJECT

Monthly Status Report

August 1992

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1.2.5.2.6	Semi-Annual Progress Reports
1.2.6.1.1	Exploratory Shaft Management, Planning, and Technical Assessment

Highlights

SNL staff submits a journal article on a preliminary total system performance assessment for the potential repository at Yucca Mountain to the Project Office for policy review.

See 1.2.1.4.1 Total System Performance Assessment on page 4

SNL staff and contractors presents the seismic considerations for sealing a repository in unsaturated fractured tuff to the Symposium on Dynamic Analysis and Design Considerations for High-Level Nuclear Waste Repositories.

See 1.2.1.4.3.4 Seal Performance Requirements and Analyses on page 6

SNL staff and management participates in a meeting organized by the Project Office and the M&O contractor to develop both short- and long-range strategies for resolving thermal design issues and establishing thermal goals.

See 1.2.4.1.1 Repository Management and Integration on page 19

SNL distributed three YMP documents:

- the user's guide for the total-system performance assessment computer code
- the report on linear-thermal-expansion data obtained for tuffs from the unsaturated zone at Yucca Mountain
- the report on docking and emplacing an automated waste canister using a sensor-based controller

See 1.2.9.1.1 Management on page 26



[The page contains several paragraphs of extremely faint, illegible text. The text is distributed across the page, with some lines appearing as dark specks or very light gray marks against the white background. The overall appearance is that of a scan of a document where the original text has been lost or is too faded to be read.]

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YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

Executive Summary August 1992

WBS 1.2.1.4.1 Total System Performance Assessment

- SNL staff submitted SAND92-1924J, "A Preliminary Total-System Performance Assessment for the Potential Repository Site at Yucca Mountain," by M. Wilson, R. Barnard, H. Dockery, and J. Gauthier, to the Project Office for policy review. This paper was prepared for submission to *Radioactive Waste Management and the Nuclear Fuel Cycle*.

WBS 1.2.1.4.3.4 Seal Performance Requirements and Analyses

- "Seismic Considerations for Sealing a Repository in Unsaturated Fractured Tuff," by J. Fernandez (SNL) and A. Richardson and M. Lin (Agapito & Associates), was presented at the Symposium on Dynamic Analysis and Design Considerations for High-Level Nuclear Waste Repositories held in San Francisco, CA on August 19 and 20, 1992.

WBS 1.2.1.4.9 Development and Verification of Flow and Transport Codes

- SNL distributed SAND85-0004, "Total System Performance Assessment Code (TOSPAC) Volume 2: User's Guide," by M. Wilson and R. Peters (SNL) and J. Gauthier, A. Dudley, and L. Skinner (SPECTRA).

WBS 1.2.3.2.7.1.2 Laboratory Thermal Expansion Testing

- SNL distributed SAND88-1581, "Linear-Thermal-Expansion Data for Tuffs From the Unsaturated Zone at Yucca Mountain," by C. Chocas and B. Schwartz (SNL).

WBS 1.2.4.1.1 Repository Management and Integration

- SNL staff and management participated in a meeting organized by the Project Office and the Management and Operations (M&O) contractor to develop a strategy for proceeding to closure on major repository thermal design issues. Working groups were formed to develop FY93 thermal goals that will provide an envelope for design studies. Testing results and site data will be incorporated to establish long-range thermal goals for use in developing thermal loading for the License Application Design (LAD).
- SNL distributed SAND91-0558, "Automated Waste Canister Docking and Emplacement Using a Sensor-Based Intelligent Controller," by L. Costin and W. Drotning (SNL).

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

SNL staff continued to support the Integrated Test Evaluation (ITE) effort.

1.2.1.2.5 CONFIGURATION MANAGEMENT PLANS AND PROCEDURES CONTROL

Status Report on Ongoing Activities

Efforts continued to develop an internal configuration management system for Sandia National Laboratories (SNL). Management and Operations contractor (M&O) responses to requests to close out inactive Interface Memoranda of Understanding (IMOU) were received. One Cost/Schedule Change Request was submitted to correct the interim Work Breakdown Structure (WBS) Dictionary.



1.2.1.3.1 SITE AND ENGINEERING PROPERTIES DATA BASE

Status Report on Ongoing Activities

Sandia staff is expecting verification reports from Edgerton, Germeshausen, & Grier Corp. (EG&G) on the data base tables submitted to them. The Site and Engineering Properties Data Base (SEPDB) was officially closed on August 1, 1992 to all submittals and product requests. Once staff receives verification reports from EG&G that are identical to those generated at SNL, the verification reports will be included in the appropriate job file at SNL, which will then be closed.

Major Activities Upcoming Next Three Months

The transition from the SEPDB to the Geographic Nodal Information Study and Evaluation System (GENESIS) data base will be the major focus of activity.

1.2.1.3.2 INTERACTIVE GRAPHICS INFORMATION SYSTEM

Status Report on Ongoing Activities

SNL received additional ARC/INFO, a geological information system, coverage from the Yucca Mountain Site Characterization Project (YMP) data base, which was then loaded onto network server for general access. Staff ordered ARCVIEW, a user interface in ARC/INFO, licenses for network access to the coverage of Yucca Mountain now available.

A technique was developed to translate ARC/INFO topography (or other contour data) coverage into a Lynx Geosystems model as an overlay map. A contoured CALMA model was successfully translated to lines in ARC/INFO using the interactive graphics exchange specification (IGES) capabilities of both software packages.

The following CALMA thermal/mechanical model job has been completed:

- Job 395 for W. Chambers - Site Seismic Test Holes

Major Activities Upcoming Next Three Months

Additional personnel will be trained in ARC/INFO and ARCVIEW. The additional licenses for ARCVIEW will be installed and a training program will be developed to familiarize users with building an ARCVIEW map at their workstation or personal computer (PC).

Staff will work with GENESIS to develop techniques to transfer data via the network and will begin to replace existing data with data qualified under a quality assurance (QA) procedure as it becomes available.

The following CALMA jobs are in progress:

- Job 386 for H. Dockery - Drill Holes/Section
- Job 391 for M. Esp - Section Through Ramps/Drift
- Job 396 for P. Gottlieb - Repository Expansion Areas



1.2.1.3.3 REFERENCE INFORMATION BASE

Status Report on Ongoing Activities

Revision 7 of Reference Information Base (RIB) Version 4 was prepared for submittal to the Project Change Control Board (CCB). This revision is editorial. Sandia is completing action on open RIB Change Requests in anticipation of the October 1, 1992 transition of the RIB activity to the M&O.

**1.2.1.3.4 TECHNICAL DATA BASE MANAGEMENT
COMPUTER SUPPORT**

Status Report on Ongoing Activities

Sandia tested a new bubble-jet color printer, scanner, and copier for possible use on the network.

Major Activities Upcoming Next Three Months

SNL staff will continue to set up new and existing workstations and personal computers and will work with the Division to provide a network.

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

Investigations of approaches to provide dependable color printing on the network will also continue.



1.2.1.3.5 TECHNICAL DATA BASE INPUT**Major Accomplishments**

SNL has suspended technical data base input until October 1, 1992 because of the transition of the SEPDB to EG&G's GENESIS data base.

1.2.1.4.1 TOTAL SYSTEM PERFORMANCE ASSESSMENT**Major Accomplishments**

SAND92-1924J, "A Preliminary Total-System Performance Assessment for the Potential Repository Site at Yucca Mountain," by M. Wilson, R. Barnard, H. Dockery, and J. Gauthier, completed SNL's internal review and has been sent to the Yucca Mountain Project Office (YMPO) for policy review. This paper was prepared for submission to *Radioactive Waste Management and the Nuclear Fuel Cycle*.

"The Most Likely Groundwater Flux Through the Unsaturated Tuff Matrix at USW H-1," by J. Gauthier, and "Implications of Stability Analysis for Heat Transfer at Yucca Mountain," by B. Ross, Y. Zhang, and N. Lu, were both submitted to the 1993 International High-Level Radioactive Waste Management Conference.

