# Residential Well Sampling QA/QC Work Plan

# Dimock Residential Groundwater Site

# Dimock, Susquehanna County, Pennsylvania
# TDD No: TL01-11-12-001
# Contract No: EP-S3-10-04

January 9, 2012

EPA Region III

***START IV - West***

Superfund Technical Assessment and Response Team

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# Sampling QA/QC Work Plan
# Dimock Residential Groundwater Site
# Dimock, Susquehanna County, Pennsylvania

Prepared for:

U.S. Environmental Protection Agency
Region III
Philadelphia, PA

| | |
|---|---|
| EPA Contract No. | : EP-S3-10-04 |
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| EPA Work Assigner | : Richard Fetzer |
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| Prepared by | : TechLaw, Inc. |

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## 1.0 INTRODUCTION

On December 19th, 2011, EPA Region III On-Scene Coordinators (OSC) Richard Fetzer tasked TechLaw, Inc. (TechLaw) Superfund Technical Assessment and Response Team (START) to perform a removal site evaluation at the Dimock Residential Groundwater Site (site) located at or near Pennsylvania (PA) Route 29 in Dimock, Susquehanna County, Pennsylvania. The purpose of the assessment is to provide information to EPA to assist in determining if residential home wells have been impacted by nearby gas well installation and development activities. Sampling activities will include the collection of residential home well groundwater samples and surface water samples. These sampling activities will be conducted under Technical Direction Document (TDD) No. TL01-11-12-001, START Contract No. EP-S3-10-04.

## 2.0 SITE DESCRIPTION

The Dimock Residential Groundwater Site is located in the rural community of Dimock Township in northeastern Pennsylvania (pop. 1,497 – 2010 Census). Degradation of drinking water and surface water quality from contamination claimed to be associated with Marcellus shale drilling and hydraulic fracturing (a.k.a. fracking) operations has been reported by local private well owners. Privately owned wells constitute the primary source of drinking water for residents in the area. Drilling and production activities involving deep shale gas extraction is prevalent throughout Susquehanna County.

The site includes affected and potentially affected media, namely ground water and surface waters, in the rural area surrounding the intersection of State Route 29 and County Route 2024 in Dimock Township. The coordinates for this location are 41.746411 north latitude, 75.898498 west longitude. Surface waters in the area enter tributaries of Burdick Creek located east/southeast from the site. Burdick Creek flows to Meshoppen Creek also located east/southeast from the site. Meshoppen Creek flows southwest and confluences the Susquehanna River at Meshoppen, PA. Surface water impoundments and/or ponds and lakes are observed in aerial photos to be present near the site. Topographic relief in the vicinity of the site is approximately 400 feet ranging from approximately 1,100 feet to 1,500 feet above mean sea level (amsl). The site is located within the glaciated low plateaus section of the Appalachian Plateaus Province. Surficial bedrock is comprised of the Devonian Catskill Formation having sandstone, siltstone, shale, mudstone and conglomerate lithology.

The Pennsylvania Ground Water Information System database (PAGWIS) identifies 44 ground water withdrawal wells within a 2-mile radius of the site, although more wells are likely to be present. Most of the wells recorded in the PAGWIS are used for domestic purposes. Depths of 19 of these wells are recorded ranging from 125 to 700 feet deep with a median depth of about 250 feet. Yields from 42 of the wells are recorded as ranging from 1-50 gallons per minute (gpm) with a median yield of 13.7 gpm.

## 3.0 BACKGROUND

Since 2009, the site has received widespread publicity beginning with reports of methane migration into local domestic water supplies following Marcellus Shale drilling

operations in the area. Ground water sampling activities have also identified the presence of other organic and inorganic contaminants in the private-use wells which may potentially be associated with nonconventional deep shale drilling activities. The origin of the contaminants has not been fully determined.

## 4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

EPA On-Scene Coordinator Richard Fetzer will provide overall direction to TechLaw (START) staff concerning project sampling requirements, objectives, and schedule. The START Site Leader is the primary point of contact with the EPA OSC. The Site Leader is responsible for the development and completion of the Sampling QA/QC Work Plan, project team organization, and supervision of all project tasks, including reports and deliverables.

## 5.0 PROJECT DESCRIPTION

### 5.1 Objectives

The objective of the sampling activity is:

- To assess for the presence and origin of substances that may present a threat to the health of persons ingesting, contacting or engaging in typical residential or recreational uses of groundwater or surface water. The analytical methods selected are based in part on contaminants that may be present due to the natural gas exploration, drilling or hydraulic fracturing activities located in the region.

