KENTUCKY WATERSHED WATCH
STREAM GRAB SAMPLE COLLECTION

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Scope and Applicability

This document has been developed by the Kentucky Division of Water (KDOW) Water Watch Program as guidance for Watershed Watch Volunteers (or as required for 319 monitoring projects in Kentucky). This document describes procedures used for the uniform and accurate collection, field processing, field handling, and quality assurance/quality control (QA/QC) of grab samples collected from the waters of Kentucky. The methods defined herein are required for grab samples, field processing and field handling. These methods and procedures must be followed to ensure the accuracy and quality of the data.

Health & Safety Warning

- During high flow, sampling should be postponed until baseline conditions exist. When these specific events are targeted, sampling crews shall use best professional judgment to obtain samples (i.e., postponement, high flow equipment, etc.). Be aware that any fast-flowing water can be unsafe.
- Waders and specialized wading boots should be utilized when conducting instream sampling to remain dry, but also to provide a barrier from potential in-stream contaminants, and natural irritants (i.e., biting insects, poison ivy). It is recommended that a wading belt be used to reduce the chances of water filling waders during a fall. Boots should have felt or studded soles to reduce the chances of slipping or falling.
- Samplers should exhibit caution around stream bank mud, boulders, bedrock or large woody debris to reduce the threat of a falling injury.
- Secure permission from landowner at selected site (most streams are bordered by private property).
- As a rule of thumb, avoid extreme temperatures.
- Do not stick hands or feet under large rocks, so as not to disturb snakes or snapping turtles. Exercise caution when handling aquatic life that has the ability to pinch, bite, etc.
- All water bodies have the potential to be contaminated. Caution should be taken to avoid water contact with body openings or cuts/sores. In addition, perform thorough hand washing/disinfection after all sampling.

- Strong acids are used as preservatives for some of the grab samples collected. Even small drops or vapors from the glass vials in which the acids are contained can cause significant harm to your skin, eyes, or other body openings. Use of disposable gloves and safety glasses while handling these preservatives is highly recommended for your safety.

Definitions

Blank - A sample bottle filled with distilled water while at the stream site. A blank serves as a check for possible contamination during sample handling or processing at the lab.

Duplicate - A sample bottle filled with stream water at your site at the same time as your regular sample. The duplicate serves as check of lab procedures and accuracy.

E. coli – shortened form of *Escherichia coli*, bacteria that live in the gut of warm-blooded animals and that are used as an indicator of the presence of pathogens.

Grab sample - A quantity of water collected for analysis as a representation of the condition of a stream at a particular moment in time.

Preservative - A substance used to reduce physical and/or chemical changes in a stream sample prior to analysis.

Wet ice - A mix of ice with clean water added until the ice is just covered, maximizing contact with the sample container for consistent cooling of the sample. This is considered a type of preservative.

Introduction to Water Quality

Through the collection of a grab sample, Watershed Watch volunteer participants will engage in a simplified approach to stream water quality evaluation through the collection and analysis of water samples for things like *E. coli*, nutrients and metals. Information collected by the

volunteers can be used by the Kentucky Division of Water to assist in its efforts to protect and preserve the quality of Kentucky's streams and rivers.

Collection and analysis procedures used in this guide are designed to be low cost, quickly and easily performed, and provide hands-on experience for individuals, community volunteer groups, and school groups of all ages. By conducting the grab sample collection, the volunteer participants will:

- develop proficiency in sample collection and analysis
- develop a greater sensitivity to the stream or streams they are evaluating
- gain an understanding of the importance of Kentucky's water resources
- become part of the growing constituency of citizens who are strongly concerned with the fate of our state's precious streams and rivers
- supplement local, state and federal agencies in their efforts to protect and preserve the quality of Kentucky's streams

It is not the intent of this guide to pinpoint subtle changes in water quality, nor will it produce "research grade" information. However, the data will show the general condition of the river or stream and provide a fairly accurate evaluation of the water quality at one point in time. Information obtained from long-term field observations will be compiled and serve as a generalized resource base for the evaluation of the quality of Kentucky's streams and rivers.

Streams are the epitome of dynamic systems as they are constantly changing. The section of stream that is polluted today may be flushed clean next week. A grab sample collected at that time would not indicate that the pollution had occurred. The effects of pollution, however, may be dramatic, and are reflected in changes in the variety and abundance of macroinvertebrate populations. A Watershed Watch (Phase 2) Biological Assessment provides a relative view of the overall quality of a stream.

