U.S. DEPARTMENT OF ENERGY

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YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

COPY

GEOLOGIC MAPPING OF THE EXPLORATORY STUDIES FACILITY

INFORMATION COPY

REV. 2

TEST PLANNING PACKAGE 92-10

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JULY 1994

UNITED STATES DEPARTMENT OF ENERGY

YMP-071-R2
06/06/94

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
TEST PLANNING PACKAGE APPROVAL AND RELEASE

Test Planning Package Title: Geologic Mapping of the Exploratory Studies Facility Revision: Rev. 2

Test Planning Package Number: TPP 92-10, Rev 2

Responsible PE: Ron Oliver

Summary of Scope: Geologic Mapping of the Exploratory Studies Facility (ESF) previous version, Rev. 1, has been revised to better focus the Test Planning Package (TPP) on general ESF testing requirements and make the TPP structure content consistent with the new TPP outline contained in the Project Office procedures. The associated job package will provide implementing detail for carrying out this test in defined phases during ESF construction.

Job Package Number: JP 92-20A

WBS Number (third level): 1.2.3.2.2.1.2

Affected Organization: U.S. Geological Survey

Concurrence of requirements by affected Technical Project Officers and Assistant Managers

TPO: for L. Hayes Robert W. Craig Date: 8/3/94

TPO: Date:

TPO: Date:

TPO: Date:

TPO: Date:

Affected Assistant Managers:

AM: R. Spence R.E. Spence (DQA) Date: 8/3/94

AM: W. Simecek W.B. Simecek (AMEFO) Date: 8/3/94

AM: Date:

Release to: Assistant Manager for Administration for job assembly

for nonfield work

YMSCO Approvals:

Responsible Assistant Manager: S. Jones Susan Jones (AMSP) Date: 8/4/94

TEST PLANNING PACKAGE 92-10
GEOLOGIC MAPPING OF THE EXPLORATORY STUDIES FACILITY

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1.0 LIST OF STUDY PLANS OR SCIENTIFIC INVESTIGATION PLANS USED IN SCIENTIFIC INVESTIGATION

Study Plan 8.3.1.4.2.2 "Characterization of the Structural Features in the Site Area," is a controlled Yucca Mountain Site Characterization Project (YMP) document that describes U.S. Geological Survey (USGS) plans for geologic mapping activities in the Exploratory Studies Facility (ESF). Information currently provided in this Test Planning Package (TPP) is limited to SCP activity 8.3.1.4.2.2.4 "Geologic Mapping of the Exploratory Studies Facility."

2.0 WORK SCOPE

Section 2.0 References:

R2.1 "Exploratory Studies Facility Design Requirements," YMP/CM-0019, 7/2/92.

R2.2 Letter: Craig to Oliver, "Planning Information for Geologic Mapping of the Exploratory Studies Facility (ESF) (TPP 92-10)," dated March 23, 1993.

R2.3 "Preliminary Test Planning Package for Support of Pre-Title II Design Studies; Planned Exploratory Studies Facility Tests" YMP/TPP 91-5, Rev. 0.

R2.4 Letter: Dyer to Elkins, "Tracer Exemption for Compressed Air used during the Construction and Geologic Mapping Activities of the North Portal Tunnel Boring Machine (TBM) Starter Tunnel," RSED:DRW-2966, dated March 9, 1993.

The Geologic Mapping of the Exploratory Studies Facility activity is discussed in Section 8.3.1.4.2.2.4 of the Site Characterization Program Baseline (SCPB).

Geologic mapping will be used to document lithologic and fracture variability throughout the vertical and horizontal extent of the underground excavations, to investigate structural features, and to provide siting data to confirm (or modify) planned test locations within the underground excavations. Geologists may take stereo-photographs of exposed rock surfaces for openings in the ESF. Detail line surveys may be performed continuously along one wall of each drift or ramp. Detail line surveys consist of recording the characteristics of fractures, geologic discontinuities, or features which intersect a datum line. Regular sampling of the wall rock and fracture infilling will be part of the mapping process.

