

**NYE COUNTY NUCLEAR WASTE
REPOSITORY PROJECT OFFICE
WORK PLAN**



TITLE: Instrumentation and Data Collection in the ESF Tunnels		Revision: 1 Date: 10/27/1998 Page: 1 of 7
APPLICABILITY: Work Package No: 2		SUPERSEDES: Revision 0 - October 7, 1996
APPROVAL Project Manager <i>Les W Brudshar</i> Date: 10.29.98		CONCURRENCE On-Site Geotechnical Representative Date: 10-29-98 Principal Investigator Date: 10-29-98 Project Quality Assurance Officer Date:

1.0 INTRODUCTION

The purpose of this work plan is to describe the objective, background, and scope of the collection of in-situ data in the East-West Drift tunnel, known as the ECRB for "Enhanced Characterization of the Repository Block". It will encompass a description of the purposes of the data collection, the history of investigations in the Exploratory Studies Facility (ESF) tunnel, and provisions for instrumentation calibration and installation performed prior to data retrieval. The ECRB is a tunnel currently being excavated off the main tunnel (ESF) at the Yucca Mountain Project Site (YMS). The ECRB tunnel will be used to further additional study of the proposed repository site. This work plan will conclude that the instrumentation and testing done at this site will support the planned

investigations and the objectives of the Nye County Nuclear Waste Repository Project Office (NWRPO) and will be accomplished in accordance with all quality control procedures.

2.0 PURPOSE

The NWRPO has identified several key scientific issues of concern that may affect repository design and performance that are not currently being addressed by DOE. These issues include:

- Adequate spatial characterization of pneumatic properties in the repository rock.
- Sufficient characterization of pneumatic conditions of the repository rock before it is disturbed by characterization activities.
- Potential present day and future disturbance of pneumatic conditions in the repository rock caused by characterization activities such as ESF tunneling.

The NWRPO has conducted borehole and tunnel instrumentation, monitoring, data analysis, and numerical modeling activities to address the above concerns about DOE's Yucca Mountain repository characterization program. In continuation of the characterization program, the instrumentation procedure in the tunnel has been modified to obtain additional monitoring data. The collected data will be used to measure tunnel ventilation characteristics including air flow and heat and moisture transport. Collected data will also be used for the calibration process in future computer modeling efforts. The purpose of this work plan is to describe the tasks required for the present calibration and installation of instruments in the ECRB tunnel and collection, processing, and analysis of monitoring data for the NWRPO.

3.0 BACKGROUND

The Nye County NWRPO provides oversight of DOE's scientific investigation program for Nye County with the primary goal of protecting the health and welfare of Nye County citizens. The Independent Scientific Investigation Program section within the NWRPO provides oversight of DOE's scientific programs designed to determine the suitability of the YMS for a repository. The major objectives of this scientific oversight program relative to this work plan are:

- To address key issues that can have an important impact on the design and performance of the repository.
- To identify areas not adequately being addressed by DOE.

The NWRPO has identified several key scientific issues of concern that may affect repository design and performance that are not currently being addressed by DOE. These issues were listed in Section 2 and are briefly discussed in the following to provide justification for the data collection, processing, and analysis tasks described in Section 4.

3.1 Concerns Regarding the Characterization of the Spatial Variability of Pneumatic Properties

Nye County is concerned that at present DOE is not adequately addressing the spatial characterization of pneumatic properties of the repository rock. This concern relates to the effect of the scale of measurements on borehole pneumatic data collected in fractured and porous tuffaceous formations. In short, the extent to which the results of tests conducted in boreholes can be meaningfully extrapolated to larger volumes of rocks is not known. For example, monitoring in-situ barometric fluctuations above and below a particular geologic formation in the subsurface is thought to provide a means of estimating large-scale vertical pneumatic conductivity of formation materials. However, the extent to which these large-scale estimates also reflect pneumatic conductivities in directions other than vertical cannot be determined from these measurements.

In order to address these spatial characterization issues, the NWRPO has been collecting appropriate pneumatic data from boreholes and the ESF tunnel to determine the permeability of repository formation materials over a large range of measurement scales. As the new tunnel (ECRB) is excavated, NWRPO wishes to collect similar pneumatic data at this site.

3.2 Concerns Regarding Characterization of Pneumatic Conditions in Regions Unaffected by Site Characterization Activities

Based on preliminary data there appears to be a potential for significant disturbance of pneumatic and hydrochemical conditions in the repository rock by air invasion resulting from tunnel construction. The potential for disturbance is described in more detail in the following section. As a result, Nye County is concerned with the adequacy of pre-excavation pneumatic conditions, as well as water and gas hydrochemistry characterization data that may be impacted.

For this reason, the NWRPO plans to monitor existing boreholes and install/monitor additional boreholes in regions not yet impacted by site characterization investigations.

