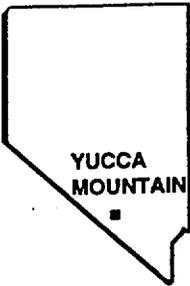


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U.S. DEPARTMENT OF ENERGY

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**YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT**

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**CHARACTERIZATION OF NEAR
SURFACE VELOCITY
STRUCTURE AT YUCCA
MOUNTAIN CREST USING
SURFACE WAVES**

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**FIELD WORK PACKAGE
FWP-SB-01-002**



UNITED STATES DEPARTMENT OF ENERGY

W17-11
NA13507

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

QA: QA

SECTION I (Project Engineer completes)

FWP/LWP Title:

Characterization of Near Surface Velocity Structure at Yucca Mountain Crest Using Surface Waves

FWP/LWP Identifier:

FWP-SB-01-002

Assigned Project Engineer:

Mark J. Esp

Affected Organizations in FWP/LWP:

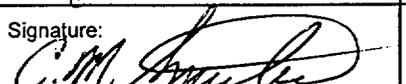
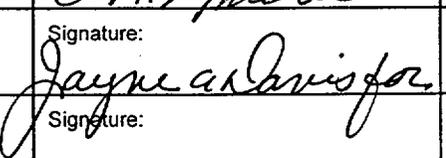
Science and Engineering Testing, Site Services and Field Support, ES&H

HISTORY OF REVISIONS

Revision Number	Effective Date	Reason for Change
0	06/18/01	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: Mark Peters	Organization: S&ET	Signature: 	Date: 6-6-01
Manager Name: Mike Sparks	Organization: SS&FS	Signature: 	Date: 6/11/01
Manager Name: Dennis Sorensen	Organization: ES&H	Signature: 	Date: 6/12/01
Manager Name:	Organization:	Signature:	Date:

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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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 the Characterization of Near Surface Velocity Structure at Yucca Mountain Crest Using Surface Waves.

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 purpose of this testing program is to better understand the seismic velocity structure of Yucca Mountain above the potential repository emplacement area. The approximate 900 foot thick velocity structure between Yucca Mountain Crest and the potential emplacement area is used in the calculations of design ground motions for the three general locations of interest at Yucca Mountain: the potential repository horizon, the mountain crest, and the site of the potential Waste Handling Building (WHB). Knowledge of this velocity structure is also required to calculate dynamic strains and curvatures as a function of depth between the crest and the emplacement area.

Previous studies to address this issue have been conducted, including Vertical Seismic Profiling (VSP) by Lawrence Berkley National Laboratory (LBNL, 1997) and Spectral-Analysis-of-Surface-Waves (SASW) by Dr. Ken Stokoe and Associates, 2000. The VSP surveys were conducted in 6 boreholes, of which only one hole was within the area directly above the emplacement area. This velocity model showed a steep velocity gradient in the top approximate 125 feet. The shallow portion (<100 ft) of the model was not considered highly reliable. Because the VSP results were largely not from boreholes above the emplacement area, large uncertainty bounds about the median profile were adopted. The seven SASW profiles show a steep velocity gradient in the top approximate 20 feet of the profile compared to the previous VSP model.

Test Objectives

Like that of all other Yucca Mountain Site Characterization Project (YMP) seismic tests, the broad objective of this program is to better constrain the Yucca Mountain velocity structure. In particular, the presence of the very

shallow gradient needs to be tested and the variability of velocities across the emplacement area needs to be quantified. The primary focus of this program is the crest of Yucca Mountain, with a secondary focus on the potential repository horizon within the Exploratory Studies Facility (ESF).

Test Description

The planned testing activities will consist of four methods to establish a comparative basis for constraining the Yucca Mountain velocity structure.

1. SASW performed by Dr. Ken Stokoe and Associates under subcontract to Bechtel SAIC Company LLC (BSC);
2. Shear-Wave Refraction performed by Redpath Geophysics, Inc., under subcontract to BSC;
3. Downhole Seismic surveys performed by Redpath Geophysics, Inc., under subcontract to BSC;
4. Surface Rayleigh-Wave recordings by the University of Nevada – Reno (UNR) Seismological Laboratory under Cooperative Agreement with the U. S. Department of Energy (DOE).

SASW - The SASW method is an in-situ seismic technique that is commonly used to assess shear stiffness profiles of layered systems. Measurements involve generating surface waves at one point on the ground surface and measuring the ground motions due to the passing waves at two locations along a single radial path from the source. Successively longer spacing between the receivers and between the source and first receiver are used to measure longer wavelengths. The distance between the source and first receiver is kept equal to the distance between the receivers. Testing is performed in several (typically six to eight) sets of receiver spacings. Phase plots are recorded for each receiver spacing.

SASW surveys will be performed at the top of Yucca Mountain in several locations above the emplacement area, and also in the ESF Main Drift to measure velocities of the middle non-lithophysal subzone of the Topopah Spring tuff. These results will provide information on velocities directly above the emplacement area, which are beyond the reach of the SASW surveys at the top of Yucca Mountain.

The source of energy will be a sledgehammer for short receiver spacings (5 ft to 12.5 ft), a bulldozer for intermediate spacings (25 ft to 100 ft), and a truck-mounted Vibroseis for the long spacings (200 ft to 800 ft). Planned surveys includes: 1) 12 profiles with the sledgehammer and bulldozer to investigate the velocity gradient within the top 100 ft of the mountain; 2) 10 deep profiles with the Vibroseis to measure velocities to a depth greater than 500 feet on the mountain; and 3) four tests within the ESF Main Drift. Planned crest surveys are shown on Attachment 1. Actual survey locations will be determined in the field based on accessible terrain and input from BSC Environmental Compliance.

Shear-Wave Refraction – Shear-wave refraction surveys are conducted in the same manner as more conventional types of surveys that use a compression-energy source such as a hammer striking a metal plate or an explosive charge. A linear array of geophones is placed on the ground and an impulsive source of energy is positioned at selected points along the line of geophones. The travel times of the seismic signals from each source are plotted as a function of distance to the detectors, and then standard interpretation methods are applied to convert the time versus distance data to velocity versus depth. At a minimum, the energy source will be positioned at both ends of the line, and in the middle of the line. The energy source planned for these studies will be a vehicle-on-a-plank aligned normal to the array, struck on both ends with a sledgehammer to generate shear wave signals. It has become standard practice for the number of geophones to be some multiple of 12 with a constant spacing along the entire length of the line. Twenty-four geophones will be employed for this study with an interval of 10 ft, for a line length of 230 ft. Shorter geophone intervals of less than 10 ft may be used near hammer points to resolve first layer velocity, if required. Horizontally-sensitive geophones will be oriented with their sensitive axes at right angles to the seismic array.

A general guideline is that the depth of investigation of a seismic refraction line is approximately one-third to one-fifth of the length of the line. The depth to which subsurface layers can be mapped will depend on the velocity contrast between layers. Refraction surveys rely on the velocity of the subsurface materials progressively increasing with depth. If a velocity inversion is present, then the low velocity material cannot be detected in a conventional refraction survey. Further, it is possible for a particular layer to have a thickness that is insufficient to be clearly manifested on the time versus distance plot, in which case it cannot be unambiguously detected and is referred to as a "hidden layer". Despite these potential drawbacks, seismic refraction surveys are widely used in engineering-oriented site investigations.

The primary objective of the refraction surveys is to validate the shallow portion of selected SASW-based velocity surveys.

Prior to conducting refraction surveys on top of Yucca Mountain, it is necessary to survey a line immediately adjacent to one of the WHB boreholes on the North Portal Pad for which reliable shallow velocities are already available. Borehole UE-25 RF#15 is suitable because bedrock is very near the surface in this hole. The preliminary survey is intended to confirm the ability of a shear-wave refraction survey to determine subsurface velocity structure at the YMP site. Seven to eight refraction line surveys on Yucca Crest are planned to verify the SASW results at shallow depths. One or two lines may be surveyed in the ESF Main Drift.

Downhole Seismic Surveys – Downhole seismic surveys will be conducted in three to five existing neutron boreholes. Boreholes UZ-N27, UZ-N66, and UZ-N76 will be the primary focus of these downhole surveys. Up to two additional neutron boreholes may be surveyed pending initial results, accessible terrain, and environmental land access.

The downhole seismic system consists of an appropriately oriented geophone suspended by a cable with an energy source and a recording/control electronics package on the surface. A vertical geophone is used for compression-wave measurements and a horizontal geophone is used for shear-wave measurements. The energy source is typically sledgehammer blows to a plank (for shear waves) or metal plate (for compression waves). The plank/plate is placed at a defined distance from the borehole. This distance is usually about 5 feet to allow meaningful measurements to be taken at relatively shallow depths. To generate compression waves, the metal plate is struck on the top as nearly vertically as practical. To generate shear waves, a vehicle is parked on the plank and the plank is struck on the side as nearly horizontally as practical.

Surface Rayleigh-Wave Recordings – Surface wave recordings generated by explosive shots at the crest of Yucca Mountain will be used to test whether a low velocity channel exists above a zone with a much higher shear wave velocity. If such a velocity contrast exists, dispersed surface waves should show up on explosion records as a wave train at the end of the record. Otherwise, there will be no dispersion, and the body waves will appear as a narrow packet of energy on the records.

Three-component velocity sensors will record explosive shots detonated in three existing boreholes on Yucca Mountain Crest. These boreholes are UZ-N27, UZ-N66, and UZ-N76. UZ-N27 is near the north end of the potential repository block, UZ-N76 is near the middle, and UZ-N66 is near the southern end of the potential repository block. An as-built sketch of each of these boreholes is contained in Attachment 2. Attachment 3 shows the location of the boreholes and the approximate planned recording sites.

UNR will deploy at least six to ten three-component L-4 velocity sensors and digital Reftek recorders to record surface waves for each blast. The sensors will either be buried just below ground surface or be buried with mounded available dirt. The closest station will be next to the shot to record the origin time of the event. The first recorder away from the borehole will be at 100' distance, with successive recorders in a pattern of increased spacing in a linear array away from the borehole. BSC will provide qualified blasting services to transport, load, and shoot the blasting agent. UNR will also deploy a string of 48 short-period vertical component geophones at 50 foot spacing recorded by a standard reflection/refraction recorder. These recordings should yield an essentially continuous measure of the wave field and thus reduce ambiguities in picking surface-wave phases for velocity estimates. It will also improve depth resolution for waves at longest periods. Shorter geophone spacings may be deployed for recording background noise levels to recover shallower velocity structure beneath the line.

Forward and inverse modeling using surface waves will be done to determine the velocity structure. Due to topographic scattering at the top of Yucca Mountain, the surface wave records might not be ideal for inverse modeling. Although contamination of surface wave records might make inverse modeling difficult, they will verify the existence of a large velocity contrast.

Shallow shear wave velocities can be determined from surface wave analysis. From the first surface wave arrival at each site, the average P-wave velocity between the source and the receiver can be estimated. Average Poisson's ratio from P- and S-wave velocities for each source-receiver pair can also be estimated.

1.1.2 Requirements Basis for the Characterization of Near Surface Velocity Structure at Yucca Mountain Crest

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

- TWP-MGR-GS-000001, Rev 0, "Technical Work Plan for Development of Seismic Design Inputs and Support to Preparation of a Seismic Topical Report", dated 10/26/00
- TWP-MGR-MD-000007, Rev 2, "Technical Work Plan for Testing and Monitoring", dated 04/06/2001
- Input Request 00462.R, "Geotechnical Data to Support Development of Seismic Design Inputs"
- U. S. DOE/UCCSN Cooperative Agreement Number DE-FC08-98NV12081, Task 12, "Great Basin Seismic Network Operations"
- Baseline Change Proposal M&O-01-007
- Multi-Year Planning System Fiscal Year (FY) 2001 at <http://ympcs1.ymp.gov> (See Work Packages in Section 4.4)
- Determination of Importance Evaluation for Surface-Based Testing Activities, BAA000000-01717-2200-00101, Rev 02/ICN02.

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 BSC organizations. The organizations involved in implementing work under this FWP, as currently assigned by the Planning and Control System (PACS) include:

BSC SUBCONTRACT PRINCIPAL INVESTIGATORS (PIs): The PI(s) will provide the scientific staff, instrumentation, and equipment necessary for conducting the field testing. This includes calibration and deployment of testing components, instrumentation, and data collection equipment; field data collection; and providing data or publishing reports as defined in subcontract documents. 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 QARD requirements as defined in subcontract documents, and submitted to the BSC Geoengineering Integration/Implementation Lead for technical review and final submission into 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).

UNR COOPERATIVE AGREEMENT PRINCIPAL INVESTIGATORS: The PI(s) will provide the scientific staff, instrumentation, and equipment necessary for conducting the field testing activities. This includes calibration and deployment of testing components, instrumentation, and data collection equipment; field data collection; and providing data or publishing reports as required by the Cooperative Agreement. The PIs are responsible for ensuring that the data and information collected during test activities done so in accordance with the University and Community College System of Nevada (UCCSN) QA Program as defined by the Cooperative Agreement. 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 (TCO): The TCO is responsible for overall field management, coordination, and monitoring of test activities as defined in this FWP. Specific responsibilities will include: planning and coordination of field testing activities, specifically coordination between the PIs and Construction Management; preparation and maintenance of working schedules based on annual budget allocations; assignment of a FWP Records Coordinator (FWPRC) to monitor the FWP records, preparation of requests for field work scope modification for activities that fall within the approved scope of this activity; and preparation and control of changes to this FWP. These responsibilities, when shared with the supporting PIs, will ensure that data processes and information gathered from the test activities described herein will meet requirements. The TCO is on site whenever construction or test-related activities are occurring. The TCO will provide ESF access for scientific staff, support staff, and Data Collection Systems (DCS) support personnel as required. The TCO is responsible for coordinating all aspects of field test implementation. The TCO will coordinate all requests specific to testing that are included in this FWP, as well as additional requests when supplied to the Responsible Engineer (RE) assigned to this test by the TCO Manager or the Field Test Manager. The term RE will hereafter be referred to as a TCO Project Engineer (PE). Field activities that are not coordinated through the TCO may cause delays to field implementation or result in changes that may directly affect field test objectives. The TCO has the responsibility of maintaining the anticipated work location of each PI or designee while working in the field.