3.0 INVESTIGATION CONTROLS

R3.1 "Exploratory Studies Facility Design Requirements," YMP/CM-0019, Rev. 0.

R3.2 Memorandum: Elkins to Dyer and Simecka, "Determination of Tracer Requirements for Construction-Related Water and Compressed Air Usage in the Exploratory Studies Facility," TWS-EES-13-LV-01-93-22, dated January 25, 1993.

R3.3 Letter: Dyer to Elkins, "Tracer Exemption for Compressed Air used during the Construction and Geologic Mapping Activities of the North Portal Tunnel Boring Machine (TBM) Starter Tunnel," RSED:DRW-2966, dated March 9, 1993.

R3.4 Letter: Craig to Oliver, "Planning Information for Geologic Mapping of the Exploratory Studies Facility (ESF) (TPP 92-10)," dated March 23, 1993.

R3.5 Letter: Statton to Oliver, "Waste Isolation and Test Interference Evaluations for the ESF Starter Tunnel Construction - JP 92-20, and Planned Tests," LV.SC.BWD.3/93-074, dated March 24, 1993.

R3.6 Memorandum: Oliver to Elkins, "Test Interference Evaluation Acceptance for Exploratory Studies Facility Ramps, Main Drift, and Alcoves," LA-EES-13-LV-07-94-007, dated July 7, 1994

R3.7 Letter: Boak to Elkins, "Waste Isolation Evaluation for Exploratory Studies Facility North Ramp and Test Alcoves (SCPB: N/A)," LA-EES-13-LV-07-94-019, dated July 12, 1994.

The following controls are based on section references, including evaluations to address potential test interference and waste isolation impacts (including planned use of tracers, fluids, and materials) and input from principal investigators (PIs).

The following controls supplement or amend performance criteria and constraints found in Appendix B of reference R3.1.

3.1 Test Interference Impacts

See Attachment 1.

3.2 Impacts to Waste Isolation

See Attachment 1.

3.3 Environmental Impacts

Controls are specified in Reference R3.1.

3.4 Consolidated Performance Criteria and Constraints

See attachment 1 for a list of consolidated test-specific performance criteria and constraints. Supplemental performance criteria and constraints are shown in italics.

3.5 Safety Analysis

Potential safety concerns regarding the interactions between the test activities and construction activities are included in the administrative work plan as a safety analyses attachment. Work plan safety analyses are administrative documents that may be revised to address changes in scope of work to be performed or changes

to construction efforts. Safety issues specific to ongoing testing activities after construction will be addressed, as necessary with revisions to the Work Plan and safety analysis specific to that test.

4.0 OTHER INSTRUCTIONS

R4.1 Letter: R.M. Sandifer to N.Z. Elkins, "Ground Support Design Verification Data Needs, dated June 17, 1994

R4.2 Letter: R.M. Sandifer to S.B. Jones, "Request for Technical Support to Provide Geological/Geotechnical Data Collection, Mapping and Reporting During Construction of the Exploratory Studies Facility (ESF)," dated March 25, 1994

4.1 Sequencing Recommended for Performing Multiple Investigations

See Attachment 1.

4.2 Data Submittals (YAP-SIII.3Q)

Participants are responsible for collection, management, submittal of data, and for compliance with Project and participant plans and procedures as described in applicable study plans. In addition, participants will be responsible for documenting test equipment and activities used to collect the data.

Key data to be obtained in the north ramp, main level, and south ramp include fracture orientation, lengths, apertures, descriptions of fracture filling materials and fracture surfaces, stratigraphic data, information on the characteristics and abundance of lithophysae, mineralogy, and contacts between the units and zones in the various volcanics.

Some activities conducted under this test planning package provide data directly to the Civilian Radioactive Waste Management System Management & Operating Contractor. Data and information needs are contained in References R4.1 through R4.2.

