URANIUM ONE USA, INC

D R A F T

GROUND WATER MONITORING QUALITY ASSURANCE PLAN

UTAH GROUND WATER QUALITY DISCHARGE PERMIT

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1.0 INTRODUCTION

1.1 Regulatory Basis

The conditions of Utah Ground Water Quality Discharge Permit UGW170003 (Permit) requires routine groundwater compliance monitoring including sampling and water level measurements from groundwater monitoring wells in accordance with the Groundwater Monitoring Quality Assurance Plan (QAP). This QAP must comply with the EPA publication titled *RCRA Groundwater Monitoring Technical Enforcement Guidance Document* (September 1986). After Executive Secretary approval, the QAP will become an enforceable document to this Permit.

1.2 Purpose and Objective

The purpose of this Groundwater Monitoring QAP is to describe the field collection and analytical methodology to be used during a two year interim period while intra-well groundwater water quality data are collected at new point of compliance (POC) wells and for long term sampling of POC wells during operations of the tailings disposal facility at the Uranium One Shootering Canyon Mill near Ticaboo, Utah. After the supplemental background data collection is completed after two years, this QAP will be reviewed and adjusted as required for compliance groundwater monitoring. This QAP includes data quality objectives for data measurement; sampling procedures; sample and document custody procedures; laboratory analytical methods; internal quality control checks; data reduction, validation, and reporting procedures; and corrective action procedures. The objective of this QAP is to guide and control sample collection actions and laboratory analyses such that the data produced are valid and reliable and accurately represent the existing chemical and physical conditions of the Entrada aquifer beneath the mill site.

2.0 QUALITY ASSURANCE OBJECTIVES

2.1 Data Quality Objectives

The overall quality assurance objective for this monitoring program is to develop and implement sampling, sample handling, and analytical procedures that will provide data that can be used to fulfill the Data Quality Objectives. Data Quality Objectives are qualitative and quantitative statements that specify the field and laboratory data quality necessary to support specific decisions or regulatory actions. The Data Quality Objectives also establish numeric limits for the data to allow the data user (or reviewers) to determine whether the data collected are of sufficient quality for their intended use. A summary of the individual tasks and their associated Data Quality Objectives for Uranium One's groundwater monitoring program are provided in Table 1.

Table 1. Field Program Descriptions, Data Quality Objectives, and Analytical Levels

Field Program Description	Data Quality Objective	Analytical Level[a]
Groundwater Elevation Measurements (feet above NGVD [d])	Assess groundwater flow paths, calculate hydraulic gradients for modeling flow directions and rates of groundwater movement, and calculate pre-sample purge volumes.	Level I
Groundwater Sampling	Assess water quality of specific parameters in Entrada groundwater to determine intra-well background concentrations, set or revise GWCLs, assess geochemical and hydrogeologic conditions at the facility, and monitor compliance of GWCLs.	Level II[b] to assess stability of groundwater prior to sampling and assess groundwater characteristics over time. Level III[c] to establish background concentrations and compliance monitoring of GWCLs.

(a) Data Levels I and II indicate field measurements; Level III indicates EPA approved methods and protocol will be used for analysis.
(b) pH, temperature, and specific conductivity.
(c) EPA test methods for evaluating solid waste, physical/chemical methods.
(d) NGVD = National Geodetic Vertical Datum
(e) GWCL = ground water compliance limit

2.2 Analytical Control Levels

Currently, five levels of analytical control are described in the EPA (1987) document *Data Quality Objectives for Remedial Response Activities Development Process*. These levels are based on the type of site, the project Data Quality Objectives, the end use of the analytical data, and the level of the documentation. Two levels of documentation will be collected during PRL groundwater compliance monitoring:

- Level I and Level II: data are qualitative or semi-qualitative data obtained by use of approved field equipment such as groundwater quality parameter meters.
- Level III: data are quantitative, have known precision and accuracy, and are produced under controlled conditions using laboratory-grade instrumentation. EPA-accepted methods under Level III.

Practical quantitation limits (PQLs) are based on the extent to which the equipment, laboratory or field, or analytical process can provide accurate measurements of a reliable quality for specific constituents in field samples. The PQL for a given analysis will vary depending on the laboratory instrument sensitivity and matrix effects.

2.3 Data Quality Definition and Measurement

The effectiveness of a Quality Assurance (QA) program is measured by the quality of the data generated in the field and by the laboratory. For the Uranium One intra-well background program and compliance monitoring, data quality will be assessed in terms of its precision, accuracy, representativeness, comparability, and completeness (the PARCC parameters). The laboratory performing the analysis will follow their procedures for precision, accuracy, representativeness, comparability and completeness as per State of Utah and/or National Environmental Laboratory Accreditation Conference (NELAC) Certification. These terms are described below.

2.3.1 Precision

Precision is the reproducibility of measurements under a given set of conditions. For large data sets, precision is expressed as the variability of a group of measurements compared to their average value (i.e., standard deviation). For duplicate measurements, precision is expressed as the relative percent difference (RPD) of a data pair and will be calculated using the following equation:

$$\mathbf{RPD} = \frac{sample - duplicate\ values}{\left(\frac{sample + duplicate\ values}{2}\right)} \times 100\%$$

where the sample and duplicate values are the reported concentrations for field duplicate analyses or the percent recoveries for matrix spike and matrix spike duplicate samples.

2.3.2 Accuracy

Accuracy is the degree of agreement of a measurement or an average of measurements with an accepted reference or "true" value, and is a measure of bias in the system. The accuracy of a measurement system is impacted by errors introduced through the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analytical techniques.

Accuracy will be evaluated by the following equation:

$$\text{Percent Recovery} = \frac{|A - B|}{C} \times [100]$$

where: A is the concentration of analyte in a spiked sample
B is the concentration of analyte in an unspiked sample
C is the concentration of spike added.

False positive or high-biased sample results will be assessed by evaluating results from equipment rinsate samples, if applicable.

2.3.3 Representativeness

Representativeness is a qualitative expression of the degree to which sample data accurately and precisely represent a characteristic of a population, a sampling point, or an environmental condition. Representativeness is maximized by ensuring that, for a given project, the number and location of sampling points and the sample collection and analysis techniques are appropriate for the specific investigation, and that the sampling and analysis program will provide information that reflects "true" site conditions.

2.3.4 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set may be compared to another. Comparability is dependent on similar objectives and is achieved through the use of standardized methods for sample collection and analysis, and the use of standardized units of measure. Data sets will contain the same variables of interest. Measuring devices will have similar detection limits. To the extent practicable, the number of observations will be the same order of magnitude for each monitoring location and each monitoring period.

2.3.5 Completeness

Completeness is defined as the percentage of valid data relative to the total number of measurements. Completeness for this project will be calculated using the following equation:

$$\text{Completeness} = \frac{\text{Number of valid data points}}{\text{Total number of measurements}} \times [100]$$

Where the number of valid data points is the total number of valid analytical measurements based on the precision, accuracy, and holding time evaluation. Project completeness is determined at the conclusion of the data validation and is calculated by dividing the number of valid sample results by the total number of sample analyses listed in the QAP. The completeness objective for this project is 100 percent for all data.

3.0 SAMPLE PROCEDURES

The ground water monitoring program has been divided into two phases: the first phase of two years of quarterly sampling to develop intra-well specific background values for all constituents in each POC well, and the second phase of annual sampling for a reduced list of constituents for the compliance monitoring. Samples and water level measurements will be collected from 15 wells. Table 2 below presents a synopsis of the wells included in the monitoring program.

