NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

TEST PLAN

TITLE: **Groundwater Sampling and Analysis of Selected Inyo County Wells, 2008**	Revision: **2** Date: **2-12-08** Page: **1 of 9**
TEST PLAN NUMBER: **TPN-11.4**	SUPERSEDES: **Revision 1, 11-29-07**

APPROVAL

Project Manager — Date: 2/12/08

CONCURRENCE

On-Site Geotechnical Representative — Date: 2/12/08

Principal Investigator — Date: 2/12/08

Quality Assurance Officer — Date: 2/12/08

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 selected Inyo County, California (Inyo County) wells in 2008. 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 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 below.

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 below.

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 point of contact, mailing address, telephone number, and email address are listed below.

Bob Metzger, Lab Manager
Radiation Safety Engineering, Inc.
3245 North Washington St.
Chandler, AZ 85225
480-897-9459
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 below.

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

The primary instrument used to measure field indicator parameters is the YSI 6820 Environmental Monitoring System with YSI-650 handheld meter. The manual or manufacturer's instructions should be available at all times when using this equipment; specific references for this manual can be found in Section 6.0 of TP-8.1.

3.1 YSI Handheld Meter and Sonde

One month (or when notification occurs) 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 designated for use by the Principal Investigator (PI). 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, notify the 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*.

4.0 LABORATORY AND FIELD ANALYSES

4.1 Laboratory Analyses

A summary of water chemistry analyses to be conducted on samples during the 2008 session is presented in Table 1. No new analytes were added for this sampling session.

4.2 Water Chemistry Monitoring and Data Collection

Calibrate the YSI meter 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 the use of the flow-though cell is preferred as it provides more accurate measurements, especially for pH.

Monitor field water chemistry parameters and assess the stability of the measurements relative to the amount of water purged from the casing. Electrical conductivity (EC), and pH should stabilize as the well is purged. Temperature of the purged water may not stabilize due to changes in air temperature or the heating of sampling equipment on the ground surface by radiant energy from the sun. If possible, record the total number of gallons pumped, as well as the pumping rate.

5.0 SAMPLE COLLECTION

The 2008 sampling session includes Inyo County wells at Texas, Nevares, and Longstreet Springs. Wells may be added or removed from this sampling program, depending upon their availability, at the discretion of the PI (or designee). Inyo County will be developing and conducting pumping tests on these wells, and has invited other agencies to sample the discharge water. Discharge samples will be collected from each well for the laboratory analyses listed in Table 1. In addition, quality assurance (QA) samples will be collected as follows: one set of blind field duplicate samples, and one set of equipment rinsate and field blank samples. The PI or designee will determine the specific wells 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.

Should bottles and preservatives from ACZ be unavailable prior to sampling, equivalent bottles and preservatives may be provided by the NWRPO.

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 in the field geochemistry scientific notebook, and minimize these sources when possible. Use new, clean tubing to fill sample bottles for each well or zone in the well. Gloves (made of latex, nitrile, or a similar, non-reactive material) must be worn while collecting water samples to prevent sample contamination protect the wearer from the sample preservatives.

Bottles that are not pre-preserved with acid must be rinsed with sample water three times, filled to the required level, and have preservatives added (when required). 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 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 at the end of each sampling day. When possible, store samples in the field in coolers with ice packs.

Upon returning to the NWRPO, determine analyte groups (according to Table 2), and store samples from analyte groups 3, 4, 6, and 9 in a cool, dry place out of the sun. Samples from analyte groups 1, 2, 5, 7, and 8 should be refrigerated as soon as possible (Eaton, et. al., 2005) 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 transfer-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, 5, 7, 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 toward 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 (i.e., hold samples that would ship Friday over the weekend and ship them Monday).

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

9.0 REFERENCES

Eaton, A.D., L.S. Clesceri, E.W. Rice, and A.E. Greenberg. Ed. 2005. *Standard methods for the examination of water and wastewater, 21st Edition.* Washington DC: American Public Health Association.

TP-8.1, *Field Collection and Handling of Water Samples*, Technical Procedure: Nye County Nuclear Waste Repository Project Office (NWRPO), Pahrump, Nevada.

WP-11, *Groundwater Chemistry Sampling and Analysis*, Work Plan: NWRPO, Pahrump, Nevada.

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 micromho per centimeter (µmho/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 ^{14}C and $^{13}C/^{12}C$.
[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 HNO_3[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 (pre-preserved)	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.