NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

TEST PLAN

TITLE: **Groundwater Sampling and Analysis of Early Warning Drilling Program Wells, 2005 to 2006**	REVISION: **0** DATE: **9-15-05** PAGE: **1 of 8**
TEST PLAN NUMBER: **TPN-11.3**	SUPERSEDES: **Pages 4 and 8**

CHANGE NOTICE NO. 1

EFFECTIVE DATE: April 10, 2006

PURPOSE: To add wells to the 2006 sampling session list and to correct one sample bottle size.

Page 4, Section 5.0: Add the following wells to the sampling session list: NC-EWDP-19IM1, -9SX, -1S, and -24PB.

Page 8, Table 2: Change Analyte Group 7 bottle size to 250 milliliters.

CONCURRENCE:

Dale Hamilton 4/7/06
On-Site Geotechnical Representative — Date

Dale Hamilton for John Walton 4/7/06
Principal Investigator — Date

Ed Swanson 4-7-06
Quality Assurance Officer — Date

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TEST PLAN NUMBER **TPN-11.3**	SUPERSEDES **New Document**
APPROVAL 9-15-05 Project Manager Date	CONCURRENCE 9/13/05 On-Site Geotechnical Representative Date 9/13/05 Principal Investigator Date 14 Sep 05 Quality Assurance Officer Date

1.0 INTRODUCTION

This test plan (TPN) provides detailed groundwater sampling and analysis instructions specific to a Nye County Nuclear Waste Repository Project Office (NWRPO) groundwater sample collection session planned for Early Warning Drilling Program (EWDP) wells from 2005 to 2006. This TPN supplements work plan (WP) 11, *Groundwater Chemistry Sampling and Analysis* and technical procedure (TP) 8.1, *Field Collection and Handling of Water Samples*, identifies testing laboratories, and provides detailed guidance for the maintenance and preparation of field measurement equipment and sample collection, preservation, storage, and shipping.

2.0 ANALYTICAL LABORATORIES

2.1 ACZ Laboratories

ACZ Laboratories (ACZ) in Steamboat Springs, Colorado, will analyze all groundwater samples, referred to in this plan as water samples, for indicator parameters, major anions and cations, trace metals, and nutrients (i.e., nitrate plus nitrite, phosphate, and ammonium). The ACZ point of contact, mailing address, telephone number, and email address are listed in the following.

Tony Antalek, Project Manager
ACZ Laboratories, Inc.
2773 Downhill Dr.
Steamboat Springs, CO 80487
970-879-6590 ext. 107
TonyA@acz.com

2.2 Coastal Science Laboratories, Inc.

Coastal Science Laboratories, Inc. (CSL), in Austin, Texas, will analyze all water samples except equipment rinsate and field blanks, as defined in Section 5.0, for stable isotope ratio analysis (SIRA) of oxygen and hydrogen in water, and SIRA of nitrogen in nitrate. The CSL point of contact, mailing address, telephone number, and email address are listed in the following.

Richard Anderson
Coastal Science Laboratories, Inc.
6000 Mountain Shadows Dr.
Austin, TX 78735
512-288-5533
csl@ccsi.com

2.3 Radiation Safety Engineering, Inc.

Radiation Safety Engineering, Inc. (RSE), in Chandler, Arizona, will analyze all water samples except equipment rinsate and field blanks, as defined in Section 5.0, for gross alpha and beta counts and tritium. The RSE points of contact, mailing address, telephone number, and email addresses are listed in the following.

Ariia Pike, Purchasing Agent
Bob Metzger, Lab Manager
Radiation Safety Engineering, Inc.
3245 North Washington St.
Chandler, AZ 85225
480-897-9459
apike@radsafe.com
rmetzger@radsafe.com

2.4 Beta Analytic, Inc.

Beta Analytic, Inc. (Beta), in Miami, Florida, will analyze all water samples except equipment rinsate and field blanks, as defined in Section 5.0, for SIRA of carbon in total dissolved inorganic carbon and radiocarbon 14 (C-14). The Beta point of contact, mailing address, telephone number, and email address are listed in the following.