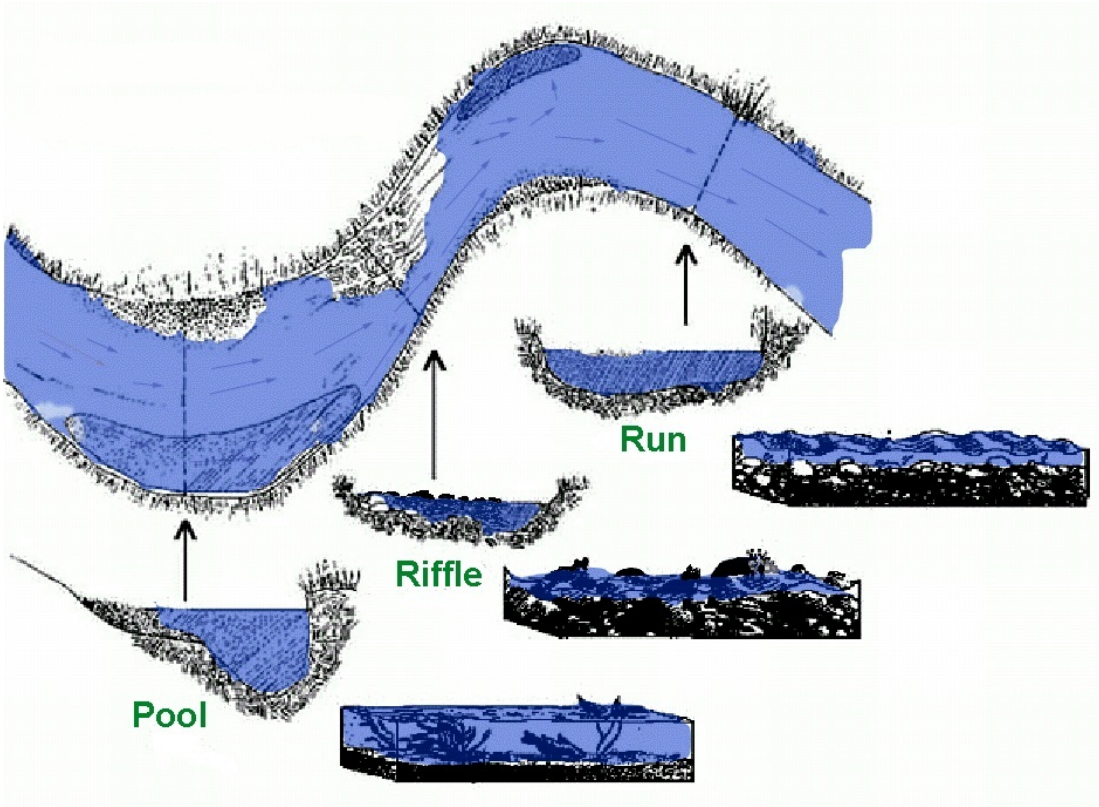
Pre-sampling Information and Procedures

Site Selection -Comparison of High Gradient and Low Gradient Stream Systems

Creeks in Kentucky vary from high gradient, cobble dominated to low gradient streams with sandy or silty sediments. A high gradient indicates a steep slope and rapid flow of water, whereas a low gradient indicates a more nearly level stream bed and slowly moving water. Low-gradient streams are defined as streams that have velocities less than 0.013m/sec (0.5ft/sec) and naturally lack riffle habitat.

Some streams flow through hilly land and have many riffles and runs. Riffles are places in the stream where the height of the stream drops to a lower point and the bottom is rocky. Because of this drop in height, the bottom of the stream and the rocks located there, are very close to the surface of the stream or sticking out of the surface. This causes the surface of the water to look rough and bubbly instead of smooth. Runs are places in the stream where the water moves quickly out of a riffle. Runs are deeper than riffles, so rocks don't stick out of the water and the surface is smooth. These steep streams that have many riffles and runs are called high gradient streams.

Other flat streams are low gradient streams. These are streams that flow through flatter land and have few, if any, riffles, many glides and pools, and mostly fine sediment bottoms. Pools are the deepest parts of the stream and normally have the slowest flow. Glides are the areas where the water is flowing more quickly out of pools in the stream and becoming increasingly shallower.



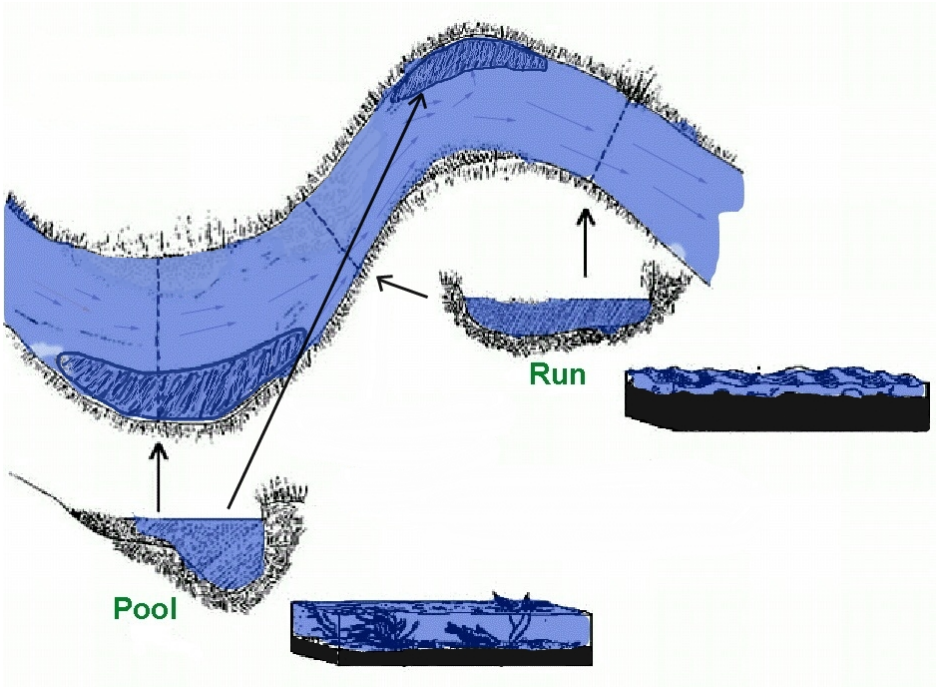
High Gradient Instream Characteristics

Pools: the deepest areas with the slowest flow in a stream

Riffles: the areas in a stream where there is a drop in elevation that causes the rocks on the bottom of the stream to extend above the surface of the water creating a churning action that causes the surface of the water to look rough and bubbly

Runs: the segments of streams that flow quickly out of a riffle

The appropriate concentrated flow location from which to collect your sample will be in the area of transition.