3.3 Concerns Regarding the Potential Disturbance of the Repository Rock Caused by Characterization Activities such as ECRB Tunneling

The excavation and operation of a large tunnel such as the ECRB in unsaturated rock creates a sink and/or source condition which could cause the movement of significant amounts of relatively dry atmospheric air into, and humid air out of the formations penetrated by the tunnel. This in turn could result in a significant disturbance of the humidity and moisture content of the formation from pre-tunnel conditions.

The NWRPO plans to conduct long-term monitoring of pneumatic potentials in the tunnel and nearby boreholes both to evaluate the present impact of tunnel

construction and ventilation on pneumatic potentials as well as provide a database to simulate long term impacts on the repository rock.

4.0 SCOPE OF WORK

The tunnel is a boundary condition for temperature, pressure, humidity, and environmental isotopes. Each of these parameters affects the unsaturated zone in various degrees depending on the properties of the host rock. Nye County plans to install instrumentation in the ECRB for monitoring barometric pressure, temperature, humidity, air velocity and moisture content.

4.1 Type and Extent of Planned Investigations

The planned investigation in the ECRB tunnel includes an instrumentation assembly to measure ventilation characteristics in the tunnel. The instrumentation assembly shall include the following calibration and installation procedures given in Technical Procedure 9.3. Data shall include (but is not limited to) temperature, pressure, humidity, air velocity, and moisture content measurements. Data collection will involve downloading data to a portable computer from data loggers connected to temperature, pressure, humidity, air velocity, and moisture content sensors located in the ECRB tunnel. Data processing tasks shall include converting downloaded data to spreadsheet files, entering these data into the NWRPO database, and checking for errors in the monitoring records. Data analysis shall include creating tabular data reports, plotting data in graphical format, and performing calculations with the data. Calculations shall involve spreadsheet programming to estimate Eddy thermal diffusivity coefficients. Data will also be prepared for calibrating computer models for predicting heat and moisture transport in the tunnel.

4.3 Location of Investigations

The selection of the location for the installation of the assembly is coordinated with the ECRB test coordinator and the Principal Investigator (PI). At least three

stations within the ECRB are required to obtain a full range of observations needed for these tests. These three stations should have different moisture and heat characteristics.

4.4 Schedule

The NWRPO Principal Investigator (PI) will determine the frequency of data collection, processing, and analysis tasks.

4.5 Responsibilities of Investigators

Designated NWRPO personnel including contract personnel (referred to as NWRPO personnel in the following) shall be responsible for collecting, processing, and analyzing in-situ data from instrumentation in the ECRB tunnel. The Principal Investigator (PI) will assign NWRPO personnel to these tasks and supervise their work. All instrumentation, monitoring, and data collection will be performed by personnel trained specifically with the instrumentation and applicable procedures. They shall follow the procedure given in Technical Procedure 9.3. The remaining data processing and analysis tasks will be conducted by an existing NWRPO contractor, Multimedia Environmental Technology (MET) located in Pahrump, NV.

4.6 Equipment and Calibration Requirements

Instrumentation used to monitor parameters in the ECRB tunnel includes, but is not limited to, the following:

- Campbell Scientific instrument packages (including sensors and data loggers) to measure temperature, pressure, humidity, and moisture content in the ECRB tunnel.
- Solomat instrument packages to measure air velocity in the ECRB tunnel.

All instruments, prior to installation in the tunnel, shall be factory calibrated in a laboratory to nationally recognized standards if available. However, if national standards do not exist for a particular instrument, the best available standard will be used, e.g., the manufacturer's calibration, a field calibration, or other

appropriate method. These instruments will be located in a manner to easily be retrievable and available for recalibration. These instruments will be recalibrated in a certified laboratory on a periodic basis as determined by the PI.

5.0 MANAGEMENT

To ensure that the work involved will be quality controlled and accomplished in accordance with the scope and objectives of the project, certain tasks must be performed. All individuals performing the tasks listed in the above sections shall be trained in technical procedures specifically applicable to conduct the task. For example, personnel performing field calibration, data collection, and/or data-processing tasks shall be professional geoscientists or engineers with applicable previous experience. Personnel performing field calibration and data-collection tasks shall document that they have read and understand the Technical Procedure. These individuals shall be referred to as NWRPO personnel. Personnel involved in the processing of data shall be trained in the use of the spreadsheet and database programs used. Finally, personnel involved in data analysis shall have appropriate education in multiphase fluid flow processes, computer modeling training and experience, and understand and follow computer modeling TP.

The project QA Officer shall be responsible for the coordination of the internal review of this work plan. They are also responsible for assuring the proper training of NWRPO personnel and verifying the compliance with the requirements of this plan. The PI shall be responsible for the preparation and modification of this work plan, as well as the oversight of the performance of the plan.