**NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE**

# WORK PLAN

| TITLE: **Sample Management** | REVISION: **4**<br>DATE: **5/31/05**<br>PAGE: **1 OF 10** |
|---|---|
| WORK PLAN NUMBER: **WP-8.0** | SUPERSEDES: **Revision 3, 7/30/02** |

## CHANGE NOTICE NO. 1

EFFECTIVE DATE: November 30, 2005

PURPOSE: Update plan to reflect new proposed wells being sampled.

Page 3, Section 1.0: Change sentence in introduction to incorporate new proposed wells.

Page 8, Table 1: Change table to reflect sampling, splitting and testing of samples for the new proposed wells.

HOW TO FILE: Remove the existing pages 3 and 8 in the work plan and replace with the new pages 3 and 8.

CONCURRENCE:

Dale Hammermeister, On-Site Geotechnical Representative — Date 11/23/05

Dale Hammermeister, Principal Investigator — Date 11/23/05

Doug Davis, Quality Assurance Officer — Date 11/23/05

**NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE**

# WORK PLAN

| TITLE: **Sample Management** | REVISION: **4**<br>DATE: **5/31/05**<br>PAGE: **1 of 10** |
|---|---|
| WORK PLAN NUMBER: **WP-8.0** | SUPERSEDES: **Revision 3, 7/30/02** |

**APPROVAL**

5-26-05

David Swanson, Interim Project Manager Date

**CONCURRENCE**

5/26/05

Dale Hammermeister, Date
On-Site Geotechnical Representative

5/26/05

Dale Hammermeister, Date
Principal Investigator

5/26/05

Doug Davis, Date
Quality Assurance Officer

## TABLE OF CONTENTS



## TABLES

## 1.0 INTRODUCTION

This work plan (WP) describes the requirements and procedures for the collection, testing, and management of samples during Phase V of the Nye County Nuclear Waste Repository Project Office (NWRPO) Independent Scientific Investigations Program Early Warning Drilling Program (EWDP). Phase V began in October 2004 with the completion of sonic corehole NC-EWDP-22PC, as described in TPN-5.3, *Construction of Sonic Corehole NC-EWDP-22PC*, and continued with the drilling of NC-EWDP-13P in September 2005. Phase V will end with the drilling, sampling, and completion of boreholes NC-EWDP-24PA and –29PA early in 2006. This WP addresses sample management for boreholes NC-EWDP-24PA and -29PA.

The NWRPO On-Site Geotechnical Representative and the contract managing geologist will be the Principal Investigators (PIs) for the geologic sampling described in this WP. A separate contractor, referred to as the "groundwater sampling and analysis PI," will serve as the PI for groundwater sampling; contractors performing all other activities described in this WP are referred to as "NWRPO" or "NWRPO personnel."

## 2.0 PURPOSE

This WP details the actions necessary to manage all borehole samples (e.g., rock or fluid) collected for the EWDP, and includes tables of sample depth intervals, required field analyses, and laboratory tests. Specific NWRPO quality assurance (QA) procedures to be used for sample collection, logging, storage, and chain of custody are listed herein. The user shall refer to the most current revision of all referenced WPs, technical procedures (TPs), test plans (TPNs), and quality administrative procedures (QAPs).

## 3.0 BACKGROUND

The EWDP is a part of the ongoing NWRPO scientific investigations related to the construction and operation of a high-level radioactive waste repository at Yucca Mountain, Nevada. Basic geologic and hydrologic data gaps exist for a large area near Yucca Mountain. Past studies conducted by the U.S. Department of Energy (DOE) have concentrated on characterizing the conditions in the immediate vicinity of the repository. The data collected to date indicate that there is significant spatial variability in hydraulic properties, water levels, temperatures, and water chemistry in the aquifers near, and downgradient of, Yucca Mountain.

According to the information presented in the *Total System Performance Assessment-Site Recommendation 2001* (DOE, 2001), water level, aquifer test, and water chemistry data are not available for a large area of southern Jackass Flats, southern Crater Flat, Oasis Valley, Rock Valley, and the northern Amargosa Desert. Quantitative hydrologic data are needed to define the conditions in these areas to identify and evaluate the risk associated with long-term waste disposal at the repository; the EWDP is designed to meet the need for these additional data.

## 4.0 SCOPE OF WORK

Two general sample types will be collected from new EWDP Phase V boreholes: drill cuttings and water samples.

