

U.S. DEPARTMENT OF ENERGY

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**YUCCA MOUNTAIN  
SITE CHARACTERIZATION  
PROJECT**

INFORMATION COPY



**PERCHED-WATER TESTING  
IN THE EXPLORATORY  
STUDIES FACILITY**

**REV. 2**

**TEST PLANNING PACKAGE  
92-11**



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PDR WASTE PDR  
WM-11

**AUGUST 1994**

UNITED STATES DEPARTMENT OF ENERGY

YMP-071-R2  
06/06/94

**YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT  
TEST PLANNING PACKAGE APPROVAL AND RELEASE**

Test Planning Package Title: Perched-Water Testing in the Exploratory Studies Facility Revision: Rev. 2

Test Planning Package Number: TPP 92-11

Responsible PE: R. Oliver

Summary of Scope: Sampling of perched-water in the ESF. Previous version Rev. 1 has been revised to make the TPP structure and content consistent with the test planning package outline in YAP-5.5Q, Rev. 0. The associated job package will provide implementing detail for carrying out this test in defined phases during ESF construction.

Job Package Number: JP 92-20B

WBS Number (third level): 1.2.3.3.1.2.4

Affected Organization: USGS

Concurrence of requirements by affected Technical Project Officers and Assistant Managers

TPO: <sup>for</sup> L. Hayes Robert W. Craig Date: 8/17/94

TPO: \_\_\_\_\_ Date: \_\_\_\_\_

TPO: \_\_\_\_\_ Date: \_\_\_\_\_

TPO: \_\_\_\_\_ Date: \_\_\_\_\_

TPO: \_\_\_\_\_ Date: \_\_\_\_\_

Affected Assistant Managers:

AM: <sup>for</sup> R. Spence R. Spence Date: 8/17/94  
(DQA)

AM: \_\_\_\_\_ Date: \_\_\_\_\_

AM: \_\_\_\_\_ Date: \_\_\_\_\_

Release to: Assistant Manager for  
Administration for job assembly  
  
for nonfield work

YMSCO Approvals:

Responsible Assistant Manager: S. Jones S. Jones Date: 8/17/94  
(AMSP)

TEST PLANNING PACKAGE 92-11  
PERCHED-WATER TESTING IN THE EXPLORATORY STUDIES FACILITY

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

Study Plan 8.3.1.2.2.4, "Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Studies Facility," is a controlled Yucca Mountain Site Characterization Project (YMP) document that describes U.S. Geological Survey (USGS) plans for perched-water testing activities in the Exploratory Studies Facility (ESF).

## 2.0 WORK SCOPE

### Section 2.0 References:

- R2.1 "Exploratory Studies Facility Design Requirements," YMP/CM-0019, Appendix B, Section B-2.2.9, 7/2/92.
- R2.2 Letter: Craig to Elkins, "Planning Information for Perched-Water Testing in the Exploratory Studies Facility (ESF) Starter Tunnel (TPP 92-11)," dated March 3, 1993.
- R2.3 Letter: Craig to Oliver, "Planning Information for Perched-Water Testing in the Exploratory Studies Facility (ESF) Starter Tunnel (TPP 92-11)," dated March 19, 1993.

The Perched-Water Testing in the Exploratory Studies Facility activity is discussed in Section 8.3.1.2.2.4.7 of the Site Characterization Program Baseline (SCPB).

The purpose of this test is to detect the occurrence, and delineate the lateral and vertical extent, of perched-water zones (if encountered) during excavation of the ESF, to identify perching mechanism(s), and to sample the perched-water for chemical analyses. Because there is significant uncertainty regarding the likelihood of encountering perched-water, the perched-water test is categorized as a "contingency test." The form and duration of the testing is dependent upon the nature of any encountered perched-water.

If perched-water is encountered during excavation, one or more small-diameter borehole(s) may be drilled to enhance drainage, facilitate collection of water samples, and allow flow and/or pressure measurements to be made. The borehole(s) may be instrumented for long-term testing and monitoring to obtain data on hydraulic pressure over time. Periodic water sampling may be required from perched-water boreholes.

