UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 3, 1994

MEMORANDUM FOR: Joseph J. Holonich, Chief
High-Level Waste and Uranium
Recovery Projects Branch, DWM

Michael J. Bell, Chief
Engineering and Geosciences Branch, DWM

FROM: Michael P. Lee, Project Manager MPL
High-Level Waste and Uranium
Recovery Projects Branch, DWM

John S. Trapp, Senior Geologist JST
Engineering and Geosciences Branch, DWM

THRU: Robert L. Johnson, Section Leader
High-Level Waste and Uranium
Recovery Projects Branch, DWM

SUBJECT: TRIP REPORT FOR THE OCTOBER 17-21, 1994, SITE VISIT TO THE NEVADA TEST SITE

During the week of October 17-21, 1994, John Trapp 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. The purpose of the visit was to collect information on DOE's plans and schedules for excavation of the ESF using the tunnel boring machine (TBM), and to establish a line of communication between DOE and the NRC staff, so as to keep NRC routinely informed on the status of ESF-TBM activities.

As a result of this visit, summarized in the enclosed report, we were able to collect information on the following ESF-related subjects: overall construction plans, ground support for ESF excavations, training requirements and access to the ESF, performing scientific observations, and current TBM status.

Moreover, both DOE and its contractors expressed an interest in providing timely information on the status and progress of ESF-TBM activities. We and DOE agreed, in principle, to an arrangement whereby an NRC staff member would contact DOE (or its contractor), on a daily basis, so as to receive information on the progress and status of TBM excavations. To facilitate future visits to the ESF construction pad and Yucca Mountain, in



102.8
WM-11
NH16

general, DOE offered to conduct General Employee Training and General Employee Radiological Training for all Division of Waste Management and contractor staff, at a mutually convenient time, soon.

Enclosure: As Stated

cc: M. Knapp/DWM
J. Greeves/DWM
J. Surmier/DWM
M. Federline/PAHB

DISTRIBUTION W/Encl.: Central File DWM r/f NMSS r/f ACNW
AGarcia KMcConnell MNataraja BJagannath On-Site Rep.
PDR/LPDR/LSS MDelligatti HLUR r/f JSurmeier CNWRA

S:\DWM\HLUR\MPL\REPORT.mpl

| OFC | HLUR | E | ENGB | E | HLUR | E | | |
|---|---|---|---|---|---|---|---|---|
| NAME | MPL MLee | | JTrapp | | RJohnson | | | |
| DATE | 11/2/94 | | 11/3/94 | | 11/3/94 | | | |

OFFICIAL RECORD COPY

general, DOE offered to conduct General Employee Training and General Employee Radiological Training for all Division of Waste Management and contractor staff, at a mutually convenient time, soon.

Enclosure: As Stated

cc: M. Knapp/DWM
J. Greeves/DWM
J. Surmier/DWM
M. Federline/PAHB

DISTRIBUTION W/Encl.: Central File DWM r/f NMSS r/f ACNW
AGarcia KMcConnell MNataraja BJagannath On-Site Rep.
PDR/LPDR/LSS MDelligatti HLUR r/f JSurmeier CNWRA

S:\DWM\HLUR\MPL\REPORT.mpl

| OFC | HLUR | E | ENGB | E | HLUR | E | | |
|---|---|---|---|---|---|---|---|---|
| NAME | MPL MLee | | JT JTrapp | | RJohnson RJ | | | |
| DATE | 11/2/94 | | 11/3/94 | | 11/3/94 | | | |

OFFICIAL RECORD COPY

ENCLOSURE

# TRIP REPORT FOR THE OCTOBER 17-21, 1994, SITE VISIT TO THE NEVADA TEST SITE

On October 17-21, 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. The purposes of the visit were to: (1) observe operation of the tunnel boring machine (TBM); (2) collect information on DOE's current plans and schedules for excavation of the ESF, using the TBM; and (3) establish a line of communication between DOE and the NRC staff so as to keep the NRC routinely informed about the status of ESF-TBM activities. As a result of this visit, both DOE and its contractors, arrangements were made to provide the NRC with timely information on the status and progress of ESF-TBM activities.

The following sections summarize DOE's plans and schedules for operation of the TBM at Yucca Mountain, Nevada. It is based on conversations with those DOE staff and its Management and Operating contractors (the "M&O") identified in Attachment 1, as well as information provided in subsequent attachments.