EWDP Phase V boreholes will be drilled using methods described in WP-5.0, *Drilling and Well Construction*. Drilling activities will be carried out in accordance with TP-7.0, *Drill Site Management*.

Drill cuttings samples will be handled and geologically logged according to TP-8.0, *Field Collection, Logging, and Processing of Borehole Geologic Samples*. Water samples will be collected and handled according to TP-8.1, *Field Collection and Handling of Water Samples*.

### 4.1 Drill Cuttings Sample Management

Prior to drilling, the onsite geologist will ensure that 1) all labels and sample documentation have been generated and are available for drill cuttings samples and 2) all necessary containers (e.g., boxes and bags) and other packing, marking, and preservation materials are available.

The types and numbers of drill cuttings samples, including splits, are summarized in Table 1. Drill cuttings sample collection will be limited to new EWDP Phase V boreholes drilled by dual-wall reverse-circulation methods. Continuous geologic drill cuttings samples will be collected using 5-gallon plastic buckets at 2.5-foot intervals in unsaturated alluvium and 5-foot intervals in saturated alluvium and bedrock. The only exception to the 5-foot interval in bedrock will be when basalt flows are encountered; in these cases the sample interval will be 2.5 feet.

Drill cuttings samples from all unsaturated zone borehole sections will be weighed for in situ bulk density calculations. Weighed samples will include the entire sample collected from each drilled interval.

After they are weighed, samples will be homogenized and split using cone and quarter or equivalent methods. Three split samples will be collected from each depth interval: two for the NWRPO and one for the DOE. In the event that sample return is insufficient to accommodate this split, the entire sample will be retained by the NWRPO. One NWRPO split will be subsampled to prepare a logging subsample and for chip tray samples for future reference. Gravel percentages are measured and sand, silt, and clay percentages are estimated on the logging subsample collected from unsaturated alluvium. The second split and the DOE split will be collected for archiving at the DOE Yucca Mountain Project (YMP) Sample Management Facility (SMF). A fourth split will be collected for laboratory testing from every other 2.5-foot interval in unsaturated alluvium and every other 5-foot interval in all other unsaturated geologic materials. The NWRPO split designated for archival will be placed in labeled canvas or olefin sample bags and shipped to the SMF under appropriate chain of custody. The NWRPO laboratory split will be placed in labeled and sealed double plastic bags and shipped to the NWRPO testing laboratory under appropriate chain of custody. All splits should weigh approximately 5 pounds or less. During weighing, homogenizing, and splitting, care will be taken to minimize the loss of water from samples by evaporation.

The laboratory tests conducted on drill cuttings samples are summarized in Table 1. The methods used to conduct these tests are summarized in Table 2. Gravimetric water content measurements will be made on all unsaturated zone samples sent to the laboratory, wet sieve and electrical conductivity measurements of soil-water extracts made on unsaturated zone alluvial samples, and hydrometer, specific gravity, and Atterberg limits measurements made on a selected ten percent of the samples.

All laboratory analyses will be submitted to the NWRPO Quality Assurance Records Center (QARC), along with all supporting documentation and metadata, immediately after data checking and reduction.

Strict chain of custody will be maintained for the drill cuttings samples at all times. The samples will be in view of the current responsible holder of the samples or secured in locked storage. The distribution of drill cuttings sample splits will be controlled and documented using the NWRPO Transfer of Custody Form found in TP-8.0.

The NWRPO split of the drill cuttings transferred to the SMF will be maintained under institutional chain of custody and sample management controls. Drill cuttings samples will be stored in sample bags inside standard core boxes. Boxes of drill cuttings will be stored inside the SMF buildings under the same environmental conditions maintained for other SMF inventory.

## 4.2 Water Sample Management

Several organizations other than the NWRPO (e.g., the University of Nevada, Las Vegas Harry Reid Center for Environmental Studies; Los Alamos National Laboratory; and the U.S. Geological Survey) will collect water samples during Phase V. The NWRPO will have the authority to approve access to well sites and sampling plans for these organizations.

NWRPO personnel will ensure that EWDP water samples are collected according to TP-8.1. Prior to sampling, NWRPO personnel will ensure that all necessary bottles and other packing, marking, and preservation materials are available, as well as the necessary calibrated instrumentation and equipment. All equipment will be calibrated according to QAP-12.1, *Control of Measuring and Test Equipment*, and will be documented in the field geochemistry scientific notebook according to QAP-3.2, *Documentation of Technical Investigations*. Water samples will be maintained under strict chain of custody at all times.