Significant Meetings Attended

SNL staff attended a meeting with members of the Geochemistry Integration Task Force to set up a workshop on colloids and their implications for Yucca Mountain performance assessment (PA).

Status Report on Ongoing Activities

Several SNL staff members are preparing papers for submission to the 1993 International High-Level Radioactive Waste Management Conference that will be held April 26-30, 1993, in Las Vegas, NV.

The next cycle of total-system performance assessment is being planned.

Analyses are being run on inventory as a function of burnup and decay to investigate whether the typical model using a lumped-source inventory is a reasonable representation. The lumped-source model ignores several potentially important radionuclides. Therefore, it may be important to represent the source term using a more realistic inventory.

Work is being done on the nominal flow scenarios to better describe the interaction of groundwater with thermally, mechanically, and radiation-induced alterations to the near field.

A Sandia letter report (SLTR) on the tectonics event tree has completed internal technical review and the



authors are responding to comments generated during management review. The nominal flow scenario report has undergone a major revision. A branch has been added to the tree that describes scenarios that assume there is no net influx of water into the mountain.

Simulations have been run using alternative boundary conditions and material properties through a cross-sectional model of Yucca Mountain that includes a drain in the vicinity of the high hydraulic gradient. Preliminary results indicate that the drain postulated by C. Fridrich of the U.S. Geological Survey (USGS) and Dudley could produce gradients similar to those observed. This work was presented to the Hydrology Technical Integration Group (TIG). Since the presentation, a cooperative program with C. Fridrich has been undertaken.

An interactive gridding refinement routine was supplied by HydroGeoLogic to work with STAFF3D. This routine has been modified to permit intermediate saving of results and the assignment of material properties. The modified routine has been used to create an areal grid of Fridrich's conceptualization of the water table in the vicinity of Yucca Mountain.

A PVwave routine was developed to permit color coding of different boundary conditions specified in STAFF3D and of another code that specifies various material properties in the grid. These are needed to check the validity of STAFF3D input files.

The Informix software for the Visual Integrated Data Base (VIDB) has been received and a disk needed to set up the data base system has been ordered.

1.2.1.4.3.1 POSTCLOSURE REPOSITORY DESIGN ANALYSIS

Significant Meetings Attended

SNL staff attended a U.S. Department of Energy (DOE)/M&O-sponsored meeting on repository thermal loading to establish a strategy for the decision process leading to a solution of a thermal load for repository design. Working groups were established to examine several issues and develop a coherent strategy and plan for resolving the thermal loading question. SNL will provide input to several groups. (Design Activities 1.11.3 and 1.11.6)

Status Report on Ongoing Activities

SAND91-1493, "Equivalent Energy Density Concept: A Preliminary Reexamination of a Technique for Equating Thermal Loads," by E. Ryder (SNL), is being prepared for printing. This report 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). (Design Activity 1.11.6)

Major Activities Upcoming Next Three Months

An extended summary of the results of thermal loading studies conducted under this WBS will be submitted for presentation at the 1993 International High-Level Radioactive Waste Management Conference, April 26-30, 1993 in Las Vegas, NV.



**1.2.1.4.3.2 PRECLOSURE RADIOLOGICAL
SAFETY ANALYSES**

Status Report on Ongoing Activities

The review of the report evaluating the alluvium as a potential Item Important to Waste Isolation (IITWI) has been delayed but is expected to be released in mid-September. A report on Items Important to Safety (IITS) is being revised and will be submitted for review in mid-September.

**1.2.1.4.3.4 SEAL PERFORMANCE
REQUIREMENTS AND ANALYSES**

Major Accomplishments

"Seismic Considerations for Sealing a Repository in Unsaturated Fractured Tuff," by J. Fernandez (SNL) and A. Richardson and M. Lin (Agapito & Associates), was presented at the Symposium on Dynamic Analysis and Design Considerations for High-Level Nuclear Waste Repositories. The symposium was held on August 19 and 20, 1992, in San Francisco, CA.



1.2.1.4.4.1 PRE-WASTE-EMPLACEMENT GROUND-WATER TRAVEL TIME

Major Accomplishments

The preliminary results for the calibration phase of the INTRAVAL study were presented at Berkeley, CA on August 25, 1992. SNL staff submitted an extended summary to the 1993 International High-Level Radioactive Waste Management Conference on the geostatistical simulations implemented for the INTRAVAL study.

A three-day short course entitled "Reliability-Based Design in Civil Engineering" was held on August 3 through 5, 1992. The course, taught by Dr. M. Harr of Purdue University, IN, stressed probabilistic approaches to estimates of system reliability. Attendees included two representatives from the State of Nevada, a representative from the YMPO, and SNL staff. Application of some of the course material to performance assessment of the Yucca Mountain site was demonstrated by SNL staff.

Significant Meetings Attended

On August 6, 1992, SNL staff met with C. Gertz, the Project Manager for the Yucca Mountain Project, and J. Boak at the Project Office in Las Vegas, NV to discuss realistic estimates of system reliability for the Yucca Mountain site. C. Gertz requested that SNL staff prepare a short paper on uncertainty that can be used to explain the concept to the public.

SNL staff attended a workshop on the INTRAVAL Yucca Mountain Test Case held at Lawrence Berkeley Laboratory (LBL) in California on August 25, 1992. SNL staff gave a presentation on the current status of SNL's modeling efforts on the test case.

Staff met with Project Office Performance Assessment staff in Las Vegas, NV on August 26, 1992 to discuss submitting a paper to the High-Level Radioactive Waste Management Conference on a proposed technical approach to evaluation of the prewaste-emplacment groundwater travel-time disqualifying condition in 10 CFR 960. The regulation was reviewed and documents identified that may help to clarify the intent and language in the regulation. A review of the regulation and the supplemental information published in Volume 49, Number 236 of the Federal Register is being conducted.

Staff met with a member of the Harry Reid Environmental Center at the University of Nevada, Las Vegas on August 26, 1992 to discuss the Center's chemical analysis of selected springs in southern Nevada.

Status Report on Ongoing Activities

A newer version of the geostatistical simulator from Stanford's GSLIB was implemented along with an increase of the anisotropy from 5:1 to 10:1. The two-dimensional variogram program has also been implemented. By the end of September, modifications should be completed to allow these programs to run using a common input file. The Geostatistical Adaptive Grid (GAG) generator has been updated to automatically provide input files to DUAL, an unsaturated zone flow code developed at Sandia; work has begun on producing input files for NORIA, a flow code. Further analyses of correlations between porosity and the other material properties were required to implement the statistical generation of these properties in GAG. The incomplete gamma function was added to DUAL for use in saturation curves. Use of the gamma function permits upscaling saturation curves from a local scale to an element scale.

Three realizations generated by the geostatistical simulator were run through the system of codes to test the system and to produce preliminary results. Graphical images were produced to assist in interpretation and to use for outside presentations. Detailed input checking and code cleanup and debugging still remains to be done.

The authors of SAND88-7054, "Processes, Mechanisms, Parameters and Modeling Approaches for Partially Saturated Flow in Soil and Rock Media," J. Wang and T. Narasimhan (LBL), submitted a camera-ready draft.

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.

SAND92-0799, "Model Domains and Hydrologic Data Base to Support Early Site Suitability and Total Systems Performance Assessment Models," by Gainer et al., is nearing completion.



1.2.1.4.6 DEVELOPMENT AND VALIDATION OF FLOW AND TRANSPORT MODELS

Status Report on Ongoing Activities

Unsaturated flow through single fractures:

Work was begun on a journal article reporting the results of the full-field instability experiments; this work will continue in September. Data collected from the single-finger experiments were reviewed in light of the results from the full-field experiments and organized for further analysis. Completion of the analysis and development of a journal article will proceed in September.

Modifications to improve light level stability in the Rotating Test Stand (RTS 1) continued; the variac controller was completed and tested. Remaining tasks are location and calibration of the photoelectric cell, which are planned for September.

