NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

WORK PLAN

TITLE:	REVISION: 1
Groundwater and Surface Runoff Water Chemistry Sampling and Analysis	DATE: 11-20-08 PAGE: 1 OF 10

WORK PLAN NUMBER:	SUPERSEDES:
WP-11	Rev. 0, 9-26-03

APPROVAL

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CONCURRENCE

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1.0 INTRODUCTION

This Work Plan (WP) describes the strategy and procedures for the collection and testing of groundwater and surface runoff water chemistry samples as part of the Nye County Nuclear Waste Repository Project Office (NWRPO) Independent Scientific Investigations Program (ISIP). This Work Plan has been prepared in accordance with the provisions of the Nye County NWRPO quality administrative procedure QAP-5.2, Preparation of Work Plans, Test Plans, and Technical Procedures.

Most NWRPO groundwater chemistry sampling and analysis have been, and will continue to be, conducted in wells constructed as part of the Nye County Early Warning Drilling Program (EWDP), which is a subprogram of the ISIP. However, some groundwater chemistry sampling and analysis may also be conducted in a limited number of strategically located private and public wells.

Studies of Nye County groundwater chemistry indicate that infiltration of surface runoff occurs in the valleys subsequent to runoff producing storms and represents a large portion of the groundwater recharge. Federal monitoring stations and funded research have studied the chemistry of precipitation nationwide and Nye County wells have provided a basis for understanding ground water chemistry. Surface runoff water samples will be collected in arroyos in the vicinity of EWDP wells to help determine the chemistry of the surface runoff that is currently recharging the groundwater.

2.0 PURPOSE

The purpose of this WP is to outline actions to manage the collection and testing of ISIP groundwater and surface runoff water chemistry samples.

Groundwater and surface runoff water chemistry sampling and analysis are being conducted to support ISIP objectives, which include 1) the collection of baseline data on a comprehensive suite of chemical parameters, 2) determining chemistry of surface runoff recharging the groundwater, 3) the identification of potential flow paths from Yucca Mountain to potential receptors in Amargosa Valley, and 4) the development of a defensible groundwater chemistry monitoring network, downgradient of Yucca Mountain, suitable for long-term performance confirmation monitoring

3.0 BACKGROUND

The ISIP is part of the ongoing NWRPO oversight investigations related to the proposed construction and operation of a high-level radioactive waste repository at Yucca Mountain, Nevada.

A large area near the proposed repository site at Yucca Mountain lacks basic geologic and hydrologic data. Past studies conducted by the U.S. Department of Energy (DOE) have concentrated on characterizing the conditions in the immediate vicinity of the site. However, according to the information presented in the Total System Performance Assessment (YMP,

2001) no water level, aquifer test, or water chemistry data are available for large portions of southern Jackass Flats, southern Crater Flat, western Rock Valley, or the northern Amargosa Desert. Quantitative hydrologic data are needed to define the conditions in these areas so that the risk associated with long-term waste disposal at the Yucca Mountain repository can be identified and evaluated. The ISIP, and subsequently the EWDP, is designed to provide the needed additional data for these areas, and will facilitate the establishment of a groundwater chemistry monitoring system downgradient from the repository site to help ensure protection for the residents of Nye County and the environment.

4.0 SCOPE OF WORK

The scope of work of this plan applies to groundwater chemistry sampling and analyses in wells that have been completed and developed and also surface runoff water sampling and analyses in arroyos in the vicinity of EWDP wells. Instructions for sampling and analyzing groundwater chemistry samples during drilling of EWDP wells are described in WP-8, *Sample Management*.