## Overall ESF Construction Plans

DOE's current plans call for excavating 1280 meters (~ 4150 feet) of the ESF during the next 12 months (see Attachment 2). This schedule consists of three sequential phases (Attachment 3) and is intended to cover that portion of the ESF addressed in the ESF 2C Design Package. Generally, DOE considers this schedule to be conservative. The ability of DOE to meet the schedule depicted will depend upon how well the start-up and shake-down phases (Phases A and B, respectively, identified in Attachment 3) proceed. Additional adjustments to the schedule can be expected as more is learned about the rock conditions encountered and the type of ground support needed in the ESF as the TBM proceeds.

DOE's current planning assumptions reflected in this schedule call for TBM operation 20 hours/day, 5 days a week; 4 hours/day will be dedicated to maintenance. These operational statistics translate into two shifts/day and, rock conditions permitting, excavating between 50 to 80 feet/day. However, the TBM operator, Kiewitt/Parsons-Brinckerhoff, currently has only enough staff trained to operate the TBM[1] for one 8-hour shift. More operating staff are being trained to cover additional shifts, and once additional workers are trained, a second shift will be added.

---

[1] TBM operation includes, at a minimum, the following activities: excavation, muck handling, trailing floor and track installation, roof bolt installation, ventilation duct installation, electrical power supply, and routine maintenance. Additional operations could include ring erection (steel sets), and geologic mapping.

Thus, the amount of daily TBM advance is currently limited by the number of excavation shifts. However, once there are sufficient trained staff, it appears that the overall controlling factor affecting the amount of daily TBM advance will be the muck-handling capacity (currently with muck cars). Once the conveyor handling system is installed, as indicated in Attachment 1 (ca. April 1995), the TBM is projected to advance up to 80 feet/day (2 shifts), again, rock conditions permitting.

The ESF project managers (Morrison-Knudsen) prepare daily reports on the progress of TBM excavation. The input information is provided by the TBM operator (Kewit/Parsons-Brinkerhoff). This report is subsequently transmitted to DOE's engineering and field operations staff in Las Vegas (M&O/SAIC), also daily.

DOE expects to be in the vicinity of the Bow Ridge fault (e.g., Ranier Mesa Tuff) in about 1 to 2 months; however, its schedule depends on how quickly TBM mining personnel can be trained. Once the Bow Ridge fault is encountered, DOE will operate the TBM 24 hours/day, 7 days/week until this geologic formation is cleared. (Estimated TBM advance will be about 100 feet/day.) The reasoning behind the aggressive schedule here is that there is concern about the engineering properties (e.g., rock displacement, roof stability) of the geology in this sequence of the stratigraphy. DOE and its contractors indicated that they don't want to risk any problems by leaving the excavated tunnel unsupported along this sequence for any extended period of time. Therefore, DOE plans to reinforce and encase the **entire** ESF section along the Ranier Mesa tuff stratigraphy with steel sets and steel lagging.

Once the TBM is through the Ranier Mesa tuff, DOE will resume a 20 hours/day, 5 days/week operating schedule.

**Ground Support for the ESF**

As noted above, the ESF *in-situ* conditions will be an important factor influencing how much the TBM advances on a daily basis. ESF Design Package 2C has identified 5 different types of ground support configurations intended to stabilize the ESF. DOE's design goal is to optimize the amount of ground support, so as to permit the ESF rock face to remain exposed while ensuring worker safety at all times.

The simplest forms of ground support are low density-spaced roof bolts; this configuration is currently the standard for the entire ESF. The most complex form of ground support are steel sets (ribs) with steel lagging; this configuration completely encases the tunnel. DOE intends to rock bolt the entire ESF.

The entire length of the ESF starter tunnel has already been roof-bolted and shot-creted, and reinforced with steel sets. DOE intends to roof-bolt and shot-cret the first 40 feet of the ESF (after the starter tunnel) so as to ensure that this length of the ESF tunnel remains stable. DOE believes that this precaution is necessary because the drill-and-blast form of excavation of the starter tunnel probably has weaken some of the rock in the direction of the ESF; DOE

doesn't want this material to fall on the TBM or mining and scientific personnel.

