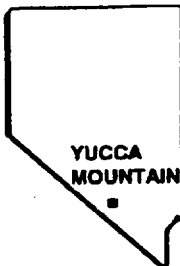


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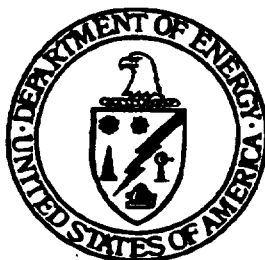


**YUCCA MOUNTAIN**  
**SITE CHARACTERIZATION**  
**PROJECT**

**IN-SITU THERMAL  
CONDUCTIVITY  
MEASUREMENTS**

**REVISION 0**

**FIELD WORK PACKAGE  
FWP-ESF-01-001**



*Wm. H.  
Dassler  
et al.*

**UNITED STATES DEPARTMENT OF ENERGY**

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**  
**FWP/LWP APPROVAL**

QA: QA

**SECTION I (Project Engineer completes)**

FWP/LWP Title:

In-Situ Thermal Conductivity Measurements

FWP/LWP Identifier:

FWP-ESF-01-001

Assigned Project Engineer:

Douglas Weaver

Affected Organizations in FWP/LWP:


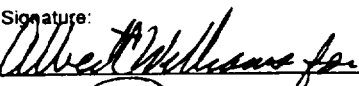
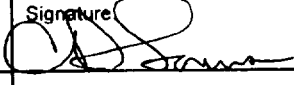
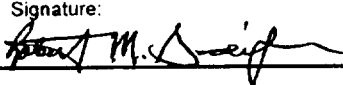
Test Integration Department, Test Coordination Office, Site Facility Department, Sample Management and Drilling Section

**HISTORY OF REVISIONS**

Revision Number	Effective Date	Reason for Change
0	02/01/01	Initial Issue

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

The following signatures authorize work to commence in accordance with this FWP/LWP and within the constraints identified in the Planning and Control System approved by the Office of Civilian Radioactive Waste Management.

Manager Name:	Organization:	Signature:	Date:
Mark Peters	TID		1/25/01
Manager Name:	Organization:	Signature:	Date:
Robert Clark	OQA		1/31/01
Manager Name:	Organization:	Signature:	Date:
Dennis Sorensen	M&O ES&H		1/30/01
Manager Name:	Organization:	Signature:	Date:
Robert Sandifer	M&O SFD		1-31-01

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

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

TCO Manager:	Signature:	Date:
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<b>INTRODUCTION .....</b>	<b>3</b>
<b>1.0 SCOPE AND DESCRIPTION.....</b>	<b>3</b>
1.1 General Scope Description .....	3
1.1.1 General Purpose, Objectives, and Test Description .....	3
1.1.2 Requirements Basis for In-Situ Thermal Conductivity Measurements Testing.....	4
1.2 Specific Scope Description.....	4
1.2.1 Organizational Responsibilities .....	4
1.2.2 Field Testing Equipment.....	6
1.2.3 Computer Software .....	6
1.3 Implementing Field Documents.....	6
1.4 Data and Deliverables.....	8
1.5 Planned Tracers, Fluids, and Materials Usage .....	8
<b>2.0 SAMPLING PLAN.....</b>	<b>8</b>
2.1 Sample Collection .....	8
<b>3.0 WORK IMPLEMENTATION AND CONTROL.....</b>	<b>9</b>
3.1 Implementation.....	9
3.1.1 General Items .....	9
3.1.2 Coring, Test Construction, and Instrumentation Activities.....	10
3.1.3 Testing .....	11
3.1.4 Data Collection.....	11
3.2 Contingency Plans .....	12
3.3 Prerequisites and Hold Points.....	12
3.4 Stop Work .....	12
3.5 Special Instructions .....	12
<b>4.0 ADMINISTRATIVE (NON-QA) INSTRUCTIONS .....</b>	<b>12</b>
4.1 Environmental, Safety, and Health.....	12
4.1.1 Environmental .....	12
4.1.2 Safety and Health.....	12
4.2 Points of Contact.....	13
4.3 Schedule .....	13
4.4 Summary Accounts .....	14
<b>5.0 FIELD VERIFICATION AND SCOPE COMPLETION .....</b>	<b>14</b>
5.1 Field Verification.....	14
5.2 Scope Completion.....	14
<b>6.0 RECORDS.....</b>	<b>14</b>
6.1 List of Records .....	14
6.2 Records Generation .....	15

**7.0 ATTACHMENTS ..... 15**

Attachment 1	Operational Preliminary Hazard Analysis Checklist and Environmental, Safety, and Health Review .....	15 Pages
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## **INTRODUCTION**

This Field Work Package (FWP), developed in accordance with AP- 5.2Q, provides both administrative guidance and instructions which implement the Quality Assurance Requirements and Description (QARD) DOE/RW-333P, and Integrated Safety Management (ISM) principles/functions related to In-Situ Thermal Conductivity Measurements Testing.

Affected organizations are responsible for conducting work in accordance with this FWP and other applicable controlled, implementing documents. 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.

### **1.0 SCOPE AND DESCRIPTION**

#### **1.1 GENERAL SCOPE DESCRIPTION**

This FWP will address testing criteria, project controls, environmental, safety, and health (ES&H) requirements, and identify roles and responsibilities specific to this testing workscope.

##### **1.1.1 General Purpose, Objectives, and Test Description**

The limited thermal conductivity data set on the Yucca Mountain host rock is a dominant source of uncertainty in critical process models. The objective of this work is to reduce this uncertainty related to thermal conductivity in the potential repository horizon rock units through a combination of analysis of existing data, laboratory measurements, and field-scale measurements. The primary customer of this data is the Subsurface Design Department.

The definition of the number of analyses in the lab and field to reduce uncertainty and understand the spatial variability of thermal conductivity needs to be considered in the light of possible design requirements ("temperature limits"). Given this and for planning purposes, certain assumptions will be made concerning number of analyses and relation to design requirements. If, as the design requirements for the low temperature design evolve, any assumptions become invalid, the testing requirements will be revised for potential refinement of the program.

##### **Objectives and Test Description**

The objectives of this field testing program are to conduct field-based measurements using the "Rapid Estimation of K and Alpha" (REKA) Probe, U.S. Department of Energy ([DOE] University Cooperative Agreement: Task 13 – University of Nevada Reno [UNR]), or similar device at several locations in the Lower Lithophysal unit of the Enhanced Characterization of the Repository Block (ECRB) Cross Drift, nominally between construction station 14+40 and 17+63 meters. In addition to REKA measurements, other slightly larger configurations may contain electric heaters and temperature measuring devices in a borehole array to obtain the parameter of bulk rock thermal conductivity. The holes are

anticipated to be horizontal, located off the left rib of the Cross Drift, NQ to HQ in diameter, and approximately 10 meters long. The specifics on the holes will be communicated during the physical work planning and control process.

In conjunction with these borehole-based measurements, each borehole may have a video log, neutron log, gamma log, a select amount of air injection tests, and/or mapping of lithophyses and fracture characteristics in order to evaluate results in a meaningful manner.

### **1.1.2 Requirements Basis for In-Situ Thermal Conductivity Measurements Testing**

The following define the requirements basis, plans and data needs for activities associated with this testing activity:

- Baseline Change Proposal M&O-01-007
- Letter, Adams to McDonnell, "Authorization to Continue Efforts to Implement Project Operations Review Board (PORB) Directions Responding to Concerns Expressed by the Nuclear Waste Technical Review Board and Nuclear Regulatory Commission", OPS:JJA-0463, Dated December 28, 2000
- Multi-Year Planning System Fiscal Year (FY) 2001 at <http://ympcs1.ymmp.gov> (See Work Packages in Section 4.4)
- DOE/UCCSN Cooperative Agreement Number DE-FC08-98NV12081, Task 13
- Determination of Importance Evaluation for Exploratory Studies Facility Subsurface Testing Activities, BAB000000-01717-2200-00011 Rev 02/ICN08

## **1.2 SPECIFIC SCOPE DESCRIPTION**

### **1.2.1 Organizational Responsibilities**

The organizations described in this section provide services in support of this testing activity. A brief scope of responsibilities for each organization is provided, including interface responsibilities. Specific ES&H responsibilities are included in Section 4.1. These organizations are current M&O organizations. The organizations involved in implementing work under this FWP, as currently assigned by the Planning and Control System (PACS) include:

**PRINCIPAL INVESTIGATORS (PIs):** The PI(s) will provide the scientific staff, instrumentation, and equipment necessary for conducting the field testing. This includes deployment of testing components, instrumentation, data collection equipment, or interactions with the data collection services provided by the TCO. The PIs are responsible for ensuring that the data and information collected during test activities associated with the testing are acceptable to meet requirements for Project needs, qualified in accordance with applicable QA requirements, and submitted to the Technical Data Management System (TDMS). The PIs are responsible for ensuring that each of their field staff has been provided an opportunity

to read and understand the contents of this FWP and associated Work Instructions (WI).

