DOCUMENT TYPE: Standard Operating Procedure

TITLE: Ground Water Sampling

PREPARED BY: Marshall K. Cheung, Ph.D., Laboratory Director _____

REVISED BY: Marshall K. Cheung, Ph.D., Laboratory Director _____

REVIEWED BY: Anne Cheung, Laboratory Manager _____

APPROVED BY: Marshall K. Cheung, Ph.D., Laboratory Director _____

Table of Contents

Document No.:	***MP 0006 – 1.0 - 006***
***Copy provided to*:**	29 Palms Band of Mission Indians
***Title*:**	Tribal Council
Address:	46-200 Harrison Place
	Coachella, CA 92336
***Copy provided by*:**	**Jan Kilduff, Ph.D.**
***Title*:**	Laboratory QA Officer
Date:	July 27, 2004

1.0 Scope and Application

1.1 This standard operating procedure is to be followed when collecting groundwater samples for laboratory analysis.

1.2 Samples are collected in such a way that no foreign material is introduced into the sample and no material of interest escapes from the sample prior to analysis.

2.0 Summary of Procedure

2.1 Procure sample containers (Refer to Sample Submission SOP # GP007).

2.2 Perform all necessary bottle preparation prior to sampling.

2.3 Assemble all necessary equipment for groundwater sampling.

2.4 Prepare equipment blank from submersible pump.

2.5 Calculate purge volume.

2.6 Purge well of three casing volumes of water.

2.7 Monitor purge water to achieve three stable pH, conductivity, turbidity, dissolved oxygen and temperature readings.

2.8 Prepare QA samples: field blanks, sample duplicates, matrix spikes, and matrix spike duplicate).

2.9 Begin sample collection.

2.10 Pack samples in ice chests so that temperature of samples is maintained at or below $4^{o}C$ (Refer to Sample Submission SOP # GP 0007).

2.11 Deliver samples to laboratory according to protocol described in SOP # GP 0007 for sample submission.

3.0 Comments

3.1 Only certified clean sample containers are recommended. Samples collected by/for the 29 Palms Tribal EPA will use only certified clean collection bottles

3.2 All equipment is decontaminated, prior to use, between sampling, and at end of use. (See cleaning procedures in the SOP for each specific piece of equipment).

3.3 All field meters are calibrated according to written SOPs before and after each day of field use. Field meter probes are decontaminated before and after use at each well.

3.4 Appropriate sample bottles and preservatives are used for each of the following analyses:

- 3.4.1 Volatile Organic Carbon- (2) 40 mL amber glass vials containing HCl
- 3.4.2 Microbiology- 100 mL sterile HDPE containers with sodium thiosulfate tablet
- 3.4.3 Metals- 500 mL HDPE bottle containing HNO_3
- 3.4.4 Physical Properties- 500 mL HDPE bottle
- 3.4.5 Total Organic Carbon- 100 mL amber glass containing H_2SO_4
- 3.4.6 General Minerals- 1000 mL HDPE bottle
- 3.4.7 Cyanide- 500 mL HDPE bottle containing NaOH
- 3.4.8 Radionuclides- (2) 1000 mL HDPE bottles containing HNO3
- 3.4.9 Organophosphorus and Organochlorine Pesticides- 1000 mL amber glass
- 3.4.10 Methylcarbamate Pesticides- 1000 mL amber glass (containing chloroacetic acid for EPA method 8318)

3.5 The safety of the sampler must be considered when hazardous substances may be present. Samplers will wear gloves and goggles during sampling and are required to wash hands immediately following their return from the field.