GEOENGINEERING INTEGRATION/IMPLEMENTATION LEAD: The BSC Science and Engineering Testing (S&ET) Geoengineering Integration/Implementation Lead is responsible for overall technical oversight and direction of BSC subcontract PIs; coordination of technical reviews of methodology, data, and reports; acceptance of methodology, data, and reports; and submittal of data into the TDMS.

SITE SERVICES AND FIELD SUPPORT: The SS/FS Department is comprised of multiple departments, which provide overall management of all site operations. These SS/FS departments include Site Construction

Department (SCD), Project Field Engineering Department (FED), Security, and Site Services Department (SSD). The SS/FS will provide an interface to the TCO. The SS/FS will ensure that criteria transmitted through design documents and FWPs will be adhered to, unless communicated to the TCO. The TCO will coordinate testing field activities with the SS/FS who will ensure departmental support in providing labor, materials, and equipment to facilitate testing activities as requested by the PIs, and transmitted through the TCO. This support for testing activities may, at a minimum, include transportation of equipment inside the ESF and on the ESF Pad, blasting services and bulldozer operation on Yucca Mountain Crest for sources of seismic energy. The SS/FS has the responsibility of ensuring safe working conditions and safe constructor operated equipment.

ENVIRONMENTAL, SAFETY, AND HEALTH: The ES&H Department is comprised of multiple departments, which provide ES&H oversight of all site operations. These ES&H departments include Safety and Health Department (S&H) and Environmental Compliance Department (ECD). The TCO will coordinate testing field activities with ES&H who will ensure departmental support in providing support to facilitate testing activities as requested by the PIs, and transmitted through the TCO. This support for testing activities may, at a minimum, include real-time Land Access archaeological/biological surveys for needed flexibility for off-road access for testing vehicles and equipment.

1.2.2 Field Testing Equipment

The PI testing organizations shall provide the test equipment required to perform the field activities associated with this FWP. The PIs shall have approved procedures, ASTM Standards, and/or scientific notebooks to follow when using this equipment.

The SASW technique requires the following typical equipment: an energy source consisting of a sledgehammer and metal plate for short receiver spacings; a bulldozer for intermediate receiver spacings, and a truck-mounted vibroseis for longer receiver spacings; accelerometer receivers, 1-Hz and 4.5-Hz geophones; a waveform recorder/analyzer, digital disk drive, laptop computer and miscellaneous hand tools connectors, cables, and tape measures. Measuring and Test Equipment (M&TE) Calibration is required on the waveform recorder/analyzer. A laboratory calibration for relative phase shift is also required on geophone pairs and accelerometer pairs.

The Shear-Wave Refraction technique requires the following typical equipment: horizontally-sensitive geophones, a recorder such as the Geometrics R-24 digital seismograph; sledgehammers with impulse switches; shear-wave plank; batteries; and various cables. Calibration is required on the timing circuit of the digital seismograph/recorder to verify time is measured to an accuracy of ± 0.01 milliseconds.

The Downhole Seismic technique requires the following typical equipment: a variable azimuth geophone that can be oriented; a vertical geophone; a recorder such as the Geometrics R-24 digital seismograph; sledgehammers with impulse switches; shear-wave plank; batteries; and

various cables. Calibration is required on the timing circuit of the digital seismograph/recorder to verify time is measured to an accuracy of ± 0.01 milliseconds.

The Surface Rayleigh Wave technique requires the following typical equipment: three-component L-4 velocity sensors; digital Reftek seismic recorders; batteries; and various cables. Line recording will require standard reflectron/refraction portable seismic recorder, 12 volt batteries, high-frequency geophones, seismic cabling, and remote recorder triggering cables. UNR Cooperative Agreement PIs shall comply with any calibration requirements as identified in the UCCSN QA Program.

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. The following analytical software is planned for use in this scientific investigation by BSC subcontract PIs:

- WinSASW
- Microsoft Word for Windows, Version 97 SR-2 or later
- Microsoft Excel for Windows, Version 97 SR-2 or later

AP-SI.1Q exempts Microsoft Word and Microsoft Excel from the software qualification requirement, however, any software routines, macros, or software applications within these programs used for quality-affecting analysis must be documented in accordance with AP-SI.1Q. WinSASW is analytical software and must be qualified as required per AP-SI.1Q.

An AP-SV.1Q Supplement V Evaluation has been conducted (Attachment 5) and has determined that electronic media will be used to record these testing activities. The BSC subcontract PIs using electronic methods as a controlled source of data will implement the following QARD Supplement V controls, unless superceded by approved scientific notebooks or subcontract documents.

- All electronic data acquired in the field shall be transferred (i.e., backed up) as soon as practical to separate data storage media. This data transfer must be checked to ensure that the transfer occurred without file alteration, and this check must be documented in a scientific notebook or field log.
- The data collected in the field will become the source files for all subsequent data processing and evaluation. These source files need to be write-protected.
- All subsequent electronic files and data transfers will be checked for alteration using a file size comparison, using a zip file format, or using Project approved file comparison software (signature generation and compare routine). Alternately, file transfers may be manually verified by printing the data from the source file and comparing that visually to a printout of the copied data. File transfers and methodology will be documented in the scientific notebook or other permanent record.
- The final files being generated as part of these geotechnical investigations also need to be write-protected before their inclusion in

- a scientific notebook or other permanent logbook record that will be turned over to the YMP.
- All physical data records (like CDs or other removable electronic media) that are original or unique, where a loss could not be easily recovered, need to be stored in a UL approved fire protected filing cabinet or, alternately, backed up and stored in dual storage.

UNR Cooperative Agreement PIs who use software or electronic methods as a controlled source of data must comply with any electronic data management controls as identified in the UCCSN QA Program.

1.3 IMPLEMENTING DOCUMENTS

The following procedures, standards, and references, or their equivalents will be utilized to implement testing activities within the scope of this FWP. The BSC PIs will conduct Quality Affecting work in accordance with QARD requirements. UNR Cooperative Agreement PIs will use UCCSN QA Program equivalent procedures to implement QA 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 4), WIs, and Job Safety Analyses. This list identifies implementing documents currently planned to implement activities. These documents may be revised, replaced, or added to, as needed, without revising this FWP.

DOCUMENT NUMBER	TITLE
AP-12.1Q	Control of Measuring and Test Equipment and Calibration Standards
AP-15.2Q	Control of Non-conformances
AP-17.1Q	Record Source Responsibilities for Inclusionary Records
AP-2.14Q	Review of Technical Products and Data
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-7.6Q	Procurement of Items and Services
AP-7.7Q	Acceptance of Items and Services
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-005	Underground Access Control Process
AP-OM-006Q*	Work Request/Work Order Process
AP-REG-001*	Managing Lessons Learned
AP-REG-004	Condition/Issue Identification and Reporting/Resolution System
AP-REG-007	Occurrence Reporting and Processing of Operations Information
AP-SC-001*	Physical Work Planning and Control Process
AP-SI.1Q	Software Management
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
ASTM D 5777 – 00	Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation
LP-ESH-010-M&O	Emergency Management
LP-ESH-012-M&O	Hazard Communication
LP-ESH-020-BSC	Respiratory Protection
LP-ESH-023-M&O*	Occupational Health Program
NTIS AD-768 710	Seismic Refraction Exploration for Engineering Site Investigations
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
SO-2000-09*	Yucca Mountain Project Road Access Control
SO-2000-13*	ESF Pad Access and Remote Area Access Training ID Card Guidelines
YAP-13.1Q	Borehole Protection and Access

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. BSC Subcontract PIs shall submit relevant scientific notebooks, field logs, data, electronic media, and interpretations/reports to the BSC Geoengineering Integration/Implementation Lead. The BSC Geoengineering Integration/Implementation Lead shall coordinate a technical review in accordance with AP-2.14Q "Review of Technical Products and Data". The BSC Geoengineering Integration/Implementation Lead shall also be responsible for accepting subcontract services in accordance with AP-7.7Q "Acceptance of Items and Services". Upon completion of the technical review and acceptance of the data, the BSC Geoengineering Integration/Implementation Lead shall submit the data to the TDMS in accordance with AP-SIII.3Q "Submittal and Incorporation of Data to the Technical Data Management System." The UNR Cooperative Agreement PIs shall submit their data and report in accordance with the respective Cooperative Agreement with the DOE. Data record responsibility is addressed in Section 6.0 of this FWP.

Data collected from these seismic testing activities will supplement existing data sets to provide a better understanding of the velocity structure between Yucca Mountain Crest and the potential emplacement area, particularly the possible near-surface velocity gradient. The principal information collected is Compression (P) and Shear (S) wave velocities as specified under the "Seismic Velocity" parameter. These velocities are typically expressed in ft/second. The test results will be used in calculations of design ground motions for the three general locations of interest at Yucca Mountain: the repository horizon, the mountain crest, and the site of the potential WHB. Knowledge of this velocity structure is also required to calculate dynamic strains and curvatures as a function of depth between the crest and the emplacement area.

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 Field Project Engineering Department is responsible for reporting construction-related TFM usage. The controls regarding the use of TFM are listed in the Determination of Importance Evaluation (DIE) for Surface-Based Testing Activities (BAA000000-01717-2200-00101), which is implemented and controlled under this FWP.

As reiterated in Attachment 4, Material Safety Data Sheets shall be readily available for all commercial 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:

- Austinite 15 – Ammonium Nitrate/Fuel Oil (ANFO) Blasting Agent, or functional equivalent
- Emulex 520 Emulsion Primer, or functional equivalent
- PRIMADET Non-Electric Delay Noiseless Lead-In-Line (NLIL), or functional equivalent
- Pea Gravel/Crushed Stone.

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

2.0 SAMPLING PLAN

2.1 SAMPLE COLLECTION

The scope of this FWP does not include sample collection.

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 are recognized as being quality affecting unless specifically graded out by the organizations performing the task. QARD Grading is accomplished in accordance with AP-2.21Q (Attachment 6). Integrated Safety Management Quality Assurance Program (ISMQAP) grading is accomplished in accordance

with AP-ESH-009 (Attachment 7). Items identified with a **QA: N/A** do not implement QARD requirements and are therefore considered administrative in scope.

PI denotes either the actual PI or PI assigned designee (i.e. Field Technician).

3.1.1 ADMINISTRATIVE ITEMS

- 3.1.1.1** The **TCO**, in conjunction with the **PIs** and affected scientific staff, shall develop **WI** according to AP-OM-006Q, 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: N/A**
- 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 comply with Area 25 Standing Order SO-2000-09 regarding vehicular access to Yucca Mountain Crest. Specifically, full-sized trucks, SUV's, and/or vans shall be used to access Yucca Crest trail. No sedans or low clearance light-duty vehicles are allowed. **QA: N/A**
- 3.1.1.6** **Affected Organizations** shall comply with Area 25 Standing Order SO-2000-13 regarding remote area access training requirements when accessing Yucca Crest. Specifically, Site Access Training (SAT), American Red Cross First Aid/CPR shall be current, or an escort current with these training requirements shall be required. **QA: NA**
- 3.1.1.7** **Affected Organizations** shall comply with all stipulations required in AP-EM-002, *Land Access and Environmental Compliance* letter(s) developed for this investigation. **QA: N/A**

3.1.2 SASW MEASUREMENTS

- 3.1.2.1** The **BSC Subcontract PI** shall coordinate and schedule SASW field activities (Yucca Crest and ESF Main Drift) with the **TCO Field Test Manager**. **QA: N/A**
- 3.1.2.2** The **BSC Subcontract PI** shall provide all labor, support equipment, and materials required for SASW measurements, including instruments, data recorder, power supply, and sledgehammer energy sources. The **PI** shall coordinate with the **TCO Field Test Manager** for vibroseis support or craft support to operate a bulldozer that will be

required as an alternate energy source for intermediate and long line spacing. **QA: N/A**

- 3.1.2.3 The **BSC Subcontract PI** shall ensure that applicable test equipment (waveform recorder/analyzer) is either current in an existing YMP-approved calibration, or is calibrated in accordance with YAP-12.1Q prior to performing field measurements. Any necessary calibrations may be arranged at the Bechtel Nevada calibration lab by contacting the **TCO Testing Procurement Coordinator**. A laboratory calibration for relative phase shift is required for geophone pairs and accelerometer pairs. **QA**
- 3.1.2.4 The **BSC Subcontract PI** shall deploy the instrumentation and testing equipment and collect the data. All data shall be collected in accordance with approved technical procedures or documented in a scientific notebook developed in accordance with AP-SIII.1Q. **QA**
- 3.1.2.5 The **BSC Subcontract PI** shall document in the scientific notebook the date, time, location, and duration/frequency (if known) of surface vibratory activities. **QA**
- 3.1.2.6 The **BSC Subcontract PI** shall notify the **TCO Field Test Manager** when SASW measurements are complete. **QA: N/A**
- 3.1.2.7 The **BSC Geoengineering Integration/Implementation Lead** shall coordinate efforts to qualify WinSASW analytical software in accordance with AP-SI.1Q. **QA**
- 3.1.2.8 The **BSC Subcontract PI** is responsible for the submittal of all Quality Affecting SASW calibration documentation, scientific notebook(s), data, and data interpretations to the BSC Geoengineering Integration/Implementation Lead. The BSC Geoengineering Integration/Implementation Lead shall coordinate a technical review of data and interpretations in accordance with AP-2.14Q and accept subcontract services/data in accordance with AP-7.7Q. Upon acceptance of data and interpretation(s) the BSC Geoengineering Integration/Implementation Lead shall submit it into the TDMS in accordance with AP-SIII.3Q. **QA**