Low Gradient Instream Characteristics

Pools: the deepest area with the slowest flow in a stream

Runs: the segments of streams that flow more rapidly between pools

The typical flow features of low-gradient streams include alternating pools and runs of varying flow speeds. The diagram above illustrates the characteristics of low-gradient streams. The appropriate concentrated flow location from which to collect your sample will be in the run between pools.

Sampling Procedures

On your first visit to your site, select an area of the stream where the flow is concentrated and where you can completely submerge the bottle without touching the bottom. The goal is to be able to always sample at the same location under a variety of stream flow conditions without bringing the sample bottle in contact with potentially contaminated sediments on the stream bottom, and in a portion of the stream that is constantly flowing to ensure a well-mixed and representative sample. The location needs to be deep enough to accommodate the width of a variety of sample containers without bottom contact, but in a riffle or run rather than a pool.

The red circle in these three photos are of the same concentrated flow location in the stream, taken from different perspectives. The left photo is facing upstream, the middle photo from the right bank, and the right photo is facing downstream.

For Low Gradient streams:

- In areas with slow flow, this concentrated flow location may be less apparent. Flow is often more uniform in these types of streams, so collect sample where the stream is narrower and/or shallower while still maintaining adequate depth to submerge all types of sample bottles.

Documentation of Sampling Location

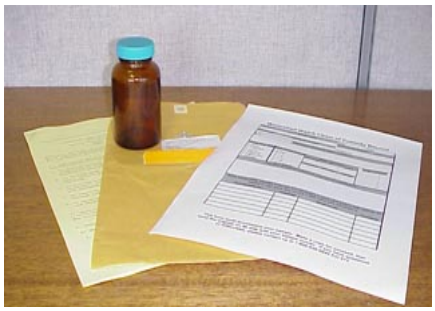
The geographic location of the sample site is defined by two positions on the surface of the Earth – the latitude and longitude. When selecting a site it is critical to have accurate information about the sampling location. If the volunteer is taking over an old site, it is important that they sample as closely as possible to the location where that site was originally established for continuity and comparability with data already collected for that site. If the volunteer is establishing a new site, accurate site coordinates will allow anyone who wishes to sample that site in the future or use the sample results and site information for any future planning or projects to exactly locate the point where the site was established.

In order to accurately identify the site Global Positioning Systems (GPS) are often utilized. When recording the GPS location information the sampler will want to use decimal degrees and use five (5) decimal places. If access to a GPS device is not available the latitude and longitude can be found on a digital map like either of the following:
http://kgs.uky.edu/kgsmap/krww/viewer.asp or Google Earth.

To further aid in the identification of the site take photos upstream and downstream of the sampling point. Be sure to include recognizable landmarks in the photo. The photos should be taken annually during the Summer sampling event and labeled in the following format: "Site#upstream" and "Site#downstream". Once the images are correctly labeled please submit the information to Water Watch office via email to OllieTheOtter@ky.gov.

Sampling Materials

Prior to the sampling event you will receive the required materials from the program coordinator or by mail. You will receive the following items for sampling:



- Instructions
- Transport information
- Chain of Custody Records
- Gloves (disposable)
- Sample containers
- Preservative (if required)

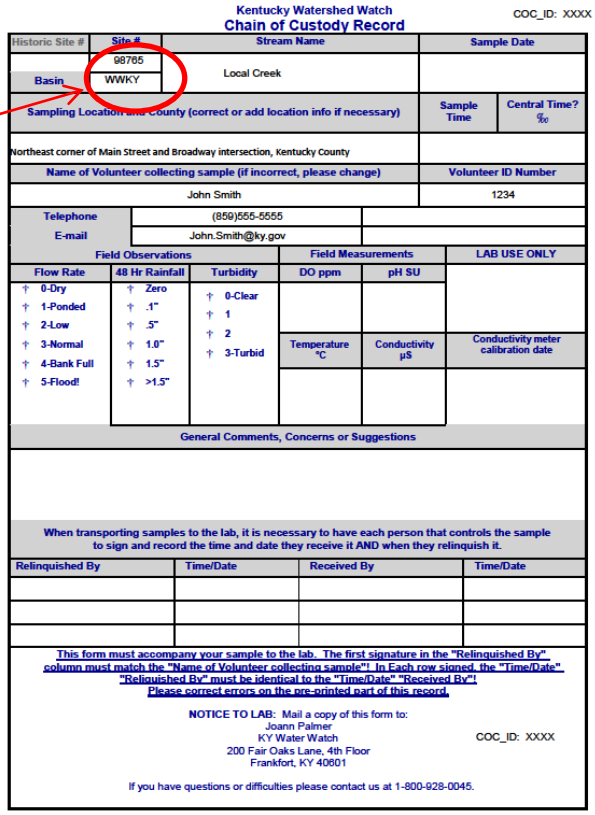
Once the materials arrive the instructions must be reviewed immediately as they contain critical information on sample times and delivery. You will also need to inspect all sample and preservative containers upon receipt for damage or breakage. Do not wait until you are in the field to review the instructions and check for damage. If you postpone the review there may not be sufficient time to rectify any potential problems resulting in possible loss of sample collection and of time.

Sample Containers

Photos (clockwise from top left): Metals w/nitric acid vial; nutrients cubitainer; *E. coli* flip-top; *E. coli* screw top

Depending on the type of analysis being done, different kinds of containers may be needed for sample collection. The basic sampling procedure, however, is the same. The main differences will be in the methods of preservation and the time window allowed getting them to the lab, as well as rinsing procedures for non-sterilized containers. Please note that the pathogen samples must be delivered to the lab within six (6) hours of collection.