Darden Hood, President
Beta Analytic, Inc.
4895 SW 74 Court
Miami, FL 33155
305-667-5167
dhood@radiocarbon.com

3.0 PORTABLE FIELD MEASUREMENT EQUIPMENT MAINTENANCE AND PREPARATION

Instruments for measuring field indicator parameters include the YSI 650 handheld meter and 6820 sonde and the Hach handheld digital titrator. Manuals or manufacturers' instructions should be available at all times when using this equipment; specific references for the manuals are found in Section 6.0 of TP-8.1.

3.1 YSI Handheld Meter and Sonde

One month before the start of sampling, the YSI handheld meter and sonde will be prepared for use according to the following steps:

- Unpack the sonde and dry it.
- Remove all attached probes from the sonde housing.
- Check all probes for signs of wear and corrosion.
- Check the probe ports for signs of water, corrosion, or condensation. Clean any corrosion buildup in the ports or on the pins of the probes with a pipe cleaner, clean cloth, or compressed air. Wipe excess water, if any, from the probe pins or sonde ports with a clean cloth, and dry the pins or port with compressed air.
- Check rubber probe O-rings for signs of wear, cracking, or deformation. Replace worn or damaged rings. Lubricate all rings with silicone grease and attach them to the sonde.
- Return the sonde to long-term storage.
- Check service kits for missing pieces and check standards to make sure that none have expired. If necessary, order new service kits, replacement probes, or standards.

One week before the start of sampling, remove the sonde from long-term storage and attach all probes. Replace the membrane of the dissolved oxygen (DO) probe before attaching it to the sonde; refer to the manual for more detail. Attach the probes to the sonde, beginning with the largest (i.e., the probe that fits in the center optical port). Ensure that all pins are correctly aligned in the ports before tightening the probes; do not overtighten. The probes should be snugly seated against but should not gouge the sonde housing.

Immediately after attaching the probes, calibrate the meter using the steps listed in Appendix A of TP-8.1 If calibration is successful, place the sonde in short-term storage, as described in Appendix A. If calibration is unsuccessful, contact the Principal Investigator (PI) or designee, and repeat the maintenance and calibration steps as directed. If calibration is still unsuccessful, contact YSI Technical Support by phone at 800-897-4151 or 937-767-7241, by fax at 937-767-1058, or by email at *environmental@ysi.com.*

3.2 Hach Handheld Titrator

One month before the start of sampling, check the acid cartridges of the Hach handheld titrator to ensure that they have not expired and that there are enough J-hook delivery tubes for the sample session. Replace expired acid cartridges or order more delivery tubes, if necessary. Check the titrator for damage and/or wear. Wipe the exterior of the titrator to minimize contamination

during sampling. Thoroughly clean the Erlenmeyer (i.e., conical) flasks and calibrated volumetric flasks. Calibrate the titrator to ensure accurate measurements of alkalinity, as described in Appendix A of TP-8.1. In general, titrator calibration problems will arise only if the titrator is dropped. If calibration problems are encountered, contact the PI or designee and repeat the above maintenance and calibration steps as directed. If calibration problems continue, contact Hach technical support at 800-227-4224.

4.0 LABORATORY AND FIELD ANALYSES

4.1 Laboratory Analyses

A summary of water chemistry analyses to be conducted on samples during the 2005 through 2006 sampling session is presented in Table 1. No analytes were added for this sample session. Discontinued analytes include SIRA of oxygen in nitrate, Strontium 87/86, iodine, cerium, rubidium, and scandium.