3.1.3 SHEAR-WAVE REFRACTION TESTING

- 3.1.3.1 The **BSC Subcontract PI** shall coordinate and schedule Shear-Wave Refraction field activities (Yucca Crest and ESF Main Drift) with the **TCO Field Test Manager**. **QA: N/A**
- 3.1.3.2 The **BSC Subcontract PI** shall provide all support equipment and materials required for Shear-Wave Refraction measurements, including geophones, seismograph recorder, sledgehammer with impulse switch, power supply, shear wave plank, and miscellaneous cables. The TCO shall coordinate support labor assistance, as required. **QA: N/A**
- 3.1.3.3 The **BSC Subcontract PI** shall ensure that applicable field instrumentation is either current in an existing YMP-approved

calibration, or is calibrated in accordance with YAP-12.1Q prior to performing field measurements. Any necessary calibrations may be arranged at the Bechtel Nevada calibration lab by contacting the **TCO Testing Procurement Coordinator. QA**

- 3.1.3.4** The **BSC Subcontract PI** shall deploy the instrumentation and testing equipment and collect/interpret the shear-wave refraction data in accordance with ASTM D 5777-00 "*Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation*", using the field and interpretative methodology contained in the National Technical Information Service (NTIS) publication AD-768 710 "*Seismic Refraction Exploration for Engineering Site Investigations*". A plank-and-vehicle method will be used as the shear-wave energy source rather than the explosive charges described in AD-768 710. **QA**
- 3.1.3.5** The **BSC Subcontract PI** shall document in a permanent record or field log the date, time, location, and duration/frequency (if known) of surface vibratory activities. **QA**
- 3.1.3.6** The **BSC Subcontract PI** shall notify the **TCO Field Test Manager** when Shear-Wave Refraction measurements are complete. **QA: N/A**
- 3.1.3.7** The **BSC Subcontract PI** is responsible for the submittal of all Quality Affecting Shear-Wave Refraction calibration documentation, field log(s), data, and data interpretations to the BSC Geoengineering Integration/Implementation Lead. The BSC Geoengineering Integration/Implementation Lead shall coordinate a technical review of the data and interpretations in accordance with AP-2.14Q and accept the subcontract services/data in accordance with AP-7.7Q. Upon acceptance of data and interpretation(s), the BSC Geoengineering Integration/Implementation Lead shall submit it into the TDMS in accordance with AP-SIII.3Q. **QA**

3.1.4 DOWNHOLE SEISMIC SURVEYS

- 3.1.4.1** **BSC Subcontract PI** shall coordinate and schedule Downhole Seismic field activities with the **TCO Field Test Manager**. Downhole seismic surveys shall be completed in boreholes UZ-N27, UZ-N66, and UZ-N76 prior to conducting Surface Rayleigh Wave measurements at these locations. **QA: N/A**
- 3.1.4.2** The **BSC Subcontract PI** shall provide all support equipment, and materials required for Downhole Seismic surveys, including instruments, data recorder, power supply, and sledgehammer energy sources. The TCO shall coordinate support labor assistance, as required. **QA: N/A**
- 3.1.4.3** The **TCO** shall obtain borehole keys in accordance with YAP-13.1Q. **QA: N/A**
- 3.1.4.4** The **BSC Subcontract PI** shall ensure that applicable test equipment is either current in an existing YMP-approved calibration, or is calibrated in accordance with YAP-12.1Q prior to performing field measurements. Any necessary calibrations may be arranged at the

Bechtel Nevada calibration lab by contacting the **TCO Testing Procurement Coordinator**. **QA**

- 3.1.4.5** The **BSC Subcontract PI** shall deploy the instrumentation and testing equipment and collect the data. All data shall be collected in accordance with approved technical procedures or documented in a scientific notebook developed in accordance with AP-SIII.1Q. **QA**
- 3.1.4.6** The **BSC subcontract PI** shall collect downhole seismic measurements at appropriate intervals in alluvium and underlying rock formation as agreed by the BSC Geoengineering Integration/Implementation Lead. In boreholes UZ-N27, UZ-N66, and UZ-N76, downhole seismic measurements shall also be made at the planned depths explosives will be located for surface Rayleigh Wave Work. **QA: N/A**
- 3.1.4.7** The **BSC Subcontract PI** shall document in the scientific notebook the date, time, location, and duration/frequency (if known) of surface vibratory activities. **QA**
- 3.1.4.8** The **BSC Subcontract PI** shall notify the **TCO Field Test Manager** when Downhole Seismic surveys are complete. **QA: N/A**
- 3.1.4.9** The **BSC Subcontract PI** is responsible for the submittal of all Quality Affecting calibration documentation, scientific notebook(s), data, and data interpretations to the BSC Geoengineering Integration/Implementation Lead. The BSC Geoengineering Integration/Implementation Lead shall coordinate a technical review of data and interpretations in accordance with AP-2.14Q and accept subcontract services/data in accordance with AP-7.7Q. Upon acceptance of data and interpretation(s) the BSC Geoengineering Integration/Implementation Lead shall submit it into the TDMS in accordance with AP-SIII.3Q. **QA**

3.1.5 SURFACE RAYLEIGH WAVE MEASUREMENTS

- 3.1.5.1** The **UNR Coop PI** shall coordinate and schedule Surface Wave field activities at Yucca Crest with the **TCO Field Test Manager**. **QA: N/A**
- 3.1.5.2** The **UNR Coop PI** shall provide all scientific labor, support equipment, and materials required for Surface Wave measurements, including velocity sensors and digital recorders. **SS/FS** shall provide blasting services. **QA: N/A**
- 3.1.5.3** The **TCO** shall obtain borehole keys to UZ-N27, UZ-N66, and UZ-N76 in accordance with YAP-13.1Q. **QA: N/A**
- 3.1.5.4** Site Construction/Project Field Engineering shall coordinate and oversee all borehole blasting activities associated with this FWP. **QA: N/A**
- 3.1.5.5** The following explosive loading depths and approximate quantity of explosives are planned to support surface Rayleigh-Wave Measurements. The primary blast of interest is the deepest shot

planned (indicated below with asterisk). Subsequent shallower blast(s) shall be conducted only if borehole conditions allow. **QA: N/A**

Borehole	Planned Depth of Explosive	Approximate Quantity of Explosive
UZ-N27	160 ft*	100 lbs.
"	50 ft	35 lbs
"	25 ft	10 lbs.
UZ-N66	50 ft*	35 lbs.
"	25 ft	10 lbs.
UZ-N76	40 ft*	35 lbs.
"	25 ft	10 lbs.

- 3.1.5.6 Blasting activities in UZ-N27 shall not exceed a depth of 160 ft to maintain Safety Assurance approved standoff distance from the underlying PTn unit. **QA**
- 3.1.5.7 Blasting activities in UZ-N27, UZ-N66, and UZ-N76 shall not exceed 125 pounds of explosive per instantaneous detonation or delay. **QA**
- 3.1.5.8 The TCO shall document the date, time, location, amount of explosive, and depth of each blasting charge for incorporation into the FWP field records package. **QA**
- 3.1.5.9 **SS/FS** shall be responsible for overall site safety during blasting activities. All **Affected Organizations** shall comply with any safety protocol or exclusion areas imposed by **SS/FS** during explosive transport, loading, and blasting activities. **QA: N/A**
- 3.1.5.10 The **UNR Coop PI** shall ensure that applicable test equipment is calibrated in accordance with the UCCSN QA Program requirements prior to performing field measurements. **QA**
- 3.1.5.11 The **UNR Coop PI** shall deploy the scientific instrumentation and testing equipment and collect the data. All data shall be collected in accordance with UCCSN QA Program approved technical procedures or scientific notebook. **QA**
- 3.1.5.12 The **UNR Coop PI** shall notify the **TCO Field Test Manager** when Surface-Wave measurements are complete. **QA: N/A**
- 3.1.5.13 The **UNR Coop PI** is responsible for the submittal of all Quality Affecting calibration documentation, data, and data interpretations to the DOE and/or TDMS as required in accordance with Cooperative Agreement Number DE-FC08-98NV12081. **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 will, if applicable, issue a stop work on those elements. If FWP revisions are required, work on affected elements will be stopped until the modifications have been completed and controlled by the Project. The S&H Department, ECD, or any employee may stop work for ES&H related issues if an imminent danger exists to the workers, public, or the environment. Employee's rights relating to S&H are described in the Safety and Health Plan. Environmental conditions are described in the Environmental Management Plan.

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.

To establish and maintain a high degree of environmental awareness on the YMP, all organizations and employees involved with YMP activities must clearly understand their roles and responsibilities in maintaining compliance with all environmental letters. All work shall comply with applicable environmental stipulations as found in AP-EM-002 and associated land access approval letters. In order to carry out and meet these environmental requirements plus fulfill this commitment, environmental requirements and stipulations will be presented in the initial Safety Tool Box meeting conducted in association with any field activity related to this FWP, and periodically presented in subsequent Safety Tool Box meetings.

Protected Species

Project supervision and site supervisors shall be responsible for ensuring compliance with the environmental stipulations and ensuring that desert tortoises are not harmed.

4.1.2 Safety and Health

Safety and Health Roles and Responsibilities: The YMP regards the S&H of all employees to be of paramount importance. 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.

See Attachment 4 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 Integration/Impl. Lead	C. Howard	295-5744
TCO Project Engineer	M. Esp	295-5859
TCO Manager	R. Oliver	295-3578
TCO Field Test Manager	R. Kovach	295-6180
FWP Record Package Coordinator	A. Mitchell	295-6539
TCO Safety Coordinator	M. Taylor	295-6379
TCO Testing Procurement Coordinator	T. Reynolds	295-3402
SASW Principal Investigator	K. Stokoe	512-471-4929
Shear Wave Refraction and Downhole Seismic Principal Investigator	B. Redpath	209-728-3705
UNR Principal Investigator	J. Brune	775-784-4975
UNR PI Support	R. Anooshehpour	775-784-1954
UNR PI Support	G. Biasi	775-784-4576
Environmental Compliance	T. Pysto	295-5082
ES&H Manager	D. Sorensen	295-4941
S&ET Manager	M. Peters	295-3644
SS/FS Manager	J. Broom	295-1692
Site Construction	C. Sparks	295-7560
Field Project Engineering	R. Dresel	295-7366
Site Services	E. Gardiner	295-6148
Site Operations	D. Davis	295-3733
Site Contracts & Coordination	R. Law	295-3699
Ranch Control	D. Christie	295-5915
DOE/YMSCO	D. Coleman	794-5537

4.3 SCHEDULE

The working schedule (QA: N/A) is expressly limited to this FWP and record development for Yucca Mountain site field activities associated with this FWP. Task dates and estimated durations are based on construction schedules and current strategies. These tasks, dates, and durations are subject to change.

ID	Task Name	Start	Finish	Jun			Jul			A
				5/13	5/27	6/10	6/24	7/8	7/22	
1	Test Planning	Tue 5/1/01	Fri 6/8/01	[Gantt bar]						
2	FWP-SB-01-002 Development	Tue 5/1/01	Fri 6/1/01	[Gantt bar]						
3	Work Instruction / Work Order Development	Mon 5/21/01	Fri 6/8/01	[Gantt bar]						
4	Control FWP-SB-01-002	Mon 6/4/01	Fri 6/8/01			[Gantt bar]				
5										
6	Field Test implementation	Mon 6/11/01	Fri 9/28/01			[Gantt bar]				
7	SASW Measurements - Yucca Crest	Mon 6/11/01	Thu 6/14/01			[Gantt bar]				
8	Site Construction Dozer Support	Mon 6/11/01	Thu 6/14/01			[Gantt bar]				
9	SASW Measurements - ESF Main Drift	Mon 6/18/01	Tue 6/19/01			[Gantt bar]				
10										
11	Surface Rayleigh Wave Measurements - Yucca Crest	Mon 6/11/01	Thu 6/14/01			[Gantt bar]				
12	BSC Blasting Support (UZ N27, N66, N76)	Mon 6/11/01	Thu 6/14/01			[Gantt bar]				
13										
14	Shear-Wave Refraction Measurements - RF#15	Mon 6/18/01	Mon 6/18/01			[Gantt bar]				
15	Shear-Wave Refraction Measurements - Yucca Crest	Tue 6/19/01	Thu 6/21/01			[Gantt bar]				
16										
17	Data Analysis/Interpretation/Documentation	Mon 6/25/01	Mon 8/13/01				[Gantt bar]			
18	Preliminary Geotech Results Available	Mon 8/13/01	Mon 8/13/01							
19										

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).

Characterization of Near Surface Velocity Structure at Yucca Mountain Crest	WBS #s	ESTIMATED START DATE	FY 01 MYPS WORK PACKAGE
Field Test Implementation			
Discrete			
Add'l Geotech Investigations of Repository Block	1.2.22.6.T	6/11/01	4201226TMM
Provide Surface-Based Test Support	1.2.22.6.T	6/11/01	6401226TN2
DOE/UCCSN Cooperative Agreement DE-FC08-98NV12081	N/A	6/11/01	N/A
Field Test Support			
Matrix Support			
Test Coordination	1.2.21.5.T	5/1/01	4201215TMF
Field Test Coordination	1.2.22.6.T	5/1/01	6401226TN1
Site Characterization Land Access	1.2.21.5.2	5/1/01	73012152M7
Environmental Regulatory Compliance	1.2.21.5.2	5/1/01	73012152N1

Provide General Management	1.2.21.5.S	5/1/01	6401215SN1
Provide Craft Supervision	1.2.21.5.S	5/1/01	6401215SN6
Provide Tech. Support to Field Act.	1.2.21.5.S	5/1/01	6401215SN7

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, data interpretations are complete, and when data is submitted to the TDMS.

