U.S. DEPARTMENT OF ENERGY

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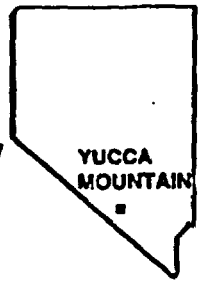
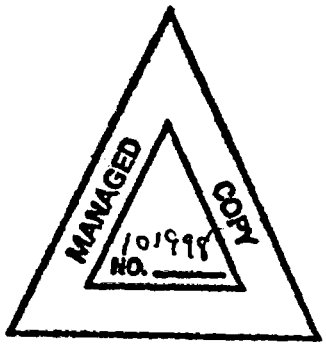


YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

DRILLING AND TESTING USW WT-24

REVISION 0



FIELD WORK PACKAGE FWP-SB-97-005

UNITED STATES DEPARTMENT OF ENERGY

YMP-267-RO
05/09/97

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
FWP APPROVAL

QA: L

SECTION I (Project Engineer completes)

FWP Title:
Drilling and Testing USW WT-24

FWP Identifier:	Assigned Project Engineer/Preparer:
FWP-SB-97-005	Steve Opp

Affected Organizations:
CRWMS M&O (SPO/PIs, TCO, CMO, Constructor/Drilling Service Provider, Geophysical Logging Support, Scientific Programs Support, Tracer Gas Injection Coordinator, Photography Support).

HISTORY OF REVISIONS

Revision	Effective Date	Pages Affected	Reason for Change
0	07/22/97	N/A	Initial issue.

SECTION II (Project Engineer obtains signatures) (N/A for expedited changes)

The following signatures authorize field work to commence in accordance with this FWP and within the constraints identified in the Planning and Control System approved by the YMSCO.

SPO Manager Approval: Larry Hayes	Signature: for LRH	Date: 7/22/97
Site Construction/Operations Manager Approval: Robert Sandifer	Signature:	Date: 7-22-97
QA Manager Concurrence: Bob Clark	Signature: R.W. Clark	Date: 7/22/97
Support Operations Concurrence: Doug Chandler	Signature: For D.K. Chandler Michael V. Harris	Date: 7/22/97

SECTION III (Project Engineer obtains signatures) (N/A for non-expedited changes)

Work approved in the previous revision of this FWP may continue with the expedited changes identified in this revision. A full review of this expedited change will be initiated within 3 working days of the effective date of this revision.

TCO Manager: N/A	Signature:	Date:

INTRODUCTION

This Field Work Package (FWP) controls activities in accordance with the Quality Assurance Requirements Document (QARD) requirements related to drilling, testing, and monitoring of borehole USW WT-24. Affected organizations are responsible for conducting field work in accordance with the Project requirement documents, this implementing FWP, and work program referenced in Section 8. This FWP is partially based on documentation provided by Test Planning Package T-95-01 and Job Package 95-10 which have been decontrolled. It is the affected organization's responsibility to determine the Quality Assurance (QA) program applicability for related activities in accordance with the Office of Civilian Radioactive Waste Management (OCRWM) approved QA program. The Test Coordination Office (TCO) may initiate addendums to this FWP to provide additional detail regarding the activities described and controlled herein.

1.0 SCOPE AND DESCRIPTION

1.1 General Scope Description

This FWP defines the process controls utilized by the TCO to manage and coordinate the activities for these site activities which include USW WT-24 borehole drilling, testing, and monitoring.

The following Site Characterization Plan sections apply to this test:

8.3.1.2.2.2 Water movement tracer tests using chloride and chlorine-36 measurements of percolation at Yucca Mountain.
8.3.1.2.2.3 Characterization of percolation in the unsaturated zone-surface-based study.
8.3.1.2.2.6 Characterization of gaseous-phase movement in the unsaturated zone.
8.3.1.2.2.7 Aqueous-phase chemical investigations.
8.3.1.2.3.1 Characterization of the site saturated-zone ground-water flow system.
8.3.1.3.2.1 Mineralogy, petrology, and chemistry of transport pathways.
8.3.1.3.2.2 History of mineralogic and geochemical alteration of Yucca Mountain.
8.3.1.4.2.1 Characterization of the vertical and lateral distribution of stratigraphic units within the site area.

Acceptance criteria for specific tests are included in the PIs procedures. Acceptance criteria for TCO checks for ponding of water include: the site identifier, is water ponding, are boreholes securely capped, does the drainage pattern direct water away from the borehole, and are corrective measures required.

Survey accuracies for the borehole are +/- 1/3 meter for all collar measurements, +/- 1/3 meter per 300 meters for borehole depth, and +/- 1 meter per 300 meters depth at the proposed repository horizon for borehole position and bottom-hole location

1.1.1 Planned Test Activity, Location, and Site Improvement Description

The U.S. Geological Survey (USGS) has requested the drilling and testing of borehole USW WT-24 to aid in the collection of data necessary for Water Table (WT) surface elevation and hydrochemical data of the saturated zone. The USW WT-24 borehole has been selected to assist in determining the cause and nature of the apparent change in the hydraulic gradient to the north of the repository block, between boreholes USW G-2 and USW H-1.

Borehole USW WT-24 will be located about 150 feet west of Castle Point Road and 0.5 miles south-east from borehole USW G-2; it is approximately 1.1 miles north of borehole UE-25 WT-18. The approximate Nevada Plane Coordinates are NVSPC: N 776,703 feet, E 562,330 feet. The elevation is approximately 4900 feet (1494m) on an existing pad for the planned drilling/testing activities.

1.1.2 Objectives

The overall objectives of borehole USW WT-24 include obtaining information regarding the potentiometric surface (uppermost surface of the groundwater table), determining borehole formation properties, collecting water samples and defining (if present) the thickness, water quality, of a perched-water zone. Potentiometric studies include the calculation of both the hydraulic gradients and the average water levels. Evaluating cause, and estimating system parameters, such as transitive and storage properties (storage properties may be determined if pumping effects are observed in nearby observation boreholes), by confirming the character and magnitude of potentiometric-level fluctuations with time and depth. Perched-Water studies include defining the water quality, elevated water surface, thickness, and hydraulic characteristics of the perched-water body.

Acceptance criteria for specific tests are included in the PIs procedures. Acceptance criteria for TCO checks for ponding of water include: the site identifier, is water ponding, are boreholes securely capped, does the drainage pattern direct water away from the borehole, and are corrective measures required.

The estimated total depth (TD) for this borehole will be approximately 2900 feet (200 feet below the Calico Hills Unit).

1.2 Specific Scope Description

1.2.1 Test Plan and Organizational Responsibilities

Test Plan

Borehole Drilling
The USW WT-24 borehole will be drilled dry. The borehole is expected to be reamed to accommodate three monitoring strings or a pump and access tubing. The planned core size for the borehole is approximately 2.4 in. A tracer gas (Sulfur Hexafluoride [SF_6]) will be added to the drilling air. Scientific tracer injection and gas sampling in the unsaturated zone may follow drilling. Only approved Tracers, Fluids, and Materials (TFM) will be used for lubrication. The "USW WT-24 Drilling Work Program", YMP/WP/97-02 describes and sequences these activities.

Borehole Sampling
Sampling at the USW WT-24 borehole will consist of collecting cuttings, water, and core samples. Cuttings will be collected for chlorine-36 analysis, and from both the unsaturated zone and saturated zone for stratigraphic analysis. Hydrochemical and hazardous materials will be sampled. Water samples will be collected for hydrochemical and isotopic analyses of the saturated zone. The water samples should be taken before Cal-Seal (if used) is added to the borehole, except during setting of initial casing or as directed by the PI or designated representative. Core collection will be coordinated by the TCO.

It may become necessary to inject J-13 water to facilitate drilling in wet or moist zones or below the water table in USW WT-24. If J-13 water is injected, the Principal Investigator (PI) will determine the quantity of J-13 water added to the borehole during drilling and the actual quantity will be recorded (this is also a TFM and State injection requirement). The traced drilling water will not be re-circulated. Tagging of the J-13 water will be done by introducing an approved tracer (LiBr) to the J-13 water before it is introduced into the borehole.

Borehole Testing
Testing at the USW WT-24 borehole will consist of Geophysical Logging, Hydrologic Testing, and Mineralogic Evaluation. Geophysical logging and downhole video logs will be run to show stratigraphic units and structural features penetrated during drilling. Hydrologic testing

will include hydraulic tests i.e., pumping and/or bailing of the borehole, monitoring of the potentiometric surface, and collecting hydrochemical samples. Mineralogic evaluation includes assessing alteration history and fracture mineralogy.

If perched-water is encountered, hydrochemical samples will be collected (SN-0104), and a video camera will be placed in the borehole to determine the location of the flow. If the inflow is greater than 30 gallons per hour, the PI may request that hydraulic tests be conducted. Temporary piping may be used for discharging both perched ground water and ground water generated from the hydraulic pump test into Sever wash. During the initial drilling of USW WT-24 the perched-water testing will be limited to a two week duration.

At TD, the borehole will be pumped to verify connection to the aquifer. The potential amount of water discharged from the borehole in order to clean it for collection of hydrochemical samples could be between 1 x 10^4 and 2 x 10^6 gal, pumped at a rate of up to 150 gal/min.

Organizational Responsibilities

The title for the CRWMS M&O will be named as M&O in this document for administrative purposes. The organizations involved in implementing work under this FWP, as currently assigned by the DOE, the YMP Planning and Control System (PACS), and the governing manager, include:

TEST MANAGEMENT (TCO)

The TCO is responsible for coordinating and monitoring test activities in support of participants and the Yucca Mountain Site Characterization Office (YMSCO), and providing regular written reports on test status. The TCO shall assign a FWP Records Coordinator (FWPRC) to monitor the FWP records process and Data Manager. The TCO has the responsibility to schedule and coordinate field activities with all affected organizations of the Project, to define requests, and control field work scope that fall within the approved scope of this FWP. These responsibilities, when shared with the sponsoring recognized organizations, will ensure that data and information gathered from the test activities described herein will meet requirements for site characterization and be consistent with the M&O Safety & Health Plan. The TCO is responsible for test coordination and implementation and maintains a Field Test Coordinator (FTC) and Field Test Representatives (FTRs) at the borehole location whenever construction or test-related activities are occurring. These representatives are responsible for ensuring that all testing requirements and constraints are adequately met during drilling/test

set-up and implementation consistent with test design and implementing documents.

SITE EVALUATION PROGRAM OPERATIONS/PRINCIPAL INVESTIGATORS

The Site Evaluation Program Operations (SPO) will provide Scientific Principal Investigators (PI), scientific staff, instrumentation and equipment necessary for providing, maintaining, and calibrating all required scientific equipment and instrumentation, accepting and instrumenting the scientific borehole, conducting, monitoring and reporting the field tests. The PIs will request all field test support functions through the TCO. The PIs are responsible for ensuring that the data and information gathered during test activities described herein are acceptable to meet requirements for site characterization and are qualified in accordance with QA requirements.

CONSTRUCTION MANAGEMENT ORGANIZATION (CMO)

The CMO will provide a management interaction between the TCO and M&O Constructor. The TCO will coordinate testing field activities with the CMO and the CMO will ensure that all testing related drilling and construction support is provided. The CMO is responsible for safety oversight of all construction activities.

CONSTRUCTOR/DRILLING SERVICE PROVIDER

The Constructor/Drilling Service Provider will conduct road enhancement, pad construction and drilling operations, survey, assist in sample collection, monitor and report all insignificant NO_x emission to M&O Environmental Programs Department (EPD) on a monthly basis, geophysical logging, and provide labor and material to support borehole testing. Construction-related TFM reporting will be provided per YAP-2.8Q.