This scope of work presents specifics for the following, which are discussed in Sections 4.1 through 4.6:

- Applicable NWRPO quality assurance (QA), quality administrative procedures (QAPs), and technical procedures (TPs)
- Responsibilities and participants for groundwater chemistry and surface runoff sampling and analysis tasks
- A strategy for water sampling and analysis, including suites of chemical parameters
- A preliminary plan for water sample archival

4.1 Applicable Quality Assurance Plans and Procedures

Groundwater chemistry sampling and analysis after well completion and development will involve well purging, as well as the measurement of field water chemistry indicator parameters during well purging, collection and labeling of samples, shipping of samples to testing laboratories, and laboratory chemical analysis of a comprehensive suite of analytes. Procedures for these and related tasks are described in technical procedures TP-8.1, *Field Collection and Handling of Water Samples.* The calibration of equipment used to measure field indicator parameters will be documented in accordance with quality administrative procedure QAP-12.1, *Control of Measuring and Test Equipment.*

Surface runoff water sampling will involve collecting samples from surface runoff samplers as well as collection of rain gauge data, collection and labeling of samples, shipping of samples to testing laboratories, and laboratory chemical analysis of a comprehensive suite of analytes. Procedures for these and related tasks are described in technical procedure TP-11.1, *Runoff Sampler Construction, Field Sample Collection and Handling of Surface Runoff Water Samples.*

Detailed groundwater and surface runoff water chemistry sampling and analysis instructions beyond the scope of the associated TP will be specified by the PI before each sampling event.

4.2 Responsibilities and Participants

The Principal Investigator (PI) or designee is responsible for the production of this WP and associated TPs, the training of NWRPO personnel and contractors in these QA documents, and the overall supervision of groundwater chemistry sampling and analysis tasks. The PI or designee will submit all original field and laboratory analysis data, together with associated metadata, to the NWRPO QA Records Center (QARC) following review and approval.

Nye County personnel and/or contractors, herein referred to as "NWRPO personnel," are responsible for implementing these QA plans and procedures; the Geoscience Manager is responsible for organizing and implementing technical reviews; and the Project QA Officer is responsible for ensuring/verifying that they contain necessary QA directives, that technical reviews are conducted, that testing laboratories are qualified as vendors, and that the plans and procedures are implemented in the field.

Several agencies separate from the NWRPO will collect groundwater chemistry samples at wellheads during each NWRPO sampling and analysis session. The NWRPO will have the authority to approve access to the well sites and sampling plans for these agencies. The NWRPO will be responsible for pumping water to the ground surface; the other agencies will be responsible for collecting samples at the wellhead. Some agencies that have previously collected groundwater chemistry samples from NWRPO sampling sessions include the University of Nevada at Las Vegas Harry Reid Center for Environmental Studies, the State of Nevada, the U.S. Nuclear Regulatory Commission, Los Alamos National Laboratory, and the U.S. Geological Survey. Only Nye County will collect surface runoff water samples due to the limited quantity of sample available.

4.3 Groundwater Chemistry Sampling and Analysis Plan

Although groundwater chemistry samples have been collected as part of the NWRPO EWDP, a detailed groundwater chemistry monitoring plan was not formally developed until 2003. Generally from 1994 through 2002, the strategy was to collect and analyze at least one groundwater chemistry sample from each well screen following the drilling, well completion, and development of each EWDP well. The following sections present a strategy implemented in 2003 for both short- and long-term groundwater chemistry monitoring, specifics and justification of the frequency of sampling and analysis, a definition of the suites of chemical parameters to be analyzed, and an overview of QA samples and data validation. This sampling and analysis plan should be utilized when planning each sampling session.

4.3.1 Overview of Short- and Long-Term Sampling and Analysis

Future groundwater chemistry sampling and analysis will be conducted in two phases. The first phase of short-term monitoring is designed to build confidence in initial data quality. The second, long-term monitoring phase is designed to investigate the temporal and spatial variations in water chemistry by sampling EWDP wells over time and depth. The first phase of sampling will produce two valid data sets from each well, separated by at least a year. The second phase will begin with sampling performed as follows:

- Wells containing one or more sampling intervals less than 200 feet deep will be sampled every 2 years
- Wells containing only sampling intervals deeper than 200 feet will be sampled every 4 years

4.3.2 Prioritization of Short-Term Sampling and Analysis

A priority scheme has been developed to guide EWDP groundwater chemistry sampling during the first phase. All wells that have been completed with screens and sand or gravel packs, and are judged to be adequately developed, are classified as one of three priority groups for Phase I sampling as defined below. Multiple-screen wells are considered one well for the following classification scheme, since logistics dictate sampling of all screens during a sampling session.