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 continued this month in efforts to understand the dynamical aspects of the wetting process and the influence of film flow in finely rough fracture surfaces. A rough draft of an abstract for the International High-Level Radioactive Waste Conference was also written.

Scoping 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 concentrated on acquiring and installing a copy of the unsaturated flow code, LLUVIA, which will be used in the analysis of test data generated by the planned experiments. Rough drafts of abstracts for the International High-Level Radioactive Waste Conference and the American Geophysical Union (AGU) Fall Conference were also written.

Gravity-driven fingering in porous media:

Measurement of the hydraulic properties of the seven similar sands used in fingering experiments conducted two years ago 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:

To support studies aimed at understanding processes governing rock-property scaling and variability, an automated gas permeameter test system is being constructed. The test system will allow efficient acquisition of gas permeability data over a range of scales. Current plans call for the system to be controlled by the commercial data acquisition package, LABTECH. Efforts were made this month to learn to operate the software and design the modules necessary to control the gas permeameter test system. Other potential applications for LABTECH within the laboratory have been identified and are being investigated.

Development of experimental capabilities:

A purchase requisition was submitted for a Phillips MG161 X-ray generator and tube head. This equipment will allow high-resolution imaging of moisture content and solute concentration fields in opaque materials (i.e., tuff samples) to be accomplished directly in the laboratory. This will prevent test chambers from being moved during testing and will facilitate performance of experiments that take days to weeks to accomplish. It will also prevent tying up other facilities outside the SNL laboratory.

Reactive transport model development:

Experiments to develop a method to determine the effect that trace surface coatings have on the surface properties of natural materials continued during August. Potentiometric titrations of Min-U-Sil, a commercially available pure quartz standard used in surface studies by other researchers, were initiated to establish the properties of a standard quartz reference material. The surface properties of Min-U-Sil that has been cleaned by a series of extractions and washing are being compared to untreated samples. The titration data obtained under CO₂-free conditions indicate that the untreated Min-U-Sil may be contaminated with a strong base that could be present as a surface coating or admixed fine material. Comparison of similar data obtained for untreated Wedron 510 sand indicate that the Wedron sand may contain a strong base contaminant that dominates its short-term behavior and a weaker base contaminant that dominates its long-term behavior.

Efforts to improve the sensitivity, accuracy, and precision of the technique used for nickel analysis



continued. Methods to correct for black body radiation and carry-over of nickel from one sample to the next were developed. Optimization of the measurement protocol has reduced measurement time by one-third and extended the usable dynamic range to 0.3-100 ppb without sacrificing precision or accuracy. In addition, the error in the Ni measurements due to interaction of the AA samples with polyethylene storage vials was determined to be approximately $\pm 1\%$.

Chemical and X-ray analysis to determine the degree of heterogeneity of the limonite that will be used in the caisson experiment continued. Analysis of splits taken from the bulk of the material that was delivered to the caisson site at Los Alamos, NM showed it to be intermediate in composition (40%-60% Fe_2O_3) compared to the previous two splits (80% Fe_2O_3 and 12.5%-40% Fe_2O_3) that were used in the preliminary batch sorption experiments at SNL. Like the previous two splits, these samples contain a strong acidic component as indicated by the low pH (3.1-3.3) of deionized water placed in contact with them. In addition to goethite, the samples contain abundant quartz and minor clays and sulfates.

Batch tests were initiated to determine the equilibrium pH and the extent of sorption of tracers (lithium, nickel, and boron) by samplers that will be used in the caisson (ceramic cups and electro dialysis tubing). The preliminary results indicate that the electro dialysis tubing contains an acidic component (equilibrated pH=5.8) and that sorption at the equilibrium pH was negligible. Results from the ceramic cup samplers will be reported next month.

Major Activities Upcoming Next Three Months

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

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

Detailed studies 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 will continue. Design calculations for the caisson experiment will continue. The caisson will be filled and instrumented. The isotherm experiments to determine the linear range of sorption of tracers will continue, as will the surface potentiometric titration of sand and goethite.

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 review of controls on the Phase II Neutron Boreholes and USGS activities in the Quaternary Fault site area was completed.

A PA of impacts of the roads and pads for NRG-G was completed.

A PA of impacts of the proposed surface geophysical surveys on waste isolation was completed.

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

Status Report on Ongoing Activities

Code development:

SNL staff met with members of the Yucca Mountain M&O group to discuss code development. This group is interested in SNL's work on methods for modeling flow in fractures, boundary integrals, method-of-lines procedures, and parallel processing. (SCP Subactivity 1.6.2.1.2)

An SNL staff member is taking a course on the use of the multiphase fluid and heat flow code, TOUGH2, taught by S. Webb (SNL).

Software QA (No SCP activity):

SNL staff prepared for and participated in the annual DOE Gold Star Audit. Directly and indirectly, software was audited the entire week.

The documentation effort for the climatology codes continues. Staff have been learning how to operate the Source Code Control System (SCCS).

All QA codes have been set up in the software configuration management system on sass459. Documentation to maintain the codes in the system (i.e., checking in/out codes) is being developed.

The NORIA-SP code has completed qualification.

STAFF3D is now maintained under the SCCS. The input was modified to permit the use of common grid-related and element property files. This gives better control and reduces archival storage requirements by an order of magnitude.



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

Significant Meetings Attended

The Sample Overview Committee (SOC) met on August 4, 1992 in Area 25 to consider several core requests. One request was approved in part and the remainder tabled until the September meeting.

Major Activities Upcoming Next Three Months

The September SOC meeting will bring together all interested principal investigators (PIs) for the first general core-examination meeting since quality-affecting drilling resumed. The first 500 ft of hole UZ-16 will be available for general requests.

1.2.3.2.2.1 SYSTEMATIC ACQUISITION OF SITE-SPECIFIC SUBSURFACE INFORMATION

Status Report on Ongoing Activities

Draft text and figures summarizing relevant information on hydrologic properties from out-crop sampling studies reported previously under this WBS element are being incorporated into a Los Alamos National Laboratory (LANL) report that compares several potential sites for a surface-based test facility or prototype ESF. Samples and derivative text were reviewed for consistency and a final text version is anticipated during September. (SCP Activity 8.3.1.4.3.1.1)

Two horizontal sample transects were collected from selected horizons in the Quaternary Bandelier tuff in the Jemez Mountains of northern New Mexico to supplement the vertical transects reported last month. The Bandelier tuff is of interest as a natural analog to some of the tuffs at Yucca Mountain; nonwelded, vitric tuffs that are poorly exposed at Yucca Mountain are widely exposed in the canyons surrounding the Jemez Mountains. Hydrologic property determinations for the more recently collected samples are in progress. (SCP Activity 8.3.1.4.3.1.1)

Preliminary evaluation of the vertical sample data from the Bandelier tuff quantitatively confirms the gross distribution of properties anticipated from the geologic setting of each transect. Geostatistical evaluation is only beginning; however, it appears that vertical correlation lengths are on the order of 100 ft, which is consistent with the equivalent correlation lengths observed in ash flow tuffs at Yucca Mountain. This consistency is observed despite the fact that Yucca Mountain tuffs are welded and the Bandelier tuff is not. Vertical correlation may be related to the overall thickness of a given cooling unit, rather than to degree of welding, mineralogy, or other geologic factors. If confirmed, such an interpretation may strengthen confidence in parameters used for geostatistical



modeling of Yucca Mountain for a given level of site data. (SCP Activity 8.3.1.4.3.1.1)

In situ measurement of important hydrologic properties in the Bandelier tuff was stymied by mechanical failure of a commercial field permeameter being evaluated for expanded use in investigating nonwelded tuffs at Yucca Mountain. If the equipment problems can be resolved, this work will resume in September. (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 intermittently to obtain samples needed to resolve questions or to confirm existing findings as appropriate. The air permeameter will be tested upon completion of repairs and used to collect permeability data from several promising locations as feasible. Emphasis will be placed on attempting to obtain field measurement from rock types that could not be cored for laboratory analysis because of their excessively friable nature. (SCP Activity 8.3.1.4.3.1.1)

Issues/Potential Problems Needing Resolution and Potential Impacts

The issue of core "missing" because of the need to preserve in situ conditions for hydrologic testing has

resurfaced. "Removal" of one-third of the core prior to geologic logging will require that procedures be modified to make more extensive use of alternative information sources such as the core videotapes, downhole TV or televiwer logs, and other geophysical logs. The greatest long-range impact of these changes may be the requirement for more detailed (and thus more expensive) downhole TV logs, such as a proprietary method discussed at a recent Project workshop on geophysical logging (Denver, CO; July 16, 1992).