**Training Requirements and Access to the ESF**

DOE's current policy regarding access to the ESF 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 (GUT) course offered by DOE, which permits unescorted access to the ESF.[2] DOE's reasoning behind this policy is twofold. First, the REECo industrial hygiene staff have decided that personal respirators will be worn by all personnel in the ESF during TBM operation, until the nature of the mine dust hazard, if any, is defined.[3] Second, during the TBM start-up and shake-down phases, DOE wishes to limit pedestrian traffic in the ESF, for safety reasons, to just tunneling personnel. DOE expects that restrictions on access to the ESF, during TBM operation, will be eased once the mine dust issue is addressed and more of the ESF is excavated.

To facilitate future visits to the ESF construction pad and Yucca Mountain, in general, DOE offered to provide GET and GERT for all DWM and contractor staff, at mutually convenient times, soon.

**Ability to Perform Scientific Observations**

The ability to actually observe the rock conditions during the tunneling process will be severely limited because of the physical layout of the TBM and the inherent dangers associated with underground construction.

As noted above, it is presently projected that once full operations are underway that the TBM will progress 50 to 80 feet/day. If we use that as a baseline, the cutter head and shields at the front of the TBM prevent direct observations for about 40 feet. In other words, steel will block off any visual inspection of the rock for the first day after encountering some feature. Some information will be gained, however, because of the instrumentation of the cutter head, as changes in rock conditions will be registered through things like changes in cutting pressure, etc. Following the cutter head assembly, the working area is devoted to scaling of the rock mass, and installation of necessary support such as ring steel and

---

[2] DOE will require that frequent or long-term visitors to the ESF take the GUT class. However, GUT has two prerequisites: General Employee Training (GET) and General Employee Radiological Training (GERT). DOE has offered to conduct GET and GERT training for all DWM and contractor staff. GET and GERT training will permit NRC and contractor staff to receive DOE badging that would allow them travel without an escort in Area 25 of the Nuclear Test Site. However, DOE and its contractor staff did note that all non-TBM personnel will be escorted while in the ESF or on the TBM, despite the receipt of GUT, until further notice.

[3] We have subsequently learned from DOE that REECo's industrial hygiene staff intend to monitor air quality, in the ESF, during the first 40 feet of TBM operation, and will prepare its decision on the use of personal respirators following an analysis of that data.

preliminary rock bolting. During operations, this is an extremely hazardous area, and no personnel except those actually performing the operations will be allowed in this area. If unusual conditions are suspected, based on geologic projections, changes in cutting characteristics, or observation of the people working in the area, it would be possible to temporarily stop the TBM and have some principal investigator perform a quick observation of conditions; however, this observation would be quite limited.

Following this work area is the control cab, which is followed by another small platform area that will serve as the temporary mapping platform. This area is also quite limited in space, and during initial operations, access to this area will be limited to an as-needed basis. During stoppages in operations, such as the maintenance shift, it would be possible to enter this area and observe the geology. This area is approximately 100 to 150 feet back of the cutter head, so it would be 2 to 3 days after a feature were encountered before it could be first directly observed by NRC.

During the initial operations, before installation of the mapping gantry, the entire TBM will be about 300 feet in length; therefore, after the initial crossing of some feature, it will be about 6 days until the TBM passes the feature. At this time, it would be possible to get the first real opportunity to observe the feature without having to wait for operations to be halted.

Once the mapping gantry is installed people who have received GUT, and have been placed on the need-for-access list, will be allowed free access, during operations, to the area of the mapping gantry. This area is roughly 200 to 250 feet behind the cutter head, so that after 5 working days from the first encounter of a feature, it would be possible for the NRC staff to directly observe it.

It should be noted that in many areas of complex geology it is entirely possible that the ring steel and lagging will preclude any real observations. Therefore, in such areas as the Bow Ridge fault DOE is planning on cutting small alcoves and recrossing the fault zone to obtain scientific observations. It is in these secondary constructed zones that the best observations of the more complex features will probably be obtained.

**Current TBM Status**

Excavations on October 17, 1994, resulted in advancing the TBM a distance of 1 foot 9 inches. As of October 17, 1994, the TBM has excavated approximately 8 feet beyond the ESF starter tunnel. As a result of the excavations on October 17, 1994, the TBM operator has decided to install bars across the mouth of the muck buckets located on the TBM cutting head. This modification is intended to prevent large rocks cut from the head of the tunnel from obstructing the muck buckets.