### 4.2.1 First Water Samples

First water will be measured, developed, and documented as described in WP-5.0. The preferred method of sample collection is bailing; however, airlifting is acceptable if bailing is not practical. If directed by the PI(s), the water will be sampled for field measurements of temperature, pH, and electrical conductivity; samples may also be collected for laboratory analysis.

### 4.2.2 Additional Water Sampling

When the borehole has been advanced to the water table, subsequent water level measurements and sampling may be done at the direction of the PI. Field measurements of temperature, pH, and electrical conductivity will be made; samples may also be collected for laboratory analysis. Field measurements and samples collected for possible laboratory analysis will be documented in the field scientific notebook according to QAP-3.2.

### 4.2.3 Post-Development Water Sampling and Analysis

After well development at all new EWDP Phase V wells, at least two groundwater samples will be collected from each well screen for the chemical analysis of a comprehensive suite of analytes. Field measurements may include pH, temperature, electrical conductivity, alkalinity, dissolved oxygen, and oxidation-reduction potential; these field parameters will be recorded according to TP-8.1. Possible laboratory analyses and testing laboratories are summarized in Table 3. Field data forms and original laboratory analyses will be submitted to the QARC upon receipt by the groundwater sampling and analysis PI, along with any processed QA data and associated metadata.

## 5.0 MANAGEMENT

The project QA Officer is responsible for the coordination of the internal review of this WP and verifying compliance with its requirements. Geologic sampling and groundwater sampling and analysis PIs are responsible for the preparation and modification of this WP, as well as oversight of its performance. NWRPO personnel are responsible for carrying out field sampling and testing.

Equipment used to measure temperature, pH, and electrical conductivity in the field will be calibrated according to QAP-12.1. Laboratory analyses of EWDP water samples will be performed by facilities certified to use methods and procedures consistent with industry standards and U.S. Environmental Protection Agency-approved methods and procedures. The NWRPO testing laboratory will follow industry-standard methods when measuring hydraulic parameters.

To ensure that the work will be quality-controlled and accomplished in accordance with the scope and objectives of the NWRPO, the following training and documentation will be accomplished before conducting the activities described in this WP. All individuals performing these activities will be trained in the applicable QA procedures listed below and will document that they have read and understand the procedures before conducting work.

- QAP-3.2, *Documentation of Technical Investigations.*
- QAP-12.1, *Control of Measuring and Test Equipment.*
- TP-7.0, *Drill Site Management.*
- TP-8.0, *Field Collection, Logging, and Processing of Borehole Samples.*

- TP-8.1, *Field Collection and Handling of Water Samples.*
- WP-5.0, *Phase V Drilling and Well Construction.*

## 6.0 REFERENCES

DOE, 2001. *Yucca Mountain Total System Performance Assessment – Site Recommendation.* Washington, D.C.: U.S. Department of Energy. TDR-WIS-PA-00001, MDL-WIS-PA-00001.

QAP-3.2. *Documentation of Technical Investigations.* Quality Administrative Procedure. Nye County Department of Natural Resources and Federal Facilities, Nuclear Waste Repository Project Office. Pahrump, Nevada.

_QAP-12-1. *Control of Measuring and Test Equipment.*

TP-7.0. *Drill Site Management.* Technical Procedure. Nye County Department of Natural Resources and Federal Facilities, Nuclear Waste Repository Project Office. Pahrump, Nevada.

_TP-8.0. *Field Collection, Logging and Processing of Borehole Geologic Samples.*

_TP-8.1, *Field Collection and Handling of Water Samples.*

TPN-5.3. *Construction of Sonic Corehole NC-EWDP-22PC.* Test Plan. Nye County Department of Natural Resources and Federal Facilities, Nuclear Waste Repository Project Office. Pahrump, Nevada.

WP-5.0. *Phase V Drilling and Well Construction*. Work Plan. Nye County Department of Natural Resources and Federal Facilities, Nuclear Waste Repository Project Office. Pahrump, Nevada.

