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THRU: Robert L. Johnson, Section Leader *RJ*
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SUBJECT: TRIP REPORT FOR THE NOVEMBER 7-11, 1994, SITE
VISIT TO THE NEVADA TEST SITE

During the week of November 7-11, 1994, Phil Justus and Mike Lee were temporarily assigned to the U.S. Nuclear Regulatory Commission's On-Site Representative Office and visited the U.S. Department of Energy's (DOE's) Yucca Mountain Field Operations Center and Exploratory Studies Facility (ESF) construction pad and ramp. The purpose of the visit was to observe and report on progress in the excavation of the ESF using the tunnel boring machine (TBM).

As a result of this visit, summarized in the enclosed report, we collected updated information on the following ESF-related subjects: current TBM status, projected TBM operating plans, access to the ESF, and DOE's geologic mapping program inside the ESF.

Attachment:

Trip Report for the November 7-11, 1994,
Site Visit to the Nevada Test Site

cc: M. Knapp/DWM
J. Greeves/DWM
J. Surmier/DWM
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TRIP REPORT FOR THE NOVEMBER 7-11, 1994, SITE VISIT TO THE NEVADA TEST SITE

On November 7-11, 1994, two members of the U.S. Nuclear Regulatory Commission Division of Waste Management (DWM) were temporarily assigned to NRC's On-Site Representative Office and visited the U.S. Department of Energy's (DOE's) Yucca Mountain Field Operations Center and Exploratory Studies Facility (ESF) construction pad at Yucca Mountain, Nevada. The purposes of the visit were to: (1) observe operation of the tunnel boring machine (TBM); and (2) collect additional and updated information on DOE's plans and schedules for excavation of the ESF.

The following sections summarize what was learned regarding DOE's current TBM operating plans and is based on conversations with a number of DOE staff and their construction management and operating contractors (the "CM&O") identified in the attachment.

Current TBM Status¹

Excavations during the week of November 7, 1994, advanced the TBM from station 0 + 73.85 meters to station 0 + 76.7 meters (approximately 9 feet), using two shifts per day.² Six steel sets and lagging were installed at the brow of the starter tunnel to provide the necessary ground support as the TBM proceeds through the fractured geology in this area of Exile Hill.³ (NRC staff observed the installation of steel set No. 6.) Also, the TBM has advanced sufficiently beyond the starter tunnel to permit the use of both sets of gripper pads. The use of both sets of gripper pads will now make it easier to compensate for the effects of "roll and pitch skew" when steering the TBM.

Before the week of November 7, operation of the TBM had been essentially uninterrupted with the exception of some minor calibration of the steering telemetry⁴ received from cutter head instrumentation. The TBM operator subsequently uses this telemetry, in the control

¹ Subsequent to this visit, DOE announced that TBM operations were halted on November 21, 1994, because of the depletion of steel sets.

² It was noted that the CM&O now has a sufficient number of trained personnel to operate the TBM for three 8-hour shifts.

³ DOE had originally intended to roof-bolt and shotcrete the first 40 feet of the ESF (beyond the starter tunnel) so as to ensure that this length of the ESF remains stable. However, based on the fractured conditions encountered in the recently excavated rock, the CM&O has decided to install steel sets and lagging until conditions improve.

⁴ This particular condition is considered to be a normal operational occurrence commensurate with the start-up of a TBM. To expedite resolution of the problem, the TBM manufacturer had dispatched its factory representative to the site to help in the "de-bugging" of the steering telemetry.

cab, to adjust the azimuth (line) and grade of the excavation, effectively steering the TBM. Seismic reflection surveys were being conducted in the vicinity of Yucca Mountain as part of site characterization, and TBM operation was periodically stopped because it created vibrations that interfered with these on-going surveys.

However, as a result of the excavations on November 8, 1994, the ground conditions at the front of the cutter head resulted in shearing of 26 bolts on one of the eight "propel cylinders," located behind the cutter head, that are used to advance it during excavations. Moreover, the keeper-ring holding these bolts was also damaged and needed repair. Therefore, operation of the TBM was suspended while the needed repairs were made. Repairs were forecast to be completed by November 10, 1994. However, because November 11 (Veteran's Day) was a union holiday and TBM construction workers would command double-time pay for working this day, the TBM operator, Kiewitt/Parsons-Brinckerhoff, decided to suspend mining operations until November 12, 1994.

