NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

WORK PLAN

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Groundwater Chemistry Sampling and Analysis	DATE: 9-26-03 PAGE: 1 OF 17

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WP-11	New Document

APPROVAL

Project Manager — Date: 9-25-03

CONCURRENCE

On-Site Geotechnical Representative — Date: 9/26/03

Principal Investigator — Date: 9/26/03

Project Quality Assurance Officer — Date: 9/27/03

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1.0 INTRODUCTION

This Work Plan (WP) describes the strategy and procedures for the collection, testing, and possible archival of groundwater chemistry samples as part of 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 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.

2.0 PURPOSE

The purpose of this WP is to outline actions to manage the collection, testing, and archival, if necessary, of ISIP groundwater chemistry samples.

Groundwater 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) the identification of potential flow paths from Yucca Mountain to potential receptors in Amargosa Valley, and 3) 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, and 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. Instructions for sampling and analyzing groundwater chemistry samples during drilling of EWDP wells are described in WP-8, *Sample Management Plan*.

This scope of work presents specifics for the following, which are discussed in Sections 4.1 through 4.4:

- Applicable NWRPO quality assurance (QA) quality administrative procedures (QAPs), technical procedures (TPs), and test plans (TPNs).
- Responsibilities and participants for groundwater chemistry sampling and analysis tasks.
- A strategy for groundwater chemistry sampling and analysis, including suites of chemical parameters.
- A preliminary plan for groundwater chemistry 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 procedure 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, *Procedures for Control of Measuring and Test Equipment.*

Detailed groundwater chemistry sampling and analysis instructions are found in test plan TPN-11.1, *Groundwater Sampling of Early Warning Drilling Program (EWDP) Wells, August to November 2003.* TPN-11.1 identifies testing laboratories and provides detailed guidance for the maintenance and preparation of field water chemistry measurement equipment; sample collection and bottling; and preservation, storage, and shipping. An updated TPN will be written for each succeeding NWRPO groundwater chemistry sampling session.

4.2 Responsibilities and Participants

The Principal Investigator (PI) or designee is responsible for the production of this WP and associated TPs and TPNs, 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 On-Site Geotechnical Representative 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.

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 has not been formally developed. Generally, the strategy has been 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. A summary of Nye County groundwater chemistry sampling and analysis for 1994 through 2002 is presented in Table 1. This table shows that the number of samples collected, as well as the time interval between sampling events, has been highly variable; in a number of cases sampling has been conducted only once following well development. The following sections present a strategy 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.

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 3 to 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 2 summarizes the prioritization of previously completed and developed EWDP wells for the August to November 2003 sampling session. Table 2 will be updated for future sampling sessions and included in the applicable TPN.

4.3.3 Chemical Parameters to be Analyzed

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

- pH.
- Electrical conductivity.
- Temperature.
- Turbidity.
- Dissolved oxygen.
- Oxidation-reduction potential.

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. Additional details specific to the August to November 2003 sampling session are found in TPN-11.1.

Testing laboratories will measure the following groundwater chemistry parameters:

- 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 the August through November 2003 NWRPO sampling session are described in TPN-11.1.

The above field groundwater chemistry indicator suite differs from the suite used prior to sampling sessions conducted during 2001 and 2002. Oxidation-reduction potential and turbidity measurements have been added and the following field parameter measurements have been discontinued: ferrous and total iron, nitrate and nitrite, ammonia, fluoride, and bisulfide.

Similarly, several parameters have been discontinued from the pre-2001/2002 analytical testing laboratory suites. For example, measurements of chlorine-36, stable isotopes of oxygen and sulfur in sulfate, and isotopes of uranium, strontium, and lead have been discontinued.

It should be noted that during future 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 TPN applicable to the sampling session.

4.3.4 Quality Assurance Samples and Data Validation

TP-8.1 presents types of field and laboratory QA samples, 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 a TPN specific to a sampling session. For example, QA-sample-related modifications required for the August to November 2003 sampling session are included in TPN-11.1.

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 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.

4.4 Groundwater Chemistry Sample Archival

The Nuclear Regulatory Commission Advisory Committee on Nuclear Waste recommended to the DOE and Nye County that plans should be developed for the long term archival of groundwater chemistry samples from representative wells. The NWRPO has therefore included groundwater chemistry sample archival in its 5-year ISIP plan and budget (NWRPO, 2002), which has received tentative approval and funding from DOE.