Table 2. Summary of Compliance Monitoring Wells and Data Collection

Well Name	PVC Casing ID	Data Type [(a)]	Measured Recorded Field Parameters [(b)]	Sample Method
RM1	3	L, S	Yes	Submersible
POC-1	3	L, S	Yes	Submersible
POC-2	3	L, S	Yes	Submersible
POC-3	3	L, S	Yes	Submersible
POC-4	3	L, S	Yes	Submersible
POC-5	3	L, S	Yes	Submersible
POC-6	3	L, S	Yes	Submersible
POC-7	3	L, S	Yes	Submersible
POC-8	3	L, S	Yes	Submersible
POC-9	3	L, S	Yes	Submersible
POC-10	3	L, S	Yes	Submersible
POC-11	3	L, S	Yes	Submersible
POC-12	3	L, S	Yes	Submersible
POC-13	3	L, S	Yes	Submersible
POC-14	3	L, S	Yes	Submersible

(a) L - Groundwater level measurement ; S - Groundwater sample analysis.
(b) Field parameters are temperature, pH and conductivity

The sampling method is determined by the diameter and condition of the casing and the depth to groundwater in relation to the total usable depth of the casing or hole and the rate at which groundwater will flow into the screen or open hole. All purging and sampling equipment that comes in contact with the sampled water will either be dedicated to a particular well or used only once (disposable). The submersible pumps will all be dedicated to a single well and single-use filters will be used for each

sample for each well. The wetted materials used will be PVC, polyethylene, polypropylene, Teflon, Noryl, nylon, rubber, stainless steel, nickel and aluminum. Sampling and Preservation methods will be followed according to EPA 40 CFR Part 136.

3.1 General Procedures

The general sequence of events during a sampling event will include:

1. Call the lab and request sample bottles and preservatives, water from lab and call the Utah Bureau of Laboratory Improvement to verify continued certification of lab.
2. Check the portable generator for proper operation.
3. Assemble the needed equipment, supplies, containers and forms
4. Check and /or calibrate the water level indicator and the multifunction meter.
5. Prepare sample containers including preservative and labeling
6. Measure the depth to water in wells that are pumped
7. Start purge, measure and record flow rate.
8. Calculate the well casing volume and the time required to pump well.
9. Measure the pH, conductivity and temperature of the water while purging.
10. Begin sampling once purging is complete.
11. Place dedicated filter in line
12. Collect the sample in the laboratory provided containers, add preservative according to laboratory directions and apply chain of custody seals to each container. Typically there will be three containers; one with nitric acid preservative, one with no preservative and one with sulfuric acid preservative
13. Try to measure the field parameters during sample collection.
14. Collect a blind duplicate sample from one well to be sent to the laboratory for each sampling cycle.
15. Place the sample containers in a cooler with ice and/or ice packs to maintain at 4ºC±2 ºC, or place samples in sample refrigerator to maintain temperature.
16. Complete the sample form and the chain of custody form.
17. Package and ship the sample coolers
18. Follow-up call to labs to verify receipt of samples.
19. Review the report from the labs including the QA information.
20. Perform internal data validation procedures comparability of field duplicate samples holding time, chain of custody analytical methods, minimum detection limits, collection of field data and status of analytical laboratory's certification in UT.
21. Take appropriate action if data quality problem is discovered.
22. Enter analytical results into spreadsheet/database and verify data entries.
23. Prepare update to annual report.

3.2 Sample Analysis

The Utah Bureau of Laboratory Improvement must certify laboratories used for analyses. Uranium One will use Energy Laboratories Inc. of Casper, Wyoming, as the primary lab and the backup laboratory will be Utah certified. Certification is to be verified before each scheduled sampling episode.

The analytical laboratory will analyze samples for all analytes except for pH; pH will be measured in the field during each sampling event. Routine samples taken will be analyzed for the parameters listed in Table 3 below.

Table 3. Summary of Compliance Monitoring Program Groundwater Analyses

Parameter[(a)]	Laboratory Method [(b)]	Reporting Limit [(c)]	GWCL[(d)]	Holding Time (days)	Preservation Method
pH (field)	N/A (field)	0.1	6.4 – 9.4	Immediate	None
conductivity (field)	N/A (field)	0.1		Immediate	None
temperature (field)	N/A (field)	0.1		Immediate	None
Total Dissolved Solids, TDS	A2540-C	10	234	7	Cool [(e)]
Bicarbonate, HCO_3	A2320 B	1	N/A	14	Cool
Carbonate, CO_3	A2320 B	1	N/A	14	Cool
Chloride, Cl	A4500-Cl B	1	15.3	28	Cool
Fluoride, F	A4500-F C	0.1	0.42	28	Cool
Ammonia, NH_3 as N	A4500-NH3G	0.05	0.23	28	H2SO4
Nitrate+Nitrite as N	E353.2	0.1	2.28	28	H2SO4
Sulfate, SO_4	A4500-SO4 E	1	36.8	28	Cool
Arsenic, As	E200.8	0.003	0.0163	180	HNO3
Barium, Ba	E200.8	0.1	0.2	180	HNO3
Cadmium, Cd	E200.8	0.001	0.064	180	HNO3
Chromium, Cr	E200.8	0.01	0.05	180	HNO3
Copper, Cu	E200.8	0.01	0.06	180	HNO3
Lead, Pb	E200.8	0.002	0.0082	180	HNO3
Mercury, Hg	E200.8	0.001	0.005	28	HNO3
Molybdenum, Mo	E200.8	0.005	0.012	180	HNO3
Selenium, Se	E200.8	0.005	0.006	180	HNO3
Silver, Ag	E200.8	0.005	0.025	180	HNO3
Zinc, Zn	E200.8	0.01	0.343	180	HNO3
Calcium, Ca	E200.7	1	26.7	180	HNO3
Magnesium, Mg	E200.7	1	28.8	180	HNO3
Potassium, K	E200.7	1	3.3	180	HNO3
Sodium, Na	E200.7	1	23.4	180	HNO3
Radium-226 + Ra-228	E903.0	0.2 pCi/l	1.8 pCi/l	N/A	HNO3
Gross alpha, adjusted	E900.0	2 pCi/l	8.74 pCi/l	180	HNO3
Uranium, U	E200.8	0.0003 mg/l	0.0073 mg/l	180	HNO3

(a) All analyses other than field are done on dissolved basis
(b) Prefix "A" notes Standard Methods and "E" notes USEPA laboratory method.
(c) Units are milligrams per liter (mg/l) except pH, Ra-226 + Ra-228 and gross alpha.
(d) GWCL means Ground Water Compliance Levels in the Permit; units are mg/l.
(e) Cool means stored in an iced cooler to maintain 4ºC ± 2 ºC.

3.3 Equipment and Supplies

At the beginning of a sampling event, the availability and functional condition of the following items are to be verified or remedied:

1. Sample bottles and preservatives
2. Coolers and ice or ice packs and field logbook
3. Disposable, in-line filters having 0.45 µm pore size
4. Forms: sampling and calibration forms, chain of custody forms, chain of custody seals for all sample bottles
5. Access roads to wells
6. Four wheel drive pick-up
7. Portable generator

8. Pump controller and electrical cords
9. Pen, pencil and permanent marker
10. Graduated container such as a beaker or plastic buckets that are marked in units of volume.
11. Calculator and watch or stopwatch, calendar or date watch
12. Water level indicator
13. Multi-function meter (pH/cond/temp) and probe or conductivity meter and probe
14. Multi-function meter and probe or hand-held pH meter
15. Key to well locks
16. Disposable nitrile or latex gloves
17. Alconox® or similar non-phosphatic detergent for equipment decontamination
18. Distilled and deionized (DI) water from laboratory for equipment decontamination blanks and testing
19. Flow cell for making field measurements of pH, conductivity and temperature from pumped wells.
20. pH buffer standard solutions and conductivity standard solutions.
21. Flow meter with totalizer or calibrated volumetric recording device
22. Dedicated electric submersible pump capable of flow rates in the range of 1 to 3 gallons per minute or 4 to 12 liters per minute

3.4 Field Instrument Check and Calibration

A water level indicator will be used to measure the depth to water in the wells and a multifunction pH/conductivity/temperature (p/c/t) meter will normally be used to measure the physiochemical field parameters.