**TEST COORDINATION OFFICE:** The TCO is responsible for coordinating and monitoring field test activities in support of participants and the Yucca Mountain Site Characterization Office (YMSCO). Explicit responsibilities include: planning and coordination of field testing activities including scheduling and coordination between the PI and other affected organization(s) of the Project; assigning a Project Engineer (PE) to interface with PI organizations, Engineering, and the Constructor on technical issues; assigning a FWP Records Coordinator (FWPRC) to monitor the FWP records process; ensuring ISM principles and functions are being met; preparing requests for field work scope modification for activities that fall within the approved scope of this activity; preparing and controlling changes to this FWP; and appointing a Data Manager for the data management activities including data distribution as described in FWP-ESF-96-001, "Field Test Data Collection Systems". These responsibilities, when shared with management, the sponsoring PI, and affected organizations, will ensure that data and information gathered from the test activities described herein will meet program requirements and be consistent with DOE directives and the ISM Program.

**SITE FACILITIES DEPARTMENT (SFD):** The Site Facilities Department (SFD) Organization is comprised of multiple departments, which provide overall management of all tunnel operations. These SFD departments include the **Craft Management Section (CRMS)**, **Field Engineering Section (FES)**, and **Construction Management Section (CMS)**. The TCO will coordinate field testing activities with SFD who will ensure departmental support in providing labor and equipment to facilitate specific activities described in Section 3.1. The SFD will provide an interface to the TCO. The SFD will ensure that criteria transmitted through design documents and FWPs will be adhered to. The TCO will coordinate field testing activities with the SFD who will ensure departmental support in providing underground labor, materials, and equipment to facilitate testing activities as requested by the PIs, and transmitted through the TCO. This support for testing activities will, at a minimum, include drilling activities, survey support, test installation support possibly including assistance in loading heavy instrumentation downhole, electrical support to the test locations, grouting of instrumentation boreholes, and the transportation of equipment and personnel inside the Exploratory Studies Facility (ESF), ECRB Cross Drift, and on the ESF Pad. The specific scope of these activities will be provided during the physical work planning and control process. The SFD has the responsibility of ensuring safe working conditions and safe constructor operated equipment.

**DATA COLLECTION STAFF:** The TCO will provide Data Collection Staff who are responsible for defining and configuring a Data Collection System (DCS) if required for the test by the PI, terminating instrumentation wires to the DCS, conducting configuration acceptance testing, assigning data channel locations within the DCS, and collecting/distributing the data to the PI Organizations. The ESF Data Manager, as defined by

FWP-ESF-96-001 and assigned by the TCO, controls and manages the Data Collection Staff and assigned responsibilities.

**WIRELINE MEASUREMENT SUPPORT (WMS):** WMS personnel will provide labor, instrumentation, and equipment to conduct geophysical logging activities and support for testing associated with this FWP. Call out for this support, as defined by the PI, will be coordinated through the responsible PE. Work will be conducted for these activities through FWP-ESF-96-013, "Borehole Wireline Measurements for ESF Testing Activities."

**SAMPLE MANAGEMENT AND DRILLING SECTION (SM&DS):** The SM&DS will provide sample collection, handling, packaging, archiving, and shipping support for samples and/or core from the boreholes as requested by the TCO.

### **1.2.2 Field Testing Equipment**

The PI and, if required for data collection, Data Collection Staff will provide the test and data collection equipment required for field activities associated with this testing and will have approved procedures and/or scientific notebooks to follow when using this equipment. The equipment will be set-up and operated by the PIs and Data Collection Staff as described in Section 3.0.

### **1.2.3 Computer Software**

Software (excluding that which is an integral part of measuring and test equipment) that uses numerical methods for complex scientific, engineering, or mathematical calculations will be controlled in accordance with appropriate QA procedures. No data manipulation software is identified at this time to support field activities.

The Data Manager and PI shall use electronic methods as a controlled source of data and will implement QARD Supplement V controls. Other Personnel who use electronic methods as a controlled source of data must also comply with Supplement V controls.

## **1.3 IMPLEMENTING FIELD DOCUMENTS**

The following procedures or their equivalents will be utilized to implement testing activities within the scope of this FWP. The PI will conduct Quality Affecting work in accordance with QARD requirements. The sequence in which these documents are applied in executing the work is presented in Section 3.0. The decision to implement these procedures or apply them to QA controlled activities is under the direction of the implementing organization. ISM principles and functions are administrative in nature and are implemented using the procedures identified by an asterisk (\*) and those identified in lower tier hazard assessment documents such as the ES&H review (Attachment 2), WIs, and Job Safety Analyses. This list identifies procedures currently planned to implement activities. If University Staff are acting in the role of PI, approved UCCSN QA Program equivalent procedures may be used. These procedures may be revised, replaced, or added to, as needed, without revising this FWP.



PROCEDURE NUMBER	TITLE
AP-12.1Q	Control of Measuring and Test Equipment and Calibration Standards
AP-17.1Q	Record Source Responsibilities for Inclusionary Records
AP-2.17Q	Tracers, Fluids, and Materials Data Reporting and Management
AP-2.21Q	Quality Determination and Planning for Scientific, Engineering, and Regulatory Compliance Activities
AP-3.14Q	Transmittal of Input
AP-EM-002	Land Access and Environmental Compliance
AP-EM-003*	NonHazardous Waste Management
AP-EM-004	Spill Management
AP-ESH-004*	Occupational Safety and Health Program
AP-ESH-008*	Hazards Analysis System
AP-OM-006Q*	Work Request/Work Order Process
AP-REG-001*	Managing Lessons Learned
AP-REG-007	Occurrence Reporting and Processing of Operations Information
AP-SC-001*	Physical Work Planning and Control Process
AP-SIII.1Q	Scientific Notebooks
AP-SIII.3Q	Submittal and Incorporation of Data to the Technical Data Management System
AP-SV.1Q	Control of the Electronic Management of Information
LANL-EES-13-DP-612	Identification, Collection, and Handling of Non-Required Assigned Core in the ESF
LANL-EES-13-DP-613	Borehole Wireline Measurements
LANL-EES-13-DP-614	Data Collection System Configuration Acceptance Testing
LANL-EES-13-DP-615	Data Collection System Field Instrument Wire Terminations
LANL-YMP-QP-S5.01	Electronic Data Management Control
LP-ESH-010-M&O	Emergency Management
LP-ESH-012-M&O	Hazard Communication
LP-ESH-014-M&O*	Permit-Required Confined Spaces
LP-ESH-020-M&O	Respiratory Protection Program
LP-ESH-023-M&O*	Occupational Health Program
LP-OM-002-M&O*	Facility Condition Inspections
LP-SMF-002Q M&O	Field Logging, Handling, and Documenting Borehole Samples
NWI-DS-002Q	Field Drilling Support Activities
NWI-DS-004Q	Logging, Handling, and Documenting Exploratory Studies Facility Non-Required Assigned Core Samples
NWI-ESF-007Q	Water Use and Control – Subsurface
NWI-ESF-008Q	Surveying
NWI-ESF-009Q	Control and Distribution of Surveying Documents
PRO-EP-001	Environmental Permit Compliance
PRO-EP-003	Authorization to Purchase Regulated Materials
PRO-SH-001*	Accident Investigation, Reporting and Recordkeeping
PRO-SH-004*	Hearing Conservation Program
PRO-SH-008*	Occupational Heat Stress
PRO-SH-014*	Silica Protection Program
YAP-SII.1Q	Submittal, Review, and Approval of Requests for Yucca Mountain Site Characterization Project Geologic Specimens
YAP-SII.2Q	Requesting Samples for Examination at the Yucca Mountain Site Characterization Project Sample Management Facility

YAP-SII.4Q	Collection, Submission, and Documentation of Non-Core and Non-Cuttings Samples to the Sample Management Facility for Site Characterization
FWP-ESF-96-013	Borehole Wireline Measurements for ESF Testing Activities

Note: AP-OM-006Q is currently being revised and the new procedure number will be AP-2.23Q. The title will remain unchanged.

#### **1.4 DATA AND DELIVERABLES**

The PI has the responsibility for the collection, analysis, submittal, and reporting of Quality Affecting data and records relating to the implementation of this FWP. Data shall be submitted to the TDMS by the PI or designee in accordance with AP-SIII.3Q "Submittal and Incorporation of Data to the Technical Data Management System." Data record responsibility is addressed in Section 6.0 of this FWP.