### 5.2 Scope of Work

The scope of work includes collection of approximately forty to sixty residential home well samples in the vicinity of Dimock Township. Tap water samples will be collected at homes where access has been granted to EPA officials by property owners. Additionally, it is anticipated that as many as twelve surface water samples may be collected from nearby water bodies.

## 6.0 DATA USE OBJECTIVES

The following data quality objectives apply to this project:

| Program Area | Sampling Objective | Data Type |
|---|---|---|
| Removal | Determine presence/extent of contamination | Definitive |

# 7.0 SAMPLING APPROACH AND ANALYTICAL PARAMETERS

Table 1, Field QC and Sampling Summary and Table 2, Sample Analytical Requirements Summary, include a summary of the numbers of samples, matrices, analytical parameters/methods, quality control (QC) samples, sample preservation, holding times, and containers. Samples will be collected using certified pre-cleaned sample bottles.

## 7.1 Residential Home Wells

Residential well samples will be collected in accordance with the EPA Environmental Response Team (ERT) Standard Operating Procedure (SOP) No. 2007 (ERT, 1995). Samples are anticipated to be collected from a valve closest to the well head (wellhead sample) and from the kitchen faucet (tap sample) within each home. Inspection of the water system may be required to identify the appropriate valve sampling location and to determine if it is downstream or upstream of any treatment apparatus. A water sample will be collected from the valve closest to the wellhead first and the sample from the kitchen faucet last.

**Wellhead Sample**

1. For the sample closest to the wellhead, the spigot will first be examined to determine if it is equipped with an aerator. If the spigot is equipped with an aerator, it shall be removed before purging. A garden hose will be connected to the spigot to direct the purge water away from the home. The spigot will be allowed to purge for a target time of 1 hour. The volume of the purge water will be measured periodically using a stop watch and a large graduated cylinder or equivalent container. Once the target time of 1 hour has been reached, water quality parameters will be recorded using an YSI 556 water quality meter or equivalent that is equipped with data logging capability and flow-through cell. The flow-through cell will be connected to the spigot using a dedicated, clean adapter and flexible tubing. Additionally, water quality parameters will be measured and recorded on field data sheets at approximately 3-5 minute intervals (in addition to instrument data logging) to determine when parameters stabilize. Stabilization will be achieved after all parameters have stabilized for three consecutive readings using the following criteria:

   pH $\pm$ 0.1 unit
   Specific Conductance $\pm$ 3%
   Dissolved Oxygen $\pm$ 10%
   Oxidation Reduction Potential $\pm$ 10 mV
   Temperature $\pm$ 3%

   These criteria are initial guidelines; professional judgment in the field will be used to determine on a well-by-well basis when stabilization occurs.

2. When stabilization is achieved a dissolved gas sample will be collected first in the sequence of samples. The water quality instrument, flow-through cell and tubing

will be removed from the spigot. A new clean length of tubing will be attached to the adapter. The sample container will be submerged in a new, clean and dedicated plastic bucket containing the sample media in order to prevent exposure of the sample to the atmosphere. (See attached Isotech procedure titled "Collection of Ground Water Samples from Domestic and Municipal Water Wells for Dissolved Gas Analysis").

3. Once the dissolved gas sample is collected, the pre-made adapters will be removed and a 1-L HDPE container will be filled to perform field screening. Field measurements will consist of turbidity, alkalinity, ferrous iron, and dissolved sulfide. Turbidity (Standard Method 180.1) will be measured using a HACH 2100Q portable turbidimeter (or equivalent instrument). Alkalinity will be measured by titrating ground water with 1.6N H2S04 to the bromcresol green-methyl red endpoint using a HACH titrator (HACH method 8203, equivalent to Standard Method 23208 for alkalinity). Ferrous iron will be measured using the 1, 10 phenanthroline colorimetric method (HACH DR890 spectrometer, HACH method 8146, equivalent to Standard Method 3500-Fe B for wastewater). Dissolved sulfide will be measured using the methylene blue colorimetric method (HACH DR890 spectrometer; HACH method 8131, equivalent to Standard Method 4500-S2-D for wastewater).

4. The VOC, SVOC and remaining organic sample volumes, respectively, will be collected in sequence by directly filling the sample containers from the spigot. After collection of the organics samples, volumes for all the remaining parameters included in Table 1 shall be collected directly from the spigot. Sample volumes for bacteria analysis should be collected last, but if necessary may be moved forward in the order of collection as long as it is taken after all organic samples are collected.