The sampling containers are pre-marked with a unique Site Number The Site Number should match the number on the "Chain of Custody Record". You will need to check your packet to make sure that you have one chain of custody form for each sample bottle and that the numbers match your site numbers.



Kentucky Watershed Watch
Chain of Custody Record

COC_ID: XXXX

Historic Site #	Site #	Stream Name	Sample Date
	98765	Local Creek	
Basin	WWKY		

Sampling Location and County (correct or add location info if necessary)	Sample Time	Central Time? ‰
Northeast corner of Main Street and Broadway intersection, Kentucky County		

Name of Volunteer collecting sample (if incorrect, please change)	Volunteer ID Number
John Smith	1234

Telephone	(859)555-5555	
E-mail	John.Smith@ky.gov	

Field Observations			Field Measurements		LAB USE ONLY
Flow Rate	48 Hr Rainfall	Turbidity	DO ppm	pH SU	
† 0-Dry	† Zero	† 0-Clear			
† 1-Ponded	† .1"	† 1			
† 2-Low	† .5"	† 2	Temperature °C	Conductivity µS	Conductivity meter calibration date
† 3-Normal	† 1.0"	† 3-Turbid			
† 4-Bank Full	† 1.5"				
† 5-Flood!	† >1.5"				

General Comments, Concerns or Suggestions

When transporting samples to the lab, it is necessary to have each person that controls the sample to sign and record the time and date they receive it AND when they relinquish it.

Relinquished By	Time/Date	Received By	Time/Date

This form must accompany your sample to the lab. The first signature in the "Relinquished By" column must match the "Name of Volunteer collecting sample"! In Each row signed, the "Time/Date" "Relinquished By" must be identical to the "Time/Date" "Received By"!
Please correct errors on the pre-printed part of this record.

NOTICE TO LAB: Mail a copy of this form to:
Joann Palmer
KY Water Watch
200 Fair Oaks Lane, 4th Floor
Frankfort, KY 40601

COC_ID: XXXX

If you have questions or difficulties please contact us at 1-800-928-0045.

Due to the requirements of the new Watershed Watch database, site numbers will no longer include a letter to identify the basin in which they are located. However, the Historic Site Numbers which include the letter will continue to be listed on the Chain of Custody (COC) for continuity and recognition by the volunteers.

The number located at the top and bottom right corners of the COC form is the Chain of Custody identification number (COC_ID). The Chain of Custody identification number is populated at the time the COC form is printed. The COC identification number is unique and is tied solely to that sampling event. This identification system is necessary for the new database that will house all the Watershed Watch data. What this means for the volunteer is that the previous COCs can not be reused or copied for current or future sampling events.

Quality Assurance - Blanks and Duplicates

If you receive a bottle with a site number that you do not recognize, check the documents in your packet, you may have been randomly assigned to collect a blank or a duplicate. The purpose of both blanks and duplicates is to ensure quality.

The sample event coordinator randomly picks some sites for blank collection. The coordinator will generate a quality control sample site ID and send you a sample bottle and a chain of custody form along with your regular sample. This sample must be filled while at the stream site collecting your regular sample. Treat this exactly like any other sample, except fill it with distilled water instead of stream water. Distilled water can be purchased very cheaply at most grocery and drug stores. You do not need to indicate that the sample is a blank – the lab should not know.

A duplicate serves as a check for variability among samples that should yield approximately the same lab results. Once again, the sample event coordinator randomly picks some sites for duplicate collection. The coordinator will generate a quality control sample site ID and send you a sample bottle and a chain of custody form along with your regular sample. Treat this exactly like your regular sample bottle and collect both stream water samples from the same location at your sampling site, either simultaneously or one immediately after the other. You do not indicate that the sample is a duplicate – the lab should not know.

Proper attire for handling samples

Gloves (disposable)

Eye Protection

Gloves and eye protection are two of the most important ways to minimize or prevent injury/infection from the stream water or chemicals used as preservatives. The main reason for using gloves is to minimize the risk of contaminating samples with bacteria or other contaminants found on volunteers' hands. Volunteers should not put on gloves until they are at the stream site and ready to collect their sample(s). This prevents contaminating the gloves while in transit to stream site (from stream banks, etc.). The advantage of actual safety goggles over sunglasses is the fuller coverage of the eye area and adjacent facial skin.

Basic equipment

Equipment list:

· Sample bottles/containers
· Preservative (if required)
· Gloves (disposable)
· Eye Protection
· Cooler with wet ice
· Chain of Custody Record form
· Watch/cell phone
· White pan
· Field Guidance cards
  Camera
· First Aid kit (optional)
· Waders (optional)
· Hand sanitizer (optional)

Grab sample collection procedures

Enter the stream at a downstream location from your sampling point and walk upstream to avoid disturbing the stream bottom. Be sure to collect your sample at the same location each time in the middle of your concentrated flow location and at mid-depth of the stream. Take caution not to contaminate samples with material from the bottom of the stream. Samples should not be collected when sample container cannot be submerged without fear of collecting sediment or other material from the stream bed. It is imperative to use caution when sampling in deeper water and to watch out for deep pools. Note in the picture below, the sampler is

wearing a personal flotation device (a good idea for deeper water and when wearing waders of any type).

E. coli Grab Sample Procedure

When collecting an *E. coli* grab sample remember to put on disposable gloves to avoid any potential contamination. With *E. coli* grab samples do not rinse out the bottle, the bottles used for the collection of bacteria samples are sterilized. You will need to point the mouth of the bottle directly over the surface of the water, dip and scoop the bottle upstream beneath the water surface, and through the water column in one swift motion to fill above the line marked on bottle. If a preservative tablet is in the bottle, alter the grab sample procedure and angle the mouth of the bottle so as not to spill the preservative while collecting the sample. Cap the bottle, leaving at least a small airspace at top to allow lab mixing. Place in wet ice immediately.

