New England
Water Works Association

A Section of the
American Water Works Association

Sampling Guide for First Responders to Drinking Water Contamination Threats and Incidents

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New England Water Works Association
125 Hopping Brook Road
Holliston, MA 01746-1471
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Acknowledgments

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IMPORTANT NOTICE

The methods and instructions in this guide reflect the U.S. Environmental Protection Agency (EPA) regulations and guidance, in addition to other reference documents. It is recognized that there can be significant differences from state to state regarding public notification, sampling procedures, laboratory safety, and handling, etc. Please check with your state drinking water representative with any questions before First Responders training and preparation is begun.

Contents, Sections 1 through 6

1. Introduction

1.1 Background/Purpose

Question: Compared with other possible terrorist targets, how probable is an actual contamination *incident* involving a water system?

Answer: The probability of an actual contamination *incident* may be low, but the probability that a contamination **threat** will occur is high.

NOTE: A contamination *incident* occurs when the presence of a harmful contaminant has been confirmed; that is, verified. This sampling guide is designed to help you take that sample for laboratory analysis in a manner that is protective of you, the sampler.

A contamination **threat** is a suggestion or indication that water has been contaminated but no conclusive proof has been collected yet to confirm the contamination actually occurred. A threat may be written, verbal, or based on observations or other evidence.

This sampling guide describes procedures and protocols for implementing **site characterization** activities in the event of a drinking **water contamination threat** or **incident**. **Site characterization** is defined as the process of collecting information from an investigation site in order to evaluate a **water contamination threat**. Site characterization is a critical step in determining whether a water contamination threat is credible and confirmed [as defined in the EPA Response Protocol Tool Box (RPT)].

Sampling in response to drinking **water contamination threats** and **incidents** is only part of the overall site characterization process. **This document is intended as a planning resource for those involved in the sample collection portion of site characterization.** While this guide was designed for drinking water suppliers, it may also be useful for other first responders such as:

- Police and fire departments
- HazMat responders
- Law enforcement (e.g. FBI and EPA criminal investigators)
- Civil support teams
- Environmental response teams from EPA or other government agencies

For large water systems or those water suppliers and/or organizations/responders with expertise and resources in place to fully respond to water supply incidents, you can find more detailed information and response measures guidance in U.S. EPA's "Sampling Guidance for Unknown Contaminants in Drinking Water" at (http://cfpub.epa.gov/safewater/watersecurity/wla.cfm); see reference 10 in Appendix B of this pocket guide.

1.2 How to Use This Guide

This pocket guide can be broken down into two parts. The first part, Sections 1 to 3, describes the site characterization process and prepares water suppliers for minimizing the risk to personnel responding to water contamination threats and incidents. The second part, Sections 4 to 6, provides sampling information including procedures for sample collection, packaging, and transport.

This guide should be utilized as a reference document and adapted to a user's specific needs and objectives. This guide should also be used in conjunction with EPA's Response Protocol Toolbox (RPT), which can be found at: www.epa.gov/watersecurity. The RPT consists of 6 modules. References to the RPT in this pocket guide will be structured in the following way: (RPT, Mod 3, 4.5) where RPT is Response Protocol Toolbox; Mod 3 refers to Module 3 of the RPT; and 4.5 refers to Section 4.5 in Module 3 of the RPT.

2. Overview of Site Characterization

A contamination threat can range from *possible* to *credible*. See figure 2-1 for details. The threat evaluation process will help determine the range of the threat. This section provides an overview of the site characterization process.

2.1 Investigating the Site

To determine if a threat is *credible* and to **confirm** a *credible* threat, you need factual evidence concerning the nature of the threat, what the contaminant is, and how serious the contaminant may be in terms of public health. **Site characterization** and sampling help you get this factual information.

- A water contamination threat is considered ***credible*** if information collected during the threat evaluation process supports evidence for the potential of a water **contamination incident** (from the threat warning).
- A water **contamination** threat is ***confirmed*** if information collected over the threat evaluation process provides definitive evidence that the water has been contaminated.

Site characterization results are important to get, but it is just as important to make sure that the site is **safe** to enter. You must decide whether other equipment or specially trained personnel are needed, whether another approach is needed, and many other issues.

Because a utility probably will not have staff trained to deal with all hazards, you will need to decide ahead of time what you can and cannot do and whether another organization or agency must help. For example, you may be able to do visual inspections and test basic water quality at low-hazard sites, but you may not have the equipment and/or training to test for more hazardous substances. You may need to call a HazMat team which has the equipment and training to safely deal with hazardous materials.

Good planning calls for your utility to make prior arrangements not only with Hazmat teams but with a laboratory to provide sample kits and clean sample containers to have on hand, before any **threat** or **incident** occurs. You will then be prepared to respond effectively if a **threat warning** is received or an emergency occurs. The best way to prepare is to communicate, plan, and practice before a threat or incident occurs.

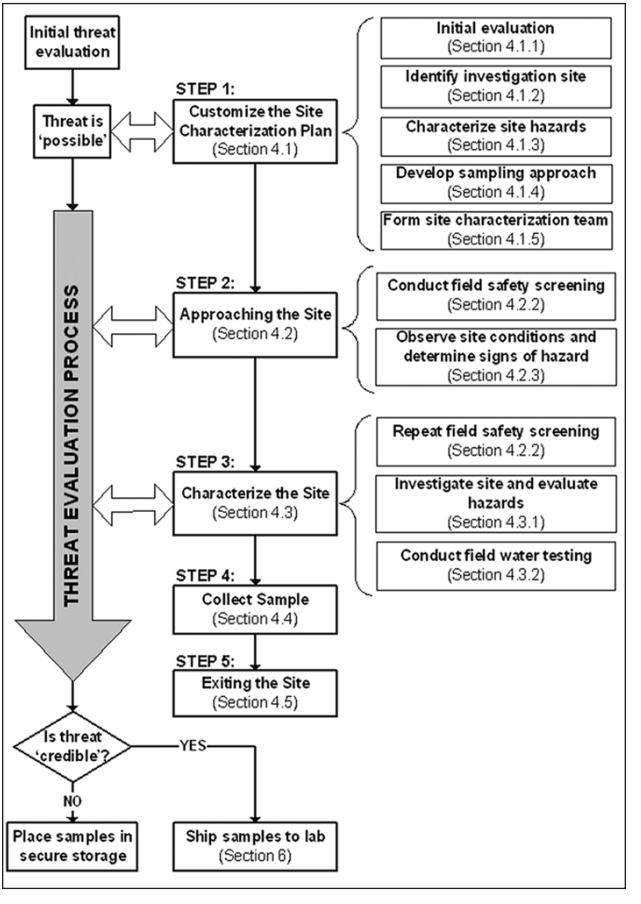


Figure 2-1 – Overview of the Site Characterization Process

For additional detail in Figure 2-1, note the sections addressed in parentheses inside the boxes. These sections are referenced from Module 3 of the Response Protocol Toolbox. The figure can be found in Module 3, (RPT, Mod 3, Fig. 3-1).

2.2 Who Conducts Site Characterization and Sampling?

The answer to this question depends on what stage of site characterization and sampling you are in. You or another designated utility emergency response lead may carry out the first steps of site characterization and sampling. An **Incident Commander (IC)**, who may be from another agency, has the overall responsibility for managing the response to the **threat**, and planning and directing site characterization activities. The **Incident Commander** may also approve the site characterization team to proceed with their activities at key decision points (e.g. whether or not to enter the site following the approach, whether or not to take a sample, and the level of expertise needed to take that (those) sample(s)). The **Incident Commander** has the ultimate responsibility for determining the scope of the site characterization activities and the team makeup. If the IC is not from the utility, it is important that the utility provide good input, particularly as it relates to the physical facility and any necessary onsite activities (e.g., sampling).

The **Site Characterization Team** is the group that actually performs site characterization and sampling activities. This team may include people from the water utility, the police and fire departments, HazMat specialists, environmental response teams from government agencies, public health officials, FBI and EPA criminal investigators, civil support teams, and other agencies. The water utility emergency response commander, – you - the **Incident Commander** manages the site characterization and sampling. The site characterization team carries out the investigation. *The water utility remains involved at all times because when someone else is in charge, they may not know the right questions to ask, or understand important details of your operation. This involvement should be very active.*

3. Site Characterization Five-Step Process

3.1 The Five-Step Process

Site characterization is defined as the process of collecting information from an investigation site in order to support the evaluation of a drinking water **contamination threat**.

The Site Characterization Team first develops and uses a **customized site characterization plan** as a set of guidelines for investigating the threat. Each **threat** or **incident** will be different, so every site characterization plan will be different. However, all plans will share certain features in common.

The site characterization process is divided into five steps or actions (RPT, Mod 3, 2.1):

Step 1: Customizing the Site Characterization Plan (RPT, Mod 3, 4.1)

- Review the initial **threat evaluation**
- Review and customize the generic site characterization plan
- Identify the investigation site
- Conduct a preliminary hazard assessment
- Develop a sampling approach
- Form the site characterization team

Step 2: Approaching the Site and Doing a Field Safety Screening (RPT, Mod 3, 4.2)

- Establish the site zone
- Conduct field safety screening
- Observe site conditions

Step 3: Characterizing the Site (RPT, Mod 3, 4.3)

- Repeat field safety screening
- Conduct the detailed site evaluation
- Perform rapid field testing of the water

Step 4: Collecting Samples (RPT, Mod 3, 4.4)

- Fill sample containers
- Preserve samples if necessary
- Initiate chain of custody – pass on to appropriate lab(s)

Step 5: Exiting the Site (RPT, Mod 3, 4.5)

- Perform final site check
- Remove all equipment and samples from the site
- Re-secure the location

Each of these steps is described in greater detail below for the safety and protection of personnel.

Safety and Protection of Personnel

Field personnel involved in site characterization activities should have proper safety training to conform to appropriate regulations, such as OSHA 1910.120 (http://www.osha.gov), which deals with hazardous substances. Depending on the expertise of the drinking water personnel, the HazMat responders may be better suited to take the sample(s).

For additional safety training references, call the National Response Center at (800) 424-8802 or (202) 267-2675 for Hazardous Materials support, or visit the National Response Team at www.NRT.org.

Step 1: Customizing the Site Characterization Plan (RPT, Mod 3, 4.1)

The first step in developing a specific site characterization plan is to decide if the site is safe to enter and investigate further. This is done by making an initial hazard assessment before the team is sent to the site. You or the **Incident Commander** (which may be you) will make this initial hazard assessment, based on available data and initial **threat evaluation**. A decision is made regarding the potential need for specialized material handling techniques or equipment. This is a very important step that protects the safety of anyone who enters the site. Response plans should specify who would be called to respond to **contamination threats** under different hazard conditions. A possible initial hazard assessment is:

- **Low Hazard, LH** – no obvious signs of radiological, chemical, or biological contamination at the site, in the air, on the surfaces or on the ground. If contaminants are present they are probably confined to the water.

  The other possible assessments are of greater hazard and would involve a HazMat team:

- **Chemical Hazard** – highly toxic chemicals may be present, posing a risk through skin contact or inhalation. Chemical weapons (e.g., nerve gas) and biological toxins (e.g., botulism or ricin) are examples of chemical hazards. Toxic industrial chemicals include strong acids, solvents, poisonous metals, and other harmful chemicals. The quantity of these chemicals present help to define the hazard.

- **Biological Hazard** – dangerous pathogenic bacteria, protozoans, or viruses may be present, posing a risk of severe illness, disease, or death through skin contact, ingestion, or inhalation.

- **Radiological Hazard** – a Geiger counter and/or other meters or indicators can show that radioactive materials may be present, posing a risk of radiation exposure.

The initial hazard assessment is also important for deciding ***who*** will be on the Site Characterization Team, because the team must have the skills, experience, and equipment needed to deal with the hazards that may exist on the site. Staff possibilities include the following:

- If the site appears to be ***low hazard***, the water utility staff may comprise the Site Characterization Team.

- If there are clear signs or evidence or information suggesting harmful contamination of a greater hazard (chemical, biological, or radiological), then there is a possible threat to the life and safety of utility personnel. The utility should consider using Hazardous Materials (HazMat) professionals trained in hazardous materials safety and handling techniques to do the initial hazard assessment and the entire site characterization as well.

- The HazMat team may do the initial hazard assessment, find that the site is safe for others to enter, and allow the utility staff to enter the site to continue the site characterization.

The **threat** warning itself may suggest what the hazard is. Be alert to the possibility of "red herrings," where the **threat** warning suggests one type of hazard and the site actually contains a different hazard. If this happens it is likely that the contamination was intentionally carried out. For specific examples of threats, refer to RPT, Mod 3, 4.1.6.

Step 2: Approaching the Site and Doing a Field Safety Screening (RPT, Mod 3, 4.2)

In this step, the Site Characterization Team approaches the site and conducts a **field safety screening**. The site characterization team leader is responsible for implementing the site characterization plan in the field and supervising site characterization personnel. The team leader must coordinate and communicate with the **Incident Commander** during site characterization.