# Table 1
## Drill Cuttings Sampling, Splitting, and Field/Laboratory Testing Summary

| Borehole (NC-EWDP-)[a] | Geologic Material Description[b] | Estimated Thickness of Material (feet) | Drill Cuttings Sample Interval (feet) | Total Number of Drill Cuttings Sample Intervals | Number of NWRPO[c] Field Measurements | | | Number of Drill Cuttings Samples | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Splits (5-pound Bags) | | | NWRPO Laboratory Analysis | | | | | | |
| | | | | | Percent Gravel Measure-ment | Density-Related Field Measure-ments | NWRPO Logging and Chip-Tray Split | NWRPO SMF[d] Split | DOE/ YMP[e] SMF Split | NWRPO Laboratory Split | Gravi-metric Water Content | Soil-Water Extract EC[f] | Specific Gravity | Atterberg Limits | Particle Size | |
| | | | | | | | | | | | | | | | Wet Sieve | Hydro-meter |
| 24PA | Unsaturated alluvium | 400 | 2.5 | 160 | 160 | 160 | 160 | 160 | 160 | 80 | 80 | 80 | 20 | 20 | 80 | 20 |
| | Saturated alluvium | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Other unsaturated rock types | 5 | 5 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | Other saturated rock types | 1095 | 5 | 219 | 0 | 0 | 219 | 219 | 219 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29PA | Unsaturated alluvium | 320 | 2.5 | 128 | 128 | 128 | 128 | 128 | 128 | 64 | 64 | 64 | 16 | 16 | 64 | 16 |
| | Saturated alluvium | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Other unsaturated rock types | 30 | 5 | 6 | 0 | 6 | 6 | 6 | 6 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| | Other saturated rock types | 1,650 | 5 | 330 | 0 | 0 | 330 | 330 | 330 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **TOTALS** | | | | **844** | **288** | **295** | **844** | **844** | **844** | **148** | **148** | **144** | **36** | **36** | **144** | **36** |

[a]Official prefix of all Nye County wells.
[b]Alluvium is defined as all unconsolidated sediments.
[c]Nuclear Waste Repository Project Office.
[d]Sample Management Facility.
[e]U.S. Department of Energy Yucca Mountain Project.
[f]Electrical conductivity.

# Table 2
# Laboratory Test Methods for Drill Cuttings Samples

| Laboratory Test | Method |
|---|---|
| Specific gravity (grain density) | ASTM D-854-02. Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer. In: 2003 *Annual Book of ASTM Standards,* Vol. 04.08, American Society for Testing and Materials. |
| Gravimetric water content | ASTM D-2216-98. Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. In: 2003 *Annual Book of ASTM Standards,* Vol. 04.08, American Society for Testing and Materials. |
| Soil extract electrical conductivity | Rhoades, J.D. 1982. Soluble Salts—Extracts at Soil/Water Ratios of 1:1 and 1:5, Electrical conductivity of saturation extract. In: Page, A.L. (ed), *Methods of Soil Analysis,* Part 2, Chemical and Microbiological Properties (2nd ed.), American Society of Agronomy, Chapter 10, pp. 169-170 and 172-173. |
| Wet sieve analysis | ASTM D-1140-00. Standard Test Methods for Amount of Material in Soil Finer Than the No. 200 (75 um) Sieve (Method B for wet sieve analysis). In: 2003 *Annual Book of ASTM Standards,* Vol. 04.08, American Society for Testing and Materials. |
| Hydrometer analysis (i.e., silt/clay break starting with No. 4 sieve) | ASTM D-422-63 (Reapproved 1998). Standard Test Method for Particle Size Analysis of Soils. In: 2003 *Annual Book of ASTM Standards,* Vol. 04.08, American Society for Testing and Materials. |
| Atterberg limits | ASTM D-4318-00. Standard Test Methods for Liquid Limit, Plastic Limit, and plasticity Index of Soils. In: 2003 *Annual Book of ASTM Standards,* Vol. 04.08, American Society for Testing and Materials. |

# Table 3
## Summary of Groundwater Analyses and Testing Laboratories

| Laboratory Analyses | Testing Laboratory |
|---|---|
| Indicator parameters (i.e., pH, electrical conductivity, total dissolved solids, and alkalinity) anions (i.e., chloride, fluoride, and sulfate), nutrients (i.e., nitrate, nitrite, and phosphate), and metals | ACZ Laboratories, Steamboat Springs, CO |
| Gross alpha and beta and tritium | Radiation Safety, Chandler, AZ |
| Stable isotope ratio analysis (SIRA) of oxygen and hydrogen in water and SIRA of nitrogen in nitrate | Coastal Science Laboratories, Austin, TX |
| SIRA of carbon in total dissolved inorganic carbon and radiocarbon-14 | Beta Analytic, Miami, FL |