NYE COUNTY NUCLEAR WASTE REPOSITORY PROJECT OFFICE

TEST PLAN

TITLE: **Groundwater Sampling and Analysis of Pahrump Valley Springs, Artesian and Other Selected Wells**	Revision: **0** Date: **2-24-12** Page: **1 of 8**
TEST PLAN NUMBER: **TPN-11.7**	SUPERSEDES: **None**
APPROVAL Project Manager Date	CONCURRENCE Geoscience Manager 24MAR 2012 Date Principal Investigator 2/24/2012 Date Quality Assurance Officer 2/24/12 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 Pahrump Valley springs and other selected wells. This TPN supplements work plan (WP) WP-11, *Groundwater and Surface Runoff Water Chemistry Sampling and Analysis* and technical procedure (TP) 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 Total Kjeldahl Nitrogen (TKN)). ACZ will also analyze field blanks. 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 Isotech Laboratories, Inc.

Isotech Laboratories, Inc., in Champagne, Illinois, will analyze all water samples except field blanks, for stable isotope ratio analysis (SIRA) of $^{\delta}18/^{\delta}16$ ($^{\delta}18O$)). The Isotech point of contact, mailing address, telephone number, and email address are listed in the following.

Steve Pelphry
1308 Parkland Court
Champaign, IL 61821
(877)-362-4190
steve@isotechlabs.com

2.4 University of Arizona, Tucson

University of Arizona in Tucson, AZ will analyze water samples for tritium. The University of Arizona point of contact, mailing address, telephone number, and email address are listed in the following.

Chris Eastoe
Department of Geosciences
1040 E. Fourth St., Room 208
University of Arizona
Tucson, AZ 85721-0077
(520)-621-1638
eastoe@email.arizona.edu

2.6 Beta Analytic, Inc.

Beta Analytic, Inc. will analyze water samples for radiocarbon dating. Beta Analytic, Inc. point of contact, mailing address, and telephone number, are listed in the following.

Darden Hood
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 Oakton 300 pH/CON meter, Oakton 10 pH/CON meter, Orion 3 Star Plus Optical Dissolved Oxygen meter, and YSI DO200 Dissolved Oxygen meter. Additionally, a Kestral 2500 weather station will be used for monitoring atmospheric pressure in the field. Manuals or manufacturers' instructions should be available at all times when using this equipment.

3.1 Oakton pH/CON Meters

Before the start of sampling, the Oakton meters will be prepared for use according to the following steps:

- Check all probes for signs of wear and corrosion.
- Condition pH and conductivity probes
- Perform a calibration check to verify pH, conductivity, and temperature accuracy.

Immediately prior to sampling calibrate pH range on the Oakton meters using 7.00, 4.01 and 10.00 pH standards then read the standards as samples and record the readings in the scientific notebook. Also immediately prior to sampling calibrate the conductivity range on the Oakton meters using a 1413 µmhos/cm standard then read the standard as a sample and record the reading in the scientific notebook. If calibration is successful per meter instructions, proceed with measurement of water sample parameters as water samples are taken. 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 Oakton Technical Support by phone at 949-757-0353, by fax at 949-757-0363.

3.2 Dissolved Oxygen Meters

Before the start of sampling verify the Orion 3 Plus meter and the YSI DO200, calibration by wetting the sponge in the calibration sleeve with distilled water, turn the meter on, and then press the calibrate button. When properly calibrated against water saturated air the meter will read 100.0 % dissolved oxygen (DO). Calibration must be verified prior to use. If calibration verification is successful proceed with measurement of dissolved oxygen in the water samples as they are taken. If calibration verification is unsuccessful, contact the PI or designee, and repeat maintenance and calibration steps as directed. If calibration problems continue for the Orion meter, contact Geotech sales and service at 800-833-7958, by fax at 303-322-7242. If calibration problems continue for the YSI meter, contact YSI Technical Support 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 sampling session is presented in Table 1.