Field safety screening is done to observe site conditions and in particular to detect any immediate threats to the response team from contaminants in the atmosphere or on surfaces.

Field safety screening might include field testing for radioactivity and volatile organic compounds, chemical weapons, and biological weapons. The site characterization team should have already been trained in the use of safety screening equipment.

The first item in a field safety screening is to define the perimeter of the site before approaching it. The site perimeter should include the immediate area of the incident as well as a buffer zone for safety. Beginning at some distance outside the site perimeter, the Site Characterization Team carefully proceeds towards the site perimeter, noting anything out of the ordinary by observing not only the instrumentation as the site is approached but other possible signs of contamination such as dead or sick animals, empty containers, discarded gloves, clothing etc.

Risks to personnel can be minimized through the use of good safety practices. Please make note of the following:

- Approach the site from upwind.
- **Do not** eat, drink, or smoke at the site.
- **Do not** drink, smell touch, or taste the suspect water.
- **Use** general personal protective equipment (PPE) such as splash-proof goggles, disposable gloves, proper footwear, safety boots/shoes, (i.e., no open toe or open heel shoes), disposable shoe covers, a chemical-resistant disposable lab coat or coveralls, long pants, and hard hat. Note: This level of protection should only be used if (a) The atmosphere (air) contains no known hazard, and (b) work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemical.

Note: After the field safety screening has been completed and if it appears safe to proceed, personnel may continue the site characterization process including the sampling of the suspect water.

- **Avoid** all skin contact with the water, and if incidental contact does occur, immediately flush the affected area with clean water brought to the site for that purpose.

- Fill sampling containers **slowly** to avoid splashing or creating spray or droplets of water that could spread the contamination.

- **Minimize** the time that personnel are on the site doing characterization and collecting samples. Depending on the situation, it may be better if the goal is to collect samples and then withdraw to a known safe area to perform the field testing. The same may hold true if Hazmat collects samples for field analysis.

If there are signs of hazards, the team should stop their investigation and immediately contact the **Incident Commander**. The Incident Commander must then decide how to proceed. It is recommended that the site be evacuated immediately and that a properly trained and equipped HazMat team be brought in to investigate. Such personnel are trained in the proper use of protective equipment and field investigation equipment, as well as the proper procedures for investigating a potentially contaminated site.

If there are no obvious signs of hazards, the team should still contact the **Incident Commander** before crossing the site perimeter and entering the site. In most cases, the Site Characterization Team will probably be able to enter the site and proceed with site characterization and collection of water samples to determine the nature of the **threat** or **incident**.

Step 3: Characterizing the Site (RPT, Mod 3, 4.3)

After the field safety screening has been completed and it appears safe to proceed, the team may continue the site characterization. The team should do a detailed visual inspection of the site. They should perform **Rapid**

Field Testing (RFT) of the water suspected of being contaminated. RFT is conducted to try to identify the types of contaminants present in the water so that proper laboratory analyses can be completed. *Recommended core field-testing consists of monitoring for radiation, cyanide, chlorine residual, and pH of the suspected water*. Equipment and instruments for RFT are listed in Table 4-3 of this guide.

Rapid Field Testing (RFT)

Rapid field testing has three objectives:

1. To provide additional information to support the **threat** evaluation process.

2. To provide tentative identification of contaminants that would need to be confirmed later by laboratory testing.

3. To determine if hazards tentatively identified in the water require special handling precautions.

The specific rapid field testing performed should be identified in the site characterization plan. Specific field testing performed should be based on the circumstances of the specific **threat** and should consider the training, experience, and resources of the site characterization team. Negative field test results are **not** a reason to forgo water sampling, since field testing is limited in scope and can result in *false negatives*.

NOTE: There is no single field testing kit that tests for all possible radiological, chemical, or biological contaminants. Therefore, field testing should be used only as a *guide*, not as the final solution. A negative result during field testing may mean that there is no contaminant, ***or*** it may mean that your field screening kit is not sensitive enough to detect the contaminant, or was not designed to measure the particular contaminant that is present. **Remember**: Qualified laboratories are more likely to prove (or confirm) that the water is safe ***or*** contaminated, you must have water samples analyzed

by a laboratory that is qualified to do such testing. *Water samples should **always** be collected if there is any question that the water might be contaminated*. These samples can be analyzed by a laboratory at a later date.

For the purpose of this guide, two general classes of samples are considered:

a. **Environmental Samples**
b. **Hazardous Samples**

a. **Environmental Samples** are those collected from environmental media, such as natural or treated waters, and are *not expected to be contaminated with hazardous materials at concentrations which would pose a risk to unprotected personnel*. The vast majority of water samples collected are expected to be classified as **Environmental Samples**.

b. **Hazardous Samples** typically consist of concentrated hazardous materials. A hazardous sample would most likely be taken from a suspected source of contamination at a water utility such as from drums, tanks, lagoons, pits, waste piles, or fresh spills. *Accordingly, they require special handling procedures due to their potential toxicity or hazard*.

The appropriate level of personal protection equipment necessary to safely perform the site characterization activities will depend on the assessment of site hazards that might pose a risk to the site characterization team.

See the hazard possibilities below (*i, ii*) to determine the necessary protection for the team.

The distinction between **Environmental Samples** and **Hazardous Samples** becomes blurred when hazardous materials might be present in an environmental sample at unknown concentrations. The decision regarding the classification of a sample as **Environmental** or **Hazardous** may be based on the hazard classification of the site from which samples were collected. The hazard categories, as discussed under the customized site characterization

plan, include: **low, radiological**, hazardous **chemicals**, and the infectious **biological** agents categories.

Note that the hazard assessment may be further refined during the approach to the site based on the results of the field safety screening and initial observation of site conditions. Below, two general possibilities (*i, ii*) are considered:

i. Low, Non-Significant Hazards or Incidents

In ***most*** cases, the investigation site will not present a significant hazard to the site characterization team, and basic equipment and training will be sufficient to conduct site characterization activities safely.

ii. Significant Hazards

In some cases, obvious signs of hazard may be observed at the time the **threat** is discovered or during the approach to the site, as described in RPT, Mod 3, 4.1.3. Under these conditions, only personnel with proper equipment and training for response to hazardous situations should enter the site and perform characterization activities, such as HazMat teams, EPA On Scene Coordinators (OSCs) and their supporting contractors, Civil Support Teams, or FBI hazardous materials response teams.

Once the field safety screening work is completed for any potential hazards, the need for personal protective equipment (PPE) will be determined by the responsible agency, usually not the utility. Information on appropriate PPE for specific chemical contaminants can be found at the Chemical Hazards Response Information System (CHRIS) at http://www.chrismanual.com. These agencies may use other resources than CHRIS, for instance just suiting up to Level A personal protection equipment.

Step 4: Collecting Samples (RPT, Mod 3, 4.4)

The objective of taking samples from a suspected contamination site or secondary investigation site is to obtain and preserve a sample of the water at a particular

time and location, so that it can be analyzed later if necessary. In order to perform sampling effectively, sampling requirements should be considered in the development of the customized site characterization plan. Factors to consider during the development of a sampling approach include:

- Which contaminants or contaminant classes will be sampled?
- What type of samples will be collected (i.e., grab or composite)?
- When and where will samples be collected?
- Are any special precautions necessary during sample collection?

Selection of target contaminants during development of a customized site characterization plan will be based on an initial assessment of information about the ***threat***. Prior to site characterization, it is likely that little will be known about the identity of suspected water contaminants. In this case, the sampling approach may need to be comprehensive and include all analytes covered by the sample kit (see Table 4-1). In some cases, the available information about the **threat** may indicate the presence of a particular contaminant or contaminant class, and the sample plan may be adjusted accordingly. However, *during this initial stage of site characterization, it may still be prudent to plan to collect a complete sample set* (i.e., all sample containers in the utility's emergency water sampling kit) from the investigation site.

Remember to identify labs well in advance and alert them that samples will be coming well ahead of time so they can begin to prepare for the analyses.

Sampling Considerations
For greater detail on sample collection kits, field test kits, and sampling procedures, see Sections 4 and 5 of this guide. It will be necessary to review these sections prior to actually collecting samples.

Step 5: Exiting the Site (RPT, Mod 3, 4.5)

After finishing the site characterization, the team should prepare to leave the site. Before leaving, the team should make sure that they have:

- Documented their findings
- Collected all samples needed
- Collected all equipment
- Re-secured the site (locked doors, hatches, gates, etc.)

There may be other actions to take before leaving the site. If the site is a possible crime scene, then it should be blocked off to prevent entry and any evidence should be protected from disturbance. If the site contains hazardous materials, it may be necessary to decontaminate the entire team and their equipment.

For a site characterized as a **low hazard**, it should not be necessary to implement extensive procedures for exiting the site. The following general precautions are recommended when exiting a **low-hazard** site:

- Verify that any hatches, locks, etc., are properly secured before leaving the site.
- Collect all samples, equipment, and materials and move them to the site perimeter. Anything brought onto the site should be removed from the site.
- Make sure that all samples are in the cooler(s) along with ice packs and that the cooler is sealed with chain of custody tape, if applicable.
- Remove all PPE at the site perimeter, and place disposable PPE, along with any other garbage, into a heavy-duty plastic trash bag. Close the bag securely.

- Place all equipment, samples, and the sealed plastic trash bag into the vehicle.

- If the site has perimeter security (e.g., a fence and gate), verify that the perimeter has been properly secured before leaving the site.

- Ensure that all forms have been completely filled out before leaving the site.

If the site was categorized at a higher hazard level and/or if the site is considered a crime scene, then special procedures for exiting the site will likely be required by HazMat officials or law enforcement. For example, personnel and equipment may be required to undergo decontamination prior to exiting the site, and access to the site is likely to be tightly controlled. If the site is considered a crime scene, the site may be secured by law enforcement, and qualified investigators will be responsible for collecting any physical evidence from the site (such as empty containers, dead animals, etc.).

4. Sample Collection Kits and Field Test Kits

Two types of kits are discussed in this guide, sample collection and field test.

4.1 Sample Collection Kits

Sample collection kits will generally contain all sample containers, materials, supplies, and forms necessary to perform sample collection activities. Sample collection kits can be constructed and pre-positioned throughout a system to expedite the sampling process. They can also be standardized throughout an area to facilitate sharing of kits in the event of an emergency that requires extensive sampling. Table 4-1 presents an *example* of a sample collection kit, while Table 4-2 provides a detailed listing of the sample containers included in the kit. The sample collection kit includes:

- Large plastic container for holding sample kit supplies
- Field resources and documentation
- General sampling supplies, including sample containers
- Pathogen sampling supplies
- Reagents
- Safety supplies

The sample collection kit described in this section is intended to *illustrate* the type of materials and supplies that *might* be useful during sampling activities. However, the design of a specific kit should be tailored to the needs and sampling objectives of the user. Furthermore, other organizations may need to be consulted in the design of a sample collection kit. For example, the laboratory may wish to provide sample containers and reagents that are consistent with the analytical approach for water samples potentially containing non-target analytes.

Keep in mind:

- Collection of a complete sample set is more likely to be achieved through the use of pre-designed kits.
- Personnel responsible for site characterization can become familiar with the content of the kits and trained in the use of any specialized equipment.

Table 4-1 – Example Design of an Emergency Water Sample Collection Kit

Item	Quantity	Notes
Field Resources and Documentation		
Field guide	2	Resource for field personnel
Health and safety plan	2	If required for the site
Sample labels	48	Waterproof (filled out in advance, if possible)
Sample documentation forms	24	For recording sample information
Custody tape (or seals)	2 rolls	Used on sample or shipping containers
Chain of custody forms	24	For documenting sample custody
Lab marker	2	Waterproof, 1 red, 1 black
General Sampling Supplies		
Sample containers	Table 4-2	For collecting samples
Device for grab sampling	1	For sampling large water bodies
10 liter HDPE container	4	For collection of large volume water samples
Lab grade tape	3 rolls	For temporary labeling in the field
Miscellaneous glassware	N/A	Beakers, graduated cylinders, spatula, etc.