- Group 1 (first priority) - All wells that meet one or any combination of the following criteria:
  - Wells that have not been previously sampled
  - Wells that are scheduled for other high-priority use in the near future (e.g., single- and cross-hole tracer testing)
  - Wells that have been sampled and analyzed at least once, but data quality is lacking
- Group 2 (second priority) - All wells sampled only once that do not meet Group 1 criteria
- Group 3 (third priority) - All wells sampled more than once, with sampling events separated by less than 12 months

Table 1 shall be used as a planning tool for sampling events by summarizing the prioritization of ground water sampling and shall be updated for each sampling session and submitted to the QARC.

4.3.3 Chemical Parameters to be Analyzed

Where possible, the following groundwater chemistry indicator parameters will be measured in the field during and following the purging of each well:

- pH
- Electrical conductivity
- Temperature

Where possible, alkalinity will also be measured in the field or at the NWRPO within 72 hours of sampling. Procedures for purging and measuring these parameters are described in TP-8.1.

Testing laboratories will measure the following groundwater chemistry parameters, unless the PI specifies different analyses for a particular sampling session:

- Major anions, major cations, total dissolved solids, and field indicator parameters
- Approximately 30 trace elements
- Nutrients, including total phosphate, nitrite plus nitrate, and ammonium
- Stable isotope ratio analyses of nitrogen and oxygen in nitrate, oxygen and hydrogen in water, and carbon in total inorganic carbon
- Tritium and radiocarbon
- Gross alpha and beta

Laboratories, testing methods, and procedures for collecting and shipping samples for specific sampling sessions shall be specified by the PI.

It should be noted that during sampling sessions, the PI may make additional changes to the field and testing laboratory parameter suites presented above. Any changes will be documented in the Scientific Notebook.

4.4 Surface Runoff Water Chemistry Sampling and Analysis Plan

Surface runoff water samples shall be collected after substantial rain events, therefore no formal test plan will be implemented. However there should be continual observance of weather conditions so that no sampling opportunities are missed. Runoff sampling will continue until the PI or designee decides that enough data has been collected to establish a baseline of surface runoff chemistry.

4.4.1 Chemical Parameters to be Analyzed

Testing laboratories will measure the following groundwater chemistry parameters, unless the PI specifies different analyses for a particular sampling session:

- Major anions, major cations, total dissolved solids, alkalinity and conductivity
- Approximately 30 trace elements
- Nutrients, including total phosphate, nitrite plus nitrate, and ammonium
- Stable isotope ratio analyses of oxygen and hydrogen in water and carbon in total inorganic carbon
- Tritium and radiocarbon

Laboratories, testing methods, and procedures for collecting and shipping samples for specific sampling sessions shall be specified by the PI.

It should be noted that during sampling sessions, the PI may make additional changes to the field and testing laboratory parameter suites presented above. Any changes will be documented in the Scientific Notebook.

4.5 Quality Assurance Samples and Data Validation

TP-8.1 and TP-11.1 present types of field and laboratory QA samples and types and sources of error measured for these samples, QA objectives for these samples, and a strategy for collecting field QA samples. The specific type and number of field QA samples required for future sampling sessions may be modified from this procedure by the PI. Modifications to QA sample requirements will be documented in the applicable TP..

The type and frequency of analysis of laboratory QA samples will be specified in the QA procedures of each testing laboratory and the results included in laboratory data reports. Data validation will consist of an evaluation by the PI or designee of the degree to which QA objectives have been met for both field and laboratory QA samples. The PI or designee will prepare a report summarizing the results of this evaluation.

Other methods that analyze original groundwater and surface runoff chemistry sample results rather than QA sample results may be used by the PI or designee to assess data quality (i.e., validate data). These methods include: charge balance analyses, a comparison of analytical results for water samples collected at the same time from the same well by different agencies, and an analysis of temporal variations in water chemistry data from a particular screened interval. Charge balance analyses compare the relative amounts of positively and negatively charged ions from each water sample analyzed. Since water is electroneutral, a charge balance other than zero indicates analytical error and/or a significant contribution from "minor" ions not included in the analysis.