GEOPHYSICAL LOGGING SUPPORT

The borehole will be logged for geophysical data in accordance with the current revision of the Yucca Mountain Site Characterization Project (YMP) Geophysical Logging Program approved according to procedure YAP-SIII.4Q and YAP-SIII.5Q.

SCIENTIFIC PROGRAMS SUPPORT

Scientific Programs Support (SPS) will provide FIELD DRILLING ENGINEERING (FDE) personnel and SAMPLE COLLECTION personnel to be scheduled and called out by the TCO. The FDE is responsible for drilling related measurements, monitoring and analyses of drilling activities, and other activities as requested by the TCO. The FDE is responsible for oversight of drilling system configurations and will support

the TCO, CMO, and DOE as subject matter experts for drilling engineering. Sample Collection personnel will provide appropriate identification, packaging, and shipping support for any samples or core collected as identified by the TCO.

TRACER GAS INJECTION COORDINATOR (INJECTION COORDINATOR)
The Injection Coordinator is responsible for providing, maintaining, set-up, and storage of the "Tracer Gas Injection System" and will designate trained personnel to operate the system in accordance with procedures whenever dry drilling activities are being conducted under the scope of this FWP.

PHOTOGRAPHY SUPPORT
Photography Support personnel will provide photography and photo processing support including archiving and distribution to assist in the documentation of testing activities as coordinated through the TCO. Call out for this support will be coordinated through the TCO.

1.2.2 Field Testing Equipment

The PI organizations will provide the testing equipment required to field activities associated with Drilling and Testing USW WT-24 and will have approved procedures and or scientific notebook procedures to follow when using this equipment. PIs are responsible for maintaining documentation for testing equipment, calibration and methods used to collect data. Specific testing equipment is identified in the PI's procedures.

1.2.3 Computer Software

Software (excluding that which is an integral part of measuring and test equipment) that used numerical methods for complex scientific, engineering, or mathematical calculations will be controlled in accordance with appropriate QA procedures. No manipulation of raw data will occur in the field during data collection, unless performed by the PI under approved procedures or documented in the PI's scientific notebook. No data manipulation software is identified at this time.

1.3 Implementing Field Documents

This FWP provides the process controls utilized by the TCO to manage the drilling and testing for the USW WT-24 borehole.

The following procedures or their equivalents will be utilized to conduct work within the scope of this FWP including work program development and revisions. The roles and responsibilities by which these procedures are applied in executing the work are presented in Section 3.0.

Procedure Number	Title
YAP-2.8Q	Tracers, Fluids, and Materials Data Reporting and Management
AP-17.1Q	Record Source Responsibilities for Inclusionary Records
YAP-SII.1Q	Submittal, Review, and Approval of Requests for Yucca Mountain Site Characterization Project Geologic Specimens
YAP-SIII.3Q	Processing of Technical Data on the Yucca Mountain Site Characterization Project
YAP-SII.4Q	The Collection, Submission, and Documentation of Non-Core and Non-Cuttings Samples to the Sample Management Facility for Site Characterization
YAP-SIII.5Q	Preparation of Borehole Geophysical Logging Programs for Surface-Based Testing Program Boreholes
AP-6.7	Authorization for the use of Radioactive Materials or Ionizing Radiation Producing Equipment
NWI-DS-001Q	Field Logging, Handling, and Documenting Borehole Samples
NWI-GL-001Q	Verification of Digital Geophysical Log Data
YMP-USGS-QMP-5.05	Scientific Notebooks (USGS)
YAP-13.1Q	Borehole Protection and Access
NLP-SIII-2	Work Program
NWI-DS-002Q	Drilling Support Activities
YAP-30.2	Land Access and Environmental Compliance

YAP-SIII.4Q	Yucca Mountain Site Characterization Project Field Verification of Geophysical Logging Operations
LANL-YMP-QP-03.5	Documenting Scientific Investigations
AP-SIII-6Q	Geotechnical Core Logging
YMP-USGS-HP-229	Core Water Content Analysis
YAP-30.10	Authorization to use Regulated Hazardous Substances and Materials
YMP-USGS-HP-07	Method to Inject Tracer Gas to Drilling Air
YMP-USGS-HP-177	Operation of Barometric Pressure Transducer
TLP-2.19	Survey Group Work Function
YAP-SIII.3Q	Processing of Technical Data on the Yucca Mountain Site Characterization Project
YAP-30.10	Authorization to use Regulated Hazardous Substances and Materials

1.4 Data and Other Deliverables

1.4.1 Data Submittals

The site characterization results obtained from testing this borehole will provide information to confirm the 3-D Geologic Framework Model and hydrologic models. These models support work required for Performance Assessment, the Total System Performance Assessment, and the Viability Assessment. The PIs have the responsibility for the collection, analysis, submittal, and reporting of data in compliance with Project and participant plans and procedures for their specific testing activities as described in this FWP. The TCO Data Manager, in conjunction with the PI, manages and facilitates the flow of test-related data. Data record responsibility is addressed in Section 6.0 of this FWP. All transfers of data between participants or to outside parties shall be conducted in accordance with YAP-SIII.3Q,

"Processing of Technical Data on the YMP," and other applicable plans and procedures.

1.4.2 Test Deliverables

Mineralogical Support of Phase II
Predicted Occurrence of Erionite in USW WT-24 with 3-D Mineralogical Modeling

1.5 Planned Tracers, Fluids, and Materials Usage and Determination of Importance Evaluation

All work shall be in compliance with "DIE for Surface-Based Testing Activities", BAA000000-01717-2200-00101, Rev. 00. TFM planned for the drilling and testing of Borehole USW WT-24 will have been approved before use. Refer to Section 3.2 for contingency plans for TFM usage. Currently approved TFM will be utilized during the drilling and testing of borehole USW WT-24. The TCO will be responsible for reporting testing TFM. The Constructor/Drilling Service Provider shall record daily water use by application and report this information as well as all construction related TFM use/removal. The TCO shall report testing related use/removal. TFM reporting will be done in accordance with YAP-2.8Q. TFM Requirements contained in the DIEs shall be applied as QA controls to limit potential impacts from these activities.

Planned Testing Related TFM:

- LiBr (Non-Q Environmental Tracer). LiBr used is restricted to 20 ppm maximum to meet State permit concentration levels with a goal of 1.5 to 2.5 ppm.

- SF_6 (Non-Q Environmental Tracer). SF_6 use is limited to 30 ppm maximum to meet State permit concentration levels.

2.0 SAMPLING PLAN

Sample locations will be identified before drilling begins by the affected PIs, and provided to the TCO. The TCO/PIs will complete YAP-SII.1Q to allocate all cuttings and core samples.

The current version of YAP-SII.4Q, "The Collection, Submission, and Documentation of Non-Core and Non-Cuttings Samples to the Sample Management Facility for Site Characterization," shall be used to document

sample collection and provide traceability of all water samples taken from the borehole.

The requirements for core samples, sidewall cores, and the collection of cuttings will be specified by the affected PIs and provided to the TCO before drilling of the borehole begins. Core samples will be processed through the Sample Overview Committee. Changes to the plan for sampling core and cuttings must be authorized by the affected PI. The PI will determine the requirements for technical content and format of the geologic log for the borehole. The PI will prepare geologic logging procedures and designate those responsible for preparing the geologic log for the borehole.

Stratigraphic units identified in core will follow the stratigraphic hierarchy and nomenclature as defined in the YMP Reference Information Base.

PI organizations will provide all non-standard sample packaging materials, transportation containers, and any associated equipment prior to the sample collection activity. PI organizations will set criteria for all sample types in accordance with YAP-SII.1Q.

2.1 Master Sample Matrix for Activity

Note: This table is a planned Matrix and may vary, based on geologic conditions.

SAMPLE TYPE	INTERVAL	ORGANIZATION	FREQUENCY
WATER	PERCHED	USGS	WHEN PERCHED-WATER ENCOUNTERED approx. 1520 feet depth (See Attachment 6, prognosis)
	SATURATED ZONE	USGS	WHEN GROUNDWATER ENCOUNTERED approx. 2390 feet depth (prognosis)
CUTTINGS	derived either from reamed drilling (after coring) or non-core drilling	LANL-Chlorine-36 measurements	package 18 kg (40 pounds) of drill cuttings from each 6 meters (20 feet) of hole advance through the Tcw unit 400 grams taken every 5' of hole advance through

		SNL Lithology (USGS) USGS-Calcite Content	Tcw, Ptn, TSw, and Chn units 5 kg (11, pounds) for each (5 feet) of advance.
CORE	Matrix Hydrologic Properties	USGS	8 cm (3 in.) of every 30 cm (12 in.) of contiguous core
GAS	Unsaturated Zone only	USGS	various packed off unsaturated intervals as chosen by PI (collected after drilling is completed)
	Hydrochemistry	USGS	30 cm (12 in.) of every 5 meters (15 feet) of contiguous core 362 feet contiguous core
	Hazardous Materials 1432' to 2615' depth Lithology 1108' to 1552' depth 2455' to 2605' depth	LANL/SNL	CONTIGUOUS CORE 350 feet Ptn 0 feet Tptpll 12 feet Tptpv to Tcb 338 feet

2.2 Contingency Plans for Sampling

In instances where a sample or test location is identified, but the sample or test is not required immediately or sampling is constrained due to safety or construction considerations, the TCO may identify a construction or test exclusion zone to allow later sampling.

3.0 WORK IMPLEMENTATION AND CONTROL

3.1 Implementation

The following list of activities includes those that both implement QARD requirements and management guidance. Items flagged with **QA:** are

recognized as being quality affecting unless specifically graded out by the organization performing the task. Items specifically graded out shall be appropriately documented and controlled by the organization performing the task. Items identified with a QA:N/A do not implement QARD requirements and are therefore considered administrative in scope. The sequence of QA activities may be modified by the TCO/FTC based on conditions in the field provided affected organizations concur and those modifications are documented.

Work conducted in the field shall be in compliance with the Surface-Based Testing Facilities Requirements Document (SBTFRD), this document and the work established in the referenced work program.

GENERAL ITEMS

QA:N/A TCO and designees will participate in constructors daily toolbox safety meetings that are held at YMP work sites during each shift. The TCO or designee may also conduct and document an additional, testing specific, toolbox safety meetings as necessary, as agreed to by the CMO.

QA:N/A PIs, SPS personnel, personnel who perform testing activities specific to this FWP shall coordinate field activities through the TCO.

QA:N/A The TCO will serve as point-of-contact for all testing activities defined in this FWP including drilling/coring operations, test installation and Data Collection Systems installation.

QA:N/A The CMO will coordinate road maintenance and dust control with the TCO/SPS to assure safe and adequate access to the worksite.

QA:N/A The TCO shall ensure that FDE, photography, and core logging services are provided as needed for the PI to collect scientific data.

QA:N/A The TCO will initiate and communicate tasks identified in this FWP.

QA:N/A Throughout the implementation of this FWP, the TCO will provide regular written reports to the DOE and M&O Managers addressing test specific progress.

QA:N/A PIs will provide necessary information to support TCO planning, management, and reporting requirements.

QA: The TCO will check pads and access roads to prevent water ponding that may enter the borehole. In accordance with DIE controls. This task will be documented.

QA:N/A The TCO will maintain a presence on behalf of DOE.

QA:N/A PHOTOGRAPHY SUPPORT personnel will take photographs as directed by the TCO and provide a list of photograph identifiers.

QA:N/A A list of photograph negative numbers supporting this FWP shall be submitted to the Project RPC by the TCO according to approved Project procedures.

QA:N/A The TCO will provide historical borehole information from the drilling report to the technical database.

QA: The **Constructor/Drilling Service Provider** will perform construction and test support activities in a manner consistent with the general construction requirements of approved design drawings and specifications.