All transfers of data between YMP participants, submittal of data to the YMP database, or transfer of data to outside parties shall be conducted in accordance with YAP-SIII.3Q and other applicable plans and procedures.

4.3 Sample Collection

Sample collection and preservation will be carried out in accordance with Project procedures. All sample locations will be surveyed and photographed where practical. See Attachment 1 for test specific sample collection requirements.

4.4 Computer Software

Participants are responsible for collection, management, submittal of data, and for compliance with Project and participant plans and procedures as described in applicable study plans. Software (including that which is an integral part of

measuring and test equipment) that uses numerical methods for complex scientific, engineering, or mathematical calculations will be controlled in accordance with the participant's QA program.

5.0 DESCRIPTION OF OPEN SCP COMMENTS THAT HAVE BEEN CONSIDERED RELATIVE TO INVESTIGATION(S) (YAP-30.3)

Section 5.0 References:

R5.1 Letter: Statton to Oliver, "Waste Isolation and Test Interference Evaluations for the ESF Starter Tunnel Construction - JP 92-20, and Planned Tests," LV.SC.BWD.3/93-074, Dated March 24, 1993.

No open constraints or commitments associated with the Site Characterization Plan (SCP) have been identified for this activity.

6.0 REFERENCES TO DESIGN REQUIREMENTS

Section 6.0 References:

R6.1 "Exploratory Studies Facility Design Requirements," Appendix B, Section B-2.2.20, "Underground Geologic Mapping," YMP/CM-0019, 7/2/92.

R6.2 "Exploratory Studies Facility Design Requirements," Sections 3.2.1 through 3.3.1, YMP/CM-0019, Rev. 0.

R6.3 Letter: Elkins to Segrest, "Transmittal of Design and Test-Related information for Design and Construction of Exploratory Studies Facility North Ramp (Design Package 2C) (SCPB: N/A), LA-EES-13-LV-03-94-026, Dated March 23, 1994

Functional requirements, performance criteria, and constraints in Sections 3.2.1 through 3.3.1 YMP/CM-0019, Rev. 0 provide the basis and control for the common facility design and its interactions with ESF testing. Requirements are implemented under the formal ESF Title II design and fielded for this phase of construction under JP 92-20, JP 94-16, or the current JP implementing ESF construction. In addition, requirements for underground test support are provided in Section 3.2.1.6.

YMP/CM-0019, Rev. 0 establishes the common facility design basis; consolidated performance criteria and constraints are consistent with, and do not require alteration of the current ESF design.

Development of test-specific construction specifications and drawings is not required for this activity.

7.0 COST AND SCHEDULE DATA

Section 7.0 References:

R7.1 Letter: Burke to Oliver, "Response to Requests for Support," LV.BMS.RAS.3/93.027, Dated March 19, 1993.

Participant	WBS	P&S Account
USGS	1.2.3.2.2.1.2	OG32212
USGS	1.2.6.1.4	OG614

See Attachment 2 (illustration) for further detail on the cost and schedule planning basis. The task dates and estimated durations are based on current design and construction strategies. These tasks, dates, and durations are subject to change. Changes will be controlled through the Project planning basis and reflected in applicable job packages or approved Project schedules.

8.0 QA PREPARATION

8.1 Closure of QA Concerns

No QA concerns have been identified.

8.2 Q-List Items/Activities

General guidance for application to site characterization activities is provided by the USGS in conjunction with the Quality Assurance Requirements and Description (QARD) DOE/RW/0333P, Project Office "Q-List" YMP/90-55. The quality affecting elements for this activity are limited to data and samples collected in support of the Study Plan listed in section 1.0.

9.0 READINESS REVIEW

The Assistant Manager for Scientific Programs (AMSP) determined that a readiness review is not required.

TEST-SPECIFIC PERFORMANCE CRITERIA AND CONSTRAINTS FOR GEOLOGIC MAPPING OF THE EXPLORATORY STUDIES FACILITY

Attachment 1 References:

A.1 "Exploratory Studies Facility Design Requirements,"Appendix B, Section B-2.2.20, "Underground Geologic Mapping," YMP/CM-0019, 7/2/92.