Since the sample bottles are sterilized, if you do not fill your sample bottle above the marked line, it is not a usable sample. That sample bottle must be discarded. To re-collect the sample you must have a new, sterile bottle which you will not have available. In this situation you would not be able to collect a usable sample.

Grab Sample Collection *other than E. coli*:

Remember to put on your disposable gloves to protect the sample from any contaminants. Rinse bottle with stream water three times (fill bottle ¼ full of stream water, cap, shake, and discard downstream). Be sure that you discard the rinse water downstream so as to avoid any potential contamination of your sample to be collected from a point in front of you (upstream). Point the mouth of the bottle upstream (against the flow), submerge entire bottle to mid-depth of stream, submerge and fill. Cap bottle.

Add preservative (if necessary) and place in wet ice. Preservatives are usually strong acids or bases. These can be very damaging to body tissues such as skin, eyes, hair, etc. Use extreme caution when handling these preservatives and avoid any contact with exposed areas of your body. The use of gloves and eye protection are required for this procedure. Upon

accidental contact with body tissues, flush the affected areas with large amounts of water and seek immediate medical attention.

Chemical Safety

Follow the first aid procedures found on the Material Safety Data Sheets (MSDS). Be sure to familiarize yourself with the MSDS information prior to your field work.

Preservation

Samples must be kept immersed in wet ice (but not frozen) until received by laboratory. Wet ice is ice that has been mixed with clean water to produce a "slurry". This insures constant contact with all parts of the sample bottle(s) and an assurance of consistent cooling of all samples at required temperatures without fear of freezing them. Ice cubes or blocks alone, or blue ice, are not adequate. They leave many air spaces and cooling may not be consistent. The ice works as a preservative, it cools the sample to a temperature that effectively slows any biological or chemical activity that could skew the sample results. Prior to a sampling event, the Science Advisor should confer with the Lab Manager, where the samples are being processed, to determine any changes in hold times or acidification procedures. Acidification may also used as a preservative until the samples can be processed by the lab.

Sample Holding Time

The sample holding time is the length of time a sample can be stored after collection and before it is analyzed without significantly affecting the results. From the minute you collect a sample, the clock starts ticking on the holding time. The holding time is established by the US Environmental Protection Agency and this time frame varies for different types of analysis. In the field remember to complete field chemistry tests before collecting *E. coli* sample. The maximum holding time for an *E. coli* sample is six (6) hours. For parameters other than *E. coli* the holding time instructions will be in the sampling event packet.

Recordkeeping – The Chain of Custody Record

The Chain of Custody (COC) Record serves to document and record the transfer of the samples from the stream to the laboratory. The COC functions as a field measurement form and provides a place for field observations. The COC must be filled out completely. If you are missing a

time, date, or signature the data cannot be used. Please check and double check. If you do not have information on some of the water chemistry parameters, write “Not Collected” to indicate these data were not recorded. The time and date are very important as the lab will use this time to determine whether the sample arrives to the lab within the prescribed holding time. Do not erase or scribble out mistakes on the COC. Any undocumented changes to the form will “break the chain” of custody that insures the quality of your sample and the results. If you make a mistake, draw a line through it and initial it.

A broken chain of custody will result in your sample results being flagged. This will mean the sample results cannot be utilized for some of the intended uses and would not be defensible.

Pre-populated Information on Chain of Custody Record

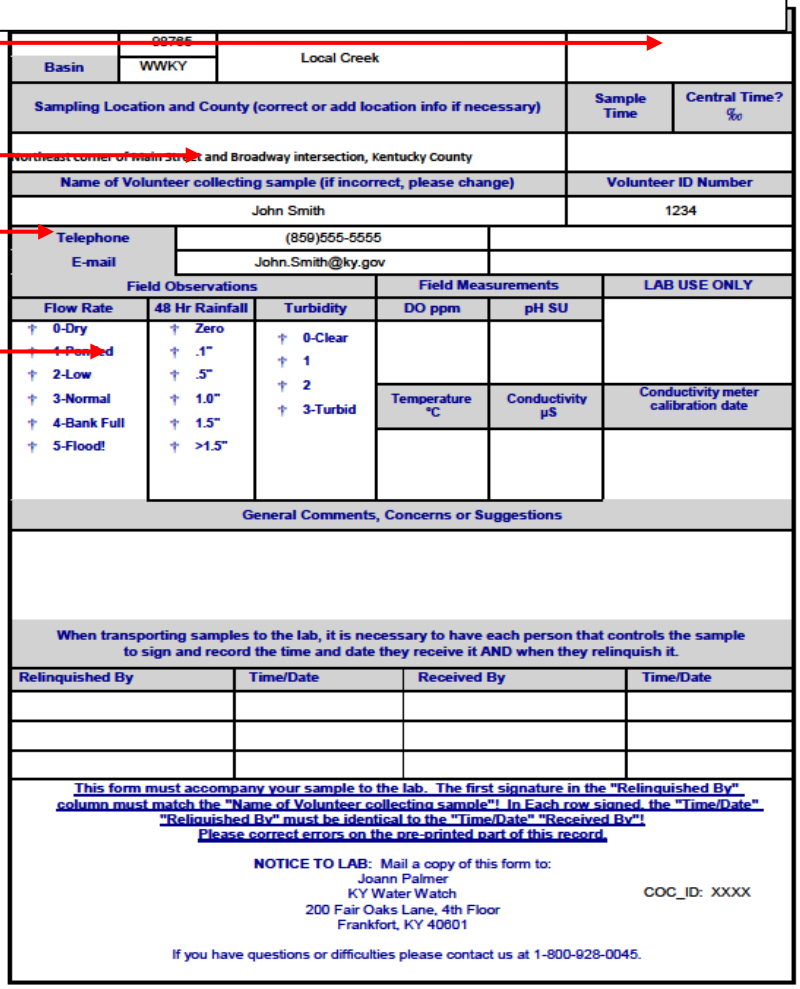
Some information will be pre-populated on the Chain of Custody Record. When volunteers receive the COC it will have the Site #, Sampling Location, and the Sample collector name and contact information already filled in. If you find a mistake in the pre-printed information, draw a line through it, initial it and make the correction.