The primary p/c/t meter currently being used is an Oakton SN 267130 model pH/CON 10 Series. The backup p/c/t meter would be an Oakton SN 267125, model pH/CON 10 Series. If it is necessary to replace the p/c/t meter, the replacement multi-function or individual pH, conductivity, or temperature meters will be the same model or have equivalent or superior specifications for resolution, accuracy and repeatability of measurement. The calibration of the p/c/t meter will be according to the manufacturer's instructions and as described later in this section. The instrument calibration data are to be recorded on the Calibration Form B, included with this QAP, and the instrument manufacturer and model will be recorded on this form.

The primary water level indicator currently being used is Slope Indicator SN 19323 model 500 foot for deeper wells requiring this indicator. The primary water level indicator would be Slope Indicator SN 25817, model 300 foot for shallower wells not requiring the 500 foot indicator. Replacement or alternate water level indicator will be the same model or have equivalent or superior specifications for resolution, accuracy and repeatability of measurement.

Use of backup equipment for making field measurement will be discouraged. In the event that the p/c/t meter or water level indicator is damaged or ceases to function during sampling and cannot be repaired in time for the next required sample, an identical instrument of the same make and model number will be used for the analysis if the original can not be repaired within 30 days. In the event of a field equipment malfunction during a quarterly sampling event the identical equipment backup device will be substituted immediately. Uranium One will have back-up instruments and equipment available to allow the sampling to be completed while the primary instruments are being replaced or repaired.

The instruments are to be tested for proper function at the start of each sample episode. The p/c/t meter is the primary means of determining field parameters and alternate methods will only be used if there is a

malfunction of the p/c/t meter. The p/c/t meter will be calibrated in accordance with the operating instructions provided by the manufacturer.

The following procedure is for a multifunction pH, conductivity and temperature meter.

Uranium One intends to use a multifunction portable field meter to measure pH, conductivity and temperature. A second multifunction p/c/t meter will be available in the event that the primary meter is rendered inoperable during sampling. See the procedure for checking function of these meters. This hand held meter is connected to a probe via a cable. The probe will be placed into a flow cell for measurement when the sampling method is a submersible pump.

pH, Conductivity and Temperature Meter

The manufacturer's directions and instructions concerning check and function testing will be followed. The discussion below can be used for a general guide.

Fill a beaker with laboratory water and place the probe and a thermometer into the beaker. Measure temperature by both means. They should agree within ± 1 oC. Adjust the meter to correspond with the thermometer, if possible.

The pH function should be checked using a pH 7 and a pH 10 or pH 11 buffer solutions. Reading should be within ±0.2 pH of the standard solution. Rinse the probe with laboratory water when transferring it from one buffer to another and when finished.

Conductivity function check should be done using a standard with the applicable range of 0-2000 µmhos/cm. Standards currently available in the lab are 400 µmhos/cm to 1412 µmhos/cm. The 400-µmhos/cm standard is the closest to the expected field values. The reading should be within ± 10 % of the value of the standard (e.g. 360 to 440 µmhos/cm for the 400 µmhos/cm standard). Rinse the probe with laboratory water. After function check place laboratory water into probe cap and replace cap so as to be ready for field data collection.

Record function check data onto the Calibration Form B. Complete the form as needed with date, time and sampler and note function testing meter.

Consult the manufacturer if battery replacement does not correct a calibration problem.

To store the probe, wash probe off with laboratory water then place a small amount of KCL solution into probe cap and replace cap onto probe. Buffer solution (pH 4 or pH 7) can be utilized instead of KCL solution.

Water Level Indicator

Immersing the probe in tap water while it is turned on tests the water level indicator. The buzzer should sound and/or the light should go on. If not, replace the batteries and try again. Do not use DI water for this test. Should the indicator fail to work, either the probe or the cable may need to be replaced. Consult the manufacturer for additional trouble-shooting and repair options. The first ten (10) feet of cable should be spooled-off into the sink at the lab and rinsed with water sent from the potable water supply and then dried with a paper towel and rewound.

3.4.1 Water Depth Measurements

The depth to water in each well will be measured prior to purging for each sampling episode. The measurements will be taken on the same day. Prior to insertion into the well casing, the water level indicator probe will be decontaminated by rinsing with water from the site potable water supply and inspected for foreign matter to ensure proper decontamination. The depth to water measurement is made with the water level indicator using the top of the plastic casing as a reference. To ensure consistency of water level measurements, the top of casing reference point is or will be permanently marked with a contrasting color marking or small notch. If there is a surface casing or other obstruction that prevents access to the plastic casing for water level measurement, the casing reference point will be located and marked on an accessible point on the surface casing. In this circumstance, the surveyed measuring point will be at this marked casing reference point or the well measuring point elevation will be adjusted to reflect the change in casing reference point. The indicator cable is marked in feet, tenths of a foot and hundredths of a foot. The measurement is to be made to the nearest hundredth (0.01) of a foot.

3.5 Pre-Sampling Well Purging

Removal of water from a well before sample collection begins is called purging. The purpose of well purging is to obtain a representative stable in-situ groundwater sample from the aquifer being monitored which is the Entrada aquifer at the Shootaring Canyon uranium mill. By removing the column of standing water from the well and filter pack, in-situ groundwater from the Entrada aquifer will replace the standing water in the well. The purging guidelines here are adapted from ASTM D 4447-85a, *Standard Guide for Sampling Groundwater Monitoring Wells*.

Removal of one casing volume is the goal but due to very low transmissivity of the Entrada aquifer, the removal of one casing volume may not be feasible while maintaining a stable ground water sample. In order to maintain a high quality control of the water well sampling program and still obtain the largest possible well sample, at least three sets of groundwater stabilization parameters will be measured and recorded for all pump sampled wells. These parameters consist of field-measured pH, temperature and conductivity and have to meet very strict criteria on the range of acceptable measured results. These field groundwater quality stabilization measurements will be taken at regular intervals throughout the purging of the well. The minimum interval for confirming stabilization is three minutes of purging or 20% of the total purge time, whichever is smaller. Multiple measurements may be taken over this minimum stabilization interval, but the stabilization must be maintained over the interval. This prevents an erroneous indication of stabilization with three measurements that are taken in rapid succession.

It is necessary to avoid collecting a sample after the pumping level reaches the pump intake level to prevent the aeration of the water sample. Given the low transmissivity of the Entrada aquifer it may not be possible in some wells to remove an entire purge volume, achieve stable groundwater quality parameters, and maintain water levels above the pump intake level. If one purge volume has not been removed and stable groundwater quality parameters have not been achieved, and the water level in the well has reached the level of the pump intakes, then purging will consist of successive full evacuation of the well before collecting a sample. In this case, the pump will be turned off and groundwater allowed to recover (refill) before emptying the well again. A sample will then be collected once sufficient water is available to meet sampling requirements. Water quality parameters will be recorded at the end of each evacuation and during sampling, stabilization of groundwater quality parameters however will not be required.