#### **1.5 PLANNED TRACERS, FLUIDS, AND MATERIALS USAGE**

The use or removal of testing related Tracers, Fluids, and Materials (TFM) by affected organizations must be identified and reported to the TCO prior to use/removal. The TCO will report the use of test-related TFM in accordance with AP-2.17Q. The FES is responsible for reporting construction-related TFM usage. The controls regarding the use of TFM are listed in the Determination of Importance Evaluations (DIE) specific to the fieldwork, which are implemented and controlled under this FWP.

As reiterated in Attachment 2, Material Safety Data Sheets are readily available for all substances used in support of these tests. Potential hazards associated with these materials, with mitigating measurements, will be briefed to personnel before use during Tool Box Safety Meetings.

Below is a list of planned TFM for these testing activities:

- Will-X Cement, Grout
- Silicon Sealant (for borehole signs)
- Test Equipment (Sensors, Heaters, Data Collection Equipment)

Procedure PRO-EP-003 will be followed for the use of all regulated hazardous materials.

#### **2.0 SAMPLING PLAN**

##### **2.1 SAMPLE COLLECTION**

Core samples from the boreholes shall be collected under NWI-DS-002Q, LP-SMF-002Q M&O, NWI-DS-004Q, and/or YAP-SII.1Q. Core determinations will be made by the TCO and concurred with by management in accordance with LANL-EES-13-DP-612.

Bulk Rock samples (if required) will be collected under YAP-SII.4Q.

Any special packaging requirements for the core will be transmitted to the TCO, and in turn, will be provided to the Sample Management Facility (SMF) for implementation.

### 3.0 WORK IMPLEMENTATION AND CONTROL

#### 3.1 IMPLEMENTATION

The following list of activities provides instructions on how work associated with this testing will be conducted and controlled. The TCO works to ensure efficient interface and coordination between the PI organization and all other organizations involved in these activities. The TCO monitors all test-related construction and testing activities associated with this FWP to ensure the appropriate controls, as necessary, are implemented through the relevant organizations(s). Safety requirements and procedures involved in these activities are addressed in Attachment 2. All physical work will be conducted in accordance with AP-SC-001, *"Physical Work Planning and Control Process"*.

The following list of activities includes actions that implement QARD requirements and management guidance that does not. Items flagged with a **QA**: **QA** are recognized as being quality affecting unless specifically graded out by the organizations performing the task. Grading is accomplished in accordance with AP-2.21Q or other equivalent procedures. Items identified with a **QA**: **N/A** do not implement QARD requirements and are therefore considered administrative in scope. The TCO or PI may modify the sequence of QA activities based on conditions in the field, provided those modifications are documented and affected organizations concur.

**PI** denotes either the actual PI or PI assigned designee.

##### 3.1.1 GENERAL ITEMS

- 3.1.1.1 The **TCO**, in conjunction with the **PIs** and affected scientific staff, shall develop WI according to AP-OM-006Q identified in Section 1.3, to specifically address detailed ES&H issues covering scientific activities. All field work shall be done consistent with the activities described in this FWP and within the ES&H controls detailed in the WI. Through AP-OM-006Q, the TCO will also request craft support specific to these activities. **QA**: **NA**
- 3.1.1.2 **Affected Organizations** shall conduct and/or participate in a Tool Box Safety Meeting held on site at the start of each shift that field activities are planned, as outlined in the WI. **QA**: **N/A**
- 3.1.1.3 Throughout the implementation of this FWP, the **TCO** shall provide regular written status reports to the DOE and Project Management addressing test specific progress. **QA**: **N/A**
- 3.1.1.4 **Affected Organizations** shall report all spills or releases of hydrocarbon materials or hazardous materials in accordance with AP-REG-007. **QA**: **N/A**
- 3.1.1.5 **Affected Organizations** shall limit the use of, to the extent practical, the loss of grout or water to the formation and the use of organics per DIE BAB000000-01717-2200-00011. **QA**: **N/A**

### **3.1.2 CORING, TEST CONSTRUCTION, AND INSTRUMENTATION ACTIVITIES**

- 3.1.2.1** The **TCO** shall request the **CMS**, through **AP-OM-006Q**, to provide at a minimum, the transportation of test apparatus and equipment inside the Cross Drift, the coring of boreholes, as-built survey of the completed holes, test installation labor support, electrical support to the test locations, grouting of instrumentation boreholes, and operational flexibility to instrument, maintain, operate, and monitor the testing program. **QA: N/A**
- 3.1.2.2** The **SFD** will provide the support listed in 3.1.2.1 and conduct all grouting operations in accordance with the controls identified in **DIEs BAB000000-01717-2200-00011** and **00005**. **QA: N/A**
- 3.1.2.3** The **PI** shall identify the borehole locations and transmit the locations to the **TCO** in writing. **QA: N/A**
- 3.1.2.4** The **PI** shall ensure that the placement of all thermal conductivity holes are nominally at least 2 meters from existing U.S. Geological Survey (**USGS**) systematic boreholes and 4 meters from existing **LBNL** systematic boreholes in the Cross Drift to prevent any potential interference from this test to the others. This will be done during field siting of the boreholes and recorded in a scientific notebook. **QA: QA**
- 3.1.2.5** The **TCO** shall provide to the **SFD** the locations and specifics of the boreholes (approximately 20 @ 10 meters each and approximately 6 @ 6 meters each) through the Work Request process, **AP-OM-006Q**. **QA: N/A**
- 3.1.2.6** The **CRMS** shall supply the personnel and equipment to core the boreholes identified in the Work Request to be provided by the **TCO** as described in 3.1.2.5. Only dry coring techniques shall be deployed. **QA: N/A**
- 3.1.2.7** The **TCO** shall define and document the disposition of core generated from coring activities associated with this FWP as outlined in procedure **LANL-EES-13-DP-612**. **QA: QA**
- 3.1.2.8** The **SM&DS** or their designees shall take custody of the core samples by removing core samples from the barrel, and processing the core in accordance with **LP-SMF-002 M&O** and/or **NWI-DS-004Q**. **QA: QA**
- 3.1.2.9** The **SM&DS** shall submit a copy of all daily drilling reports to the records center in accordance with **AP-17.1Q**. **QA: QA**
- 3.1.2.10** The **FES** shall survey and document the borehole collar location and orientation, and downhole points in accordance with **NWI-ESF-008Q** and **NWI-ESF-009Q** and submit the survey records to the **TDMS** in accordance to **AP-SIII.3Q**, unless excluded by the **TCO**. As directed by the **TCO** through the work control process, survey to layout specific borehole arrangements will be required **QA: QA**

- 3.1.2.11** The PI shall document acceptance of each borehole to the TCO or provide further direction to obtain a suitable hole. **QA: QA**
- 3.1.2.12** The PI shall provide labor and necessary materials/equipment to install test components, instrumentation, and data collection equipment. The TCO shall provide Data Collection Staff to install, maintain, and operate a DCS per the PIs request. **QA: N/A**
- 3.1.2.13** The PI shall install instrumentation and test components in accordance with approved technical procedures identified in Section 1.3 and/or with a scientific notebook developed in accordance with AP-SIII.1Q. **QA: QA**
- 3.1.2.14** The TCO shall report the use of test-related TFM in accordance with AP-2.17Q. **QA: QA**

### **3.1.3 TESTING**

- 3.1.3.1** The PI shall conduct the field testing in accordance with their scientific notebooks or other applicable procedures identified in Section 1.3. **QA: QA**
- 3.1.3.2** The PI shall ensure all field instrumentation is calibrated according to appropriate procedures. **QA: QA**
- 3.1.3.3** The PI and/or TCO shall collect raw data in accordance with their scientific notebooks or other applicable procedures identified in Section 1.3. **QA: QA**
- 3.1.3.4** **WMS** personnel shall conduct borehole wireline measurements, as required by the PI, in accordance with LANL-EES-13-DP-613, FWP-ESF-96-013 and associated WIs. **QA: QA**

### **3.1.4 DATA COLLECTION**

**NOTE** The DCS is defined as any stand alone data acquisition system or data logger for which the ESF Data Manager is responsible for the configuration, operation, and maintenance. This is independent of any active measurements that may be conducted or data loggers that may be supplied and operated by the PIs.

- 3.1.4.1** The **DATA COLLECTION STAFF** shall connect wires to the DCS according to LANL-EES-13-DP-615. **QA: QA**
- 3.1.4.2** The **DATA COLLECTION STAFF** will conduct Configuration Acceptance Testing on all effected DCS channels according to LANL-EES-13-DP-614. **QA: QA**
- 3.1.4.3** The **DATA COLLECTION STAFF** shall collect data and document in a scientific notebook developed in accordance with AP-SIII.1Q. **QA: QA**

- 3.1.4.4** The **DATA COLLECTION STAFF** shall distribute data to the PIs in accordance with AP-SV.1Q, LANL-YMP-QP-S5.01, and document the activities in a scientific notebook developed in accordance with AP-SIII.1Q. **QA: QA**
- 3.1.4.5** The PI shall collect active testing data or stand-alone (i.e. REKA measurements) that is not all ready being collected by the DCS, through a PI provided data logger data, in accordance with instructions contained in a scientific notebook developed in accordance with AP-SIII.1Q or a UCCSN QA Program approved equivalent. **QA: QA**
- 3.1.4.6** **PIs** are responsible for the submittal of applicable DCS data to the TDMS in accordance with AP-SIII.3Q. **QA: QA**

### **3.2 CONTINGENCY PLANS**

No contingency plans have been identified for work covered in this FWP.