This groundwater chemistry sample archival plan includes the following components and assumptions:

- Ten replicate groundwater chemistry samples will be collected from each of 31 representative EWDP wells in 2007.
- Appropriate and proven archival containers and collection and storage methods will be available by 2007.
- Groundwater chemistry samples will be archived at the DOE Sample Management Facility.
- DOE will fund the Sample Management Facility to store these groundwater chemistry samples.

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 is 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 this work plan and the following:

- TP-8.1, *Field Collection and Handling of Water Samples*
- QAP-12.1, *Procedures for Control of Measuring and Test Equipment*
- TPN-11.1, *Groundwater Sampling of Early Warning Drilling Program (EWDP) Wells, August to November 2003*

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

Quality control in groundwater 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. 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.

Applicable NWRPO Plans and Procedures

Quality Administrative Procedure QAP-5.2, *Preparation of Work Plans and Technical Procedures*

Quality Administrative Procedure QAP-12.1, *Procedures for Control of Measuring and Test Equipment.*

Technical Procedure TP-8.1, *Field Collection and Handling of Water Samples*

Test Plan TPN-11.1, *Groundwater Sampling of Early Warning Drilling Program (EWDP) Wells, August to November 2003*

Work Plan WP-8, *Sample Management Plan.*

Table 1
Summary of Nye County Groundwater Chemistry Sampling and Analysis for 1994 through 2002

Well/Borehole	Private Well (Yes/No)	Sampling Date	Sampling Interval (feet)	Sample Type			Analysis									Comments
				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
Amargosa Valley School	Yes	3/11/2000	Unknown			X					X					Pressurized water supply tank
Bond Gold Mining Well 13	Yes	7/19/1999	1005+			X	X	X	X	X	X	X	X	X	X	Submersible centrifugal pump
McCracken Well	Yes	6/19/2000	100-170			X	X	X	X		X	X		X	X	Submersible centrifugal pump
NC-EWDP-12P	No	3/22/2000	177.1	X			X	X			X					Bailing
NC-EWDP-12PA	No	5/22/2000	325-384			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-12PA	No	10/25/2000	325-384			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-12PB	No	5/22/2000	325-385			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-12PB	No	10/25/2000	325-385			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-12PC	No	5/22/2000	170-230			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-12PC	No	10/25/2000	170-230			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-15P	No	2/27/2000	210		X		X	X			X					Bailing
NC-EWDP-15P	No	5/23/2000	200-260			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-15P	No	10/26/2000	200-260			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-19D	No	5/13/2000	7 zones			X	X	X	X	X	X	X	X	X	X	Submersible centrifugal pump
NC-EWDP-19P	No	3/10/2000	366.4	X			X	X			X					Bailing
NC-EWDP-19P	No	5/23/2000	359-459			X	X	X	X	X	X	X	X	X	X	Bennett pump

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Well/Borehole	Private Well (Yes/No)	Sampling Date	Sampling Interval (feet)	Sample Type			Analysis									Comments
				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
NC-EWDP-1DX	No	12/12/1998	70	X			X	X								Bailed, water level at 70 feet.
NC-EWDP-1DX	No	12/12/1998	240	X			X	X	X	X						Air-lifted from 240 feet.
NC-EWDP-1DX	No	5/24/1999	2160-2240			X	X	X	X	X	X	X	X	X	X	Bennett pump at 210 feet.
NC-EWDP-1DX	No	5/24/1999	2160-2240			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-1DX	No	5/25/2000	2160-2240			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-1S	No	1/27/1999	60	X			X	X	X	X		X				Bailed 3 times
NC-EWDP-1S	No	5/17/1999	210-270			X	X	X	X	X	X	X	X	X	X	Bennett pump set at 250 feet
NC-EWDP-1S	No	5/17/1999	160-180			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-1S	No	5/18/1999	160-180			X	X	X	X	X	X	X	X	X	X	Bennett pump at 150-160 feet
NC-EWDP-1S	No	11/8/1999	210-270			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-1S	No	11/8/1999	160-180			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-1S	No	5/18/2000	210-270			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-1S	No	5/19/2000	160-180			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-2D	No	1/14/1999	312	X			X	X	X	X		X				Bailed, water level at 312 feet
NC-EWDP-3D	No	1/24/1999	240	X			X	X	X			X				USGS collected 1/23/99, bailed
NC-EWDP-3D	No	1/24/1999	240	X			X									Duplicate