Projected TBM Operating Plans

As noted in a staff trip report for the week of October 17-21, the overall controlling factor affecting the amount of daily TBM advance is the muck-handling capacity of the excavation operation (it is currently done with rail cars). Once the conveyor handling system is installed (ca. April 1995), the TBM is projected to advance more swiftly underground, rock conditions permitting. However, until then, the ESF project managers (Morrison-Knudsen) supervising the tunneling believe that the controlling factors affecting the amount of daily TBM advance will continue to be: (1) the number of shifts worked; and (2) the type of ground conditions encountered (and attendant ground support needed).

The CM&O personnel have noted that the rock conditions encountered have been generally considered less than desirable. Moreover, some minor mechanical difficulties (e.g., the recent shearing of the keeper-ring bolts and questionable steering telemetry) have also contributed to the slow advance of the TBM. Although this phase of tunneling is still considered to be part of the "shake-down" phase, the CM&O announced plans to proceed with TBM operation three shifts/day (8 hours each), five days/week. This was expected to begin on November 21, 1994, and will continue until further notice.⁵ The CM&O is optimistic that tunneling will improve noticeably with time, for two reasons: (1) the TBM operating crews will become more efficient through additional operating experience⁶; and

⁵ As also noted in the staff's October 17-21 trip report, DOE plans to operate the TBM 24 hours/day, 7 days/week once the Bow Ridge fault (e.g., Ranier Mesa Tuff) is encountered and will continue to do so until this geologic formation is cleared. (DOE currently estimates that the TBM is about 113 meters (~366 feet) from the Bow Ridge fault.)

⁶ TBM operation includes, at a minimum, the following activities: excavation, muck handling, trailing floor and track installation, roof bolt installation, and any additional ground support (including steel-set erection), ventilation duct installation, electrical power supply, and routine maintenance. As part of the shakedown phase,

(2) the engineering properties of the rock will improve ahead.

Finally, the CM&O reported that they understand that fabrication of the mapping gantry is expected to be complete by Thanksgiving and that it should be delivered to the site sometime in December 1994. However, it was noted that the assembly and installation of the mapping gantry on the TBM train may be delayed until the TBM safely negotiates the expected soft ground of the Ranier Mesa Tuff and Bow Ridge fault.

Tunneling activities will be temporarily suspended because the TBM will be partially disassembled to install the mapping gantry. There are a number of logistical matters under consideration by CM&O that need to be considered. For example, TBM Car Nos. 4 and 5 will have to be decoupled and backed out of the ESF, to move the gantry cars into proper place on the train. Because of their length, the mapping gantries can't make turns well. A special siding that does not exist yet will thus have to be built that will allow the mapping gantry to be introduced into its proper order on the TBM. Moreover, the many electrical lines on the TBM itself cannot be disconnected in segments and therefore will have to be replaced when the mapping gantry is added. Finally, the miners' "Dry House" is due to be removed permanently from the train because it is believed to be interfering with the muck conveyor system.

Thus, given the previously noted concerns about the engineering characteristics of this portion of Yucca Mountain and the logistical demands to be addressed in the mapping gantry installation, the staff understands that if the TBM is located within the Ranier Mesa Tuff when the mapping gantry arrives, DOE will defer its installation until that section of the stratigraphy is cleared by the TBM.

ESF Safety Policy and Access to the ESF

DOE's current policy on access to the ESF has not changed. As reported earlier, the safety policy is that only TBM operating personnel and geologic mapping staff will be permitted in the ESF while the TBM is operating; when the TBM is not operating, there are no restrictions other than receiving the General Underground Training course offered by DOE, which permits unescorted access to the ESF.

However, it was learned that REECo's industrial hygiene staff completed its monitoring of air quality, in the ESF, so as to understand the nature of the mine dust hazard, if any. REECo's analysis is reported to conclude that the level of mine dust in the ESF, during the first 40 feet of TBM operation, was well within the accepted limits, and thus personal respirators will not be needed by mining personnel in the ESF during TBM operation.