The volume purged will be determined by direct measurement using either a flow meter with totalizer or volumetric by repeated filling a calibrated collection device (i.e. bucket). Well purge time is calculated based on the calculated purge volume and the flow rate of the pumping device. The flow rate can be

determined by using a flow meter or volumetrically. An example is a purge volume of 30 gallons with a pumping rate of 1 gallon per minute would give a 30-minute pump time for evacuation of one purge volume. The purge volume and sample time will be recorded on the field sample sheet. Purging will use electric submersible pumps capable of flow rates in the range of 1 to 3 gallons per minute or 4 to 12 liters per minute. The flow rate will be selected for each well based on the demonstrated short-term sustainable yield resulting from ground-water flow to each well.

To show that the groundwater is stable three consecutive sets of groundwater stabilization parameters must met the following criteria:

- pH = ± 0.2 units
- Specific conductivity = ± 10 percent

This stabilization requirement for the field parameters restricts the variation of the pH to a total range of 0.4 of a pH unit and the variation of the specific conductivity to a small range. For example: a conductivity of 300 can only vary from 270 to 330 to meet these stabilization criteria.

Temperature readings will also be taken but not used as a stabilization criterion due to the influence of heat from the submersible pumps and surface temperatures. Field groundwater quality measurements will be made during sample collection as a check on the stability of the groundwater sampled over time. All of the field parameter measurements will be recorded on Groundwater Sampling Form A. In addition, the appearance of the purged water will be recorded on this form.

Purged water may be discharged to the surface at a convenient location not less than 10 feet from the well casing. The discharged purge water must not be allowed to collect or puddle around the well casing. If there is a significant change in water quality indicating a source of contamination, Uranium One will notify the Division of Radiation Control (DRC) Project Manager and proceed with modification of the field sampling procedures to provide for collection and disposal of purged water. With concurrence by the DRC Project Manager and the Uranium One Safety and Environmental Review Panel (SERP), the QAP will be modified to reflect the changes.

The purging should continue until stabilization is demonstrated or a maximum three purge volumes have been removed. If at any time prior to three volumes being purged the water level reaches the level of the pump intakes and it is not possible to continue pumping, then sampling will occur after successive full evacuations of the well has occurred.

3.6 Purging Activity Sequence

Field procedures for purging monitoring wells will be conducted according to following sequence of events.

1. Calibrate/function check pH, conductivity and temperature meters or meter and water level indicator and the beginning and record results
2. Measure depth to water
3. Calculate the purge volume

Purge Volume Calculation

Purge volume will be calculated to determine the purging requirements of a well. The purge volume will include the casing volume plus the pore volume of the filter pack

within the water column. The purge volume will be calculated for each well using the following equation.

Purge Volume: $V_p = [(\pi r^2_1 h_1) \times (7.48 \text{ gal/ft}^3)] + [((\pi r^2_2 h_1) \times (7.48 \text{ gal/ft}^3) \times 0.40) - ((\pi r^2_1 h_1) \times (7.48 \text{ gal/ft}^3))]$

where: V_p=purge volume (gal)
π= 3.14 (constant)
r^2_1=radius of monitoring well casing (ft)
r^2_2=radius of borehole (ft)
h_1= height of water column; i.e., total well depth minus depth to water (ft)

Purge volume calculations and the actual purge volume removed from each well will be recorded on the Groundwater Sampling Form A.

4. Check operation of dedicated pump located at bottom of screened interval
5. Attached flow-through cell and/or flow meter to pump discharge line
6. Attach additional discharge hose to direct discharge at least 10 feet from well
7. Purge Monitoring Well
   a. Purge AT LEAST one purge volume, then continue to purge until field stabilization parameter readings have stabilized. Do not exceed three purge volumes. Begin sampling once field stabilization parameters have stabilized or three purge volumes have been removed. Record field groundwater quality parameters during sampling.
   b. If the groundwater level reaches the pump intake prior to stabilization of field stabilization parameters or prior to three purge volumes having been removed, record field groundwater quality parameters, cease pumping, and allow the well to recover (refill) until enough water is available to meet sampling volume requirements. Calculate the volume required by determining the height of the water column above the pump intake required to produce the required volume

      Height Water Column Required: $hr = Vr / [(\pi r^2) \times (7.48 \text{ gal/ft}^3)]$

      where: V_r= Sample volume required (gal)
      π = 3.14 (constant)
      r^2 = radius of monitoring well casing (ft)
      h_r = height of water column required; i.e., depth to water minus depth to top of pump intake (ft)

      Begin purging again until the groundwater level reaches the pump intake, record field groundwater quality parameters, and cease pumping. Allow recovery of well until sufficient water is available to meet sampling requirements. Begin sampling. Record field groundwater quality parameters during sampling.

If the collected field measurements do not met accepted stabilization criteria or if pumping to achieve stabilization is not possible, a sample should be collected and processed using the standard procedures, and the purging and sampling procedures should be clearly noted on the Groundwater Sampling Form A. Following this, the site Project Manager should be notified and the Groundwater Sampling Form A provided to the Uranium One site Project Manager as soon as possible. The Uranium One site Project Manager may elect to resample the well with necessary adjustments in the procedure to overcome the sampling difficulties or, if necessary, notify the Division of Radiation Control (DRC) Project Manager.

3.7 Sampling

3.7.1 Sample Filtering

After the well has been purged and the water quality parameters have met the stabilization criteria described above, groundwater samples must be filtered prior to collection. The purpose of filtering samples is to remove particulate that may have been come from the aquifer matrix and to limit the groundwater analyses to the dissolved fraction contained in the groundwater. A dedicated inline filter is placed in the dedicated discharge tubing and sample collection can begin.

3.7.2 Sample Labeling

There are two primary types of samples that must be labeled accordingly: Environmental samples and QA/QC samples.

Environmental Samples

All environmental groundwater samples will be labeled on the outside with a completed self-adhesive label or permanent marker with the following information:

- Facility name or PRL
- Sample identification (well name)
- Date and time of collection
- Sample preservative (if any)
- Name or initials of sample collector

QA/QC Samples

QA/QC samples will be designated based on their type. Blind duplicates will be designated with fictitious sample identification and sample time, e.g., the blind duplicate for RM-3 taken at 2:30 pm may be labeled as RM-33 taken at 4:30 pm. Samples required for MS and MSD analyses will come from the environmental samples sent to lab and will be processed as per the lab procedures. State certification requires the lab to process for MS and MSD samples.

3.7.3 Sample Collection and Preservation

Sample containers are to be filled in the following order:

1. Nitric acid preserved container first (Metals),
2. Unpreserved sample container second (Major ions and TDS), and
3. Sulfuric acid preserved sample container last (Nutrients).

Sample containers are to be polyethylene with polypropylene caps having polyethylene liners or seals. One-quarter to one-half liter size is sufficient for each sample container except for the nitric acid-preserved sample that will require a total sample of 2 liters. A sample will consist of three separate analyte containers. The analytical laboratory will supply containers; caps, labels, preservative capsules or preservatives already placed in the containers, chain of custody form, chain of custody seals, analyses request forms, coolers and ice containers. Table 4 below provides information on the sample analytes, containers, and preservatives.

