

December 19, 1994

MEMORANDUM TO: Michael J. Bell, Chief  
Engineering and Geosciences Branch, DWM/NMSS

FROM: Harold E. Lefevre, Geologist  
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ENGB/DWM/NMSS

THRU: Mysore S. Nataraja, Acting Section Leader  
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SUBJECT: TRIP REPORT FOR THE NOVEMBER 14-18, 1994, VISIT TO  
THE YUCCA MOUNTAIN SITE

During the week of November 14-18, 1994, Harold Lefevre (NRC) and Simon M. Hsiung (CNWRA) were temporarily assigned to the NRC'S On-Site Representative Office. Lefevre and Hsiung visited DOE's Yucca Mountain Field Operations Center (FOC) and Exploratory Studies Facility (ESF) construction pad and north portal drift. The purposes of the visit were to observe and report on progress in the excavation of the ESF using the tunnel boring machine and to acquire, to the extent possible, documents bearing on procedures governing current ESF activities, as well as to report on the degree to which procedures were being implemented.

As a result of this visit, summarized in the attached report, we were able to collect information on the following ESF-related subjects: current TBM status; projected TBM operating plans; procedures applicable to ground support and geologic mapping; and supplemental information regarding surface-based testing (seismic reflection surveys).

Attachment: As stated

cc: M. Knapp  
J. Greeves  
J. Surmeier

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**TRIP REPORT FOR THE NOVEMBER 14-18, 1994  
VISIT TO THE YUCCA MOUNTAIN SITE**

During the week of November 14 through 18, 1994, representatives of two organizations, one a member of the U.S. Nuclear Regulatory Commission's Division of Waste Management (DWM) and the other a member of the Center for Nuclear Waste Regulatory Analyses (CNWRA), were temporarily assigned to NRC's On-Site Representative Office. The two visited the U.S. Department of Energy's (DOE's) Yucca Mountain Field Operations Center (FOC) and Exploratory Studies Facility (ESF). The purposes of the visit were to: (1) observe and report on the operation of the tunnel boring machine (TBM), (2) collect additional and updated information on DOE's plans and schedules for excavation of the ESF, and (3) acquire, to the extent possible, documents bearing on procedures governing current ESF activities.

The following sections summarize what was learned regarding the current status and projected plans of activities at the ESF. The summary is based upon (1) information contained in a number of the acquired documents listed in Attachment 1, (2) conversations with a number of the individuals (DOE staff, DOE's construction management and operating contractor (the "CM&O"), and the U.S. Department of the Interior (U.S. Geological Survey and Bureau of Reclamation) identified in Attachment 2.

**TBM OPERATIONS - CURRENT STATUS**

During the week of November 14, 1994, the TBM advanced 14 meters (approximately 46 feet) from Station 0 + 76.7 meters to Station 0 + 90.7 meters. As was the situation during the previous week, poor ground conditions (fractured rock) continued and required the installation of an additional 11 steel sets and occasional lagging, especially at the crown of the excavation. As of November 18, 1994, 17 steel sets have been installed. Deteriorating rock conditions, coupled with depletion of the steel set inventory (specifically carriage bolts), have resulted in the halt of TBM operations at Station 0+97.5 meters at the end of the swing shift (midnight) on Friday, November 18. Although sufficient unsupported tunnel excavation is available, installation of steel set 18 has been deferred pending receipt of the carriage bolts necessary for assembly. Three additional steel sets are on hand, but also lack carriage bolts.

### Acquisition of Additional Steel Sets

As discussed at the weekly (Wednesday) ESF Status Meeting at the North Portal pad and at the weekly (Thursday) Test Coordination Meeting at the FOC, closure of non-conformance report (NCR) YMSCO-95-0007 ("Steel sets manufactured by unapproved supplier") is urgent since delivery of additional steel sets is necessary for the continuation of TBM mining operations. The NCR centers about the vendor (supplier) of the steel sets not being qualified to perform fabrication. Additionally, fabrication of the steel sets was performed in the absence of approved specifications. The 21 on-site steel sets, 17 of which have been installed in the ESF North Ramp drift as Category 4 ground supports, were supplied by this unqualified vendor. The sets were installed because the CM&O considered them necessary for personnel safety and for the continuation of TBM mining operations.