QA: The TCO will visually check drill pads, test pits, and trenches for changes to drainage characteristics and for evidence of water ponding. These checks will be scheduled to the most restrictive of the following criteria: 1) at least monthly during construction/maintenance activities, 2) at least yearly during non-site disturbing activities, or 3) within 72 hours after 1 inch of liquid precipitation falls within a 24 hour period (as measured at meteorlogical station NTS-60).

QA: The **Constructor/Drilling Service Provider** will check vehicles for hydrocarbon leaks at least monthly, and will contain, mitigate and repair hydrocarbon leaks in excess of drips from all site sources upon discovery.

QA: The **Constructor/Drilling Service Provider** shall limit water application to 2.6ft/yr, or 0.48 gal/yd2/day unless approved by the Safety Assurance Department and prevent ponding of water.

QA: **Affected Organizations** may not permanently emplace chlorine/chloride-bearing compounds without documented evaluation and approval by the TCO prior to utilization.

QA: The **Constructor/Drilling Service Provider** may not use potable water nor DUSTAC for dust suppression, nor chlorine-containing salt grounding solutions.

QA: The **Constructor/Drilling Service Provider** shall grout boreholes consistent with the criteria identified in the grout plan.

BOREHOLE DRILLING

QA:N/A The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will supply the personnel and equipment to drill the borehole including: provide a sump catchment system (i.e., a tank or lined pit), provide adequate inner core barrels and any needed split lines to allow coring operations to proceed without interference from coring extraction, logging, and boxing will monitor and provide fuel usage and hours of operations of all NO_x producing equipment to M&O EPO on a monthly basis.

QA: The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will minimize use of water when approved for drilling activities and will transfer core samples to Sample Support Personnel.

QA: The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will provide traced water in quantities as requested by TCO and record traced water use on a shift basis at the direction of the TCO. Re-circulated water shall not be re-traced with LiBr.

QA:N/A The **FDE and/or Constructor/Drilling Service Provider** will notify the TCO immediately if any changes or modifications to the drilling program based on the work program occur and will document such changes.

QA:N/A The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will: (1) maintain footage drilled per drill bit; (2) note who is the driller on site during coring operations; and (3) report these items on a daily operations report.

QA:N/A The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will maintain compliance with the Nevada State permit referenced in Section 8, including providing a Nevada State licensed water well driller.

QA: The **INJECTION COORDINATOR** is responsible for limited maintenance, set-up, and storage of the "Tracer Gas Injection System" as well as designating trained personnel to operate the system in accordance with HP-07 and the State approved Underground Injection Permit (UIC).

QA:N/A During active drilling activities, the **INJECTION COORDINATOR or DESIGNEE** will check daily the injection equipment to adjust and report events associated to the "Tracer Gas Injection" system.

QA:N/A FDE staff will note on the daily operations report which Injection Coordinator or Designee is on site during air coring operations.

QA:N/A The **INJECTION COORDINATOR OR DESIGNEE** shall ensure that SF_6 or other approved tracer, is used to tag drilling air used in any dry

drilled/cored boreholes under the scope of this FWP. At a minimum, they will monitor the pressure in the SF_6 compressed gas cylinder; monitor the digital read-out of the power supply connected to the mass flow controller and adjust as necessary; and shut off gas flow when not in use. Generally the digital reading should be one half of the compressed air flow output connected to the drill rig.

QA:N/A The **TCO** will provide on-site direction for drilling transitions to coring and collection of water samples and perched-water/water table testing.

QA: The **INJECTION COORDINATOR** or Designee will halt drilling/coring operation when the cylinder pressure drops below 500 psig.

QA:N/A The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** shall ensure that two cylinders of compressed SF_6 be on location at all times. One cylinder should be in-use and a spare (full) cylinder should be available for change-out. The Constructor/Drilling Service Provider will supply SF_6 gas and provide limited maintenance.

QA:N/A If the tracer concentration exceeds the UIC permit level as identified or if any problems are encountered, the **INJECTION COORDINATOR OR DESIGNEE** will halt all dry drilling/coring operations, notify the TCO Field Test Manager, document the problem, and repair the system if necessary.

QA: The **INJECTION COORDINATOR** will provide to the SPS written documentation listing total volumes used including concentration of initial gas used for all dry drilling conducted in support of this FWP.

QA:N/A The **INJECTION COORDINATOR** or **TCO** is responsible for reporting tracer gas usage and concentrations to the M&O EPD on a monthly basis.

QA: The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will survey and document the borehole collar locations in accordance with QA procedures.

QA: **Affected Organizations** shall leave surface casings in place or re-install them to prevent surface water intrusion into boreholes.

QA: The **TCO** or **designee** will visually examine drill core and cuttings for evidence of natural water sources during drilling and notify the PI if perched-water is suspected.

QA: Upon discovery of perched water, the **TCO** will stop drilling and invoke the perched water plan developed by the PI.

BOREHOLE TESTING

QA:N/A The **TCO** will direct activities on geophysical logging.

QA: PIs are responsible for collection, management, and submittal of data, in compliance with Project and applicable PI plans and procedures. All transfers of data between YMP Participants, submittal of data to the YMP database, and transfer of data to outside parties shall be conducted in accordance with YAP-SIII.3Q, "Processing of Technical Data on the Yucca Mountain Site Characterization Project," and other applicable plans and procedures.

QA: Borehole gyroscopic surveys will be provided by **geophysical logging support** at direction of the TCO.

QA:N/A The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will provide labor, technical support service, support equipment and materials required for test instrumentation installation, including grouting, lifting, and access, as directed, coordinated and scheduled by the **TCO**.

QA: The PIs affected, or scientific staff may install instrumentation in agreement with the TCO and in accordance with their QA technical procedures or scientific notebook procedures.

QA: Upon notification from the TCO, the PI will conduct daily tests for the presence of free-standing perched-water provided conditions allow for the use of a moisture probe.

QA: The PIs, or designees, will collect field data in accordance with scientific notebook procedures identified in Section 1.3 or other applicable QA procedures.

QA: The PI will transmit initial and reduced data to the records system in accordance with YAP-SIII.3Q as identified in Section 6.1 of this FWP.

QA:N/A The PI will request and schedule instrumentation package installation and removal with the TCO.

QA:N/A PI organizations will provide an information copy of instrumentation description, calibration reference, instrument location and the instrument system unique identifier by physical location to the TCO.

QA: The Affected Organizations shall limit the release of committed organic substances in boreholes to no more than 11.24 grams per 20 meters of borehole length unless approved by the Safety Assurance Department.

BOREHOLE SAMPLING

QA: The PIs will accept the Boreholes in writing.

QA:N/A: A list of unique sample numbers shall be provided to the TCO by the **Sample Collection Support** and the PI.

QA:N/A The **TCO** will define and document the disposition of cutting and/or core generated from drilling/coring activities associated with this FWP as outlined in procedures YAP-SII.1Q, YAP-SII.2Q, and YAP-SII.4Q. The records resulting from these procedures provide the sample collection criteria including sample packaging requirements.

QA: The **SAMPLE COLLECTION SUPPORT** personnel will collect cutting or core samples from the Constructor/Drilling Service Provider in accordance with NWI-DS-001Q.

3.2 Contingency Plans

No foreign material is to be left in or around the borehole following completion of the drilling activity to the extent practical.

Any item lost in the borehole will be evaluated and pursued using fishing operations for recovery. And if not recoverable, it shall be reported, and recorded in the TFM database in accordance with YAP-2.8Q.

Every effort shall be made to avoid spilling of fuels, lubricants or coolants into or around the borehole area. Should spills occur, they should be cleaned up as much as practical (e.g., recovery of oil-soaked sand) by the constructor per their procedures. Any spilled materials not recovered shall be recorded in terms of quantity, description of local area impacted, and nature of material spilled. This record shall be entered into the activities records and reported to the TFM Manager in accordance with YAP-2.8Q.

3.3 Prerequisites and Hold Points

N/A

3.4 Stop Work

Affected organizations must inform the TCO if quality-related work elements cannot be conducted as described in this FWP. The TCO will, if applicable, stop work on those elements. If FWP revisions are required, work on affected elements will be stopped until the modifications have been completed and controlled by the Project. The Assistant Manager for

Environmental Safety and Health (AMESH) or any individual may stop work for Safety and Health-related issues if an imminent danger exists. Employees' rights relating to safety or health imminent danger conditions are described in Section 1.8.3 of the M&O Safety and Health Plan.

4.0 ADMINISTRATIVE (NON-QA) INSTRUCTIONS

4.1 Environment, Safety, and Health

4.1.1 Environment

Environmental Compliance
All work shall be in compliance with the Environmental Stipulation Letters produced for the activities at the USW WT-24 Borehole.

A Radiation Work Permit (RWP) is requested for use of radioactive materials. AP-6.7 and Radiological Protection Program will govern radiological related-work . State permits may also be required.

4.1.2 Safety and Health

1. General Safety and Health (S&H) requirements apply to this test activity; there are no specific requirements.
2. Participating organizations shall comply with the requirements of the M&O Safety and Health Plan and established M&O procedures and rules.

Safety and Health Roles and Responsibilities:
The TCO and the M&O for the YMP regards the S&H of all employees to be of paramount importance. In order to establish and maintain a high degree of safety and health awareness on the YMP all organizations and employees involved with the scientific characterization activities must clearly understand their roles and responsibilities in maintaining a safe and healthful workplace.

The responsibility for S&H on the YMP begins with the M&O Contractor, flows down through the M&O CMO, then to the TCO and the Constructor. From these organizations, responsibility flows down to the respective organizations conducting actual work on the YMP, including scientific characterization organizations, through the umbrella of the M&O Safety and Health Plan. The M&O Safety and Health Plan establishes implementing guidance through written YMP S&H programs and procedures (i.e., Occupational Respiratory Protection, Noise Control and Hearing Conservation).

Responsibility for the S&H of M&O employees flows through **M&O line management and each organization's supervision, then ultimately to individual employees.**

The Constructor/drilling service provider: The constructor performs support services for the scientific characterization work being conducted on the YMP. The constructor/drilling service provider has S&H responsibility for their own employees, for maintaining the YMP Site in a safe and healthful condition, for maintaining mobile and stationary equipment, some S&H training, and training in the safe operation of certain pieces of equipment. The constructor/drilling service provider will only maintain a full time presence during drilling activities at all remote worksites on the YMP, but will assist anytime when contacted. The TCO as the M&O manager for field testing activities, and/or assigned scientific organization staff (i.e., LLNL, LBNL, SNL, and/or USGS) will maintain M&O line management and/or organization supervision at the Site at all times.

TEST COORDINATION OFFICE, and other Scientific Organizations: TCO, and other scientific organizations are responsible for the S&H of their employees through M&O line management and each organization's supervision. When both the TCO and scientific organization line management and supervision occupy a YMP worksite at the same time, the TCO will have S&H coordinating responsibility. When a YMP worksite is not occupied by the TCO, scientific organization line management and each organization's supervision will have S&H coordinating responsibility.

TCO, and other scientific organizations always perform work under the M&O Safety and Health Plan, and/or their own organization Safety and Health Plan.

Organization supervisors are responsible for the workplace implementation of S&H standards, codes, regulations Project procedures and programs.

The TCO, under agreement with the CMO may conduct additional testing specific Toolbox Safety meetings during each shift.

Individual M&O Employees: Individual M&O employees, regardless of their employer, are responsible for understanding the requirements of the safety and health programs of their employer and specific YMP S&H programs (i.e., Occupational Respiratory Protection, Noise Control and Hearing Conservation, Personal Protective Equipment [PPE]).

Individual M&O employees are responsible for ensuring that the S&H training they have received is followed and implemented, regardless of whether the training was received from their parent organization or on the YMP. Individual M&O employees are responsible for immediately notifying the construction shift supervisor and their M&O line manager of unsafe acts, conditions, and/or equipment.