Table 4-1 – Example Design of an Emergency Water Sample Collection Kit (continued)

Item	Quantity	Notes
Collapsible cooler	1	For sample storage
Rigid shipping container	1	For shipping by overnight service if needed
1 qt. zippered freezer bags	1 pack 100	For double bagging ice and sample containers
Thermometer	2	For checking water temperature
Paper towels	2 rolls	Wiping wet containers and containing spills
Pathogen Sampling Supplies		
Tubing and clamp	1	For sample tap flushing, etc.
Stopwatch & graduated cylinder	1	For measuring flow rate
Ultrafiltration apparatus	1	For concentrating pathogen samples
Reagents (may need to be kept separate from the rest of the kit)		
Laboratory grade water	5 liters	For sample dilution in the field
Sodium thiosulfate crystals	100 grams	For water sample dechlorination
Ascorbic acid	100 grams	For water sample dechlorination
Sodium sulfite crystals	100 grams	For water sample dechlorination

Table 4-1 – Example Design of an Emergency Water Sample Collection Kit (continued)

Item	Quantity	Notes
Potassium dihydrogen citrate	100 grams	For carbamate preservation
6 Molar ACS grade hydrochloric acid (HCl)	25 mL	In dropper bottle for preservation of samples for organic analyses
6 Molar trace metal-grade nitric acid (HNO3)	25 mL	In dropper bottle for preservation of samples for trace metals analysis
10 Normal Sodium hydroxide (NaOH)	25 mL	In dropper bottle for preservation of samples for cyanide analyses
pH paper in ranges from 0 - 14	50 strips	For checking the pH of samples preserved with acid or base (sensitive to 0.5 pH units)
Safety Supplies		
Splash resistant goggles	2	One per individual (minimum)
Disposable gloves	20 pairs	Nitrile or polyethylene, powder-free
Disposable shoe covers	2 pairs	One pair per individual (minimum)
Disposable laboratory coats	2	One per individual (minimum)
Clear, heavy duty plastic trash bags	4	For disposal of lab coat, gloves, etc.
Rinse water	20 liters	For general use and first aid
Antiseptic wipes	1 container	For cleaning hands, sample containers, etc.

Table 4-1 – Example Design of an Emergency Water Sample Collection Kit (continued)

Item	Quantity	Notes
Bleach solution (at least 5%)	1 gallon	For decontamination if necessary
Squirt bottle	2	For use with rinse water or lab grade water
First aid kit	1	For general first aid
Flashlight/headlamp	3	For working at night or in dark locations

Table 4-2 – Sample Containers for Emergency Water Sample Collection Kit

Sample Type	Container Size	Container Type	No.	Dechlorinating Agent	Preservative	Analytical Technique	Reference Methods
CHEMISTRY - BASIC SCREEN (Established Techniques)							
Organic Analytes							
Volatiles	40 mL	Glass w / Teflon faced septa	5	Ascorbic acid	1:1 HCl to pH < 2 See method.	P&T – GC/MS	EPA 524.2, 8260B
						P&T – GC/PID/ ELCD	EPA 502.2, 8021B

Table 4-2 - Sample Containers for Emergency Water Sample Collection Kit (continued)

Sample Type	Container Size	Container Type	No.	Dechlorinating Agent	Preservative	Analytical Technique	Reference Methods
Semi-volatiles	1 L	Amber w / Teflon-lined screw caps	4	Sodium sulfite	6M HCl. See method.	SPE GC/MS	525.2, 8270D/3535
Quarternary nitrogen compounds	1 L	Amber PVC or silanized glass	4	Sodium thiosulfate	Sulfuric acid to pH 2	SPE HPLC - UV	549.2
Carbamate Pesticides	40 mL	Glass w / Teflon faced septa	4	Sodium thiosulfate	Potassium dihydrogen citrate sample pH to ~3.8	HPLC-fluorescence	531.2
Inorganic Analytes							
Metals/ Elements	125 mL	Plastic (i.e. HPDE)	2	None	Trace metal grade nitric acid. See method.	ICP-MS	200.8
						ICP-AES	200.7
						AA	200.9

Table 4-2 - Sample Containers for Emergency Water Sample Collection Kit (continued)

Sample Type	Container Size	Container Type	No.	Dechlorinating Agent	Preservative	Analytical Technique	Reference Methods
Organometallic compounds	125 mL	Plastic (i.e. HPDE)	2	None	Nitric acid to pH <2. See method.	AA – cold vapor automater	245.1
						AA – cold vapor automater	245.2
Cyanide	1 L	Plastic	2	Ascorbic acid	Sodium hydroxide to pH 12. See method.	Titrimetric Spectro-photometric	335.2
						Colorimetric UV	335.3
Radiological	2 L	Plastic	2	None	None – mark samples not preserved	Gross alpha, gross beta, gamma isotopes, specific radionuclides	900 Series
CHEMISTRY - EXPANDED SCREEN (Exploratory Techniques)							
Unknown organics (volatile)	40 mL	Glass w / Teflon faced septa	5	None	None – mark samples not preserved	P&T-GC/MS	See RPT Module 4

Table 4-2 - Sample Containers for Emergency Water Sample Collection Kit (continued)

Sample Type	Container Size	Container Type	No.	Dechlorinating Agent	Preservative	Analytical Technique	Reference Methods
Unknown organics (general)	1 L	Amber Glass	4	None	None – mark samples not preserved	Prep: SPE, SPME, micro LLE, direct aqueous injection, headspace	See RPT Module 4
						Analysis: GC/MS, GC, HPLC, LC-MS	
Unknown inorganics	1 L	Plastic	2	None	None - mark samples not preserved	ICP-MS	See RPT Module 4
Immunoassays	1 L	Amber Glass	2	Consult manufacturers instructions	Consult manufacturers instructions	Consult manufacturers instructions	None
PATHOGENS – EXPANDED SCREEN (Established and Exploratory Techniques)							
Pathogens - culture	100 mL	HDPE (plastic)	2	Thiosulfate	TBD	Per target pathogens	See RPT Module 4
Pathogens - PCR	100 mL	HDPE (plastic)	2	Thiosulfate	TBD	Per target pathogens	See RPT Module 4

Table 4-2 - Sample Containers for Emergency Water Sample Collection Kit (continued)

Sample Type	Container Size	Container Type	No.	Dechlorinating Agent	Preservative	Analytical Technique	Reference Methods
BASELINE WATER QUALITY PARAMETERS (See Module 3, Section 3.4 of Response Protocol Toolbox)							
Water quality: bacteria	250 mL	Plastic	1	Thiosulfate	None	Fecal coliform, E.coli,	Standard methods
Water quality: chemistry	1 L	Plastic	1	None	None - mark samples not preserved	Conductivity, pH, alkalinity, hardness, turbidity	Standard methods
Surrogates	1 L	Amber glass	2	None	None - mark samples not preserved	Total organic carbon, ultraviolet absorbance, color, chlorine demand	Standard methods
Toxicity	125 mL	Glass	2	Consult manufacturers' instructions.	Consult manufacturers' instructions.	Rapid toxicity assay (several vendors)	None

4.2 Field Test Kits

Field test kits contain the equipment and supplies necessary to perform field safety screening and rapid field testing of the water. These more expensive field test kits may be assigned to specific site characterization teams or personnel. Recommended equipment necessary for minimal field safety screening and Rapid Water Testing is shown in Table 4-3.

Table 4-3 – Core and Expanded Field Test Kits

CORE FIELD TEST KIT (Rapid Field Test list of "Step 3", pgs 11 &. 12)			
Target Parameter	**Class**	**Methodology**	**Comments**
Radioactivity (alpha, beta, and gamma)	Primarily a Safety Screen	G-M probe and meter	May be expanded to water testing with a special probe.
Cyanide	Water Testing	Colorimetric or ion selective electrode	Tests water for cyanide ion, but not combined forms.
Chlorine residual	Water Testing	Colorimetric	Absence of residual may indicate a problem.
pH/conductivity	Water Testing	Ion selective electrode	Abnormal pH or conductivity may indicate a problem.
EXPANDED FIELD TEST KIT			
Target Parameter	**Class**	**Methodology**	**Comments**
General hazards	Safety Screen	HazMat (explosives, oxidants, etc.)	Should be performed by trained HazMat responder.
Volatile chemicals	Safety Screen	Sniffer-type devices	Detects chemicals in air.

Table 4-3 - Core and Expanded Field Test Kits (continued)

Target Parameter	Class	Methodology	Comments
Chemical weapons (VX, sarin, etc.)	Both	Enzymatic/ colorimetric	Many kits may also detect certain pesticides.
Water quality parameters	Water Testing	Variable (e.g., ion probes, colorimetric)	Kits available for a variety of common parameters.
Pesticides (OP and carbamates)	Water Testing	Immunoassays	Quick and simple to use.
VOCs and SVOCs	Water Testing	Portable GC/MS	Expensive, but expands field capability for chemicals.
Toxins (ricin, botulinum, etc.)	Field Screening	Immunoassays	Quick and simple to use. (Generally not sensitive for drinking water purposes.)
Pathogenic diseases (tularemia, anthrax, plague, etc.)	Field Screening	Immunoassays and PCR	Preconcentration will increase sensitivity.
Toxicity	Water Testing	Inhibition of biological activity.	Need to establish a baseline.

Following Rapid Field Testing, (see Section 3, Step 3 of this guide for details on RFT), samples of the potentially contaminated water will be collected for potential laboratory analysis. The decision to send samples to a laboratory for analysis should be based on the outcome of the **threat** evaluation in Figure 2-1. If the **threat** is determined to be *credible*, then samples should be

immediately delivered to the laboratory for analysis. If the **threat** is not credible, then the samples should be stored in a safe place for a specific period of time in case it becomes necessary to analyze them at a later date.

5. Sampling Guide

5.1 General Sampling Considerations

The following general guidelines are applicable to sampling for both chemicals and pathogens (**Biologicals**), while specific sampling procedures for these two contaminant classes are provided later in this Section, 5.2.

These guidelines are applicable to the collection of samples from investigation sites within the distribution system, including storage tanks, pressurized pipes, and other distribution system components. In most cases, samples will be collected from a tap connected to the distribution system component. It may be necessary, however, to collect samples from a large body of water such as a finished water reservoir. Sampling from such large bodies of water, whether finished or source water, requires different sampling techniques than those used to sample from distribution systems.

The two most common types of **Environmental Samples** are *grab samples* and *composite samples*. A *grab sample* is a single sample collected at a particular time and place that represents the composition of the water only at that time and location. The sample is collected all at once and at one particular point in the sample medium. A *composite sample* is composed of several smaller sample amounts collected at various sample locations and/or different points in time, which are then combined to form one *composite sample*. Analysis of a *composite sample* produces an average value and can, in certain instances, be used as an alternative to analyzing a number of individual *grab samples* and calculating an average value.

In general, it is recommended that **only** *grab samples* be collected from distribution systems. However, in

some situations it may be necessary to take *composite samples* over time or location. An example of a scenario in which it may be necessary to collect *composite samples* is sampling conducted to characterize a large reservoir where collection and analysis of a large number of discrete samples may be time and cost prohibitive. One disadvantage of *composite samples* is that they may dilute concentrations of contaminants that would otherwise be detected in discrete *grab samples*. Another disadvantage is that if a contaminant is detected, it is impossible to know which specific individual sample was the source of the contaminant.

The **time** and **location** of sample collection will be addressed by the selection of investigation sites, as discussed in RPT, Mod 4, 1.2.

Due to the potential spread of a suspected contaminant through a distribution system, sampling may be performed at *secondary investigation* sites rather than the primary site.

The need for **special precautions** during sample collection will likely be determined by the site hazard assessment described in Section 3 (Step 2 & Step 3) of this guide. Figure 5-1 illustrates four sampling approaches based on the four hazard categories: **low hazard**, **chemical hazard**, **biological hazard**, and **radiological hazard**. Prior to the initiation of site characterization activities, there may be limited information available to determine which sampling approach is appropriate. However, the results of the site evaluation and field testing may allow for a more precise characterization of the hazards at the site, and thus provide a basis for refining the sampling approach.

Under **Low Hazard** conditions, no special sampling techniques are necessary beyond good safety practices as described in Section 3, Step 2 of this pocket guide (RPT, Mod 3, 3.1). Under this scenario, samples for chemical and pathogen analysis are collected according to the procedures described in Section 5.2 of this guide.

5.2 General Water Sampling Procedures

5.2a Low-Hazard General Sampling Procedures

Note: These guidelines are for Low-Hazard Scenarios

1) Review the site characterization plan prior to sampling to ensure that all samples are collected.

2) Each sample container should be properly labeled using a waterproof marker with the following information:

   i) analysis
   ii) preservative (if any)
   iii) dechlorinating agent (if any)
   iv) sample location
   v) sample identification
   vi) sample collection date and time
   vii) sampler's initials

   Additional information requested on the sample label should be provided as well. It is recommended that sample labels for each container be completed **before** beginning sample collection. Typically, it is done just before obtaining the sample, or the "time" is left blank and entered immediately after collecting the sample.

   During routine drinking water sampling, containers are often taken into the field with preservatives already in them. Samplers need to determine in advance if "pre-preservation" of containers is appropriate.

3) Flush sample taps for a time sufficient to displace the water in connecting lines in order to obtain a representative sample from the distribution system component of interest. The typical flushing time is 4 – 5 minutes. The sample tap should be a cold water tap. In some cases, flushing may displace all the contaminant. You may want to consult with the IC before flushing.

   a) Keep the flow rate from the sample tap sufficiently low in order to avoid splashing and aerosolizing water droplets. Divert water to a drain if possible.

b) If the water flushed from the tap might pose a hazard to the discharge area, it may need to be collected for decontamination.