### **3.3 PREREQUISITES AND HOLD POINTS**

No prerequisites or hold points have been identified specific to work described in this FWP.

### **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, if appropriate, will stop work on those elements until the FWP is changed to reflect the correct work practices.

Any employee has authority to stop work if an imminent danger exists to the workers, the public, or the environment.

### **3.5 SPECIAL INSTRUCTIONS**

None identified.

## **4.0 ADMINISTRATIVE (NON-QA) INSTRUCTIONS**

### **4.1 ENVIRONMENTAL, SAFETY, AND HEALTH**

#### **4.1.1 Environmental**

All spills or releases of hydrocarbon materials or hazardous materials shall be immediately reported in accordance with AP-EM-004, "*Spill Management*".

No tracers are approved for this activity.

All operations must comply with the conditions of DOE/NV environmental permits.

#### **4.1.2 Safety and Health (S&H)**

See Attachment 2 for ES&H Responsibilities and Controls. Potential hazards and associated mitigations will be identified in accordance with AP-ESH-008, "Hazard Analysis System."

## 4.2 POINTS OF CONTACT

Geoengineering Sect. Mgr.	C. Howard	295-5744
TCO Project Engineer/TCO Lead	D. Weaver	295-5916
Field TCO Lead	R. Kovach	295-6180
FWP Record Package Coordinator	A. Mitchell	295-6539
TCO Safety Coordinator	M. Taylor	295-6379
SNL Principal Investigator	C. Howard	295-2714
UNR Principal Investigator	G. Danko	775-784-4284
Data Manager	F. Homuth	295-4900
Data Collection Staff	R. Sievert	295-5798
Data Collection Staff	T. Williams	295-4313
Environmental Compliance Department	T. Pysto	295-5082
ES&H Manager	D. Sorensen	295-4941
Test Integration Department Mgr.	M. Peters	295-3644
Site Facilities Department Mgr.	R. McDonald	295-3703
Craft Management Section Mgr.	C. Sparks	295-7560
Field Engineering Section Mgr.	R. Dresel	295-7366
Support Services & Maintenance Mgr.	D. Davis	295-3733
Construction Management Section Mgr.	R. Law	295-3699
DOE/YMSCO	D. Coleman	794-5537

### 4.3 SCHEDULE

ID	Task Name	Start	Finish	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
	TEST PLANNING MILESTONES	1/6/01	1/6/01			
M\$1	Initiation of Field Work Package FWP-ESF-01-001	1/5/01	1/5/01			
	FIELD TEST IMPLEMENTATION	1/28/01	9/28/01			
	Field Test Implementation - Discrete	2/1/01	9/28/01			
D1	Thermal K Coring	2/5/01	9/21/01			
D2	Thermal K Scientific Efforts	2/12/01	9/28/01			
	Field Test Support - Matrix Support	1/2/01	9/28/01			
M1	Test Coordination	1/2/01	9/28/01			
M2	Sample Management Facility	2/5/01	9/28/01			
M3	Field Test Coordination	2/5/01	9/28/01			
M4	Logging and Video Support	2/5/01	9/28/01			
M5	Field Tech Support to Field Activities	2/5/01	9/28/01			
M6	Provide ESF Craft Services	2/5/01	9/28/01			
M7	Provide Site Mgt., Coord & Control	2/5/01	9/28/01			
M8	Construction Management	2/5/01	9/28/01			

#### 4.4 SUMMARY ACCOUNTS

FY 01 summary accounts associated with the activities described in this FWP and related information are as follows (QA: N/A).

In-Situ Thermal Conductivity Measurements	WBS#s	LEAD MATRIX ORG.	EST. START DATE	FY01 WORK PACKAGE NUMBER	FY01 WP FUNDING (\$K)*
<b>Field Test Implementation</b>					
<b>Discrete</b>					
D1 Thermal K Coring	1.2.22.6.1	MK	2/5/01	6401215TN2	\$251K
D2 Thermal K Scientific Efforts	1.2.21.5.1	SNL	2/12/01	4201215TMN	\$500K
<b>Field Test Support</b>					
<b>Matrix Support</b>					
M1 Test Coordination	1.2.21.5.1	LANL	1/2/01	4201226TMF	\$1258K
M2 Sample Management Facility	1.2.21.5.1	SAIC	2/5/01	4201226TMG	\$917K
M3 Field Test Coordination	1.2.21.5.1	LANL	2/5/01	6401226TN1	\$800K
M4 Logging and Video Support	1.2.21.5.1	LANL	2/5/01	4201226TMK	\$286K
M5 Field Tech. Support to Field Act.	1.2.21.5.S	MK	2/5/01	6401215SN7	\$543K
M6 Provide ESF Craft Services	1.2.21.5.S	MK	2/5/01	6401215SNF	\$2231K
M7 Provide Site Mgt., Coord. & Control	1.2.21.5.S	MK	2/5/01	6401215SN2	\$827K
M8 Construction Management	1.2.21.5.S	MK	2/5/01	6401226CN5	\$390K
Subtotal - Discrete					\$751K

\* Discrete funding listed only from Change Request (CR).

#### 5.0 FIELD VERIFICATION AND SCOPE COMPLETION

##### 5.1 FIELD VERIFICATION

No field verifications have been identified for this work.

##### 5.2 SCOPE COMPLETION

The scope of this FWP will be completed when no further field data is being collected.

Scope completion will be documented by the responsible Section Manager and provided to the TCO for inclusion into the FRP.

#### 6.0 RECORDS

##### 6.1 LIST OF RECORDS

PIs are responsible for collection, management, and submittal of data, in compliance with applicable PI plans and procedures as per the cooperative agreement. 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 AP-SIII.3Q, and other applicable plans and procedures.

Records shall be submitted to the records center within 60 days of their completion.



The FWPRC will coordinate and monitor the development of the FWP records package. The record package shall contain documents that demonstrate compliance with YMP procedures. The completed records package may contain (or reference) the following:

RECORD	RESPONSIBLE ORGANIZATION	QA DESIGNATOR
Revision/Changes to the FWP	TCO	QA: QA
ES&H Review and/or other Hazard Assessments	TCO	QA: N/A
Regular Reports Addressing Test Status	TCO	QA: N/A
ESF Drilling Reports and Related Information	SM&DS	QA: QA
Sample Numbers	SM&DS	QA: QA
Planned Borehole Locations	PI	QA: N/A
Borehole Survey Data	FES	QA: QA
Wireline Measurements (Video, Logging Data)	TCO	QA: QA
Scientific WIs	TCO	QA: N/A
Tool Box Safety Briefing Forms Containing Feedback or New Process	TCO	QA: N/A
Documentation Identifying Work as Complete	PI	QA: QA
Borehole Acceptance	PI	QA: QA
Borehole Wireline Measurements and Video	WMS	QA: QA

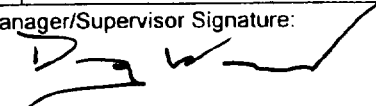
## 6.2 RECORDS GENERATION

Activities within the scope of the FWP will be documented in accordance with approved procedures. See Section 6.1 above.

All personnel associated with this testing activity are responsible for ensuring that documents associated with this FWP 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 procedures.