A discussion of the roles and responsibilities addressed in this FWP is also included in the Safety Review (SR) (Attachment 5) that is conducted by the TCO S&H Specialist.

The SR is an attachment to the FWP and has been compiled in order to evaluate and transmit information on the potential hazards that may be encountered while installing, operating and/or maintaining scientific investigation equipment or instrumentation on the YMP. Each organization's line management and supervision should read the SR and use it as a guideline for informing, educating and implementing protective measures for the identified hazards. A copy of the SR, Laser Operating Permit, and RWP for the temporary use of radioactive materials will be available at the TCO field office, the Las Vegas Office, and will be transmitted to test and constructor organizations working on the YMP.

Employee Training: Personnel requiring access to the YMP ESF Site must have completed or be escorted by an individual with General Employee Training (GET) and First Aid training.

PPE is required for all persons entering any construction site on the YMP (i.e., hard hat, steel toe shoes, approved (ANSI Z87) safety glasses, and/or hearing protection (plugs or muffs).

In certain areas of the ESF, Occupational Respiratory Protection is required. Managers and supervisors should be aware that respirator fit testing is an annual requirement that includes a physical examination.

All participants shall adhere to the Occurrence Reporting and Processing System for accident reporting in accordance with DOE Order 0232.1.

Use of Tracers in excess of State approved levels must be brought to the attention of the M&O Environmental Department by the TCO as soon as possible.

Hazardous materials (i.e., Erionite) may be encountered above and/or below the Topopah Springs vitrophyre during drilling or reaming

operations. The buffer zone is 50 feet above the vitrophyre and 50 feet below the vitrophyre of the Calico Hills Unit.

4.2 Points Of Contact

Steve Opp	Project Engineer	295-6379
Loretta Camp	FOC Visitor Control	295-5915
Frederick Venzie	FOC Logistics Coordinator	295-5438
Ronald Oliver	TCO Manager	295-3578
Michael Taylor	TCO Safety Coordinator	295-3647
Richard Kovach	FTC	295-6180
Donald Unglesbee	Photography Support	295-5965
Drew Coleman	DOE/YMSCO	794-5537
Thomas Pysto	Environmental	295-5082
Richard McDonald	Construction Manager	295-3703
Kurt Rautenstrauch	Environmental Studies Department	295-4952
Paul Buck	Contact for DRI Archaeologist	895-0424
Charles W. Parker	Safety and Health Manager	295-2442
Debra L. Edwards	Test Coordinator	295-5745
Alan Mitchell	Testing TFM	295-6539
Chris Lewis	SMF	295-6105
Eddie Wright	SPS Manager	295-5589
Jan Zigler	Tracer Injection	295-5533
Bud Thompson	Geophysical Logging Support	295-4866

4.3 Schedule

See Section 7.0, Attachment 3

5.0 FIELD VERIFICATION AND SCOPE COMPLETION

5.1 Field Verifications

No field verifications for this scope of work have been identified at this point.

5.2 Scope Completion

The scope of this FWP will be completed when each PI has notified the TCO in writing that all testing activities associated with this FWP have been completed and no further data will be collected.

6.0 RECORDS

6.1 Records Identification

PIs are responsible for collection, management, and submittal of data, in compliance with Project and applicable PI plans and procedures. All transfers of data between YMP Participants, submittal of data to the YMP database, and transfer of data to outside parties shall be conducted in accordance with YAP-SIII.3Q, "Processing of Technical Data on the Yucca Mountain Site Characterization Project," and other applicable plans and procedures.

All records shall be submitted to the Records Processing Center (RPC) within 90 days of their completion. An information copy of any records submitted to the RPC will be sent to the TCO Test Manager assigned to the activity. The FWPRC will coordinate and monitor the development of the FWP records package. The records package shall contain documents that demonstrate compliance with YMP procedures. The completed records package for this test may contain (or reference) the following:

Record	Organization	QA Designator
Revisions/Changes to this FWP	TCO	QA:L
Regular Reports Addressing Test Status	TCO	QA:N/A
Photograph Negative Numbers Supporting Test Activities	Photography Support	QA:N/A
Sample Numbers and Corresponding Accession Numbers Supporting Test Activities	Sample Collection Support and/or PIs	QA:L
As-Constructed Borehole Survey Coordinates	Constructor/Drilling Service Provider	QA:L
Safety Reviews	TCO	QA:N/A
TCO Modifications to the FWP Work Sequence	TCO	QA:L
TDIFs containing Historical Borehole Information	TCO	QA:L
Drilling Information/Reports	FDE	QA:L

SF_6 Usage Information	Injection Coordinator	QA:L
All Construction/Testing Related TFM Usage	Constructor/Drilling Service Provider and TCO	QA:L
Toolbox Safety Meeting Documentation	Constructor/Drilling Service Provider and TCO	QA:N/A
Documentation that Boreholes Drilled or Cored are Acceptable for Test Instrumentation.	PI Organizations	QA:L
Documentation Identifying Work As Complete	PI Organizations TCO	QA:L
Checks for ponding of water and changes to drainage characteristics	TCO	QA:L
Results of testing for perched-water	PI	QA:L
Construction/Testing related use of TFM	Constructor/Drilling Surface Provider/TCO	QA:L
Downhole survey measurements	Geophysical Logging Support	QA:L
Perched Water Plan	PI	QA:L
Grout Plan	TCO	QA:L

6.2 Records Generation

Activities within the scope of this FWP will be documented in accordance with AP-17.1Q.

All records generated by the affected organizations in testing and test support will meet the legibility, accuracy, and completeness requirements specified in AP-17.1Q, as applicable. If a scientific notebook is utilized, it shall be stored in accordance with the participant procedures.

7.0 ATTACHMENTS

Attachment 1 Location Map for Planned Activity (QA:N/A)
Attachment 2 Schedule of Activities (QA:N/A)
Attachment 3 Field Operations Permit (QA:N/A)

Attachment 4 Safety Review (QA:N/A)
Attachment 5 Prognosis

8.0 REFERENCES

1. Moisture Studies in the Exploratory Studies Facility, FWP-ESF-96-004, Rev. 1, March 13, 1997.

2. Test Planning Package T-95-01, Borehole USW WT-24 Drilling and Testing, Rev. 0, August 1995.

3. Job Package 95-10, Borehole USW WT-24 Drilling and Testing, Rev. 0, August 1995.

4. "Nevada Revised Statutes and the Nevada Injection Control Permit Number UNEV89031," January 25, 1996.

5. USW WT-24 Drilling Work Program, YMP/WP/97-02, Rev. 0, June 2, 1997.

6. Surface-Based Testing Facilities Requirements Document, YMP/CM-0022, Rev. 2, February 14, 1996.

7. Quality Assurance Requirements and Description, DOE/Rw-0333P, Rev. 7, June 2, 1997.

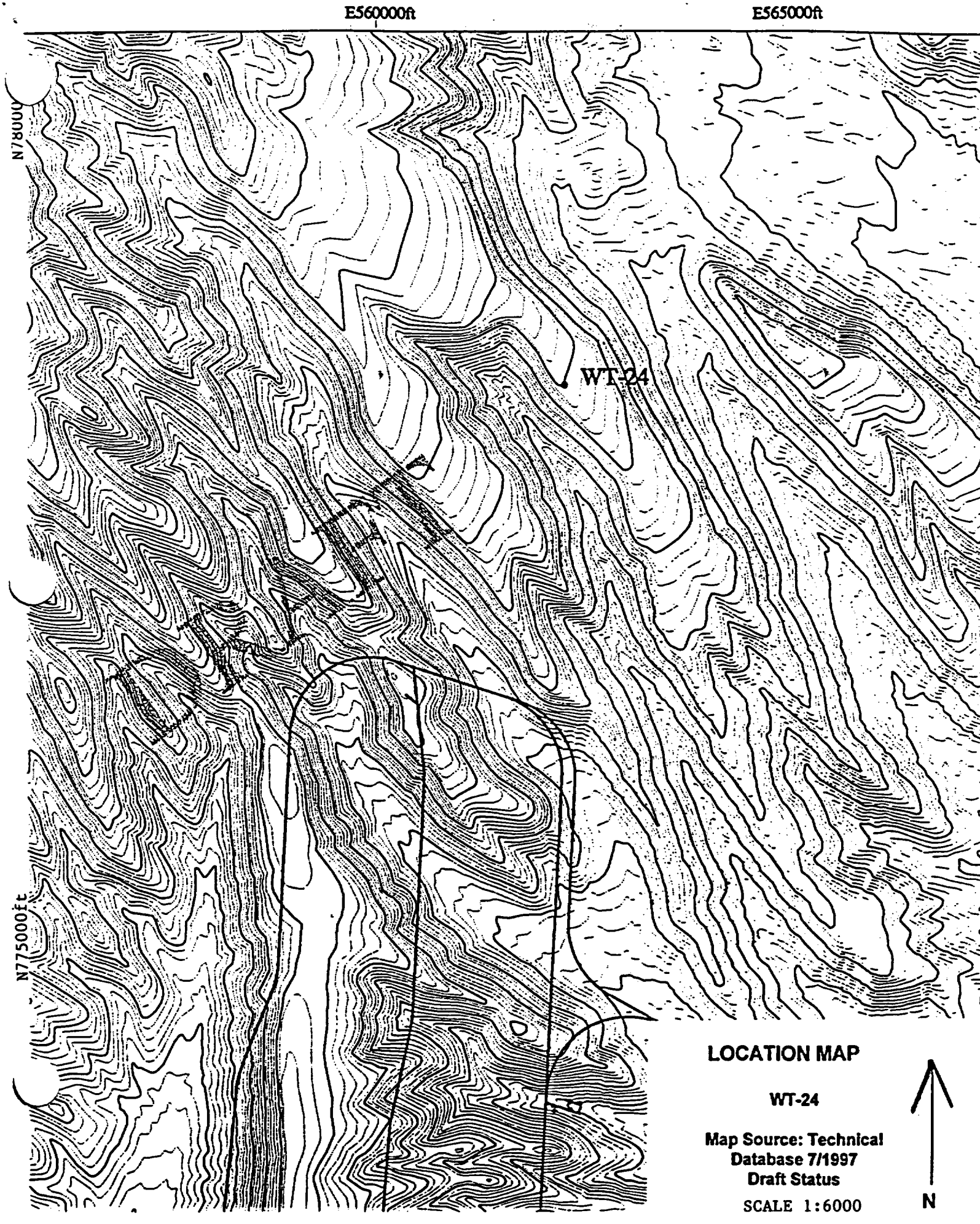
8. Electronic Correspondence, Eddie Wright to Drew Coleman, "UZ/SD Hole," dated October 4, 1996.

9. M&O Safety and Health Plan, B-00000000-01717-4600-00016, Rev. 02, December 11, 1996.

10. "DIE for Surface-Based Testing Activities," BAA000000-01717-2200-00101, Rev. 00, July 13, 1997.