4) Critical information for each sample should be documented:

a) The same information captured on the sample labels should be transferred to a hardcopy sample documentation form to serve as an inventory of the samples.

b) Sample custody should be closely tracked and documented using a Chain of Custody form (see Appendix D for an example form or RPT, Mod 3, App 8.5).

5) **Samples may be considered evidence**, and thus should be subject to appropriate security measures:

a) Samples should be under the control of designated personnel at all times.

b) When samples are not in the possession of designated personnel, they should be secured (e.g., locked in a secure area) and only accessible by designated personnel. In the field, samples may need to be locked in a vehicle.

c) Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms.

d) If necessary, duplicate samples can be collected for law enforcement.

e) Take photographs of the samples at the site of collection as another form of sample documentation. Some law enforcement agencies don't like photographs—some do. A digital image, transmitted from the field back to the commander, can help explain a lot although this capability might not be available by all first responders.

6) If the decision is made to analyze the samples immediately, the laboratory should be contacted as soon as possible so they can prepare for arrival of the samples.

7) If the decision is made to hold samples rather than send them to the laboratory for immediate analysis, the following precautions should be taken:

   i. Samples should be chilled, but protected from freezing.

   ii. Samples should be held until the **threat** evaluation has been completed and the decision has been made to either analyze the samples or close the investigation.

   iii. The shortest *holding time* for a particular analysis will dictate the maximum time that samples should be held prior to analysis. Holding times for preserved chemical samples differ based on the type of contaminant. They are typically 7-28 days for properly preserved samples, although the respective analytical method should be consulted for details, e.g., nitrite is 48 hours when preserved, hexavalent chromium is 24 hours. If it is necessary to store unpreserved samples, the stability of the target analyte in water should be considered when determining how long an unpreserved sample might be stored.

For holding times & preservatives for specific materials refer to either Table 4-2 Standard Methods - www.standardmethods.org. or www.nemi.gov.

It is important to follow any special laboratory requirements regarding sample collection and transport since these may affect the quality of the analytical results. For example, some procedures or laboratories may require analysis of special Quality Control (QC) samples such as field duplicates, field blanks, trip blanks, and field matrix spikes. There may also be specific chain of custody, notification, and shipping requirements.

Arrangements should be made with a laboratory before an incident so that samplers are aware of, and can prepare for any special requirements.

It may also be advisable to collect backup samples in case there is a problem with the set that is delivered to the laboratory, or if there is a need for additional samples for confirmation or analysis by another entity (e.g., specialty laboratory or law enforcement). Backup samples should be properly stored, secured, and tracked so that the integrity of the samples is maintained. While collection of individual backup samples may be appropriate in some cases, it may be logistically simpler to collect a large volume sample in a 10-liter container as a backup.

NOTE: This is not suitable for volatile organics, which must be stored in separate containers with zero headspace. It is not acceptable for bacterial samples, which must be collected and stored in sterile containers.

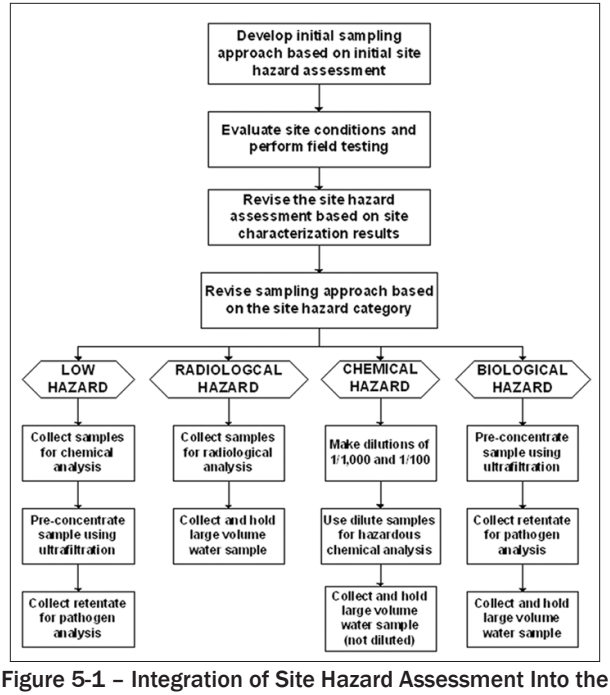


Figure 5-1 – Integration of Site Hazard Assessment Into the Sampling Approach

5.2.b. Biological (Microbiological) Sampling Procedures

Specific signs of biological contamination are less obvious than those associated with chemical contamination. There are two general approaches to microbial pathogen sampling and analysis that depend on whether or not a pathogen has been tentatively identified, as illustrated in Figure 5-2.

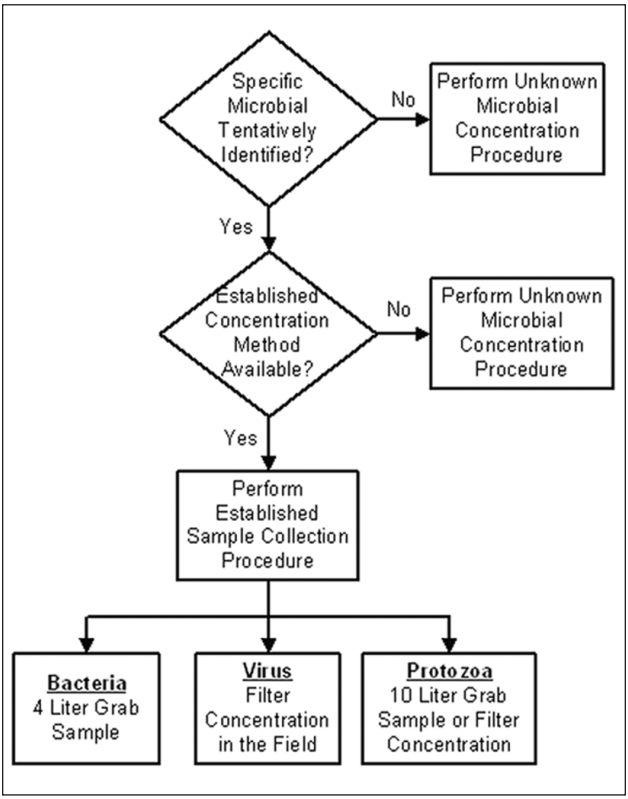


Figure 5-2 – Sampling Approach for Microbial Contaminants

If the microbiological contaminant has been tentatively identified *and* has an established analytical technique suitable for water, then samples should be collected in accordance with that technique. However, established and validated sample collection and analytical techniques for microbial contaminants in water are limited to a few pathogenic microorganisms, principally enteric bacteria, viruses and protozoa, and a few other organisms with

known waterborne transmission. Figure 5-2 indicates the sampling approach for bacteria, virus, and protozoa:

- **Bacteria**: collect a 4-liter grab sample for membrane filtration and culture of several different types of bacteria through use of selective media.

- **Virus**: filter between 100 and 1,200 liters of water through a positively charged filter. The processed filters can be shipped to the laboratory or viruses adsorbed to the filter can be **eluted** in the field and shipped as a 1-liter **retentate** (or concentrate) to a laboratory for further processing by conventional procedures.

- **Protozoa**: collect a 10-liter grab sample for shipment to a laboratory where it is filtered to concentrate the protozoa for subsequent processing and analysis. Another alternative is to perform the filtration in the field, similar to the approach for virus.

- See EPA Methods 1622 or 1623 for additional details about the standard sampling approach for Protozoa: http://www.epa.gov/safewater/lt2/training/module_crypto then click on "Menu." Many microbiological methods also specify the addition of a dechlorinating agent in order to maintain the viability of the organisms so that they can be cultured. The established method for the target microbiological contaminant should be consulted to determine the appropriate dechlorination and preservation techniques. Due to a variety of analytical methods available, biological sampling is an area where it is perhaps even more important to work with the lab receiving the samples to predefine sampling procedures.

If the microbial contaminant is unknown, sample collection is performed through the use of **ultrafiltration**.

Ultrafiltration is a membrane filtration process that retains particles, including microorganisms, larger than the molecular weight cut-off (**MWCO**) of the membrane (RPT, Mod 4, 8.4.1). Ultrafiltration is a very specialized procedure and will require a specialist to perform.

Ultrafiltration can concentrate viruses, bacteria, spores, and parasites if the **MWCO** is sufficiently small. Thus, the method is suitable for sampling water with an unknown microbiological contaminant.

General Water Sampling Procedures for Microbiological Contaminants

WARNING: Important safety precautions for all microbial contaminants. Safety glasses must be worn. Wash hands before and after sampling. The use of clean, powder-free nitrile gloves is strongly recommended. Do not collect samples with exposed skin on hands.

1. Avoid splashing or aerosolizing water droplets during sample collection or field concentration.

2. Do not rinse or overfill the sample containers. This is especially important if the sample container contains a preservative or dechlorinating agent. Do not use rubber or plastic tubing for the collection of samples.

3. Any sample collected for culture analysis should be handled in a manner such that viability of the microorganisms is maintained.

4. If necessary, add any preservatives and/or dechlorinating agents. Preservatives and/or dechlorinating agents may be added to the sample containers during sample kit preparation, which can significantly decrease the complexity and time required for sample collection. (See Table 4-2).

5. Wipe the outside of the sealed containers with an aseptic wipe or a mild bleach solution.

6. Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms. Complete the forms with the appropriate information such as PWS identification number, exact sample location, date and time, type of sample collection (raw, plant tap, entry point, or distribution) and type of analyses to be run.

7. Attach custody seal to the individual sample container, if required by the organization responsible for sample collection and handling. In some cases, it may be sufficient to place the custody seal on the shipping container rather than the individual sample containers themselves. Record the information on a Chain of Custody record (see Appendix D or RPT, Mod 3, App 8.5).

8. Place the sample container into a sealable plastic bag (bubble wrap baggies can provide protection against breakage of glass sample containers).

9. Additional instructions for packaging samples potentially containing infectious biological contaminants are provided in Section 6 of this guide.

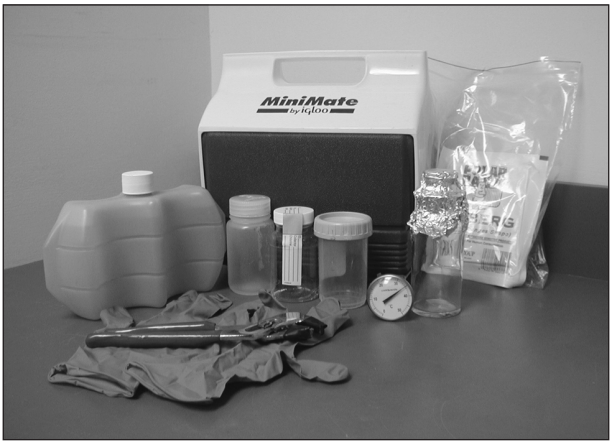
10. Place the sealed plastic bags containing the samples into an appropriate, rigid, shipping container and pack with frozen ice packs (preferred) or sealable freezer bags filled with ice. If ice is used, the bag should be thoroughly sealed and double bagged to avoid leakage. See Section 6 for more details on sample packaging in coolers and shipment.

Low Hazard Confirmatory Step Only

Sampling Procedure for Total Coliform/*E. coli* Bacteria

Sample Containers

Although different sizes and types of sampling containers may be used for collecting coliform samples, most laboratories supply 125 mL sterilized, plastic bottles. Some laboratories will wrap the bottles in paper to protect them from contamination. Glass-stoppered bottles sometimes have foil covering the top for protection. A few laboratories may furnish single-service, sterilized bottles. Do not sample with any bottles that appear to have been tampered with.



Typical sampling containers and equipment used for coliform sampling.

Procedure

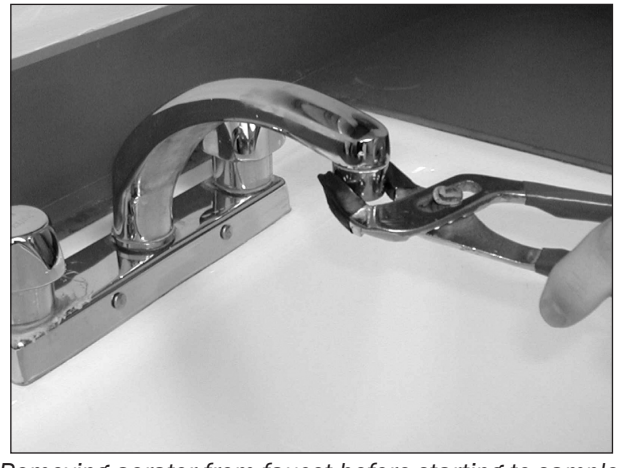
The laboratory that supplies the sampling containers normally provides instructions with the kit for the type of monitoring being done. Refer to those instructions when provided.

The following instructions and photos illustrate the general sampling procedures for collecting coliform and *E. coli* samples.