5. For the total metals analysis, a 1-L HDPE container will be filled. An additional 1-L HDPE container will be filled for dissolved metals analysis. This sample will be filtered using a peristaltic pump and an in-line high-capacity (0.45 micron) filter. At least 100 ml of water will be allowed to pass through the filter before the sample is collected.

6. The sample for bacteria analysis will be collected by first using an alcohol swab/wipe to disinfect the sampling port or spigot. Two applications of alcohol will be applied to the spigot, with the first application removing the gross contamination and the second application for final cleaning of the spigot surface. The alcohol will be allowed to evaporate from the spigot surface before sampling proceeds. The spigot will be turned on to flush any residue from the spigot surface before collection of the sample occurs. During sample collection, care will be made to not touch the mouth of the bottle to the spigot.

7. At several initial sample locations, a 1-L HDPE container will be filled and field-screened for turbidity, alkalinity, ferrous iron, and dissolved sulfide to evaluate changes in water quality across the sampling period.

**Tap Sample**

1. Once the wellhead sample is collected a sample will then be collected from the kitchen faucet (tap sample). The faucet will first be examined to determine if it is equipped with an aerator, which will be removed if present. The faucet will be turned on and allowed to run for approximately 15 minutes to flush any water from within the indoor plumbing.

2. A 1-L HDPE container will be filled to perform field screening in accordance with the procedure noted in item 3 above. Field measurements will consist of turbidity, alkalinity, ferrous iron, and dissolved sulfide.

3. For all other parameters, sample volumes will be collected in similar sequence and in general accordance with the procedures outlined for well head samples stated above. Samples for dissolved gas analysis will not be collected at the tap.

4. At several initial sample locations, a 1-L HDPE container will be filled and field-screened for turbidity, alkalinity, ferrous iron, and dissolved sulfide to evaluate changes in water quality across the sampling period.

All samples will be placed on ice after collection and will be brought to the sample management trailer to be prepared for shipment to approved laboratories.

Analytical services will be coordinated through EPA and include using the EPA Regional Laboratory, the EPA Contract Laboratory Program (CLP) and/or Tier IV subcontracted laboratory services through TechLaw.

## 7.2 Surface Water Sampling

Up to twelve surface water samples will be collected from locations near the site. The surface water samples will be collected in accordance with ERT SOP No. 2013, utilizing the direct method (ERT, 1994). Surface water sample media will be collected directly into laboratory certified pre-cleaned sample bottles as specified in Table 2. All samples will be placed on ice after collection. The analyses to be conducted on the surface water samples are summarized in Table 1.

Analytical services will be coordinated through EPA and include using the EPA Regional Laboratory, the EPA Contract Laboratory Program (CLP) and/or Tier IV subcontracted laboratory services through TechLaw.

## 7.3 Sample Identification Numbers

### 7.3.1 CLP Sample Numbers

Samples to be analyzed by CLP laboratories will be assigned CLP sample numbers (Nos.) in addition to Station Location Numbers. The CLP sample Nos.

will be automatically assigned by the Forms II Lite™ software. The sample number format will be as follows:

C#### where;

C indicates that the sample is to be analyzed under a CLP organics SOW.
#### indicates numbers that will be sequentially assigned as the sample data are entered into the Forms II Lite™ program.

### 7.3.2 Station Location Numbers

Sample Station Location numbers will be assigned by the sampling team to correspond with the location and the type of sample collected. The sample station location No. format will be as follows:

XX##-PF, where XX is:

RW = a ground water sample from a Dimock residential well
SW = a surface water sample
TB = trip blank
FB = field blank
EB = equipment blank
F = indicates a sample is filtered for metal analysis
P = indicates a post filtration sample

and where ## is:

## = the unique identifier for each residential well sampled. This identifier will be related in a separate database to the specific residence being sampled.

### 7.3.3 DAS Sample Numbers

Samples to be analyzed under the Delivery of Analytical Services (DAS) program will receive a DAS sample number in addition to the station location numbers. Samples analyzed by the EPA OASQA laboratory are under the DAS program. The DAS sample number will be assigned as follows:

R3###-##, where:

R3### = the Region-assigned DAS project number; and
-## = the sequential number of the sample as collected.

## 7.4 Sampling Equipment and Decontamination

Dedicated, disposable sampling equipment will be used by TechLaw whenever possible.