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Well/Borehole	Private Well (Yes/No)	Sampling Date	Sampling Interval (feet)	Sample Type			Analysis									Comments
				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
NC-EWDP-3D	No	2/17/1999	323		X		X	X	X	X		X				Submersible centrifugal pump in casing at 323 feet
NC-EWDP-3D	No	2/17/1999	323		X		X									Duplicate
NC-EWDP-3S	No	5/20/1999	478-520			X	X	X	X	X	X	X	X	X	X	Bennett pump at 450 feet
NC-EWDP-3S	No	5/20/1999	338-420			X	X	X	X	X	X	X	X	X	X	Bennett pump at 390 feet
NC-EWDP-3S	No	11/15/1999	478-520			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-3S	No	11/15/1999	338-420			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-3S	No	5/17/2000	478-520			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-4PA	No	1/9/2000	398-429	X			X	X	X		X	X				Bailed
NC-EWDP-4PA	No	2/23/2000	405-485		X		X	X			X					Stainless steel logging bailer
NC-EWDP-4PA	No	3/2/2000	405-485			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-4PA	No	5/15/2000	405-485			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-4PA	No	10/26/2000	405-485			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-4PB	No	2/23/2000	740-839		X		X	X			X					Stainless steel logging bailer
NC-EWDP-4PB	No	3/2/2000	740-839			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-4PB	No	5/16/2000	740-839			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-4PB	No	5/26/2000	740-839			X	X	X	X	X	X	X	X	X	X	Bennett pump

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				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
NC-EWDP-4PB	No	10/26/2000	740-839			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-5S	No	2/8/1999	378	X			X	X	X	X		X		X		Bailed
NC-EWDP-5SB	No	5/16/2000	379-489			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-5SB	No	5/17/2000	379-489			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-5SB	No	5/17/2000	379-489			X	X	X	X	X	X	X	X	X	X	Duplicate sample for tritium
NC-EWDP-5SB	No	10/23/2000	379-489			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-7S	No	2/25/2000	21		X		X	X			X					Bailed
NC-EWDP-7S	No	10/24/2000	28-40			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9S	No	12/12/1998	99	X			X	X	X			X				Bailed, from about 100 feet
NC-EWDP-9SX	No	1/15/1999	132		X		X	X	X	X		X		X	X	Submersible centrifugal pump during spinner test, open hole
NC-EWDP-9SX	No	5/18/1999	330-340			X	X	X	X	X	X	X	X	X	X	Bennett pump at 310.2 feet
NC-EWDP-9SX	No	5/19/1999	250-290			X	X	X	X	X	X	X	X	X	X	Bennett pump at 270.4 feet
NC-EWDP-9SX	No	5/19/1999	140-160			X	X	X	X	X	X	X	X	X	X	Bennett pump at 150 feet
NC-EWDP-9SX	No	5/19/1999	90-120			X	X	X	X	X	X	X	X	X	X	Bennett pump at 111 feet
NC-EWDP-9SX	No	11/9/1999	330-340			X	X	X	X	X	X	X	X	X	X	Bennett pump

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Well/Borehole	Private Well (Yes/No)	Sampling Date	Sampling Interval (feet)	Sample Type			Analysis									Comments
				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
NC-EWDP-9SX	No	11/9/1999	250-290			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9SX	No	11/10/1999	140-160			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9SX	No	11/10/1999	90-120			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9SX	No	5/19/2000	330-340			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9SX	No	5/19/2000	250-290			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9SX	No	5/20/2000	140-160			X	X	X	X	X	X	X	X	X	X	Bennett pump
NC-EWDP-9SX	No	5/20/2000	90-120			X	X	X	X	X	X	X	X	X	X	Bennett pump
Ponderosa Dairy	Yes	4/25/2000	350-400			X	X	X	X		X	X		X	X	Submersible centrifugal pump
UE#25-ONC#1	No	12/15/1994	1458	X			X	X				X				Teflon bailer, saturated zone
UE#25-ONC#1	No	12/22/1994	1428	X			X	X				X				Air-lifted, collected from cyclone
NC-EWDP-19IM	No	11/14/2001	410-430			X	X		X	X		X				Bennett pump
NC-EWDP-19IM1 (blind field duplicate)	No	11/14/2001	410-431			X	X		X	X		X				Bennett pump
NC-EWDP-19IM1	No	11/15/2001	515-535			X	X		X	X		X				Bennett pump
NC-EWDP-19IM1	No	11/15/2001	575-675			X	X		X	X		X				Bennett pump
NC-EWDP-19IM1	No	11/15/2001	725-785			X	X		X	X		X				Bennett pump
NC-EWDP-19IM1	No	11/15/2001	850-950			X	X		X	X		X				Bennett pump