11. Class II Air Quality Operating Permit #AP9611-0573, July 1, 1997.

LOCATION MAP FOR PLANNED ACTIVITY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WT-24
LOCATION MAP
WT-24
Map Source: Technical
Database 7/1997
Draft Status
SCALE 1:6000
N

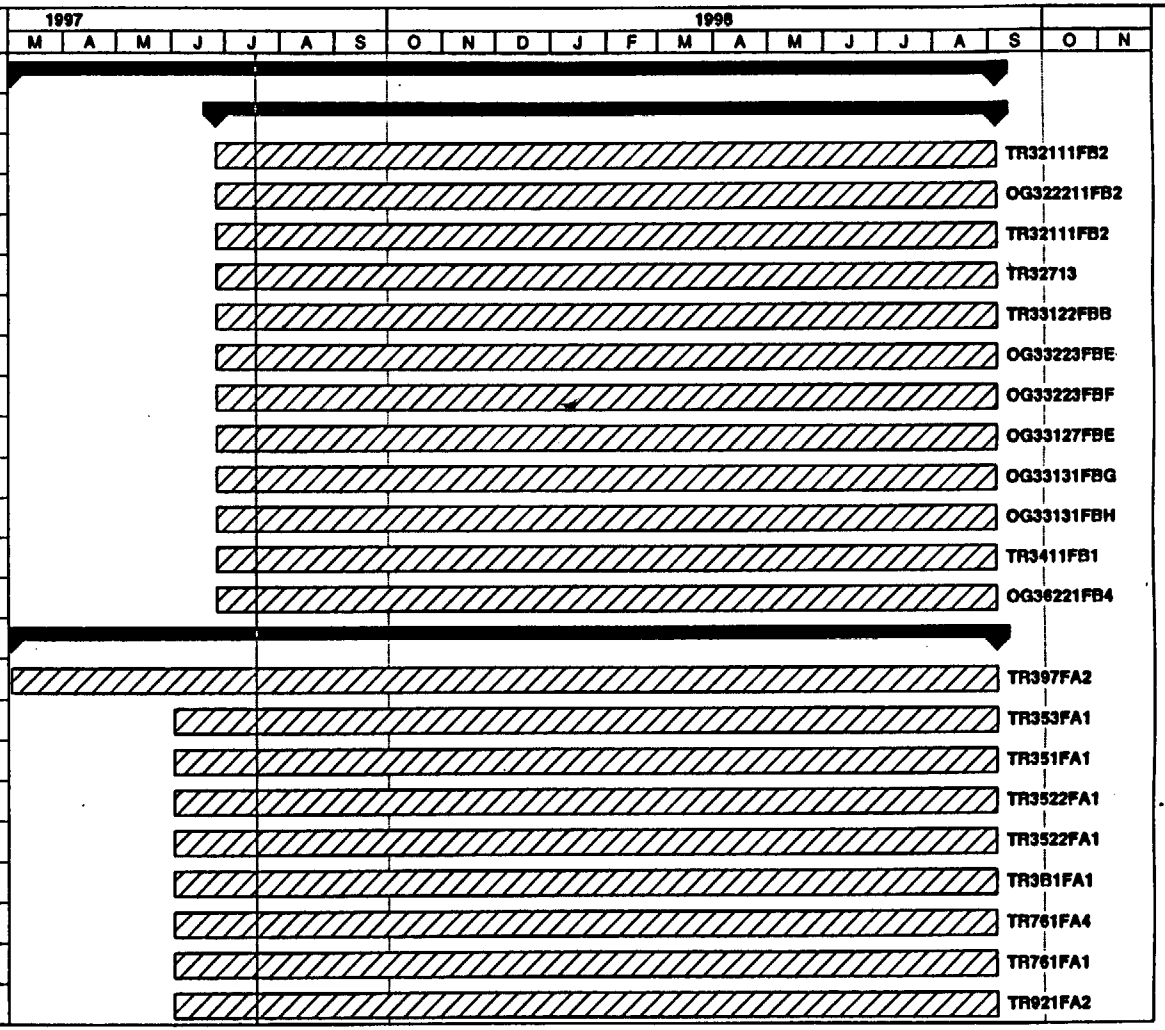
Borehole UE WT-24 Drilling and Testing

FWP-SBT-97-005, R0 ATTACHMENT 2

Summary Schedule Information (QA:NA)

Note: years are represented as fiscal years.

ID	Task Name	Dur	Start	Finish
1	Borehole UE WT-24 Summary Schedule	395d	3/3/97	9/4/98
2	Test Implementation- Discrete	312d	6/26/97	9/4/98
3	Quantitative Mineralogy	312d	6/26/97	9/4/98
4	Stratigraphy	312d	6/26/97	9/4/98
5	Lithologic Logging	312d	6/26/97	9/4/98
6	Rock Analysis	312d	6/26/97	9/4/98
7	Chlorine-36	312d	6/26/97	9/4/98
8	Pneumatic Monitoring and Air Permeability	312d	6/26/97	9/4/98
9	Matrix Properties of Hydrologic Units	312d	6/26/97	9/4/98
10	UZ Hydrochemistry	312d	6/26/97	9/4/98
11	Perched-Water and SZ Hydraulic Testing	312d	6/26/97	9/4/98
12	Eh & pH Measurements	312d	6/26/97	9/4/98
13	SZ Hydrochemistry	312d	6/26/97	9/4/98
14	Analysis of cuttings/core and geophysical log	312d	6/26/97	9/4/98
15	Test Implementation- Matrix	395d	3/3/97	9/4/98
16	Test Management	395d	3/3/97	9/4/98
17	Construction Support	330d	6/2/97	9/4/98
18	SMF Management	330d	6/2/97	9/4/98
19	Tracer Support	330d	6/2/97	9/4/98
20	Drilling Engineers	330d	6/2/97	9/4/98
21	Surface-Based Geophysical Log Data	330d	6/2/97	9/4/98
22	Photographic Support	330d	6/2/97	9/4/98
23	Field Surveying for Site Characterization	330d	6/2/97	9/4/98
24	Project Schedule Analysis and Maintenance	330d	6/2/97	9/4/98



Project: Borehole UE WT-24 Drilling and Testing
Date: 7/18/97

Task Summary

ADMINISTRATIVE USE ONLY

Borehole UE WT-24 Drilling and Testing

FWP-SB-97-005 R0, Attachment 2

Summary Account Information QA:NA

ID	Borehole UE-25 WT-24 Drilling and Testing TASK DESCRIPTION	WBS#'S	LEAD MATRIX ORG.	START DATE	FY 97 SUMMARY ACCOUNT NUMBER	FY 97 FUNDING SUMMARY ($K)	FY 97 COST ESTIMATE ($K)	FY 98 COST ESTIMATE ($K)
Borehole UE-25 WT-24 Drilling and Testing								
Test Implementation- Discrete								
3	Quantitative Mineralogy	1.2.3.2.1.1.1	M&O/LANL	6/26/97	TR32111FB2	780	273	273
4	Stratigraphy	1.2.3.2.2.1.1	USGS	6/26/97	OG322211FB2	176	79	62
5	Lithologic Logging	1.2.3.2.2.1.1	M&O/SNL	6/26/97	TR32111FB2	100	45	35
6	Rock Mechanical Properties	1.2.3.2.7.1.3	M&O/SNL	6/26/97	TR32713FB1	80	28	28
7	Chlorine-36	1.2.3.3.1.2.2	M&O/LANL	6/26/97	TR33122FBB	768	84	77
8	Pneumatic Monitoring and Air Permeability	1.2.3.3.1.2.3	USGS	6/26/97	OG33223FBE	704	317	246
9	Matrix Properties of Hydrologic Units	1.2.3.3.1.2.3	USGS	6/26/97	OG33223FBF	137	62	48
10	UZ Hydrochemistry	1.2.3.3.1.2.7	USGS	6/26/97	OG33127FBE	124	56	43
11	Perched-Water and SZ Hydraulic Testing	1.2.3.3.1.3.1	USGS	6/26/97	OG33131FBG	1,049	74	247
12	Eh & pH Measurements	1.2.3.3.1.3.1	USGS	6/26/97	OG33131FBH	1,049	472	367
13	SZ Hydrochemistry	1.2.3.4.11	LANL	6/26/97	TR3411FB1	651	163	163
14	Analysis of cuttings/core and geophysical logs	1.2.3.6.2.2.1	USGS	6/26/97	OG36221FB4	134	60	47
Test Implementation- Matrix								
16	Test Management	1.2.3.9.7	M&O/LANL/WCF	3/2/97	TR397FA2	376	169	169
17	Construction Support	1.2.3.5.3	TRW	6/2/97	TR353FA1	1,000	450	450
18	SMF Management	1.2.3.5.1	M&O/ SAIC	6/2/97	TR351FA1	1,610	290	97
19	Tracer Gas Support	1.2.3.5.2.1	USGS	6/2/97	OG3521FA1	80	12	0
20	Drilling Engineers	1.2.3.5.2.2	M&O/ SAIC	6/2/97	TR3522FA1	500	105	105
21	Surface-Based Geophysical Log Data	1.2.3.11.1	M&O/ SAIC	6/2/97	TR3B1FA1	117	53	53
22	Photographic Support	1.2.7.6.1	TRW	6/2/97	TR761FA4	128	13	0
23	Field Surveying for Site Characterization	1.2.7.6.1	TRW	6/2/97	TR761FA1	505	51	0
24	Project Schedule Analysis and Maintenance	1.2.9.2.1	TRW/ WCFS	6/2/97	TR921FA2	917	9	9
	Subtotals - Discrete					5,752	1,714	1,635
	Subtotals - Matrix Support					5,233	1,151	883
	Totals					10,985	2,865	2,518

FIELD OPERATIONS PERMIT

FIELD OPERATIONS PERMIT

Estimated Start Date 06/02/97 Permit Number 97-14

Date Permit Closed _____ Field Work Package 97-005

Date J.P. Closed _____ Date Approved 05/07/97

Sponsoring Field Agency(ies): CRWMS M&O, U.S. Geological Survey (USGS)

Field Activity/Operation: *(brief description)* Road Enhancement, Pad Construction, Drilling Borehole, Testing Borehole USW WT24

Field Points of Contact:		Telephone #	Radio Net
Field Work Coordinator	William Distel	295-6485	
Construction/Drilling, etc.	Richard Kovach	295-6180	
Field Engineering	Eddie Wright	295-5589	
Principal Investigator(s)	Ron E. Smith	295-3453	
Site Safety Coordinator	Charlie Parker/Michael Taylor	285-4807	

Are radioactive or hazardous materials involved? ☒ Yes ☐ No

If Yes, explain: Geophysical Logs

Permit approved by TOD: *(if required)* N/A Date: _____

The following guidelines apply to this work:

X 1. Provisions of applicable YMP-FOIs/NTS-SOPs except as may be described below.
X 2. All YMP materials being transported off the NTS must be processed through the YMSO-FOC and REECo RAMATROL.
X 3. The YMSO-FOC (5-5915) will be notified upon completion of this operations permit.
X 4. Safety and health coordination responsibilities assigned.
X 5. All hazardous waste packaged in appropriate containers and reported to the YMSO-FOC.
X 6. Personnel field safety training completed.
X 7. Head counts and personnel location are to be reported to YMSO-FOC each day before 0830 hours.
X 8. Daily progress reports provided to YMSO-FOC by 0830 hours the day following activity.
X 9. YMSO-FOC to notify OCC upon completion of activity.
X 10. All accidents are to be reported to the YMSO-FOC as soon as possible.
_____ 11. Comments/remarks _____

N/A

Agency Representative Signature *(if required)*

Permit Issued By

CC: TEST OPERATIONS DIVISIONS, NV
OCC-CP-1, M/S 210
TEST SITE OFFICE, M/S 701
YUCCA MOUNTAIN SITE OFFICE, M/S 717

SAFETY REVIEW OF FIELD WORK PACKAGE (FWP) FOR DRILLING AND TESTING USW WT-24

1.0 INTRODUCTION

This Safety Review (SR) has been compiled by the Test Coordination Office (TCO) to evaluate the potential hazards that may be associated with Drilling and Testing of USW WT-24. This SR is also being conducted to ensure that information about potential hazards will be transmitted to all affected organizations, TCO employees, and constructor organizations working at the USW WT-24 Borehole Site.

