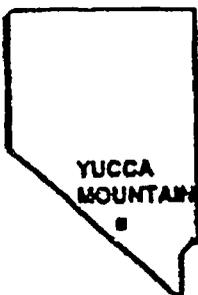


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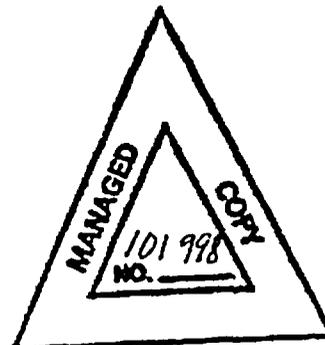
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**YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT**

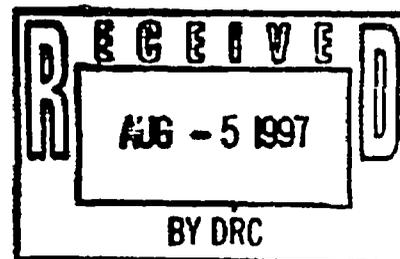
BOREHOLE USW SD-6

REVISION 0



**FIELD WORK PACKAGE
FWP-SB-97-002**

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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:
Borehole USW SD-6

FWP Identifier:
FWP-SB-97-002

Assigned Project Engineer/Preparer:
Steve Opp

Affected Organizations:
CRWMS M&O (PI, TCO, CMO, Construction), 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	8/6/97	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: 	Date: 7/30/97
Site Construction/Operations Manager Approval: Robert Sandifer	Signature: 	Date: 8-1-97
QA Manager Concurrence: Robert Clark	Signature: 	Date: 7/30/97
Support Operations Concurrence: Doug Chandler	Signature: 	Date: 07/30/97

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:

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INTRODUCTION

This Field Work Package (FWP) controls activities in accordance with the Quality Assurance Requirements Description (QARD) requirements related to the Drilling and Testing, and monitoring of borehole USW SD-6. Affected organizations are responsible for conducting field work in accordance with the Project Requirement Documents and this implementing FWP and associated work program. 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. The TCO is committed to complete this task as prudently and efficiently as possible.

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 SD-6 pad construction, road enhancement, 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 PI's 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 potential repository horizon for borehole position and bottom-hole location

1.1.1 Planned Test Activity, Location, and Site Improvement Description

The planned test activity consists of road and pad construction, drilling, perched-water testing and monitoring, saturated zone, testing and monitoring, geophysical logging, confirmation of lithology, and sampling. The borehole is located in the western portion of the potential repository block near the crest of Yucca Mountain. Attachment 1 shows borehole location, pad configuration and road modification. The borehole will be drilled by a constructor/drilling service provider using the LM-300 or a similar drill rig. Drilling techniques will include using air as the drilling fluid and Sulfur Hexafluoride (SF₆) as the tracer in the airstream. Drilling would be to a total depth of approximately 2800 feet. Cutting and core samples will be collected at designated intervals throughout the borehole. All Site improvements are temporary and will be limited to a temporary pad, access improvements, generators, electrical, grounding plans, water discharge array and road improvements to facilitate equipment mobilization and demobilization.

1.1.2 Objectives

This borehole will allow the collection of critical stratigraphic, structural and rock property characteristics data from the western potential repository block. Borehole information also provides a key data set required for completion of repository design by furnishing a better understanding of construction parameters. Borehole results will provide input to the 3-D Geologic Framework Model and hydrologic models which support work required for Performance Assessment, Total-System Performance Assessment, and the Viability Assessment.

1.2 Specific Scope Description

1.2.1 Test Plan and Organizational Responsibilities

TEST PLAN

Road Enhancement

Work will consist of enhancement of the existing Yucca Mountain crest access road to accommodate the transportation of the drill rig and

ancillary equipment to the USW SD-6 location. Enhancement will include any needed excavation of rock material, installation of fill material, and road maintenance during drilling/testing activities. Road maintenance during drilling/testing will only include maintenance to enhancements and will not include maintenance of any roads not maintained by the contractor under the present contract.

Pad Construction

Work will consist of preparing a drill pad suitable for accommodating the LM-300 or similar drill rig and ancillary equipment, in order to drill the USW SD-6 Borehole. Site preparation will include any needed excavation of rock material, and installation of fill material as necessary to form the pad area. Additionally, the work will include the construction of a short access road to the proposed drill pad location.

Borehole Drilling

The USW SD-6 Borehole will be drilled using the LM-300 or similar drill rig utilizing air as the drilling fluid. The borehole is expected to be of adequate size to accommodate up to 3 monitoring strings or a pump and access tubing. A tracer gas (SF₆ preferred) will be added to the drilling air. Approximately 600' of core will be collected from identified intervals in the borehole. Cuttings will also be collected at specified intervals. Drilling rates, records, bit life, Tracers, Fluids and Materials (TFM) usage, and other drilling related consumables shall be documented during drilling/testing activities. The borehole will be drilled to a depth of approximately 2800'. During the initial drilling/testing activity, perched-water testing will be limited to a two week period. Geophysical logging, including borehole video and sidewall coring, will be accomplished in approximately two days.

Borehole Testing

Testing at the USW SD-6 borehole will consist of Geophysical Logging, Perched-Water Sampling, Hydrologic Testing, and Mineralogic Evaluation. Borehole monitoring may be tied into a data collection system. 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 perched and saturated zone, and collecting hydrochemical samples. Perched-Water sampling will occur at each interval perched-water is encountered (if any). Mineralogic evaluation includes assessing alteration history and fracture mineralogy.

At Total Depth, the borehole will be pumped to ensure connection to the aquifer and saturated zone tests will be conducted.