Operation of the TBM is not expected to re-commence until the ground support procedures, contained in ESF Design Package 2C, are approved by DOE. The necessary approval is

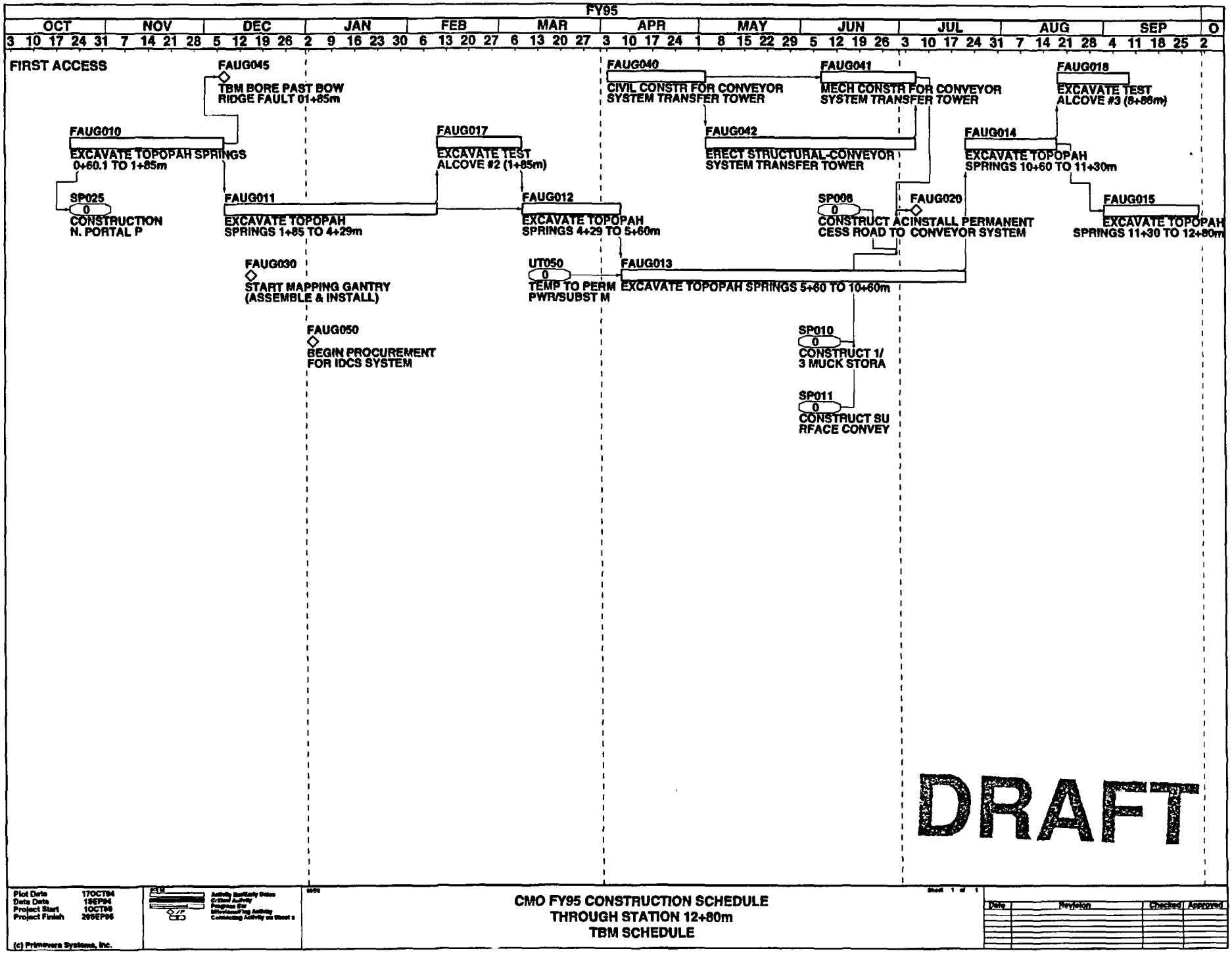
expected by October 31, 1994. Finally, geologic mapping of the ESF will take place on a platform behind the cutter head tail shield until the mapping gantry is installed (ca. December 1994).