1. *Assemble all of the sampling supplies before beginning. The proper preservatives will be added to the sampling containers by the laboratory before you receive them. A dechlorinating agent is used when sampling chlorinated waters (such as those found in the distribution system). Handle the containers carefully as they are sterilized. Do not rinse out or dispose of any liquids, powders, or tablets inside the containers. This material is the preservative.*

2. *Go to the sampling location(s) specified in the sampling plan. Each representative sampling location is usually located in the distribution system and is accessible during the day. Examples include hospitals, city buildings, pump stations, restaurants, and dedicated sampling stations. The tap should be clean, free of attachments (hoses, etc.), and in good repair (no leaks). If possible, avoid single lever, mixing-valve faucets and drinking fountains.*

3. *If possible, remove any aerator, strainer, or hose that is present, as any of these may harbor bacteria.*



Removing aerator from faucet before starting to sample

4. *Optional Step: Spray tap with chlorine solution or wipe it with alcohol. (This step is optional since many people believe this practice does not kill attached bacteria and is not necessary if the sampling tap is selected carefully.)*

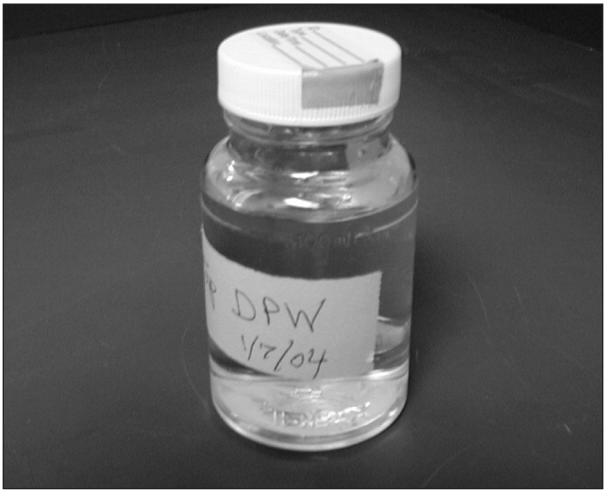
5. *Turn on the cold-water tap and run the water until the water temperature has stabilized as determined by a thermometer. This typically takes 4-5 minutes. Then reduce the flow so that the stream is no greater than ¼ inch in diameter.*

   While the water is running fill out the labels, tags, and laboratory forms in waterproof ink and apply the labels to the containers. Do not change the water flow once the sampling has started as that could dislodge microbial growth.

6. *Remove the bottle cap. Be careful not to contaminate the sample by touching the inside of the cap or the inside of the sample container with your fingers. Then position the bottle under the water flow. Hold the bottle in one hand and the cap in the other. Do not lay the cap down or put it in your pocket!*

7. *Fill the bottle to the shoulder or to about ¼ inch from the top. Many bottles have a 100 mL fill line.*

Holding the bottle under the water flow with cap in other hand.

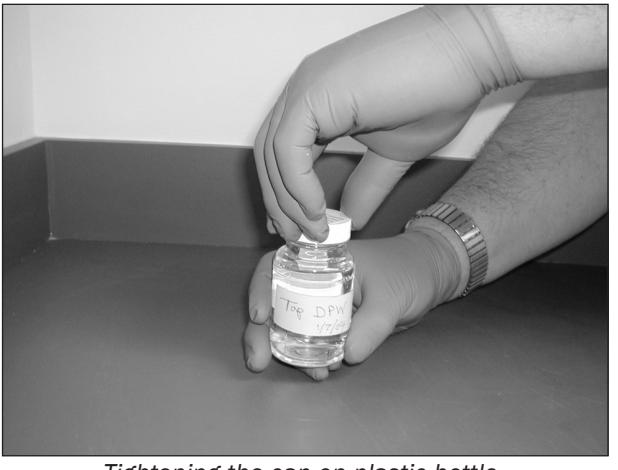


Bottle filled to the shoulder.

8. *Place the cap on the bottle and close it tightly. Samples should be cooled immediately.*

9. *Turn the tap off. Replace the aerator, strainer, or hose.*

10. *Check that the information on the label is correct (or check the laboratory form and attach it to the bottle with a rubber band).*



Tightening the cap on plastic bottle.

11. *Complete any additional laboratory forms that came with the sample bottle, including chain-of-custody form (if required by the state).*

The samples must reach the laboratory and the analysis must begin within 30 hours of collection. It is recommended that all samples be refrigerated or cooled to 4° to 10°C (39° to 50°F). If the laboratory is nearby, refrigerate with freezer packs, and deliver the samples there directly. If not, send the samples overnight by U.S. mail or by an overnight courier.

5.2.c Chemical Sampling Procedures

The following procedures are appropriate for collecting samples for chemical analysis from drinking water distribution systems. If samples need to be collected from a large body of water without a suitable sample tap, the surface water sampling guidelines may be used. If the samples are considered to be hazardous, it may be necessary to implement certain hazardous materials sampling techniques in addition to the guidelines presented below.

General Water Sampling Procedures for Chemical Contaminants

1. Carefully fill sample containers with water flowing from the sample tap. Avoid splashing or aerosolizing water droplets during sample collection. Do not use

rubber or plastic tubing for the collection of samples for chemical analysis.

2. Do not rinse or overfill the sample containers. This is especially important if the sample container contains a preservative or dechlorinating agent.

3. If necessary, add any preservatives and/or dechlorinating agents. Preservatives and/or dechlorinating agents may be added to the sample containers during sample kit preparation, which can significantly decrease the complexity and time required for sample collection (See Table 4-2). If necessary, adjust the pH of the sample per method instructions.

4. When sealing sample containers that have open top caps and septa, make certain that the Teflon® side (smooth side) is facing towards the water.

5. **VOC** samples must be collected with no **headspace**.

6. For containers with closed top caps (pesticides, etc.) attempt to fill the container to the top leaving very little or no headspace.

7. Wipe the outside of the sealed containers with an antiseptic wipe or a mild bleach solution if deemed necessary.

8. If the sample container is not pre-labeled, place a label on the container and complete the requested information. It is better to label the container before the sample is added because the outside of the container may get wet during filling. Transfer the information on the sample label to the Sample Documentation Form (RPT, Mod 3, App 8.4).

9. Attach a custody seal to the individual sample container, if required by the organization responsible for sample collection and handling. In some cases, it may be sufficient to place the custody seal on the shipping container rather than the individual sample containers themselves. Record the information on a Chain of Custody record (see Appendix D or RPT, Mod 3, App 8.5).

10. Place the sample container into a sealable plastic bag (bubble wrap baggies can provide protection against breakage of glass sample containers).

11. Place the sealed plastic bags containing the samples into an appropriate, rigid, shipping container and pack with frozen ice packs (preferred) or sealable freezer bags filled with ice. If ice is used, the bag should be thoroughly sealed and double bagged to avoid leakage. See Section 6 of this guide for more details on sample packaging in coolers and shipment.

INORGANIC CHEMICALS (IOCs)

Pre-cleaned glass or plastic bottles are used. The size of the container may vary. Follow the laboratory's instructions, if provided.

General Water Sampling Procedures for Inorganic Chemicals:

WARNING: Important safety precautions for all three groups of IOCs. Safety glasses must be worn. Wash hands before and after sampling. The use of clean, powder-free nitrile gloves is strongly recommended. Do not collect samples with exposed skin on hands.

1. Remove any attachment from the tap.

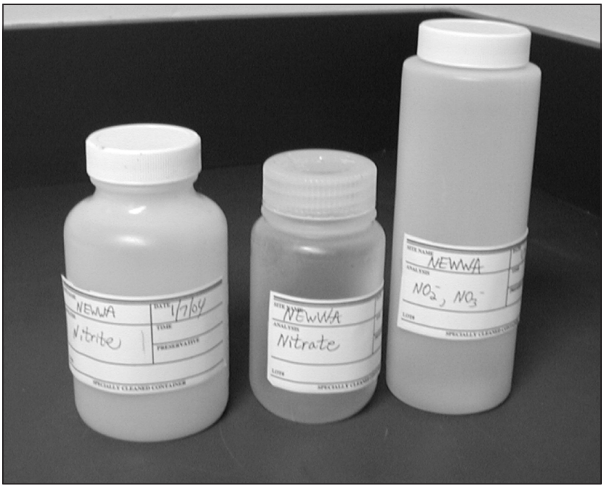
2. Turn on the cold-water tap and run the water until the temperature has stabilized as determined by a thermometer. This typically takes 4-5 minutes. Then reduce the flow so that the stream is no greater than ¼ inch in diameter.

3. While the water is running, Fill Out The Label with the required information and apply to sample container while it is still dry.

If the laboratory has any additional recommendations or requirements, they should be followed.

There are three different IOC groups that need to be considered while sampling.

The first group is comprised of inorganic non-metals. (In Table 4-2 referred to as Baseline Water Quality Parameters.) This group includes alkalinity, bromate, chloride, color, conductivity, fluoride, odor, orthophosphate, silica, total dissolved solids, and sulfate. Follow the laboratory's instructions regarding the volume of sample to collect. One container may provide water for the analysis of several parameters. Fill the container to its shoulder, leaving room for shaking.



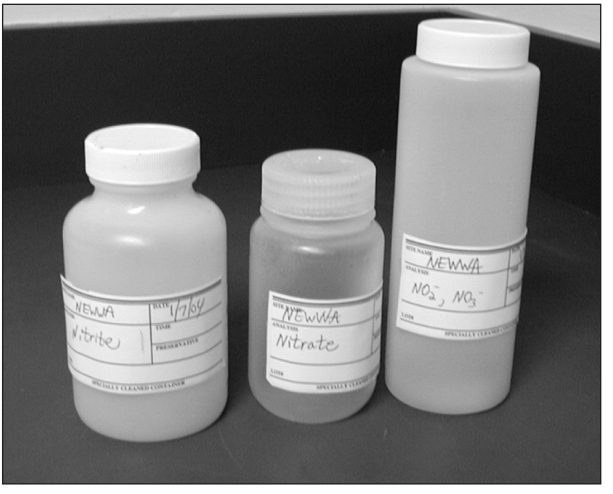
Typical nitrite and nitrate sampling containers.

The second group is inorganic metals. The containers used may have an acid added as a preservative.

Containers up to one liter may be used. Usually, a separate container is provided for mercury. The laboratory may add nitric acid to the empty containers before providing them.

Hold the bottle at an angle pointing away from your face and carefully fill it to its shoulder. If acid has been added to the bottle, it will mix rapidly with the water and may spatter a bit. Leave room in the container for gentle shaking to mix.

The third "group" is cyanide. For cyanide 1-liter brown glass or plastic containers are used. The laboratory should NOT add a preservative to them. The sample MUST be dechlorinated in the field before the sample pH is adjusted. Therefore, the laboratory must not add preservatives to the bottles before sending them to the site.



Typical nitrite and nitrate sampling containers.

Note: If the laboratory has not provided ascorbic acid (a powder) and a separate bottle containing sodium hydroxide preservative, do **NOT** collect the cyanide samples and contact the laboratory for further instructions. Cyanide samples must be dechlorinated and preserved with sodium hydroxide at the time of collection as discussed below.

1. Fill the bottle to its shoulder leaving room for adding preservatives and for shaking.

2. Add 0.1 gram of powered ascorbic acid. Cap the bottle and shake to dissolve the ascorbic acid. Check a small portion of the sample with a chlorine field test kit to determine if any chlorine is present. If chlorine is still present, repeat this step. NOTE: Starch iodide paper may be used to check for chlorine in a suspect cyanide sample too.

3. Open the sample container and add 10 drops of sodium hydroxide to the sample. Cap the bottle and shake briefly to disperse the sodium hydroxide. Open the bottle, pour a few drops of the sample into the bottle cap, and check the pH with pH paper. If the pH is not 12 or greater, repeat this step.

All of the three groups should complete the following steps.

1. Screw the cap on the container.

2. Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms. Complete the forms with the appropriate information such as PWS identification number, exact sample location, date and time, type of sample collection (raw, plant tap, entry point, or distribution) and type of analyses to be run.

3. Pack the samples in a cooler with freezer packs.

4. Deliver the samples to the laboratory or ship the samples by an overnight courier.

NITRATE (NO3-) AND NITRITE (NO2-)

Samples may be collected for nitrate, nitrite, and/or nitrate-plus-nitrite. Check with the laboratory to see if any preservatives need to be added. The required volume is 500mL or less as determined by the laboratory, and the laboratory may require only one container for both parameters. The container may be made of glass or plastic.

Typical nitrite and nitrate sampling containers.

Procedures

The general sampling procedures for nitrate and nitrite monitoring are below.

Warning: Important safety precautions. Safety glasses must be worn. Wash hands before and after sampling. The use of clean, powder-free nitrile gloves is strongly recommended. Do not collect samples with exposed skin on hands.

1. One sample at each entry point to the distribution system.

2. Remove any attachment(s) from the tap.

3. Turn on the cold-water tap and run the water until the temperature has stabilized as determined by a thermometer. This typically takes 4-5 minutes. Then reduce the flow so that the stream is no greater than ¼ inch in diameter.