Serious unresolved schedule issues regarding the timing and sequencing of drill holes for the Systematic Drilling Program arose during the recent Mission 2001 scheduling exercise. It is unclear that the current drilling schedule (and especially the current sequence) will provide information from the proper geographic locations at the proper times to support geologic modeling necessary for Project-level performance assessment and ESF design milestones. Without subsurface information from the proper locations, design decisions will be made in a vacuum with the potential to mislocate portions of the ESF underground workings. Additionally, performance assessment calculations to support the Advanced Conceptual Design (ACD) will be made with spatially biased data. The direction of bias cannot be predicted accurately because of the general paucity of data located away from faults and other anomalous features.



1.2.3.2.2.2 THREE-DIMENSIONAL ROCK CHARACTERISTICS MODELS

Major Accomplishments

An extended summary entitled "Recent Developments in Stochastic Modeling and Upscaling of Hydrologic Properties in Tuff," by C. Rautman (SNL) and T. Robey (Spectra Research Institute), which describes both the geostatistical simulations and adaptive grid algorithm work, was prepared and submitted to the technical program committee for the 1993 International High-Level Radioactive Waste Management Conference. (SCP Activity 8.3.1.4.3.2.1)

Significant Meetings Attended

SNL staff participated by invitation in the USGS Unsaturated Zone Section meeting on August 25-26, 1992. A field trip held in conjunction with the meeting focused on the modeling implications of geologic structures (faults and broken zones). The geostatistical simulation work described below was presented to the group. Simulations of hydrologic properties will eventually be used as input to the site-scale unsaturated zone model being developed at Lawrence Berkeley Laboratory (LBL) under direction of the USGS unsaturated zone program (among other uses). Another important aspect of modeling that unexpectedly arose at the meeting was the identification of parallel interests in upscaling material properties to block-effective values. USGS and SNL staff will explore these opportunities for coordination in the months ahead.

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. Geostatistical evaluation of the preliminary simulations indicate moderately good reproduction of the spatial continuity patterns used as input. Some discrepancies at short vertical separations were identified and traced to the fact that these runs simulated two grossly disparate lithologies in a single pass (welded and nonwelded tuff). Efforts will continue to integrate the various subroutines (from the GSLIB subroutine library) into a coherent package and to evaluate the impact of the one-pass, Gaussian simulation approach. A theoretically more elegant approach would be to utilize indicator simulation algorithms that allow for separate specification of continuity patterns (including anisotropy) for welded

and nonwelded portions of the section. However, the indicator methodology involves significantly more effort and the effect on the results of groundwater flow models is unknown. (SCP Activity 8.3.1.4.3.2.1 and WBS element 1.2.1.4.)

Development of the adaptive grid algorithm, which is being applied to the geostatistical simulations, continues. Most work this month focused on integration of the grid algorithm with the numerical flow model. (SCP Activity 8.3.1.4.3.2.1 and WBS element 1.2.1.4.1)

SNL and USGS staff met briefly to discuss using the Lynx Geotechnical Modeling System (GMS) to model quantitatively the uncertainty associated with various types of geologic computer models (both geometric and material properties). There are two major alternatives available and the more rigorous method is more difficult. Staff will explore the feasibility of combining expert judgment with a computationally simple but theoretically questionable numerical method to map uncertainty in the near term. Normalization of the uncertainty estimates using expert judgment may alleviate much of the objection to blind use of kriging variances as an uncertainty measure in the violation of certain parametric assumptions regarding the underlying data. (SCP Activities 8.3.1.4.3.2.1 and 8.3.1.4.2.3.1)

SNL staff also made several previously developed Lynx GMS data sets available for jump-starting Lynx modeling efforts at the USGS. Limited resources has hindered development of Lynx models at SNL and it appears that much of the initial (geometric) modeling using the system will be performed by USGS staff and contractors. (SCP Activities 8.3.1.4.3.2.1 and 8.3.1.4.2.3.1)

Major Activities Upcoming Next Three Months

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

Work should resume on the geostatistical description of material properties obtained for the two-dimensional surface transect of the shaly base microstratigraphic unit of the Tiva Canyon Member. This evaluation has been deferred because of staff commitments to other activities. SNL and USGS personnel will meet in the field in early September to explore interesting features identified by preliminary analysis of the data. Permeability measurements should be completed by that time as well. An extended summary describing the



data set and its implications will be prepared for the 1993 International High-Level Radioactive Waste Management Conference. (SCP Activity 8.3.1.4.3.2.1)

Issues/Potential Problems Needing Resolution and Potential Impacts

Additional resources will need to be committed to this task if activities now in progress, for example, the Lynx GMS modeling capabilities, are to be covered adequately.

1.2.3.2.7.1.1 LABORATORY THERMAL PROPERTIES

Status Report on Ongoing Activities

Geologic samples G4-1008.3-1-SNL and BB-13A-1-SNL have been subdivided and machined for use in the scoping study on the effects of thermal conductivity. One of these samples will be used to replace G2-1349.8, which is identified in Experimental Procedure (EP)-41 as a test sample. Sample G2-1349.8 is brittle and highly fractured and probably will not survive the saturation/testing/drying cycles. An Interim Change Notice (ICN) to EP-41 will be issued to identify the new sample(s) to be tested. (SCP Activity 8.3.1.15.1.1.3)

The C-Matic LT system has been recalibrated, including the permanent thermocouples, reference thermocouples, electronic ice reference, and the HP 3421 data acquisition unit. The procedure for calibration of the permanent thermocouples was modified because the required calibration range exceeded that of the standards available. The lower plate of the instrument could be as low as 5°C, but the thermocouple calibrations were referenced against a National Institute of Standards and Technology (NIST) thermocouple calibrated from 24 to 300°C. To overcome this limited calibration range, an ice bath was employed as described in American Society for Testing Materials (ASTM) STP 470B and the voltage outputs of the permanent thermocouples were measured. This procedure, which yields an accuracy better than 0.01°C or 0.4 μV, will be added to Technical Procedure (TP)-207 as an ICN.

The C-Matic LT instrument will be used for measuring thermal conductivity at temperatures from 20 to 100°C. (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 approved, and the relevant procedures are 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

SAND88-1581, "Linear-Thermal-Expansion Data for Tufts from the Unsaturated Zone at Yucca Mountain, Nevada," has been issued. (SCP Activity 8.3.1.15.1.2.1)

A series of verification runs of the dilatometer with the saturation test apparatus (STA) are in progress. These are the first attempts at verifying the dilatometer measurements with the STA and the results are promising. The temperature of the linear variable differential transformer (LVDT) chamber has been controlled at 30°C during these runs and the drift ($\Delta\mu$) during the isothermal segment of the run has been minimal ($<1 \mu$). Also, calibration factors for the replacement signal conditioner are being established. The verification runs identified glitches in the data acquisition program. The code has been revised to correct the problems. (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 approved, a scoping study on the effects of sample size on thermal expansion will be initiated. (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 continues. 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 Activity 8.3.1.15.1.3.2)

SAND92-0119, entitled "Experimental Comparison of Laboratory Techniques in Determining Bulk Properties of Tuffaceous Rocks," has been technically and editorially reviewed. The document is being revised in response to the resulting comments. (SCP Activity 8.3.1.15.1.3.2)