4.0 Equipment/Supplies

4.1.1 Folding chairs
4.1.2 Folding table
4.1.3 Canopy
4.1.4 Well pump (Properly decontaminated prior to use)
4.1.5 Well pump power regulator
4.1.6 Power generator (with topped off gas and oil)
4.1.7 Depth sounder (Properly decontaminated prior to use)
4.1.8 Circuit breaker extension cord
4.1.9 Disposable bailer (For volatiles and microbiology)
4.1.10 Tool box (large crescent wrench, screw drivers, hammer)
4.1.11 Tape measure (25 ft.)
4.1.12 Five gallon bucket
4.1.13 Shovel
4.1.14 pH meter with probe
4.1.15 pH buffers (4.00, 7.00, 10.00 + 7.00 for ICV/CCV)
4.1.16 Conductivity meter with probe
4.1.17 Conductivity standards (100, 1000, 10000 + 1000 for ICV/CCV –µS/cm)
4.1.18 Turbidity Meter
4.1.19 DO Meter with probe
4.1.20 Spare batteries (9 volt and AA)
4.1.21 Kimwipes
4.1.22 Deionized (DI) water bottles (2)
4.1.23 Deionized water (5 gal)
4.1.24 Sterile water (1 L)
4.1.25 Beakers - 250 mL (6)
4.1.26 Sample bottle set
4.1.27 Waste water container
4.1.28 Ice chests with frozen blue ice
4.1.29 Gloves (rubber or latex)
4.1.30 Goggles
4.1.31 Ziploc bags
4.1.32 Packing material
4.1.33 Trash bag
4.1.34 Driller's logs
4.1.35 Calculator
4.1.36 GPS unit
4.1.37 Two (2) Waterproof (Sharpie) pens and two (2) black ink writing pens
4.1.38 Camera
4.1.39 Stopwatch

4.1.40 Well lock keys
4.1.41 Chain of Custody forms
4.1.42 Drinking water and/or Gatorade in cooler
4.1.43 Logbooks
- 4.1.43.1 Groundwater Monitoring Log
- 4.1.43.2 Sample Collection Log
- 4.1.43.3 Redi-Flo Pump Log
- 4.1.43.4 Generac EXL Generator Log
- 4.1.43.5 GPS Log
- 4.1.43.6 pH Meter Log
- 4.1.43.7 Conductivity Meter Log
- 4.1.43.8 Turbidity Meter Log
- 4.1.43.9 DO Meter Log
- 4.1.43.10 Camera Log

5.0 Procedure

5.1 *Prior to sampling*, obtain sample bottle set from laboratory or laboratories (see SOP #GP007 Laboratory Sample Submission).
5.2 Notify sampling personnel of sampling event plan (date and location).
5.3 Take inventory of standards for field analyses (pH, conductivity, turbidity and dissolved oxygen).
5.4 Order standards if necessary.
5.5 Take inventory of deionized water (DI water) and gloves. Prepare or order if necessary.
5.6 Organize sample bottles, labeling each appropriately with indelible marker.
5.7 Each label should include the following information:
- 5.7.1 Client name and analyte for which analysis requested.
- 5.7.2 Unique sample number and description, including whether it is a grab or composite.
- 5.7.3 Date and time of sampling (completed in the field with a permanent marker).
- 5.7.4 Initials of sampler (completed in the field with a permanent marker).

5.8 Place colored tape on lids of field blanks and equipment blanks to identify these bottles to be filled with DI water (sterile DI for microbiology samples – See 5.12).
5.9 Verify presence of preservatives in bottles (see 3.3).
5.10 Enter all relevant information in Sample Collection Logbook (4.1.43.2).
5.11 Enter all relevant information in laboratory Chain of Custody form(s) (4.1.41).
5.12 Prepare sterile water by autoclaving dI water in I L glass bottle for 30 minutes (see SOP # MP001 Autoclave Operation).
5.13 Arrangements with laboratories must be made to transfer samples collected.
- 5.13.1 29 Palms Laboratory samples are hand delivered as soon as possible.
- 5.13.2 Applied Physics and Chemistry Laboratories (APCL) samples are delivered to Beaumont, where samples are relinquished to a courier within 6 hours of collection if micro samples are included.
- 5.13.3 Agriculture Priority Pollutants Laboratories (APPL) samples are shipped via Federal Express.