4. While the water is flushing, fill out the label with the required information. If the water is known to be chlorinated, add this information to the label. Fill out label.

5. Hold container at an angle pointing away from your face and carefully fill it to its shoulder. If acid is in the container, it will mix rapidly with the water and may splatter a bit. Leave enough room in the bottle so that the sample can be shaken to mix.

Collecting the sample.

Caution - Hazard: Containers may contain liquid acid which is toxic and will cause burns. If any preservative contacts skin or eyes, flush with liberal amounts of water until EMTs arrive.

6. For samples to be analyzed for nitrite and/or nitrate *separately*, do not add acid (and do not use a container which may already contain acid).

7. For *nitrate-plus-nitrite samples only*; if acid has not been added to the sample bottle and the laboratory has instructed you to preserve the sample, add sulfuric acid one drop at a time to the sample to adjust the pH to 2, following the laboratory's instructions. Swirl the sample gently after each addition of acid. Measure the pH with a pH meter or pH paper.

8. Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms.

9. Pack the samples in a cooler with freezer packs. See Section 6 of the guide for more details on sample packaging in coolers and shipment.

10. Deliver to the laboratory the same day or ship by courier or overnight delivery service.

VOLATILE ORGANIC COMPOUNDS (VOCs)

The required containers are 40mL to 120mL glass vials. The laboratory will normally add the proper preservative in advance. For chlorinated waters, a powdered dechlorinating agent (ascorbic acid) will be added, and the sampler must subsequently add hydrochloric acid to the filled vials. For unchlorinated waters, the laboratory will add the acid to the empty vials. Samplers should obtain specific instructions from the laboratory at the time the empty vials are to be used.

Important. If the laboratory supplying the sample containers is not at the same immediate location as the

water utility, it will send **field reagent blanks**, also known as **trip blanks**, along with the sample vials. A trip blank consists of two vials filled with water at the laboratory. They will be in the shipping container sent by the laboratory. Do not open these blanks. Leave them in the shipping container and return them to the laboratory with the samples. If the laboratory has not included trip blanks, contact the laboratory before taking any samples.

Typical VOC sampling containers and equipment.

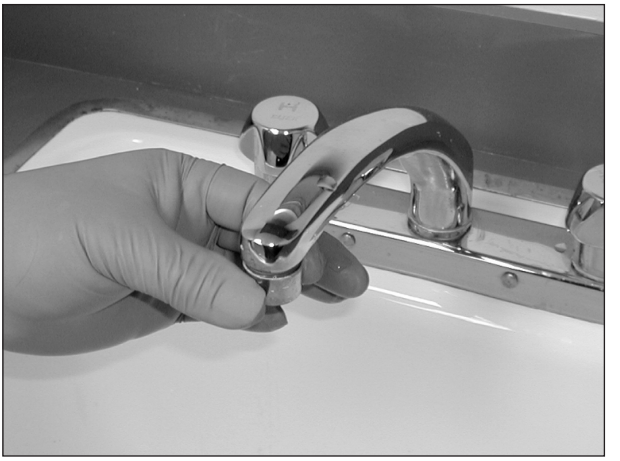
Procedure

The following instructions and photos illustrate the general sampling procedures to be followed for collecting VOC monitoring samples.

WARNING: Important safety precautions. Safety glasses must be worn. Wash hands before and after sampling. The use of clean, powder-free nitrile gloves is strongly recommended. Do not collect samples with exposed skin on hands.

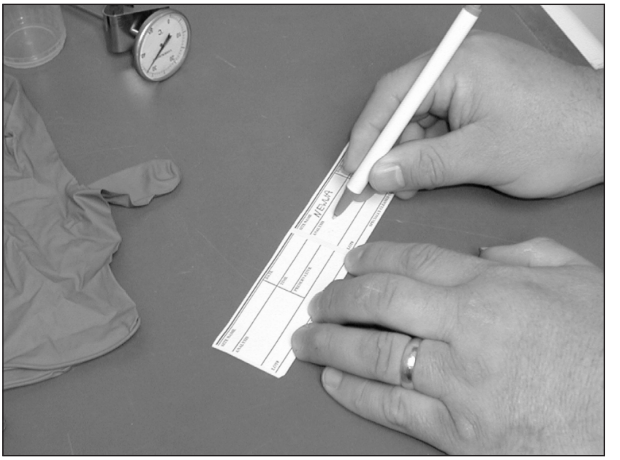
1. If possible, use a non-mixing valve faucet and remove all attachments, including any aerators, strainers, and hoses. Do not take a sample if all attachments cannot be removed because they will alter the concentrations of any VOCs present.

2. Turn on the cold-water tap and run the water until the temperature has stabilized as determined by a thermometer. This typically takes 4-5 minutes. Then reduce the flow *so that the stream is no greater than ¼ inch in diameter*.



Removing aerator from faucet before starting to sample.

3. While the water is running fill out the label in waterproof ink. Be sure to clearly identify the exact sample location, the date and time of collection, and the sampler's name.



Filling out the label.

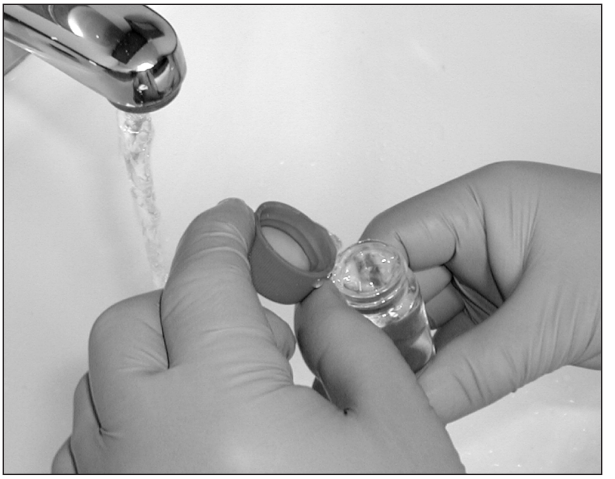
Caution-Hazard. Vials may contain liquid or powdered preservative. Liquid preservative will cause burns. If it contacts skin or eyes, flush with liberal amounts of water until EMTs arrive.

4. If the water has been chlorinated, select vials to which powdered ascorbic acid has been added. If the water has not been chlorinated, select vials to which liquid hydrochloric acid has been added. Fill at least two vials for each sample that is taken.

   Remove the cap from the vial, keeping the vial upright to prevent spilling any preservatives. Do not put the cap face down or put it in your pocket. Do not allow the inside of the cap, the inside of the vial, or the bottle threads to be touched by any object.

5. Hold the vial at an angle pointing away from your face and carefully fill it until it is nearly full. Be careful not to rinse out the preservative. If acid has been added to the vial by the laboratory, it will mix rapidly with the water and may spatter a bit. If ascorbic acid powder (dechlorinating agent) has been added to the vial by the laboratory, it will rapidly dissolve. Carefully complete filling the vial by putting water inside the cap and transferring it one drop at a time to the vial to form a meniscus.

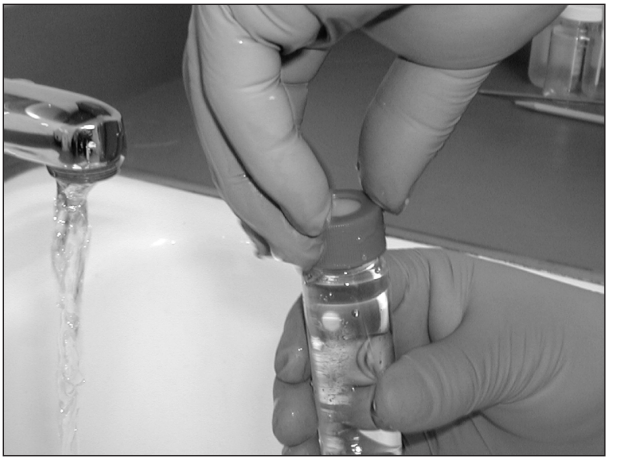
Tilting the vial to prevent formation of air bubbles.



Topping off the vial with the bottle cap to form a meniscus.

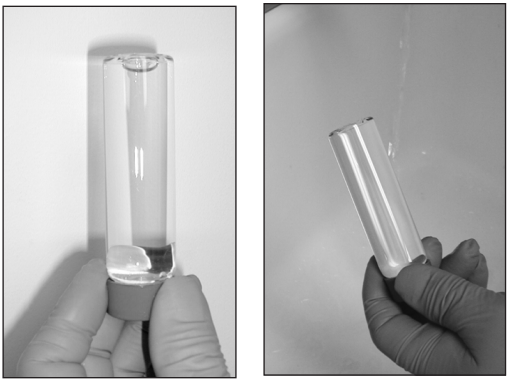
6. If the water has been chlorinated, add one drop of 1:1 (one part acid to one part water) hydrochloric acid (HCl) for each 20mL of sample volume. For example, for a 40mL vial, add two drops with a pipette to the top of the meniscus.

7. Screw the cap on the bottle so that the shiny white (Teflon®) side of the septum is in contact with the water. *Do not touch the septum and do not overtighten the cap!*



Screwing on the cap.

8. Invert the bottle, tap against your other hand, and check for air bubbles. If any are present, add additional water to reform the meniscus, seal and check again.



Inverting the vial to determine if there are air bubbles (left) or no air bubbles (right).

9. Shake the bottle vigorously for 1 minute.

10. Remember that each "sample" consists of 2 to 3 filled vials. Repeat steps 6-10 above to fill additional vials for each sample.

11. Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms. Complete the forms with the appropriate information such as public water system (**PWS**) identification number, exact sample collection location, date and time, type of sample collection (raw, plant tap, entry point, or distribution), and type of analysis to be run.

12. Place the samples in a cooler. The trip blanks should still be in the cooler. Keep the samples at 2° to 6° C (36° to 43° F) and keep them away from direct light or gasoline and solvent vapors. Deliver them to the laboratory or ship them by courier or overnight express to the laboratory. Enough ice or freezer packs must be included to keep the samples at 2° to 6° C (36° to 43° F), but they must be kept from freezing.

See Section 6 of this guide for more details on sample packaging in coolers and shipment.

SYNTHETIC ORGANIC CHEMICALS (SOCs)

Several containers are required because the laboratory uses several different methods to analyze for all the contaminants. The volume of the sampling containers may be 40mL, 60mL, or 1 liter, depending on the analytical method used. The containers must be made of glass, except for the container for diquat, which must be made of high-density amber polyvinyl chloride (PVC) or silanized amber glass. It is essential that the laboratory be informed whether the water is chlorinated or unchlorinated.

The laboratory will normally add the proper preservative in advance. For chlorinated waters, a powdered dechlorinating agent will be added, and you may be required to add an acid (usually hydrochloric acid) to the filled containers. For unchlorinated waters, the laboratory will add the acid to the empty containers, if necessary, instead of a dechlorinating agent. Obtain specific instructions from the laboratory before taking samples. The instructions provided by the laboratory will indicate whether field reagent blanks are needed. If you are sampling for carbamates, obtain specific instructions from the laboratory.

Procedures

Follow the procedures recommended by the laboratory (if any) for sampling and addition of preservatives.

The following instructions and photos illustrate the general sampling procedures to be followed for collecting SOC monitoring samples.

WARNING: Important safety precautions: Safety glasses must be worn. Wash hands before and after sampling. The use of clean, powder-free nitrile gloves is strongly recommended. Do not collect samples with exposed skin on hands.

1. If possible, use a non-swivel faucet and remove all attachments, including any aerators, strainers, and hoses. Do not take a sample if all attachments cannot be removed because they will alter the concentrations of any SOCs present.

2. Turn on the cold-water tap and run the water until the temperature has stabilized as determined by a thermometer. This typically takes 4-5 minutes. Then reduce the flow so that the stream is no greater than ¼ inch in diameter.

3. While the water is running fill out the label in waterproof ink. Be sure to clearly identify the exact sample location, the date and time of collection, and the sampler's name.

Warning: Caution - Hazard. Containers may contain liquid acid which is toxic and will cause burns. If any preservative contacts skin or eyes, flush with liberal amounts of water until the EMTs arrive.

Flushing the tap until the water temperature stabilizes.

4. Remove the cap from the container, keeping the container upright to prevent spilling any preservatives. Do not put the cap face down or put it in your pocket. Do not allow the inside of the cap, the inside of the container, or the container threads to be touched by any object.

5. There are two different SOC groups that need to be considered while sampling.

   5a. SOCs collected in bottles. Hold container at an angle pointing away from your face and carefully fill it to its shoulder. If acid is in the container, it will mix rapidly with the water and may splatter a bit. Leave enough room in the bottle so that the sample can be shaken to mix the preservative.

   Put the cap on the container, tighten it, and shake the bottle vigorously for one minute. Proceed to step 6.