Table 4. Sample Analytes, Containers, and Chemical Preservatives

Analytes	Sample Container	Preservative
Metals[(a)]	One 2-qt Plastic[(d)]	HNO_3 (nitric acid) Red Label
Major Ions[(b)]	One 250-milliliter plastic[(d)]	None White Label
Nutrients[(c)]	One 250-milliliter plastic[(d)]	H_2SO_4 (sulfuric acid) Yellow Label

(a) As, Ba, Cd, Cr, Cu, Pb, Hg, Mo, Se, Ag, Zn, Ra226, gross alpha, U.
(b) Chloride, fluoride, sulfate, carbonate, bicarbonate, TDS
(c) Ammonia, nitrate+nitrite.
(d) Number and size of sample containers subject to changes by laboratory

After samples containers have been properly labeled, filled, and preserved, the sample containers will be immediately placed in iced or iced packs coolers to maintain a temperature of 4ºC ± 2 ºC until receipt by the analytical laboratory. Samples are to be stored in the onsite refrigerator while awaiting shipment to the laboratory. Refrigerator temperature will be monitored to provide sample preservation of 4ºC ± 2ºC. Field sample personnel shall place Chain of custody seals on each bottle before placement into refrigerator or cooler for shipping. The date and initials of the sampler will be written on the custody seal.

3.7.4 QA/QC Samples

To ensure the reliability and validity of field and analytical laboratory data of the compliance-monitoring program, QA/QC samples are required. The primary types of QA/QC samples include field blanks and blind duplicates.

Field Blanks

Field banks will not need to be collected as there are no air-borne volatile compounds required for analysis. Field blanks are utilized to detect air-borne volatile compounds.

Blind Duplicates

Blind duplicate samples will be used to assess variability in the sample media and to assess sampling and analytical precision. Blind duplicate samples will be collected for five percent of the total number of samples collected for all analyses, or one duplicate per sample event for the current sampling program. A blind duplicate sample pair is a single grab sample that is split into two samples during collection. The environmental sample will be collected by alternately filling the environmental sample and the duplicate sample. Typically, the environmental sample container will be filled to one-third the total volume, and then the duplicate sample container will be filled to one-third the total volume. Both sample containers will be alternately filled until both containers are filled.

Matrix Spike and Matrix Spike Duplicate Samples

Samples for Matrix Spike and Matrix Spike Duplicate (MS/MSD) analysis will be collected as per lab procedures. Utah Lab Certification process for labs require each lab to prepare and run MS and MSD samples from the water samples received for analysis.

3.7.5 Sample Packing and Shipping

All samples are to be packed into coolers having ice, ice packs or both. Completely fill out the laboratory chain-of-custody and analytical request form including your signature. Complete a purchase order including account coding and keep one copy of this form. Place these forms into a zip lock bag and put

the bag into the cooler. Wrap the cooler securely and attach a shipping label and tracking label. Ship via United Parcel Service being sure to complete the UPS form for tracking purposes. Best to keep in mind that expedited services often do not work from Ticaboo, UT. Alternative to shipping is to hand deliver to the laboratory.

Save the pink copy of the chain of custody form in the onsite file for Groundwater QA to act as a reminder of the shipment. It can be replaced later with the signed original that comes with the analytical report from the laboratory. The samples should be tracked to insure receipt by the laboratory and the arrival condition of the samples.

Samples will be shipped to:

Energy Laboratories
2393 Salt Creek Highway
Casper, WY 82601
Phone: (307) 235-0515

3.7.6 Field Documentation

As discussed in the above paragraphs, all well specific data collected during groundwater sampling will be recorded on the Groundwater Sampling Form A. The sampling personnel will also maintain a field logbook consisting of a weather resistant, bound, survey-type book, with non-removable pages. The logbook will be updated on a daily basis during sample event to include:

- Personnel onsite
- Weather conditions
- Name and address of the field contact person
- The date(s) groundwater sampling was started and completed
- Purging and sampling methodology
- Relevant observations
- Any corrective actions that were approved.

4.0 DATA REDUCTION, VALIDATION, AND REPORTING

4.1 Field Measurements

Raw data from the field measurements and sample collection activities will be recorded in the field logbook and the appropriate forms. All field data generated during this program will be reviewed under the direction of Uranium One's Radiation Safety Officer or designee. The dates and corresponding water depths will be entered into the Excel spreadsheet to calculate groundwater elevations.

4.2 Laboratory Data

Data will be reduced as specified by the analytical methods. These calculations are specific to the analytical instruments that are used for the analysis, the level of automation, and the type of software used to reduce the data. The procedures used for data reduction for each analytical method are described in the laboratory's SOPs, and can be reviewed in the laboratory office. The Energy Laboratory's QAP is attached to this document.

ELI's process for data validation within the laboratory consists of multiple steps along the production of the results. Samples received by the laboratory are checked in by the login department. The samples are

checked for proper container, temperature, and preservation. Any sample anomalies are noted during this process for potential follow-up with the client or report notes. The sample is then logged in for the requested analytes and test methods. This login record is then reviewed by management level staff for correctness. The sample login is then either approved for analysis or returned to the login department for corrections. During the sample analysis, the analyst reviews the sample results, QC sample types and uploads or re-runs the samples based on this review. Upon data upload, the data is reviewed by a section supervisor and QA'ed by the supervisor. Upon completion of the job, the data set associated with the sample is reviewed for compliance with the laboratories quality objectives by the QA department. Upon approval of the work order by the QA department, the job is forwarded to reporting. Upon a cursory review by the reporting department, the printed final report is forwarded back to the QA department. The QA department checks the run once again, reviews the report for transcription errors and either approves the report for release or sends the job back for additional analysis or report correction. Once the report is approved by the QA department, it is sent to the laboratory director who reviews the report and either approves the final report for release to the client or rejects the report and sends it to be corrected.

The laboratory will perform in-house analytical data reduction and review under the direction of the Laboratory Supervisor and the Data Validator before data are released to Uranium One. The Laboratory Supervisor and Data Validator are also responsible for assessing the data quality and qualifying any data that may be unreliable. The laboratory will prepare and retain full analytical and QC documentation. During the Laboratory data reduction and review the Laboratory shall notify Uranium One if they find excess holding time or precision or accuracy problems demonstrated by spike duplicates or matrix spikes.

The laboratory review of the data will include assessing compliance with the control limits in this QAP. Accuracy and precision are the primary data parameters that can be used to calculate control limits. Data to evaluate accuracy are obtained primarily from separately prepared laboratory QC samples. Data used to evaluate precision are QC sample analyses or the replicate analysis of field samples. The calculations that are used to evaluate precision and accuracy are defined in the laboratory's SOP. Precision and accuracy quality control limits are generated from the statistical analysis of QC sample results.

4.3 Data Reporting

The field forms, chain-of-custody copy and the purchase order copy will be placed in the correct files. When the data report is received from the laboratory, check to see that it includes a signed chain-of-custody form and a Quality Assurance report. Review all information received for anomalies and errors or problems. A checklist follows:

1. Presence of results for all wells sampled for all parameters requested
2. Presence of signed chain of custody and the lab quality assurance information
3. Date of analysis for TDS – seven-day maximum
4. Compare results for the duplicate and calculate RPD values
5. Review the MS and MSD results and ensure that the percent recovery and RPD values are within the laboratory QAP requirements.

Communicate with the laboratory if problems or errors are encountered. If the blank has a positive result, request that the sample be analyzed again. A second positive may mean that the sampling will need to be repeated if anomalous results for the wells are also present. Missing data, if not simply a lab oversight, may require resampling. A discrepancy in the results for the blind duplicate or matrix spikes will require investigation and possible resampling. If the concentration (or activity) of the constituent is more than three times greater than the detection limit, a discrepancy of more than ±15% between the blind duplicate and the sample will require further investigation and possibly resampling. If the concentration (or activity) of the constituent is less than three times greater than the detection limit, a discrepancy of more

than ±25% between the blind duplicate and the sample will require further investigation and possibly resampling.