## 3.0 INVESTIGATION CONTROLS

- R3.1 Letter: Statton to Oliver, "Waste Isolation and Test Interference Evaluations for the ESF Starter Tunnel Construction - JP 92-20, and Planned Tests," LV.SC.BWD.3/93-074, dated March 24, 1993.
- R3.2 "Exploratory Studies Facility Design Requirements," YMP/CM-0019, Rev. 0.

- R3.3 Memorandum: Dyer to File, "Approval of Lithium Bromide and Related Controls for Use as the Tracer in Underground Construction Water at the Exploratory Studies Facility (ESF)," RSED:JRD-3560, dated April 1, 1993.
- R3.4 Letter: Oliver to Elkins, "Submitted Test Interference Evaluation Acceptance for Exploratory Studies Facility Ramps, Main Drift, and Alcoves (SCPB: N/A)" LA-EES-13-LV-07-94-007, dated July 6, 1994.
- R3.5 Letter: Boak to Elkins, "Waste Isolation Evaluation for Exploratory Studies Facility North Ramp and Test Alcoves (SCPB: N/A)" LA-EES-13-LV-07-94-019, dated July 12, 1994.

The following controls are based on section references, including evaluations to address potential test interference and waste isolation impacts (including planned use of tracers, fluids, and materials) and information from principal investigators (PI). These controls may supplement or amend performance criteria and constraints found in YMP/CM-0019, 7/2/92.

### 3.1 Interference

See Attachment 1.

### 3.2 Impacts to Waste Isolation

See Attachment 1.

### 3.3 Environmental Impacts

Controls are specified in Reference R3.1.

### 3.4 Consolidated Performance Criteria and Constraints

See Attachment 1 for a list of consolidated test-specific performance criteria and constraints. Supplemental performance criteria and constraints are identified by italicized text.

### 3.5 Safety Analysis

Potential safety concerns regarding the interactions between the test activities and construction activities are included in the administrative work plan (WP) as a safety analyses attachment. WP safety analyses are administrative documents that may be revised to address changes in scope of work to be performed or changes to construction efforts. Safety issues specific to ongoing testing activities after construction will be addressed, as necessary with revisions to the WP and safety analysis specific to that test.

There are no radiologic safety issues associated with these activities.

## **4.0 OTHER INSTRUCTIONS**

### **4.1 Sequencing Recommended for Performing Multiple Investigations**

See Attachment 1.

### **4.2 Data Submittals (YAP-SIII.3Q)**

Participants are responsible for collection, management, submittal of data, and for compliance with Project and participant plans and procedures.

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

Key data to be obtained are described in the referenced study plan; this includes, but is not limited to flow rates and cross sectional area open to flow. In addition, water samples will be analyzed for major cations and anions and stable and radioactive isotopes. Instrument installation will be documented.

### **4.3 Sample Collection**

See Attachment 1.

### **4.4 Computer Software**

Software (including that which is an integral part of measuring and test equipment) that uses numerical methods for complex scientific, engineering, or mathematical calculations will be controlled in accordance with the users quality assurance program.

## **5.0 REFERENCE TO SCP COMMENTS THAT HAVE BEEN CONSIDERED RELATIVE TO INVESTIGATION(S) (YAP-30.3)**

### **Section 5.0 References:**

- R5.1 Letter: Statton to Oliver, "Waste Isolation and Test Interference Evaluations for the ESF Starter Tunnel Construction - JP 92-20, and Planned Tests," LV.SC.BWD.3/93-074, dated March 24, 1993.**
- R5.2 Letter: Leonard to Distel, "Review of Exploratory Studies Facility (ESF) Test Planning Study Plans," dated May 18, 1994.**