4.2 Water Chemistry Monitoring and Data Collection

Calibrate all portable field equipment onsite before data collection. Following the instructions given in step 4 of Section 5.1.4 of TP-8.1, attach the flow-through cell to the discharge line of the pump, ensuring that the direction of flow is from bottom to top. Avoid direct water flow and excess bubble formation on the probes. Always check to make sure that bubbles have not built up on the probes before recording measurements. If the discharge water contains a large number of air bubbles, it may be necessary to attach the sonde covering and place the sonde in a bucket containing well water. Note that this method is less accurate than that of the flow-through cell, especially for measurements of pH, DO, and oxidation-reduction potential (ORP).

If excess bubbles are present in the sampling line when using a Bennett pump, compressed nitrogen gas may be used instead of compressed air. The PI or designee will make this decision, if necessary, during the sampling session.

Monitor field water chemistry parameters and assess the stability of the measurements relative to the amount of water purged from the casing. Turbidity, electrical conductivity (EC), and pH should stabilize as the well is purged. DO, ORP, and temperature of the purged water may not stabilize, due to changes in air temperature, atmospheric pressure, or the heating of sampling equipment on the ground surface by radiant energy from the sun.

After purging is complete at each well screen, collect a sample for field or office measurement of alkalinity. Filter and collect the sample in a 1-liter high-density polyethylene (HDPE) bottle. Alkalinity tests using the Hach titrator will be conducted in the field, when possible, or in the NWRPO office.

5.0 SAMPLE COLLECTION

The 2005 to 2006 sampling session includes, but is not limited to, NC-EWDP-12PA, -12PB, -1DX, -1S, and -19IM1 from Phases I, II, and III; EWDP Phase IV wells NC-EWDP-16P, -24P, -27P, -28P, and -29P; and Phase V wells NC-EWDP-13P and -24PB. Post-purging samples will be collected from each of the well screens for the laboratory analyses listed in Table 1. In addition, quality assurance (QA) samples will be collected as follows: blind field duplicate samples from approximately every fifth well screen sampled and equipment rinsate and field blank samples from approximately every tenth equipment rinsing episode. The PI or designee

will determine the specific well screens to be sampled for QA samples. Detailed QA sample collection instructions will be given in the field by the PI or designee and recorded in the field geochemistry scientific notebook.

Blind field duplicates will be analyzed for all analytes listed in Table 1; equipment rinsate and field blank samples will be analyzed only for nutrients (i.e., nitrate plus nitrite, phosphate, and ammonium), metals, major anions and cations, and indicator parameters.

6.0 SAMPLE FILTERING, BOTTLING, AND PRESERVATION

Table 2 summarizes sample filtration, bottling, and preservation requirements for major analyte groups. Filtering and bottle labeling methods are described in TP-8.1. Specific bottle type, size, and numbers are listed on Table 2. Sample bottles are to be filled to the levels indicated in Table 2. ACZ will provide bottles and preservatives for samples being sent to its laboratory.

The sampling work area (i.e., table or bench tops) should be thoroughly cleaned before sampling and kept as clean as possible during sample collection to minimize sample contamination. When filling sample bottles, note sources of contamination and minimize these sources when possible. Use new, clean tubing to fill sample bottles for each well or zone in the well.

Rinse bottles that are not acid pre-preserved with sample water three times, fill the bottle to the required level, and add preservatives when required, ensuring that all preservative is added. Adding preservatives as a last step helps to ensure that the work area is not contaminated with acids and that the sample is preserved properly. Process samples requiring preservatives last to minimize the chance of contaminating gross chemistry and nutrient samples with acids. Have one person add preservatives and put on new gloves before changing preservative types. It is important to handle preservatives carefully to ensure that they are not spilled in the work area. Preservatives pose a potential safety risk and can easily contaminate samples with nitrate, sulfate, or other ions. If acid preservatives are spilled on the work area, neutralize the acid with a solution of water and sodium bicarbonate, rinse with bottled tap water, and wipe the area dry with paper towels.