### Test Alcove and Starter Tunnel (Testing and Mapping)\*

"Radial borehole testing continues in the test alcove. Testing will continue for 1 to 2 weeks after which the holes will be closed in and monitored until after Christmas. A high pressure/high volume compressor is due to arrive in mid-December for future radial borehole testing."

"Mapping of the North Ramp will begin as soon as the cab of the TBM advances past the start of new ground. The mappers request that the amount of lagging used should be only enough to safely support the rock. There are discussions with the A/E downtown regarding how much lagging must be installed."

\* As reported in the minutes of the weekly ESF Status Meeting of Wednesday, November 16, 1994.

### Work Schedule

As a result of the cessation of TBM mining, the previously-announced plans (see trip report of November 7-11, 1994) for the expansion of the daily work schedule from the current two shifts per day to three shifts per day, five days per week, have been set aside until further notice. The three shift day was to have begun the week of November 21, 1994.

### Documents Acquired

In order to enable the staff to better monitor selected ESF-related activities such as geologic mapping, consolidated sampling, and ground support determination, a number of documents were acquired (see Attachment 1). Additional documents have been identified (see Attachment 3) and have yet to be obtained in order to complete the acquisition of reference documents. These documents can be

acquired at the FOC's Document and Records Center by NRC staff upon the resumption of mining at the ESF North Ramp (currently scheduled for early January 1995). As in the case of the documents identified in Attachment 1, a reference copy is to remain at the NRC's office at the FOC with an additional copy to be provided to NRC Headquarters and to the Center's San Antonio, Texas office.

### Geologic Mapping Inside the ESF

The nature and frequency of geologic mapping remains as described in the trip report of November 7-11, 1994, with only reconnaissance mapping taking place. Limited photogrammetric mapping, using a hand-held camera, was conducted on Thursday, November 17, 1994.

The Test Planning Package (TPP 92-10, "Geologic Mapping of the Exploratory Studies Facility") and the job package (JP 92-20A, "Geologic Mapping of the Ramps, MTL Drifts, and Alcoves) identified in the November 7-11, 1994, trip report have been acquired. In addition, two other documents related to geologic mapping have also been acquired. These are: (1) Geologic Mapping of the Ramps, MTL Drifts, and Alcoves (Work Plan [WP] 29-90a), and (2) the technical procedure "Underground Geologic Mapping".

### TBM OPERATIONS - PROJECTED

#### Status as of Monday, November 21

Upon delivery of carriage bolts (scheduled for delivery today) plans call for:

- 1) Installation of the eighteenth steel set.
- 2) Excavation of approximately one additional meter of tunnel to allow the installation of the nineteenth steel set.
- 3) Cessation of TBM operations pending arrival of additional steel sets.

#### Status as of Monday, November 28

#### TBM

Operations have been halted with maintenance being performed. Trailing gear is being dismantled in preparation for adding the mapping platform.

#### Bolts for steel sets

Originally scheduled for delivery on Monday, November 21, the carriage bolts required for assembly of steel sets eighteen and nineteen have not yet arrived. The shipper of the bolts has been contacted in order to trace their location.

### Steel sets

As of November 22 the steel set vendor has been granted authorization to fabricate the steel. Delivery of the sets is scheduled to begin December 15.

### Mapping Gantry

Components are scheduled to begin arriving on December 2.

### Resumption of TBM Operations

Scheduled to resume January 7, 1995, after assembly and installation of the mapping gantry.

## PROCEDURES APPLICABLE TO GROUND SUPPORT AND GEOLOGIC MAPPING

### Ground Support

The five classes of ground support (Categories 1 through 5) are described in ESF [Design] Package 2C, dated October 11, 1994. Drawing 40,151 (Rev. 1) identifies the guidelines to be applied when determining the category of ground support. Category 1 is installed under "good" rock conditions while Category 5 is installed under "extremely poor" conditions. Category 4, consisting of steel sets on approximate four foot centers with partial lagging (full lagging at the tunnel crown with occasional lagging along the tunnel walls), has been used since initiation of TBM operations. Category 4 ground support system is installed when "very poor" rock conditions are encountered.

The initial determination of the category of rock support to be installed is made by construction personnel for safety reasons and is based upon tunneling experience, not through the employment of technical procedures. It is expected that this process, initial installation of a support system based upon safety considerations, rather than through the implementation of technical procedures, will be used throughout TBM operations.

It is the understanding of NRC/Center staff that, following assembly of the complete TBM "train" (this includes the drill/cleaning platform, the mapping gantry and a supplemental ground support platform) that a determination will be made regarding the category of support system warranted. This determination, using engineering-based rock characteristic parameters coupled with geologic information acquired through detailed mapping, will be based on guidelines shown on Drawing 40,151, Design Package 2C. Because of time constraints, the NRC/Center staff was unable to identify, and procure, ground support procedures. Time permitting, these procedures can be acquired at the FOC's Document and Records Center by NRC/Center

staff upon the resumption of mining at the ESF North Ramp. Because of the obscuring of the tunnel wall through installation of the Category 4 ground support system, much of the rock face can not be mapped geologically. Based upon the operator's impression, rock roof conditions currently being penetrated by the TBM (and not yet visible) appear to be worse than the rock conditions previously encountered. Based upon the operator's impression, one could conclude that installation of the Category 4 ground support system will continue, at least for the near term, and that perhaps Category 5 support may be necessary. Category 5 consists of steel sets at two to four foot centers plus a full profile of lagging. If this is the case, the situation could arise such that very little, if any, rock will be exposed for subsequent geologic mapping. The Department of Energy is aware of this potential (inability to characterize the geologic conditions because of the presence of the ground support system) and is considering other options under which geologic mapping can be conducted. One option under consideration would suggest the removal of the installed lagging for a period of time sufficient to acquire data/information considered necessary for site characterization.

With respect to the ground support system, ESF [Design] Package 2C Drawing 40,151 indicates that the following determinations have yet to be made:

- 1) Verification of seismic design values
- 2) Verification of the rock mass rating (RMR) values
- 3) Verification of the 100 year maintainable life
- 4) Determination of thermally induced stresses

### Geologic Mapping

As identified in Attachment 1, technical procedures are in place in order to conduct geologic mapping. In addition to the underground geologic mapping technical procedure, three other guidance documents are available. These supplemental geologic mapping guidance documents include an office work plan, a job package and a test planning package.

Although the technical procedures that are in place describing the kinds and types of mapping to be conducted in the ESF are reasonably clear for implementation purposes, direction relating to fault characterization is obscure. It is not evident to the staff, given the availability of the above four documents, that investigators actually performing the mapping and the acquisition of rock samples for various test purposes would be aware that rock samples are to be acquired for purposes of dating of the faults. To the staff's knowledge, the need for such information is not directly identified in any of the documents referenced in Attachment 1. It is the staff's impression, that it is only through the acquisition of a number of documents referenced within the text of the attachment citations that an investigator would be

made aware of the need for the rock sample acquisition for fault age-dating purposes. Determination of the ages of encountered faults is a necessary part of the site characterization effort.

#### SUPPLEMENTAL INFORMATION

##### Seismic Reflection Surveys

The seismic reflection surveys reported in the November 7-11, 1994, trip report have been completed. Approximately twenty-three miles of high quality data have been acquired. The surveys (consisting of two separate lines) extend from the Amargosa River southwest of Yucca Mountain and continue to the northeast, reportedly crossing the large geophysical anomaly in Crater Flat, terminating at the approximate mid-point of the area encompassed within the perimeter drift outline. The second survey line continues from that point to the southeast, terminating in Jackass Flats.

The data acquired as a result of these surveys are reportedly of excellent quality and, although two dimensional, are expected to yield significant subsurface information. Data processing is estimated to take approximately six months to complete.

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VISIT TO THE YUCCA MOUNTAIN SITE

DOCUMENTS ACQUIRED

ESF TEST COORDINATION OFFICE WORK PLANS

<u>Designation</u>	<u>Title</u>	<u>Date of Most Recent Change</u>
WP 92-90A	GEOLOGIC MAPPING OF THE RAMPS, MTL DRIFTS, AND ALCOVES	Aug. 10, 1994
WP 92-20B	PERCHED-WATER TESTING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Aug. 25, 1994
WP 92-20C	CONSOLIDATED SAMPLING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Sept. 7, 1994
WP 92-20D	CONSTRUCTION MONITORING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Aug. 10, 1994

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JP 92-20A	GEOLOGIC MAPPING OF THE RAMPS, MTL DRIFTS, AND ALCOVES	Aug. 16, 1994
JP 92-20C	CONSOLIDATED SAMPLING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Sept. 22, 1994