A.2 "Preliminary Test Planning Package for Support of Pre-Title II Design Studies; Planned Exploratory Studies Facility Tests," YMP/TPP 91-5, Rev. 0,

A.3 Letter: Statton to Oliver, "Waste Isolation and Test Interference Evaluations for the ESF Starter Tunnel Construction - JP 92-20, and Planned Tests," LV.SC.BWD.3/93-074, dated March 24, 1993.

A.4 Memorandum: Oliver to Elkins, "Submitted Test interference Evaluation Acceptance for Exploratory Studies Facility Ramps, Main Drift, and Alcoves," LA-EES-13-LV-07-94-007, dated July 7, 1994.

A.5 Memorandum: Boak to Elkins, Waste Isolation Evaluation for Exploratory Studies Facility North Ramp and Test Alcoves," LA-EES-13-LV-07-94-019, dated July 12, 1994.

A.6 Memorandum: Elkins to Dyer and Simecka, "Determination of Tracer Requirements for Construction-Related Water and Compressed Air Usage in the Exploratory Studies Facility," TWS-EES-13-LV-01-93-22, dated January 25, 1993.

A.7 Letter: Dyer to Elkins, "Tracer Exemption for Compressed Air used during the Construction and Geologic Mapping Activities of the North Portal Tunnel Boring Machine (TBM) Starter Tunnel," RSED:DRW-2966, dated March 9, 1993.

A.8 Letter: Craig to Oliver, "Planning Information for Geologic Mapping of the Exploratory Studies Facility (ESF) (TPP 92-10)," dated March 23, 1993.

Appendix B of the YMP/CM-0019 provided a verbatim statement of applicable performance criteria and constraints for this ESF testing activity. A consolidated list of performance criteria and constraints, derived from section references and focused on specific testing needs for this phase of the activity, is found below. TPP 91-5 provided the controlled basis for testing activities planning based on the selected Alternatives Study ESF facility configuration. References A.3, A.4, and A.5 provided the basis for constraints to address potential impacts to waste isolation and test interference. References A.6, A.7, and A.8, along with a review of the study plan by the Los Alamos National Laboratory Test Coordination Office, provided the basis for additional design and test-related information. Note: performance criteria and constraints follow the format established in YMP/CM-0019, 7/2/92.

The following performance criteria and constraints represent the controlled requirements basis for tests to be conducted in the Exploratory Studies Facility. Not all portions of these tests will be conducted at all locations; however all tests will be conducted in a manner consistent with these requirements. Test requirements will be implemented through job

packages, referenced design specifications and drawings, and controlled procedures. Compliance with test requirements will be demonstrated through records submissions and reporting requirements.

Supplemental planning information, other reference information, and a review of the reference information by the ESF TCO was used as indicated to modify, add, supplement, or otherwise amend ESFDR, Appendix B performance criteria and constraints for Geologic Mapping. Supplemental criteria and constraints are consistent with the reference information and ESF Title II design; they are shown in italics in the following sections. Changes to performance criteria or constraints which represent a general change to the testing program will be submitted, as appropriate, as proposed changes to the current version of the ESFDR, Appendix B to assure consistency with higher level requirements.

Performance Criteria (Reference A.1: Section B-2.2.20)

1a. The test organization will map all ESF excavations, on a daily basis, usually mapping the extent of daily progress, up to an expected maximum of 75m in TBM drifts. Mapping will generally be done prior to installation of any chain-link, mesh, or shotcrete. Where ground conditions require fabric or shotcrete, the excavation and mapping sequence will need to be modified to permit mapping near the heading.

In roadheader and/or mobile miner excavations, mapping will be done as near the heading as possible. The machines will need to pull back from the face while mapping is being done.