Borehole Sampling

Sampling at Borehole USW SD-6 will consist of collecting cuttings, core and water samples. Cuttings will be collected for Chlorine-38 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 analysis of the saturated zone. The water sample should be collected before Cal-Seal (if used) is added to the borehole except during the setting of the 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 UE-25-J-13 water to facilitate drilling in wet or moist zones or below the water table in USW SD-6. If UE-25-J-13 water is injected, the USGS PI will determine the quantity of UE-25-J-13 water added to the borehole during drilling and the actual quantity used will be recorded (this is also a TFM requirement). Tagging of the UE-25-J-13 water will be done by introducing an approved tracer (LiBr) to the water before it is introduced into the borehole.

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 U.S. Department of Energy (DOE), the Yucca Mountain Site Characterization Project (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 Data Manager and a FWP Records Coordinator (FWPRC) to monitor the FWP records process. 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/PRINCIPAL INVESTIGATORS (PIs)

The Site Evaluation Program will provide PI's 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 repository design and are qualified in accordance with QA requirements.

CONSTRUCTION MANAGEMENT ORGANIZATION (CMO)

The CMO will provide a management interface 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, responsible for monitoring and reporting all insignificant NO_x emissions to M&O Environmental Programs Department (EPD) on a monthly basis, geophysical logging and labor and materials to support borehole testing. Construction-related TFM and daily reports will be provided per YAP-2.8Q.

GEOPHYSICAL LOGGING SUPPORT (GLS)

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.5Q.

SCIENTIFIC PROGRAMS SUPPORT (SPS)

Scientific Programs Support 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, and monitoring and analyses of drilling activities, and

other activities as required 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

Field testing equipment is identified in scientific procedures listed in Section 1.3.

1.2.3 Computer Software

Vendor provided software will be utilized.

1.3 Field Implementing Documents

This FWP provides the process controls utilized by the TCO to manage the drilling, testing and construction of the road and pad for USW SD-6 Borehole.

The following procedures or their equivalents will be utilized to conduct work within the scope of this FWP. (The roles and responsibilities by which these procedures are applied in executing the work 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-SII.4Q	The Collection, Submission, and Documentation of Non-Core and Non-Cuttings Samples to the Sample Management Facility for Site Characterization
YAP-SIII.3Q	Processing of Technical Data on the Yucca Mountain Site Characterization Project
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
TIP-YM-3	Labeling, Tracking & Shipping of Samples
USGS-YMP-HP-07	Method to Inject and Monitor Tracer Gas in Drilling Injection/Return Air Streams
YAP-SIII.4Q	Yucca Mountain Site Characterization Project Field Verification of Geophysical Logging Operations
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-SIII.5Q	Preparation of Borehole Geophysical Logging Programs for Surface-Based Testing Program Boreholes
YAP-30.2	Land Access and Environmental Compliance
LANL-YMP-QP-03.5	Documenting Scientific Investigations
SNL-TP-162	Geologic Description and Core Logging
AP-SIII-6Q	Geotechnical Core Logging
USGS-YMP-HP-229	Core Water Content Analysis
TCP-2.19	Survey Group Work Function

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 model. 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 Yucca Mountain Site Characterization Project," and other applicable plans and procedures.

1.4.2 Test Deliverables

Mineralogical Support of Phase II

Predicted Occurrence of Erionite in USW SD-6 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 :

- Determination of Importance Evaluation (DIE) BAA000000-01717-2200-00101, Rev 0, "DIE for Surface-Based Testing Activities."

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 Refer to section 3.2 for contingency plans for TFM usage.

USW SD-6 Borehole Testing Related TFM:

- LiBr (Non-Q Environmental Tracer). LiBr used is restricted to 30 ppm maximum to meet State permit concentration levels.
- SF₆ (Non-Q Environmental Tracer). SF₆ used is restricted to 20 ppm maximum to meet State permit concentration levels with a goal of 1 to 2.5 ppm.

2.0 SAMPLING PLAN

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. 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 geologic log for the borehole. These tasks will be accomplished through the Sample Overview Committee.

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.

The M&O EPD may take Non-Q water samples.

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. 1299 feet depth (See prognosis in Attachment 3)
	SATURATED ZONE	USGS	WHEN GROUNDWATER ENCOUNTERED approx. 2485 feet depth (prognosis)
CUTTINGS	derived either from reamed drilling (after coring) or non-core drilling	LANL-Chlorine-36 measurements SNL Lithology (USGS)	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 Tcw, Ptn, Tsw, and Chn units
CORE	Matrix Hydrologic Properties	USGS	6 cm (3 in.) of every 30 cm (12 in.) of contiguous core
	Hydrochemistry	USGS	30 cm (12 in.) of every 5 meters (15 feet) of contiguous core 362 feet contiguous core
	Hazardous Materials 1298' to 1660' depth	LANL	<u>CONTIGUOUS CORE 600 feet</u> Ptn 121 feet TptpII 35 feet Tptpv toTcb

(continued from previous page)	Lithology 426' to 547' depth 1000' to 1035' depth 1500' to 1927' depth	SNL	442 feet
CLAS	Unsaturated Zone only	USGS	various packed off unsaturated intervals as chosen by PI (collected after drilling completed)

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 that does not implement QARD requirements. 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 in 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 Field Test Coordinator based on conditions in the field, provided affected organizations concur and those modifications are documented.

The controls provided in the following sections are based on TCO communications with the scientific investigators and repository design. References documenting these communications are included in Section 8.

Safety assurance department controls are provided by the documents referenced in Section 1.5. Work in the field shall be in compliance with the Surface-Based Testing Facilities Requirements Document (SBTFRD).

GENERAL ITEMS

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

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 meeting as necessary, as agreed to by the CMO.

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 in accordance with DIE controls to prevent water ponding and prevent water from entering the borehole.

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

QA: The TCO will provide historical borehole information from the drilling reports to the technical database.

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 with information or status memoranda to the Project Engineer responsible for this FWP.

QA:N/A: The **CONSTRUCTOR/DRILLING SERVICES PROVIDER** will provide M&O EPD time to collect and analyze water samples prior to discharging water into the environment.

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 the ESF North Portal).