   5b. SOCs collected in vials. Hold the vial at an angle pointing away from your face and carefully fill it until it is nearly full. Be careful not to rinse out any preservative. If a dechlorinating agent has been added to the vial by the laboratory, it will rapidly dissolve. Carefully complete filling the vial by putting water inside the cap and transferring it one drop at a time to the vial to form a meniscus. (The meniscus is the curved upper surface of a liquid formed by surface tension.) Screw the cap on the bottle so that the shiny white (Teflon®) side of the septum is in contact with the water. **Do not touch the septum and do not overtighten the cap!** Proceed to step 6.

6. Remember that each "sample" consists of 2 to 3 filled containers. Repeat steps 4-5 above and 7-8 below to fill additional containers for each sample.

7. Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms. Complete the forms with the

appropriate information such as PWS identification number, exact sample collection location, date and time, type of sample collection (raw, plant tap, entry point, or distribution), and type of analyses to be run.

8. Place the samples in a closed cooler. The **trip blanks** should still be inside the cooler. Keep the samples at 2° to 6° C (36° – 43° F) and keep them away from direct light and gasoline or solvent vapors. Deliver them directly or ship them by courier or overnight express to the laboratory.

   See Section 6 of this guide for more details on sample packaging in coolers and shipment.

5.2.d Radionuclides Sampling Procedures

Specific signs of radiological and biological contamination are less obvious than those associated with chemical contamination; however, the general evidence of contamination as determined in the 5-Step Process listed earlier in Section 3 of this guide still applies. The lack of obvious signs of radiological contamination underscores the importance of including field testing for elevated levels of radioactivity.

If the site is characterized as a radiological hazard due to the detection of excessive levels of radioactivity during field safety screening, samples should be collected for radiological analysis by personnel trained and equipped to work at radioactive contamination sites (e.g., Superfund teams). Figure 5-1 also suggests the collection of a large volume water sample using the 10-liter containers listed in Table 4-1, in case it is necessary to perform analyses for additional contaminants following radiological analysis. The large volume water samples should only be handled by the trained responders and stored in appropriate facilities that would minimize the risk of potential exposure to radiation.

General Sampling Procedures for Radionuclides Contaminants

Containers used for radionuclide sampling are either a pre-cleaned 1-gallon plastic bottle or two pre-cleaned 2-liter plastic bottles per sample. No preservative is added.

1. Remove any aerator or screen from the sample tap.

2. Turn on the cold-water tap and run the water until the water temperature has stabilized as determined by a thermometer. This typically takes 4-5 minutes. Then reduce the flow so that the stream is no greater than 1/4 inch in diameter.

3. Fill out the labels in waterproof ink while the water is running. Fill out labels/forms.

4. Remove the container cap. Do not put cap face down or in your pocket. Do not allow the inside of the cap, the inside of the bottle, or the bottle threads to be touched by any object.

5. Fill the bottle to the shoulder and screw on the cap securely.

6. Complete the chain of custody form if provided (See Appendix D or RPT, Mod 3, App 8.5) and any associated paperwork that the laboratory supplied. Fill out all labels/forms. Complete the labels/forms with the appropriate information such as PWS identification number, exact sample location, date and time, type of sample (raw, plant tap, entry point or distribution, and type of analyses to be done).

7. Place the samples in a cooler supplied by the laboratory.

8. Deliver them to the laboratory immediately or ship them by courier or overnight express to the laboratory.

6. Sample Packaging and Transport (RPT, Mod 3, 6.1 and 6.2)

Prompt and proper packaging and transport of samples will:

- Protect the integrity of samples from changes in composition or concentration caused by bacterial growth or degradation that might occur at increased temperatures.
- Reduce the chance of leaking or breaking of sample containers that would result in loss of sample volume, loss of sample integrity, and potential exposure of personnel to hazardous substances.
- Help ensure compliance with shipping regulations.

Need to View Ahead of Time:

Sampling packaging and transport is governed by a number of regulations, as administered by the International Air Transport Association (IATA, www.iata.org) and the U.S. Department of Transportation (DOT, www.dot.gov). In addition, there may be additional requirements specified by states, local authorities, and/or shipping companies. The regulations and requirements that govern the packaging and transport of samples will depend on the nature of the material in the samples. The pertinent regulations are largely based on whether the samples are classified as hazardous material. **Hazardous material** is defined as any substance that appears in the 49 CFR Hazardous Materials Table (http://hazmat.dot.gov/rules.htm), subject to certain exemptions based on the quantity and concentration of material.

The following is some general information regarding the packaging and transport of **low-hazard** and **high-hazard** samples.

6.1 Low-Hazard Samples (RPT, Mod 3, 6.1)

These types of samples typically fall into the "environmental" sample category discussed in Section 3.1, Step 3a of this pocket guide.

Packaging

The sampling procedures in Section 5 describe the placement of the samples into a prepared cooler. Cooler preparation is an important part of packaging, and it is imperative that samples are correctly and carefully packed in shipping containers to prevent the sample containers from breaking or leaking. Following are steps in preparing a cooler:

1. Use a clean cooler to prevent cross contamination. Seal all drain holes of the cooler, both inside and out, to prevent leakage in the event of a compromised sample container.

2. Check all lids and caps to make sure they are tightly sealed and will not leak.

3. Seal samples within a clear plastic bag.

4. If possible, fully chill samples to 4°C or less prior to placement within suitable packing materials. Remember to contact the lab(s) well ahead of time so they can begin to prepare for the analyses.

5. For additional protection in case of breakage, the cooler may be lined with non-combustible, absorbent packing material such as rock wool, ground corncobs, perlite, or clay-based absorbents (e.g., kitty litter or 'oil dry').

6. After the samples are placed in the cooler, conduct an inventory of the contents of the shipping cooler against the corresponding sample inventory and chain-of-custody records.

7. Cover samples in double-bagged ice, or frozen ice packs, to prevent water damage to packing materials. Do not pour loose ice directly into the sample cooler. The bagged ice will maintain the temperature of the samples within the shipping cooler.

8. A temperature blank may be included within each cooler being shipped. The temperature blank may be a 40-mL vial filled with water and labeled

"temperature blank." There are also "memory" thermometers and other data-logging devices available for this purpose.

9. Include necessary paperwork (copies of sample documentation and chain-of-custody forms) in the cooler. It may be convenient to place all of this in a plastic bag or pouch and affix it to the underside of the lid of the cooler. The original documentation should be maintained by the utility.

10. After the contents of the cooler have been checked for completeness, all openings of the cooler should be sealed with tape. Correct chain-of-custody seals, if required, should be attached to the cooler in a manner such that it would be apparent if the cooler has been opened prior to laboratory receipt.

11. Prepare the cooler appropriately for shipping depending on the way the container is to be transported.

12. Clearly label the cooler with the address of the laboratory where the samples are to be sent.

Transport

In some cases, it may be desirable to have the site characterization team transport the samples directly to the laboratory. During sample transport, it is important that the team take steps to maintain sample integrity and chain of custody. Maintaining sample integrity may involve delivering the samples to the laboratory as soon as possible, without making any unnecessary stops. Lengthy, unnecessary stops may introduce more time for the samples to degrade – even when the samples are chilled – and therefore reduce the quality of the results. Coolers also have limited insulation value, so if a cooler is left in a warm vehicle while the driver performs errands, the samples could heat up, potentially degrading some sample components. In addition, leaving the sample unattended may violate chain-of-custody procedures, which must be observed at all times. If it is necessary to hand over control of the cooler to another responsible party, this transfer should be noted on the chain-of-custody form.

In other cases, the only option may be to use an overnight shipping company to deliver the samples to the laboratory. Many shipping companies currently do not have special requirements for shipment of **environmental** water **samples** in coolers, other than leak prevention. If overnight shipping is to be used, the site characterization team should have ready access to all pertinent information about the shipping company, including: name, phone number, hours of operation, shipping schedule, any special shipping requirements, and pick-up/drop-off requirements. Chain of custody is also important when using an overnight shipping service. Shipping records should be maintained as part of documenting chain of custody. Most major companies are able to maintain chain of custody upon sample receipt, although this should be verified.

6.2 High-Hazard Samples (RPT 3, 6.2)

In general, HazMat teams or other parties, such as Tech Escort, CDC etc., will likely have packaging and shipping procedures for **high-hazard samples** that might contain radiological, chemical, or biological contaminants. It is important to verify that local HazMat teams that might assist on-site characterization activities have the procedures and capabilities in place to transport **hazardous samples**. The following is a brief overview of considerations for shipment of high-hazard samples. This is for you, the water supplier, to understand the needs of the Hazmat team in packing high-hazard samples. **This is for informational purposes only since water utilities will not be involved in this procedure.**

Packing

Relevant classes for *high-hazard* water samples include Class 2.3 (poisonous gases), Class 6.1 (poisonous materials, inhalation hazard), Class 6.2 (infectious substance), and Class 7 (radioactive substances).

Radiological Hazards. Trained hazardous materials responders should select from the most appropriate packaging for a specific radioactive hazard.

Chemical Hazards. Packaging requirements for chemical hazards are similar to those for *low-hazard chemicals* except that special care is necessary to prevent release of the contaminated water, as might occur through water leaks or volatilization. Preventing such release may involve providing multiple layers of containment, and a regular cooler by itself might not offer appropriate protection. Placing the sample inside an approved shipping container, which in turn is placed inside the cooler, may satisfy the packaging requirement. Some approved shipping containers include a temperature control system (i.e., freezer packs), so the cooler may not be necessary. Approved containers that meet regulatory requirements are readily available since *hazardous materials* are packaged and shipped routinely in a number of industries.

Transport of hazardous materials requires proper labeling and declaration of hazards. This labeling and declaration may be necessary even if a commercial shipper is not used. For instance, if samples are transported to the laboratory by vehicle, it is important that the content and potential hazards of the packages are clearly documented to facilitate proper safety and handling precautions during transfer of sample custody.

A special situation exists for chemical weapons. Following collection, the samples must be placed under a tent for a set period of time and the tent monitored for the potential release of chemical weapon vapors using a suitable detector. *If chemical weapons are suspected, law enforcement should be contacted* as they will have access to expertise and procedures for safely packaging and transporting these types of samples.

Biological Hazards. Packing requirements and procedures for biological samples have been developed by the Centers for Disease Control and Prevention (CDC) to facilitate safe shipment of the samples to Laboratory Response Network (LRN) laboratories, which may be found at www.bt.cdc.gov/labissues/PackagingInfo.pdf. In summary, triple packaging (primary receptacle, watertight secondary packaging, and durable outer packaging) is required for infectious biological agents or materials that are known or suspected of containing them.

Need to View Ahead of Time:

For biological hazards, the "Infectious Substance" label (shown at the Web site listed on page 64) must be placed on the outside of the package. This packaging must be certified to meet rigorous performance tests as outlined in the IATA, DOT, USPS, and PHS regulations. Detailed information about this packaging is found in "Biosafety in Microbiological and Biomedical Laboratories," United States Department of Health and Human Services, 4th Ed., edited by J.Y. Richmond and R.W. McKinney, U.S. Government Printing Office, 1999. This document is also available at www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4s1.htm.

Currently, the largest available container size that meets the CDC shipping requirements is 4 liters; however, CDC is working on packaging designs to accommodate 10-liter samples. There are also specific requirements and guidance available for certain agents, such as anthrax, http://hazmat.dot.gov/guide_anthrax.htm, although the applicability of this guidance to water samples should be carefully considered.

Transport

Many of the same principles that apply to the transport of **low-hazard** samples also apply to **high-hazard samples**, assuming they are properly packaged and labeled. Depending on the nature of the hazard, law enforcement may be involved in the transport of hazardous samples, especially if the services of a specialty laboratory are required. For instance, if chemical weapons are suspected, a technical escort service from the military may take custody of the samples and transport them to a chemical weapons laboratory. Other technical escort services are available for a variety of samples, but this resource is limited and may be accessed only through specific channels, such as law enforcement.

Many commercial shipping companies (such as FedEx, UPS, USPS, etc) have varying policies regarding labeling and documentation for overnight shipping of **hazardous materials**, some based on regulatory requirements. Some companies offer free advice and training on packaging and shipping such samples. The site characterization team should be familiar with the regulatory requirements, as well as other shipping company policies. In general, commercial shipping companies may transport some **hazardous samples** provided that packaging and declaration requirements are fulfilled. However, the shipper may not pick up potentially hazardous samples, but require that they be delivered to the shipping center.

Remember, maintaining and documenting the chain of custody is important when using an overnight shipping service for both **high-hazard** and **low-hazard** samples. Shipping records should be maintained as part of documenting chain of custody, and it should be verified that the company can maintain chain of custody throughout the delivery process.

Appendix A: Glossary/Acronyms

Definitions in this glossary are specific to this Guide for First Responders but conform to common usage as much as possible.

Contamination site
The location where a contaminant is known or suspected to have been introduced into the drinking water system. For example, a distribution system storage tank where a security breach has occurred may be designated as a suspected contamination site. The contamination site will likely be designated as an *investigation site* for the purpose of *site characterization*.

Credible
Believable, plausible, or reliable. A contamination threat is **credible** if the threat is *both* **possible** and other reliable information shows that there is reason to believe that the threat warning is real and that contamination is likely. A **credible** threat is a much higher threat level than a **possible** threat. Examples of threat warnings are, security breach, witness account, unusual water quality, consumer complaints, increased illness in community, and others. Note, the greater the separate sources of information indicating something has happened to the water system indicates a greater credibility an incident has occurred.

Field Safety Screening
Screening performed to detect any environmental hazards (i.e., in the air or on surfaces) that might pose a threat to the site characterization team. Monitoring radioactivity as the team approaches the site is an example of field safety screening.

Incident Commander
The individual responsible for managing the overall response to the crisis.

Investigation Site
The location where site characterization activities are performed. If a suspected *contamination site* has been identified, it will likely be designated as a *primary investigation* site. Additional or *secondary investigation* sites may also be identified due to the potential spread of a contaminant.

Possible
The first stage of the Threat Evaluation process. A threat is "**possible**" if the circumstances of the threat appear to have provided an opportunity for contamination. It is always possible that intentional contamination could be carried out, but the probability of this actually happening needs to be determined at each individual water system.

Rapid Field Testing
Analysis of water during *site characterization* using rapid field water testing technology in an attempt to tentatively identify contaminants or unusual water quality.

Site Characterization
The process of collecting information from an *investigation site* in order to support the evaluation of a drinking water contamination threat. Site characterization activities include the site investigation, *field safety screening, rapid field testing* of the water, and sample collection.

Threat Evaluation
Part of the threat management process in which all available or relevant information about the threat is evaluated to determine if the threat is *possible* or *credible*, or if a *contamination incident* is confirmed. This is an iterative process and can therefore be revised with each step.

Water Contamination Incident
A situation in which a contaminant has been successfully introduced into the system; this occurs when the presence of a harmful contaminant has been confirmed, that is, verified. A water contamination incident may or may not be preceded by a water contamination threat.

Water Contamination Threat
A situation in which the introduction of a contaminant into the water is threatened, claimed, or suggested by evidence. Here is a suggestion or an indication that water has been or will be contaminated, but no conclusive proof has been collected yet to confirm that contamination has actually occurred. A threat may be written, verbal, or based on observations or other evidence. Compare *water contamination threat* with *water contamination incident*. Note that tampering with a water system is a crime under the Safe Drinking Water Act as amended by The Bioterrorism Act of 2002.

AA
Atomic Absorption

GC
Gas Chromatography

HPLC
High Performance Liquid Chromatography

ICP-AES
Inductively Coupled Plasma - Atomic Emission Spectrometer

ICP-MS
Inductively Coupled Plasma - Mass Spectroscopy

MS
Mass Spectrometry

P&T
Purge & Trap

SPE
Solid Phase Extraction

UV
Ultraviolet

QC
Quality Control

VOC
Volatile Organic Compound

Eluted
Occurs when viruses are released from a filter into a solution.

Filtrate
Water that passes through the ultrafiltration membrane.

Retanate
Solution that contains the concentrated particles and pathogens.

MWCO
Molecular Weight Cut-Off

Appendix B: Additional Resources

1. **Agency for Toxic Substance and Disease Registry (ATSDR):** ATSDR is a national public health agency which compiles information on contaminants and disease-causing agents - www.atsdr.cdc.gov.

2. **Centers for Disease Control and Prevention (CDC):** CDC compiles and tracks information on diseases, illness, outbreaks, contaminants, effects, emergency preparedness and response, the national Laboratory Response Network (LRN), bioterrorism agents, and other topics - www.cdc.gov, 1-800-CDC-INFO.

3. **National Response Center (NRC) and National Response Team (NRT):** The NRC is an agency for reporting incidents relating to oil, hazardous material discharges, suspicious activity, security breaches, or terrorism occurring in the United States. The NRT is an organization of 16 federal departments and agencies responsible for coordinating emergency preparedness and response to oil and hazardous substance pollution incidents. EPA and the U.S. Coast Guard (USCG) serve as chair and vice chair, respectively. Call the NRC at 1-800-424-8802 or 1-202-267-2675 or visit the NRT's Web site at www.nrt.org.

4. **National Environmental Methods Index for Chemical, Biological, and Radiological Contaminants (NEMI-CBR):** NEMI and CBR Methods Advisor are two tools which will provide information on chemical, biological, and radiological contaminants and analytical methods of detection, analysis, and identification. These tools are being developed by the EPA Water Security Division. The National Environmental Methods Index (NEMI) is a free searchable Internet-based database of environmental methods that allows comparison of methods, performance, cost, and other information. NEMI is available on the Internet at www.nemi.gov. NEMI-CBR incorporates the CBR Methods Advisor, which can help a user to quickly assess a threat, evaluate the site of the incident, collect samples, and choose the best method for a given situation when there is limited information available regarding the possible identity of a contaminant.

5. **Physician Online Reference Guide for Waterborne Disease**: This online reference provides information on water-related diseases and other medical and health emergency response information - www.WaterHealthConnection.org/indexasp.

6. **A Water Security Handbook: Planning for and Responding to Drinking Water Contamination Threats and Incidents**: This EPA document is an abbreviated companion to EPA's Response Protocol Toolbox: *Planning for and Responding to Drinking Water Contamination Threats and Incidents* – www.epa.gov/watersecurity.

7. **Response Protocol Toolbox: Planning for and Responding to Drinking Water Contamination Threats and Incidents**: The EPA developed and wrote the toolbox, building on the experience of several water utilities, particularly the Metropolitan Water District of Southern California. Organized in modular format, the toolbox assists with emergency preparedness and will be of value to drinking water utilities, laboratories, state drinking water programs, technical assistance providers, and public health and law enforcement officials - www.epa.gov/watersecurity.

8. **Standardized Analytical Methods for Use During Homeland Security Events**: This comprehensive compendium of analytical methods was developed by the EPA for use during an environmental restoration event. The document, EPA Publication No. EPA/600/R-04/126, is available at http://www.epa.gov/nhsrc/pubs/reportsSAM030107.pdf.

9. **Water Contamination Information Tool (WCIT)**: EPA developed WCIT, which is a secure online database that provides information on contaminants of concern for water security. To learn more about WCIT, download the WCIT fact sheet at http://cfpubl.epa.gov/safewater/watersecurity/tools.cfm or log on to www.epa.gov/wcit. Access to this Web site is controlled.

10. **Sampling Guidance for Unknown Contaminants in Drinking Water**: The EPA developed this document to provide comprehensive guidance for pathogen, toxin, chemical and radiological sample collection, preservation, and transport procedures for the detection and identification of potential contaminants in drinking water for large water systems. http://cfpub.epa.gov/safewater/watersecurity/wla.cfm.

Appendix C: Five-Step Process Template

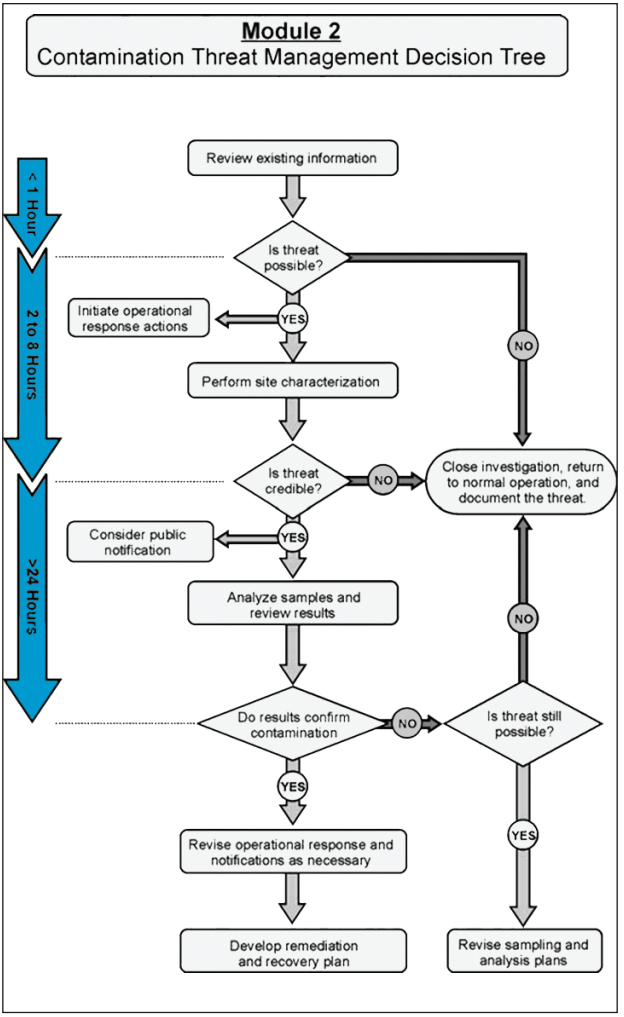


Figure 2. Process of Threat Evaluation and Response

Appendix D: Chain of Custody

Relinquished by:	Date/ Time	Received by:	Date/ Time
Dispatched by:	Date/ Time	Received for Lab by:	Date/ Time
Method of Shipment _____ Seal Intact: Yes _____			
Sample Lab # Relinquished by:	Date/ Time	Received by:	Date/ Time
Sample Lab #	Date/ Time	Removed from Refrig	Date/ Time
Sample Lab # Locked in Refrig	Date/ Time	Removed from Refrig	Date/ Time

Figure 1. Chain of Custody Report

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The sampling portion of this guide was originally developed by the EPA's OGWDW Cincinnati, Ohio in 1992 (EPA/814-B-92-001, April 1992) and was modified in 1994 (EPA/814-B-94-001, July 1994). Those two versions were revised into NEWWA's *A Pocket Sampling Guide for Operators of Small Water Systems* under EPA's Assistance Agreement No. X98116501-3. The sampling as outlined in this pocket guide relied heavily on the latter document of NEWWA (App. B, #8).

The emergency response portion of this pocket guide relied heavily on U.S. EPA's *A Water Security Handbook: Planning for and Responding to Drinking Water Contamination Threats* (App. B, #6) and *Response Protocol Toolbox: Planning for and Responding to Drinking Water Contamination Threats and Incidents* (App. B, #7).

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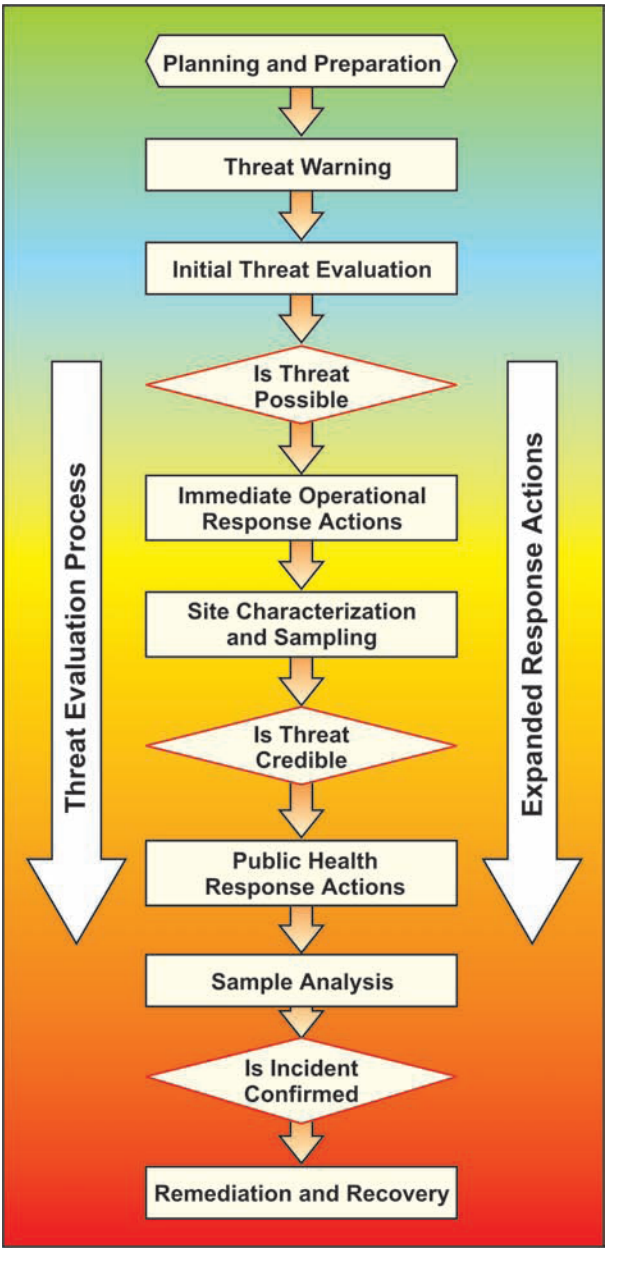

Chart from
U.S. EPA Publication No. 817-B-06-001
www.epa.gov/watersecurity