Differences in the analytical results from different agencies can be caused by variations in field sample collection, preservation, and processing procedures and/or laboratory testing methods, equipment, or expertise. A high degree of agreement between results from different agencies increases the level of confidence in the data, and great disagreement is indicative of significant field and/or laboratory error and the need for improved procedures.

Finally, an evaluation of variations in analytical data over time from a particular sampling point (i.e., well screen) also helps to support data quality assessment. For example, significant differences in analytical results from one sampling session to several other sampling sessions suggest that field and/or laboratory error may be responsible for the outlier data.

In summary, the results of all applicable charge balance analyses, interagency comparisons, and temporal evaluations to identify outlier data will be included in the data validation report.

5.0 MANAGEMENT

To ensure that the work described in this work plan will be quality controlled and accomplished in accordance with the scope and objectives of the ISIP, certain responsibilities must be met and tasks performed. Responsibilities of key personnel were described briefly in Section 4.2 and are described in more detail in the following.

Training is a critical management tool and detailed responsibilities in this area are specified as follows. The PI and QAO are responsible for ensuring that all NWRPO personnel performing

the tasks described in the above sections will be trained in the plans and procedures specifically applicable to the equipment and methods used before conducting work. At a minimum, NWRPO personnel will document that they have read and understand the applicable QA plans and procedures which include but are not limited to this work plan and the following:

- TP-8.1, *Field Collection and Handling of Water Samples*
- TP-11.1, *Runoff Sampler Construction, Field Sample Collection and Handling of Surface Runoff Water Samples*
- QAP-12.1, *Control of Measuring and Test Equipment*

NWRPO personnel, under the supervision of the PI or designee, are responsible for collecting and processing groundwater and surface runoff chemistry samples according to these procedures. The QA officer is responsible for verifying, via surveillances and audits, that NWRPO personnel follow these procedures.

Quality control in water chemistry testing laboratories is equally important to field quality control. Laboratory analyses of groundwater chemistry samples will be performed by facilities certified to use analytical methods and procedures consistent with industry standards and/or U.S. Environmental Protection Agency approved methods and procedures. The QA officer is responsible for verifying that testing laboratories are appropriately certified, have the necessary QA program in place, and that this QA program is followed while laboratory analyses are conducted.

6.0 REFERENCES

Nuclear Waste Repository Project Office (NWRPO). 2002. *Final Nye County Proposal for Additional Independent Scientific Investigations Program Activities for Fiscal Years 2002 – 2006*. Nye County Department of Natural Resources and Federal Facilities, Nuclear Waste Project Office (NWRPO). February 2002, NWRPO-2001-01, Revision 2.

Yucca Mountain Project (YMP). 2001. *Total System Performance Assessment - Analyses for Disposal of Commercial and DOE Waste Inventories at Yucca Mountain - Input to Final Environmental Impact Statement and Site Suitability Evaluation*, REV 00, ICN 02, December 2001, Las Vegas, Nevada.

QAP-5.2, *Preparation of Work Plans, Test Plans, and Technical Procedures*, Quality Administrative Procedure: Nye County NWRPO. Pahrump, Nevada.

QAP-12.1, *Control of Measuring and Test Equipment.*

Technical Procedure TP-8.1, *Field Collection and Handling of Water Samples*, Technical Procedure: Nye County NWRPO. Pahrump, Nevada.

TP-11.1, *Runoff Sampler Construction, Field Sample Collection and Handling of Surface Runoff Water Samples.*

WP-8, *Sample Management*, Work Plan: Nye County NWRPO. Pahrump, Nevada.

Well Sampling Prioritization Plan

Form WP 11-1 Rev.1

Well/Borehole	Sampling Dates	Short Term Sampling						Long Term Sampling	
		Group I (First Priority)			Group II (Second Priority)	Group III (Third Priority)	Short Term Sampling Completed	One or More Sampling Interval < 200 ft Deep	Sample Intervals > 200ft Deep
		Not Sampled Previously	Data Quality Issues	Immediate Sampling Required	Sampled Only Once	Less than One Year Between Sampling Events		Sample Every 2 Years	Sample Every 4 Years