If a shaft is excavated as part of the ESF, mapping will be either from the bottom deck of the galloway (if drill/blast) or from platform designed for the purpose of mapping (machine excavation). In both cases, the walls must be mapped prior to any wire mesh, shotcrete, or permanent utilities are installed.

i. Only the first paragraph applies to ESF tunnel mapping.

ii. Mapping will be coordinated with construction and other tests.

iii. Hand specimens (samples) may be obtained for petrographic evaluations.

iv. Maximum progress is expected to be 45 m (150 ft) as controlled by gantry and trailing floor.

v. Test organization will map all ESF excavations not previously mapped on a daily basis.

1b. Survey accuracy for the Underground Geologic Mapping Test shall be ±1cm for the benchmarks. The ability should be retained to resurvey and upgrade the initial mapping survey and reference points.

i. Survey accuracy for mapping and sampling in the starter tunnel is ±2cm (.79 in) (horizontally and vertically from the benchmark).

ii. Survey laser alignment will be at least third order class II quality.

1c. A securable, underground space of about 5 x 6m with a height of 2.5m is required for storage of mapping equipment. If the North and South ramps are developed separately, a storage room is required in each one.

i. Design Package 2C has deferred construction of alcoves for mapping equipment storage.

1d. A geological storage and staging trailer or building of at least 18 m^2 (200-sq-ft) area shall be provided at the ESF surface facility in Midway Valley. This building shall be equipped with heating, air conditioning, electricity, running water at a sink, smoke detectors, first aid kit, and shelving.

i. As provided in north ramp surface facility design (Package 1A), storage during early ESF construction will be provided in a testing trailer located on the north ramp pad.

1e. If the optional shaft is required, the shaft sinking galloway must be provided with equipment to assure a stable platform for photography. In drifts other than those excavated by full-face tunnel boring machine, a collapsible platform must be provided to allow geologists access to all surfaces of the excavation.

1f. The construction contractor will clean the walls using compressed air/water following procedures developed during prototype testing.

i. Tracers for Construction Water. For water applied underground in dust suppression; blasthole drilling; in grout, mortar, concrete and shotcrete; wall washing (blowdown) prior to mapping; and other construction applications, addition of a universal tracer is required. Lithium bromide shall be the only tracer (universal) required and acceptable from the standpoint of ESF testing. The concentration of lithium bromide tracer in construction water should be 20 ppm (as bromide) with an acceptable tolerance of ±10% and a maximum range of 10 ppm to 30 ppm. Tracer system verification should include an automated volumetric analyzer (electrode) and periodic sampling for laboratory analysis.

ii. Tracers for construction usage of compressed air. For the ESF north ramp starter tunnel, the use of compressed air in blasthole drilling, other pneumatic tool usage, and in blowdown operations prior to geologic mapping does not require tagging with a chemical tracer. This exemption does not include any test-related drilling for later tests such as hydrochemistry and radial boreholes, planned for an alcove off the ESF north ramp starter tunnel.

iii. An air mist blow pipe system has been previously developed and will be used in ESF north ramp tunnel mapping.

1g. A light-tight photography laboratory (in a trailer or building) approximately 2.5m by 4m (8 ft by 14 ft, with a minimum of 100 sq ft) shall be provided at the ESF surface facility, adjacent to or in the geological storage and staging trailer or building. This laboratory shall be equipped with heating, air conditioning, and the following: (1) sink with hot and cold running water and (2) two 110-V, 20-A circuits and one 220-V, 30-A circuit.

i. Photography laboratory is not required for this phase.

Constraints (reference A.1: Section B-2.2.20)

A. In TBM drifts and ramps, a distance of at least 75m must be left directly behind the trailing gear, where utilities are confined to one quadrant of the circumference of the excavation. This confinement is necessary to allow an unobstructed view of as much of the exposed rock as possible for photogrammetric mapping.