Major Activities Upcoming Next Three Months

R. Price (SNL) will be at NER in White River Junction, VT in early September to discuss progress on the series of experiments designed to investigate the time-dependent deformation of the welded Topopah Spring Member tuff. SAND92-1810, "Unconfined Compression Experiments on Topopah Spring Member Tuff at 22°C and a Strain Rate of 10^{-9}s^{-1} : Data Report," and SAND92-0847, entitled "Modulus Dispersion and Attenuation in Tuff," have been drafted and will begin technical and editorial review in September. (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} will be submitted to the Data Records Management System (DRMS) by mid-September. (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 degrees to the sample axis. The confining pressure and the axial stress difference are both 10 MPa, which gives 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. 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 experiment has been performed on a tensile fracture. The cyclic shear test was done at a constant normal stress of 2 MPa and was started in the mated condition. The stress-slip and dilation-slip curves both 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, the Project Office, and Headquarters personnel; the review comments were received in May. The Fracture Properties Working Group (W. Olsson, S. Brown, and R. Price) met August 6 and 21, 1992 to discuss the appropriate responses to the comments. The study plan is being revised. (SCP Activities 8.3.1.15.1.4.1 and 8.3.1.15.1.4.2)

Work continues 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 8.3.1.15.4.1 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 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 are performing 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 REGENCY OF FAULTING NEAR PROSPECTIVE SURFACE FACILITIES

Status Report on Ongoing Activities

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



1.2.3.2.8.4.6 QUATERNARY FAULTING WITHIN THE SITE AREA

Major Activities Upcoming Next Three Months

A technical exchange is planned for September 1992 with the Nuclear Regulatory Commission (NRC).

Issues/Potential Problems Needing Resolution and Potential Impacts

Geomatrix has run out of funds to continue this work. Additional funding is being investigated.

1.2.3.6.2.1.6 FUTURE REGIONAL CLIMATE/ ENVIRONMENTS

Status Report on Ongoing Activities

Evaluation of spatial and seasonal characteristics of the model surface climatology over the whole United States from the 3-1/2-year present-day simulation with MM4 driven by GENESIS continues. During this reporting period, the characteristics of the frequency of occurrence and intensity of model-produced precipitation have been compared with observations. Preliminary analysis indicates that the model typically produces precipitation events too frequently, but with less intensity than observed. Accurate simulation of the frequency and intensity of precipitation is important to determine the effects on the surface hydrology. 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, and runoff) produced by the BATS component of the MM4. High-quality data sets of evapotranspiration and soil moisture have been identified and are being acquired for use in validation.

The draft software evaluation reports of auxiliary codes TERRAIN, MM4CCM, INBATS, BDYOUT, and MM4PROC have been completed. The reports will now undergo reviews and final approval.

The Phase I Report, "Simulation of the Arid Climate of the Southern Great Basin Using A Regional Climate Model," has been accepted for publication in the Bulletin of the American Meteorological Society.

Major Activities Upcoming Next Three Months

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

The 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.

A sample run of the Regional Climate Model (RCM) for software documentation purposes will be completed.



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

Significant Meetings Attended

SNL staff and management participated in a meeting organized by the YMPO and the M&O contractors to develop a strategy for proceeding to closure on major repository thermal design issues. As a result of the meeting, working groups were formed to address issues related to thermal loading. These groups will develop a plan for FY93 detailing the strategy to develop reasonable thermal goals that will provide an envelope for the design studies. The long-range strategy is to incorporate testing results and other site data into the establishment of thermal goals that will eventually be used to establish the thermal loading used in the License Application Design (LAD).

Status Report on Ongoing Activities

Several integration efforts are ongoing. A plan has been developed in cooperation with Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (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 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 M&O in September.

Major Activities Upcoming Next Three Months

SNL will participate in the development of a plan for addressing the thermal loading of the repository.



1.2.4.2.1.1.1 EXCAVATION INVESTIGATIONS

Significant Meetings Attended

SNL staff supported the test coordination meeting of August 18, 1992.

1.2.4.2.1.1.2 IN SITU THERMOMECHANICAL PROPERTIES

Status Report on Ongoing Activities

Staff continued writing the report on thermal effects on the instrumentation that will support the ESF thermomechanical experiments. The report lists test instrumentation requirements and environments, matches this list with available off-the-shelf instrumentation if possible, and details existing new technologies that may be able to fill the gaps if off-the-shelf instruments cannot meet instrumentation requirements.



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. Proposed resolutions for most of the comments have been formulated. Additions to the study plan reflecting the new configuration and mining method of the ESF are being written.

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. Progress was made on the software to be used to interpret the Moire fringes. Specifically, the masking algorithm to blank out the hole in the specimen was developed. Pro-Matlab is being used to develop a digital bandpass filter and smoothing algorithms. The monochromatic light was received and has been used to obtain much sharper fringe patterns than before. SNL has also been working on developing displacement gages to monitor the deformations of the hole in the specimen and on preparing a new friction sample to measure joint properties.

Significant progress was made this month in qualifying critical software for quality-affecting work. Three codes have received QA certification, albeit on a restricted-use basis. These codes are

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

The restricted-use limitation is applied because these codes use utility libraries (e.g., memory management, free-field readers, and low-level graphics drivers) that have not been QA-certified. These libraries are heavily used at SNL and are very reliable. SNL is currently discussing how these utilities should be entered into the QA system. The QA certification of the thermal-mechanical finite-element code JAC2D is underway and steps have been taken to accelerate the QA work for JAC2D. Analysts will be working closely with the QA staff to expedite this work.

With these critical codes receiving QA certification, the EFS support analyses have begun. These analyses will determine the spacing required between experiments to avoid experiment interference.

The University of Colorado has been studying the effects of nonstandard loading conditions on the frictional properties of joints. SAND92-1853, "Effect of Boundary Conditions on the Strength and Deformability of Replicas of Natural Fractures in Welded Tuff: Data Report," which details experimental techniques and resulting data, has been drafted and is in technical review. A separate SAND document of the data analysis is being prepared.



SAND92-0449, "Fracture Analysis and RQD Estimation for the Yucca Mountain Site Characterization Project," and SAND92-0450, "Rock Mass Mechanical Property Estimates for the Yucca Mountain Site Characterization Project," both by M. Lin and M. Hardy (Agapito & Associates) and S. Bauer (SNL), are being delayed until appropriate data referencing is completed. SLTR 92-002, "Review of Failure Criteria for Use in the Yucca Mountain Site Characterization Project," by J. Holland, is in technical review and has been returned to the author with comments.

1.2.4.2.3.1 CERTIFICATION OF DESIGN METHODS

Status Report on Ongoing Activities

SNL staff made significant progress this month in its efforts to check and verify the various jointed rock continuum models. This effort has shown that the convergence characteristics of the SNL jointed rock continuum model depends on the particular numerical implementation, i.e., seemingly small differences in the order of operations can significantly affect convergence. This is a fairly surprising result and has been revealed only because staff has two numerical implementations of the same model. Last month, it was believed that the new and old versions of the model were yielding identical results for a set of test problems. Closer examination showed that this was true for the final converged results, but not for the intermediate results. Efforts were initiated to understand why the intermediate results were different. By examining the inputs, outputs, and internal variables of the different implementations of the constitutive model, very small differences were found. The differences are on the order of an expected round-off error. Because these were the only differences that were found, it was concluded that the convergence characteristics of models are sensitive to round-off error. This does not appear to be a serious problem because convergence can be obtained by using smaller load steps. Both models were used to analyze a flatjack loading problem. Staff obtained identical results using both models, but the load step needed to be reduced when using the new implementation. This is not necessarily bad; fewer iterations per load step were used when the step sizes were cut. The final converged results from these analyses are essentially identical. To complete this work, staff will run another representative large test case, the Benchmark Problem, as manpower permits. This work will be presented in a SAND report and will serve to document the baseline behavior of the continuum joint model. This document will be important in certifying this joint model for quality-affecting work.

Significant progress has also been made in SNL's work to combine finite-element and boundary-element technology. During this month, calculations involving coupled finite element and boundary elements were performed. These problems include pressurized circular holes and tunnels. Very good results were obtained. Testing will continue next month using a series of tunnels.