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 to 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

ROAD ENHANCEMENT AND PAD CONSTRUCTION

QA:N/A: The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** will conduct road enhancement and pad construction in compliance with their work program and this FWP.

QA:N/A: TCO will concur to changes in the work program and inform the M&O EPD of those changes.

QA: To prevent water from entering the borehole, the **Constructor/Drilling Service Provider** will ensure (1) the drill pad slopes away from the borehole at a minimum of a 2% grade, (2) that measures such as drill hole casing and

caps are utilized, and (3) that the drainage pattern flows away from the borehole such that water does not accumulate on the pad.

QA: The **Constructor/Drilling Service Provider** will limit the use of explosive materials to no more than 30 pounds per instantaneous detonation or delay unless approved by the Safety Assurance Department.

QA: The **Constructor/Drilling Service Provider** will document the date, time, location, amount of explosives used per charge, and sequencing of blasts to minimize the impact on seismic monitoring activities

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) and provide adequate inner core barrels and any needed split lines to allow coring operations to proceed without interference from coring extraction, logging, and boxing.

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 the TCO and record traced water use on a shift basis at the discretion of the TCO.

QA:N/A: The **FIELD DRILLING ENGINEER (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: The **FDE** will generate the drilling report in accordance with their own procedures.

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 SF₆ 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 SF₆ compressed gas cylinder; and 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: The **INJECTION COORDINATOR OR DESIGNEE** will halt drilling/coring operations when the cylinder pressure drops below 500 psig.

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:N/A: The **CONSTRUCTOR/DRILLING SERVICE PROVIDER** shall ensure that two cylinders of compressed SF₆ 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 SF₆ gas and provide limited maintenance.

QA: 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 Organization** 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 (GLS)** at the 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 designees will 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 scientific staff, 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 Organization 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: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 procedure 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.

QA: PIs will take perched-water samples, if encountered, in accordance with their scientific notebook controls or with applicable procedures.

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). 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. Refer to Section 1.5 for TFM recording and reporting responsibilities.

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 effected 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 and 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 SD-6 Borehole.

A radiological work permit is needed before any activity involving the use of radioactive materials. The Radiological Protection Plan will apply to these activities as may State permits.

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 Contractor 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 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 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/drilling service provider performs support services for the scientific characterization work being conducted on the YMP. The constructor 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 pieces of equipment. The constructor/drilling service provider will not maintain a full time presence at remote worksites on the YMP once testing commences, 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: The 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.

The 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.

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 S&H 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), found in Attachment 4, 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 Radiation Work Permit (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 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.

4.2 Points Of Contact

Steve Opp	Project Engineer	295-6379
Loretta Camp	FOC Visitor Control	295-5915
Frederick Venzi	Logistics Coordinator	295-5438
Ronald Oliver	TCO Manager	295-3578
Michael Taylor	TCO Safety Coordinator	295-3647
Donald Unglesbee	Photography Support	295-5965
Drew Coleman	AML Representative	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
Chris Lewis	Sample Management Facility	295-6105
Eddie Wright	SPS Manager	295-5589
Jan Zigler	Injection Coordinator	295-5533
Bud Thompson	Geophysical Logging Support	295-48

Fred Homuth	Data Manager	295-4900
Richard Kovach	Field Test Coordinator	295-6180
Alan Mitchell	TFM Testing	295-6539

4.3 Schedule

See Section 7.0, Attachment 2

4.4 Summary Accounts

See Attachment 2 for Summary Account Information

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. Scope completion will be documented by the PI.

6.0 RECORDS

6.1 List of Records

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 RPC within 90 days of their completion. An information copy of any records submitted to the RPC should be sent to the TCO PE 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	QA:L
As-Constructed Borehole Survey Coordinates	Constructor/Drilling Service Provider	QA:L
All Testing Related TFM Usage	TCO	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
All Construction Related TFM Usage	Constructor/Drilling Service Provider	QA:L
Toolbox Safety Meeting Documentation	Constructor/Drilling Service Provider and TCO	QA:N/A
Drilling Information/Reports	FDE	QA:L
SF ₆ Usage Information	Injection Coordinator	QA:L
Documentation Identifying Work as Complete	PI Organizations and TCO	QA:L
Geophysical Logging Records	GLS	QA:L
Checks for ponding of water and changes to drainage characteristics	TCO	QA:L
Results of testing for perched-water	PI	
Documentation related to blasting activities	Constructor/Drilling Surface Provider	QA:L

Surface survey information	Construction/Drilling Surface Provider	QA:L
Perched-Water Plan	PI	QA:L
Grout Plan	TCO	QA:L

6.2 Records Generation

Activities with the scope of this FWP will be documented in accordance with AP-17.1Q. See Section 6.1 above.

All records associated with this testing activity shall meet the legibility and indexing requirements established in AP-17.1Q. If a scientific notebook is utilized, it shall be stored in accordance with the participant procedures.