5.14 Prior to sampling, assemble all equipment and supplies (see 4.0), calibrate all instrumentation, and prepare a data dictionary for GPS.
5.15 Immediately prior to departure to sampling site, prepare ice chests with ice to keep samples at 4^{o}C from the time of sampling until they are received by laboratory.
5.16 Once at the site, collect GPS data on sample collection location (refer to SOP #SP003 GPS Data Collection) and record in GPS logbook.
5.17 Set up analysis station, making sure all instrumentation is not exposed to direct sunlight.
5.18 Check calibration of field analysis meters: Temperature, pH, conductivity, turbidity and dissolved oxygen. Record calibration information in appropriate logbook.
5.19 Collect equipment rinsate blanks for the portable pump and the disposable bailer.
  5.19.1 Following the procedure for cleaning the pump prior to sampling in SOP #SP004, Redi-Flo Pump Operation, collect equipment blanks from deionized water rinse.
  5.19.2 Equipment rinsate blanks are submitted blind to the laboratory.
5.20 Record all relevant information into the Groundwater Monitoring Logbook.
5.21 Measure static water level (refer to SOP #SP006).
5.22 Start the generator (refer to SOP # SP005).
5.23 Insert the pump into the well.
5.24 Start the pump (refer to SOP # SP004).
5.25 Calculate casing volume of well (See *6.1*).
5.26 Determine the flow rate of the pump.
  5.26.1 Obtain a five-gallon bucket.
  5.26.2 Time how long it takes to fill the bucket from the water coming out of the pump and record the time in the Groundwater Monitoring Logbook.
  5.26.3 Calculate the average of the three times and record.
5.27 Calculate the time required to purge three full casing volumes and start timer (See *6.4*).
5.28 After three full casing volume has been purged, begin collecting samples for field analysis.
5.29 Determine stability of temperature, pH, conductivity, turbidity and dissolved oxygen.
5.30 Continue collecting samples at 15-minute intervals until stable readings are achieved, recording results for each. Stabilization occurs when: the temperature is constant (varies by less than 1.0 ^{o}C), pH measurements remain constant within 0.1 Standard Unit, conductivity varies no more than 10 %, turbidity varies no more than 1 NTU, and DO remains constant within 1% for at least three consecutive readings taken at not less than 15 minute intervals.
5.31 Record results of temperature, pH, conductivity, turbidity and dissolved oxygen trials in the Groundwater Monitoring Logbook.
5.32 If the water quality has stabilized, begin collecting samples.
5.33 If the water quality has not stabilized after four well casings have been purged, insert a comment into the logbook and proceed with sample collection.
5.34 Collect field blanks by pouring DI water directly into sample collection bottles designated for that purpose, using sterile DI water for microbiology.
  5.34.1 Field blanks are included to account for anything in the immediate environment (contaminants, airborne particulates, etc.) that could affect sample results.
  5.34.2 Field blanks are submitted blind to the laboratory
5.35 Sample duplicates are filled consecutively for each type of analysis and are submitted blind to the laboratory.

5.36 VOC samples are collected first after adjusting the pump flow rate to < 100 mL/min and dispensing into VOC amber glass vials as follows:
- 5.36.1 A test vial will be preserved with HCl to determine the amount of preservative needed to lower the pH to less than 2. The appropriate amount of HCl will then be added to the sample vials prior to the addition of the sample.
- 5.36.2 Carefully remove cap on vial, avoiding contamination by hands or particles in air by holding the cap and bottle on the outside surface.
- 5.36.3 Fill the vial all the way to the top just to the point of overflowing.
- 5.36.4 Replace cap carefully.
- 5.36.5 Invert the vial and check for air bubbles.
- 5.36.6 If a bubble appears, the vial is to be discarded and a new sample will be collected.

5.37 Increase the flow rate to a moderate level and proceed with collecting samples for other analyses starting with microbiology.

5.38 Microbiology samples are collected by aseptically dispensing into sterile microbiology containers.

5.39 All bottles designated for a particular analysis will be filled sequentially before bottles for a different analysis.

5.40 Do not rinse sample bottles prior to sample collection.

5.41 Collect samples in containers provided, filling nearly full without overflowing. Some bottles contain a preservative and it is vital not to allow the bottle to overflow.

5.42 For metals, filtered and unfiltered samples will be collected if the turbidity of the groundwater samples is greater than 5 Nephelometric Turbidity Units (NTUs).
- 5.42.1 Attach a Teflon tube to the end of the pump tubing and a new 5-micron filter is attached to the outlet.
- 5.42.2 Samples are filtered via pump pressure and the filtrate is collected directly into the sampling container. A sample number appended with an "F1" will represent a sample filtered with a 5-micron filter.
- 5.42.3 After the filtered sample has been collected, the Teflon tube and filter is removed and an unfiltered sample is then collected.

5.43 Matrix spike and matrix spike duplicate samples will be collected for each type of analysis.

5.44 Record the time and date that the samples were taken and by whom on the label and put the bottle in a cooler containing frozen blue ice.

5.45 Record sample specifics in the Sample Collection Logbook and Chain of Custody Form.

5.46 Send the samples to a laboratory within 24 hours. (Refer to Sample Submission SOP- GP007 for more instructions).

6.0 Calculations

6.1 *Calculating well casing water volume*

6.1.1

$$CWV = \frac{\pi d^2 h}{77.01}$$

where: CWV = Casing water volume of the well expressed in gallons ($1 ft^3 = 7.48$ gallons);

π = 3.14;

d = Diameter of the well casing expressed in inches; and
h = Total depth of the water column in the well in feet (well depth-static water level, see Static Water Level Determination SOP # SP006)

6.1.2 Example:

6.1.2.1 If Diameter of the well casing = 6 inches
Depth of well = 550 feet
Static water level = 50 feet

6.1.2.2 Then d = 6
h = (550 – 50) = 500

6.1.2.3 And $CWV = \frac{3.14 \times (6)^2 \times 500}{77.01}$

$= \frac{3.14 \times 36 \times 500}{77.01}$

$= \frac{56{,}520}{77.01}$

= 734 gallons

6.2 *Calculate total purge volume*

6.2.1 Purge volume (PV) = 3 x CWV (casing water volume)

6.2.2 Example:

6.2.2.1 If CWV = 734 gallons (*6.1.2.3*)

6.2.2.2 Then PV = 3 x 734 gallons

= 2202 gallons

6.3 *Determine pumping flow rate*

6.3.1 $\text{Flow Rate (gallons/minute)} = \frac{\text{Volume of bucket (gallons)}}{\text{Average time to fill bucket (seconds)}} \times \frac{60 \text{ seconds}}{1 \text{ minute}}$

6.3.2 Example:

6.3.2.1 If Volume of bucket = 5 gallons
Avg. time to fill bucket = 50 seconds

6.3.2.2 Then Flow Rate = $\frac{5 \text{ gallons}}{50 \text{ seconds}} \times \frac{60 \text{ seconds}}{1 \text{ minute}}$

= $\frac{300 \text{ gallons}}{50 \text{ minutes}}$ = 6 gallons/minute

6.4 *Estimating Purge Time*

6.4.1 Purge Time (minutes) = $\frac{\text{Purge Volume (gallons) } (6.2)}{\text{Pumping Flow Rate (gallons/minute) } (6.3)}$

6.4.2 Example:

6.4.2.1 If Purge Volume = 2,202 gallons (*6.2.2*)
Flow rate = 6 gallons / minute (*6.3.2.2*)

6.4.2.2 Then Purge Time = $\frac{2202}{6}$

= 367 minutes x $\frac{1 \text{ hour}}{60 \text{ minutes}}$

= 6 hours 7 minutes

7.0 Bibliography

7.1 *U.S. EPA Region 9 Laboratory Field Sampling Guidance* Document #1220.
7.2 *Guidance for Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents*. November, 1995 (EPA QA/G-6).