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 a draft report submitted for internal SNL review. 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-field 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. A summary of the results obtained thus far will be submitted to the 1993 International High-Level Radioactive Waste Management Conference.

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. In the past month, the bulk of the calculations have been completed and a letter report is in preparation.

1.2.4.6.1 SEAL DESIGN AND DESIGN REQUIREMENTS**Status Report on Ongoing Activities**

Work continued on the review of available techniques to seal underground openings. The primary activity included reviewing information on vertical stemming systems used by LLNL and LANL.

Geochemical evaluations continued on evaluating the performance of backfill under heated and saturated and partially saturated conditions. The runs performed during the month were scoping runs to obtain a basic understanding of backfill alteration.



1.2.4.6.2 SEALING TESTING

Major Accomplishments

Draft report SAND92-0960, "Field Testing Definitions of Subsurface Sealing and Backfilling Tests in Unsaturated Tuff," by J. Fernandez (SNL) and J. Case and J. Tyburski (IT Corporation), completed SNL management review. The report is currently undergoing modification in response to this review.

To support the backfill strategy development, a gaseous flow analysis was completed. A simplified, linear, axisymmetric gas-transport problem was prepared to estimate the effect of settling volumes on the gas permeability along the backfilled drifts. The analysis showed that if seals are periodically placed within the backfilled drift, the increase in the overall gas permeability resulting from the voids can be held to a minimum.



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 participated in the public tour conducted at Yucca Mountain on August 22, 1992. These tours are conducted monthly as part of the DOE public outreach program. A representative of each Project participant is requested to staff the exhibits at the Field Operation Center (FOC) and to answer questions the public might have about the displays.

1.2.5.2.5 STUDY PLAN COORDINATION

Status Report on Ongoing Activities

Verification of Study Plan 8.3.1.5.2.1, Revision 2, "Characterization of the Yucca Mountain Quaternary Regional Hydrology," written by USGS staff, was completed by G. Barr (SNL) on August 4, 1992.

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 received by J. Gibson (SNL) for review on August 7, 1992.



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

Three SAND reports were printed and distributed in August 1992:

- SAND85-0004, "Total System Performance Assessment Code (TOSPAC). Volume 2: User's Guide," by M. Wilson and R. Peters (SNL); and J. Gauthier, A. Dudley, and L. Skinner (Spectra). (WBS 1.2.1.4.9)
- SAND88-1581, "Linear-Thermal-Expansion Data for Tuffs From the Unsaturated Zone at Yucca Mountain, Nevada," by C. Chocas and B. Schwartz (SNL). (WBS 1.2.3.2.7.1.2)
- SAND91-0558, "Automated Waste Canister Docking and Emplacement Using a Sensor-Based Intelligent Controller," by L. Costin and W. Drotning (SNL). (WBS 1.2.4.1.1)

Status Report on Ongoing Activities

The status of all report publication efforts is being assessed to ensure timely completion.

1.2.9.1.4 RECORDS MANAGEMENT

Major Accomplishments

For the second year, the SNL/YMP Records Management Program completed the DOE/YMP Audit with no audit findings or major observations.

The Local Record Center (LRC) staff completed review and record-packaging efforts for archived Training Records. Processing of training records is now on a current level.

Significant Meetings Attended

The SNL YMP Records Coordinator, attended the Nuclear Information Records Management Association (NIRMA) Symposium in San Francisco, CA. She is a member of a new DOE Special Interest Group (SIG) that will address specific DOE concerns in the field of nuclear energy and waste management. P. Warner also volunteered to lead a major effort to identify and publish guidance for the selection criteria to identify QA Records.

Status Report on Ongoing Activities

Major efforts are underway to identify, collect, and submit Technical Data Information Forms (TDIFs) for technical data that either was not submitted to the LRC or was submitted to the Central Records Facility (CRF) without the TDIFs. As a result of CAR 92-08, some TDIFs must be revised to identify technical data that were not collected under a qualified QA program.

The INFORMIX Controlled Document System (CDS) has been used in parallel with the existing CDS system during August.

Major Activities Upcoming Next Three Months

A major effort will be extended to conduct an inventory of all records. Completion of this effort will (1) meet the requirements of DOE Order 1324.2A (also required



by the Office of Civilian Radioactive Waste Management Information Resource Management of all participants) and (2) complete one small segment of the same requirement that the a SNL Recorded Information Management Department will soon be initiating as an SNL-wide effort.

A continuing effort is the revision of the Master List of File Codes.

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

Status Report on Ongoing Activities

The training staff has distributed and received responses to the Job Effectiveness Training (JET) survey. These responses are being compiled and analyzed.

Progress on the manager and staff orientation manuals continues. These manuals are expected to be completed by September 30, 1992.

Procedure abstracts have been developed for each procedure. Subject-matter experts are currently reviewing these abstracts and should have them finalized by September 30, 1992.

SNL staff is developing prototype lesson plans for global, refresher, and classroom training. Staff is also developing the lesson plan for the first Interdisciplinary Technical Training (ITT) course, Geology for Non-Geologists, scheduled to begin the first week of October 1992.

Staff is verifying training record accuracy and revising as necessary. The only revisions required thus far have been to dates; these errors apparently result from transpositions and other typographical errors.

Major Activities Upcoming Next Three Months

Major activities will include:

- Distribution of JET survey results.
- Completion of orientation manuals.
- Completion of lesson plan development.
- Completion of training records accuracy verification.
- Start of Geology for Non-Geologists course.



1.2.9.2 PROJECT CONTROL**Major Accomplishments**

The Basis of Estimates worksheets were completed and prepared for submittal. The initial 1993 fiscal year budget estimates were submitted to SNL financial departments in support of the SNL budget call. A WBS crosswalk was prepared to facilitate the conversion of SNL Planning and Control System (PACS) software to the new WBS structure. The crosswalk was submitted to YMP. The new NOVELL server computer was received. The PACS monthly status was again successfully transmitted electronically to the YMP.

Status Report on Ongoing Activities

The SNL PACS software is being adapted to support the conversion to the new fiscal year and the new WBS structure. The effort to install YMP SNL budget and cost data online for access by YMP SNL task leaders has begun.

Major Activities Upcoming Next Three Months

During September, PACS activities will focus on the conversion to the new WBS structure and the conversion to the new fiscal year. The effort to install online access to YMP SNL budget and cost data for the SNL YMP task leaders will continue. The new NOVELL server computer hardware will be tested and the installation process begun. INFORMIX programming efforts for the Administrative Information Management System (AIMS) will focus on resolving existing critical software errors and the development of the personnel database.

1.2.9.3 QUALITY ASSURANCE PROGRAM**Major Accomplishments**

An internal surveillance of WBS 1.2.1.4.3.4, "Seal Performance Requirements and Analyses," was performed and completed this month.

The SNL YMP hosted a Yucca Mountain QA Division audit. The audit addressed QA Program elements 3, 5, 6, 17, 19, and 20, as well as technical work in WBS elements 1.2.1.3.1, 1.2.1.4.7, 1.2.4.2.1.2, and 1.2.4.2.3.2.

Significant Meetings Attended

QA staff attended a Technical Data Management Workshop held at SNL in Albuquerque, NM on August 4, 1992.

Status Report on Ongoing Activities

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

QA staff continued to provide input to the process of developing an improved training program.

A team of QA staff and personnel from the YMP Management Support Department developed Work Agreements for the SNL YMP. Work Agreements are interface documents between the Technical Project Officer (TPO) and the WBS element Task Leaders.

QA Review of Procurement Actions

Routine QA review of procurement documents has been supplemented by special in-depth reviews of existing contract QA requirements. This review resulted in quality improvement of Statements of Work for several contracts and is a continuing process to bring SNL contracts up to date with current YMP QA requirements as specified in QA Grading Reports.

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 1992.

Two surveillances are scheduled for the next quarter. Areas to be reviewed include Ground-Water Travel Time Analyses (WBS 1.2.1.4.4.1) and Three-Dimensional Rock Characteristic Models (WBS 1.2.3.2.2.2.2).

APPENDIX A: REFERENCE INFORMATION BASE

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

<u>RIBCR</u>	<u>Subject</u>	<u>Participant</u>	<u>Status</u>
None.			

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

<u>RIBCR</u>	<u>Subject</u>	<u>Status</u>
CR58	Volcanic Features	Cancelled
CR63	Estimated Water Usage	Cancelled
CR80	Water Application Rates	Cancelled
CR83	Heat Cap Update	To be submitted to the Change Control Board (CCB)
CR84	Rock Fail Update	To be submitted to CCB
CR85	Soil Properties Update	To be submitted to CCB
CR86	Groundwater Chemistry	To be submitted to CCB
CR87	Saturation Level Update	To be submitted to CCB
CR88	Saturation Hyd. Cond. Update	To be submitted to CCB
CR89	Reference Boundary Update	To be submitted to CCB
CR90	Thermal Analysis Update	To be submitted to CCB
CR91	UNE Seismic Fix	To be submitted to CCB
CR92	Radiological Monitoring	Cancelled

3. INFORMATION ENTERED INTO THE RIB

Not applicable.

*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

No activity to report this period.

2. DATA FORMALLY SUBMITTED TO THE TECHNICAL DATA BASE

Participant Description of Data SNL Data Auth. No.

No activity to report this period.

3. DATA FORMALLY ENTERED INTO THE TECHNICAL DATA BASE

Participant Description of Data SNL Data Auth. No.

No activity to report this period.





United States Department of the Interior



Oct 19 2 48 PM '92

GEOLOGICAL SURVEY
BOX 25046 M.S. 425
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

IN REPLY REFER TO:

cc: *Stucky Stucker - ew27*
cc: *Simmons/Wallace - ew27*
cc: *Connelly*
cc: *Ryer*
cc: *Ryan*
cc: *Proskopf*
cc: *Jones, S*
cc: *Crawley*

WBS: 1.2.9.2
QA: N/A

October 16, 1992

Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization Project Office
U.S. Department of Energy
P.O. Box 98608
Las Vegas, Nevada 89193-8608

RECEIVED
10/19/92

SUBJECT: U.S. Geological Survey Yucca Mountain Project Monthly Summary for September, 1992.

Dear Carl:

In compliance with the revised Yucca Mountain Project monthly reporting procedures, following is the YMP USGS input for September, 1992. If you have any questions, please contact Raye Ritchey at (303)236-0517.

WBS 1.2.1 - SYSTEMS ENGINEERING

In support of the development of flow and transport models, the preliminary heating experiment is complete and a paper was submitted to the International High Level Waste Symposium. In general, it has been determined that increased temperature permanently alters (increases) the permeability of both the welded Topopah Spring and the nonwelded Calico Hills. The porosity and bulk density change, but recover upon rewetting. There is a large increase in fractures in the nonwelded tuff, which may be of some concern for water and air flow. A more in-depth study is planned to explore other affected units and to look at water characteristic functions.

WBS 1.2.3 - SITE INVESTIGATIONS

The regional potentiometric levels project reports that, in support of prototype equipment testing for small diameter wells, additional testing of a small diameter pump jack was performed in a well on

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the west side of Franklin Lake playa. The observation well was pumped to dryness in about 1 hour at a rate of about 5 gpm. Equipment installation and removal from the well went very smoothly.

The natural infiltration project reports that there were delays in starting the two boreholes in Split Wash, N-31 and N-32, due to environmental surveys and tracer permits. These two boreholes are meant to serve as analogs to the intensively analyzed boreholes N-54 and N-55, which were drilled in WT-2 Wash. They both begin in lower Tiva Canyon Hackly or upper Columnar, and will penetrate through the Topopah Spring caprock. N-31 is located in a channel and N-32 is on a ridge with little alluvial cover. This is the same topographic situation as in WT-2, but is farther north and situated in the middle of the repository zone. These holes will help to assess the horizontal variability of the deep moisture profiles for help in analysis of the deep borehole hydrologic processes. N-31 is now complete and N-32 has been started.

In support of the surface based borehole studies, geophone cable mounts for instrumenting UZ-16 have been designed, and prototypes built. Manufacturers are being canvassed for fabrication of 100 geophone cable mount assemblies. Testing of tremie pipes with different internal coating finishes was conducted to identify a suitable tremie pipe for stemming UZ boreholes with calcium sulfite grout. Tests so far have indicated that rigid steel pipe, regardless of the type of internal coating, is not resistant to internal build-up of grout. Flexible pipe has performed better than rigid pipe and is being looked at as an alternative. A criteria letter addendum for instrumenting UZ-16 was submitted to the YMPO. The criteria letter also identified NTS contractor support needs for conducting the VSP field surveys at UZ-16.

In support of vertical seismic profiling, field activities to test cross-hole tomography techniques are underway at the Colorado School of Mines experimental mine in Idaho Springs. Data collection will take approximately one month. Weather could impact the schedule because road access to the testing site is difficult.

In support of intact fracture testing, the deepened "north test pit" (#1) at Fran Ridge, Yucca Mountain was inspected for possible sampling sites. There are areas in the test pit which could yield cores suitable for testing. When the mapping work is complete, the bottom of the test pit will be mucked out entirely and possibly some surfaces of the test pit disturbed to enhance evaluation of sampling sites.

Staff from the prototype tracer testing project completed week-long, dry, batch-type experiments of the adsorption of SF6 onto volcanic tuffs of the Pah Canyon member, Topopah Spring member (UZ-4 & 5), and the bedded tuff between the Pah Canyon and Topopah Spring members. Additional batch-type testing will be needed on the volcanic tuffs that show evidence of adsorption.

Staff supporting the development of conceptual and numerical models of flow in unsaturated zone fractured rocks report that the percolation test is taking much longer than expected and that original expectations of percolation performance have changed. Three new theories are being investigated to explain longer than expected water infiltration: 1) plugging of porosity from dust in the gravel pack, 2) precipitation of minerals in fracture and pore spaces, and 3) development of pore clogging bacteria.

In support of stratigraphic studies, a series of leaching experiments were designed on Topopah Springs high-silica rhyolite whole-rock samples from UE-25a #1. Both leachates and residues will be analyzed for Sr contents and isotopic compositions in order to better define multi-component mixing between primary Sr incorporated in phenocrysts and tuff matrix versus secondary Sr presumably added along with minor carbonate. Quantitative leaching was initiated on six whole-rock samples analyzed previously without prior removal of acid-soluble Sr. Initial results indicate that whole-rock samples contain a small to substantial amount of Sr that is soluble in weak HCl. The relationships between primary and secondary Sr need to be characterized in order to understand the minor variations observed in Sr isotopic composition in the Topopah Springs unit, as well as to characterize the source of disseminated carbonate in the repository horizon. UZ-16 core was examined to the 550 ft. depth and an initial log compiled. This depth appears to be near the middle of the non-lithophysal zone. At the top of the Topopah Spring member (189 ft. depth) is pumiceous, vitric tuff with an orange coloration decreasing downward that may indicate a weathering horizon. The core records penetration of the non- to densely-welded cap rock and two non-lithophysal zones with an intervening well-developed lithophysal zone.

In support of borehole geophysical surveys, an algorithm was developed and tested to compute air-filled and water-filled porosity in the unsaturated zone using density and dielectric logs. Linear response functions are used to relate the component (mineral and water) responses to the log response. The interdependent pair of equations can be solved directly for air-filled and water-filled porosities. Resolution appears to be adequate. A test on G-2 data produced very reasonable porosity logs.

Staff supporting mapping of zonal features continued isotopic analysis on a series of whole-rock tuff samples from the Raven Canyon geochemical reference section, consisting of unaltered welded and non-welded units collected in outcrop. Results will be compared to compositions of the same units collected from drill core beneath Yucca Mountain to help assess the chemical variations induced by water/rock interactions occurring beneath the paleo water table. Two days were spent in the field mapping part of the Paintbrush Canyon Fault and compiling field photographs for the stratigraphic analysis study of the tuffaceous rocks of the Calico Hills Formation. Mapping was completed of Calico Hills tuffaceous rocks in upper Black Glass Canyon and upper Paintbrush Canyon. Mapping along the Paintbrush Fault in the extreme north end of

Paintbrush Canyon identified similarities to the Ghost Dance Fault farther south. The Paintbrush Fault appears to be a zone of multiple faults with observable offsets, local pull-apart structures, and graben development along synthetic/sympathetic faults. Well-developed slickensides and indications of several episodes of both oblique and strike/slip movement were noted. Primary target of the mapping is quantification of fault offset.

Staff from the geologic mapping (ES & drifts) project provided field oversight for the deepening of the Fran Ridge pit. The pit was deepened to a total depth of 20 feet and 14 feet nominal diameter. The walls of the pit were scaled for safety and thoroughly cleaned using an air/water blowpipe. Clearing of the pavement surrounding the Fran Ridge pits was completed.

In support of regional paleoflood evaluations, preliminary mapping of the Amargosa River drainage basin boundary was completed, and data will be incorporated with other regional paleoflood data. The goal is to develop a data base that can be used to evaluate precipitation and streamflow runoff relationships. Ultimately, these data will be used to quantify the differences between modern and past streamflow events. A climatic data base was completed of monthly precipitation in southern Nevada and southeastern California for the period 1968-1992. These data will enable analysis and correlation of regional precipitation and streamflow runoff events.

Staff from the calcite silica project collected detailed samples from Trench 14d, from the long trench east of Exile Hill, and from sand ramp calcretes and fault-filling calcretes at Busted Butte. Relationships between fault events and cross-cutting mineralization at these trenches and exposures recently has been mapped in detail, providing the opportunity to date faulting events and to determine the stable isotope systematics of age-constrained pedogenic calcrete samples.

Technical chapters for the DOE topical report on erosion were completed this month.

In support of site flood and debris hazards studies, a report was received from the National Park Service (NPS) stating that a flood had occurred at Willow Beach, downstream from Hoover Dam, on August 21. Damage to park facilities in Jumbo Wash reportedly was serious. The NPS collected precipitation data at eight gage sites that should help to characterize the storm. A site visit to collect these data will be conducted as soon as possible. Aerial reconnaissance was conducted of the mouth of Fortymile Wash to determine a method for deriving the flow paths of recent floods. Preliminary work showed that detailed maps could be prepared to accurately delineate the locations and paths of floodwater that may have flowed recently through the distributary network that extends from Fortymile Wash canyon to the Amargosa River.

The existing Southern Great Basin seismic network continued to record aftershocks of the Little Skull Mountain earthquake. Seismicity rates remain elevated with most "excess" seismicity occurring in the vicinity of Little Skull Mountain.

In support of Midway Valley studies, field work is complete for the surficial map. Twelve out twenty-five soil pits have been logged and described. Field logs for trench NWV T5-a were completed, and data from multiple logging sheets were compiled. Preliminary stratigraphic relationships were determined in trench NWV T6 and appropriate horizons were nailed. Field logs were completed around the fault structures exposed trench 17.

Staff from the evaluation of the Rock Valley Fault system project completed reconnaissance field work. Exposed faults were examined in all three fault zones, but work primarily was concentrated along the Rock Valley Fault zone where abundant evidence of quaternary faulting and strike-slip displacement was observed.

WBS 1.2.9 - PROJECT MANAGEMENT

USGS records transmitted to the Central Records Facility included 2,063 pages comprised of 134 criteria-related records and 27 criteria-related packages. Three publication packages and three data packages also were transmitted.

Audit Report USGS-92-07, SCP activity 8.3.1.5.2.1.4b, was submitted with one Audit Finding. Audit Report USGS-92-08, Branch of Geologic Risk Assessment, had no findings or observations. USGS programmatic audit USGS-92-10 was conducted resulting in three Findings, seven Observations, and numerous recommendations. The August Open Items and Trend Analysis Report was issued indicating an increase of three in the number of Open Items, bring the total to 79. A trend CAR was initiated to identify an adverse trend concerning data submittals. The QA office reviewed five technical procedures, two study plans, and three publications. QA review of FY 1992 final procurement documents was completed.

Sincerely,

Larry R. Hayes

Larry R. Hayes
Technical Project Officer
Yucca Mountain Project
U.S. Geological Survey

cc: D. Appel, USGS/Denver
J. Blakey, USGS/CR
T. Blejwas, SNL/Albuquerque
R. Bullock, RSN/Las Vegas
D. Campbell, USBR/Denver
J. Canepa, LANL/Los Alamos
T. Chaney, USGS/Denver
T. Conomos, USGS/WR
J. Cook, USGS/SR
R. Craig, USGS/Las Vegas
J. Docka, Weston/Washington D.C.
R. Dyer, DOE/YMPO/Las Vegas
L. Ducret, USGS/Denver
W. Dudley, USGS/Denver
D. Faust, TESS, Las Vegas
D. Gillies, USGS/Denver
R. Hirsch, USGS/Reston
✓ V. Iorii, DOE/YMPO/Las Vegas
C. Johnson, TESS/Las Vegas
K. Krupka/PNL
R. Lowder, MACTEC/Las Vegas
R. Pritchett, REECO/Las Vegas
R. Ritchey, USGS/Denver
E. Roseboom, USGS/Reston
D. Russ, USGS/
J. Sauer, USGS/NR
V. Schneider, USGS/Reston
M. Siegel, SNL, Albuquerque
-A. Simmons, DOE/YMPO/Las Vegas
R. St. Clair, TESS, Las Vegas
T. Statton, TESS, Las Vegas
J. Stuckless, USGS/Denver
K. Taylor, Washington, D.C. (U.S. Senate)
N. Trask, USGS/Reston
J. Verden, TESS, Las Vegas
B. Viani, LLNL/
J. Weeks, USGS/Denver
R. Wesson, USGS/
YMP-USGS Local Records Center File 1.1.02



United States Department of the Interior

GEOLOGICAL SURVEY
BOX 25046 M.S. 425
DENVER FEDERAL CENTER
DENVER, COLORADO 80225



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IN REPLY REFER TO:

September 29, 1992

WBS: 1.2.9.1.1

QA: N/A

Carl P. Gertz, Project Manager
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98608
Las Vegas, Nevada 89193-8608

SUBJECT: U.S. Geological Survey (USGS) Detailed Monthly Status Report for July, 1992

9-29-92

Dear Carl:

Enclosed is the USGS detailed monthly status report for July, 1992. If you have any questions or comments, please contact Raye Ritchey at FTS 776-0517.

Sincerely,

Larry R. Hayes
Technical Project Officer
Yucca Mountain Project Branch
U.S. Geological Survey

Attachment

*Janit
Smeck
Geyer / Gertz
Geym
Grodsky
Jones, S.
Crawley
Stucker } ewas
Wallace }*

10/2/92

cc: D. Appel, USGS/Denver
T. Blejwas, SNL/Albuquerque
R. Bullock, RSN/Las Vegas
D. Campbell, USBR/Denver
W. Clark, LLNL/Livermore
M. Chornack, USGS/Denver
R. Craig, USGS/Las Vegas
W. Dudley, USGS/Denver
D. Gillies, USGS/Denver
R. Herbst, LANL/Los Alamos
✓ V. Iorii, DOE/Las Vegas
R. Luckey, USGS/Denver
B. Parks, USGS/Denver
Z. Peterman, USGS/Denver
R. Pritchett, REECO/Las Vegas
R. Ritchey, USGS/Denver
E. Roseboom, USGS/Reston
D. Porter, SAIC/Golden
R. Spengler, USGS/Denver
J. Stuckless, USGS/Denver
K. Taylor, Washington, DC
N. Trask, USGS/Reston
J. Whitney, USGS/Denver
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