1.1 EQUIPMENT SCOPE AND SCOPE

This SR will provide guidance for scientific personnel conducting Geophysical Logging, Perched Water Sampling, Hydrologic Testing and Mineralogical Evaluations at the USW WT-24 Borehole Site. The USW WT-24 borehole will be "dry drilled" using the Stratmaster Drill Rig. The planned core size for the borehole is approximately 2.4 inches, with compressed air being used as the drilling fluid.

A tracer gas (Sulfur Hexafluoride/SF6) will be added to the drilling air. Core cuttings, water, and core samples will be collected from the borehole. Hydrochemical and hazardous materials (i.e., Erionite) will be sampled.

Testing at the USW WT-24 borehole will consist of Geophysical Logging and downhole videos, Hydrologic tests will include hydraulic tests (i.e., pumping and/or bailing of the borehole, monitoring the potentiometric surface, and collecting hydrochemical samples. Mineralogical evaluations include assessing alteration history and fracture mineralogy.

A detailed description of all data collection system activities can be found in Field Work Package (FWP-SB-97-005).

2.0 HAZARDS

2.1 SITE SPECIFIC HAZARDS

Potential hazards to surface-based testing personnel conducting Stratmaster Drill Rig Activities and Borehole Testing Activities on the YMP are:

HAZARD No	HAZARD Yes	
	X	**Working Alone/Working in Remote/Isolated Areas:** The USW WT-24 Borehole will be located in a remote/isolated site. Working alone is not permitted. A buddy system should always be used. Radio Net and/or telephone communications is required.
	X	**Extended Working Hours/Extended Driving Hours:** During some USW WT-24 Borehole testing activities, extended working hours and extended driving hours will be encountered.
	X	**Inclement Weather/Temperature Extremes:** High winds, rain, hail, lightning strikes and snow. Personnel working on the USW WT-24 Borehole could encounter both cold and hot temperature extremes.
	X	**Crystobalite Silica & Erionite:** In certain geologic zones, at the USW WT-24 Borehole, Silica Dust containing Erionite could be encountered during "dry drilling" and core recovery operations.
	X	**Mechanical/Equipment:** Well hoisting equipment. Stratmaster Drill Rig Equipment.
	X	**Physical Hazards - High Noise Levels:** Equipment used at the USW WT-24 Borehole site will require hearing protection.
X		**Chemical Hazards/Hazardous Materials:** Tracers, Fluids and Materials (TFM) that may be used at the USW WT-24 Borehole site must be on the YMP Approved list.
	X	**Electrical:** Power cables, junction boxes, extension cords and hand tools.
	X	**Fall Hazards:** When working at a height greater than six feet.
	X	**High Pressure:** Air compressors and pneumatic equipment. Compressed air equipment, gas/air in bottles/cylinders.
	X	**Hantavirus:** Work areas that have signs of rodent infestations (i.e., droppings, nesting materials) need to have traps set to eliminate the rodents, and the areas need to be cleaned and disinfected before occupancy by YMP Personnel.

X **Radiation:** Neutron sources will be used to conduct wireline borehole logging operations.

X **Fire:** No hazards identified at this time.

X **Walking and Working Surfaces:** Slips, trips and falls.

3.0 HAZARD CONTROLS

Working Alone/Working in Remote/Isolated Areas: The USW WT-24 Borehole site is located in a remote/isolated area. Therefore field work shall be conducted in teams of two or more persons. Use of the buddy system is mandatory. The scientific personnel conducting borehole activities shall be in two-way communications (either by radio and/or phone) with a base station (i.e., ESF TCO-295-3483, Net #5 Radio; or Ranch Control-295-5915, YMP#1 Radio Net) and established a regular check-in schedule.

At the beginning and end of daily borehole activities, scientific personnel need to check in with Ranch Control and the ESF TCO with a head count of personnel.

Personnel conducting USW WT-24 Borehole activities should never venture into the field without a radio, first aid kit, and water.

For life-threatening injuries or medical emergencies, on the NTS Radio Network, call "Mayday, Mayday, Mayday". Ranch Control also has to be notified.

Extended Working Hours/Extended Driving Hours: During some USW WT-24 Borehole testing activities extended working and extended driving hours will be encountered. Whenever possible, personnel conducting borehole activities should utilize the "buddy system". Transportation, back and forth to the borehole site should be done in pairs (or more) riding together in a single vehicle. Find someone to ride with who will stay awake and monitor your driving.

Nevada State Law requires you to wear seat belts, and U.S. Department of Energy requires you to wear a seat belt if you are driving a government vehicle. Drivers of vehicles are responsible for ensuring that passengers wear their seat belts.

Inclement Weather/Temperature Extremes/Sunburns: Personnel conducting USW WT-24 Borehole activities could encounter severe inclement weather (rain, lightning strikes, and/or high winds) with little or no warning.

Sunburn is a very define possibility if you are going to be outside most of the day. Always wear "sun screen", long pants and long sleeved shirt.

NTS Net Radio Control ("900") monitors the National Weather Service for conditions on the test site, and broadcasts them over all radio nets on the NTS, including the YMP site. Borehole security personnel should have YMP Net 1 radios with them when they go into the field in order to monitor "900" weather control. If severe weather warnings and/or lightning strikes are issued, personnel should suspend work and take cover inside vehicles or leave the site altogether. At certain times of the year, severe cold and hot temperatures could be routinely encountered at borehole sites.

In cold environments: The objective of preventing USW WT-24 Borehole personnel from experience the effects of cold stress is centered around preventing the deep body (core) temperature from falling below 36 degrees C (96.8 degrees F). For a single, occasional exposure to a cold environment, a drop in core temperature to no lower that 35 degrees C (95 degrees F) is permitted.

Lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

In protecting borehole security personnel from the effects of cold stress, the following items should be noted:

- Pain in the extremities may be the first early warning of danger to cold stress.
- Suits and cold weather gear should provide whole body protection, with emphasis on hands, feet and head from cold injury.
- The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If fine work is to be performed with bare hands for more than 10-20 minutes in cold conditions below 16 degrees C (60.8 degrees F), special provisions should be established for keeping employees hand's warm (i.e., fuel burners, warm air jets, electric radiators).
- If USW WT-24 Borehole work involves the use of evaporative chemicals/liquids (i.e., gasoline, alcohol, or cleaning fluids), then special precautions should be taken to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.
- If work at the borehole sites needs to be performed contiguously in temperatures that are below -7 degrees C (19.4 degrees F) then a "Work-Warming Regimen" must be established and implemented.

Controlling Cold Stress:

Personnel conducting USW WT-24 Borehole activities can find guidance for working in cold environments and for work/rest regimens in the 1993-1994 Threshold Limit Values Booklet for Chemical Substances and Physical Agents published by the American Conference of Governmental Industrial Hygienist (ACGIH).

In hot environments: Temperatures in Area 25 can reach 120 degrees F in the hottest part of the summer. Working in these hot work conditions/environments with elevated humidity readings will produce elevated heat stress levels. In conditions such as these, three types of emergencies can occur that involve heat stress; heat cramps, heat exhaustion and heat stroke.

Personnel conducting USW WT-24 Borehole activities should be aware of the following symptoms of heat stress and accompanying first aid treatments:

Heat Cramps:

Symptoms:

1. Muscle cramps in legs and abdomen.
2. Pain accompanying cramps.
3. Profuse sweating.
4. Faintness.

First Aid Treatment:

1. Move to cool (air conditioned) place.
2. Sip salted water (1 teaspoon of salt in 1 quart).
3. Massage cramped muscles.
4. Obtain medical treatment.

Heat Exhaustion:

Symptoms:

1. Profuse sweating.
2. Intense thirst from dehydration.
3. Cool, moist skin (clammy and pale).
4. Fatigue, weakness, dazed.
5. Dizziness.

First Aid Treatment:

1. Move to cool (air conditioned place).
2. Loosen tight clothing and remove excess clothing.
3. If conscious, sip salted water.
4. Treat for shock, lay on back and raise feet slightly.
5. Stay with the victim until medical aid arrives.

Heat Stroke:
(Please note: Heat Stroke is a medical emergency)
Symptoms:
1. Can occur suddenly, with little warning.
2. Dizziness, raging headache.
3. Hot, dry, flushed skin.
4. Full and fast pulse.
5. Breathing deep at first, later shallow breathing.
6. High temperature (106 degrees or higher).
7. Confused delirious behavior.
8. Muscle twitching, growing into convulsions.
9. Loss of consciousness or coma.

Emergency Care:
1. Heat Stroke is a true medical emergency, arrange transport to a medical facility without delay.
2. Move to cool (air conditioned) place.
3. Strip to underclothes.
4. Lay on back, head and shoulders raised slightly.
5. Assure breathing airway is open.
6. Put ice or cold wet cloth on head.
7. Cool body with water or wet cloth.
8. Do not give coffee, cigarettes or a stimulant.

Controlling Heat Stress: Personnel conducting USW WT-24 Borehole activities should:

- Follow scheduled work/rest cycles. Guidance for work/rest regimens can be found in the 1993-1994 ***Threshold Limit Values Booklet for Chemical Substances and Physical Agents***, published by the ACGIH.
- Workers should alternate between light and heavy work.
- Where possible, rotate duties among several workers.
- Drink plenty of water. Drink at least 16 ounces about an hour before and then 5 to 7 ounces every 15 to 20 minutes during work. Some people find electrolyte drinks (i.e., Gatorade) effective instead of, or in addition to water.
- Encourage workers to wear loose fitting, light-colored clothes whenever possible.

Personnel conducting USW WT-24 Borehole activities should drink plenty of liquids and take frequent breaks. M&O Safety and Health Department procedure, **NAP-SH-008, Occupational Heat Stress,** provides guidance for dealing with potential heat stress conditions and establishes responsibilities within the M&O.

Crystobalite, Silica & Erionite: There are several crystalline silica minerals (i.e., quartz, cristobalite and erionite) that may be encountered while conducting

"dry drilling" operations at WT-24 on Yucca Mountain that are classified by the International Research Agency on Cancer (IARC) as "probable" human carcinogens.

As reported in the "Distribution of Potentially Hazardous Phases of the Subsurface at Yucca Mountain, Nevada"(LANL #LA-12573-MS) the mineral "Erionite" has been found in geologic zones that have been identified by previous drilling activities. The Stratmaster Drilling activities at the WT-24 Borehole site could penetrate some of these zones that contain Erionite.

Erionite may pose a risk if encountered in sufficient quantity even when standard modern Stratmaster "Dry" Drilling practices are followed, due to its apparently extremely high carcinogenic potential. However, erionite occurrence at Yucca Mountain appears to be restricted to zones immediately below the potential repository horizon. Consequently, it may only be a concern where the ESF workings may penetrate into the basl vitrophyre of the Topopah Spring Member.

Predicting the Occurrence of Erionite in the WT-24 Borehole is part of the "test deliverables" that have been developed for the FWP at WT-24.

The WT-24 Borehole will be drilled to a depth of 2800 ft. At depths determined by the geologists, sampling and analysis for "Potentially Hazardous Minerals" will be conducted.

When the WT-24 Borehole reaches a depth of 1424 ft (50 ft above the vitrophyre) to 1616 ft (50 ft below the vitrophyre) or as directed by the borehole site geologist, an **Erionite Control Zone** will be established at the Stratmaster equipment site.

The Erionite Control Zone will consist of work practices, engineering, administrative and personnel protective equipment **control measures.**

A. The following **engineering controls** will be used to control drilling dust through the Erionite Control Zone:

   - The Stratmaster Dust Collection System.
   - The Haz-Vac.
   - Maintaining negative pressure on the dust collection system.

B. **Administrative controls** will involve the establishment of an **Erionite control zone/exclusion area and Decontamination Area.** Inside the control zone/exclusion area personnel will be required to wear respirators and other PPE as outlined in Section 1.6. This area will encompass the following:

- Area around the Stratmaster Dust Collection System (or Haz-Vac, if used), the conveyer, and cutting pit.