Chain of Custody ID

Site #

Location Description

Sample collector’s information fields



	08785		
Basin	WWKY	Local Creek	
Sampling Location and County (correct or add location info if necessary)		Sample Time	Central Time? ‰
Northeast corner of Main Street and Broadway intersection, Kentucky County			
Name of Volunteer collecting sample (if incorrect, please change)		Volunteer ID Number	
John Smith		1234	
Telephone	(859)555-5555		
E-mail	John.Smith@ky.gov		

Field Observations			Field Measurements		LAB USE ONLY
Flow Rate	48 Hr Rainfall	Turbidity	DO ppm	pH SU	
0-Dry	Zero	0-Clear			
1-Ponded	.1"	1			
2-Low	.5"	2	Temperature °C	Conductivity µS	Conductivity meter calibration date
3-Normal	1.0"	3-Turbid			
4-Bank Full	1.5"				
5-Flood!	>1.5"				

General Comments, Concerns or Suggestions

When transporting samples to the lab, it is necessary to have each person that controls the sample to sign and record the time and date they receive it AND when they relinquish it.

Relinquished By	Time/Date	Received By	Time/Date

This form must accompany your sample to the lab. The first signature in the "Relinquished By" column must match the "Name of Volunteer collecting sample"! In Each row signed, the "Time/Date" "Relinquished By" must be identical to the "Time/Date" "Received By"!
Please correct errors on the pre-printed part of this record.

NOTICE TO LAB: Mail a copy of this form to:
Joann Palmer
KY Water Watch
200 Fair Oaks Lane, 4th Floor
Frankfort, KY 40601

COC_ID: XXXX

If you have questions or difficulties please contact us at 1-800-928-0045.

Volunteer entries on the Chain of Custody

Date and time of sample collection

Field Observations & Measurements

Date and time of sample Relinquished/Received Time & Date must be identical.

Kentucky Watershed Watch
Chain of Custody Record

COC_ID: XXXX

Historic Site #	Site #	Stream Name	Sample Date
Basin	98765 WWKY	Local Creek	

Sampling Location and County (correct or add location info if necessary)	Sample Time	Central Time? ‰
Northeast corner of Main Street and Broadway intersection, Kentucky County		

Name of Volunteer collecting sample (if incorrect, please change)	Volunteer ID Number
John Smith	1234

Telephone	(859)555-5555	
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Field Observations			Field Measurements		LAB USE ONLY
Flow Rate	48 Hr Rainfall	Turbidity	DO ppm	pH SU	
† 0-Dry † 1-Ponded † 2-Low † 3-Normal † 4-Bank Full † 5-Flood!	† Zero † .1" † .5" † 1.0" † 1.5" † >1.5"	† 0-Clear † 1 † 2 † 3-Turbid	Temperature °C	Conductivity µS	Conductivity meter calibration date

General Comments, Concerns or Suggestions

When transporting samples to the lab, it is necessary to have each person that controls the sample to sign and record the time and date they receive it AND when they relinquish it.

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Joann Palmer
KY Water Watch
200 Fair Oaks Lane, 4th Floor
Frankfort, KY 40601

COC_ID: XXXX

If you have questions or difficulties please contact us at 1-800-928-0045.

The "Date sample taken" and "Time sample taken" are very important. The lab will use this time to determine whether the sample arrives to the lab within the prescribed holding time. Every time the sample changes hands the Relinquished By and Received By spaces must be completed and the Time/Dates of that transaction must match. If they don't, the chain of custody will be broken. Also the next time the sample is handed off, the person who previously "Received" the sample will be the person who "Relinquishes" it. If this isn't recorded correctly, the chain of custody will be broken.

Transportation – Sample Delivery

Volunteers should be working with their area coordinator to make delivery arrangements before the sampling event. If the volunteer does not know who their area coordinator is they will need to contact their Basin Steering Committee or call the Watershed Watch office. The Watershed Watch office contact information can be found at the bottom of the Chain of Custody Record. The volunteer will take the sample and Chain of Custody to the designated drop-off location. Be sure to discuss the date and time information with the person you are handing off your sample to and check to ensure that both parties are documenting identical information. If a mistake is detected, draw a line through it and initial it, and then write the correction. Be sure to double check all fields of the COC and once data has been verified for accuracy, sign the document.

Results

All the samples will be taken to a professional, state certified lab for analysis. Lab analysis costs are expensive, but are paid for by the individual basin Watershed Watch groups through a variety of funding methods. The results will be posted on the Kentucky Geological Survey website after the basin data manager and KY Watershed Watch have reviewed the data for any errors. The website is http://kgs.uky.edu/kgsmap/krww/viewer.asp .