Scope completion will be documented by the BSC Geoengineering Integration/ Implementation Lead and provided to the TCO for inclusion into the Field Records Package.

6.0 RECORDS

6.1 LIST OF RECORDS

UNR Coop PIs are responsible for collection, management, and submittal of data, in compliance with applicable PI plans and procedures as per the cooperative agreement. BSC Subcontract PIs are responsible for collection, management, and submittal of data to the Geoengineering Integration/ Implementation Lead in compliance with subcontract documents. 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 Processing Center in accordance with AP-17.1Q. 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
Documentation of Borehole Blasting Activities	TCO	QA: QA
Documentation of Surface Vibratory Activities	PI	QA: QA
Scientific WIs	TCO	QA: N/A
Tool Box Safety Briefing Forms Containing Feedback or New Process	TCO	QA: N/A
Software Qualification Documentation	Geoengineering Lead	QA: QA
Documentation Identifying Work as Complete	Geoengineering Lead	QA: N/A

6.2 RECORDS GENERATION

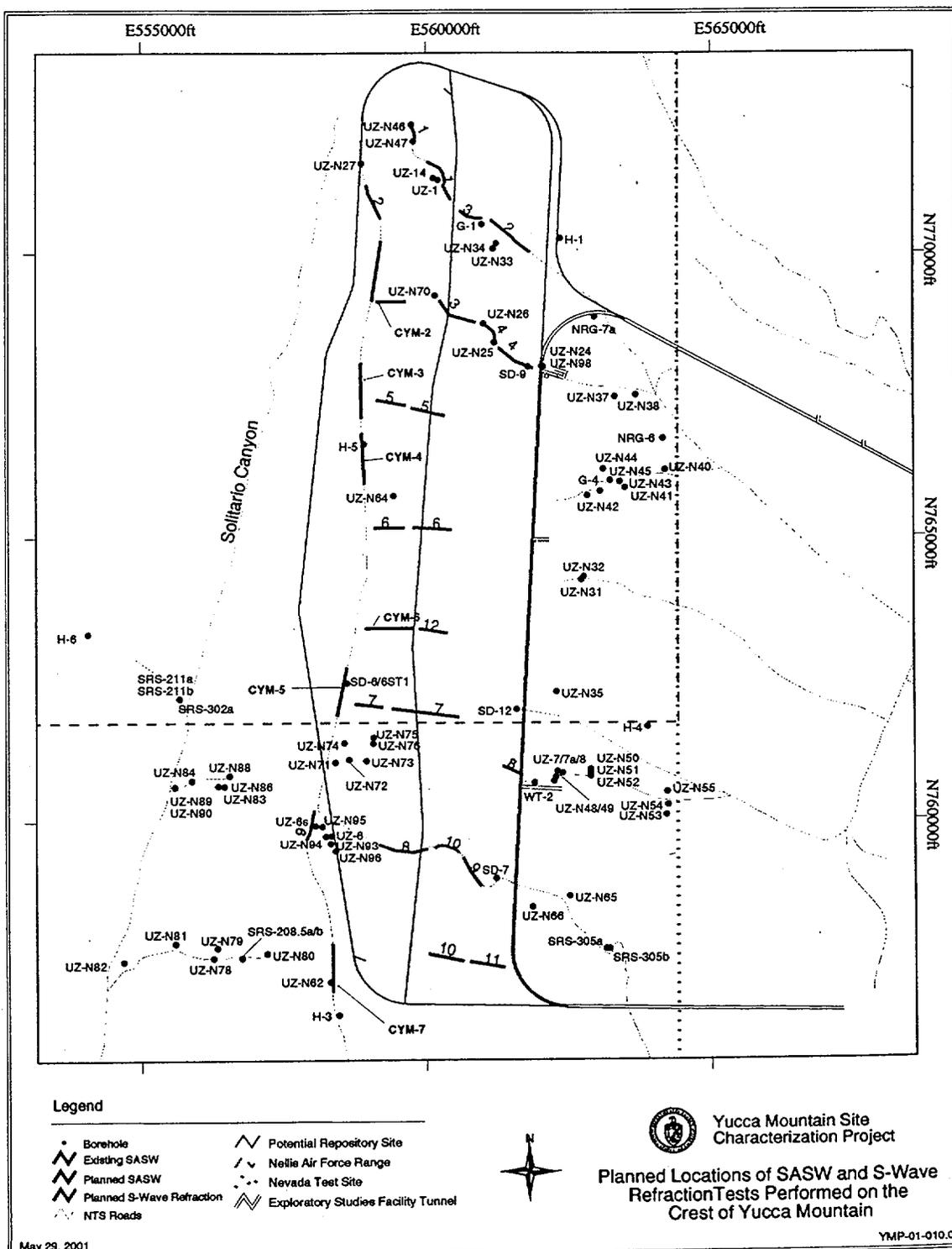
Activities within the scope of the FWP will be documented in accordance with approved procedures and/or standards. See Section 6.1 above.

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 appropriate procedures.

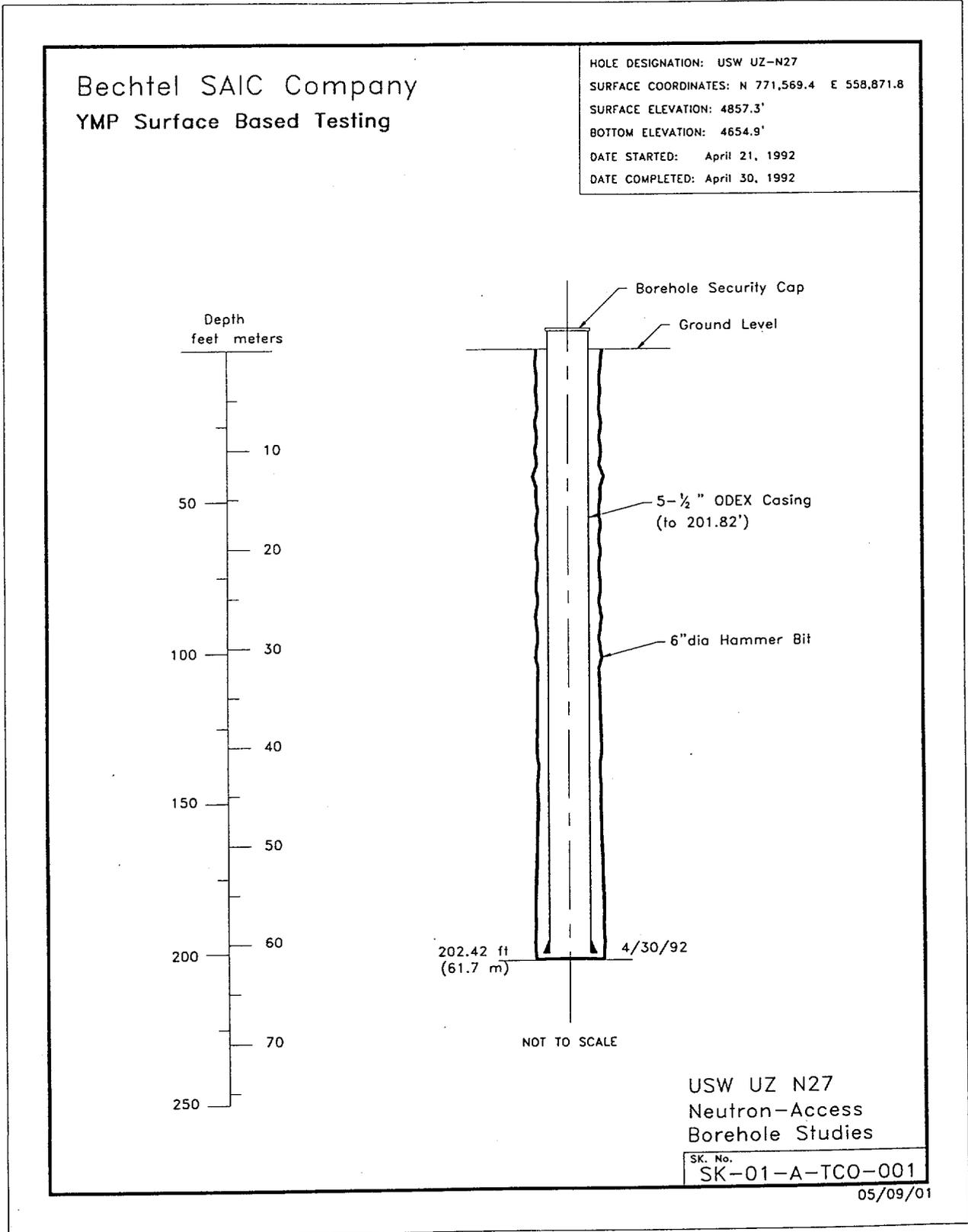
7.0 ATTACHMENTS

- Attachment 1 SASW and Wave Refraction Planned Locations (QA: N/A)
- Attachment 2 Borehole As-Built Sketches (QA: N/A)
- Attachment 3 Surface Rayleigh Wave Planned Locations (QA: N/A)
- Attachment 4 Operational Preliminary Hazard Analysis Checklist and Environmental, Safety, and Health Review (QA: N/A)
- Attachment 5 Process Control Evaluation for Supplement V (QA: QA)
- Attachment 6 Activity Evaluation (QA: QA)
- Attachment 7 Integrated Safety Management Quality Assurance Program (ISMQAP) Grading Report (QA: N/A)

SASW and Wave Refraction Planned Locations

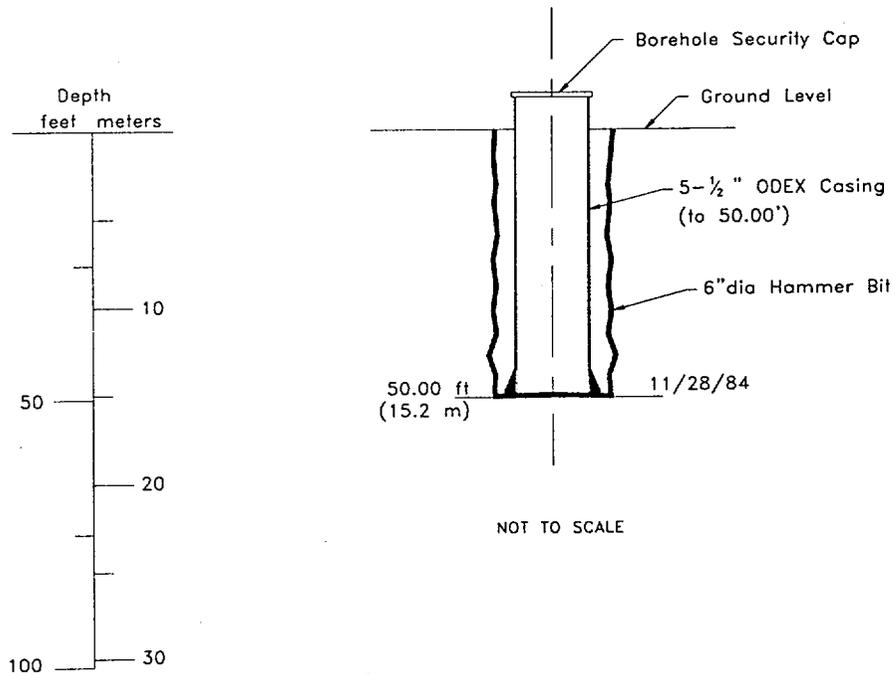


Borehole As-Built Sketches



Bechtel SAIC Company
YMP Surface Based Testing

HOLE DESIGNATION: USW UZ-N66
SURFACE COORDINATES: N 758,433.9 E 561,881.7
SURFACE ELEVATION: 4357.9'
BOTTOM ELEVATION: 4307.9'
DATE STARTED: November 27, 1984
DATE COMPLETED: November 28, 1984



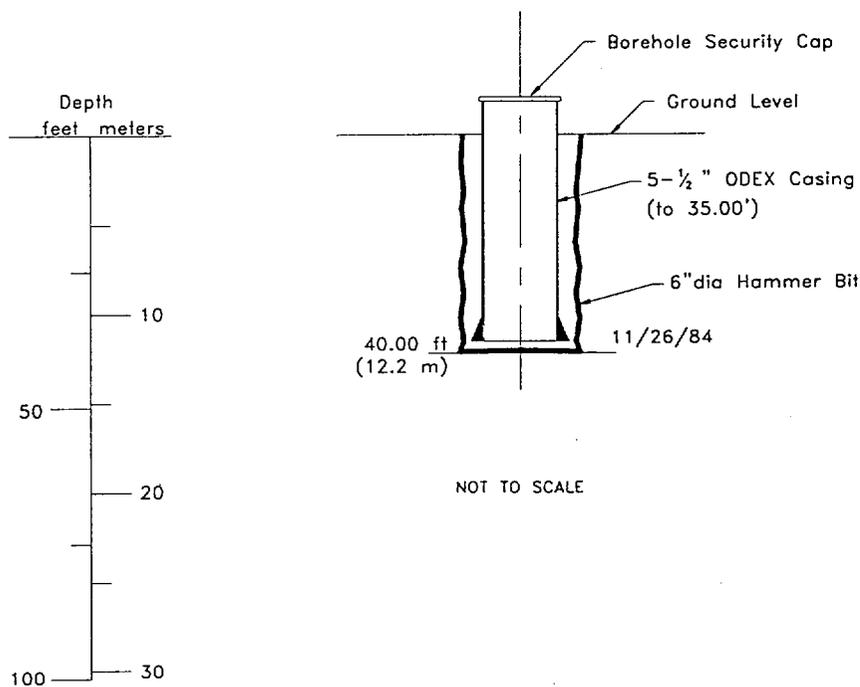
USW UZ N66
Neutron-Access
Borehole Studies

SK. No.
SK-01-A-TCO-002

05/09/01

Bechtel SAIC Company
YMP Surface Based Testing

HOLE DESIGNATION: USW UZ-N76
SURFACE COORDINATES: N 761,356.9 E 559,067.4
SURFACE ELEVATION: 4795.5'
BOTTOM ELEVATION: 4755.5'
DATE STARTED: November 21, 1984
DATE COMPLETED: November 26, 1984

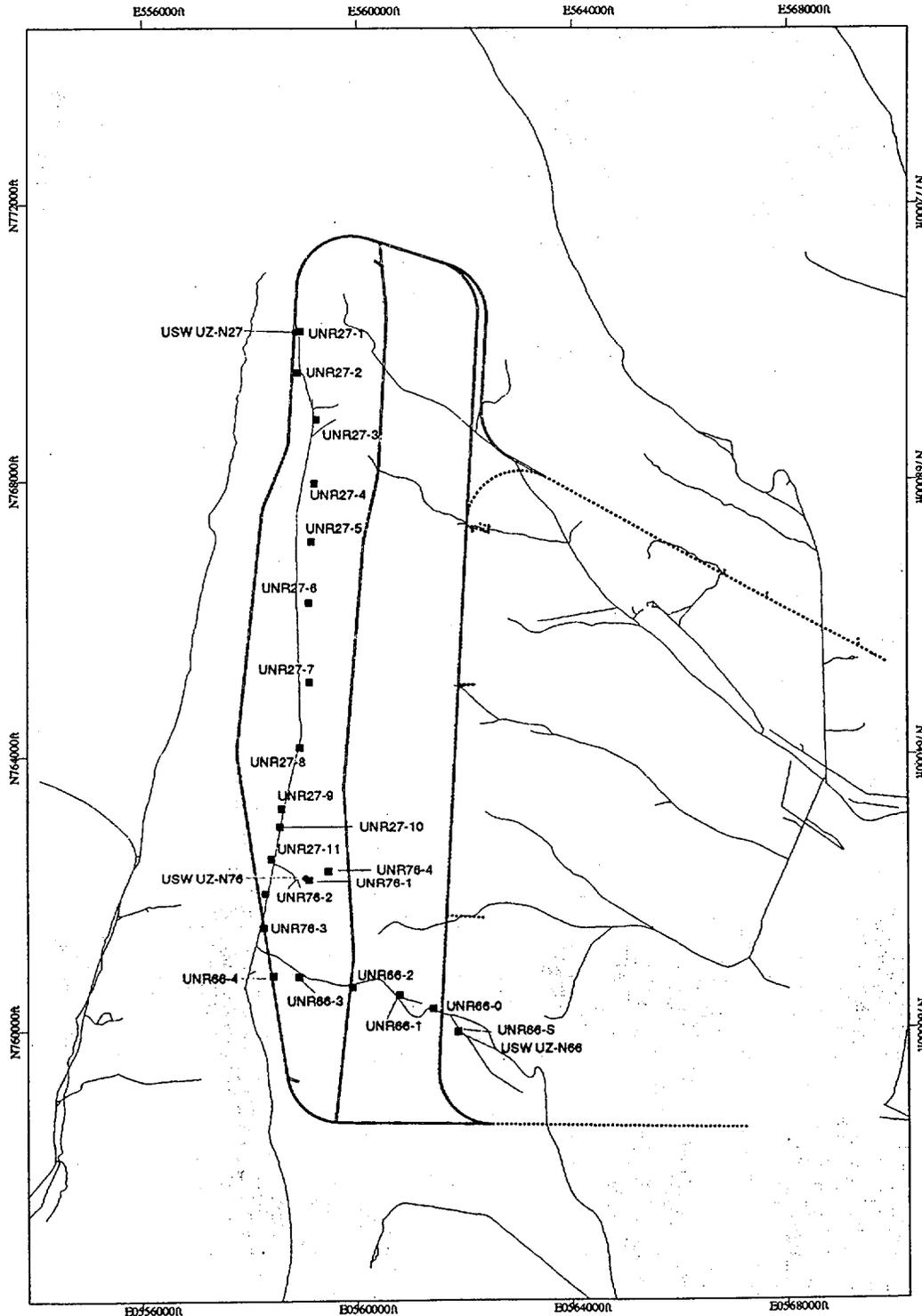


USW UZ N76
Neutron-Access
Borehole Studies

SK. No.
SK-01-A-TCO-003

05/09/01

Surface Rayleigh Wave Planned Locations



- Borehole
- Proposed Retek Station
- ▬ Perimeter Drift Boundary
- Exploratory Studies Facility Tunnel



ENVIRONMENTAL, SAFETY, AND HEALTH REVIEW

1.0 INTRODUCTION

This Environmental, Safety, and Health (ES&H) Review of the Field Work Package (FWP) for Characterization of Near Surface Velocity Structure at Yucca Crest Using Surface Waves has been compiled by the Test Coordination Office (TCO) ES&H Specialist. The purpose of this ES&H Review is to: (1) provide an **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 Characterization of Near Surface Velocity Structure at Yucca Mountain Crest. This ES&H 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 Bechtel SAIC Company, LLC (BSC) **Hazard Analysis System** (the latest version of this and the following procedures can be found in the OCRWM Program Documents Database through Yucca Mountain Site Characterization Project [YMP] Lotus Notes on Server YMLN1). The **Hazard Analysis System** 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 the **Hazard Analysis System**. All MNAs must be conducted and documented in accordance with Section 5.7 of the **Hazard Analysis System**.

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 and 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 with the BSC Procedure for **Environmental Permit Compliance**. This includes compliance with the BSC Procedure for **Land Access and Environmental Compliance**.

This review has been conducted to ensure that information about potential hazards and control measures will be transmitted to all affected organizations on YMP and within the BSC Organization in order to integrate ES&H into all activities, processes, work requests, work orders, work instruction, and operations described by the FWP.

All work requests, work orders (work instructions) must be written in accordance with the BSC Procedure for **Work Requests/Work Order Process**.

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

OBJECTIVES, TEST SCOPE AND DESCRIPTION

There will be four primary activities performed as part of this FWP; Spectral-Analysis-of-Surface-Wave (SASW) Surveys, Shear-Wave Refraction Surveys, Downhole Seismic Surveys, and Surface Rayleigh Wave measurements. The SASW will be performed by the Dr. Ken Stokoe and Associates, the Shear-Wave Refraction surveys and Downhole Seismic surveys will be conducted by Redpath Geophysics, Inc., and the Surface Rayleigh Wave Measurements performed by the University of Nevada Reno (UNR) Seismological Laboratory. These surveys will be conducted at the crest of Yucca Mountain and underground in the Exploratory Studies Facility (ESF).

The BSC Site Services and Field Support (SS&FS) Organization may supply craft labor support.

SASW surveys will be performed at the top of Yucca Mountain in several locations above the planned emplacement area and budget permitting, also in the main drift to measure velocities of the middle non-lithophysal subzone of the Topopah Spring tuff. The source of energy will be a sledgehammer for short receiver spacing, a bulldozer for intermediate spacings, and a truck mounted vibroseis for long spacings.

The Shear-Wave Refraction Surveys will be conducted in the same manner as the more conventional type of survey that uses compression-energy source such as a hammer striking a metal plate.

The Downhole Seismic Surveys will be conducted by measuring shear and compression waves in existing neutron boreholes. The energy source will be generated by striking a shear-wave plank and metal plate on the ground surface with a sledgehammer.

The Surface Rayleigh Wave measurements will be conducted by measuring surface waves created by explosive shots in select neutron boreholes.

A detailed description of all Characterization of Near Surface Velocity Structure at Yucca Crest activities can be found in FWP-SB-01-002.

2.0 HAZARDS

2.1 OPERATIONAL PRELIMINARY HAZARD ANALYSIS:

Identified Hazards: Listing of activities/tasks and the potential hazards too scientific testing personnel conducting Characterization of Near Surface Velocity Structure at Yucca Crest activities:

Activity/Task:

Work with explosives (blasting). Geophysical Investigation. Working with material/soil containing crystalline silica. Hand excavation of Seismology Monitoring Stations.

Potential Hazards:

Exposure (E) to noise, being struck by (SB) premature detonation.
Exposure (E) Crystalline Silica Dust.
Exposure (E) to Respirable Silica Dust. Contact with (CW) pinch points of hand tools. Cuts, scrapes, and

Surface Construction. Working with heavy equipment. Working outside in inclement weather. Exposure to temperature extremes.

blisters.

Being struck by (SB), contact with (CW) equipment, or equipment components. Exposure (E) to cold temperature extremes, cold stress. Exposure (E) to hot temperature extremes & high humidity. Heat cramps, heat exhaustion, and heat stroke.

Working off-normal hours or in remote locations.

Vehicle accidents. An injured person in a remote area will experience a delay in the promptness of medical help due to isolated conditions and limited communications.

Biological hazards. Occupying rodent and/or insect infested work areas. Random potential for contact with scorpions, black widow spiders, and poisonous snakes.

Exposure (E) to Hantavirus, insect bites. Potential of arachnid stings and snake bites.

Operational activities. Working underground.

Exposure to Radon, dust, and diesel emissions.

Use of chemicals that are flammable/ignitable, corrosive or toxic. Generation, storage of Hazardous and Non-Hazardous Waste(s).

Exposure to (E) & contact with (CW) chemicals. Fire.

Exposure to high noise levels.

Physical hazard, exposure (E) to high noise levels, hearing impairment, and hearing loss.

Working on uneven, slippery surfaces.

Slips, trips, and falls (FSL).

3.0 HAZARD CONTROLS

ACTIVITY #1

Work with explosives (blasting). Geophysical Investigation. Working with material/soil containing crystalline silica. Hand excavation of Seismology Monitoring Stations.

POTENTIAL HAZARD 1A:

Exposure to noise, being struck by premature detonation. Exposure to Crystalline Silica Dust. Exposure to Respirable Silica Dust. Contact with pinch points of hand tools. Cuts, scrapes, and blisters.

Using explosives may produce pollutants such as Carbon Monoxide, Hydrogen Sulfide, and Oxides of Nitrogen. The SS&FS Organization will assign a blasting engineer to determine the type and amount of explosives that will be used as part of the Characterization of Near Surface Velocity Structure at Yucca Crest activities. The purchasing, transportation, storage, and use of all explosives will be conducted in accordance with the procedures of the SS&FS. (See Section 4.2, Specific Group and Individual Safety and Health Roles and Responsibilities, SS&FS).

All explosive loading and firing operations will be conducted and controlled by a certified blaster, in accordance with applicable JSAs for conducting surface and subsurface-based blasting operations. The certified blaster is usually a supervisory level employee of the SS&FS Organization or subcontractor. Scientific characterization seismology personnel must receive permission from the certified blaster and check-in with the Person-In-Charge (PIC) before entering the area. (See Section 4.2, Specific Group and Individual Safety and Health Roles and Responsibilities, Person-In-Charge). Smoking is not allowed in the areas where explosives are being handled and used. The immediate area will be evacuated during blasting operations. During post-blasting operations, the certified blaster, the PIC and/or Industrial Hygiene (IH) will monitor conditions around the blasting area prior to re-entry/re-occupation of the area by scientific characterization personnel. Do not attempt to re-occupy the area until it is cleared by the certified blaster, the PIC, and/or the IH.

Characterization of Near Surface Velocity Structure at Yucca Crest activities may require YMP personnel to perform hand excavations or to work around subsurface construction operations. Respirable dust containing Crystalline Silica could be produced as a result of these types of operations/activities.

Any subsurface or surface operation or activity that could produce dust should only be conducted according to the Work Practices as outlined in the BSC Program for **Silica Protection**.

The **Silica Protection Program** requires line managers and supervisors to implement 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 **Silica Protection Program** requires employees to attend a training course on the hazards and control measures for Silica exposure. The **Silica Protection Program** recommends that workers exposed to high dust levels in 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 BSC **Respiratory Protection Program** should respiratory protection be required as part of the Characterization of Near Surface Velocity Structure at Yucca Crest 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 or the valve function of the respirator.

The BSC **Occupational Health Program** describes how employees can arrange for physical examinations, on site through Bechtel Nevada (BN), Mercury Medical. To schedule physical examinations call 5-2957.

Respiratory equipment, fit testing, and training for Project and scientific characterization personnel is supplied by BSC IH and the BSC Training Organization. Contact the IH Staff (day shift only) in Trailer #5 on the ESF Pad (5-7506) for respirator fit testing and equipment issue support. It is recommended that you call and make a reservation/appointment in advance for IH support. Contact the BSC Training Organization in Trailer #1 on the ESF Pad for respirator training support.

Currently, employees are required to wear occupational respiratory protection, i.e., at a minimum, ½ mask HEPA Filtered Air Purifying Respirator whenever operational 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 employee's breathing zones and work areas is being conducted by BSC IH. Control measures are being constantly evaluated and additional engineering, administrative and work practice control measures will be recommended/implemented when they are required.

ACTIVITY #2

Surface Construction. Working with heavy equipment. Working outside in inclement weather. Exposure to temperature extremes.