### 7.5 Investigation Derived Wastes

TechLaw field team members will make every effort to minimize the generation of investigation-derived wastes (IDW) throughout the field event. Purge water for residential home well samples will be discharged in accordance with the Groundwater Monitoring and Maintenance Manual (PADEP, 2001). Disposable personal protective clothing and/or any sampling equipment generated during field activities will be bagged in opaque plastic garbage bags, and disposed of appropriately.

## 8.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PROCEDURES

### 8.1 Quality Control of Field Activities

The START Site Leader is responsible for ensuring that sample quality and integrity are maintained in accordance with the QA/QC Procedures, and that the sample labeling and documentation is performed as described in Section 8.2 of this sampling plan.

### 8.2 Sample Documentation

All sample documentation will be completed legibly using indelible black or blue ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing and dating the error.

At each sampling location GPS coordinates will be collected using a GPS unit. These coordinates are to be recorded on the field data sheet or in the field logbook. The field data sheet will be used to document pertinent field screening measurements and sample information. Photographs of each house and each sampling spigot/faucet will be collected. The date and time stamp option will be selected (if available) on each camera. The data logging option (if available) will be selected on each water quality instrument used.

#### 8.2.1 Field Logbook

The use of field logbooks by START for site documentation will be consistent with TechLaw SOP 03-01-04, Maintaining a Field Logbook (TechLaw, 2011a). The field logbook is a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed. All entries will be dated and signed by the individual making the entries, and include (at a minimum) the following:

1. Site name and project number.
2. Name(s) of personnel on site.
3. Dates and times of all entries (military time preferred).
4. Descriptions of all site activities, including site entry and exit times.
5. Noteworthy events and discussions.
6. Weather conditions.
7. Site observations.
8. Identification and description of samples and locations.
9. Subcontractor information and names of on-site personnel.

10. Date and time of sample collections, along with chain of custody information.
11. Record of photographs.
12. Site sketches.

### 8.2.2 Sample Labels/Tags QC

Sample labels and tags must clearly identify the particular sample. Required information for sample labels and tags is presented in *Contract Laboratory Program Guidance for Field Samplers*, EPA Publication 540-R-09-03, Final (January 2011) and is provided below.

Sample bottle labels must include the following information:

1. Sample number, as applicable;
2. Case No.;
3. Preservative(s);
4. Analysis/fraction.

Additional information may be included on the label, such as the Station Location (Sampler-assigned sample No.), date and time collected, etc.

Sample tags must include the following information:
1. Sample number, as applicable;
2. Case No.;
3. Station No. and/or Station Location No. (assigned by sampler);
4. Date sample was collected (month, day, and year);
5. Time sample was collected (in military time);
6. Preservative, if any (specify "None" if sample is not preserved);
7. Type of sample (grab or composite);
8. Analysis/fraction requested;
9. Sampler's names/signature(s);

Sample labels will be securely affixed to the sample container. Tie-on sample tags will be properly secured around the neck of the container.

### 8.2.3 Chain of Custody Record QC

Proper chain of custody will be maintained from the time the sample is collected to its final deposition. Every transfer of custody will be noted and signed. When samples (or groups of samples) are not under direct control of the individual responsible for them, they will be stored in a locked container sealed with a Custody Seal.

The Chain of Custody record/EPA Traffic Report (COC/TR) will include (at minimum) the following information:

1. Sample number, as applicable;
2. Case No.;

3. Sample matrices;
4. Specify sample type (grab or composite);
5. Analyses requested;
6. Laboratory turnaround time (TAT) [*Note: This does not include the TAT for data validation. If preliminary results (PR) are required, this must be specified on the COC.*)
7. Preservative(s);
8. Station location identifier (sampler assigned sample No.);
9. Date and time sample collected;
10. Field QC information (identify trip/field/blanks only as "Field QC");
11. Specify samples to be used for laboratory QC (MS/MSD);
12. Name(s) and signature(s) of sampler(s);
13. Signature(s) of any individual(s) with control over samples;
14. Carrier, air bill No., and date of the shipment.

#### 8.2.4 Custody seals QC

Custody seals will be used on all shipping containers used to ship samples. Custody Seals demonstrate that a container has not been tampered with or opened. The individual shipping the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook. EPA Region III does not require custody seals on individual sample containers and has specifically directed samplers not to use custody seals on individual sample containers containing samples for volatile organics analysis (VOA).