Discussion of Sampling Results

E. coli is shortened form of *Escherichia coli*. *E. coli* are a microscopic bacteria that live in the intestines of warm-blooded animals and are passed in fecal material. *E. coli* is used as an indicator of the possible presence of pathogens that may cause infection or illness. In the past Watershed Watch samples were analyzed for Fecal Coliforms as indicators of the potential presence of pathogens. Fecal Coliforms were used because the standards for surface water from EPA and for Kentucky were based on it. The standards for surface water have been updated and are now based on *E. coli,* so current Watershed Watch samples are analyzed for *E. coli* as well. Fecal Coliforms are a group of different bacteria with similar characteristics. *E. coli* is one specific bacterium in this group and the results for *E. coli* analysis methods have been determined to be more accurate in representing the actual levels of bacteria and pathogens in the water.

The Surface Water Quality Standard for *E. coli* for primary contact recreation is 240 cfu/100 ml from a single grab sample. This standard applies during

Recreation Season from May 1 to October 31. There is also a lower *E. coli* standard of 130 cfu/100 ml which is a geomean average based on five samples collected from the same site within thirty days.

Where are E. Coli coming from?

- Failing septic systems, straightpipes, leaking sewage lines
- Inadequately treated discharge from sewage treatment plants
- Livestock (runoff from pasture or direct access to waterbody)
- Pet waste or wildlife waste (i.e., geese, ducks, deer)

Nutrients generally refer to forms of nitrogen (N) and phosphorus (P). Excess nutrients in streams can cause overgrowth of algae and plants, which in turn disrupts healthy natural processes. This can lead to large decreases in dissolved oxygen, a condition called eutrophication. Eutrophication results from an excess of nutrients (N & P) which then results in the abundant growth of algae and other aquatic vegetation. As the algae die and begin to decompose, oxygen is consumed. The resulting low dissolved oxygen levels can lead to fish kills. Fish aren't the only animal population affected by low DO levels in water. Other less visible populations of macroinvertebrates and mussels are affected or killed.

Numeric surface water quality standards for Nutrients are not currently established in Kentucky for all nutrients of concern (including Total Nitrogen and Total Phosphorus); however, there are narrative standards which can be used and interpreted. Numeric surface water standards in Kentucky regulations include:

- Ammonia (un-ionized) 0.05 mg/l (parts per million)
- Nitrate (NO_3) 10 mg/l
- Sulfate (SO_4) 250 mg/l

The Division of Water is working on developing standards for Total N and Total P. Part of the difficulty in establishing standards is the variability of naturally occurring levels of these nutrients determined by the chemical composition of the underlying geology and resulting soils in different areas across the state. Some Watershed Watch basins might not include these nutrient compounds in their laboratory analyses.

Where are nutrients coming from?

- residential fertilizer application
- sewage and manure runoff
- natural breakdown of soils, plants, animals

- geology varies across the state, so naturally occurring amounts of phosphorus and nitrogen will also vary

Metals

Metals are elemental substances that are good conductors of heat and electricity. Metals are naturally occurring in rock and soil, and can be weathered and carried to streams when exposed. Metals are also released into the air or soil by many human activities and carried by stormwater runoff into streams. Some industrial processes release metals directly into streams. Metals can be harmful to humans or aquatic life at low levels over a long time (chronic) or at higher levels for a short time (acute).

Surface Water Quality Standards for Metals

Aluminum	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	Boron
Cadmium	Calcium	**Chromium**	Cobalt	**Copper**	Gold
Iron	**Lead**	Lithium	Magnesium	Manganese	**Nickel**
Phosphorus	Potassium	**Selenium**	Silicon	**Silver**	Sodium
Strontium	Sulfur	**Thallium**	Tin	Vanadium	**Zinc**

Underlined and bolded metals in the table above are ones for which Kentucky has water quality standards, which can be found in 401 KAR 10:031 Section 6. The complete list of metals includes all of the ones in the suite of metals analyzed by Kentucky Geological Survey's laboratory for Watershed Watch. KAR refers to Kentucky Administrative Regulations and can be found at: http://www.lrc.ky.gov/kar/401/010/031.htm .

Where are metals coming from?

- Mining
- Industrial discharges
- Atmospheric deposition
- Stormwater runoff from roads and parking lots
- Stormwater runoff from exposed rock and soil

A fish consumption advisory is in effect statewide for all Kentucky waters for mercury. Women of childbearing age and children 6 years of age or younger

should eat no more than one meal per week of freshwater fish. Adult men and other women are not included in the consumption notice.

This is not an emergency as organic mercury can occur naturally in the environment and does not affect swimmers, skiers or boaters. Fish can accumulate these low levels of mercury by eating plankton and other small aquatic creatures.

- More information can be found at the Division of Water's webpage: http://water.ky.gov/waterquality/Pages/FishConsumption.aspx

- Or at the Department for Fish and Wildlife Resources: http://fw.ky.gov/fishadvisory.asp

Pesticides/Herbicides are typically manmade chemicals used to kill undesirable plants or insects. Improper timing of application and overuse can lead to runoff into streams. Some of these products are designed to decompose (break down in to harmless or less harmful components) in a short period of time after application but, some persist in the environment for long periods of time.

Numeric Surface Water Quality Standards for Pesticides/Herbicides are not currently established in Kentucky for all pesticides/herbicides (including atrazine).
Surface water standards in Kentucky regulations include:

- 2,4-D 0.1 mg/l (parts per million)

Where are pesticides/herbicides coming from?

- Runoff *or overspray* from agricultural, commercial and residential application

Appendix

MSDS Sample Preservatives

Fisher Scientific

Part of Thermo Fisher Scientific

Material Safety Data Sheet

Creation Date 12-Mar-2009 **Revision Date** 27-Sep-2011 **Revision Number** 3

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Nitric acid (65 - 70%)**

Cat No. **A198C-212, A200-212, A200-212LC, A200-500, A200-500LC, A200-612GAL, A200C-212, A200S-212, A200S-212LC, A200S-500, A200SI-212, A467-1, A467-2, A467-250, A467-500, A483-212**

Synonyms Azotic acid; Engraver's acid; Aqua fortis

Recommended Use Laboratory chemicals

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. HAZARDS IDENTIFICATION

DANGER!