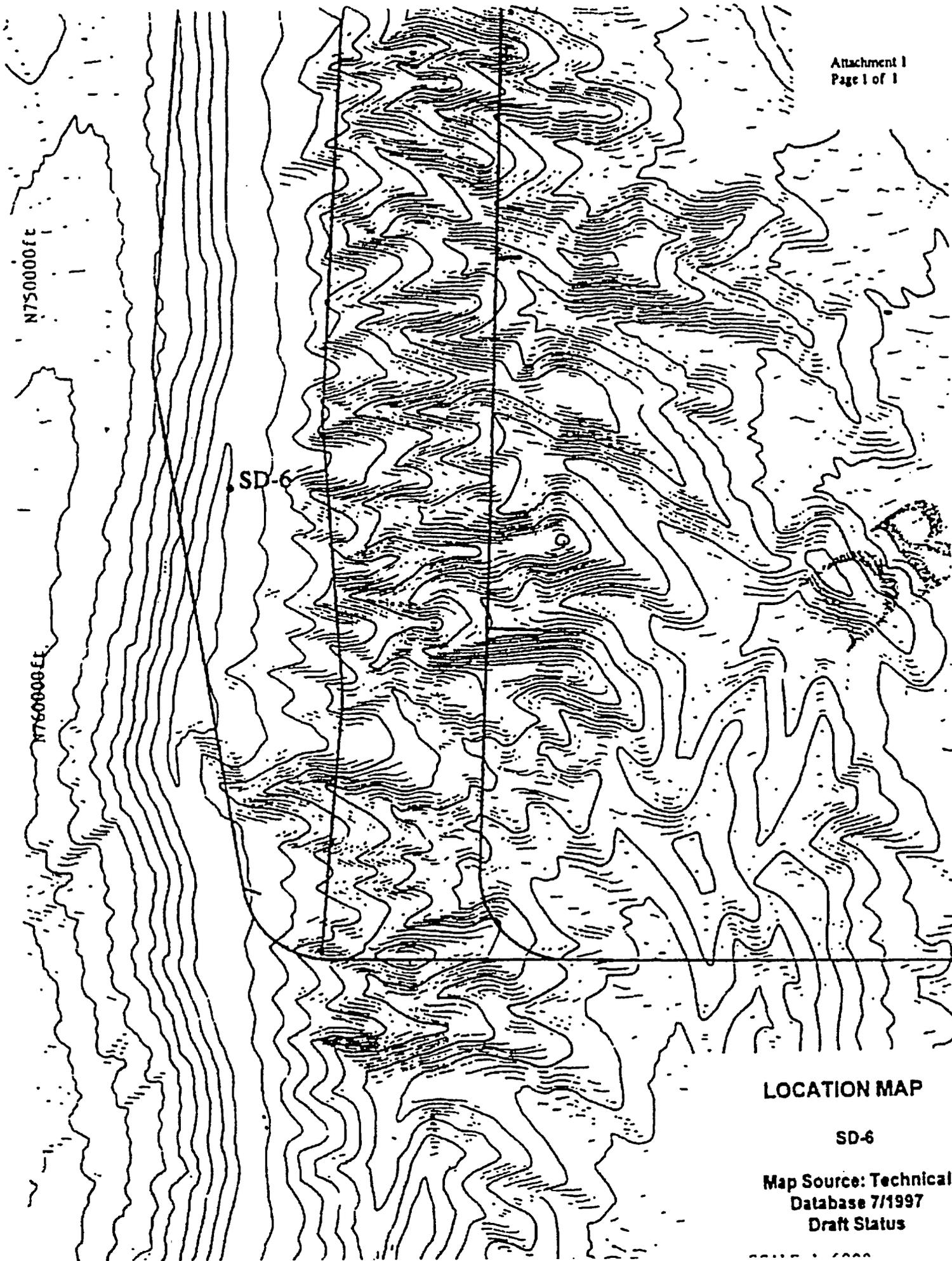
7.0 ATTACHMENTS

Attachment 1	Location Map for USW SD-6 Borehole Location, QA:N/A
Attachment 2	Schedule of Activities and Summary Accounts QA:N/A
Attachment 3	Description of Modeled Units and Elevation for USW SD-6 QA:N/A
Attachment 4	Safety Review QA:N/A
Attachment 5	Geophysics QA:N/A
Attachment 6	Sketch of USW-306 Discharge Dissipation Technique QA:N/A

8.0 REFERENCES

1. Moisture Studies in the Exploratory Studies Facility, FWP-ESF-96-004, Rev 1, March 13, 1997.
2. Land Access and Environmental Compliance Letter for USW SD-6.
3. "Management and Operations Health and Safety Plan," B00000000-01717-4600-00016, Rev 1, January 1, 1997.
4. "Nevada Revised Statutes and the Nevada Injection Control Permit Number UNEV89031," January 25, 1996.

5. USW SD-6 Drilling Work Program, YMP/WP/97-01, 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. Interoffice Correspondence, R. D. Oliver to Eddie Wright, "Crest Borehole USW SD-6," dated February 21, 1997.
9. Interoffice Correspondence, R. D. Oliver to Distribution, "Crest Borehole USW SD-6," dated February 19, 1997.
10. Interoffice Correspondence, R. D. Oliver to P. Hastings and R. Wembauer, "Crest Borehole USW SD-6," dated February 21, 1997.
11. Outgoing Facsimile Transmittal, Dave Vaniman to Paul Dixon, "SD-6," dated March 14, 1997.
12. JOE Letter Report, Dennis R. Williams to M. Tynan and D. Coleman, "Logging Program for DOE Crest Borehole (SD6)," dated March 26, 1997.



LOCATION MAP

SD-6

**Map Source: Technical
Database 7/1997
Draft Status**

Borehole USW SD-6

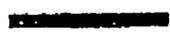
FWP-SB-97-002, R0 ATTACHMENT 2

Summary Schedule Information (QA:NA)