### 8.3 Sample Packaging, Storage, and Shipping

In accordance with TechLaw SOP 04-02-01, Packaging and Shipping Samples – Environmental Procedures (TechLaw, 2011b), and *Contract Laboratory Program Guidance for Field Samplers*, sample containers will be labeled and shipped with a label and sample tag affixed to each container. Samples will be placed in plastic zipping bags. Bagged containers will be placed in appropriate transport containers and the containers will be packed with appropriate absorbent material and bubble wrap. All sample/traffic reports/COC documents will be affixed to the underside of each transport container lid. The lid will be sealed with shipping tape and custody seals affixed to the transport container. Transport containers will be labeled with the origin and destination locations. Regulations for packaging, marking, labeling, and shipping of hazardous materials and wastes are promulgated by the U.S. Department of Transportation (DOT). Air carriers which transport hazardous materials, in particular, Federal Express, require compliance with the current International Air Transport Association (IATA) Regulations, which apply to the shipment and transport of hazardous materials by air carrier. TechLaw will follow IATA regulations to ensure compliance.

### 8.4 Field QC Samples

Field QC will consist of one field duplicate for every ten field samples, or one per matrix if fewer than ten are collected. Duplicate samples will be documented in the Field Activities Logbook and on the Traffic Report (TR)/COC. The field duplicate will test the reproducibility of sampling procedures and analytical procedures. A trip blank will be collected and included in all coolers shipped that contain samples for VOC and dissolved gas analyses. A field blank will be collected to ensure the cleanliness of sample containers and to ensure that no cross-contamination has occurred during sample collection, preservation, and shipment, as well as in the laboratory. An equipment blank will be collected each day from the in-line filter which is used to collect samples for the dissolved metals analysis.

### 8.5 Laboratory QC

Laboratory QC will be in accordance with the method requirements.

### 8.6 Data Validation

Analytical data generated by the EPA OASQA laboratory will be reviewed and validated in accordance with OASQA standard procedures. Other analytical data for organic analyses generated under this Sampling QA/QC Work Plan will be evaluated in accordance with EPA *Region III Modifications to National Functional Guidelines for Organic Data Review Multi-Media, Multi-Concentration (OLMO1.0-OLMO1.9)* (September 1994) to Data Validation Level M2, and in accordance with *EPA Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (April 1993) at the IM2 Level. Validation for the analytical services subcontract arranged through TechLaw will be requested through the EPA ESAT contractor.

## 9.0 SCHEDULE OF ACTIVITIES

The schedule for the site is projected as follows:

| Task Description | Start Date | End Date |
|---|---|---|
| Mobilize to area | 1/10/12 | 1/10/12 |
| Sample collection; sample packaging; sample shipping to laboratory | 01/11/12 | 01/30/12 |

## 10.0 DELIVERABLES

The following deliverables will be provided under this project:

**Analytical Data**

- Expedited preliminary data turnaround time (<5 days) will be provided on the following list of compounds/tests:

| | |
|---|---|
| coliform bacteria | aluminum |
| bis(2-ethylhexyl) phthalate (DEHP) | arsenic |
| ethylene glycol | lithium |
| 2-methoxyethanol (Ethylene glycol monomethyl ether) | manganese |
| methane | sodium |
| 2,2'oxybisethanol (diethylene glycol) | iron |
| triethylene glycol | |

- With exceptions listed above, preliminary unvalidated data will be provided to the EPA OSC within 15 business days after receipt of the samples at the laboratory.

- A Data Validation Report will be provided to the EPA OSC within approximately 21 days of receipt of the laboratory analytical data package by TechLaw.

- TechLaw will incorporate the validated data from this sampling event into a Trip Report and/or After Action Report for the project.

## 11.0 REFERENCES

EPA, 2011. U.S. Environmental Protection Agency, *Contract Laboratory Program (CLP) Guidance for Field Samplers, Final*, Office of Solid Waste and Emergency Response (OSWER) publication EPA540-R-07-006, Washington, D.C. January.

ERT, 1994. U.S. Environmental Protection Agency Environmental Response Team. Standard Operating Procedure for Surface Water Sampling, SOP# 2013. January 26.

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Isotech, 2011. Isotech Laboratories, Inc., Collection of Ground Water Samples from Domestic and Municipal Water Wells for Dissolved Gas Analysis, Website Accessed December 2011: < http://www.isotechlabs.com/customersupport/samplingprocedures/DGbottle.pdf>

PADEP, 2001. Pennsylvania Department of Environmental Protection, *Groundwater Monitoring Guidance Manual,* Document number 383-3000-001, dated January 1st, 1999, revised December 1st, 2001.

TechLaw, 2011a. TechLaw, Inc., Standard Operating Procedures, *Field Documentation Procedures - Maintaining a Field Logbook, 03-01-04*, Chantilly, VA. March.

TechLaw, 2011b. Standard Operating Procedures, *Packaging and Shipping Samples-Environmental Procedures, 04-02-01,* Chantilly, VA. March.

**TABLE 1 - 01/20/12**
**FIELD AND QC SAMPLING SUMMARY**
**DIMOCK RESIDENTIAL GROUNDWATER SITE**
**DIMOCK, SUSQUEHANNA COUNTY, PENNSYLVANIA**

| Parameter/Method | Matrix | Field Samples | QC Sample Summary | | | | | Total Field and QA/QC Analyses (not including MS/MSD)[4] |
|---|---|---|---|---|---|---|---|---|
| | | | Dup | Trip[1,2] Blanks | Field[1,3] Blanks | Equip[1] Blanks | MS/MSD | |
| EPA R2 Lab | | | | | | | | |
| **Methylene Blue Active Substances (MBAS)** (SM 5540C) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| EPA R3 Lab | | | | | | | | |
| **Anions:** Chloride, Bromide, Fluoride, Orthophosphorus as P, Sulfate as SO4 (300.0) | drinking water | 60 | 6 | - | 5 | - | 7 | 71 |
| **Glycols incl. 2-Butoxyethanol** (Modified 8321) | drinking water | 60 | 6 | - | 5 | - | 4 | 71 |
| **Metals Dissolved:** Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Na, Ni, Sb, Se, Sn, Sr,Ti, Tl, U, V, Zn (200.7/200.8/245.1) | Filtered drinking water | 60 | 6 | - | - | 5 | 7 | 71 |
| **Metals:** Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Na, Ni, Sb, Se, Sn, Sr,Ti, Tl, U, V, Zn (200.7/200.8/245.1) | drinking water | 60 | 6 | - | 5 | - | 7 | 71 |
| **Semi-Volatiles** (TCL plus TICs) (OLC03.2) | drinking water | 60 | 6 | - | 5 | - | 4 | 71 |
| **Solids, Total Dissolved** (TDS) (SM 2540C) | drinking water | 60 | 6 | - | 5 | - | 7 | 71 |
| **Solids, Total Suspended** (TSS) (SM 2540D) | drinking water | 60 | 6 | - | 5 | - | 7 | 71 |
| **Volatiles + Acrylonitrile** (TCL + TICs) (OLC03.2) | drinking water | 60 | 6 | 1 | 5 | - | 4 | 71 |
| **Wet Chemistry:** - Phosphorus, Total (365.4); - Nitrate/Nitrite (353.2); - Nitrogen; Total (353.2) | drinking water | 60 | 6 | - | 5 | - | 7 | 71 |
| **Oil & Grease (HEM)** (1664A) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Alcohols:** Ethanol, methanol, 1-propanol, 1-butanol, 2-butanol (8015D) | drinking water | 60 | 6 | - | 5 | - | 4 | 71 |
| EPA R9 Lab | | | | | | | | |
| **Dissolved Gases, Methane, Ethane, Ethene, Propane, Butane** (RSK-175, or equiv - EPA R9 SOP 325) | drinking water | 60 | 6 | 1 | 5 | - | 4 | 71 |
| **DRO** (8015M, or equiv-EPA R9 SOP 385) | drinking water | 60 | 6 | - | 5 | - | 4 | 71 |
| **GRO** (8015M, or equiv-EPA R9 SOP 380) | drinking water | 60 | 6 | - | 5 | - | 4 | 71 |
| NAREL | | | | | | | | |
| **Alpha Spec ( Th-228, Th-230, Th-232)** (DOE HASL 300) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Alpha Spec (U-234, U-235, U-236, U-238)** (DOE HASL 300) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Gamma Spec** Bi-212, Bi-214, K-40, Ra-226, Ra-228, Th-232, Th-234, U-234, U-235, U-238 (901.1) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Gross Alpha/Beta** (900.0) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Ra-226** (903.1) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Ra-228** (904.0) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| Tier IV | | | | | | | | |
| **Ethylene Glycol** (8015M) | drinking water | 60 | 6 | - | 5 | - | 4 | 71 |
| **Bacteria (fecal & total coliform, HPC)** (SM 9222B; SM 9215B w/R2A medium) | drinking water | 60 | 6 | - | 5 | - | - | 71 |
| **Isotech** - d13C and d2H of methane; - Complete compositional analysis of headspace gas; - Stable isotopes of water (O,H) | drinking water | 18 | 2 | - | - | - | - | 20 |

Notes:

1. This QA sample will be an aqueous matrix.
2. Trip blank samples will be collected at a rate of 1 per VOA and 1 per RSK-175 cooler per day
3. Field blank samples will be collected at a rate of 1 per day
4. Estimate based on 5 sampling days

Key:

Bkgd = Background
MS/MSD = Matrix Spike/Matrix Spike Duplicate
CRQL = Contract-Required Quantitation limit.
QA/QC = Quality assurance/quality control
Dup = Duplicate

**TABLE 2 - 01/20/12**
**SAMPLE ANALYTICAL REQUIREMENTS SUMMARY**
**DIMOCK RESIDENTIAL GROUNDWATER SITE**
**DIMOCK, SUSQUEHANNA COUNTY, PENNSYLVANIA**

| Analytical parameter and Method | Matrix | Sample Preservation | Holding Time (Days) | Sample Container(s) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Qty | Vol (ml) | Bottle Type | Comments |
| EPA R2 Lab | | | | | | | |
| **Methylene Blue Active Substances (MBAS)**<br>(SM 5540C) | drinking water | Ice, 4°C | 2 | 1 | 500 | HDPE | |
| EPA R3 Lab | 0 | | | | | | |
| **Anions:**<br>Chloride, Bromide, Fluoride, Orthophosphorus as P, Sulfate as SO4<br>(300.0) | drinking water | Ice, 6°C | 28 | 1 | 500 | HDPE | |
| **Glycols incl. 2-Butoxyethanol**<br>(Modified 8321) | drinking water | Ice, 6°C | 7 | 1 | 40 | Glass Vial | No Headspace |
| **Metals Dissolved:**<br>Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Na, Ni, Sb, Se, Sn, Sr,Ti, Tl, U, V, Zn<br>(200.7/200.8/245.1) | Filtered drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 500 | HDPE | |
| **Metals:**<br>Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Na, Ni, Sb, Se, Sn, Sr,Ti, Tl, U, V, Zn<br>(200.7/200.8/245.1) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 500 | HDPE | |
| **Semi-Volatiles (TCL plus TICs)**<br>(OLC03.2) | drinking water | Ice, 6°C | 7 | 2 | 1000 | Amber Glass | Teflon Lined Lids |
| **Solids, Total Dissolved (TDS)**<br>(SM 2540C) | drinking water | Ice, 6°C | 7 | 1 | 500 | HDPE | |
| **Solids, Total Suspended (TSS)**<br>(SM 2540D) | drinking water | Ice, 6°C | 7 | 1 | 500 | HDPE | |
| **Volatiles + Acrylonitrile (TCL + TICs)**<br>(OLC03.2) | drinking water | 2 drops of 1:1 HCl, pH<2, Ice, 6°C | 14 | 4 | 40 | Glass Vial | Teflon Lined Lids No Headspace |
| **Wet Chemistry:**<br>- Phosphorus, Total (365.4);<br>- Nitrate/Nitrite (353.2);<br>- Nitrogen; Total (353.2) | drinking water | pH<2, H2SO4, and cool with ice, 4°C | 28 | 1 | 500 | HDPE | |
| **Oil & Grease (HEM)**<br>(1664A) | drinking water | pH<2, H2SO4, and cool with ice, 4°C | 28 | 1 | 1000 | WM Amber Glass | Teflon Lined Lids |
| **Alcohols:**<br>Ethanol, methanol, 1-propanol, 1-butanol, 2-butanol<br>(8015D) | drinking water | Ice, 6°C | 7 | 2 | 40 | Glass Vial | Teflon Lined Lids No Headspace |
| EPA R9 Lab | 0 | | | | | | |
| **Dissolved Gases, Methane, Ethane, Ethene, Propane, Butane**<br>(RSK-175, or equiv - EPA R9 SOP 325) | drinking water | pH<2 with HCl and cool with ice, 4°C | 7 | 2 | 40 | Glass Vial | |
| **DRO**<br>(8015M, or equiv-EPA R9 SOP 385) | drinking water | Ice, 4°C | 7 (1) | 2 | 1000 | Amber Glass | Teflon Lined Lids |
| **GRO**<br>(8015M, or equiv-EPA R9 SOP 380) | drinking water | pH<2 with HCl and cool with ice, 4°C | 14 | 2 | 40 | Glass Vial | Teflon Lined Lids No Headspace |
| NAREL | 0 | | | | | | |
| **Alpha Spec ( Th-228, Th-230, Th-232)**<br>(DOE HASL 300) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 1000 | HDPE | |
| **Alpha Spec (U-234, U-235, U-236, U-238)**<br>(DOE HASL 300) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 1000 | HDPE | |
| **Gamma Spec**<br>Bi-212, Bi-214, K-40, Ra-226, Ra-228, Th-232, Th-234, U-234, U-235, U-238<br>(901.1) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 1000 | HDPE | |
| **Gross Alpha/Beta**<br>(900.0) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 1000 | HDPE | |
| **Ra-226**<br>(903.1) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 1000 | HDPE | |
| **Ra-228**<br>(904.0) | drinking water | pH<2 with HNO3 and cool with ice, 4°C | 180 | 1 | 1000 | HDPE | |
| Tier IV | 0 | | | | | | |
| **Ethylene Glycol**<br>(8015M) | drinking water | Ice, 4°C | 7 | 2 | 40 | Glass Vial | Teflon Lined Lids No Headspace |
| **Bacteria (fecal & total coliform, HPC)**<br>(SM 9222B; SM 9215B w/R2A medium) | drinking water | Ice, 4°C (.008% Na2S2O3 if residual Cl- present) | 0.25 | 1 | 125 | Pre- Sterilized Poly | |
| **Isotech**<br>- d13C and d2H of methane;<br>- Complete compositional analysis of headspace gas;<br>- Stable isotopes of water (O,H) | drinking water | Ice, 4°C, biocide pill in sample container | 180 | 1 | 1000 | ClearHDPE | |