7.0 SAMPLE STORAGE

In the field, minimize the exposure of samples to heat and direct sunlight, and transport samples to the NWRPO office at the end of each sampling day. When possible, store samples in the field in coolers with ice packs.

In the NWRPO office, referring to Table 2, determine analyte groups and store samples from analyte groups 3, 4, 6, 7, and 9 in a cool, dry place out of the sun. Samples from analyte groups 1, 2, 5, and 8 should be refrigerated as soon as possible and kept refrigerated until they are shipped. Samples from analyte group 10 should be frozen as soon as possible and kept frozen until they are shipped. For samples being sent to Beta, place a tape seal around the cap/bottle joint to help prevent loss or exchange of carbon dioxide from the water sample.

8.0 SAMPLE SHIPPING

Ship all samples to the appropriate testing laboratory within 7 days of sampling in boxes or coolers with NWRPO chain-of-custody forms and any forms required by the lab. Place all samples in the boxes or coolers with the caps up; do not place them on their sides. Pad the sides

of the box or cooler with bubble wrap and pack samples so that they are held snugly in place. Use additional bubble wrap to prevent the samples from moving during shipping; pack the top of the box or cooler with bubble wrap so that samples cannot move vertically. Samples from analyte groups 1, 2, 4, 5, 8, 9 and 10 require cold packs in the coolers. Pack all refrigerated and frozen samples with blue ice or some form of cold pack. If possible, pack all refrigerated and frozen samples together to ensure a longer cold period. Do not use free ice in the coolers; the water from melted ice can wash labels off, contaminate samples, and remove labeling tape. Ensure that boxes or coolers are securely closed and will not open during shipping. If boxes are used, label box sides with arrows pointing upward towards the box top and clearly label "THIS SIDE UP."

Referring to Table 2, determine analyte groups and ship boxes or coolers containing samples from groups 1, 2, 5, 7, and 8 to ACZ, groups 4 and 6 to RSE, groups 3 and 10 to CSL, and group 9 to Beta. To minimize the chance of contamination if a bottle breaks open, place samples with added preservatives into separate containers, to the extent reasonably possible. Ship all samples by overnight carrier (i.e., Federal Express) to the addresses listed below. Do not ship samples on Friday.

ACZ Laboratories, Inc.
c/o Tony Antalek
2773 Downhill Dr.
Steamboat Springs, CO 80487
800-334-5493

Coastal Science Laboratories
c/o Richard Anderson
6000 Mountain Shadows Dr.
Austin, TX 78735
512-288-5533

Radiation Safety Engineering, Inc.
Sample Receiving
3245 North Washington St.
Chandler, AZ 85225
480-897-9459

Beta Analytic, Inc.
c/o Darden Hood
4895 SW 74 Court
Miami, FL 33155
305-667-5167

Table 1
Water Chemistry Analytes

Parameter	Detection Limit
Aluminum	0.03 milligrams per liter (mg/L)
Antimony	0.0004 mg/L
Arsenic	0.0005 mg/L
Barium	0.003 mg/L
Beryllium	0.002 mg/L
Boron	0.01 mg/L
Cadmium	0.005 mg/L
Calcium	0.2 mg/L
Chromium	0.01 mg/L
Cobalt	0.01 mg/L
Copper	0.01 mg/L
Iron	0.02 mg/L
Lead	0.0001 mg/L
Lithium	0.02 mg/L
Magnesium	0.2 mg/L
Manganese	0.005 mg/L
Molybdenum	0.01 mg/L
Nickel	0.01 mg/L
Potassium	0.3 mg/L
Selenium	0.001 mg/L
Silica	0.2 mg/L
Silver	0.00005 mg/L
Sodium	0.3 mg/L
Strontium	0.00005 mg/L
Thallium	0.0001 mg/L
Titanium	0.005 mg/L
Vanadium	0.005 mg/L
Zinc	0.01 mg/L
Alkalinity as CaCO3	2 mg/L
Bromide	0.1 mg/L
Chloride	1 mg/L
Conductivity at 25 degrees centigrade (°C)	1 micromhos per centimeter (µhos/cm)
Fluoride	0.1 mg/L
Nitrate/Nitrite as N	0.02 mg/L
Nitrogen, ammonia	0.05 mg/L
pH (laboratory)	0.1 units
Phosphorus	0.01 mg/L
Sulfate	10 mg/L
Residue, filterable (total dissolved solids [TDS]) at180 °C	10 mg/L
TDS	10 mg/L
Gross alpha	0.4 picocuries per liter (pCi/L)
Gross beta	0.1 pCi/L
Tritium	365 pCi/L
Radiocarbon (C-14)	300 micrograms carbon/liter (µg C/L) as DIC[a]
SIRA[b] of carbon in TDIC[c]	300 µg C/L as DIC
SIRA of oxygen and hydrogen in water	N/A
SIRA of nitrogen in nitrate	N/A