## 7.0 ATTACHMENTS

Attachment 1 Operational Preliminary Hazard Analysis Checklist and Environmental, Safety, & Health Review (QA: N/A)

Operational Preliminary Hazard Analysis Checklist					
Review the Hazard Identification Checklist and provide a "YES" or "NO" answer. The work/activity check list addresses potential hazards to personnel, property, or the environment. The Safety Basis checklist is used to determine impacts to existing systems.					
1. WP/FWP/Laboratory Work Package (LWP) Title and Number: FWP-ESF-01-001, "In-Situ Thermal Conductivity Measurements"					
2. Date of Analysis: 1/3/01					
3. Scope of Work Description: See Section 1.1 of FWP-ESF-01-001					
4. Will the work involve any of the following activities?			5. Will the work impact any of the following YMP Systems?		
Work Activity	Yes	No	Safety Basis System	Yes	No
Trenching/ Excavation		X			
Geophysical Investigation	X				
Subsurface Construction		X			
Surface Construction		X	Compressed Air (FCL2)		X
Dry Drilling (by Crafts)	X				
Wet Drilling		X			
Modification to existing structures		X			
Sample Collection	X				
Decontamination		X			
Work outside in inclement weather		X			
Exposure to temperature extremes		X			
Work on off-normal hours or in remote locations		X			
Maintenance activities		X			
Operational activities		X			
Heavy Equipment (by Crafts)	X				
Lasers or Laser systems		X			
Material/soil containing Crystalline Silica	X				
Radioactive materials/logging tools	X				
Biological hazards		X			
Utility/Electrical Modifications		X			
Exposure to high noise levels	X				
Confined Space entry & work		X			
Equipment with exposed mechanical/moving parts		X			
Working at a height greater than 6 ft		X			
Welding, cutting, brazing (by Crafts)		X	Other: Hazardous Material Inventory		X
Working on uneven, slippery surfaces		X	6. Is the activity adding a system that has not been developed through the design process (A/E or Field Design)?		X
Use of any chemical that is Flammable/Ignitable, Corrosive, Reactive or Toxic		X			
Fire or explosive hazards		X	(FCL1) = Functional Classification Level 1 (FCL2) = Functional Classification Level 2		
Generation, storage of Hazardous and Non-Hazardous Waste(s)		X	(FCL3) = Functional Classification Level 3		
Work with Explosives (Blasting)		X	(FCL4) = Functional Classification Level 4		
Impacts to external Organizations/Facilities		X			
7. All "Yes" responses in block 5 require additional documented hazard analysis and mitigating control development. A "Yes" response in block 6 requires the proposed activity to be subjected to the Section 5.2 screening process of AP-ENG-001.			8. Manager/Supervisor Signature:  Date: 1-24-01		

## ENVIRONMENTAL, SAFETY, AND HEALTH REVIEW (QA: N/A)

### 1.0 INTRODUCTION

This Environmental, Safety, and Health (ES&H) Review of the Field Work Package (FWP) for In-Situ Thermal Conductivity Measurements has been compiled by the Test Coordination Office (TCO) ES&H Specialist. The purpose of this ES&H Review is to: (1) provide a *Operational Preliminary Hazard Analysis (OPHA)* which identifies and lists hazards; and (2) recommend engineering, administrative, work practice, and personal protective equipment (PPE) control measures for coordinating and conducting In-Situ Thermal Conductivity Measurements. This review strives to incorporate the seven guiding principles and five core functions of Integrated Safety Management (ISM).

The hazard analysis was conducted in accordance with *AP-ESH-008, Hazard Analysis System*. *AP-ESH-008* also requires incorporation of subordinate hazard analysis processes such as Design Hazard Analysis, Work Package Hazard Analysis, Work Order Hazard Analysis, Job Safety Analysis (JSA), Medical Needs Analysis (MNA), Occupational Exposure Assessment (OEA), and Personal Protective Equipment Hazard Analysis (PPEHA). All JSAs must be conducted and documented in accordance with *Section 5.4 of AP-ESH-008*. All MNA's must be conducted and documented in accordance with *Section 5.7 of AP-ESH-008*.

This review has been conducted to ensure ES&H functions have been integrated into the activities described by the FWP. This ES&H Review does not address all environmental permit compliance stipulations. Line managers and supervisors should contact the Environmental Compliance Department (ECD) to ensure that necessary environmental permits have been applied for and approved in accordance the *ECD Procedure, PRO-EP-001, Environmental Permit Compliance*. This includes compliance with *AP-EM-002, Land Access and Environmental Compliance*.

This ES&H Review is also being compiled to ensure that information about potential hazards and control measures will be transmitted to all affected organizations on the Yucca Mountain Site Characterization Project (YMP) and within the Bechtel/SAIC (BSC) Organization in order to **integrate ES&H into all activities, processes, work requests, work orders, work instructions and operations** described by the FWP. All work requests, work orders, (work instructions) must be written in accordance with *AP-OM-006Q, Work Requests/Work Order Process*. Please note that *AP-OM-006Q* will be changed in the near future to *AP-2.23Q, Work Requests/Work Order Process*.

Line managers and supervisors should read/review this document and work with Safety and Health (S&H) in order to evaluate work processes and operations where further hazard analysis will need to be conducted and documented.

### 1.1 OBJECTIVES, TEST SCOPE, AND DESCRIPTION

See Section 1.1 of this Field Work Package, FWP-ESF-01-001.

## 2.0 HAZARDS

### 2.1 OPERATIONAL PRELIMINARY HAZARD ANALYSIS:

**Identified Hazards:** Listing of activities/tasks and the potential hazards to scientific personnel conducting In-Situ Thermal Conductivity Measurement Activities:

	ACTIVITY/TASK	POTENTIAL HAZARD
1	Mechanical excavation, geophysical investigation, geologic sample collection, subsurface construction, and "dry" core drilling. Working with material/soil containing Crystalline Silica.	Exposure (E) to Respirable Dust containing Crystalline Silica.
2	Working around heavy and drilling equipment. Working around equipment with exposed mechanical/moving parts. Working with high pressure equipment.	Being struck by (SB), contact with (CW) equipment, or equipment components.
3	Working with Radioactive Materials and logging tools.	Exposure (E) to ionizing radiation.
4	Utility/Electrical modifications.	Contact with (CW) energized electrical systems and components.
5	Working in high noise level areas.	Physical hazard; exposure (E) to high noise levels.
6	Working on uneven, wet, slippery surfaces.	Slips, trips, and falls (STF). Fall to same level (FSL).

### 3.0 HAZARD CONTROLS

#### ACTIVITY #1:

***Mechanical excavation, geophysical investigation, geologic sample collection, subsurface construction, and "dry" core drilling. Working with materials containing Crystalline Silica.***

**POTENTIAL HAZARD 1A:** Exposure to Respirable Dust containing Crystalline Silica.

Thermal Conductivity coring activities may require employees to work around mechanical excavation, underground construction, and "dry" core drilling operations. Water use during some of these activities could be limited or restricted. Some boreholes will be "dry" drilled using compressed air as the drilling fluid. **Respirable dust containing Crystalline Silica** could be produced during these types of operations/activities.

#### MITIGATION 1A:

Dry core drilling should only be conducted according to the Work Practices as outlined in Section 5.2 of the M&O Safety and Health Procedure *PRO-SH-014, Silica Protection Program*. *PRO-SH-014* requires implementation of effective engineering controls, such as atomizing water spray, highly efficient particulates and aerosols/air (HEPA) filtration system, dust diverter, torit dust collector, and/or administrative controls (rotation of personnel), and work practices to control Silica dust.

The Management and Operating contractor (M&O) Silica Protection Program requires employees to attend a training course on the hazards and control measures for Silica exposure. *PRO-SH-014* recommends that workers exposed to high dust level work areas receive a chest x-ray and "uniforms" to wear. In addition, as part of this program, employees may be required to wear a respirator as a secondary line of defense.

Employees will follow the guidance/requirements that can be found in the *LP-ESH-020, Respiratory Protection Program* should respiratory protection be required as part of the Thermal Conductivity Testing activities. Supervisors and employees wearing respirators have several specific responsibilities/actions under this procedure. Employees must have completed a physical examination within the past year and have no facial hair that interferes with the sealing surface of the respirator. Line Procedure, *LP-ESH-023-M&O, Occupational Health Program* describes how M&O employees can arrange for physical examinations, on site through Bechtel Nevada Medical. To schedule physical examinations call 5-2957.

Respirator Training for M&O Project and Scientific Characterization Personnel is handled by the M&O Training Department in Trailer #1. Respiratory equipment and fit testing for M&O Project and Scientific Characterization Personnel is supplied by M&O Industrial Hygiene (IH). Contact the IH Staff (day shift only) in Trailer #5 on the ESF Pad (5-7506) for respirator fit testing, equipment issue, and training support. It is advised that you call and make a reservation/appointment in advance.

Currently, employees are required to wear occupational respiratory protection, i.e., at a minimum, 1/2 mask HEPA Filtered Air Purifying Respirator whenever mechanical excavation, subsurface construction, or "dry" core drilling activities are being conducted and dust generation is above the Action Level (AL). Smoking and chewing of tobacco is not allowed in areas of the ESF or the ECRB where respirators are required. Approved respiratory protection shall be worn in posted areas and whenever so directed by supervision.

An ongoing IH sampling and monitoring program which includes both the sampling of employees' breathing zones and work areas is being conducted by M&O IH. Engineering controls are being constantly evaluated and additional engineering controls will be recommended when they are required.