In road header/mobile miner drifts, utilities (including permanent fan line) must not be installed until an area has been mapped and photographed. Generally, mapping will keep up with the daily excavation process.

i. A distance of at least 45 m (150 ft) must be left directly behind the TBM.

ii. Only non-photogrammetric mapping is planned for the exposed rock.

B. Ground support in the form of rock bolts and anchors may be installed as near the working face as necessary without detriment to mapping. The installation of chain-link fabric, wire mesh, or application of shotcrete may not take place until mapping is completed.

i. Ground conditions encountered during initial ESF north ramp tunnel excavation may impose safety-related limitations on access to, or exposures for, mapping activities.

C. Mapping in the TBM drifts will require construction of a mapping platform which will allow access to required portions of the crown and walls for sampling and detailed mapping. The platform may also be used for installation of ground support, surveying, installation of utilities, etc., as long as these operations are coordinated with the mapping effort.

Mapping in the roadheader/mobile miner drifts may be done from a collapsible platform (i.e., scissor lift).

i. A platform lift, provided by the constructor, will provide access to the tunnel back for mapping and sample collection.

D. During drift wall mapping, all unnecessary equipment will be removed from the section of the drift being mapped.

i. Unnecessary equipment that may hinder mapping activities, as determined by the PI, will be removed.

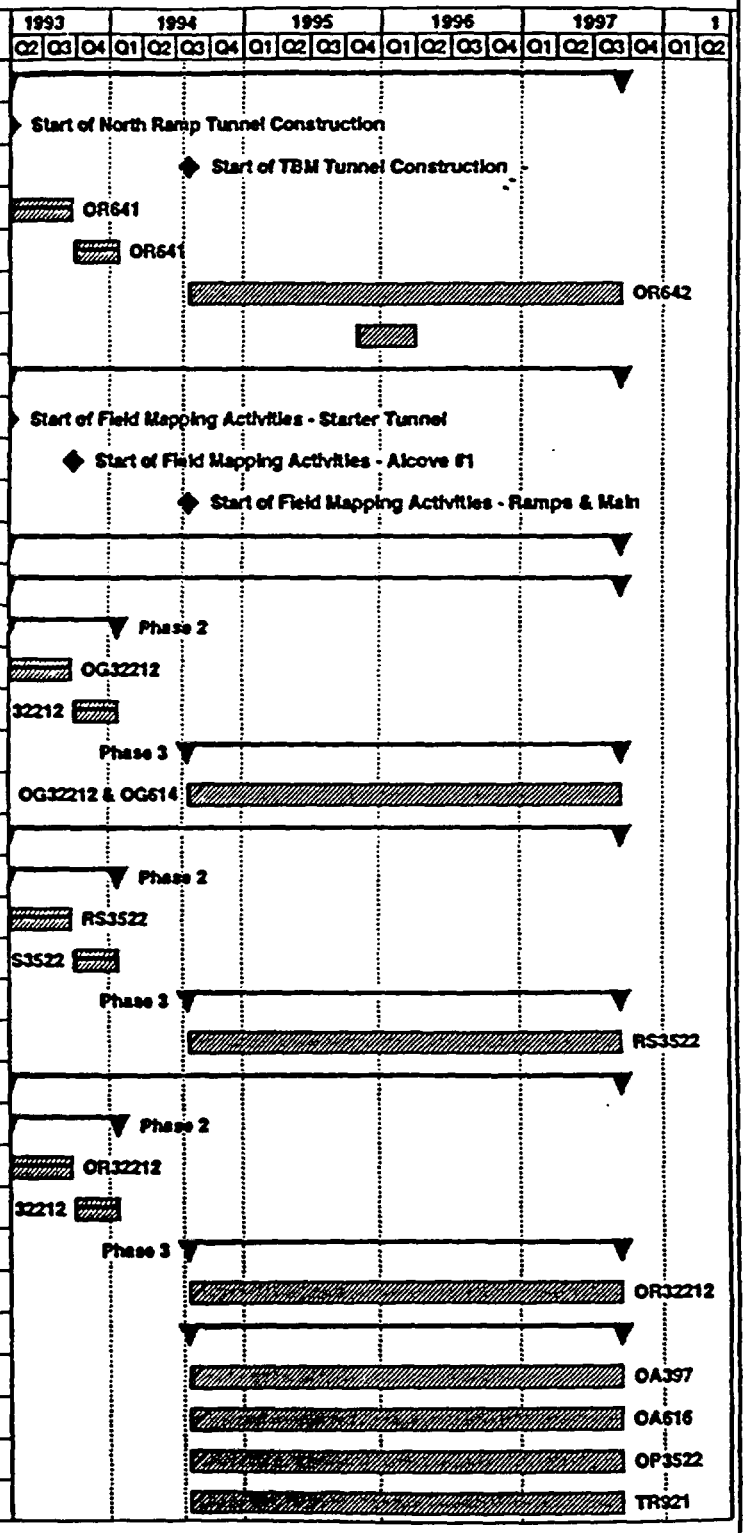
E. If a shaft is constructed as part of the ESF, provision must be made to allow unobstructed mapping of the shaft walls prior to the installation of wire mesh, shotcrete, or permanent utilities. Specific requirements will depend on the excavation method (machine vs. drill-blast).