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

## 6.0 REFERENCES TO DESIGN REQUIREMENTS

### Section 6.0 References:

- R6.1 "Exploratory Studies Facility Design Requirements," Appendix B, Section B-2.2.9, "Perched-Water Testing in the Exploratory Studies Facility," YMP/CM-0019, 7/2/92.
- R6.2 Letter: Craig to Elkins, "Planning Information for Perched-Water Testing in the Exploratory Studies Facility (ESF) Starter Tunnel (TPP 92-11)," dated March 3, 1993.
- R6.3 Letter: Craig to Oliver, "Planning Information for Perched-Water Testing in the Exploratory Studies Facility (ESF) Starter Tunnel (TPP 92-11)," dated March 19, 1993.
- R6.4 Letter: Elkins to Segrest, "Transmittal of Design and Test-Related Information for Design and Construction of Exploratory Studies Facility North Ramp (Design Package 2C) (SCPb: N/A), LA-EES-13-LV-03-94-026, dated March 23, 1994.

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

YMP/CM-0019, 7/2/92 establishes the common facility design basis; consolidated performance criteria and constraints (Attachment 1) are consistent with, and do not require any alteration of the current ESF design.

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

## 7.0 COST AND SCHEDULE DATA

### Section 7.0 References:

- R7.1 Letter: Burke to Oliver, "Response to Requests for Support," LV.BMS.RAS.3/93.027, dated March 19, 1993.
- R7.2 Memorandum: Rainey to Kinter, "Request for Supplemental PACs Information," dated July 7, 1994.

<u>Participant</u>	<u>WBS</u>	<u>P&amp;S Account</u>
USGS	1.2.3.3.1.2.4	OG33124

See Attachment 2 for further detail on the cost and schedule planning basis. The task dates and estimated durations are based on current design and construction strategies.

These tasks, dates, and durations are subject to change. Changes will be controlled through the Project planning basis and reflected in applicable job packages or approved Project schedules.

## 8.0 QA PREPARATION

### 8.1 Closure of QA Concerns

No relevant QA concerns have been identified.

### 8.2 Q-List Items/Activities

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

The following quality assurance grading report (QAGR) associated with the testing activities has been approved:

<u>Participant</u>	<u>QAGR</u>	<u>WBS</u>	<u>Subject</u>
USGS	G1233124	1.2.3.3.1.2.4	Characterization of Yucca Mountain Percolation in the Unsaturated Zone -- ESF Study (Perched-Water in ESF)

## 9.0 READINESS REVIEW

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

**TEST-SPECIFIC PERFORMANCE CRITERIA  
AND CONSTRAINTS FOR PERCHED-WATER TESTING  
IN THE EXPLORATORY STUDIES FACILITY**

**Attachment 1 References:**

- A.1 "Exploratory Studies Facility Design Requirements, "Appendix B, Section B-2.2.9, "Perched-Water Testing in the Exploratory Studies Facility," YMP/CM-0019, 7/2/92.
- A.2 Letter: Statton to Oliver, "Waste Isolation and Test Interference Evaluations for the ESF Starter Tunnel Construction - JP 92-20, and Planned Tests," LV.SC.BWD.3/93-074, dated March 24, 1993.
- A.3 Letter: Craig to Elkins, "Planning Information for Perched-Water Testing in the Exploratory Studies Facility (ESF) Starter Tunnel (TPP 92-11)," dated March 3, 1993.
- A.4 Letter: Craig to Oliver, "Planning Information for Perched-Water Testing in the Exploratory Studies Facility (ESF) Starter Tunnel (TPP 92-11)" dated March 19, 1993.
- A.5 "Preliminary Test Planning Package for Support of Pre-Title II Design Studies; Planned Exploratory Studies Facility Tests," YMP/TPP 91-5, Rev. 0.

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

The following performance criteria and constraints represent the controlled requirements basis for tests to be conducted in the Exploratory Studies Facility. Not all portions of these tests will be conducted at all locations; however all tests will be conducted in a manner consistent with these requirements. Test requirements will be implemented through job packages and referenced design specifications and drawings and controlled procedures. Compliance with test requirements will be demonstrated through records submissions and reporting requirements.