POTENTIAL HAZARD 2A:

Being struck by, contact with equipment or equipment components. Exposure to cold temperature extremes, cold stress. Exposure to hot temperature extremes & high humidity. Heat cramps, heat exhaustion, and heat stroke.

Personnel conducting Characterization of Near Surface Velocity Structure Experiments on the Yucca Crest could encounter severe inclement weather, including high wind, rain, and lightning strikes. In the winter, snow could be encountered with little or no warning.

Nevada Test Site (NTS) Net Radio Control "900" monitors the National Weather Service for conditions on the NTS, and then broadcasts them over all radio nets (including YMP Net #1). Personnel should have a YMP Net #1 Radio with them when they go into the field in order to monitor "900" weather control. If severe weather (i.e., high winds, rain, snow, and/or lightning strikes) warnings are issued, personnel should suspend work and take cover inside vehicles or leave the site altogether.

In Cold Environments: The objective of preventing scientific characterization 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 temperature 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 scientific characterization 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.
- Thermal work suits and other cold weather gear should provide whole body protection, with emphasis on protecting the hands, feet, and head from cold injury.
- If fine work is 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 scientific testing activities involve the use of evaporative chemicals/liquids (i.e., gasoline, alcohol, or cleaning fluids), then special precautions should be taken to avoid soaking of clothes or gloves with liquids because of the added danger of cold injury due to evaporative cooling.
- If scientific testing activities need 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 scientific characterization activities can find guidance for working in cold environments and for work/rest regimens in the latest version of the **Threshold Limit Values Booklet for Chemical Substances and Physical Agents** published by the ACGIH.

Personnel conducting Characterization of Near Surface Velocity Structure Activities on the surface or underground could encounter certain work areas, especially underground where elevated temperature and humidity are routinely found. In the summer months outside temperatures can routinely reach over 100 degrees F. The combination of wearing respiratory equipment and working in an environment with elevated temperatures and humidity could produce heat stress. On the surface and/or underground, in hot/humid environments three types of emergencies can occur that involve heat stress; heat cramps, heat exhaustion, and heat stroke.

Personnel conducting Characterization of Near Surface Velocity Structure Activities should be aware of the following symptoms of heat stress and the proper first aid treatments:

Heat Cramps

Symptoms

1. Muscle cramps in legs, hands, feet, or 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 patient until medical aid arrives.

Heat Stroke

(Please note: Heat Stroke is a medical emergency)

Symptoms

(Can occur suddenly, with little warning.)

1. Dizziness, raging headache.
2. Hot, dry, flushed skin.
3. Full and fast pulse.
4. Breathing deep at first, later shallow breathing.
5. High temperature (106 degrees or higher).
6. Confused, delirious behavior.
7. Muscle twitching, growing into convulsions.
8. 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. Loss of consciousness or coma is a medical emergency, seek immediate medical attention.

Controlling Heat Stress: Personnel conducting the surface wave velocity testing activities should:

- Follow scheduled work/rest cycles. Requirements for work/rest regimens can be found in the latest **Threshold Limit Values Booklet for Chemical Substances and Physical Agents**, published by the

- American Conference of Governmental Industrial Hygienists (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 work starts 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 clothes, whenever possible.

Personnel conducting surface wave velocity testing activities should drink plenty of liquids and take frequent breaks. The BSC Program for **Occupational Heat Stress** provides guidance/requirements for controlling potential heat stress conditions and establishes responsibilities within the BSC Organization.

ACTIVITY #3:

Working off-normal hours or in remote locations.

POTENTIAL HAZARD 3A:

Vehicle accidents. An injured person in a remote area will experience a delay in the promptness of medical help due to isolated conditions and limited communications.

Characterization of Near Surface Velocity Structure Experiments on Yucca Mountain Crest will require scientific characterization personnel to travel on gravel/dirt roads. Sections of the road to the crest of Yucca Mountain have switchbacks and step grades of more than 15%. Rubber tire vehicles can slide when attempting to stop. Use low gears when traveling back down the mountain.

Transportation back and forth to the remote/isolated site of Yucca Mountain Crest should be done in pairs (or more) riding in a single vehicle.

Radio Net and/or telephone check-in/check-out with Ranch Control for a "head count" is required on a daily basis. Personnel conducting Characterization of Near Surface Velocity Structure Experiments on the Crest of Yucca Mountain should never venture into the field without a radio (YMP Net #1), first aid kit, food, and water.

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

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 calls.

Personnel conducting scientific characterization activities should be aware that working alone in remote/isolated locations is not allowed without prior authorization and arrangement. (See Section 6.0 below, "Emergency

Resources Location and Contacts”). Arrangements should be made through your own organization for a working partner or through the TCO for an escort.

Scientific testing personnel conducting work at surface-based locations need to be aware that the high fire hazard seasons on the NTS runs from fall to spring. 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 fire hazards is remote, personnel conducting scientific testing activities at surface-based locations need to remain alert and report any fire or smoke immediately to "900" Radio Net Control. Personnel going to the field locations should carry fire extinguishers and shovels.

Area 25 Vehicular Backup Awareness Warning: In a 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 the awareness of your fellow worker.

In addition **Standing Order (SO) #2000-09, "Yucca Mountain Crest and Busted Butte Road Access Control"** requires radio check-in with the Field Operations Center (FOC) when access dirt roads and other unimproved roads on the YMP. Copies of this and other applicable **Standing Orders** that scientific characterization personnel should be aware of are available at the service desk/counter in Trailer #7009 on the ESF Pad.

ACTIVITY #4:

Biological hazards. Occupying rodent and/or insect infested work areas. Random potential for contact with scorpions, black widow spiders, and poison snakes.

POTENTIAL HAZARD 4A:

Exposure to Hantavirus, insect bites. Potential of arachnid stings and snake bites.

Hantavirus: An outbreak of a potentially fatal illness has occurred in the Southwest, primarily in New Mexico and Arizona, although three 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. Rodents such as deer mice are the primary carriers of the virus.

As a precaution, all scientific personnel on the 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.
- The virus can infect humans through breathing the dust of dried out rodent feces and urine, and/or 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 or job site in which scientific personnel are working has visible signs of "heavy" rodent infestations (i.e., rodent excreta, 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. IH personnel have trained SS&FS craft personnel in pest control techniques, and only they have the expertise, equipment, and supplies to trap and clean-up heavy infestations. Scientific Characterization Personnel should contact the TCO (R. Kovach), who will coordinate with craft management for rodent control and clean-up services.

Insects, scorpions, black widow spiders, and poisonous snakes:

Work areas that have signs of insect infestations should be sprayed with pesticides. Trained SS&FS craft personnel will also conduct these types of pest control spraying operations. Do not bring your own insect spray onto the site.

Scientific testing personnel should be vigilant when walking in field locations for spiders, scorpions, and poisonous snakes. Seek immediate medical attention if bitten (**Note** Medics are located in the Change House next to the North Portal on the ESF Pad).

Scientific Characterization Personnel should contact the TCO (R. Kovach 5-6180), who will coordinate with craft management for insect and pest control services.

ACTIVITY #5:

Operational activities. Working underground.

POTENTIAL HAZARD 5A:

Exposure to radon, dust, and diesel emissions.

Scientific Characterization Personnel conducting surface wave velocity testing activities underground should be aware that work is not allowed in drifts, alcoves, adits, or niches where ventilation has not been established or maintained. A minimum of 30 liner feet per minute (LPM) must be maintained in all areas underground. During daily operation in the ESF and ECRB, BSC IH will conduct air quality and air quantity inspections, and on as needed basis. Test alcove, adits and niches that have been closed will need to be monitored by IH and Health Physics (HP) personnel before anyone can re-enter. Contact the TCO to arrange to provide IH and HP support. Exemptions may be granted through the TCO Field Test Manager (FTM) on a case by case basis.

An inadequate supply of fresh air could result in an increased breathing rate, headache, and dizziness. Diesel emissions contain Carbon Monoxide (CO) and Nitrogen Dioxide (NO₂). Exposure to low levels of NO₂ could result in eye and respiratory tract irritation, exposure to low levels of CO could cause an increased respiration rate. Exposure to CO inhibits the blood's ability to absorb Oxygen (O₂). Exposure to very high levels of CO and NO₂ could result in serious health effects, including death. Working inside the ESF and the ECRB could also expose personnel to Radon. Radon is not toxic, however Radon and Radon Daughters (a decay product of Radon) are radioactive and emit radiation. Continued chronic exposure to high levels of these gases has been linked to the

incidence of lung cancer. Radon is a colorless, odorless, tasteless gas. Radon daughters are of particular concern, because they adhere to the respirable dust and once inhaled, they become deposited in the lungs where they continue to decay, giving off radiation and damaging the lung tissue.

For scientific characterization purposes and to preserve the moisture content of the rock, some of the alcoves, niches, and adits in the ESF and ECRB have been closed off, either with bulkhead doors or sealed with plastic. Other alcoves in the ESF and the ECRB will be protected with safety orange barricades. This is being done to prevent/control employee exposure to naturally occurring Radon. Re-entry/re-occupation of any closed, barricaded, or sealed alcove, niche and/or adits in the ESF and the ECRB must be coordinated through the TCO and the SS&FS Organization with the assistance of BSC IH and HP.

The BSC Program for **Radiation Protection** provides guidance/requirements to scientific characterization personnel and other YMP personnel in order to limit exposure to Radon. The **Radiation Protection Program** requires the implementation of the requirements listed below for Naturally Occurring Radon that may be encountered during Characterization of Near Surface Velocity Structure Experiments:

Radiation Dosimetry Program: The **Radiation Dosimetry Program** 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, access to radiological areas, and terminating the use of an individual's radiation dosimeter. The procedure establishes the dosimetry requirements detailed in the **BSC Radiation Protection Program** and ensures compliance DOE radiological safety requirements for monitoring personnel, as specified in 10 CFR 835, Occupational Radiation Protection and NV/YMP Radiological Control Manual (RCM). Contact the BSC HP at 5-5969 for information on obtaining personal Radon Dosimeters.

Radiological Surveys: The program for **Radiological Surveys** establishes the methodology for performing and documenting radiological surveys conducted by the BSC Radiation Protection Program Personnel.

Posting and Entry Training Requirements for Radiological Areas: **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 the BSC RPP, the requirements of 10 CFR 835, Occupational Radiation Protection, and NV/YMP RCM. Sections of the ESF and ECRB, alcoves, niches, and adits are to be posted "Caution Airborne Radioactive Area – Naturally Occurring Radon". An explanation of the Radon procedures/issues will be included in General Underground Training (GUT).

Entry Permit: Entry into closed, sealed, or barricaded alcoves, niches, and/or adits will require an entry permit. In addition, a sign-in/sign-out log will be kept and entry can only be done after Radon levels, air quality, and air quantity measurements have been made.

ESF, ECRB, and Alcove Ventilation Operating Procedure: In accordance with this ventilation operating procedure notification of TCO, SS&FS, IH, and HP is required one day in advance when scientific characterization activities require re-entry behind a barricade or closed bulkhead, alcove, adit, or niche. This is to ensure that the fan(s) are operating and have been operating for an appropriate period of time prior to entry in accordance with this ventilation operating procedure. Exemptions may be granted by the TCO FTM on a case by case basis to support testing activities.

Personal Protective Equipment: Respiratory protection for short term entries will be a "field call" by HP personnel monitoring the situation.

ACTIVITY #6:

Use of chemicals that are flammable/ignitable, corrosive or toxic. Generation, storage of Hazardous and Non-Hazardous Waste(s).

POTENTIAL HAZARD 6A:

Exposure to and contact with chemicals.

Chemical explosives will be used in the Characterization of Near Surface Velocity Structure Seismology Experiments on Yucca Crest. These explosives will be provided/supplied by the SS&FS Organization. The chemical explosives and any other Tracers, Fluids, and Materials (TFM) that could be used as part of scientific characterization activities, must be approved in accordance with the BSC ECD Plan entitled **Regulated Material Management Plan**. The **Regulated Material Management Plan** requires that a MRA form be submitted and approved before chemicals and materials can be transported and used on the project.

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

The requirements for identifying, characterizing, tracking, and documenting the disposition, management, and disposal of non-hazardous waste (including empty and used containers of explosives) generated during the Characterization of Near Surface Velocity Structure Activities on the YMP shall be in accordance with **BSC Non-Hazardous Waste Management**.

The Federal, State, and DOE requirements mandate that regulated and hazardous materials are managed to minimize the potential of their release during transportation, storage, and use. The BSC **Spill Management Procedure** directs those who transport, store, and use regulated materials to use appropriate engineering practices, develop plans to be followed in the event of a release or spill, be capable of responding to such a release, and be able to notify appropriate authorities.

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 BSC Procedure on **Hazard Communication**. 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/material underground. Contact the ESF TCO ES&H Specialist, if there are questions regarding TFM usage.

ACTIVITY #7:

Exposure to high noise levels.

POTENTIAL HAZARD 7A:

Physical hazard; exposure to high noise levels, hearing impairment, hearing loss.

Personnel conducting Characterization of Near Surface Velocity Structure Activities underground in the ESF need to be aware that the core drill, jack-leg drill, drill jumbo, and any related equipment that may be used could produce high noise levels. Hearing protection (ear plugs and/or ear muffs) must be used during any operation that produces high noise levels. The operation(s) should be posted by IH at the request of SS&FS. Ear plugs are available from the portal shack at the entrance to the ESF. Ear muffs are available from the Tool Crib located on the ESF Pad.

Personnel conducting Characterization of Near Surface Velocity Structure at Yucca Crest activities need to be aware that some site surface construction activities could produce a limited amount of exposure to high noise levels. In addition, the detonation of the explosives could produce short duration, peak noise levels. This means that hearing protection (ear plugs and/or ear muffs) may be required when conducting some activities. Ear plugs are available from the portal shack at the entrance to the ESF. Ear muffs are available from the Tool Crib located on the ESF Pad.