All forms and reports must be filed correctly. The groundwater sampling and field equipment calibration forms are attached to this QAP.

4.4 Data Validation

Results from the field and laboratory analysis are compared to previous values. If the values are five times greater than the next highest value measured at the Shootaring site, a request will be made to the lab to recheck the analysis and/or reporting of the value. The Radiation Safety Officer or his designee and the corporate consultant both independently conduct a review of the newly collected data. Questionable data will be evaluated to determine whether it should be removed from the data set. Trend plots will also be used to evaluate the data to determine if changes are consistent with adjacent data.

5.0 INTERNAL QUALITY CONTROL

5.1 Field Programs

Internal quality control evaluates whether a method is performing within acceptable limits of precision and accuracy. On the sampling level, this includes calibration of p/c/t meters prior to sampling, function checks on p/c/t meters prior to sampling, and quality control samples used to assess field-sampling techniques and environmental conditions during sample collection and transportation include blind duplicates.

Blind duplicate samples will be used to assess variability in the sample media and to assess sampling and analytical precision. Blind duplicate samples will be collected for five percent of the total number of samples collected for all analyses, or one duplicate per sample event for the current sampling program.

5.2 Laboratory Analysis

The general objectives of the QC program are to:

- Ensure that all procedures are documented, including any changes in administrative and/or technical procedures. A file containing memoranda describing all changes in administrative and/or technical procedures will be maintained on site and in the Uranium One office.
- Ensure that all analytical procedures are validated and conducted according to method guidelines and status of Laboratory certification for analytical methods used. To satisfy this objective, the continued Laboratory certification will be confirmed prior to each sampling event, and the reporting of the results reviewed to insure the correct methods are used.
- Monitor the performance of the laboratory using a systematic inspection program. In addition to reliance on the Utah laboratory certification, the data will be reviewed after each sampling event to detect anomalies or unlikely trends.
- Ensure that all data are properly archived. Paper copies of the sampling results will be maintained on site and in the Uranium One office and electronic copies will be maintained in a water quality database.
- Insure limits on holding times are met. See corrective actions below in the event of an exceedance.
- Prevent excessive Minimum Detection Limits (MDL). See corrective action below in the event of unsatisfactory MDL.

- Eventually the data will be compared with GWPL or GWCL, but during Background sampling this comparison will only be done on an annual basis.

Corrective actions that will be taken by Uranium One in the event that one or more of the cited QC objectives is not met are as follows:

- If Laboratory is not certified in Utah then locate a second laboratory that is certified and can perform the required analysis at an acceptable cost.
- Should the Laboratory not utilize the required analytical method, then request second analysis utilizing the correct analytical method.
- Should holding times exceed required time, review the results and compare with previous sampling results to determine if there was any noticeable deviation from typical water quality for the well. If any of the sample analysis results are outside of the range of previous results for the well, or are otherwise suspect, the well should be resampled as soon as possible. Because the sampling is done quarterly, resampling within the appropriate quarter following receipt of the laboratory results may not be possible. The sample analysis should be rejected if there are any indications that the results are affected by the excessive holding time, but the Uranium One Radiation Safety Officer or his designee may elect to utilize the analysis if it is consistent with previous sample analyses and rejection would result in loss of a quarterly sample. The lab should be notified in writing of the exceedance of allowable holding time, and a notice of the exceedance included in the summary reporting to the DRC.
- Should poor comparability occur with field duplicates, then review field notes and laboratory procedures and handling of sample to determine what the reason is for the difference.
- Should the MDL be to excessive then request the laboratory run another analysis at the correct MDL, or alternatively, resample the well and have the analysis performed at the correct MDL.
- If a laboratory fails on repeated instances to meet one or more of the stated laboratory analysis QC objectives, a second laboratory that is certified in Utah to perform the required analysis will be used, either in lieu of, or in combination with, the first laboratory, as a means of verifying or refuting results from the first laboratory, for certain sample analyses, and until any required corrective actions are undertaken and successfully implemented at the first laboratory.

All contract laboratories will conduct internal quality control for analytical services in accordance to National Environmental Laboratory Accreditation Conference (NELAC) standards.

Laboratory quality control consists of two distinct components: a laboratory component and media component. The laboratory components measure the performance of the laboratory analytical processes during sample analyses. Laboratory components include holding time, refrigerator blanks, method blanks, and laboratory control samples. Media components measure the effects on the method performance of a specific media (i.e., water) and include matrix spikes, matrix spike duplicates, and surrogate spikes.

The laboratory QC Criteria that will be used in this project are listed in Table 5.

Table 5. Laboratory QC Criteria

Parameter	Laboratory Method	ICV[a] Range %Rec	CCV[b] Range %Rec	MS/MDS[c] Range %Rec	LCS[d] Range %Rec	Duplicate[e] Requirement % RPD	Method Blank Requirement	Batch Size/ MSMSD Frequency
Total Dissolved Solids, TDS	A2540-C	90 –110	90 -110	90 -110	90 -110	10	< Lab RL	10/1
Chloride, Cl	A4500-Cl B	90 -110	90 -110	90 -110	90 -110	10	< Lab RL	10/1
Fluoride, F	A4500-F C	90 -110	90 -110	90 -110	90 -110	10	< Lab RL	10/1
Ammonia, NH_3 as N	A4500-NH3G	80 – 120	80 - 120	80 - 120	80 - 120	20	< Lab RL	10/1
Nitrate+Nitrite, NO_3+NO_2 as N	E353.2	90 - 110	90 - 110	90 - 110	90 - 110	10	< Lab RL	20/1
Sulfate, SO_4	A4500-SO4 E	90 – 110	90 - 110	90 - 110	90 - 110	10	< Lab RL	10/1
Arsenic, As	E200.8	90 – 110	90 - 110	70 – 130	80 – 120	20	< Lab RL	20/1
Barium, Ba	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Cadmium, Cd	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Chromium, Cr	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Copper, Cu	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Lead, Pb	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Mercury, Hg	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Molybdenum, Mo	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Selenium, Se	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Silver, Ag	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Zinc, Zn	E200.8	90 - 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1
Bicarbonate	A2320 B	90 – 110	90 - 110	90 - 110	90 - 110	10	< Lab RL	10/1
Carbonate	A2320 B	90 – 110	90 - 110	90 - 110	90 - 110	10	< Lab RL	10/1
Calcium, Ca	E200.7	95 – 105	90 - 110	70 – 130	90 - 110	20	< Lab RL	20/1
Magnesium, Mg	E200.7	95 - 105	90 - 110	70 – 130	90 - 110	20	< Lab RL	20/1
Potassium, K	E200.7	95 - 105	90 - 110	70 – 130	90 - 110	20	< Lab RL	20/1
Sodium, Na	E200.7	95 - 105	90 - 110	70 – 130	90 - 110	20	< Lab RL	20/1
Radium 226D	E903.0	N/A	70 – 130	70 – 130	70 – 130	30	< Lab RL	20/1
Gross Alpha	E900.0	N/A	70 – 130	70 – 130	70 – 130	30	< Lab RL	20/1
Uranium D	E200.8	90 – 110	90 – 110	70 – 130	80 – 120	20	< Lab RL	20/1

Laboratory method Prefix "A" indicates Standard Methods and "E" indicates USEPA laboratory method.