Note: years are represented as fiscal years

Task Name	Dur	Start	Finish	1997					1998																
				M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	
Borehole USW SD-6 Summary Schedule	395d	3/3/97	9/4/98	[Rollup Bar]																					
Test Implementation- Dicrete	312d	6/26/97	9/4/98	[Rollup Bar]																					
Quantitative Mineralogy	312d	6/26/97	9/4/98	[Hatched Bar]																					TR02111FB2
Stratigraphy	312d	6/26/97	9/4/98	[Hatched Bar]																					OG332211FB2
Lithologic Logging	312d	6/26/97	9/4/98	[Hatched Bar]																					TR02111FB2
Rock Analyses	312d	6/26/97	9/4/98	[Hatched Bar]																					TR32713
Chlorine-36	312d	6/26/97	9/4/98	[Hatched Bar]																					TR33122FBB
Pneumatic Monitoring and Air Permeability	312d	6/26/97	9/4/98	[Hatched Bar]																					OG33223FBE
Matrix Properties of Hydrologic Units	312d	6/26/97	9/4/98	[Hatched Bar]																					OG33223FBF
Gas Phase Movement in the UZ	312d	6/26/97	9/4/98	[Hatched Bar]																					OG33126FB1
UZ Hydrochemistry	312d	6/26/97	9/4/98	[Hatched Bar]																					OG33137FBE
Perched-Water and SZ Hydraulic Testing	312d	6/26/97	9/4/98	[Hatched Bar]																					OG33131FBG
Eh & pH Measurements	312d	6/26/97	9/4/98	[Hatched Bar]																					OG33131FBH
SZ Hydrochemistry	312d	6/26/97	9/4/98	[Hatched Bar]																					TR3411FB1
Analysis of cuttings/core and geophysical logs	312d	6/26/97	9/4/98	[Hatched Bar]																					OG36221FB4
Test Implementation- Matrix	395d	3/3/97	9/4/98	[Rollup Bar]																					
Test Management	395d	3/3/97	9/4/98	[Hatched Bar]																					TR187FA2
Construction Support	330d	6/2/97	9/4/98	[Hatched Bar]																					TR353FA1
SMF Management	330d	6/2/97	9/4/98	[Hatched Bar]																					TR361FA1
Tracer Support	330d	6/2/97	9/4/98	[Hatched Bar]																					TR3822FA1
Drilling Engineers	330d	6/2/97	9/4/98	[Hatched Bar]																					TR3822FA1
Surface-Based Geophysical Log Data	330d	6/2/97	9/4/98	[Hatched Bar]																					TR381FA1
Photographic Support	330d	6/2/97	9/4/98	[Hatched Bar]																					TR761FA4
Field Surveying for Sae Characterization	330d	6/2/97	9/4/98	[Hatched Bar]																					TR761FA1
Project Schedule Analysis and Maintenance	330d	6/2/97	9/4/98	[Hatched Bar]																					TR921FA2

USW SD-6
9/1/97

Task		Milestone		Rollup Task		Rollup Progress	
Progress		Summary		Rollup Milestone			

Borehole USW SD-6
FWP-SB-97-002 R0, ATTACHMENT 2
Summary Account Information QA:NA

ID	Borehole USW SD-6 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 USW SD-6 Drilling and Testing								
Test Implementation- Discrete								
3	Quantitative Mineralogy	1232111	M&O/LANL	8/26/97	TR32111FB2	780	273	273
4	Stratigraphy	1232211	USGS	8/26/97	OG322211FB2	176	79	62
5	Lithologic Logging	1232211	M&O/SNL	8/26/97	TR32111FB2	100	45	35
6	Rock Mechanical Properties	1232713	M&O/SNL	8/26/97	TR32713	60	28	28
7	Chlorine-36	1233122	M&O/LANL	8/26/97	TR33122FBB	768	84	77
8	Pneumatic Monitoring and Air Permeability	1233123	USGS	8/26/97	OG33223FBE	704	317	246
9	Matrix Properties of Hydrologic Units	1233123	USGS	8/26/97	OG33223FBF	137	62	48
10	Gas Phase Movement in the UZ	1233126	USGS	8/26/97	OG33126FB1	155	70	54
11	UZ Hydrochemistry	1233127	USGS	8/26/97	OG33127FBE	124	56	43
12	Perched Water and SZ Hydraulic Testing	1233131	USGS	8/26/97	OG33131FBG	1,049	472	367
13	Eh & pH Measurements	1233131	USGS	8/26/97	OG33131FBH	1,049	472	367
14	SZ Hydrochemistry	123411	LANL	8/26/97	TR3411FB1	651	183	163
15	Analysis of cuttings/core and geophysical logs	1236221	USGS	8/26/97	OG36221FB4	134	60	47
Test Implementation- Matrix								
17	Test Management	12397	M&O/LANL/WCF	3/2/97	TR397FA2	376	169	169
18	Construction Support	12353	TRW	6/2/97	TR353FA1	1,000	450	450
19	SMF Management	12351	M&O/SAIC	6/2/97	TR351FA1	1,610	290	97
20	Tracer Gas Support	123521	USGS	6/2/97	OG3521FA1	60	12	0
21	Drilling Engineers	123522	M&O/SAIC	6/2/97	TR3522FA1	500	105	105
22	Surface-Based Geophysical Log Data	123111	M&O/SAIC	6/2/97	TR381FA1	117	53	53
23	Photographic Support	12761	TRW	6/2/97	TR761FA4	128	13	0
24	Field Surveying for Site Characterization	12761	TRW	6/2/97	TR761FA1	706	51	0
25	Project Schedule Analysis and Maintenance	12821	TRW/WCFS	6/2/97	TR821FA2	917	9	9
Subtotals - Discrete						8,907	2,181	1,810
Subtotals - Matrix Support						5,233	1,151	883
Totals						11,140	3,332	2,693

Description of Modeled Units and Elevations for USW SD-6 (QA:N/A)