4.2 Water Chemistry Monitoring and Data Collection

Calibrate all portable field equipment on-site before data collection as indicated above.

Monitor field water chemistry parameters for electrical conductivity (EC), pH, DO, and temperature, and record in Scientific Notebook and Groundwater Sample Collection Form. Collect a sample for field measurement of pH, conductivity, and DO. Collect the sample in a 60 milliliter or 125 milliliter high-density polyethylene (HDPE) bottle.

5.0 SPRING ASSESSMENT

The assessment of each spring will include some or all of the following: reconnaissance geologic and geomorphic mapping, estimation of spring discharge where feasible, measurement of field water quality parameters (pH, temperature, conductivity, dissolved oxygen, and turbidity), water sample collection and analysis for major cations and anions, stable isotopes and tritium, and $^{14}C/^{13}C$, identification of the source aquifer, and preliminary assessment of flora and fauna. Springs will be classified based on the classification system described in Springer et al. (2008).

6.0 SAMPLE COLLECTION

Wells will be purged when possible as described in TP-8.1. Samples will be collected from each of the wells for the laboratory analyses listed in Table 1. In addition, quality assurance (QA) samples will be collected as follows: blind field duplicate samples and blanks from approximately once per week. The PI or designee will determine the specific well 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 Groundwater Sampling and Analysis of Pahrump Valley Springs, Artesian and Other Selected Wells Scientific Notebook.

Blind field duplicates will be analyzed for all analytes listed in Table 1; 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.

7.0 SAMPLE FILTERING, BOTTLING, AND PRESERVATION

Table 2 summarizes sample filtration, bottling, and preservation requirements for sample collection. 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. Ensure that at least two volumes of the sample fluid

pass through each new tubing/filter combination before collecting samples rinse bottles and caps that are not acid pre-preserved with sample water three times unless bottles have been baked, fill the bottle to the required level, and add preservatives when required, ensuring that all preservative is added. *Note: analytes requiring preservation for analysis by ACZ are taken in bottles provided by ACZ that are pre-preserved.* Adding preservatives as a last step, as described in TP-8.1, 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.

8.0 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.

When back at the NWRPO office store samples as indicated in Table 2.

9.0 SAMPLE SHIPPING

Ship all samples to the appropriate testing laboratory within approximately 7 days of sampling in coolers with NWRPO chain-of-custody forms, as found in TP-8.1, and any forms required by the lab. Any samples with an EC of <1500 µS/cm must be labeled with "DO NOT DILUTE SAMPLES, IF DILUTION IS NECESSARY CONTACT [Levi Kryder]" on the chain-of-custody form for ACZ only . Place all samples in the coolers with the caps up; do not place them on their sides. Pack all bottles in packing material. Pad the sides of the cooler with packing material and pack samples so that they are held snugly in place. Use additional packing material to prevent the samples from moving during shipping; pack the top of the cooler with packing material so that samples cannot move vertically.

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 coolers are securely closed and will not open during shipping.

Collate analyte groups for each laboratory and ship coolers containing samples as indicated in Table 2 Ship all samples by overnight carrier (i.e., Federal Express) to the addresses as indicated in section 2.0. Do not ship samples on Friday.

10.0 REFERENCES

Springer, A.E., Stevens, L.E., Anderson, D.E., Parnell, R.A., Kreamer, D.K., Levin, L, and Flora, S.P., 2008, *A Comprehensive Springs Classification System: Integrating Geomorphic, Hydrogeochemical, And Ecological Criteria*, in Stevens, L.E. and Meretskey, V.J., Aridland Springs in North America, University of Arizona Press, Tucson

Table 1

Analyte	Detection Limit	unit
arsenic	0.0005	mg/L
calcium	0.2	mg/L
magnesium	0.2	mg/L
potassium	0.3	mg/L
sodium	0.3	mg/L
bromide	0.1	mg/L
chloride	1	mg/L
fluoride	0.1	mg/L
nitrate/nitrite as N	0.02	mg/L
phosphate	0.01	mg/L
sulfate	10	mg/L
alkalinity as CaCO3	2	mg/L
conductivity	1	µmhos/cm
Silica	0.01	mg/L
Strontium	0.01	mg/L
TDS	10	mg/L
TKN	0.33	mg/L
pH	NA-	

Isotopes	Detection Limit or Precision	unit
18O - 2H [a]		o/oo
14C (AMS)		
d13C [a]	0.25	o/oo
tritium (3H)	0.6	T.U. (Tritium units)

[a] Stable isotope ratio analysis.

Table 2
Sample Collection, Storage, and Shipping Information

Wells to be Sampled:										
Analyte Group	**Sample Type**	**Filter (Yes/ No)**	**Fill Level**	**Preservative**	**Bottle Type**	**Bottle Size**	**Bottles per Sample**	**Type of Storage**	**Laboratory**	**Special Shipping Instructions**
1	Alkalinity, PO4	No	Fill completely	No	HDPE[a]	500ml	1	Refrigerate.	ACZ	Ship with cold packs.
2	NO3-NO2	No	To the neck	Yes (H_2SO_4)[b]	HDPE[a]	250	1	Refrigerate.	ACZ	Ship with cold packs.
CHANGE GLOVES										
3	SIRA of oxygen and hydrogen in water	No	Fill completely	No	Glass[cd]	250ml	1	Cool, dry, and unexposed to sunlight.	Isotech	None.
4	Tritium	No	To the neck	No	HDPE	500 ml	1	Cool, dry, and unexposed to sunlight.	Univ. Of AZ.	None.

[a] High density polyethylene.
[b] Sulfuric Acid.
[c] Polyseal Lids.
[d] Precleaned and Baked.

Wells to be Sampled:										
Analyte Group	**Sample Type**	**Filter (Yes/ No)**	**Fill Level**	**Preservative**	**Bottle Type**	**Bottle Size**	**Bottles per Sample**	**Type of Storage**	**Laboratory**	**Special Shipping Instructions**
5	Bromide, Chloride, Fluoride, Sulfate, TKN & TDS	Yes	Fill completely	No	HDPE	250	1	Refrigerate.	ACZ	Ship with cold packs.
4	Dissolved Metals	Yes	Fill Completely	Yes (HNO_3)[d]	HDPE[c]	250	1	Cool, dry, and unexposed to sunlight.	ACZ	Ship with cold packs
CHANGE GLOVES										
7	SIRA of carbon in total dissolved organic carbon; radiocarbon (C-14/C-13)	Yes[b]	To the neck	Na OH	Amber glass[a]	1,000 ml	1	Refrigerate.	Beta Analytic	Ship with cold packs.

[a] Precleaned and Baked.
[b] Sodium Hydroxide.
[c] High density polyethylene.
[d] Nitric Acid.

Attachment A
Groundwater Sample Collection Form

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Well Data

Sheet ____ of ____

Sampling Episode Description	Sandpack Interval(s) (ft bgs)			
			Depth to Water (ft bgs)	
			Total Depth (ft bgs)	
Well ID	Water Level before Purging (ft bgs)	Water Level After Purging (ft bgs)	Casing Diameter (ID, ft)	
Sampler			Water-filled Casing Volume (ft^3)	Water-filled Casing Volume (gallons)

Purging Data

Initials	Date	Clock Time	Elapsed Time (min, sec)	Purge Volume Calculations/Measurements				Field Water Quality Parameters				
				Pump Rate (gpm)	Purge Volume (gallons)	Number of Casing Volumes	Cumulative Number of Casing Volumes	Temp (°C)	pH	EC (µmhos/ cm)	DO (%)	Comments

Groundwater Sample Collection Data

Initials	Sample Number	Analyte Group	Testing Laboratory	Bottle	Filtered (yes/no)	Preservative	Analyte Group	Testing Laboratory	Bottle	Filtered (yes/no)	Preservative