[a] ICV or Initial Calibration Verification constitutes a spiked DI sample using secondary standard source separate from the calibration solution stock. The ICV is run after the instrument calibration solutions to verify calibration stability. Analytes that fail in the ICV analysis are not valid analysis data and must be re-analyzed after re-calibrating the instrument.

[b] CCV or Continuing Calibration Verification constitutes a spiked DI sample using the same solutions as used in calibration of the instrument. The CCV is run before each batch of samples is run and directly afterwards. The purpose of the CCV is to demonstrate calibration stability during the entire analysis run. Samples that are associated with failing CCV results must be re-analyzed in order to be considered valid sample results.

[c] MS/MSD or Matrix Spike/Matrix Spike Duplicates constitute actual client samples, spiked with the same solutions used in calibration of the instrument. The MS/MSD is run on one random sample per batch. The purpose of the MS/MSD is to determine if any matrix interferences are potentially present in the sample matrix and also to demonstrate reproducibility (via RPD calculation) of the analysis. Samples with failing MS/MSD results will be notated on the laboratory report as having suspected sample matrix effects.

[d] LCS or Laboratory Control Sample constitutes a spike DI sample using a secondary standard source separate from the calibration solution stock. The LCS sample is run through all preparatory steps that the client samples are and will detect anything within those steps that might negatively impact the reliability of the client sample measurements. Samples with failing LCS results should be re-prepared and re-analyzed in order to be considered valid sample results.

[e] RPD or relative percent difference constitutes a duplicate sample, either a sample duplicate or a matrix spike duplicate run within the sample batch in order to demonstrate reproducibility. Samples with failing RPDs will be notated on the analytical report. It should be noted that RPD failures only become significant if the measured analyte concentration is at or above 10 times the laboratory's RL.

6.0 PERFORMANCE SYSTEM AUDITS

6.1 Field Programs

Oversight of the field procedures will be the direct responsibility of the Uranium One's Radiation Safety Officer or his designee who will review all elements of the QAP to ensure that the objectives of the monitoring are met. Figure 1 presents the organizational chart for the review of Shootaring Canyon quality control. In addition to an initial review, the sampling procedures will be reviewed regularly so that any necessary modifications can be made. Uranium One has limited personnel, one at the site for field sample collection and one in the corporate office for backup to field sample collection and all other required duties outlined in this QAP.

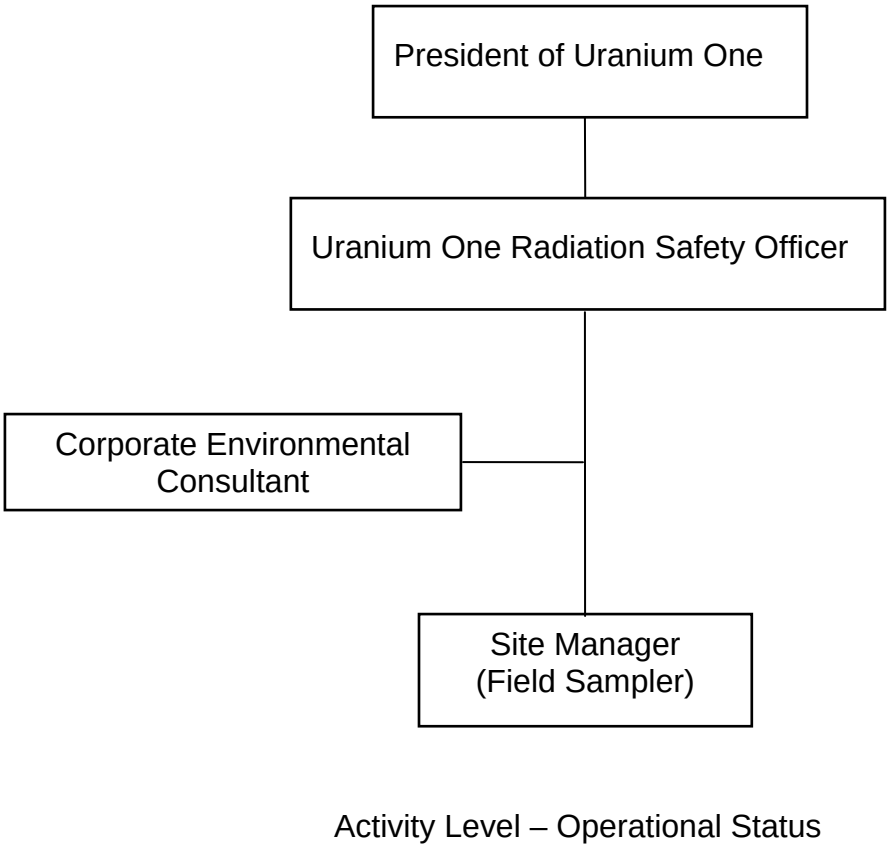

Figure 1 Organizational Chart – Shootaring Canyon Uranium Mill

The Uranium One Radiation Safety Officer (or designee) will conduct internal audits of field activities (sampling and measurements). The audits will include examining field measurement records, field equipment calibration records, field sampling records, field instrument operation records, sample collection procedures, sample handling and shipping procedures, and chain-of-custody procedures. The audit will also include a check on the accuracy of data transfer from the laboratory records into the reporting spreadsheets. Field activities will be audited immediately after the approval of this QAP to verify that all the procedures in the QAP are being followed. Follow-up audits will be conducted on a

semi-annual basis to correct deficiencies, and to verify that QA procedures are maintained throughout the project. A report of the audit will be kept in the files on site and in the Uranium One office.

The regulatory agencies such as Utah Division of Radiation Control, Division of Water Quality, may conduct external field audits. Field audits may be conducted at any time during the field operations and will be based upon the information present in the QAP. The audits may or may not be announced at the discretion of the regulatory agencies.

6.2 Laboratory Audits

In-house and regulatory agency audits of laboratory systems and performance are a regular part of a laboratory QC program and are outlined in the laboratory's QA/QC plan. The audits consist of a review of the entire laboratory system and at a minimum, include examination of sample receiving; sample log-in; sample storage; sample chain-of-custody documentation procedures; sample preparation and analysis; and instrumentation procedures.

External audits may be performed by regulatory or Uranium One personnel prior to or during field activities to verify proper implementation of laboratory procedures and adherence to this QAP. These audits may or may not be announced and are conducted at the discretion of the auditing agency. External audits will include but are not limited to review of laboratory analytical procedures, laboratory on-site audits, and/or submission of Performance Evaluation samples to the laboratory for analysis.

7.0 CORRECTIVE ACTIONS

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-quality-control performance that may affect the data quality. All proposed and implemented corrective action will be documented in the data validation to the appropriate project management. The Uranium One Radiation Safety Officer or his designee will implement corrective actions only after approval. Approval will come from Project Manager and DRC contact. If immediate corrective action is required, approvals secured by telephone from the Uranium One Radiation Safety Officer or designee will be documented in an additional memorandum to the DRC.

For each noncompliance, a formal corrective action program will be established and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the Uranium One Radiation Safety Officer or his designee, who in turn will notify the DRC Project Manager. Implementation of the corrective action will be confirmed in writing as described previously.

Any nonconformance with the established QC procedures specified in this QAP will be identified and corrected in accordance with the QAP. Corrective actions will be implemented and documented in the field logbook. No Uranium One staff member will initiate a corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, the appropriate personnel may issue a stop work order until the problem can be resolved.