Supplemental planning information, other reference information, and a review of the reference information by the ESF TCO was used as indicated to modify, add, supplement, or otherwise amend performance criteria and constraints; this information is fully consistent with the section references and ESF Title II design and are identified by italicized text. Changes to performance criteria or constraints which represent a general change to the testing program will be submitted, as appropriate, as proposed changes to the current version of the ESFDR, Appendix B to assure consistency with higher level requirements.

Performance Criteria (Reference A.1: Section B-2.2.9)

- 1a. Space requirements for this test depend upon the type of perched-water zone encountered. Small perched-water zones (seeps, etc.) may require an opening in the ramp or drift wall large enough to contain water sampling equipment and a data logger (1m x 1m x 0.5m). In the event that boreholes are required for sampling, testing, and monitoring large volume perched-water zones, an alcove large enough to contain a coring rig may be needed to move the drilling operations out of heavy traffic areas in the ESF. Because of the nature of perched-water, the location of its occurrence cannot be predicted.
- 1b. Boreholes cored specifically for this test should be HQ3-sized boreholes, deep enough to retrieve natural state samples, oriented approximately horizontal (this is not critical), and drilled dry (air as the circulating fluid).
- 1c. Boreholes drilled to develop and concentrate the flow of perched-water will be instrumented to conduct hydraulic tests, to monitor pressure and temperature, and to collect water samples. Data loggers will be used to collect and store data from these boreholes.
- 1d. The locations of perched-water tests will be controlled by the occurrence of perched-water. Access to ramp or drift faces may be required immediately after the detection of any perched-water. The orientation of boreholes drilled for this test will be controlled by the nature of the perched-water zone.
- 1e. Boreholes are drilled in the ESF for this test to concentrate and collect perched-water samples for laboratory testing. Additionally, the boreholes will be instrumented to test and monitor perched-water zones. Small flow perched-water zones may only require that water samples be collected along with an estimate of the flow rate and total volume of water produced.
- 1f. Standard ESF utilities are required for this test.
- 1g. Perched-water zones in the ramps and drifts need to be sampled and examined as soon as they are encountered. This activity may require that the tunnel boring machine be pulled back or driven forward to provide access to the perched-water, whichever is faster. After initial sampling, a determination as to the extent of the perched-water zone will be made. Based on this information, it will be decided whether to suspend excavation operations to allow for more complete testing and sampling or to allow excavation operations to continue. Long-term sampling and monitoring of perched-water zones, either in boreholes or along ESF walls, will continue until the nature of a perched-water zone is determined.
  - i. *Use of tracers, fluids, and materials in conduct of this test shall be recorded and reported as described in the applicable job package.*
  - ii. *If sample requirements for perched-water tests are met, additional samples will be sent to the USGS for hydrochemistry tests (activity 8.3.1.2.2.4.8 in Study Plan 8.3.1.2.2.4). If samples are available in excess of that required for hydrochemistry tests, they will be sent to LANL for analyses specified in Study Plan 8.3.1.2.2.2 (Water Movement).*

**Constraints (Reference A.1: Section B-2.2.9)**

- A. Perched-water testing will be initiated as soon as any perched-water is encountered in the ESF. This test should not interfere with any other test. Core samples collected from boreholes drilled for this test will be provided to the matrix hydrologic properties test if necessary.
  - i. As soon as practicable, after potential perched-water is observed, an assessment will be made of appropriate steps to be taken for sampling.*
- B. No IDS requirements are foreseen at this time. Perched-water data collected on data loggers may be transmitted and stored on the IDS system.
- C. This test will be conducted wherever perched-water is encountered in the ESF. No interference envelope is required.
- D. If boreholes are needed, dry drilling is required for this test. If grouting of the ramp and drift walls is required, a chemical tracer must be added to the grout. If alcoves are constructed for this test, minimal water may be used in drilling the blast holes.