F. Re-mapping, or more detailed mapping, of excavation surfaces may be required to support the site characterization program. Emphasis will be placed on preserving the ability to re-examine areas that have been previously mapped, consistent with the ESF's primary goal of site characterization.

Geologic Mapping Test Planning Package Schedule

TPP 92-10
Ramps, MTL Drifts & Alcoves

ID	Task Name	Dur	Start
C1	JP 92-20 CONSTRUCTION ACTIVITY	1161d	4/2/93
C2	Start of North Ramp Tunnel Construction	0d	4/2/93
C3	Start of TBM Tunnel Construction	0d	8/8/94
C4	Starter Tunnel Construction	122d	4/2/93
C5	Alcove #1 Construction	88d	9/27/93
C6	Ramps & Main Tunnel Construction	810d	8/8/94
C7	North Ramp Extension Construction (Contingency)	109d	11/1/95
I1	TEST IMPLEMENTATION - GEOLOGIC MAPPING	1162d	4/1/93
I2	Start of Field Mapping Activities - Starter Tunnel	0d	4/1/93
I3	Start of Field Mapping Activities - Alcove #1	0d	9/27/93
I4	Start of Field Mapping Activities - Ramps & Main	0d	8/8/94
I5	Test Implementation - Discrete	1161d	4/2/93
I6	USGS/USBR Test Implementation	1161d	4/2/93
I7	Phase 2	214d	4/2/93
I8	Starter Tunnel	122d	4/2/93
I9	Alcove #1	88d	9/27/93
0	Phase 3	810d	8/8/94
I11	Ramps & Main	810d	8/8/94
I12	RSN Field Survey & Processing	1161d	4/2/93
I13	Phase 2	214d	4/2/93
I14	Starter Tunnel	122d	4/2/93
I15	Alcove #1	88d	9/27/93
I16	Phase 3	810d	8/8/94
I17	Ramps & Main	810d	8/8/94
I18	REECo Geologic Mapping Support	1161d	4/2/93
I19	Phase 2	214d	4/2/93
I20	Starter Tunnel	122d	4/2/93
I21	Alcove #1	88d	9/27/93
I22	Phase 3	810d	8/8/94
I23	Ramps & Main	810d	8/8/94
I24	Test Implementation - Matrix Support	810d	8/8/94
I25	Los Alamos TCO Test Management & Planning	810d	8/8/94
I26	Los Alamos TCO ESF Test Management	810d	8/8/94
I27	JC Photographic Services	810d	8/8/94
I28	CRWMS M&O Project Control Support	810d	8/8/94



Project: Geologic Mapping
Date: 7/21/94
Revision #2

Task | Progress | Milestone | Summary

Checked By:
Approved By: