Stream Monitoring Protocols

For Gas Drilling

Watchdog Program

Protocols developed with partial assistance from the

C-SAW Technical Assistance Program

Protocol development and technical assistance provided by:

Alliance for Aquatic Resources Monitoring, PA Trout Unlimited, Delaware Riverkeeper Network, US Geological Survey, and Delaware River Basin Commission

Version 3 (June 2011)

Basics about Chloride (Cl^-)

Chloride (the ionic form of chlorine) is one of the most common chemicals found in water. When salts, such as sodium chloride (table salt) dissolve, the ions Na^+ and Cl^- enter solution. Depending on the underlying geology, a certain amount of chloride will naturally be present in groundwater and surface water. In Pennsylvania, groundwater typically has chloride concentrations lower than 25 mg/L. Concentrations in surface water can be higher than this amount, and can show wide seasonal variations. In the Upper Delaware, volunteer monitors have documented chloride levels in small headwater streams to be in the 20-50 mg/l range for most streams monitored year-round – indicating healthy freshwater conditions. In contrast, gas well waste fluids (flowback water) can contain over 150,000 mg/L of chloride and other salts, often being up to five times saltier than seawater. Elevated chloride levels are not a surefire indication of fracking fluid pollution but they are a good indicator to use to determine if drilling pollution may be present. High chlorides in streams could also be caused by road salt, community wastewater from water treatment, agricultural and stormwater runoff, or a variety of industrial pollutants.

Exposure to high concentrations of chloride is directly toxic to fish, macroinvertebrates and aquatic plants that live in streams as it disturbs their ability to regulate their body's normal functions and osmoregulation. Most freshwater life depends on a consistent ionic pressure as their bodies cannot adapt to significant changes or fluctuations in the salinity of their environment. Monitoring chloride levels is useful because it is a quick, low-cost test that can alert us to possible contamination by other serious pollutants that might be present with the chloride.

PA DEP and EPA drinking water standard for chloride at the point of water intake is 250 mg/L. In 1988, EPA recommended an ambient chloride standard for streams to protect aquatic life as "except possibly where a locally important species is very sensitive, freshwater aquatic organisms and their uses should not be affected unacceptably if-the four-day average concentration of dissolved chloride, does not exceed 230 mg/L more than once every three years on the average and if the one-hour average concentration does not exceed 860 mg/L more than once every three years on the average. Due to gas drilling impacts, a chloride standard for streams was proposed by PADEP in 2010 but it was not adopted.

The LaMotte Chloride Test Kit uses a sophisticated chemical reaction to measure the amount of chloride in a sample. First, the sample is spiked with a solution containing chromate (Chloride Reagent #1), then a silver nitrate solution (Chloride Reagent #2) is slowly added to the sample. Both chloride and chromate can bond with silver to form insoluble precipitates, but chloride has a much stronger desire to do so. In fact, so long as any un-bonded chloride is present, no chromate will bond with the silver. Thus, when silver chromate begins to form, we know that all the chloride in the sample has reacted. Since silver chromate has a distinctive red color, it is easy to tell when this point has been reached. And since a known amount of silver nitrate was added, we can tell how much chloride was present in the original sample. This procedure, the Argentometric Method (from the Latin word for silver, argentium), is recognized by scientists around the world for its accuracy and precision.

LaMotte Chloride Test Kit Protocol (Code 4503-DR-01)

Equipment in Kit:

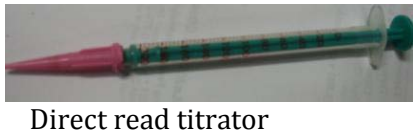

Test tube


Phenol. indicator


Sulfuric acid


Reagent #1

Reagent #2


Direct read titrator

Additional 20 mL test tube and 1 mL plastic syringe provided for potential dilutions needed during a pollution event.

Step-by Step Protocol:

Protect yourself and the environment- *Be sure to wear Personal Protective Equipment – plastic gloves and eye goggles – when handling chemicals in this test kit. Collect waste in sealed plastic bottle for proper disposal.*

1. Rinse the test tube with sample water three times.
2. Fill the test tube (LaMotte Code 0778) to the 15 mL line with the sample water.
3. Add one drop of Phenolphthalein Indicator, 1% (LaMotte Code 2246). If the solution remains colorless, proceed to step 4. If the solution turns a pink color, add Sulfuric Acid, 0.5 N (LaMotte Code 6090) one drop at a time, mixing after each drop, until the pink color disappears.
4. Add three drops of Chloride Reagent #1 (LaMotte Code 4504). Cap and swirl to mix the solution. It will turn yellow.
5. Fill the Direct Reading Titrator (LaMotte Code 0382), the syringe, with Chloride Reagent #2 (LaMotte Code 4505DR). Do this by sticking the Titrator in the opening of the reagent bottle, tipping the bottle upside down, and pulling the plunger of the syringe until the plunger line hits the zero line on the syringe. Be sure to remove any air bubbles from the titrator by pushing the reagent back into the bottle with the plunger until no air bubbles exist. Put the bottle back right side up and take out the Titrator. Insert the Titrator in the center hole of the test tube cap. (See next page for diagram of how to read titrator.)
6. While gently swirling the tube, slowly press the plunger on the Titrator to add Chloride Reagent #2 one drop at a time, until the yellow color changes to orange brown.

Finding the titration end point

The test tube on the left is properly titrated to the end point (orange brown color). The sample on the right is over-titrated (too dark and red in color).

7. Read the test result directly from the scale where the large ring on the titrator meets the titrator barrel (see next page). Each line on the titrator is equal to 4 ppm. Record result on datasheet as ppm Chloride.

NOTE: If the plunger line reaches the bottom line on the Titrator scale (200 ppm) before the endpoint color change occurs, rinse of the tip of the titrator and then refill the Titrator and continue the titration. When recording the test result, be sure to include the original amount of reagent dispensed (200 ppm).

8. Since the reagents and indicators contain hazardous ingredients, pour the solution in a plastic container that will not leak (like a soda bottle marked hazardous). Store it until it can be sent to appropriate hazardous waste drop off events for proper processing.

9. Rinse the test tube with distilled water. Rinse the titrator with distilled water (inside and out) but do not take the titrator apart to do this. A small amount of distilled water can be poured in the 20 mL test tube and then can be taken up with the titrator plunger and rinsed out three times. Allow the kit to dry before storage.

High Chloride Readings – Dilution Instructions

***It is important to follow through with a dilution if it appears there is extremely high readings based on your first test as high readings could indicate a pollution event and documentation of this high reading will be very important to be able to provide to agencies for proper response and documentation.*

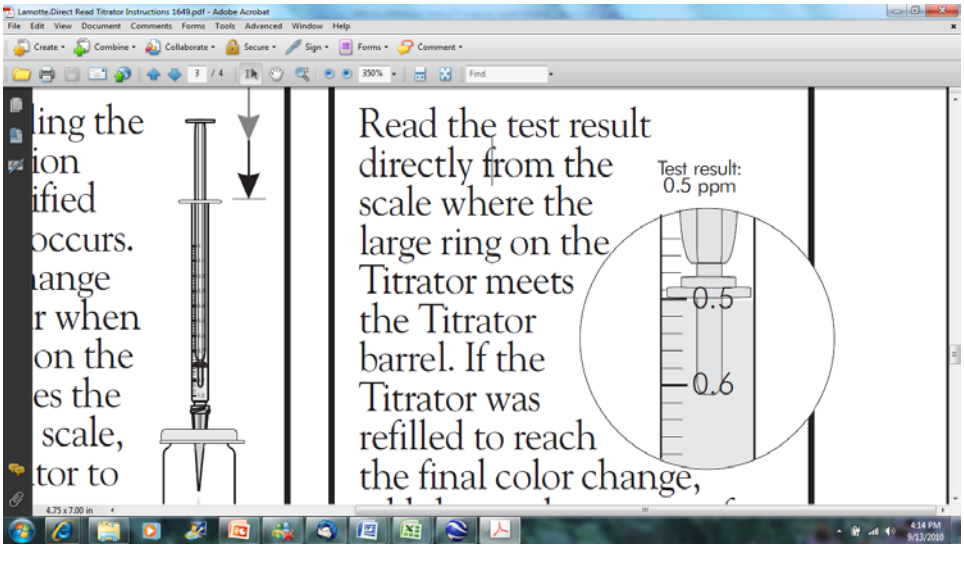
For high chloride readings, the sample must be diluted to bring it within an appropriate range for titration. For example, 1 mL of sample water can be diluted in 20 mL of distilled water. To do this, use the plastic 1 ml syringe (provided) to add 1 ml of sample water to the 20 mL titration tube (provided). Then fill the test tube to the 20 ml mark with distilled water. Swirl to mix. This is your diluted sample.

Then fill the test tube in the chloride test (0778) to the 15 mL line with the diluted sample water and proceed with steps 3-7 above.

When you get a reading using this diluted sample, multiply the titrator reading by 20 to get the actual chloride concentration in ppm.

Note: For an even more diluted sample, you could take 1 mL of sample and add it to 100 mL of distilled water. The end reading on the titrator would then be multiplied by 100 to get the actual reading of chloride in ppm.

Reading the Direct Read Titrator:



Basics about Conductivity/ Salinity /Total Dissolved Solids

The conductivity of water is a measurement of its ability to carry an electrical current. Pure water is an extremely poor conductor, so the ability of stream water to conduct electricity is due to the presence of dissolved ions. Some of these ions, like sodium and potassium are harmless but others, like heavy metals, copper and aluminum are dangerous. Normal conductivity values for surface water range from 50 µS to 1500 µS, but the ideal range for most freshwater aquatic species is between 150 µS and 500 µS. Examining Delaware River Basin Commission data for the Upper Delaware from 2000-2004, the mean conductivity reading for 15 streams sampled (1,028 data points) was 160 µS/cm with a range from 10 µS to 600 µS. Data collected as part of this gas watchdog program begun in 2010 in the Delaware also indicates low and healthy TDS values for the streams sampled – most readings ranged from 30 µS/cm – 100 µS/cm. As you sample your stream on a regular basis, you will begin to establish natural fluctuations and typical readings for your stream. Large fluctuations could indicate pollution and can affect the aquatic life such as sensitive mayflies that have a narrow regime to regulate their cellular fluids (osmoregulation).

Conductivity is measured with a meter and a probe that contains two electrodes. The basic unit of measurement of conductivity is microsiemens per centimeter (µS/cm) or micromhos/centimeter (µmhos/cm), which are the same. A voltage is applied between the electrodes, and the voltage drop caused by the resistance of the water sample is used to calculate its conductivity. The LaMotte Tracer PockeTester tests a water sample directly for conductivity, then multiplies the reading by known conversion ratios to calculate values for salinity and total dissolved solids. It has a range of between 0 µS and 19,990 µS. Interestingly, the meter will calculate a salinity value under the assumption that chloride is the only source of salinity. Other contaminants that may be present, like dissolved metals, will affect conductivity to a different extent than chloride, so if the calculated salinity reading does not closely match the measured chloride concentration, that could indicate the presence of these pollutants. Each body of water has its own normal range of conductivity values which can be established by consistent monitoring. Any larger deviation from this range could also indicate the presence of pollutants or a spill or pollution event from gas drilling activities or other pollution source.

Due to high amounts of flowback pollution from the drilling industry and the salty nature of flowback water, PA DEP has phased in new permit limits for discharges of gas drilling wastewater. Discharge standards are 500 mg/L for total dissolved solids (TDS). All new and expanding facilities which treat gas well wastewater are to not exceed the TDS discharge limit of 500 mg/l as of late 2010.

Example readings for conductivity: Note change in units is big change in concentrations.

Solution	Conductivity
Distilled water	0.5 - 3 µS/cm
Power plant boiler water	1.0 µS/cm
Good city water	50 µS/cm
Typical freshwater Streams	150-500 µS/cm
Ocean water	53 mS/cm
Gas production waste	366 mS/cm

Conductivity – µS/cm or mS/cm - Note: 2,500 µS = 2.5 mS
Total Dissolved Solids (TDS) - ppm or ppt --- Note: 1 part per thousand (ppt) equals 1000 parts per million (ppm).
Salinity - ppm S or ppt S – Example 3.1 ppt = 3,100 ppm

Basics About Temperature

It is important to monitor temperature because it affects a variety of chemical and biological processes in streams and affects directly aquatic life. The solubility of chloride and the conductivity of water are influenced by the water's temperature; the higher the temperature, the higher the solubility and conductivity. It also affects the concentration of dissolved oxygen as warmer water holds less oxygen than colder water. Water temperature can be raised by a variety of human activities. Removing stream buffer vegetation allows in more sunlight. Constructing dams and ponds allows water to slow down and be heated up. Paving of watersheds heats up runoff before it enters the body of water. And increased amounts of sediment cause water to retain more heat. If drilling is allowed to begin in the watershed, many of these impacts from construction, improper Erosion and Sediment Controls, depletive use water withdrawals for fracking, and loss of trees and natural vegetation could impact local streams and heat up coldwater streams that are critical to survival of the fish and macroinvertebrates that live in these clean streams.

Streams in the upper Delaware watershed host healthy populations of cold water fish such as native brook trout and and native mussels including the federally listed endangered dwarf wedgemussel. The main stem Delaware River, with no dams on its entire main stem length, also boasts populations of migratory fish including American eel, American shad, alewife, and blueback herring. Diverse and healthy macroinvertebrate communities also abound in the Upper Delaware tributaries and main stem and are reliant on clean water and cool temperatures to survive. Reproduction of species can be affected if temperatures become too warm. For example, trout won't spawn if the average weekly temperature is above 55º F (13ºC), and juveniles will fail to mature in water that exceeds 66ºF (19ºC). Documenting accurate stream temperatures with the TRACER meter is critically important to protecting the diverse aquatic life of the Upper Delaware region. Other species, such as catfish and carp, will tolerate considerably warmer water and are more indicative in impoundments and downstream warm water streams and areas of the Basin.

A Thriving and Healthy Delaware River Watershed and Community….

Federal legislation established the Upper and Middle Delaware River as part of the National Wild & Scenic River Management program in 1978 in recognition of the scenic and recreational values and uses and exceptionally high water quality of this area. DRBC's Special Protection Waters (SPW) program, established in 1992 and modified in 1994, 2005 and 2008, created an anti-degradation management regime – the SPW program – to implement the objective established by the Upper Delaware Scenic and Recreational River Management Plan (Conference 1986), and the General Management Plan for the Delaware Water Gap National Recreation Area/ Middle Delaware Scenic and Recreational River (DWGNRA 1987) of preserving and protecting the exceptionally high quality of these waters. For more than three decades, the water resources of the upper and middle Delaware River have been accorded special status and protections by agencies of federal and state government. --- Patrick O'Dell, National Park Service, Potential for Development of Natural Gas Exploratory Wells to Adversely Affect Water Resources of the Delaware River Basin. November 23, 2010.

LaMotte Tracer PockeTester (Conductivity/TDS/Salinity/Temp Meter) (Code 1749)

Equipment:
Conductivity Standard (6354-L) (recommended use of 1413 µS/cm potassium chloride standard for streams)
TRACER Meter & sample cup
Distilled water rinse bottle

Battery Cap

Display

Mode Button

Calibration Button

On/Off Button

Electrodes w/Protective Shield

Example readings for conductivity:

Solution	Conductivity
Distilled water	0.5 - 3 µS/cm
Power plant boiler water	1.0 µS/cm
Good city water	50 µS/cm
Typical freshwater Streams	150-500 µS/cm
Ocean water	53 mS/cm
Gas production waste	366 mS/cm

Getting Started & Proper Meter Maintenance

The Lamotte TRACER meter costs $90 and if cared for, should last at least five years.
All new meters were soaked for several minutes in isopropyl alcohol (70%) as recommended by Lamotte Company to remove any finger prints from manufacturer assembly.

Replacement electrodes are $44 so good maintenance will increase the life of the electrodes.
Before and after storage, rinse the electrode (including the two black metal probes) in distilled water and gently shake off excess water from probe before capping. Lightly wipe the plastic part of the electrode with a clean tissue to remove excess water before longer term storage. Avoid touching the plastic or the two black probes with fingers. **NOTE**: White KCL (potassium chloride) crystals may be present in the cap or on the electrode. This is to be expected if the TRACER has been stored for any length of time. The crystals will dissolve with a light soak in tap water or they can be rinsed off with tap water. Proper rinsing with distilled water after use will help avoid crystals from forming and help keep the meter working properly.

Be sure to store the meter out of extreme temperatures. Do not store in the trunk of a hot car for example or in freezing conditions. Be sure after use, store meter in bubblewrap pouch and box to avoid damage. Standards should also be stored out of extreme temperatures and out of the sun or freezing conditions.

Calibrating the Meter Before Stream Sampling (at home)

The TRACER can be calibrated with high, middle, or low standard solutions. For purposes of freshwater stream monitoring, the 1413 µS/cm potassium chloride (mid) standard will be used to calibrate the meter. **Meter calibration should be conducted at the beginning of each sampling day for thorough quality assurance/quality control (QA/QC).** If the meter is used for multiple samples on the same day, it only needs to be calibrated once before the first sample. Lamotte manufacturer instructions recommend the meter be calibrated every 4 weeks at a minimum.

For the most accurate calibration and results, allow sufficient time for the temperature of the probe to reach the temperature of the standard before calibrating. This will be indicated by a stable temperature reading on the display of the meter.

1. Fill the sample cup to the 20 mL line with the mid-range 1,413 µS/cm potassium chloride (1.413 mS/cm) conductivity standard.

2. Remove the cap from the bottom end of the TRACER to expose the electrode. Press the ON/OFF button to turn the TRACER on. Make sure the TRACER is in conductivity measurement mode (µS displayed above 0.0 display). (You can scroll through the display modes by pressing and holding the MODE button for 3 seconds).

3. Insert the electrode into the standard solution. Tap or stir the sample with the TRACER to get rid of air bubbles.

4. Press and hold the CAL/RECALL button for approximately 3 seconds. CAL will appear and the display will flash.

5. The meter will automatically recognize and calibrate to the conductivity standard (1413 will stop flashing). The display will briefly say "SA" and "End" and then return to the measurement mode. (SA will not appear if the calibration fails.)

6. The calibration range indicator (M) will appear circled on the display.

7. Turn off the TRACER, rinse the electrode with distilled water, gently shake off the extra moisture, and replace the cap. The meter is now calibrated for the days sampling events. Do not reuse the calibration standard by pouring back into the bottle to avoid contamination of the standard. The used standard can be poured out on the ground away from the stream or down the sink. Rinse sample cup with distilled water after calibration.

Changing the Measurement Function of the Meter (Modes)

1. Turn the TRACER on.

2. Press and hold the MODE button for 3 seconds. The measurement will change. Press and hold the MODE button again and the measurement will change again. The display will begin to scroll through the units in the following order:
µS or mS (Conductivity) --- Note: 2,500 µS = 2.5 mS
ppm or ppt (TDS) --- Note: 1 part per thousand (ppt) equals 1000 parts per million (ppm).

ppm S or ppt S (Salinity) – Example 3.1 ppt = 3,100 ppm
3. Release the MODE key when the desired mode is displayed. When recording different measurements for the sample, remove the TRACER from the sample, then press the mode button to the desired mode to be sure the mode has changed and re-submerge the electrode to record the next parameter reading. The screen is small and units vary greatly - be sure to look closely to ensure you have the correct reading.

NOTE: The MODE button works also acts as a hold function when it is pressed for less than 2 seconds. If "Hold" is displayed in the lower left corner of the display, press the MODE button to turn off the hold function.

To take a Sample Measurement in the Field:

You may measure the conductivity and TDS of the water by inserting the meter directly into the stream, but it may be difficult to read the display. Therefore, if you would prefer, you can collect a water sample in a clean sample container (rinsed three times with sample water) and do the measurements when you return to streamside.

NOTE: The same sample can be used to record all three parameters (conductivity, TDS, and salinity) by scrolling through displays using the MODE button. **Temperature should also be recorded on the datasheet but record the temperature either directly from the stream or shortly after grabbing the sample to reflect the value closest the actual stream temperature.** Take the TRACER out of the sample or stream between parameter readings, then change the measurement function by pressing MODE for 2 seconds and checking the display units have changed. Then immerse the TRACER again in the sample or stream to take the next reading. For QA/QC purposes, record two readings for each parameter (ex. two readings for conductivity, two readings for TDS and two readings for salinity) on the datasheet. Then calculate the relative percent difference (RPD) to compare the replicates and record the result on the datasheet. If RPD is greater than 20%, a third reading with the meter should be completed and recorded.

1. Rinse a CLEAN sample container/bucket with sample water (stream water) three times. Be sure to take your sample from the middle of the stream channel. (alternatively you may take the readings directly from the stream channel rather than a sample container if you prefer). It is best to take a temperature reading directly from the stream if possible to reflect accurate stream temperature.

2. Fill the CLEAN sample container with the sample water. Sample depth must be greater than or equal to 1.5 inches in the sample cup so that the electrode can be submerged in the liquid.

3. Press the ON/OFF button. (8888 and then SELF CAL will appear in the display during the initial diagnostics.)

4. Remove the cap to the TRACER and immerse the TRACER electrode in the sample water. Make sure the electrode is completely submersed in the sample. Slowly rotate the TRACER to remove any air bubbles in the sample.

5. Wait for the display to stabilize (it may take several minutes because the stream sample will vary from the meter temperature – observe the temp display and when the temp stabilizes, the reading should stabilize). Record the appropriate reading on the datasheet. Press the MODE button for 3

seconds to display the next unit to measure. Wait for the reading to stabilize and then record the next result and so on. Until you have recorded conductivity, TDS, and salinity.

6. After all readings (including replicates) have been recorded, turn off the TRACER and rinse the electrode with distilled water. Gently shake off the extra moisture and replace the cap. (If done for the day, wipe the outer distilled water off of the TRACER with a clean tissue.)

If you suspect a pollution event

If you suspect a pollution event based on unusually high readings or fluctuations, retest and if similar results, **collect a stream sample to take with you for possible further testing**. This is important as pollution slugs can quickly move downstream so capturing this information immediately is important. After taking a sample, if you can, safely investigate upstream to see if you can determine where the pollution source may be originating. Contact Delaware Riverkeeper Network and appropriate agency officials (see DRN's hotline list) to report your observations and document the situation with photos if possible. Delaware Riverkeeper Network's hotline is 1-800-8DELAWARE. If after business hours, contact DRN's Monitoring Director at 610-291-1403.

To determine if the readings may be a pollution event, a good rule of thumb suggested by ALLARM is if the TDS reading is greater than 3 times the usual baseline value at a comparable streamflow, then retest to ensure an outlier and call Delaware Riverkeeper Network and the appropriate agencies to report your findings. Let the agency know that you are a trained Delaware Riverkeeper Network volunteer monitor using approved stream testing protocols, you have collected baseline data in the past for the stream and this is an unusual reading, and that you have participated in ALLARM's QAQC program to validate your monitoring techniques.

HOTLINE NUMBERS

DELAWARE RIVERKEEPER NETWORK HOTLINE:

1-800-8-DELAWARE

STATE HOTLINE NUMBERS

STATE DEPT. OF ENVIRONMENTAL PROTECTION	PHONE #
PA DEP (STATE HEADQUARTERS)	800-541-2050
NE (CARBON, LACKAWANNA, LEHIGH, LUZERNE, MONROE, NORTHAMPTON, PIKE, SCHUYLKILL, WAYNE)	570-826-2511
PADEP OIL AND GAS NORTHEAST REGION	570-321-6550
SE (BUCKS, CHESTER, DELAWARE, MONTG., PHILA, BERKS)	484-250-5900
NJ DEP (STATE HEADQUARTERS)	877-927-6337
NY DEC (STATE HEADQUARTERS	800-847-7332
DE DNREC (STATE HEADQUARTERS)	800-662-8802

NATIONAL HOTLINE NUMBERS

NATIONAL AGENCIES FOR EMERGENCY MNGMT	PHONE #
USEPA – EYES ON DRILLING HOTLINE - eyesondrilling@epa.gov	877-919-4EPA
U.S. FISH AND WILDLIFE SERVICES: DIV. OF ENV. QUALITY	800-344-9453
COAST GUARD EMERGENCY (24 HOUR)	800-424-8802
EPA- ENDANGERED SPECIES PROGRAM (PESTICIDES)	800-447-3813
EPA- OFFICE OF WATER (OWRC) (WETLANDS)	800-832-7828
EPA – SPILLS REGION 2 (NJ, NY)	212-637-3660
EPA – SPILLS REGION 3 (PA, DE)	800-438-2474

FISH AND WILDLIFE

STATE AND REGIONAL WILDLIFE RESCUE/HUMANE CENTER	PHONE #
TRI-STATE (NJ,PA,DE) MARINE MAMMAL STRANDING CENTER	609-266-0538
TRI-STATE (NJ,PA,DE) BIRD RESCUE	302-737-9543
PA GAME COMMISSION	717-787-4250
NE (CARBON, LUZERNE, PIKE, WAYNE, MONROE)	570-675-1143
SE REGION (BERKS, BUCKS, CHESTER, LEHIGH, NA, PHILA)	717-783-6526
DE FISH & WILDLIFE ENFORCEMENT (DNREC)	302-739-9913
NJ (MERCER COUNTY) WILDLIFE CENTER	609-883-6606
NJ DEP FISH/GAME/WILDLIFE ENV ACTION LINE	877-927-6337
NJ ENFORCEMENT- NORTH (HNTDN, MORRIS, WARREN, SUSSEX)	908-735-8240
NJ ENFORCEMENT- CENTRAL (BURL CO, MERCER, WARREN, MON.)	609-259-2120
NJ ENFORCEMENT- SOUTH (CAMDEN, CAPE MAY, SALEM, GLOUC.)	856-629-0555
PA FISH AND BOAT COMMISSION (STATE HQ LAW ENFORCEMENT)	717-705-7800
NE REGION LAW ENFORCEMENT (CARBON, PIKE, MONROE, WAYNE, SULLIVAN, LACKAWANNA, LUZERNE COUNTIES)	570-477-5717
SE REGION LAW ENFORCEMENT (BUCKS, BERKS, CHESTER, DELAWARE, LEHIGH, MONTGOMERY, NA, PHILA, SCHUYLKILL)	717-626-0228

SEDIMENT AND EROSION PROBLEMS / SEWAGE SPILLS AND OVERFLOWS

COUNTIES	COUNTY AGENCY	PHONE #
STATE OF DELAWARE		
KENT	DEPT OF PUBLIC WORKS- ENV	302-335-6000
NEW CASTLE	DEPT OF EMERGENCY MNGMT	302-395-2700
	DEPT OF SPECIAL SERVICES (SEWER EMERGENCY)	302-395-5700
	COUNTY ENVIRONMENTAL OPERATIONS	302-395-5710
SUSSEX (DE)	DEPT OF ENG: SEWER AND WATER (EMERGENCY)	302-855-7803
	DEPT OF ENG: ENV SERVICES	302-855-7730

STATE OF NEW JERSEY		
CAPE MAY	HEALTH DEPARTMENT- ENV	609-465-1209
	CAPE-ATLANTIC SOIL CONSERVATION DIST	609-625-3144
CUMBERLAND	OFFICE OF EMERGENCY MNGMT	856-455-8526
	CUMBERLAND-SALEM SOIL CONSERVATION DIST	856-451-2422
SALEM	CUMBERLAND-SALEM SOIL CONSERVATION DIST	856-451-2422
	DEPT OF PUBLIC HEALTH AND SAFETY	856-935-7510
GLOUCESTER	DEPT OF EMERGENCY RESPONSE	856-307-7100
	DEPT OF PUBLIC WORKS- PLANNING, ENV	856-307-6650
	GLOUCESTER CO SOIL CONSERVATION DIST	856-589-5250
CAMDEN	OFFICE OF EMERGENCY MNGMT	856-783-4808 x5420
	PUBLIC HEALTH AND SAFETY: DIV OF ENV	856-374-6000
	CAMDEN CO SOIL CONSERVATION DISTRICT	856-767-6299
BURLINGTON	DIV OF PUBLIC SAFETY: EMERGENCY MNGMT	609-261-3900
	HAZ WASTE RESOURCE RECOVERY	609-499-5200
	BURLINGTON CO SOIL CONSERVATION DISTRICT	609-267-7410
MERCER	MERCER CO SOIL CONSERVATION DISTRICT	609-586-9603
HUNTERDON	HEALTH DEPT- ENV SERVICES	908-788-1351
	OFFICE OF EMERGENCY MNGMT	908-788-1196
	HUNTERDON CO SOIL CONSERVATION DISTRICT	908-788-9466
WARREN	WARREN COUNTY SOIL CONSERVATION DIST	908-852-2579
SUSSEX (NJ)	DEPT OF HEALTH AND ENV SERVICES	973-579-0370
	DEPT OF EMERGENCY MNGMT (NAT DIST)	973-579-1884
	SUSSEX SOIL CONSERVATION DISTRICT	973-579-5074
STATE OF NEW YORK		
DELAWARE (NY)	DEPT OF EMERGENCY SERVICES	607-746-9600
	DE COUNTY HUMANE SOCIETY	607-746-3080

	DE County Soil Conservation District	607-865-7161
Sullivan	Sullivan County Soil Conservation Dist Sullivan County Dept of Emergency Services Sullivan County Dept of Public Works	845-292-6552 x101 845-794-3000 x3100 845-794-3000 x5002
Orange	Orange Co Soil Conservation Dist	914-343-1873 x3811
Ulster	Ulster Co Soil Conservation Dist	845-883-7162 x5

Sediment and Erosion Problems / Sewage Spills and Overflows

County	County Agency	Phone #
State of Pennsylvania		
Wayne	Dept of Emergency Management Wayne County Conservation District	570-253-1622 570-253-0930
Pike	Pike County Conservation District	570-226-8220
Monroe	Monroe County Conservation District Dept of Emergency Management	570-629-3060 570-992-4113
Carbon	Dept of Emergency Management Carbon County Conservation District	570-325-3097 610-377-4894 x4
Northampton	NA County Conservation District NA Emergency Mngmt Operator Dept of Public Works- Parks and Rec Div	610-746-1971 610-746-3194 x229 610-746-1975
Lehigh	Lehigh Co Emergency Services Lehigh Co Conservation Dist- Compliance	610-782-3073 610-391-9583
Schuylkill	Schuylkill County Conservation District	570-622-3742 x5

	Emergency Management Agency	570-622-3739
Berks	Berks County Conservation Dist	610-372-4657
	Dept of Emergency Services	610-374-4800
Bucks	Bucks Co Conservation District	215-345-7577
	Bucks County Health Dept	215-348-6000
	Health Dept: Environmental Engineering	215-340-8612
	Bucks County Emergency Services	215-340-8700
Montgomery	Mont Co Conservation District	610-489-4506
	Mont County Public Safety Dept	610-631-6500
Philadelphia	Office of Emergency Management	215-686-1100
	Dept of Public Health – Env. Services	215-685-7492
	Public Animal Care and Control Assoc.	267-385-3800
	24 Hour Poison Control (Pesticides)	1800-222-1222
Chester	Chester County 9-1-1 communications center	610-344-5000
	Chester Co Health Dept Bureau of Env.	610-344-6225
	Chester Co Conservation District	610-925-4920
Delaware	DE County Cons District: Env. Problems	610-892-9484
	DE County Emergency Services	610-565-8700
	DE County Dept of Public Works	610-891-4668

EPA ESTABLISHES TIPLINE FOR SUSPICIOUS GAS DRILLING ACTIVITIES

The U.S. Environmental Protection Agency (EPA) has created an "Eyes on Drilling" tipline for citizens to report non-emergency, suspicious activity related to oil and natural gas development. EPA is asking citizens to call 1-877-919-4EPA (toll free) if they observe what appears to be illegal disposal of wastes or other suspicious activity. Report also may be sent by email to eyesondrilling@epa.gov. Citizens may provide tips anonymously if they don't want to identify themselves. In case of an emergency, such as a spill or release of hazardous material, including oil, to the environment, citizens are advised to call the National Response Center at 1-800-424-8802. EPA is asking citizens to report the location, time and date of such activity, as well as the materials, equipment and vehicles involved and any observable environmental impacts. Instructions for the tipline are at: http://www.epa.gov/region03/marcellus_shale/tipline.html.

DELAWARE RIVERKEEPER NETWORK FIELD DATA SHEET

Station Code: _____ **Observer Emails:** _____

Date (mm/dd/yy):_____ **Time**: (e.g. 1420)_____

Observer Names/Phone:_____

Stream Name:_____

Location:_____
(*if monitoring at a road crossing, sample at least 100' upstream of the road crossing*)

Latitude_____ **Longitude** _____

Present Weather Conditions: ☐ Sunny; ☐ Overcast; ☐ Rain; ☐ Snow; Other_____

Precipitation last 48 hours (Rain Gage Reading):_____ inches

7-day USGS gage station information attached: Yes ☐ No ☐ www.usgs.gov

Nearest Downstream USGS gage (Code/Name): _____

Weather Past 2-5 Days: _____

Temperature: Air _____ ^{o} C; Water _____ ^{o} C

General Water Conditions: (color, odor, etc.) _____

_____

Flow Observations: ☐ normal; ☐ faster than normal; ☐ slower than normal

Aquatic Vegetation: (algal growth and instream vegetation) _____

_____

Stream Bottom Survey of Riffle Habitat:

Identify and monitor riffle habitat for the stream bottom survey to help track changes in macroinvertebrate habitat due to sediment changes. (check off using an X – no percentages needed)

	Bedrock	Boulder	Cobble	Gravel	Sand	Silt/ Clay/Mud
Dominant Substrate						
Subdominant Substrate						

Bedrock, larger than a car; **Boulder**, greater than basketball & smaller than car; **Cobble**, tennis ball to basketball size; **Gravel**, pea to tennis ball size; **Sand**, tiny gritty particles, smaller than gravel but courser than silt; **Silt/Clay/Mud**, sticky/cohesive feeling, sediments behave like ooze