TEST PLANNING PACKAGES

TPP 92-10, REV. 2	GEOLOGIC MAPPING OF THE EXPLORATORY STUDIES FACILITY	Aug. 4, 1994
TPP 92-1i, REV. 2	PERCHED-WATER TESTING IN THE EXPLORATORY STUDIES FACILITY	Aug. 17, 1994
TPP 92-14 REV. 2	CONSOLIDATED SAMPLING IN THE EXPLORATORY STUDIES FACILITY	Sept. 1, 1994

TECHNICAL PROCEDURE

NWM-USGS- GP-32, REV. 0	UNDERGROUND GEOLOGIC MAPPING	Aug. 12, 1994
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EXPLORATORY STUDIES FACILITY DRAWINGS - DESIGN PACKAGE 2C

40,100,REV. 1	OVERALL SUBSURFACE LAYOUT - TS LEVEL PLAN	Sept. 13, 1994
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EXPLORATORY STUDIES FACILITY DRAWINGS DESIGN PACKAGE 2C  
TS NORTH RAMP

<u>Designation</u>	<u>Title</u>	<u>Date of Most Recent Change</u>
40,104 REV. 1	GENERAL ARRANGEMENT- PLAN AND PROFILE	Sept. 13, 1994
40,110-40,116 REV. 1	EXCAVATION LAYOUT PROFILE (SEVEN DRAWINGS)	Sept. 26, 1994
40,120-40,140 REV. 1	EXCAVATION LAYOUT PLAN (TEN DRAWINGS)	Sept. 26, 1994
40,151-40,156 REV. 1	GROUND SUPPORT MASTER ELEVATION (SIX DRAWINGS)	Oct. 11, 1994
40,157 REV. 1	ROCKBOLTS AND ACCESSORIES DETAILS	Oct. 11, 1994

TS NORTH RAMP ALCOVES

40,161-40,163 REV. 1	ROCKBOLTS & SHOTCRETE SECTIONS (THREE DRAWINGS)	Oct. 11, 1994
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STARTER TUNNEL - EXPLORATORY STUDIES FACILITY

OA-46-171	FULL-PERIPHERY GEOLOGY MAP	June 6, 1994
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**UPDATED LIST OF DOE AND M&O ESF-TBM CONTACTS**

<i>Name</i>	<i>Affiliation</i>	<i>Function/Responsibility</i>
Robert Adams	SAIC	TBM schedules
Steven Beason*	BuRec	ESF Underground Mapping
Tom Bjerstedt	DOE	Yucca Mountain Licensing Team
Nancy Chappell*	SAIC	Yucca Mountain Licensing Team
Ned Elkins	LANL	ESF Testing Coordination
Rick Davis	M-K	TBM Shift Supervisor
Tom Fortner	DOE	ESF Construction Manager
Tim Greene	SAIC	NTS Training
Scott Hanson*	M&O	NTS Training
Dick Kovach*	LANL	ESF Testing Coordinator
Bob Law	M-K	TBM Project Assistant Manager (construction)
Keith Lobo	SAIC	TBM Project Manager (operations)
Richard McDonald	M-K	TBM Project Manager (construction)
John McNeely	M-K	TBM Management Assistance (operations)
Bill Mitchell	BuRec	ESF Underground Mapping
Nelson O'Connor*	M-K	TBM Shift Supervisor
Jim Replogle	DOE	Acting Assistant Manager Engineering and Field Operations
Ralph Schneider	DOE	Director Field Operations Center
Dan Soeder*	USGS	Field Test Coordinator
Tim Sullivan	DOE	Geotechnical Investigations Lead
Bernie Verna	DOE	Acting ESF Construction Manager
Arthur Watkins*	M&O, A/E	Quality Assurance
Winfred Wilson	DOE	Site Office Manager

**\* Additional contacts made during November 14-18, 1994, Site Visit**

**TRIP REPORT FOR THE NOVEMBER 14-18, 1994  
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**DOCUMENTS YET TO BE ACQUIRED**

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<b><u>Designation</u></b>	<b><u>Title</u></b>	<b><u>Date of Most Recent Change</u></b>
JP 92-20B	PERCHED-WATER TESTING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Unknown
JP 92-20D	CONSTRUCTION MONITORING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Unknown

**TEST PLANNING PACKAGES**

TPP 92-XX	CONSTRUCTION MONITORING IN THE RAMPS, MTL DRIFTS, AND ALCOVES	Unknown
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