**ACTIVITY #2:**

***Working around heavy and drilling equipment. Working around equipment with exposed mechanical/moving parts. Working with high pressure equipment.***

**POTENTIAL HAZARD 2A:** Being struck by, or contact with equipment, or equipment components. Working around heavy equipment can present health hazards of respirable dust (See POTENTIAL HAZARD 1A) and safety hazards from contact with and being struck by moving equipment. The hazards of working with air under pressure and high pressure systems include being struck by and contact with equipment and equipment components.

### **MITIGATION 2A:**

When Thermal Conductivity Measurement activities require scientific characterization personnel to conduct work on electrical circuits or any form of equipment with stored energy (i.e., mechanical systems/components, drilling systems monitoring devices, conveyor belt systems), the systems/components must first be de-energized, isolated, and rendered inoperative before employees can begin work. This process of de-energizing, isolating, and rendering inoperative is known as Lockout/Tagout. (See Activity #4, Utility/Electrical modifications.)

The Lockout/Tagout program is not required for working around mobile in-use equipment. Scientific personnel conducting testing activities where heavy and drilling equipment is being used should check-in with the Craft Management Section (CRMS) craft personnel (operating engineers) operating the equipment to ensure that the operators/miners/ teamsters know of your presence. To become familiar with an operation where drilling and electrical equipment is being used, attend the beginning of each shift Tool Box Safety Meeting and talk with CRMS and the craft personnel conducting the work.

Contact the ESF TCO FTR to arrange for Lockout/Tagout assistance through CRMS with craft support.

When scientific characterization activities require work in the same area as heavy and drilling equipment, personnel should be aware of the following:

- Do not stand behind mobile equipment when it is running. (The operator may not be able to see or even hear you).
- All mobile equipment i.e., front-end loaders, forklifts, are required by OSHA regulation to have warning systems installed on them that sound a loud alarm whenever the equipment/machine is placed in reverse. Pay attention to these alarms and watch for moving equipment.
- Most mobile equipment is operated with a spotter (a driller and/or another operator), who watch the machine as it moves and warn the operator of foot travelers in the area. Pay attention to the commands of the operator and/or the spotter.
- Whenever you are working around drilling and heavy equipment, pay attention to your surroundings, and follow all directions of the CRMS craft personnel operating the equipment.

Scientific Personnel conducting testing activities could encounter compressed air and high pressure compressed gas systems and equipment, including air compressors, pneumatic tools, and gas/air in bottles/cylinders. Never walk under or near any of this equipment while it is in operation or use.

Compressed air will be used as the drilling fluid and to provide power to drilling and related equipment. Air compressors and air receivers (storage tanks) must be equipped with pressure relief valve/apparatus. Air hoses must be equipped with whip checks, to 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 must be equipped with bleed down valves and pressure indicating gauges to ensure that all air pressure is relieved before attempting to tighten, remove, or adjust any components. Inside the ESF the compressed air line system will be managed in accordance with

*LP-OM-010-M&O, Compressed Air Operating Procedures.*

Large K bottles or cylinders which contain 200 cubic feet of compressed gas may be used at underground locations where these testing activities are taking place. These cylinders are used for operations such as oxygen/acetylene cutting and tracer gas injection. Any cylinder that is not being used must be stored in an upright position, secured to a rack with a chain, and have the protective cap on the cylinder valve. Cylinders should be transported using a cart that is designed for this purpose.

In addition *Standing Order (SO) #2000-07* requires maintaining a minimum of 90 psig (pounds per square inch gauge) and daily inspection of the compressed air system in the ECRB. Copies of other applicable *Standing Orders* that scientific characterization personnel should be aware of are available at the service desk in Trailer 7009, Construction Management Section (CMS) Trailer on the ESF Pad.

**ACTIVITY #3:**

***Working with Radioactive Materials and logging tools.***

**POTENTIAL HAZARD 3A:** Exposure to ionizing Radiation.

**MITIGATION 3A:**

Radioactive Sources (Gamma and Neutron) could be used to log boreholes as part of the scientific characterization activities. Authorization for the use of ionizing radiation producing materials will be through the M&O Radiation Control (RADCON) Manager, and will be conducted under Field Work Package FWP-ESF-96-013, Borehole Wireline Measurements For Exploratory Studies Facility Testing Activities and in accordance with the administrative procedures listed below:

*AP-RP-001, External Radiation Dosimetry*, describes the process for issuing radiation dosimeters to individuals, processing the reported dose results, investigating any dose anomaly results, controlling radiation exposure of a declared pregnant worker, revoking the individual's dosimeter and access to radiological areas, and terminating the use of an individual's radiation dosimetry. This procedure establishes the dosimetry requirements detailed M&O Radiation Protection Program (RPP) and ensures compliance with DOE radiological safety requirements for monitoring personnel, as specified in 10 CFR 835, Occupational Radiation Protection and NV/YMP Radiological Control Manual (RCM).

*AP-RP-002, Radiological Work Permit (RWP) – Authorization for Use of Radioactive Sources/Materials or Radiation Producing Equipment*, identifies the requirements for obtaining approval from the M&O Radiological Control Manager (YMP Rad Con Manager), for the use of radioactive sources/materials and radiation producing equipment on the YMP, through the use of the Radiological Work Permit (RWP). RWP's establish the protective requirements for personnel entry into radiological environments or for performing work where radiological exposure from radioactive sources/materials exists or when radiation producing equipment is used, handled, or stored. The RWP also serves as the mechanism for informing personnel and organizations that might be affected whenever radioactive sources/materials or radiation producing equipment is stored, handled, or used on the YMP.

*AP-RP-003, Radioactive Source/Material Control and Accountability*, establishes the responsibilities and methods to be followed to control and account for radioactive sources/materials being received, used, or stored on the YMP.

*AP-RP-004, Radiological Surveys*, establishes the methodology for performing and documenting radiological surveys conducted by M&O radiation protection program personnel. Radiological surveys will be conducting during the deployment and use of ionizing radiation producing equipment.

*AP-RP-005, Posting and Entry Training Requirements for Radiological Areas*, identifies the posting and entry requirements for areas that are managed for the purpose of radiological control. This procedure establishes radiological warning and posting requirements in accordance with M&O RPP, the requirements of 10 CFR 835, Occupational Radiation Protection and NV/YMP RCM.

**ACTIVITY #4:**  
***Utility/Electrical modifications.***

**POTENTIAL HAZARD 4A:** Contact with energized electrical systems and components. Electrical shock.

**MITIGATION 4A:**  
Personnel conducting Thermal Conductivity Measurement activities will note that anytime personnel are required to conduct work on electrical circuits or any form of equipment with stored energy (i.e., electrical/mechanical systems/components, drilling systems monitoring devices), the systems/components must first be de-energized, isolated, and rendered inoperative before employees can begin work. This process of de-energizing, isolating, and rendering inoperative is known as Lockout/Tagout. Lockout/Tagout is an Occupational Safety and Health Administration (OSHA) program requirement that seeks to ensure that equipment needing maintenance, repair, or service has been locked and tagged (identified) in order to prevent injuries to employees by accidental activation. All Lockout/Tagout activities should be performed in accordance with M&O line procedure, *LP-OM-001-M&O, Lockout/Tagout Process*.

Personnel conducting Thermal Conductivity Measurement activities will note that 440 volt cable(s) will be lying on the ground around the drilling/mining equipment. Avoid contact with these cables. However, if the nature of any scientific characterization activity could possibly cause physical damage to the electrical cable jacket(s) or conductors, it is mandatory that contact be made with a TCO Field Test Representative (FTR) and the Lockout/Tagout Coordinator to arrange with CRMS for services of the craft electricians to move the cable(s).

Scientific characterization personnel should not attempt to open or work on any electrical components, such as junction or panel boxes. Contact the TCO FTRs and the Lockout/Tagout Coordinator to arrange with CRMS for services of the craft electricians. All electrical systems must be locked and tagged out before any work can even be attempted.

All cord and plug connected equipment (i.e., electrical cords or multi-outlet devices) at surface and sub-surface construction sites must be either part of an "Assured Grounding Program" (LP-CON-003-M&O, "ESF Assured Grounding



Conductor Program") or plugged into outlets that are Ground Fault Circuit Interrupt (GFCI) protected. Underground, panel boxes equipped with GFCI protected circuits can be identified by plug and cord connections wrapped with blue tape. All scientific characterization personnel must ensure that any cord and plug connected equipment used underground and not connected to a GFCI device is entered into the "Assured Grounding Program". The "Assured Grounding Program" uses a "color coding" system on extension cords and equipment, contact the TCO FTR to arrange with CRMS for the services of the craft electricians, who perform this service. Extension cords cannot be over 50 feet in length and no more than one extension cord can be used at any one outlet/location. Permanent or hard wired power drops should be used in place of extension cords whenever possible. All extension cords, or multi-outlet devices must be Underwriters Laboratory (UL) listed and be rated for heavy duty/outside use. Underground, extension cords cannot be hung in the same rack/hook as the tunnel power cables and they must be designated for hard or extra hard use. Extension cords designated for hard or extra hard use will have the following letters written on the outside: S, ST, SO, STO, SJ, SJO, SJT, SJTO, etc. Guidance/requirements for extension cord use can be found in OSHA 29 CFR 1926.405 (a) (ii) (J) or the National Electrical Code (NEC), Table 400-4. Contact the TCO for assistance from the CRMS craft electricians for permanent power drops or rack/hook hardware installations.