- Area used by personnel assigned to remove the core catcher and core from the inner barrel.

- Area for core extruding, processing/transmittal, and packaging of core and/or core cuttings. This area must be large enough to allow for cleaning and vacuuming of core boxes.

- Area for decontamination of personnel and equipment and donning and doffing of PPE. This area should have a shower enclosure.
- (See 1.7 below).

- In addition, a buffer zone will be established approximately 20' wide outside the Erionite control zone/exclusion area. No one will be allowed in this area, since it serves as a buffer zone to the area where PPE must be worn.

C. The **Decontamination Area** for personnel and equipment coming from working inside the control zone/exclusion area shall have the following features:

- A "de-con" area for removal and disposal of PPE.

- A shower enclosure. The shower enclosure may be located with one end in the regulated area, and the other end outside the regulated area.

- Area for storage of street clothes and an area for donning PPE.

- A personal hygiene area, (i.e., hand washing station).

D. The following administrative controls will be effect inside the control zone/exclusion area:

- Personnel will not be allowed to remove respirators or PPE to eat, drink, smoke, and/or chew tobacco.
- Work-rest routines will be worked out for all personnel through supervision. These routines will allow for personnel to remove PPE and respirators and take rest/food breaks outside the control zone/exclusion area.

- Good work place hygiene practices.

E. Inside the control zone/exclusion area the following **Personal Protective Equipment and Occupational Respiratory Equipment** will be worn at all times:

- A full face Powered Air Purifying Respirator (PAPR) with HEPA (Highly Efficient Particulates and Aerosols) Filter.
- Respirator selection, issue and use shall conform to the requirements of M&O Safety and Health Department Procedure **NAP-SH-009 "Respiratory Protection".**
- A "Tyvek" disposable full body overall, longsleeve with "booties" and hood.
- Two pairs of gloves (inner-surgical)(outer-work). The inner and outer gloves must be taped.

F. The following **Industrial Hygiene sampling and monitoring** shall be conducted while the Stratmaster drill rig passes through the Erionite Control Zone:

- Full shift employee **Breathing Zone and Area Sampling** for the presence of crystalline silica minerals (i.e., quartz, cristobalite and erionite).

G. Hazard Communication Employee Training. All employees (regardless of employer) shall receive Hazard Communication Employee Training that conforms to the M&O Safety and Health Department Procedure **NAP-SH-003 "Compliance with the OSHA Hazard Communication Standard" before** being assigned to the WT-24 site. In addition to this M&O "Haz-Com" Training, WT-24 employees shall receive the following "site specific" components:

- A description of the chronic and acute nature of the physical health hazards involved with crystalline silica minerals (i.e., quartz, cristobalite and erionite) that **could** be encountered within the drilling dust of the Erionite Control Zone at the WT-24 site.
- A description of the work practices, engineering, administrative and personal protective equipment control measures that are employed specifically at the WT-24 (Stratmaster) site.

H. Medical Surveillance. Supervisors and employees wearing respirators have specific responsibilities/actions under the respirator program. Employees must have completed a physical examination within the past year.

- WT-24 personnel requiring physical exams in order to wear occupational respiratory equipment should follow the guidelines that can be found in the M&O Safety and Health Department Procedure **NAP-SH-007 "Medical Surveillance"**. This procedure describes the requirements for medical surveillance and how M&O employees can arrange for physical examinations, on site through Bechtel Nevada Medical.

M&O Contractor Safety and Health Procedure, **NAP-SH-009, Respiratory Protection**, describes the respiratory protection program. Supervisors and employees wearing respirators have several specific responsibilities under this procedure. Employees must have completed a physical examination within the past year, and have no facial hair that interferes with the sealing surface of the respirator. M&O Safety and Health Procedure, **NAP-SH-007, Medical Surveillance**, describes how M&O employees arrange for physical examinations conducted on-site through Bechtel Nevada Medical. To schedule a physical examination, call 702-295-2957.

Mechanical: When USW WT-24 Borehole activities require scientific personnel to climb onto any piece of equipment, the equipment **must** first be locked and tagged out.

The Lockout-Tagout program is required by OSHA. It ensures that any time any type of work has to be done on electrical circuits and/or equipment with mechanical systems or components (i.e., hoisting equipment, drill rig equipment) they have to be deenergized, isolated, and rendered inoperative before employees can begin work. The program requires that the control circuits to these pieces of equipment be locked and tagged out to prevent accidental activation. Contact the TCO Field Test Representative (FTR) to arrange Lockout -Tagout assistance with the Constructor.

Before working around drilling equipment, attend the Constructor's Toolbox Safety Meeting that is held at the beginning of each shift. During the meeting, check with the Constructor's Drilling Forman and his personnel operating the equipment to ensure they know of your presence and that a daily safety inspection/equipment check has been done.

Physical Hazards - High Noise Levels: Personnel conducting USW WT-24 Borehole activities need to be aware that some of the areas around the site will be classified as high noise level areas. Hearing protection (ear plugs and/or ear muffs) must be used at all times and in all areas of these sites. Ear plugs and ear

muffs are available from the portal guard at the entrance to the tunnel. Ear muffs are available from the Constructor's Tool Crib located on the ESF Pad. During certain operations, (i.e., drill rig operation) dual protection, both ear plugs and ear muffs, may be required. Contact the TCO Safety and Health Specialist for information on locations and activities where dual protection may be required.

The M&O Safety and Health Department Procedure **NAP-SH-004 "Occupational Noise Protection"** specifies the requirements for employees working in high noise level areas. All employees working in these areas must be in a "Hearing Conservation Program" and, among other things obtain a baseline and annual audiogram (hearing test).

Chemical: Any chemicals and materials used for Perched-Water Sampling, Hydrologic Testing, and/or Mineralogical Evaluations will be provided by the Constructor's Tool Crib. Other Tracers, Fluids and Materials (TFM) that could be part of testing activities will be on the ESF approved list for materials that can be transported and used on the YMP.

A Determination of Importance Evaluation (DIE) has been completed in support of planned TFM usage. They capture any controls or constraints identified through the DIE process in the field implementing documentation.

The use or removal of testing-related TFM by affected organizations must be identified and reported to the TCO prior to such use or removal. The TCO ES&H Specialist coordinates the annual inventory of hazardous chemicals, as required by OSHA regulation and the M&O Safety and Health Department Procedure, **NAP-SH-003, Compliance with the OSHA Hazard Communication Standard.** The affected organization must know the location of the Material Safety Data Sheets (MSDS), and the proper storage, use, transportation and Personal Protective Equipment (PPE) requirements for all the hazardous chemicals they use. The MSDS should always be reviewed before using any product or material underground. Contact M.F. Taylor, TCO ES&H Specialist, if there are questions regarding TFM usage in the ESF.

Electrical Hazards: Personnel who conduct USW WT-24 Borehole activities will note that High Voltage cable(s) will be lying on the ground. Casual contact with power cables is not a safety concern. However, if the nature of any testing activity could cause physical damage to electrical cable jacket(s) or conductors, it is mandatory that the TCO FTR be contacted to arrange with the Constructor to have the cable(s) moved. Do not attempt to open or work on any electrical component. Contact the TCO FTR to obtain the services of the Constructor's electricians. All electrical systems must be locked and tagged out before any work can be attempted.

All USW WT-24 Borehole site electrical outlets will be 3-phase grounded OSHA Standard. All electrical outlets and cords at the USW WT-24 Borehole site are either part of an Assured Grounding Program or Ground Fault Circuit Interrupt (GFCI) protected. The Assured Grounding Program uses a color coding system that is changed every quarter (3 months) on extension cords and equipment. Contact the TCO FTR for assistance in getting equipment, tools, and extension cords entered into the Assured Grounding Program.

Fall Hazards: Scientific personnel conducting USW WT-24 Borehole activities who have to work at a height greater than six (6) feet off the ground, must either work behind OSHA approved scaffolding with guard rails (top rail minimum height, 42, mid-rails, toeboards), or use OSHA approved fall protection equipment. This includes a **body harness, lifelines, Sala Block** and/or **lanyards**.

OSHA approved ladders (set at an angle of between 75 and 90 degrees) should always be used. Do not attempt to crawl up the side of a piece of equipment without fall protection aids. Approved fall protection equipment is available on the ESF Pad from the Constructor's Tool Crib. Harnesses and lanyards must be attached to structural components that will support at least 5,000 pounds. Contact the TCO FTR to make arrangements for getting the proper fall protection equipment.

High Pressure: Personnel conducting USW WT-24 Borehole activities could encounter air compressors, pneumatic equipment, and gas/air in bottles/ cylinders. Never walk under or around any of this equipment while it is in operation.

Compressed air will be used as the drilling fluid on the Stratmaster Drill Rig as part of dry drilling scientific characterization activities. Air compressors and air receivers (storage tanks) should be equipped with pressure relief valves/apparatuses. Air hoses should be equipped with whip checks which prevent accidentally separated hoses from thrashing about, injuring employees. Never attempt to tighten, remove or adjust any compressed air or gas equipment, lines, or pipes while the components are pressurized. **Compressed air equipment, lines, or pipes should be equipped with bleed down valves to ensure that all air pressure is relieved before attempting to tighten, remove or adjust any components.** No work should ever be attempted on any system, lines, or components that are live or charged. Large K bottles or cylinders which contain 200 cubic feet of compressed gas may be encountered at the USW WT-24 site. These cylinders are used for such operations as oxygen/acetylene cutting and tracer gas injection. In general, any cylinder that is not being used should be stored in an upright position, secured to a rack with a chain, and have the protective cap over the cylinder valve. Cylinders should be transported using a cart that is designed for this purpose.

Hantavirus: An outbreak of a potentially fatal illness has occurred in the Southwest, primarily in New Mexico and Arizona, although two cases have been reported in Central Nevada.

The cause of the illness has been identified by the Center for Disease Control (CDC) as the Hantavirus.

Hantavirus is usually transmitted by contact with rodent saliva, urine, or feces. Rodents such as pocket mice, deer mice, canyon mice, and kangaroo rats are the primary carriers.

A study in 1993 by the CDC on the NTS found that only the deer mice population was infected, and the infections existed only at higher elevations on the NTS (i.e., Pahute Mesa, Rainier Mesa). No infected rodents were found in Area 25 locations.

As a precaution, all scientific personnel on the Yucca Mountain Site Characterization Project (YMP), working in field locations should be aware of the possibility of exposure to the Hantavirus and follow this advice:

- Avoid human contact with rodents, rodent droppings, rodent nesting materials. Infected rodents carry the virus in saliva, urine and feces. Never touch a live or dead rodent.

- The virus can infect humans through breathing the dust of dried out rodent feces and urine, and contact with rodent feces/urine through skin that is cut, dried or broken. Avoid breathing the dust from rodent infested areas, avoid skin contact with rodent infested areas.

- If a facility in which scientific personnel are working has visible signs of "heavy" rodent infestations (i.e., rodent excreta (droppings) and/or rodent nests, the rodents should be trapped/removed and the facility cleaned and disinfected.

- Scientific personnel should make no attempt to remove or clean-up rodent infested areas. Kiewit/PB Industrial Hygiene has personnel that are trained in pest control techniques, and they have the expertise, equipment, and supplies to trap and cleanup heavy infestations.

Contact R. Kovach to arrange for the services of Kiewit/PB Industrial Hygiene.

Radiation: Neutron sources will be used to log the USW WT-24 Borehole at selected time intervals. Authorization for the use of these ionizing radiation producing materials will be through the M&O Radiation Control (RADCON) Manager, and will be in accordance with YMP Administrative Procedure (AP-6.7).