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	Tpcpin	TCw	4895	0 / 446	Last 26'		
crystal-poor non- partly-welded vitric sub-zones of Tiva Cyn Tuff	Tpcpv1-2	PTn	4449	446 / 39			
pre-Tiva Canyon Tuff bedded tuff	Tpbt4	PTn					
Yucca Mountain Tuff	Tpy	PTn	4410	485 / 35			
pre-Yucca Mountain Tuff bedded tuff	Tpbt3	PTn					
Pah Canyon Tuff	Tpp	PTn					
pre-Pah Canyon Tuff bedded tuff	Tpbt2	PTn	4375	520 / 27			
Topopah Spring Tuff upper non-partly-welded vitric sub-zones	Tptrv2-3	PTn	4348	547 / 24			
Topopah ** upper densely welded vitric sub-zone	Tptrv1	TSw1	4324	571 / 10			
Topopah ** xl-rich nonlithophysal zone	Tptm	TSw1	4314	581 / 95	First 20' (Total 181')		
Topopah ** xl-rich lithophysal zone	Tptrl	TSw1	4229	666 / 12			
Topopah ** lithic rich member	Tptf	TSw1					
Topopah ** upper lithophysal zone	Tptpul	TSw1	4217	676 / 169			
Topopah ** middle nonlithophysal zone	Tptpmn	TSw2*	4048	647 / 163	(Total 70')		
Topopah ** lower lithophysal zone	Tptpl	TSw2	3885	1010 / 289	+/- 36' @ 3672		
Topopah ** lower nonlithophysal zone	Tptpin	TSw2	3596	1299 / 175	Last 20'		
Perched water anticipated at this depth			3596	1299			
Topopah ** lower densely welded vitric sub-zone	Tptpv3	TSw3	3421	1474 / 50			
Topopah ** non- partly-welded vitric sub-zones	Tptpv1-2	CHn1	3371	1524 / 42	(Total 48')		
pre-Topopah Spring Tuff bedded tuff	Tpbt1	CHn1	3329	1566 / 4			
Calico Hills Formation undifferentiated	Tac	CHn1	3325	1570 / 182			
pre-Calico Hills Formation bedded tuff	Tacbt	CHn2					
Prow Pass Tuff upper nonwelded zone	Tcp (unw)	CHn3	3143	1752 / 399	First 170' Last 40'		
Prow Pass Tuff welded zone	Tcp (w)	PPw					
Prow Pass Tuff lower nonwelded zone	Tcp (lnw)	CFUn			(Total 50')		
pre-Prow Pass Tuff bedded tuff	[bt]	CFUn					
Bullfrog Tuff upper nonwelded zone	Tcb (unw)	CFUn	2744	2151 / 274	First 10'		
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	Tcl	CFMn2, TRW	2470	2425			
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	2485			
Total Depth				2800			

SAFETY REVIEW OF FIELD WORK PACKAGE (FWP) FOR BOREHOLE USW SD-6 (FWP-SB-97-002, R0)

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 Borehole Drilling and Borehole Testing at USW SD-6. This review is also being compiled to ensure that information about potential hazards will be transmitted to all affected organizations, TCO employees, and constructor organizations working at the USW SD-6 surface borehole.

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. The LM-300 or similar drill rig will be used to "dry drill" the borehole. A detailed description of all data collection system activities can be found in Field Work Package (FWP-SB-97-002, R0).

2.0 HAZARDS

2.1 SITE SPECIFIC HAZARDS

Potential hazards to surfaced-base-testing personnel conducting Drill Rig Activities and Borehole Testing Activities on the YMP are:

HAZARD

No

Yes

- X** **Working Alone/Working in Remote/Isolated Areas:** The USW SD-6 Borehole will be located in a remote/isolated site. Working alone is not permitted. A buddy system should always be used. Radic. Net and/or telephone communications are required.
- X** **Extended Working Hours/Extended Driving Hours:** During some USW SD-6 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 SD-6 Borehole could encounter both cold and hot temperature extremes.

- X **Crystobalite Silica & Erionite:** In certain geologic zones at the USW SD-8 Borehole, Silica Dust containing Erionite could be encountered during drilling and core recovery operations.
- X **Mechanical/Equipment:** Well hoisting equipment. LM-300 Drill Rig Equipment.
- X **Physical Hazards - High Noise Levels:** Equipment used at the USW SD-8 Borehole site will require hearing protection.
- X **Chemical Hazards/Hazardous Materials:** Tracers, Fluids and Materials (TFM) that may be used at the USW SD-8 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 SD-8 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 establish 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 SD-6 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, Maydzy, Mayday". Ranch Control also has to be notified.

Extended Working Hours/Extended Driving Hours: During some USW SD-6 Borehole testing activities, extended working and extended driv. 7 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 the 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 SD-6 Borehole activities could encounter severe inclement weather (rain, lightning strikes, and/or high winds) with little or no warning.

Sunburn is a very definite 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 SD-6 Borehole personnel from experiencing 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 than 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 employee's hands warm (i.e., fuel burners, warm air jets, electric radiators).
- If USW SD-8 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 SD-8 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 SD-8 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 SD-6 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 SD-6 Borehole activities should drink plenty of liquids and take frequent breaks. M&O Safety and Health Department procedure, CAP-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 LM-300 "Dry" Drilling operations at USW SD-6 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-12573-1), the mineral "erionite" has been found in geologic zones that have been identified by previous drilling activities. The LM-300 Drilling activities at the USW SD-6 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 LM-300 "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 basal vitrophyre of the Topopah Spring Member.

Predicting the Occurrence of Erionite in the USW SD-6 Borehole with 3-D Mineralogical Modeling, Providing Hazardous Mineral Predictions and Analysis of Potentially Hazardous Minerals are all part of the "test deliverables" that have been developed for the FWP at USW SD-6.

The USW SD-6 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 USW SD-6 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 LM-300 equipment site

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

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

3.1.1 The LM-300 Dust Collection System.

3.1.2 The Haz-Vac.

3.1.3 Maintaining negative pressure on the dust collection system.

3.2 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:

3.2.1 Area around the LM-300 Dust Collection System (or Haz-Vac, if used), the conveyer, and cutting pit.

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

3.2.3 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.

- 3.2.4** Area for decontamination of personnel and equipment and donning and doffing of PPE. This area should have a shower enclosure. (See 1.7 below).
- 3.2.5** 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.
- 3.3** The **Decontamination Area** for personnel and equipment coming from working inside the control zone/exclusion area shall have the following features:
 - 3.3.1** A "de-con" area for removal and disposal of PPE.
 - 3.3.2** A shower enclosure. The shower enclosure may be located with one end in the regulated area, and the other end outside the regulated area.
 - 3.3.3** Area for storage of street clothes and an area for donning PPE.
 - 3.3.4** A personal hygiene area, (i.e., hand washing station).
- 3.4** The following administrative controls will be in effect inside the control zone/exclusion area:
 - 3.4.1** Personnel will not be allowed to remove respirators or PPE to eat, drink, smoke, and/or chew tobacco.
 - 3.4.2** 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.
 - 3.4.3** Good work place hygiene practices.
- 3.5** Inside the control zone/exclusion area the following **Personal Protective Equipment and Occupational Respiratory Equipment** will be worn at all times:
 - 3.5.1** A full face Powered Air Purifying Respirator (PAPR) with HEPA (Highly Efficient Particulates and Aerosols) Filter.
 - 3.5.2** Respirator selection, issue and use shall conform to the requirements of M&O Safety and Health Department Procedure **NAP-SH-009 "Respiratory Protection"**.