**ACTIVITY #5:**

***Working in high noise level areas.***

**POTENTIAL HAZARD 5A:** Physical hazard; exposure (E) to high noise levels. Hearing impairment and hearing loss.

**MITIGATION 5A:**

Scientific Characterization Personnel conducting testing activities need to be aware that the core drill and related equipment that will be used to core drill boreholes could produce high noise levels. Hearing protection (earplugs and/or earmuffs) must be used during any drilling operation. The operation should be posted by IH at the request of the Construction Management Section (CMS). Ear plugs and earmuffs are available from the portal shack at the entrance to ESF. Earmuffs are available from the Tool Crib located on the ESF Pad.

During certain operations, (i.e., drill jumbo, jackleg drilling, or jack hammering operations), dual protection, both earplugs and earmuffs, may be required. Contact the M&O Industrial Hygiene for information on underground construction areas where dual protection may be required. Approved hearing protection shall be worn in posted areas and whenever so directed by supervision.

The M&O Safety and Health Procedure *PRO-SH-004, Hearing Conservation Program* specifies the requirements for employees working in high noise areas. All employees working in these areas must be in the hearing conservation program and, among other things, obtain a baseline and annual audiogram that is usually conducted during annual physical examinations.

**ACTIVITY #6:**

***Working on uneven, wet, slippery surfaces.***

**POTENTIAL HAZARD 6A:** Slips, trips, and falls (STF). Fall to same level (FSL).

#### **MITIGATION 6A:**

In some cases, personnel conducting Thermal Conductivity Measurements in the ECRB will be escorted by a fully underground trained and qualified TCO FTR, who is familiar with the underground operations, equipment, and construction process. Follow the direction of these TCO FTRs.

The ECRB has treated wood ties to which the railroad lines are attached/secured. These ties will have gaps and irregularities. These invert sections have gaps and irregularities on the walking surface. Slips, trips, and falls could be hazardous. When accessing the ECRB main, always walk on the rib that has the lights strung on it.

In the underground drifts, when a train approaches, the operator will sound the horn on the locomotive. In the ESF main drift when pedestrians hear or see an approaching train, they must stop, move as far off the right rib and away from the track as possible, and stand with their backs to the rib while facing the oncoming equipment. Remain still until the equipment has passed. While the locomotive passes, they will keep their eyes on the operator/swapper but not shine their cap lamp in the operator/swapper's eyes. Pedestrians will proceed only after all the rail cars and equipment has cleared the area.

In the ECRB drifts when pedestrians encounter a train, the locomotive operator will stop and wait for personnel to move up onto the utility pipes on the left rib. Only after pedestrians have moved to the utility pipes, will the train continue. Remain still until the equipment has passed. While the locomotive passes, keep your eyes on the equipment and the operator, but do not shine your cap lamp in his/her eyes. Proceed only after all the rail cars and equipment have cleared the area. Reflective safety vests (red or orange) are required to be worn by all personnel working, walking, or visiting the ECRB East West Cross Drift.

In the ESF main drift and at the ECRB intersection, do not stand on or near any of the rail switches while equipment is approaching. Rail cars and equipment have a larger potential to "de-rail" in these areas. These switches have currently been installed at the North Portal and ECRB intersection 20+00 meters.

Curves in the tunnel make it more difficult for the locomotive operator to see pedestrians. The locomotive operator will sound the horn when entering these areas. Pedestrian traffic needs to pay attention and watch for train traffic. If possible, limit foot traffic when train traffic is in these areas.

When testing activities require personnel to access the ESF and the ECRB, and/or alcoves that are in an active mining stage, pedestrians should be aware of the following:

- Alcoves in the ECRB should be accessed on the right rib, just like the ESF main drift. Watch for mobile equipment and follow the directions of the mining personnel on where to walk and stand.
- Do not stand behind mobile equipment when it is running. The locomotive operator, swapper, and miners communicate with a series of cap lamp/flashlight visual signals. Pedestrians should be aware of the following signals:
- Horizontal movement of the cap lamp/flashlight = Stop (freeze in place).

- Vertical movement of the cap lamp/flashlight = move away from the person giving the signal.
- Circular movement of cap lamp/flashlight = approach the person giving the signal.

Follow all directions of the TCO FTR, PIC, or CRMS personnel while accessing underground work areas.

#### 4.0 ROLES AND RESPONSIBILITIES - SAFETY AND HEALTH

**Safety and Health Roles and Responsibilities:** The M&O is in charge of the YMP and has the responsibility for S&H for all teammate organizations, employees, visitors, and personnel from other organizations when they are on M&O controlled worksites. Clear roles and lines of responsibility, authority, and accountability are established at all levels of the organization to ensure protection of workers, the public, the environment, and property.

Therefore, in order to fully implement the principals of ISM, the M&O has appointed a Person-In-Charge (PIC) for the work area or location where construction (testing support) and/or scientific testing activities are being conducted. (A description of the PIC's roles and responsibilities is provided below).

Scientific characterization personnel will discuss the daily construction (testing support) and/or scientific testing activities scheduled to be conducted and appoint a PIC for each specific work area or location from their line management and supervision staff. Depending on each specific work activity i.e., construction/testing support or scientific, the PIC may be any individual from the TCO, or a scientific testing organization. The PIC will be identified in the Tool Box Safety Meeting prior to the start of daily activities.

**Specific Group and Individual Safety and Health Roles and Responsibilities:** See Section 1.2.1 of the FWP for specific organizational responsibilities. The following are specific S&H roles and responsibilities for each group:

**Site Facilities Department (SFD):** The SFD includes the Sections of Construction Management (CMS), Craft Management (CRMS), Field Engineering (FES), Sample Management and Drilling (SMDS) and Support Services & Maintenance Management (SS&MMS). The SFD, primarily the CMS and the CRMS are responsible for jointly selecting (with the TCO) the PIC. The SFD is responsible for implementing the requirements of this FWP during the construction/test support and scientific testing processes. SFD provides construction/test support services to the organizations conducting scientific testing activities work on the YMP. SFD is responsible for oversight and management of all construction/test support activities on the YMP. CMS is responsible for integrating the requirements of M&O S&H Policy and Procedures into all construction/test support and scientific testing activities. SFD has S&H responsibility for all persons (employees and visitors) inside YMP construction/test support and scientific testing work areas and locations. SFD is responsible for maintaining YMP construction/test support and scientific testing work areas and locations in a safe and healthful condition, for maintaining mobile and stationary equipment, S&H training, and training in the safe operation of some pieces of equipment.

**Test Coordination Office:** is responsible for jointly, selecting (with the SFD, CMS, and CRMS) the PIC. The TCO is responsible for scientific testing activities on the YMP. The TCO is responsible for the implementation of the requirements of this FWP and for coordinating all scientific testing activities/requirements with construction/testing support activities. The TCO and other scientific organizations are responsible for the S&H of their employees and conducting scientific testing activities in compliance with M&O S&H Policy and Procedures.

**Line Managers and Supervisors:** M&O line management and supervision is responsible and accountable for the protection of workers, the public, the environment, and property. M&O line managers and supervisors are responsible for evaluating their work operations, activities, or processes that present new or unusual hazards, then conducting and documenting a JSA. A JSA is a structured, step-wise method to identify discrete tasks in a job, recognize the hazard(s) involved in each task, and specify mitigations to eliminate or reduce the hazard(s) to an acceptable level (i.e., engineering, administrative or PPE controls, and employee S&H training). All JSAs must be conducted and documented in accordance with *Section 5.4 of AP-ESH-008, Hazard Analysis System Procedure*. Contact the TCO ES&H Specialist for assistance in determining which scientific characterization activities require JSAs. Once the JSAs have been produced, reviewed, and approved, they will be used as a task guide for employee training purposes, and this training will be documented.

**M&O Employees:** M&O employees (once they have been trained and understand the requirements), regardless of their employer, are responsible for understanding and following the requirements of the ES&H programs of their employer and specific YMP ES&H Programs. M&O employees are responsible for ensuring that the ES&H Training they have received is followed and implemented, regardless of whether the training was received from their parent organization or on the YMP. M&O employees are responsible for knowing the identity of the PIC in their specific work area or location. M&O employees are responsible for immediately notifying the PIC and then their M&O organization supervisor of unsafe acts, conditions, and/or equipment.