Attachments:

1. DOE and M&O ESF-TBM Contacts
2. CMO FY95 Construction Schedule through Station 12+80m -- Draft
3. TBM Phases (including construction) -- Draft

## DOE AND M&O ESF-TBM CONTACTS

| *Name* | *Affiliation* | *Function/Responsibility* |
|---|---|---|
| Robert Adams | SAIC | TBM schedules |
| Tom Bjerstedt | DOE | Yucca Mountain Licensing Team |
| 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) |
| 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 |




Attachment 2

# TBM PHASES

**Phase A1** - Basically this is a test phase for the TBM. The excavation will be in accordance with an early partial release of Design Package 2C. The input sheets and drawings/specs., for early release will be accepted by DOE today (9-12-94). It is estimated, excavation will be from station 00+60 meters (200 feet) to approximately station 00+72 (i.e. approximately 12 meters, or 40 feet further into the mountain). If the TBM tests go smoothly and The Safety and Health Plan review and comments are incorporation into the document (expected to be completed within 2 working days), then this test phase is expected to start on approximately September 20, 1994. Note this phase may be completed in less than 2.4 meters.

**Phase A2** - Starts either at station 00+72 meters, or somewhere between stations 00+60 through 00+72 meters. The reason for this phase starting between the window described above is because the ground support design required to sustain TBM operations will be available in balance of Design package 2C. which is scheduled to be released for construction on about September 26, 1994. The materials to support TBM operations, such as pre-cast invert sections, water, utilities, etc, will be available at this time. The tentative start date for this phase is scheduled for October 30, 1994. Phase B will be complete when the Mapping Gantry arrives and is in place and ready for use. The distance this phase will proceed to is estimated to be 128 meters to Sta. 01+89 meters marker.

**Phase B** - Operations of the TBM with the mapping gantry will facilitate site characterization mapping and testing efforts in an expeditious manner. The task of mapping the tunnel geology is greatly enhanced with this platform support. The platform provides a safe area to conduct the drilling required for the installation of test equipment during tunnel mapping. Phase B is expected to start with the arrival and installation of the mapping gantry in December 1994. Phase B will continue until the arrival, installation and operation of the conveyer system. The distance this phase will proceed is estimated to be 741 meters to the sta 09+30 meters marker.

**Phase C** - Operations is scheduled to start on approximately May 95. The operations of the conveyers will allow the TBM to proceed at higher excavation rates. It is worth noting that the first three phases of TBM operation are at reduced rates because of the learning curve for new TBM operations, and DOE's wish to proceed cautiously so TBM operators and testers can get acclimated to the work environment. Once the learning curve is overcome the peak average production/day is estimated to be about 42.5 meters

# TBM CONSTRUCTION PHASES

| | | Project Milestone Schedule | Target Schedule |
|---|---|---|---|
| A. | STARTUP TESTING PHASE | | |
| | • C WALK TBM TO FACE | 7/12/94 | |
| | • S FIRST EXCAVATION TEST (O+60) | 8/8/94 | |
| | • S TWO SHIFT OPERATIONS, STATION 0+70 | 8/94 | |
| B. | SHAKEDOWN PHASE | | |
| | • S 7 DAY WORKWEEK (3 SHIFTS) | 10/94 | |
| | C ALCOVE #2, STATION 1+XX (10/94)* | | |
| | • S EXCAVATE RAINIER MESA, STATION 1+90 | 9/94 | |
| | • C EXCAVATE RAINIER MESA, STATION 2+60 | 10/94 | |
| | • C MAPPING PLATFORM | 1/95 | 12/94 |
| | C ALCOVE #3, STATION 8+XX (5/95)* | | |
| | C ALCOVE #4, STATION 10+XX (6/95)* | | |
| C. | OPERATIONAL PHASE | | |
| | • C CONVEYOR | 6/95 | 2/95 |
| | S NRG-6 INFLUENCE ZONE, STATION 17+XX | | |
| | C DRILL HOLE WASH STRUCTURE, STATION 21+XX | | |
| | • S NORTH RAMP EXT STUBOUT, STATION 21+XX | 7/95 | 5/95 |
| | C ALCOVE #5, STATION | | |
| | • C NORTH RAMP, STATION 29+00 | 10/95 | 8/95 |

• - milestone
C - complete
S - start
* - variable depending on scientific need