During certain operations (i.e., drill jumbo, jack-leg drilling, or jack-hammering operations) dual hearing protection, both ear plugs and ear muffs may be required. Contact the ES&H Lead for information on locations where dual hearing protection may be required. Approved hearing protection shall be worn in posted areas and whenever so directed.

The BSC Hearing Conservation Program specifies the requirements for employees working in high noise areas. All employees working in high noise level areas must be in the hearing conservation program and, among other things, obtain a baseline and annual audiogram which is usually conducted during annual physical examinations.

ACTIVITY #8:

Working on uneven, slippery surfaces.

POTENTIAL HAZARD 8A:

Slips, trips, and falls.

In most cases, Scientific Characterization Personnel conducting Near Surface Velocity Measurements Activities in the ESF or the ECRB will be fully trained and qualified to work underground. Visiting Scientific Characterization Personnel may also be escorted by a fully trained and qualified TCO Field Test Representative (FTR). These TCO FTRs are familiar with the underground operations, equipment, and construction process. Follow the direction of these TCO FTRs.

A pre-cast concrete invert section system has been chosen for installation in the main ESF Tunnel. Railroad lines for equipment and man-trains have been attached/secured to these invert sections. The invert sections have gaps and irregularities on the walking surface. Slips, trips, and falls could be hazardous.

The ECRB has treated wood ties to which the railroad lines are attached/secured. These ties will have gaps and irregularities. A metal grate walkway has been installed in the ECRB for pedestrians.

When accessing the main drift in the ESF to conduct Scientific Characterization Activities 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, keep your eyes on the operator and the equipment, but do not shine your cap lamp in the operator's eyes. Pedestrians can proceed only after all the rail cars and equipment has cleared the area.

In the ECRB drift, 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 all pedestrians have moved to the utility pipes, will the train sound its horn and continue. Remain still until all the equipment has passed, and once again while the locomotive passes, keep your eyes on the operator and the equipment, but do not shine your cap lamp in the operator's eyes. Pedestrians can proceed only after all the rail cars and equipment has cleared the area. **Orange reflective safety vests** are required to be worn by all personnel working, walking, or visiting the ECRB East-West Cross Drift.

In the ESF main drift, at the ECRB "Y", do not stand on or near the "California Switch" (rail switch) while equipment is approaching or actually on the switch. Rail cars and equipment have a larger potential to "de-rail" in this area. One of these rail switches has currently been installed at 19+5- meters at the ESF/ECRB "Y".

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 the area.

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

- * Alcoves 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 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 the cap lamp/flashlight = Approach the person giving the signal.

Follow all directions of the TCO FTR, the Person-In-Charge (PIC), or SS&FS Craft Personnel while accessing underground work areas.

Borehole sites where the seismology experiments will be taking place are located on the East Side of the Yucca Mountain Crest. This location has step inclines and grades, desert vegetation, rock outcroppings, and pockets of loose gravel. Footing is very loose; pay attention to your footing, caution should be exercised when accessing the site on foot. Slips, trips, and falls could be hazardous.

In most cases, scientific characterization personnel conducting seismology experiments will be working along side and be accompanied by TCO Representatives who are familiar with the operation and conditions at surface based locations. Follow the direction of these craft employees when accessing seismology sites.

4.0 ROLES AND RESPONSIBILITIES - SAFETY AND HEALTH

- 4.1 **Safety and Health Roles and Responsibilities:** BSC controls all work activities on the YMP and has the responsibility for S&H for all organizations, employees, visitors, and personnel from other organizations when they are on BSC 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, BSC has appointed a **Person-In-Charge (PIC)** for each underground and surface-based 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).

SS&FS and the TCO will discuss the daily construction (testing support) and/or scientific testing activities scheduled to be conducted and appoint a PIC or 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 SS/FS, TCO or a scientific testing organization. The PIC will be identified in the Tool Box Safety Meeting prior to the start of daily activities.

4.2 **Specific Group and Individual Safety and Health Roles and Responsibilities:**

The following groups and individuals are responsible for:

SS&FS Organization: The SS&FS and the TCO are responsible for jointly selecting the PIC. The SS&FS is responsible for implementing the requirements of this FWP during the construction/test support and scientific testing processes. SS&FS provides construction/test support services to the organizations conducting scientific testing activities work on the YMP. SS&FS is responsible for oversight and management of all construction/test support activities on the YMP. The SS&FS is responsible for integrating the requirements of BSC S&H policy and procedures into all construction/test support and scientific testing activities. The SS&FS has S&H responsibility for all persons (employees and visitors) inside YMP construction/test support and scientific testing work areas and locations. SS&FS 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: The TCO is responsible for jointly selecting (with the SS&FS) the PIC. The TCO is responsible for coordinating 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 that are in compliance with the BSC S&H policy and procedures.

Line Managers and Supervisors: BSC line management and supervision is responsible, and accountable for the protection of workers, the public, the environment, and property. BSC line managers and supervisors are responsible for evaluating their work operations, activities and 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, work practice, employee S&H training, or PPE). All JSAs must be conducted and documented in accordance with the Hazard Analysis System Procedure. All JSAs must be reviewed and approved by the BSC S&H. Contact the TCO ES&H Specialist for assistance in determining which specific scientific characterization activities require JSAs. Once the JSA have been produced, reviewed, and approved, they will be used as a task guide for employee training purposes, and this training will be documented.

BSC Employees/Scientific Characterization Personnel: BSC Employees and Scientific Characterization Personnel (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. BSC Employees and Scientific Characterization Personnel are responsible for ensuring that 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. BSC and Scientific Characterization Employees are responsible for knowing the identity of the PIC in their specific work area or location. BSC and Scientific Characterization

Employees are responsible for immediately notifying the PIC and then their organization supervisor of unsafe acts, conditions, and/or equipment.

Person-In-Charge: The PIC is responsible for conducting the specific work (construction/testing support or scientific testing) activity in accordance with BSC established S&H rules and guidelines. The PIC is responsible for ensuring that the "Toolbox Safety Meeting" is conducted at the beginning of a 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 training, experience, 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 the SS&FS and the TCO and serve as the focal point of contact for issue resolution.

- 4.3 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 that can be 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, work practice, 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 SS&FS Organizations working on the YMP.

BSC and Scientific Characterization Organizations and employees will still perform work that is authorized by their respective FWPs, work plans, work instruction, and/or work procedures. BSC and Scientific Characterization Organizations perform their work as an "integrated group" to the ES&H Policies and Procedures as set forth by BSC.

The BSC **Occupational Safety and Health Program** establishes implementing guidance/requirements through S&H Procedures and applicable Environmental Plans that can be found in the FWP.

5.0 EMPLOYEE TRAINING

Visiting Scientific Characterization Personnel requiring access to the YMP surface based worksites must watch a short training video and be escorted by an individual with Site Access Training (SAT), First Aid Training, and CPR Training. Visiting Scientific Characterization Personnel requiring access to underground worksites on the YMP must watch a short training video and be escorted by an individual with SAT, First Aid, CPR, and GUT. Scientific Characterization Personnel requiring routine access to work underground in the ESF and/or the ECRB must coordinate through the TCO in accordance with the BSC

Underground Access Control Process. Personnel requiring routine underground access must also be current in SAT, GUT, First Aid/CPR, Respirator, and Hearing Conservation Training. 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. Dark sunglasses (safety or regular prescription) will not be worn inside buildings on the ESF Pad or in any areas underground.

All participants on the YMP shall adhere to the BSC Procedure for **Accident Investigation, Reporting and Recordkeeping**, for instructions on reporting and processing of information on injuries, illnesses, and property damage.

5.1 OTHER TRAINING

All personnel entering YMP controlled worksites should attend the "Tool Box Safety Meeting" that is held at the beginning of each shift. If you cannot attend this meeting, ask the manager/supervisor or the PIC for current conditions at the site before entry. This is to ensure compliance with applicable OSHA Standards.

The TCO, under agreement with the BSC may conduct an additional scientific testing specific Tool Box Safety Meeting during each shift to address specific testing issues.

6.0 EMERGENCY RESOURCES LOCATION AND CONTACTS

6.1 EMERGENCY REPORTING

The BSC **Emergency Management** Procedure was developed for managers and supervisors who have responsibilities for a facility, operation, or worksite. In an emergency, telephone 911. Over the radio announce "Mayday, Mayday, Mayday", and then give name and location. The Mercury Communications Information Center will get the details of assistance required and dispatch the appropriate response organization.

For weekend, off normal work hours (including work at remote surface-based sites), scientific characterization personnel will need the approval of the TCO Field Test Manager. The DOE operations organization will also need to be notified. A "**Safety and Emergency Procedure Description Plan**" must be completed and on file with the TCO. The "Safety and Emergency Procedure Description Plan" lists participants and emergency contacts and is distributed by e-mail to Project and construction/site/facility personnel.

6.2 NEAREST HOSPITAL OR CLINIC

Mercury, Nevada (approximately 45 miles from the crest of Yucca Mountain). The NTS Paramedics and an ambulance are stationed at the Dry House on the

ESF Pad. Do not contact them directly. Always go through the Mercury Operator.

6.3 NEAREST FIRST AID STATION/PARAMEDIC

A First Aid Station is located on the ESF Pad in the Dry/Change House. Two paramedics, who work a ten hour shift in order to ensure that medical coverage is provided during the underground shift, man the First Aid Station.

Scientific characterization organizations, including line managers and supervisors performing work away from the ESF Pad should also be aware that a "Medical Needs Analysis" that is in accordance with Section 5.7 of the BSC Hazard Analysis System should be completed and on file with the TCO.

6.4 NEAREST FIRST AID KIT/EYE WASH STATION

First aid kits are available from the Logistics Office in the Field Operations Center (FOC) in Area 25 of the YMP. Eye wash kits are available through the "Tool Crib" located on the ESF Pad. Underground First Aid Kits and eye wash stations are located in scientific alcoves and other work areas.

6.5 NEAREST POTABLE WATER

Orange "Gott" Drinking Water Coolers should be available at remote work sites on the YMP through the Teamsters employed by the SS&FS.

6.6 SUGGESTED EMERGENCY EVACUATION ROUTE AND MEETING AREA(S)

At surface-based work sites on the YMP emergency situations could occur that might require immediate evacuation. These situations may include, but are not limited to, range fire, equipment/vehicle fire, and/or a chemical release or spill. During an emergency, all personnel will take direction for an emergency evacuation route and a meeting area from the BSC line manager/supervisor and/or the PIC at the scene.

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 situation(s) occur underground, the GAI-Tonics Mine 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 SS&FS Supervisor Personnel, or the PIC handling the emergency situation.

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

7.0 TCO PERSONNEL

Some TCO Personnel carry hand held radios and are available on the NET.

7.1 TCO FIELD TEST COORDINATION PERSONNEL AND PHONE NUMBERS

Dick Kovach	FTM	295-6180
Catherine Longhouser	Secretary	295-3483
Mark Esp	Principal Engineer (PE)	295-5859
Mike Taylor	TCO ES&H Specialist	295-3647
	Beeper	794-6676

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROCESS CONTROL EVALUATION FOR SUPPLEMENT V		QA: QA	
		Page <u>1</u> of <u>1</u>	
A. Procedure/Work Activity Identification: (check one)			
<input type="checkbox"/> Procedure (identify process procedure number, title, revision and ICN level being evaluated), or <input checked="" type="checkbox"/> Work Activity (identify by work package number, Technical Workplan, technical product, etc., including title and revision) FWP-SB-01-002 Characterization of Near Surface Velocity Structure at Yucca Mountain Crest Using Surface Waves			
B1. Processes/Process Functions/Work Activities Evaluation			
	Yes	No	
1. Will, or does, the process/process function/work activity depend on a form of electronic media to store, maintain, retrieve, modify, update, or transmit information?	✓		
2. Will, or does, the process/process function/work activity manage, control, or use an electronic database, spreadsheet, set of files, or other holding system for information?	✓		
3. Will, or does, the process/process function/work activity transfer information electronically from one location to another? (The method may be File Transfer Protocol, electronic download, tape to tape, disk to disk, etc.)	✓		
<i>If the answers in Section B1 are all "No," process in accordance with Section 5.1.b)6), otherwise proceed to B2.</i>			
B2. Processes/Process Functions/Work Activities Compliance Evaluation			
	Yes	No	N/A
1. Does the procedure or work activity document provide adequate controls to protect information from damage and destruction for its prescribed lifetime?	✓		
2. Does the procedure or work activity document provide adequate controls to ensure that information are readily retrievable?	✓		
3. Does the procedure or work activity document provide adequate controls to describe how information will be stored with respect to media, conditions, location, retention time, security, and access?	✓		
4. Does the procedure or work activity document provide adequate controls to properly identify storage and transfer media as to source, physical and logical format, and relevant date?	✓		
5. Does the procedure or work activity document provide adequate controls to ensure completeness and accuracy of the information input and any subsequent changes?	✓		
6. Does the procedure or work activity document provide adequate access controls to maintain the security and integrity of the information?	✓		
7. Does the procedure or work activity document provide adequate controls to ensure that transfers are error free or within a defined permissible error rate? (e.g., copying raw information from notebook to electronic information form, electronic media to another electronic media, File Transfer Protocols, etc.)	✓		
<i>If a "No" answer is given for any question in Section B2, proceed to Section C, otherwise process in accordance with Section 5.1.b)6). Mark "N/A" for those items that are not applicable to the specific process or work activity.</i>			
C. Results of Evaluation			
Provide a summary of the "as-is condition," proposed remedial actions, and expected completion date of document revision, for each item in B2 that was indicated as "No."			
Responsible Manager: <i>Cliff Howard</i>			Date: <i>6-6-01</i>
Cliff Howard, Geoenvironmental Integration/Implementation Lead			

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ACTIVITY EVALUATION

QA: QA

1. Revision No.: 0

1a. Page: 1 Of: 3

This form is provided for use by the Technical Work Plan Manager to assist with meeting the requirements of AP-2.21Q in determining whether the workscope is subject to QARD and/or ISMOAP requirements. Supplemental sheets may be used. Pagination shall include all sheets.