Finally, the staff learned that DOE has also relaxed its policy on the maximum allowable

the M&O is determining the number of personnel needed to perform these and any other TBM operations.

number of personnel working at one time in ESF. Previously, the CM&O had an informal safety policy that set a ratio between the number of personnel in the ESF and the number of mine rescue teams needed on site. The ratio had been 25:1 and appears to be predicated on the CM&O's previous mining experience as well as some general guidance from the Mine Safety and Health Administration. However, DOE and its CM&O have re-evaluated the basis for the 25:1 ratio because of numerous requests to enter the ESF during TBM operation and have decided that the ratio could be increased without sacrificing mining safety and other relevant bases for the mine rescue-team requirement. However, the revised ratio has not been reported.

Geologic Mapping inside the ESF

The mapping of the geology within the ESF is intended to support the Yucca Mountain repository program in two areas: (1) site characterization; and (2) geologic repository operations area design and construction. Information on the types and kinds of mapping to be conducted in the ESF is provided in two sources. DOE Study Plan 8.3.1.4.2.2⁷ ("Characterization of Structural Features in the Site Area") describes DOE's general plans for geologic mapping at the site. Detailed plans for geologic mapping of the ESF, consistent with Site Characterization Plan activity 8.3.1.4.2.2.4, are described in Test Planning Package 92-10 ("Geologic Mapping of the Exploratory Studies Facility").⁸ The associated job package provides the specific details for carrying out these plans. The necessary mapping is to be performed by the U.S. Geological Survey (USGS) and the Bureau of Reclamation (BuRec). The USGS is responsible for identification of the stratigraphic units encountered within the ESF. The BuRec has been contracted to perform the detailed geologic mapping. The Los Alamos National Laboratory (LANL) is coordinator for the overall testing program, including mapping.

As noted in the October 17-21, 1994, trip report, the ability to actually observe rock conditions at the cutter head location will be severely limited until the TBM advances the first section of the mapping gantry to the exposed ESF wall, approximately 150 feet behind the TBM cutter head. The narrow annulus between the TBM and the ESF wall, the obscuring of the ESF wall by the cutter head shielding, and the ground support systems used to mitigate the inherent dangers associated with tunneling in fractured rock limit observation in the first 150 feet of the TBM. Because of ground conditions and because the mapping gantry is not in-place, only preliminary geologic reconnaissance mapping is taking place. The frequency with which the mapping teams appear at the ESF is currently being determined by the rate of TBM advance. Given the TBM's current advance rate, the

⁷ U.S. Department of Energy, "Characterization of Structural Features in the Site Area," Office of Civilian Radioactive Waste Management, Study Plan 8.3.1.4.2.2, Revision 2, December 1992.

⁸ U.S. Department of Energy, "Geologic Mapping of the Exploratory Studies Facility," Yucca Mountain Site Characterization Project/Office of Civilian Radioactive Waste Management, Test Planning Package 92-10, Revision 2, July 1994.

mapping team has only had to visit the ESF about every other day.

As the rate of TBM advance increases, the frequency with which the mapping teams visit the ESF is expected to increase. Also, on-going discussions between DOE and the U.S. Nuclear Waste Technical Review Board (NWTRB) on the scale of mapping and the types of data to be collected within the ESF may modify DOE's plans for geologic data collection within the ESF. DOE expects to re-map the ESF beyond the starter tunnel⁹ once the TBM shake-down is complete and the mapping gantry is in place.

Attachment:

Updated List of DOE and M&O ESF-TBM Contacts

⁹ Detailed geologic mapping of the starter tunnel, including photogrammetric mapping, was performed before the starter tunnel was shotcreted.

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
Tom Bjerstedt	DOE	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
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
Jim Replogle	DOE	Acting Assistant Manager Engineering and Field Operations
Ralph Schneider	DOE	Director Field Operations Center
Tim Sullivan	DOE	Geotechnical Investigations Lead
Bernie Verna	DOE	Acting ESF Construction Manager
Win Wilson	SAIC	Site Office Manager

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