All RADCON operations will be conducted in accordance with the NV/YMP RADCON Manual and the **M&O Radiation Protection Program and Implementation Plan (RPP).**

A Radiological Work Permit (RWP) will be issued before any activity involving the use of radioactive materials/tools is permitted. Radiological Health Surveys will be conducted during the use of these radioactive materials/tools. Radioactive Material Areas (RMA) with controlled access will be established during deployment. Signage, posting and barricade requirements will be in effect. Foot traffic may be restricted or limited during calibration and insertion activities inside and around the RMA. Any employee required to be inside the RMA will at a minimum, have General Employee Radiation Training (GERT) and Rad Worker I Training. Any employee inside the RAM will have the following personal monitoring devices: NTS Whole Body Thermoluminescent Dosimeter (TLD) and Neutron Dosimeter. Personnel handling the tool and related accessories will wear finger TLDs.

Fire: The high fire hazard season at the Nevada Test Site usually runs from spring to fall. Brush fires have been started by lightning strikes. Fires have also been started by vehicle's exhaust pipes coming into contact with brushes while off-road driving. Vehicle exhaust pipes can reach 500 degrees F or more. While the likelihood of such fires is remote, personnel conducting borehole activities need to remain alert to such fire hazards and report any fire as soon as it is sighted using the "900 Radio Net Control" to call the fire station. Personnel should carry fire extinguishers and shovels.

Walking and Working Surfaces: Personnel conducting USW WT-24 Borehole activities should be aware that most borehole sites have rocky, gravel or dirt surfaces. These areas have gaps and irregularities on the walking surface. Slips, trips, and falls could be hazardous.

4.0 ROLES AND RESPONSIBILITIES - SAFETY AND HEALTH

4.1 SAFETY AND HEALTH ROLES AND RESPONSIBILITIES

The TCO and the M&O Contractor for the YMP regards the Safety and Health (S&H) of all employees to be of paramount importance. In order to establish and maintain a high degree of S&H awareness on the YMP, all organizations and employees involved with the scientific characterization activities must clearly understand their roles and responsibilities in maintaining a safe and healthful workplace.

The responsibility for S&H on the YMP begins with the M&O Contractor, flows down through the CMO, then to the TCO and the Constructor. From these organizations, responsibility flows down to the respective organizations

conducting actual work on the YMP, including scientific characterization organizations, through the umbrella of the M&O Safety and Health Plan.

Responsibility for the S&H of YMP employees flows through **M&O line management and each organization's supervision, then ultimately to individual M&O Employees.**

The Constructor: The Constructor and/or Drilling Contractor performs support services for the scientific characterization work being conducted on the YMP. The Constructor, as the constructor organization, has S&H responsibility for their own employees, for maintaining the YMP Site in a safe and healthful condition, for maintaining mobile and stationary equipment, some S&H training, and training in the safe operation of some limited pieces of equipment. The constructor will only maintain a full time presence during drilling activities at all remote worksites on the YMP, but will assist anytime when contacted. The TCO as the M&O manager for field testing activities, and/or assigned scientific organization staff (i.e., LLNL, LBNL, SNL, and/or USGS) will maintain M&O line management and/or organization supervision at the Site at all times.

TEST COORDINATION OFFICE, and other Scientific Organizations: TCO, and other scientific organizations are responsible for the S&H of their employees through M&O line management and each organization's supervision. When both the TCO and scientific organization line management and supervision occupy a YMP worksite at the same time, the TCO will have S&H responsibility. When a YMP worksite is not occupied by the TCO, scientific organization line management and each organization's supervision will have S&H responsibility.

TCO and other scientific organizations always perform work under the M&O Safety and Health Plan, and/or their own organization's Safety and Health Plan.

TCO line managers and organization supervisors are responsible for the workplace implementation of S&H standards, codes, regulations Project procedures and programs.

The TCO, under agreement with the CMO, may conduct additional testing specific Toolbox Safety Meetings at the beginning of each shift.

Individual M&O Employees: Individual M&O Employees, regardless of their employer, are responsible for understanding the requirements of the S&H programs of their employer and specific YMP S&H programs (i.e., Occupational Respiratory Protection, Noise Control and Hearing Conservation, PPE). Individual M&O Employees are responsible for ensuring that the S&H training they have received is followed and implemented, regardless of whether the training was received from their parent organization or on the YMP. Individual M&O Employees are responsible for immediately notifying the construction shift

supervisor and their M&O and the Construction Shift Supervisor line manager of unsafe acts, conditions, and/or equipment. Organization supervisors are responsible for ensuring that their employees attend the Constructor's Toolbox Safety Meeting that is held at the beginning of each shift.

TCO Safety Review (SR): The SR is an attachment to the FWP and has been compiled in order to evaluate and transmit information on the potential hazards that may be encountered while installing, operating and/or maintaining scientific investigation equipment or instrumentation on the YMP. Each organization's line management and supervision should read the SR and use it as a guideline for informing, educating and implementing protective measures for the identified hazards. A copy of the SR and RWP for the temporary use of radioactive materials will be available at the TCO field office, the Las Vegas Office, and will be transmitted to test and constructor organizations working on the YMP.

4.2 EMPLOYEE TRAINING

Personnel requiring access to the YMP bore sites must have completed or be escorted by an individual with General Employee Training (GET) and First Aid training.

PPE is required for all persons entering any construction site on the YMP (i.e., hard hat, steel toe shoes, approved (ANSI Z87) safety glasses, and/or hearing protection (plugs or muffs). Casual dress (shorts, no shirt, sandals) is not allowed at YMP borehole sites. Work shirts (short sleeve or long sleeve if your worried about sunburn), long pants are the normal attire. M&O Safety and Health Department Procedure **NAP-SH-002 "Procurement of Required Personal Protective Equipment"** describes how M&O employees go about obtaining prescription safety glasses and approved footwear through the M&O purchasing system.

All participants shall adhere to the M&O Safety and Health Procedure **NAP-SH-001 "Occupational Injury/Illness/Property Damage Reporting and Investigation"** for guidance on occurrence reporting and processing of information through the DOE system.

4.3 OTHER TRAINING

All personnel entering YMP borehole sites who have **not** received the shift tool box briefing are to ask if a Constructor Supervisor is on site and receive the briefing from that person. This is to ensure compliance with applicable Occupational Safety and Health Administration (OSHA) Standards.

5.0 EMERGENCY RESOURCES LOCATION AND CONTACTS

5.1 EMERGENCY REPORTING

M&O Safety and Health Department Procedure **NAP-SH-005, "Emergency Management"**, was developed for supervisors who have responsibilities for a facility or operation. In case of an emergency telephone: Dial 911. Over the Radio: "Mayday, Mayday, Mayday", then give name and net number, Net 900 Radio Control will then make contact and get details of assistance required.

5.2 NTS RADIO NET

The NTS Radio Net (Station 900) is manned 24 hours a day, every day of the year. Personnel conducting borehole security can contact 900 over the radio and be patched into all other Net Systems on the NTS.

5.3 NEAREST HOSPITAL OR CLINIC

Mercury, Nevada (approximately 38 miles).

5.4 CONDUCTING A MEDICAL NEED ANLAYSIS: A medical needs analysis as called out by NAP-SH-012 has been completed and is on file at the CMO.

5.5 NEAREST FIRST AID KIT/EYE WASH STATION

First aid kits and eye wash stations should be located at all "active" borehole sites.

5.6 NEAREST POTABLE WATER

Carry potable drinking water when traveling to remote borehole sites on the YMP. Orange "Gott" Drinking Water Coolers with ice are available from the Constructor on the ESF Pad in the Switch Gear Building.

5.7 SUGGESTED EMERGENCY EVACUATION ROUTE AND MEETING AREA(S)

Situations may occur at YMP Borehole sites that will require immediate evacuation of the operation. These situations may include, but are not limited to fire, explosions, and hazardous chemical releases or spills. If such a situation occurs, notify 900 Radio Net Control and Ranch Control immediately. Follow the direction given.

6.0 TCO PERSONNEL

Some TCO Personnel carry hand held radios and are available on the YMP Net #1 or NTS Net #5.

6.1 TCO FIELD TEST COORDINATION PERSONNEL AND PHONE NUMBERS

Dick Kovach, FTM	295-6180
Joan Dyson, Secretary	295-3483
Gene Pokorny, FTR	295-7496
Gene Griego, FTR	295-7496
Joe Spoeneman, FTR	295-6189
John Dinsmoor, FTR	295-3727
Mike Taylor, ES&H Specialist	295-3647
	Beeper - 794-6676

PROGNOSIS

Description of Modeled Units and Elevations for WT-24

Description of Modeled Units	Project Stratigraphy	Thermal/ Mechanical	Approx. Elev.	Depth / thickness	Coring Interval	Sidewall Coring & Logging	Hazardous Mineral Zone
crystal-poor densely welded vitric sub-zone of Tiva Canyon Tuff		TCw	4900	0/217			
crystal-poor non- partly-welded vitric sub-zones of Tiva Cyn. Tuff	Tpcpv1-2	PTn	4683	217/24			
pre-Tiva Canyon Tuff bedded tuff	Tpbt4	PTn					
Yucca Mountain Tuff	Tpy	PTn	4659	241/204			
pre-Yucca Mountain Tuff bedded tuff	Tpbt3	PTn					
Pah Canyon Tuff	Tpp	PTn	4455	445/158			
pre-Pah Canyon Tuff bedded tuff	Tpbt2	PTn	4297	603/5			
Topopah Spring Tuff upper non-partly-welded vitric sub-zones	Tptrv2-3	PTn	4292	608/-			
Topopah " " upper densely welded vitric sub-zone	Tptrv1	TSw1	-	NP			
Topopah " " xl-rich nonlithophysal zone	Tptrn	TSw1	4283	617/176			
Topopah " " xl-rich lithophysal zone	Tptrl	TSw1	4107	793/84			
Topopah " " lithic rich member	Tptf	TSw1					
Topopah " " upper lithophysal zone	Tptpul	TSw1	4023	877/228			
Topopah " " middle nonlithophysal zone	Tptpmn	TSw2	3795	1105/15			
Topopah " " lower lithophysal zone	Tptpll	TSw2	3780	1120/312	Last 12'		
Topopah " " lower nonlithophysal zone	Tptpln	TSw2	3468	1432/47			
Topopah " " lower densely welded vitric sub-zone	Tptpv3	TSw3	3421	1479/52			
Perched water anticipated at this elevation				1520	(Total 200')		
Topopah " " non- partly-welded vitric sub-zones	Tptpv1-2	CHn1	3369	1531/21			
pre-Topopah Spring Tuff bedded tuff	Tpbt1	CHn1	3348	1552/18			
Calico Hills Formation undifferentiated	Tac	CHn1	3330	1570/1045	First 20'		
pre-Calico Hills Formation bedded tuff	Tacbt	CHn2			2455 elev.		
Prow Pass Tuff upper nonwelded zone	Tcp [unw]	CHn3	2285	2615/523	Total 150		
Prow Pass Tuff welded zone	Tcp [w]	PPw			2605 elev.		
Prow Pass Tuff lower nonwelded zone	Tcp [lnw]	CFUn					
pre-Prow Pass Tuff bedded tuff	[bt]	CFUn					
Bullfrog Tuff upper nonwelded zone	Tcb [unw]	CFUn	1762	3138/333			
Bullfrog Tuff welded zone	Tcb [w]	BFw					
Bullfrog Tuff lower nonwelded zone	Tcb [lnw]	CFMn1					
pre-Bullfrog Tuff bedded tuff	[bt]	CFMn2					
Tram Tuff undifferentiated	Tct	CFMn2,	1429	3471			
pre-Tram Tuff bedded tuff	[bt]	n/a					
lower Tertiary units undifferentiated	n/a	n/a					
Paleozoic and older units	n/a [pz]	n/a					
Water Table			2410	2390			
Total Depth				3850'			