KEY:

| | | |
|---|---|---|
| °C = degrees Celsius | HN03 = Nitric Acid | Sr = Strontium |
| CLP = Contract Lab Program | HPC = Heterotrophic Plate Count | TCL = Target Compound List |
| CLP = Contract Lab Program | ml = milliliter | TICs = Tentatively Identified Compounds |
| D2H = delta of deuterium | Na2S2O3 = Sodium Thiosulfate | ug/L = micrograms per liter |
| H2SO4 = Sulfuric Acid | pH = potential Hydrogen | (1) Days to extract |
| HDPE = High density polyethylene | QL = Quantitation Limit | |

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# Collection of Ground Water Samples from Domestic and Municipal Water Wells for Dissolved Gas Analysis

These instructions are based on sampling protocol created by Anthony Gorody, adopted by the Colorado Oil and Gas Conservation Commission, and are reproduced here with their permission.

The basic technique is to fill a white 5 gallon bucket with source water and then fill the 1 liter sample collection bottle fully immersed in the bucket.

When sampling from a pressurized water system, it is recommended to use an outdoor spigot or other source which bypasses any water treatment systems (i.e. water softeners, etc.).

**To collect a sample for isotopic and chromatographic analysis from water that is not effervescent, using 1L bottle with septum cap:**

After purging the well, fill the 5 gallon bucket with water. Attach a nozzle and 12" length of ¼ inch diameter tubing to the end of the 5/8 inch hose connected to a faucet. Make sure that the flow rates through the tubing are low. Remove the cap of the 1 L bottle and fill it with water. Once the bottle filled, immerse it in the 5 gallon bucket full of water, keeping the tubing at the bottom of the bottle. Place the bottle at the bottom of the bucket under a head of water, and keep water flowing at a low rate until another 2 volumes of water have been displaced from the bottle. Then slowly lift the tubing out of the bottle and immediately cap it under water. No air should be allowed into the 1 L bottle. When finished, tape the cap to the bottle around the neck, pack the bottle upside down in ice, and ship it overnight.

**To collect a headspace gas sample from an effervescent water well:**

Fill the bottle with water. Submerge the bottle into the 5 gallon bucket filled with well water and invert it. Insert the ¼ inch tubing into the bottle, increase the flow rate to 2-3 gpm and allow the bubbling gases to displace water in a headspace until 1/4 to 1/2 of the water in the bottle has been displaced. Seal the container under water with the septum and screw cap, tighten it securely. When finished, tape the cap to the bottle around the neck, pack the bottle upside down in ice, and ship it overnight.

Please note Isotech's receiving hours of **Monday thru Friday** 8:00 am to 4:30 pm.
Ship samples to:

Isotech Laboratories, Inc.
1308 Parkland Court
Champaign, IL 61821

These instructions have been provided to simplify the collection of samples for dissolved gas analysis. Although we try to foresee and avoid problems in the field, it is never possible to predict every situation. If you encounter any difficulties, or if any additions or changes in these instructions would be beneficial, please let us know. Isotech Laboratories, Inc. makes no warrantee as to the applicability and/or safety of the procedures described herein.



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