[a]Detection limit of total dissolved inorganic carbon in groundwater to obtain both 14C and 13C/12C.
[b]Stable isotope ratio analysis.
[c]Total dissolved inorganic carbon.

Table 2
Sample Collection, Storage, and Shipping Information

Analyte Group	Sample Type	Filter (Yes/No)	Fill Level	Preserve with HNO3[a] (Yes/No)	Preserve with H_2SO_4[b] (Yes/No)	Preserve with NaOH[c] (Yes/No)	Preserve with HCl[d] (Yes/No)	Bottle Type	Bottle Size (milliliters)	Bottles per Sample	Type of Storage	Laboratory	Special Shipping Instructions
1	Alkalinity, electrical conductivity (EC) pH	No	Fill completely	No	No	No	No	HDPE[e]	50	1	Refrigerate.	ACZ[f]	Ship with cold packs.
2	Wet chemistry- unfiltered	No	Fill completely	No	No	No	No	HDPE	500	1	Refrigerate.	ACZ	Ship with cold packs.
3	SIRA[g] of oxygen and hydrogen in water	No	To the neck	No	No	No	No	HDPE	125	1	Cool, dry, and unexposed to sunlight.	CSL[h]	None.
4	Tritium	No	To the neck	No	No	No	No	Amber glass	125	1	Cool, dry, and unexposed to sunlight.	RSE[i]	Wrap in bubble wrap.
5	Wet chemistry-filtered	Yes	Fill completely	No	No	No	No	HDPE	250	1	Refrigerate.	ACZ	Ship with cold packs.
6	Gross alpha and beta	Yes	To the neck	Yes	No	No	No	HDPE	1,000	4	Cool, dry, and unexposed to sunlight.	RSE	None.
7	Dissolved metals	Yes	Fill completely	Yes (prepreserved)	No	No	No	HDPE	250	1	Cool, dry, and unexposed to sunlight.	ACZ	None.
CHANGE GLOVES													
8	N-NH3, NO3-NO2, total P	No	To the neck	No	Yes (pre-preserved)	No	No	HDPE	250	1	Refrigerate.	ACZ	Ship with cold packs.
CHANGE GLOVES													
9	SIRA of carbon in total dissolved inorganic carbon; radiocarbon (C-14)	No	To the neck	No	No	Yes	No	HDPE	1,000	1	Cool, dry, and unexposed to sunlight.	Beta[j]	Ship with cold packs, tape seal around cap.
CHANGE GLOVES													
10	SIRA of nitrogen in nitrate	No	85%	No	No	No	Yes	HDPE	1,000	4	Frozen.	CSL	Ship with cold packs.

[a]Nitric acid. [b]Sulfuric acid. [c]Sodium hydroxide. [d]Hydrochloric acid. [e]High density polyethylene.
[f]ACZ Laboratories. [g]Stable isotope ratio analysis. [h]Coastal Science Laboratories, Inc. [i]Radiation Safety Engineering Laboratory.
[j]Beta Analytic, Inc.