- 3.5.3 A "Tyvek" disposable full body overall, long sleeve with "booties" and hood.
- 3.5.4 Two pairs of gloves. (inner-surgical, outer-work). The inner and out gloves must be taped.
- 3.6 The following **Industrial Hygiene sampling and monitoring** shall be conducted while the LM-300 passes through the Erionite Control Zone:
 - 3.6.1 Full shift employee **Breathing Zone and Area Sampling** for the presence of crystalline silica minerals (i.e., quartz, cristobalite and erionite).
- 3.7 **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 USW SD-6 (LM-300) Site. In addition to this M&O "Haz-Com" Training, USW SD-6 employees shall receive the following "site specific" components:
 - 3.7.1 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 USW SD-6 site.
 - 3.7.2 A description of the work practices, engineering, administrative and personal protective equipment control measures that are employed specifically at the USW SD-6 (LM-300) Site.
- 3.8 **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.
 - 3.8.1 USW SD-6 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.

Mechanical: When USW SD-6 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 SD-6 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 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 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 SD-6 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 SD-6 Borehole site electrical outlets will be 3-phase grounded OSHA Standard. All electrical outlets and cords at the USW SD-6 Borehole site are either part of an Assured Grounding Program or Ground Fault Circuit Interrupt (GFI) 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 SD-6 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, Sava 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. Lifeline 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 SD-6 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 LM-300 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 in the ESF. 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 or rib 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, and 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 SD-8 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 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 Dos.~~

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 SD-8 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.

The **M&O Safety and Health Program, B00000000-01717-4600-00016**, 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 M&O Employees**.

The Constructor: The Constructor and/or **CONSTRUCTOR/DRILLING SERVICE PROVIDER** 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 not maintain a full time presence 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 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: 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 you are 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 S&H Administration (OSHA) Standards.

5.0 EMERGENCY RESOURCES LOCATION AND CONTACTS

5.1 EMERGENCY REPORTING

M&O S&H 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 NEEDS ANALYSIS

A medical needs analysis as called out by NAP-SH-012 and 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 Dinamoor, FTR	295-3727
Mike Taylor, ES&H Specialist	295-3647
	Beeper - 794-6678

GEOPHYSICS

YMP-207-RO
01/23/95

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
GEOPHYSICAL LOG REQUEST

Page 1 of 1

ART I

Requestor Name:
Ron Smith

Requestor Organization:
M&O SPO

Borehole Name:
USW SD-6

Standard Logging Suite Type from Table I: (check one)

Group I

Group II

Group III

Group IV

PART II (use continuation sheet if necessary)

Other Required Measurement (not included in standard logging suite) Selected from Table II

Measurement or Log

Justification and Funding

Continuous Temperature

In-situ temperature gradient required

Funding - WBS 1.2.3.11.1 (TR3B1FBI)

PART III (use continuation sheet if necessary)

Special Requirements Measurements or Logs Not Listed in Table II

Measurement or Log

Justification and Funding

Mechanical Sidewall Coring Tool

Sidewall samples required in lieu of continuous whole core. 50 to 100 side wall samples. Funding as above.

Requestor:
Ron Smith

Ron Smith

Date:

3/25/97

By:

Ken E 'bud' Thompson

Ken E Thompson

Date:

3/25/97

Approved

Denied (see explanation on continuation sheet)

YMP-208-RO
01/23/95

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
APPROVED LOGGING PROGRAM
CONTINUATION SHEET

Page 2 of 2
Revision No. 0

Borehole Name:
USW SD-6

Tool/Log Name	Measurements or Curves	Logging Run Number(s)
Borehole Video	Radial, Axial (only in air-filled portion of hole)	1,2,3
Resistivity	ILD, ILM, GR, BHT, Temp profile.	1,2,3
Density	RHOB, DELTARHO, CAL, GR, PEF, BHT	1,2,3
Neutron	Neutron Porosity, GR, BHT	1,2,3
Spectral Gamma Ray	Total GR, K, U, T, BHT	1,2,3
Oriented 4-arm Cal	CAL1, CAL2, GR, borehole orientation	1,2,3
Temperature Profile	Continuous temperature survey	1,2,3
Side Wall Sampling	Depth to sample location	1,2
	CCL added where appropriate	

**YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
APPROVED LOGGING PROGRAM**

Borehole Name:

USW SD-6 NOTE: Logging Run #s used for purposes of developing prognosis. All may not be required..

Logging Run #	<u>1</u>	<u>2</u>	<u>3</u>	_____	_____
Casing Size (ID)	<u>13 3/8-in.</u>	<u>9 - 7/8-in.</u>	<u>9 - 7/8 in.</u>	_____	_____
Casing Depth	<u>50 ft.</u>	<u>1460 ft.</u>	<u>1460 ft.</u>	_____	_____
Borehole Size	<u>12 - 1/4 in</u>	<u>8 - 3/4 in.</u>	<u>8 - 3/4 in.</u>	_____	_____
To Depth	<u>1460 ft</u>	<u>2550 ft</u>	<u>2850</u>	_____	_____
Borehole Size	_____	_____	_____	_____	_____
To Depth	_____	_____	_____	_____	_____
Borehole Size	_____	_____	_____	_____	_____
To Depth	_____	_____	_____	_____	_____
Borehole Size	_____	_____	_____	_____	_____
To Depth	_____	_____	_____	_____	_____
Depth to Water	<u>1460</u>	<u>2550</u>	<u>2550</u>	_____	_____
Drilling Depth	<u>1470</u>	<u>2550</u>	<u>2840</u>	_____	_____

By: Loren E. 'Bud' Thompson

Loren E. Thompson

Date: 3/25/97

AMSP:

Date:

**LOGGING PROGNOSIS - BOREHOLE USW SD-6
SUBJECT TO REVISION**

Run 3 - Scenario - Previous logging run made; last casing string set near perched water; drilling continued into the water leg. Likely 200 or more feet of water standing in the borehole.