I. Description of Activity

2. FY 2001	3. DOE Manager Vince Iorri	4. Work Package Number(s) FWP-SB-01-002
5. Subproduct Element/Subproduct Title 1.2.22.6.T/Testing and Monitoring , FWP-SB-01-002 Char. of Near Surface Vel. Structure at YM Crest Using Surface Waves		
6. Originating Organization Test Coordination Office		7. TWP Manager (Print name/initial/date) Ron Oliver DW for 6-6-01
6a. USGS (If applicable) N/A		7a. USGS Responsible Manager (Print name/initial/date) N/A
8. ES&H Representative (Print name) Jayne Davis	9. Signature <i>Jayne Davis</i>	10. Date 6-6-01
11. Approval (by next level manager or higher, Print name) Mark Peters	12. Approval Signature <i>Mark Peters</i>	13. Date 6-6-01
14. Brief Description (including relationship to licensing or site characterization): This test program's purpose is to better understand the seismic velocity structure of Yucca Mountain above the potential emplacement area. The ~900 foot thick velocity structure between Yucca Mountain Crest and the potential emplacement area is used in the calculations of design ground motions for the three general locations of interest at Yucca Mountain: the repository horizon, the mountain crest, and the site of the potential Waste Handling Building. Knowledge of this velocity structure is also required to calculate dynamic strains and curvatures as a function of depth between the crest and the emplacement area.		
15a. List activities not subject to QARD or exempt in AP-2.21Q, Section 2.0: <input type="checkbox"/> Work Activities are exempted by AP-2.21Q, Section 2.0, Applicability: (These activities <u>do not</u> require Section II or Section III evaluation) <input checked="" type="checkbox"/> Work Activities are Non-Q because they are not subject to the QARD: (Non-Q tasks <u>must have</u> a negative answer to all questions in Section II) Craft support for testing activities		
15b. List activities subject to QARD (Q Tasks): SASW measurements and interpretations, Shear-Wave Refraction measurements and interpretations, Surface Rayleigh Wave measurements and interpretations, Downhole Seismic Surveys, M&TE Calibrations, Supplement V controls, DIE and other QA controls identified in FWP-SB-01-002		

II. Evaluation of QARD Applicability

1. Is the activity subject to QARD requirements because it affects an item on the Waste Acceptance-Storage and Transportation/Mined Geologic Disposal System <i>Q-List</i> (QL-1, QL-2 or QL-3); or because it affects an item that is assumed to be subject to QARD requirements because that item has not yet been QA-classified? (For example, does the activity consist of design, procurement, construction, fabrication, production, handling, packaging, shipping, storing, cleaning, assembly, inspection, testing, operation, maintenance, repair, modification, or decontamination of a <i>Q-List</i> item?) Results from latest classification analysis (QAP-2-3, <i>Classification of Permanent Items</i> , for example) can be used as a basis.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Rationale: This is a test support activity that does not affect a Q-List item. The "QA Classification Analysis of Test Support Areas" (BABEA000-01717-2200-000001) supports this classification.		
2. Is the activity subject to QARD requirements because it is related to site characterization sample collection or collection and analysis of data used to support performance confirmation or performance assessments?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Rationale: Site Characterization data will be collected and analyzed.		

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
 ACTIVITY EVALUATION
 (Continued)**

Page: 2 Of: 3

Activity Title

1.2.22.6.T/Testing and Monitoring , FWP-SB-01-002 Char. of Near Surface Vel. Structure at YM Crest Using Surface Waves

II. Evaluation of QARD Applicability (continued)

<p>3. Is the activity subject to QARD requirements because it is intended to provide data used to assess the potential dispersion of radioactive materials from a licensed facility?</p> <p>Rationale: Data that is collected will be used to assess the potential dispersion of radioactive materials from a licensed facility, specifically in the event of an earthquake or other seismic occurrence.</p>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<p>4. Is the activity subject to QARD requirements because it is related to high-level waste form development through qualification, production, and acceptance?</p> <p>Rationale: This activity is unrelated to high level waste form development</p>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<p>5. Is the activity subject to QARD requirements because it is associated with characterization of, and conditioning through acceptance of, DOE spent nuclear fuel?</p> <p>Rationale: This activity is unrelated with characterization and conditioning of DOE spent Nuclear fuel</p>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<p>6. Is the activity subject to QARD requirements because it is a site-disturbing activity that can adversely impact the waste isolation function of the natural or engineered barriers or impact site characterization results (for MGR only)?</p> <p>Rationale: This activity is a site disturbing activity. A Determination of Importance Evaluation for Surface-Based Testing Activities, BAA000000-01717-2200-00101, Rev 02/ICN02 has been conducted for these types of activities and established QA controls that are captured in FWP-SB-01-002.</p>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<p>7. Is the activity subject to QARD requirements because it affects an item required for physical protection as defined by 10 CFR 73?</p> <p>Rationale: This activity does not affect an item required for physical protection</p>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
<p>8. Is the activity subject to QARD requirements because it involves tasks which support work activities or work package deliverable(s) subject to QARD requirements? (For example, does the activity require special trade or technical training such as welding, equipment operator, preparation or processing of records, QA functions, etc.?)</p> <p>Rationale: This FWP does support work activities subject to QARD requirements and involves the preparation and processing of QA records.</p>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>

If the answer to any of the questions in Section II is "yes," the activity is subject to QARD requirements. Use appropriate Q procedures for the conduct of those activities. If full applicability of QA controls is not possible, address alternate controls to be applied per section 18 of the TWP. If existing procedures are not adequate to control the activity, revise or develop new procedures in accordance with AP-5.1Q, *Plan and Procedure Preparation, Review, and Approval*, or other appropriate procedures.

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ACTIVITY EVALUATION
(Continued)

Page: 3 Of: 3

Activity Title

1.2.22.6.T/Testing and Monitoring , FWP-SB-01-002 Char. of Near Surface Vel. Structure at YM Crest Using Surface Waves

III. Evaluation of ISMQAP Applicability

1. Does the activity affect a structure, system, or component (SSC) as identified in the *CRWMS M&O Safety Basis Report*, TDR-CRW-SE-000008, Section 2; or does the activity affect an SSC that is assumed to be subject to the ISMQAP and it has not yet been evaluated in accordance with AP-ENG-001, *Management of Safety Basis Change Process*? Yes No

If the answer to question 1 is "no," proceed directly to question 3.

If the answer to question 1 is "yes," prepare a QA Programmatic Grading Report in accordance with AP-ESH-009. Then proceed to question 2.

2. Does the work involve an engineered item? Yes No

If the answer to question 2 is "no," proceed directly to question 3.

If the answer to question 2 is "yes," determine and grade the QA/QC controls needed to ensure the physical attributes of the SSC, as delineated within the appropriate work planning documents and controlling implementing procedures as developed in accordance with AP-5.1Q.

3. Does the activity involve environmental or industrial safety and health hazards? Yes No

If the answer to question 3 is "no," no grading for ES&H hazards is required.

If the answer to question 3 is "yes," determine and grade QA/QC controls needed to ensure integrated safety management at the controlling activity level to prevent or mitigate those hazards as delineated within the appropriate work planning documents and controlling implementing procedures as developed in accordance with AP-5.1Q.

NOTE: If a grading report is required, include the report with Activity Evaluation and appropriate planning documents.

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
 INTEGRATED SAFETY MANAGEMENT
 QUALITY ASSURANCE PROGRAM (ISMQAP)
 GRADING REPORT**

QA: N/A
 Page 1 of 6

1. Structure, System, or Component (SSC) or Supporting Activity:

Characterization of Near Surface Velocity Structure at Yucca Mountain Crest Using Surface Waves
 SSC = Boreholes

2. Work Package No.:

FWP-SB-01-002

3. Functional Classification Level (FCL):

FCL4

4. Originating Organization:

Test Coordination Office

5. Responsible Manager: (Print Name)

Ron Oliver

6. Signature:

Ron Oliver for

7. Date:

6-6-01

8. Environmental, Safety & Health Rep. Review: (Print Name)

Jayne Davis

9. Signature:

Jayne Davis

10. Date:

6-6-01

11. Approval: (Print Name [next upper level of mgmt. or above])

Mark Peters

12. Signature:

Mark Peters

13. Date:

6-6-01

ISMQAP Criterion	14. Is This Criterion Applicable? If No, Include Justification.	15. If Criterion is Applicable (i.e., Full Implementation or Partial Implementation with Exception Statement)	16. Implementing Documents
1 Organization	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Justification: <u>This activity is unrelated to creating or maintaining an organizational structure to implement the ISM program. Organizational structure is defined at the Project Management level.</u>	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	N/A
2 Quality Assurance Program	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Justification: _____ _____ _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	DOE/RW-0333P, Addendum 1, Integrated Safety Management Quality Assurance Program

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
 INTEGRATED SAFETY MANAGEMENT
 QUALITY ASSURANCE PROGRAM (ISMQAP)
 GRADING REPORT**

ISMQAP Criterion	14. Is This Criterion Applicable? If No, Include Justification.	15. If Criterion is Applicable (i.e., Full Implementation or Partial Implementation with Exception Statement)	16. Implementing Documents
3 Design Control	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Justification: <u>This activity is unrelated to design analysis or design verification.</u> _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	N/A
4 Procurement Document Control	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - This activity does not include the purchase of any items or services which are required to meet specified requirements; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	AP-7.6Q, Procurement of Items and Services
5 Implementing Documents	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Justification: _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	AP-5.2Q, Testing Work Packages AP-OM-006Q, Work Request / Work Order Process
6 Document Control	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Justification: _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	AP-6.1Q, Controlled Documents

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
 INTEGRATED SAFETY MANAGEMENT
 QUALITY ASSURANCE PROGRAM (ISMQAP)
 GRADING REPORT**

ISMQAP Criterion	14. Is This Criterion Applicable? If No, Include Justification.	15. If Criterion is Applicable (i.e., Full Implementation or Partial Implementation with Exception Statement)	16. Implementing Documents
7 Control of Purchased Items & Services	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - This activity does not include the purchase of any items or services which are required to meet specified requirements; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	AP-7.6Q, Procurement of Items and Services
8 Identification & Control of Items	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - This activity does not involve any materials, parts, components or samples associated with items subject to the requirements of the ISMQAP; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	N/A
9 Control of Special Processes	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - There are no "special processes" involved with this activity; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	N/A
10 Inspection	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - This activity does not involve the inspection of any items or facilities subject to the requirements of the ISMQAP; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	N/A

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
 INTEGRATED SAFETY MANAGEMENT
 QUALITY ASSURANCE PROGRAM (ISMQAP)
 GRADING REPORT**

ISMQAP Criterion	14. Is This Criterion Applicable? If No, Include Justification.	15. If Criterion is Applicable (i.e., Full Implementation or Partial Implementation with Exception Statement)	16. Implementing Documents
11 Test Control	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - This activity does not involve any testing of items, activities or facilities which are necessary to prevent or mitigate industrial (i.e., non-NRC) environmental, safety or health hazards; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	N/A
12 Control of Measuring & Test Equipment	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - This activity does not involve the use of measuring and test equipment; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	AP-12.1Q
13 Handling, Storage & Shipping	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No - This activity does not involve the handling, storage, cleaning, packaging, shipping or preservation of items to prevent damage or loss, or to minimize deterioration; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	AP-7.6Q
14 Inspection, Test & Operating Status	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - This activity does not involve the maintenance of inspection, test and/or operating status of any items; or <input type="checkbox"/> No - Justification: _____ _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____	N/A

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
 INTEGRATED SAFETY MANAGEMENT
 QUALITY ASSURANCE PROGRAM (ISMQAP)
 GRADING REPORT**

ISMQAP Criterion	14. Is This Criterion Applicable? If No, Include Justification.	15. If Criterion is Applicable (i.e., Full Implementation or Partial Implementation with Exception Statement)	16. Implementing Documents
15 Nonconformances	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Justification: _____ _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	AP-15.2Q, Control of Nonconformances
16 Corrective Action	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Justification: _____ _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	AP-REG-004, Condition / Issue Identification and Reporting / Resolution System AP-16.1Q, Management of Conditions Adverse to Quality
17 Quality Assurance Records	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Justification: _____ _____ _____ _____	<input checked="" type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	FWP-SB-001-002 developed via AP-5.2Q shall identify required records. Inclusionary records shall be handled in accordance with AP-17.1Q, Records Source Responsibility for Inclusionary Records.
18 Audits	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - IAW ISMQAP, Criterion 18.0, No audits are requested from the Office of Quality Assurance.	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	N/A

**OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
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ISMQAP Criterion	14. Is This Criterion Applicable? If No, Include Justification.	15. If Criterion is Applicable (i.e., Full Implementation or Partial Implementation with Exception Statement)	16. Implementing Documents
19 Assessments	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No - No specific assessment is planned on this item. However, this item is subject to the ISMQAP Assessment Program. <input type="checkbox"/> No - Justification: _____ _____ _____	<input type="checkbox"/> Full Implementation <input type="checkbox"/> Partial Implementation Exception(s): _____ _____ _____ _____	N/A