**Person-In-Charge:** is responsible for ensuring the specific work (construction/testing support or scientific testing) activity is conducted in accordance with M&O established S&H procedures. The PIC is responsible for ensuring that the Tool Box Safety Meeting is conducted at the beginning of each shift, on a daily basis. A PIC shall be present in the specific work area during all construction/testing support or scientific testing activity, operation, or process. The PIC will determine if the workers present have the experience, training, knowledge, skills, and abilities needed to perform their work safely and competently. The PIC will be a point of contact for all visitors to the specific work area. i.e., all workers in the specific work area should be able to immediately identify the PIC. If the PIC needs to leave his/her assigned specific work area, a new PIC will be selected and the change will be communicated to all individual workers in the specific work area. If an issue arises, the PIC will be responsible for notifying the appropriate manager(s) within SFD and the TCO, and serve as the focal point of contact of issue resolution.

#### **Written Safety and Health Roles and Responsibilities - TCO ES&H Review**

The ES&H Review is an attachment to this FWP and contains both a OPHA and a section recommending control measures for all identified hazards. The ES&H

Review is specific to the construction/testing support and scientific testing activities found in this FWP. Each organization's line management and supervision shall read the ES&H Review and use it as both guidelines and minimum requirements for informing, educating, and implementing protective measures, i.e., engineering, administrative, PPE controls, training to a JSA, or environmental controls for the identified hazards. A JSA may be assigned by the TCO to be generated by another organization and will be incorporated in the work described in this FWP. A copy of the ES&H review will be available at the ESF TCO field office, the Las Vegas Office, and will be transmitted to test and SFD Sections working on the YMP.

M&O Teammate organizations and employees will still perform work that is authorized by their respective FWPs, work plans, WI, and/or work procedures. Teammate organizations perform their work as an "integrated group" to the ES&H policies and procedures as set forth by the M&O.

M&O Teammate organizations and employees will continue to conduct construction/testing support and scientific testing work on the YMP through the umbrella of the M&O Safety and Health Plan and the listed Environmental Plans that can be found in the FWP.

*AP-ESH-004, Occupational Safety and Health Program*, provides program elements, methods, and processes to implement Federal and states laws, regulations, standards, and DOE directives applicable to safety and health (i.e., Respiratory Protection, Noise Control and Hearing Conservation, Silica Awareness, Airborne Radiation Protection).

## **5.0 EMPLOYEE TRAINING AND PPE**

Visiting scientific characterization personnel requiring access to the YMP site must watch a short training video and be escorted by an individual with General Education Training (GET), General Underground Training (GUT), and First Aid/CPR Training. Scientific characterization personnel requiring routine access to work underground in the ESF and/or the ECRB must coordinate through the TCO in accordance with *AP-OM-005, Underground Access Control Process*, and be current in GET, GUT, First Aid/CPR, Respirator, and Hearing Conservation Training. As part of GUT employees are issued an "A" or a "B" sticker for their hard hat, depending on their access requirements and worker category. Personnel entering the ECRB must have an "A" or "B" sticker, or be escorted by a worker with an "A" or "B" sticker.

PPE is required for all persons entering any construction site on the YMP. On the ESF Pad, other than during shift change or when walking to or from the buses or parking lots, all personnel are required to wear the following personal protective equipment:

- Approved safety shoes (ANSI Z41)
- Approved hard hat (ANSI Z89.1)
- Approved safety glasses (ANSI Z87.1)

Side shields are required on all safety and regular prescription glasses. (Procurement contracts require vendors to supply side shields for all prescription safety glasses ordered through the M&O prescription eyewear program). Dark sunglasses (safety or regular prescription) will not be worn inside buildings on the ESF Pad or in any areas underground. Guidance for M&O employees to

go about obtaining prescription ANSI approved safety glasses (with side shields) and footwear through the M&O purchasing system can be found in *AP-ESH-004, Occupational Safety and Health Program, Section 5.14, Personal Protective Equipment*. Section 5.14 states that M&O employees should follow the instructions provided in the Lotus Notes Safety and Health Information Database under "Procedure to Procure Safety Shoes and Glasses". Casual dress (i.e., no shirt, tank tops, cut-offs, shorts, and/or sandals) is not allowed at YMP worksites. If you have any questions regarding PPE, contact your M&O Supervisor or an M&O Safety and Health Representative.

All participants shall adhere to the M&O Safety and Health Procedure *PRO-SH-001, Accident Investigation, Reporting and Recordkeeping*, for instruction on reporting and processing of information on injuries, illnesses, and property damage.

## 5.1 OTHER TRAINING/INFORMATION

All personnel entering the ESF and/or the ECRB, who have **not** received the shift tool box briefing, are to ask the portal guard for current conditions in the tunnel before they enter. This is to ensure compliance with applicable OSHA Standards.

**Area 25 Vehicular Backup Awareness Warning:** In all YMP Area 25 operating areas it is required for drivers of light duty government vehicles not equipped with backup alarms to sound their horn twice prior to backing vehicles. This measure will increase your awareness and awareness of your fellow worker.

Seat belts must be worn in all government vehicles and equipment where provided. Nevada State Law requires all YMP personnel to wear seat belts, and the DOE requires wearing seat belts while driving or riding in a government vehicle. Drivers are responsible for ensuring that passengers wear their seat belts.

## 6.0 EMERGENCY RESOURCES LOCATION AND CONTACTS

### EMERGENCY REPORTING

Radio Net and/or telephone check-in/check-out with Ranch Control for accountability is required on a daily basis. Personnel conducting field test coordination or oversight activities should never venture into the field without a radio (YMP Net #1), first aid kit, food, and water.

Any testing support activity at remote surface-based locations on weekends or during off normal hours requires additional approval from the TCO. A "Safety and Emergency Procedure Description and Plan" must be completed and approved by the TCO. This safety and emergency plan lists participants and emergency contacts and is distributed by e-mail to Project Operations, Construction and Craft Management Organizations.

Any Off Normal Occurrence must be reported to your supervisor and the Conduct of Operations (CONOPS) in accordance with *AP-OM-001, Conduct of Operations Procedure*.

To report life threatening injuries or medical emergencies call "911", on the NTS Radio Network call "Mayday, Mayday, Mayday", emergency services will answer,

and will request information on the nature of your emergency and support/assistance you may require. Ranch Control monitors "911" telephone calls and "Mayday" radio communications.

M&O Safety and Health Procedure *LP-ESH-010, Emergency Management*, was developed for supervisors who have responsibilities for a facility or worksite. In an emergency, telephone 911. Over the Radio announce "Mayday, Mayday, Mayday", then give name and location. The Mercury Communications Information Center will get details of assistance required and dispatch the appropriate response organization.

Any testing support activity that will be taking place on weekends at remote (off the ESF Pad) sites or will require a Medical Needs Analysis (MNA). MNAs must be conducted and documented in accordance with *Section 5.7 of AP-ESH-008, Hazard Analysis System Procedure*.

## **6.2 NEAREST UNDERGROUND PHONE**

Mine Phones are located at the entrance to alcoves and spaced approximately 1500 feet apart, along the right rib of the ECRB. To use the mine phone, depress the black switch in the handset, and ask the portal guard to pick-up. State the location and nature of the emergency.

## **6.3 NEAREST HOSPITAL OR CLINIC**

Mercury, Nevada (approximately 38 miles). The NTS paramedics and an ambulance are stationed at the ESF Pad in the Change House. Do not contact them directly. Always go through the Mercury Operator.

## **6.4 NEAREST FIRST AID STATION/PARAMEDIC**

A First Aid Station is located on the ESF Pad at the Change House. The First Aid Station is manned by two paramedics, who work a ten (10) hour shift in order to ensure that medical coverage is provided during the underground shift.

## **6.5 NEAREST FIRST AID KIT/EYE WASH STATION**

First aid kits and eye wash stations are located in scientific alcoves and other work areas.

## **6.6 NEAREST POTABLE WATER**

Orange "Gott" Drinking Water Coolers are located throughout the ESF and the ECRB.

## **6.7 SUGGESTED EMERGENCY EVACUATION ROUTE AND MEETING AREA(S)**

Underground, situations may occur that will require immediate evacuation of an operation or area. These situations may include: but are not limited to uncontrollable fire, explosions, collapse, hazardous chemical release, or chemical spill.

If such a situation(s) occurs, the Mine Service Phones are equipped with a speaker which will serve as an underground paging system to announce any

emergency condition. Follow the direction given by the announcement, the SFD Supervisor Personnel, or the PIC handling the emergency.

Should access to the portal be cut off or evacuation routes become questionable, all personnel in the tunnel should report to the SFD Supervisory Personnel or the PIC in their work area and follow the instructions provided.

## **7.0 KEY PERSONNEL AND PHONE NUMBERS**

See Section 4.2 of the FWP.