Logging Program (Group 1)

**Borehole Video
Resistivity
Density
Neutron
Spectral Gamma Ray
Oriented 4-arm Cal (includes deviation)
Continuous Temperature Profile
Side Wall Sampling (25 samples)**

9 - 5/8" casing set near 1460 ft.

**Logging in 8 - 3/4- in open hole.
Logging from TD to tie into last csg string.**

Water Table = 2550 ft

TD = 2849 ft

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Provided for planning purposes only.
Subject to revision. Not to any scale

**LOGGING PROGNOSIS - BOREHOLE USW SD-6
SUBJECT TO REVISION**

**Run 2 - Scenario - After casing
off perched water zone near 1460
ft, drilling continued to just above
water table at 2550 ft. Possibly
several feet of water in borehole
during logging.**



9 - 5/8" casing set near 1460 ft.

**Logging in 8 - 3/4-in open hole
from 2540 to tie into previous
run near 1460 ft.**

**Logging depth five to ten feet
above water table near 2550 ft.**

**Provided for planning purposes only.
Subject to revision. Not to any scale**

**LOGGING PROGNOSIS - BOREHOLE USW SD-6
SUBJECT TO REVISION**

**Run 1 - Scenario: Perched Water
at 1460 ft; section logged to
surface; casing will be set after
logging. Possibly 20 ft of water
standing in borehole during
logging.**

Casing set at 50 ft.

**Logging in 12-1/4-in open hole
- 1460 ft. to surface.**

Perched water at 1460 ft.

Logging Program (Group 1)

**Borehole V: 'o
Resistivity
Density
Neutron
Spectral Gamma Ray
Oriented 4-arm Cal (includes deviation)
Continuous Temperature Profile
Side Wall Sampling (25 samples)**

**Provided for planning purposes only.
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LET 3/25/97

USW SD-6 DISCHARGE OF PUMPED WATER

**SKETCH OF PROPOSED FLOW DISSIPATION
TOPOGRAPHIC MAP SHOWING LOCATION OF DISCHARGE LINE**

**5/15/97
J. S. OPP**

DESCRIPTION OF DISCHARGE DISSIPATION TECHNIQUE

Water will be pumped from the borehole USW SD-6 west over the ridge of Yucca Mountain down into Solitario Canyon.

The anticipated pump rate is a maximum of 150 gallons per minute (GPM).

A water conveyance line will be installed from the borehole (located on the Yucca Mountain Crest) to the bottom of Solitario Canyon which crosses the surface trace(s) of the Solitario Fault (as identified by the US Geological Survey).

The water conveyance line will flow into a collection tank located within Solitario Canyon and will discharge by overflowing onto the ground surface in Solitario Canyon.

Specifications for overflow of pumped groundwater:

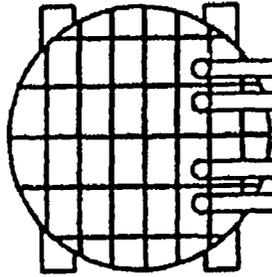
- The collection tank will overflow
- The collection tank will be above the ground-surface placed on wooden planks
- The tank will be 6-8 feet high
- The conveyance line into the collection tank will be approximately 4 inches in diameter
- The collection tank will act to decrease the flow rate for the discharge water which descends approximately 750 feet into Solitario Canyon

Copies to.

John Zeisloft
Tom Pysto
Kent Fitzgerald
Ron Oliver
Bill Distel

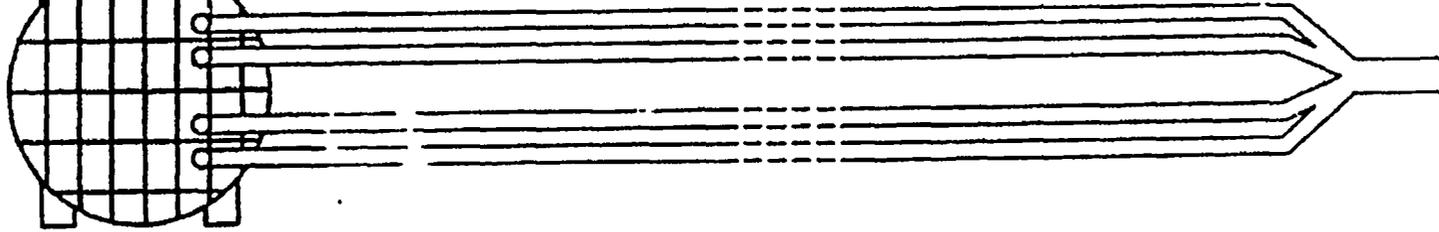
Solitario Canyon Sketch of SD-6 Discharge Dissipation Technique

Water Collection Tank (8' to 6' height)



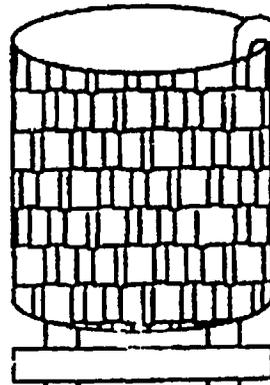
Wooden Planks

4" diameter conveyance line to SD-6



Top View

Water Collection Tank (8' to 6' height)



Wooden Planks

4" diameter conveyance line to SD-6