Table 1
Summary of Nye County Groundwater Chemistry Sampling and Analysis for 1994 through 2002

Well/Borehole	Private Well (Yes/No)	Sampling Date	Sampling Interval (feet)	Sample Type			Analysis									Comments
				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
J-13 Well	No	11/28/2001	996-3488			X	X		X	X		X				Submersible centrifugal pump
J-13 Well (blind field duplicate)	No	11/28/2001	996-3488			X	X		X	X		X				Submersible centrifugal pump
EWDP-10P (field blank)	No	8/27/2002	NA			X	X	X	X	X	X					Bennett pump
NC-EWDP-10P	No	8/27/2002	801-860			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-10P	No	8/27/2002	660-699			X	X	X	X	X	X	X				Bennett pump
EWDP-10P (pump rinsate)	No	8/27/2002	NA			X	X	X	X		X					Bennett pump
NC-EWDP-10S	No	9/12/2002	660-700			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-10S	No	9/11/2002	800-860			X	X	X	X	X	X	X				Bennett pump
EWDP-10S (field blank)	No	9/12/2002	NA			X	X	X	X	X	X					Bennett pump
NC-EWDP-18P	No	8/26/2002	835-885			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22PA	No	8/28/2002	661-759			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22PA	No	8/28/2002	520-579			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22PA (blind field duplicate)	No	8/28/2002	520-579			X	X	X	X		X	X				Bennett pump
NC-EWDP-22PB	No	8/30/2002	1140-1179			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22PB	No	8/29/2002	881-979			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22S	No	9/11/2002	521-581			X	X	X	X	X	X	X				Bennett pump

Table 1
Summary of Nye County Groundwater Chemistry Sampling and Analysis for 1994 through 2002

Well/Borehole	Private Well (Yes/No)	Sampling Date	Sampling Interval (feet)	Sample Type			Analysis									Comments
				First Water Encountered During Drilling	Pre-Development/ Purging	Post Well Development/Purging	Gross Chemistry	Field Electrode/Probe Measurements	Trace Elements	Tritium	Gross Alpha-Beta Activity	Stable Isotopic Ratio Analyses	Carbon 14 and TDIC	Unstable Isotopic Ratios	Chlorine-36/35 ratio	
NC-EWDP-22S	No	9/10/2002	661-760			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22S	No	9/10/2002	880-980			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-22S (blind field duplicate)	No	9/10/2002	880-980			X	X	X	X		X	X				Bennett pump
NC-EWDP-22S	No	9/9/2002	1140-1180			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-23P	No	10/1/2002	650-689			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-7SC	No	9/13/2002	80-90			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-7SC	No	9/13/2002	180-210			X	X	X	X	X	X	X				Bennett pump
NC-EWDP-7SC	No	10/3/2002	270-370			X	X	X	X	X	X	X				Bennett pump
EWDP-7SC (pump rinsate)	No	9/13/2002	NA			X	X	X	X		X					Bennett pump

Table 2
Well Sampling Prioritization for First Sampling Phase

Well/Borehole	Group I (First Priority)			Group II (Second Priority)	Group III (Third Priority)
	Not Sampled Previously	Data Quality Issues	Immediate Sampling Required	Sampled Only Once	Less than One Year Between Sampling Events
NC-EWDP-24P	X				
NC-EWDP-29P	X				
NC-EWDP-16P	X				
NC-EWDP-27P	X				
NC-EWDP-28P	X				
NC-EWDP-3S		X			
NC-EWDP-4PB		X			
NC-EWDP-23P		X			
NC-EWDP-22PA			X		
NC-EWDP-22PB			X		
NC-EWDP-22S			X		
NC-EWDP-7S				X	
NC-EWDP-7SC				X	
NC-EWDP-10P				X	
NC-EWDP-10S				X	
NC-EWDP-18P				X	
NC-EWDP-19D				X	
NC-EWDP-19P				X	
NC-EWDP-19IM1				X	
NC-EWDP-19IM2				X	
NC-EWDP-4PA					X
NC-EWDP-5SB					X
NC-EWDP-12PA					X
NC-EWDP-12PB					X
NC-EWDP-12PC					X
NC-EWDP-15P					X