7.1 Field Corrective Action

During any field activity, the field staff will be responsible for documenting and reporting all suspected technical and QA nonconformances and suspected deficiencies. The nonconformances and/or deficiencies will be documented in the field logbook and reported to the Uranium One Radiation Safety Officer or his designee. If the problem is associated with the field measurements or sampling equipment,

the field staff will take the appropriate steps to correct the problem. Typical field procedures to correct problems include the following:

- Repeating the measurement to check for error.
- Making sure the meters or instruments are adjusted properly for the ambient conditions, such as temperature.
- Checking, recharging, or replacing batteries.
- Re-calibrating instruments.
- Replacing the meters or instruments used to measure field parameters.
- Stopping the work until the problem is corrected (if necessary).

If a nonconformance or problem requires a major adjustment to the field procedures as outlined in this QAP (e.g., changing sampling methodology), the Uranium One Radiation Safety Officer or his designee, in conjunction with the DRC Project Manager, will be responsible for initiating corrective actions. Modification to or replacement of the QAP to address major changes in field procedures will be done with concurrence by the Uranium One Radiation Safety Officer or his designee and DRC project manager.

7.2 Laboratory Corrective Action

Corrective actions are required whenever unreliable analytical results prevent the quality control as specified by the method or the laboratory QAP from being met. The corrective action that is taken depends on the analysis and the nonconformance. NELAC provides an outline of the corrective actions that will be taken for problems associated with specific laboratory analyses.

Corrective action will be taken if one of the following occurs:

- QC data are outside the acceptance criteria for precision and accuracy.
- Blanks contain contaminants above acceptance limits.
- Undesirable trends are detected in spike recoveries, or spike recoveries are outside the QC limits.
- There are unusual changes in detection limits.
- Inquiries concerning data quality are received from Uranium One.

Corrective actions are handled primarily at the bench level by the analyst who reviews the sample preparation or extraction procedures, performs the instrument calibration and analysis. If the problem persists or its cause cannot be identified, the matter will be referred to the department supervisor or QA department for further investigation. Once resolved, full documentation of the corrective action procedure will be filed with the QA department. A summary of the corrective actions will be included in the data package submitted to Uranium One. Table 5 presents the laboratory QC Criteria that will be used in this project.

7.3 Data Validation Corrective Action

Corrective actions may be initiated during data validation or data assessment. Potential corrective actions may include re-sampling by the field team or reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, how critical the data are to the project data quality objectives, or whether the samples are still within holding time criteria. When the data validator identifies a corrective action situation, the Uranium One Radiation Safety Officer or his designee will be notified and has final responsibility for authorizing the implementation of the corrective action, including re-

sampling or reanalysis. As indicated in Figure 3, if data that indicates a value which exceeds a groundwater compliance limit, the laboratory will be requested to check the data result and, if the lab reports that the data were reported correctly, the re-analysis of the sample will be requested. Upon confirmation from the laboratory of data indicating non-compliance, DRC will be notified within 48 hours and re-sampling of the well will be performed within 14 days of receipt of confirmation from the laboratory.

8.0 QUALITY ASSURANCE REPORTS

All of the analytical data collected during the Shootaring Canyon Mill groundwater compliance program, which includes the intra-well background data collection, will be presented in semi-annual reports, as required by the Ground Water Quality Discharge Permit. During this time the supplemental background data collection study is ongoing. The analytical data will be submitted to Uranium One and copies compiled into the semi annual reports. The following information will be included in the semi-annual reports:

- Sampling procedures (planned and implemented, problems encountered, if any, and corrective actions implemented, if any).
- Analytical procedures and detection limits.
- Analytical data (environmental and QA/QC sample results).
- Trend analysis results
- Water level potentiometric surface map
- Results of the data validation evaluation.
- Field data sheets
- Conclusions and Recommendations.

9.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1986. RCRA Ground Water Monitoring Technical Enforcement Guidance Document.

U.S. Environmental Protection Agency (EPA), 1992. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition.

U.S. Environmental Protection Agency (EPA), 1994. EPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review.

Utah Department of Environmental Quality, Divisions of Radiation Control and Water Quality, 1999. Plateau Resources Limited Ground Water Quality Discharge Permit No. UGW170003. Renewal dated January 14, 2004.

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GROUND WATER SAMPLING FORM A

Sample Identification:_____Description: _____
Date sampled: _____ Person(s) taking sample: _____
Depth to water from top of casing (to 0.01 ft): _____
Sampling method:_____
Flow rate of pump:_____
Time Start: _____ Time Stop: _____ Purge Time:_____
Volume purged in gal:_____
Appearance of purged water:_____

Casing Volume Calculation
Well Depth: _____ ft
Depth to Water: _____ ft
Feet of Water:_____ ft

Water Volume Above Pump
Pump Depth: _____ ft
Depth to Water: _____ ft
Feet of Water: _____ ft

3 Inch Diam. Well Casing Volume: (0.37) x (_____ ft of water) =_____ gal.
5 Inch Diam. Well Casing Volume: (1.0) x (_____ ft of water) =_____ gal.

3 Inch Diam. Well Volume above pump: (0.37) x (____ ft of water) =_____ gal.
5 Inch Diam. Well Casing Volume above pump: (1.0) x (____ ft of water) =_____ gal.

Gallons pumped (_____) ÷ Casing Vol. (_____) = _____ Casing Volumes

Field Parameters

Time	Specific Conductance @25ºC µmhos/cm	pH	Temperature (ºC)

Function Check on pH/Conductivity/Temperature Meter

Parameter	Reading	Stand. Soln.	Variance	Range	Approval
pH		4.00	± 0.2		
pH		7.00	±0.2		
pH		10.00	±0.2		
Conductivity		1413	±10%		
Temperature			±1°C		

Sample Analytes, containers, and Chemical Preservatives Verification

Analytes	Sample Container	Preservative	Correct Preservative in Correct Container?
Metals	One 2 qt plastic	HNO_3 (nitric acid): Red Label	Yes/No
Major Ions	One ≥250-ml plastic	None: White Label	Yes/No
Nutrients	One ≥250-mil plastic	H_2SO_4 (sulfuric acid): Yellow Label	Yes/No

Comments:

Calibration Form B
pH/Conductivity/Temperature Meter & Water Level Meter

Date: ____________________ **Time:** ______________ **Sampler:** ______________________

pH\CND\Temp Meter Make: ___________________ Model\SN: ___________________
Water Level Meter Make: ___________________ Model\SN: ___________________

	Reading	Standard Soln.	Variance	Range	Approval
pH		4.00	± 0.2		
pH		7.00	±0.2		
pH		10.00	±0.2		
Conductivity		1413	±10%		
Temperature			±1°C		
Water Level	Responds [circle one]: (Yes) (No)				

Date: ____________________ **Time:** ______________ **Sampler:** ______________________

pH\CND\Temp Meter Make: ___________________ Model\SN: ___________________
Water Level Meter Make: ___________________ Model\SN: ___________________

	Reading	Standard Soln.	Variance	Range	Approval
pH		4.00	± 0.2		
pH		7.00	±0.2		
pH		10.00	±0.2		
Conductivity		1413	±10%		
Temperature			±1°C		
Water Level	Responds [circle one]: (Yes) (No)				

Date: ____________________ **Time:** ______________ **Sampler:** ______________________

pH\CND\Temp Meter Make: ___________________ Model\SN: ___________________
Water Level Meter Make: ___________________ Model\SN: ___________________

	Reading	Standard Soln.	Variance	Range	Approval
pH		4.00	± 0.2		
pH		7.00	±0.2		
pH		10.00	±0.2		
Conductivity		1413	±10%		
Temperature			±1°C		
Water Level	Responds [circle one]: (Yes) (No)				