Consolidation of Riffle: ☐ Loose; ☐ Moderate; ☐ Difficult to dislodge

Station Code: _____ Date: _____

Parameter	*Water Quality Measurements*				
	Replicate #1	***Replicate #2***	***Average (of 2 closest values)***	***RPD***	***Replicate #3 (if RPD is greater than 20%)***
Conductivity (µS/cm)					
TDS (ppm)					
Salinity (ppm)					
Temperature (^{o}C)					
Chloride (ppm)					

ppm=mg/L

Surrogate Stream Flow (tenths of ft): _____ ft X _____ ft = _____ft^2

(1" = 0.08 ft) (width) (depth) (cross-sectional area)

Additional Comments or Observations: _____

_____

_____

IMPORTANT – if unusually high readings are documented, retest to ensure accuracy and **grab a sample for lab analysis. Then contact the PA DEP pollution hotline (request a case number), the county conservation district, and PA Fish and Boat Commission to report the issue. See DRN hotline list for phone numbers. Contact DRN's hotline: 1-800-8DELAWARE. If possible, follow and test upstream to help determine origin of pollution.*

Calculating Relative Percent Difference

x_1 represents the larger of the two values and x_2 represents the smaller of the two replicates. The top of the equation computes the difference of the two replicates, using absolute value to keep the solution positive, and the bottom of the equation computes the average. This solution is then multiplied by 100 to make the value a percentage. The higher the percent value, the less precision of the two values. If the RPD is greater than 20%, run a third replicate and average the two closest measurements.

$$\%\text{Diff} = \frac{|x_1 - x_2|}{((x_1 + x_2)/2)} \times 100$$

$$RPD = \frac{|9.3-7.9|}{(9.3+7.9)/2} \text{ X } 100$$

$$\frac{1.4}{17.2/2} \text{ X } 100 = \frac{1.4}{8.6} \text{ X } 100 = 0.163 \text{ X } 100 = 16.3\%$$

Keep one copy of this form for your own records and mail the original within 24 hours to Delaware Riverkeeper Network 925 Canal Street, Suite 3701, Bristol, PA 19007. Questions? Call 215-369-1188 ext. 110

Visual Assessment Form

Checklist for Gas Related Earth Disturbance

In addition to your regular stream sampling, if there is public access to a drill site being developed, please visit the site during construction as often as possible to look for violations and problems related directly to best management practices (BMPs) being conducted at the construction zone. Please take photos (dated) to record observations during every visit (zoom lens and binoculars helpful – **do not trespass**) and record your observations on this datasheet regularly and send to Delaware Riverkeeper Network. If you observe suspected violations, take dated photos immediately of the suspected problem and contact the Wayne County Conservation District (or CD appropriate) at 570-253-0930. Call the DRN hotline at 1-800-8DELAWARE.

Date and Time of Site Visit: _____

Name/Email/Phone of Observer: _____

Name and Location of Pad Site Observed: _____

Photos Taken: [ ] **Yes** [ ] **No** (email photos to faith@delawareriverkeeper.org)

Receiving Streams:

[ ] Visual evidence of sediment entering stream, pond, wetland or other body of water

[ ] Sediment plume

[ ] Discolored water

[ ] Increased sediment deposition on the stream bottom

Access Road:

[ ] Mud/sediment on Township / State Road that access road enters

[ ] Mud/sediment entering public road ditch from site

[ ] Access road to site not stabilized with clean gravel

[ ] Access road crosses stream with access road drainage directly emptying into stream

[ ] Access road carrying drainage from site directly to road ditch or stream

[ ] Road banks not stabilized with mulch, seeding, vegetation, etc.

Pad/Storage Pond/Staging Areas:

[ ] Earth disturbance to edge of water body with no controls to stop or filter

[ ] Clean water entering site from uphill (no diversion ditch)

[ ] Outlets of sediment control structures go directly to water body without filtering/cleaning

[ ] diversion ditch

[ ] sediment pond

[ ] road drainage

[ ] silt barrier (fence, hay bales, tubes, etc.)

[ ] Soil stockpile areas not stabilized if open longer than 20 days

[ ] Outlets of ditches, sediment control structures, etc. are not stabilized and are causing erosion

Checklist for Spills and Discharges

[ ] Unusual odor in water

[ ] Persistent foam or bubbles in absence of high level of agitation

[ ] Dead fish or other organisms in the water or along the bank

[ ] Discolored water, especially an oily film on the water surface

[ ] Increased bank erosion (may indicate a high water event)

Checklist for Water Withdrawal

[ ] Water hoses in or adjacent to stream

[ ] Unusually low flow in the stream not related to drought conditions

[ ] Trucks parked beside streams where there are no signs posted that it is a withdrawal area.

Checklist for Gas Migration or Leakage

[ ] Gas bubbling from a pool puddle, or stream

[ ] Odor due to mercaptan compounds

Additional Observations

(datasheet developed by ALLARM and PA Trout Unlimited; excerpt from 1.2 Marcellus Shale Gas Extraction: A Study Design for Volunteer Monitoring, June 2010)