Emergency Overview

Oxidizer: Contact with combustible/organic material may cause fire. Causes severe burns by all exposure routes. May cause pulmonary edema.

Appearance Clear Colorless, Light yellow **Physical State** Liquid **odor** strong Acrid

Target Organs Eyes, Respiratory system, Skin, Teeth, Kidney, Gastrointestinal tract (GI)

Potential Health Effects

Acute Effects
Principle Routes of Exposure

Eyes Causes severe burns. May cause blindness or permanent eye damage.
Skin Causes severe burns. May be harmful in contact with skin.
Inhalation Causes severe burns. May cause pulmonary edema. May be harmful if inhaled.
Ingestion Ingestion causes burns of the upper digestive and respiratory tract. May be harmful if swallowed.

Chronic Effects Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen. May cause adverse kidney effects. Experiments have shown reproductive toxicity effects on laboratory animals.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions Preexisting eye disorders. Skin disorders.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Nitric acid	7697-37-2	65 - 70
Water	7732-18-5	30 - 35

4. FIRST AID MEASURES

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point Not applicable
Method No information available.

Autoignition Temperature No information available.
Explosion Limits
Upper No data available
Lower No data available

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
Oxidizer: Contact with combustible/organic material may cause fire. Corrosive Material. Causes severe burns by all exposure routes. Thermal decomposition can lead to release of irritating gases and vapors.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

NFPA **Health** 4 **Flammability** 0 **Instability** 0 **Physical hazards** OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Wear self-contained breathing apparatus and protective suit. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal. Keep away from clothing and other combustible materials.

7. HANDLING AND STORAGE

Handling Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Keep away from clothing and other combustible materials. Do not breathe vapors/dust. Do not ingest. Contents under pressure.

Storage Keep containers tightly closed in a cool, well-ventilated place. Do not store near combustible materials

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitric acid	TWA: 2 ppm STEL: 4 ppm	(Vacated) TWA: 2 ppm (Vacated) TWA: 5 mg/m^3 (Vacated) STEL: 4 ppm (Vacated) STEL: 10 mg/m^3 TWA: 2 ppm TWA: 5 mg/m^3	IDLH: 25 ppm TWA: 2 ppm TWA: 5 mg/m^3 STEL: 4 ppm STEL: 10 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Nitric acid	TWA: 2 ppm TWA: 5.2 mg/m^3 STEL: 4 ppm STEL: 10 mg/m^3	TWA: 2 ppm TWA: 5 mg/m^3 STEL: 4 ppm STEL: 10 mg/m^3	TWA: 2 ppm STEL: 4 ppm

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Clear Colorless, Light yellow
odor	strong Acrid
Odor Threshold	No information available.
pH	1.0 (0.1M)
Vapor Pressure	0.94 kPa (20°C)
Vapor Density	No information available.
Viscosity	No information available.
Boiling Point/Range	120.5°C / 248.9°F
Melting Point/Range	-41°C / -41.8°F
Decomposition temperature	No information available.
Flash Point	Not applicable
Evaporation Rate	No information available.
Specific Gravity	1.40
Solubility	No information available.
log Pow	No data available
Molecular Weight	63.02
Molecular Formula	HNO3

10. STABILITY AND REACTIVITY

Stability	Oxidizer: Contact with combustible/organic material may cause fire.
Conditions to Avoid	Incompatible products. Combustible material. Excess heat.
Incompatible Materials	Strong bases, Reducing agents, Organic materials, Aldehydes, Alcohols, Cyanides, Metals, Powdered metals, Ammonia
Hazardous Decomposition Products	Nitrogen oxides (NOx)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions .	None under normal processing..

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Nitric acid	Not listed	Not listed	130 mg/m^3 (Rat) 4 h 7 mg/L (Rat) 1 h

Irritation Causes severe burns by all exposure routes

Toxicologically Synergistic Products No information available.

Chronic Toxicity

Carcinogenicity There are no known carcinogenic chemicals in this product

Sensitization No information available.

Mutagenic Effects No information available.

Reproductive Effects Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects No information available.

Teratogenicity Teratogenic effects have occurred in experimental animals..

Other Adverse Effects See actual entry in RTECS for complete information.

Endocrine Disruptor Information No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Nitric acid	Not listed	72 mg/L LC50 96 h	Not listed	Not listed

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available

Mobility .

Component	log Pow
Nitric acid	-2.3

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. TRANSPORT INFORMATION

DOT

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

TDG

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IATA

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IMDG/IMO

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

15. REGULATORY INFORMATION

All of the components in the product are on the following Inventory lists:

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL
Nitric acid	X	X	-	231-714-2	-		X	X	X	X	X
Water	X	X	-	231-791-2	-		X	-	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Nitric acid	7697-37-2	65 - 70	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	Yes

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Nitric acid	X	1000 lb	-	-

Clean Air Act
Not applicable

OSHA

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Nitric acid	-	TQ: 500 lb

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Nitric acid	1000 lb	1000 lb

California Proposition 65
This product does not contain any Proposition 65 chemicals.

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Nitric acid	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Nitric acid	2000 lb STQ

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

C Oxidizing materials
E Corrosive material

16. OTHER INFORMATION

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

Creation Date 12-Mar-2009

Print Date 27-Sep-2011

Revision Summary (M)SDS sections updated 3

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS