

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Water Supply Management

Document Number: 383-3130-106

Title: Guidance for Giardia Sampling & Response

Effective Date: February 1, 1998

Authority: Pennsylvania's Safe Drinking Water Act (35 P.S. § 721.1 et. seq.) and regulations at 25 Pa. Code Chapter 109

Policy: This document contains the guidance and procedures developed to direct and support staff implementation of the requirements for the surface water treatment rule under the drinking water management programs.

Purpose: The purpose of this document is to establish a rationale and reasonable basis for staff decisions in the field which will promote quality, timely and consistent service to the public and regulated community.

Applicability: This guidance will apply to public water systems as defined under the Pennsylvania Safe Drinking Water Act.

Disclaimer: The guidance and procedures outlined in this document are intended to supplement existing requirements. Nothing in this document shall affect more stringent regulatory requirements.

The guidance and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give this document that weight or deference. The guidance and procedures merely explain how and on what basis DEP will administer and implement its responsibilities with respect to the surface water treatment rule. DEP reserves the discretion to deviate from the guidance and procedures in this document if circumstances warrant.

Page Length: 18 pages

Location: Volume 20, Tab 05

Definitions: See 25 Pa. Code Chapter 109

**GUIDANCE FOR
GIARDIA SAMPLING & RESPONSE**

TABLE OF CONTENTS

	<u>Section</u>
Sampling Instructions for <u>Giardia</u> and Microscopic Particulate Analysis	I
<u>Giardia</u> Contamination Response Strategy	II

**SAMPLING INSTRUCTIONS FOR GIARDIA
AND MICROSCOPIC PARTICULATE ANALYSIS**

JANUARY 1993

REVISED FEBRUARY 1, 1998

PREPARED BY:

DIVISION OF DRINKING WATER MANAGEMENT
BUREAU OF WATER SUPPLY MANAGEMENT
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

SAMPLING INSTRUCTIONS FOR GIARDIA AND MICROSCOPIC PARTICULATE ANALYSIS

The following set of instructions for collecting high-volume samples (Giardia and microscopic particulate analysis) has been prepared to supplement the Filter Plant Performance Evaluation (FPPE) protocol and Surface Water Identification Protocol (SWIP). All staff should schedule samples at least 7 days in advance with the Bureau of Laboratories.

GENERAL EQUIPMENT INFORMATION

Pump Operation

The manual on the pump operation is included with each pump. Please read it carefully prior to using the pump.

The original gas tank provided with the pump has been disconnected. A one-liter plastic jar equipped with a gas filter and tubing replaces the original gas tank and allows for a much longer sampling time before refueling (about 1.5 to 2 hours). Keep the one-liter tank level with the pump.

Extreme care should be taken when handling the gasoline. To prevent contamination of the water sources, the one-liter gasoline reservoir should be filled in an area away from the water supply. Attach the tubing to the carburetor securely. **Keep the gas and tubing away from the engine exhaust.**

NOTE: Gasoline for pump operation must be mixed with oil as per the instruction manual.

Equipment

Each Field Operations Region should have two complete sampling kits that include the following equipment and supplies. Regional Offices are responsible for procuring and maintaining supplies.

1. One portable gas engine utility pump
2. Two Fulflow filter cartridge holders - No. LT-10 and replacement O-rings
3. One water meter - size 5/8 inch
4. Twelve Commercial Filters - one micron porosity
5. One garden hose - 50' x 1/2 inch
6. One bucket
7. One funnel
8. One can two cycle engine oil - 8 ounce
9. Four hose couplings - 1/2 inch
10. Two meter couplings - 3/4 inch
11. Two brass adapters - 3/4 male pipe to male hose
12. One brass adapter - 3/4 inch female pipe to male hose
13. Whirl-Pak bags - 5-1/2" x 14"
14. One cake pan
15. One 1,000 ml gas tank
16. One roll of Teflon tape

17. One 10-1/2 inch test tube brush
18. Meter gaskets and hose washers

Supplies that must be purchased by the Regional Offices prior to sampling

1. One gas can (safety)
2. One screwdriver
3. One adjustable wrench
4. One pair of pliers
5. One 50-foot rope
6. One anchor (a plastic bottle filled with gravel will do)
7. Dish detergent
8. Ziploc bags 9" x 13"

EQUIPMENT SET-UP FOR PUMPS

Figure 1 illustrates the proper equipment set-up for sampling springs, reservoirs and streams when a pump is needed. The system must be as airtight as possible.

1. Attach a $\frac{3}{4}$ -inch water meter adapter to the inlet side of the pump using Teflon tape for a proper seal (A). Insert a rubber gasket and attach the water meter. Make sure that the arrows on the meter are pointing toward the pump.
2. Attach a $\frac{3}{4}$ -inch brass fitting (male pipe - male hose) to the "In" side of the filter housing.
3. Connect the other $\frac{3}{4}$ -inch water meter adapter to the "Out" side of the filter housing, insert a gasket and attach to the water meter (B). A new section of garden hose with a female hose connection and gasket can now be attached to the filter housing (C).
4. A discharge hose on the pump is often desirable to prevent water from flowing back into the area in the reservoir, stream or spring being sampled. A $\frac{3}{4}$ -inch brass adapter (male pipe - male hose) can be attached to the pump enabling a piece of hose to be connected (D).
5. At least 300 gallons of water are to be sampled and generally no more than 2,000 gallons should be sampled. The rate of flow should not exceed 4 gallons per minute and preferably maintained near 2 gpm. For springs, the end of the sampling hose should be as close to the source as possible.
6. After sampling, the filter holder is disassembled and the filter cartridge is then placed into a Whirl Pak bag. Any water remaining in the filter holder is poured into the Whirl Pak bag containing the filter, the Whirl Pak bag is sealed, and then placed into a ziploc bag.
7. Samples of chlorinated water should all be fixed with 5 ml of 1.6% sodium

thiosulfate when packaged. Request sodium thiosulfate fixative, with instructions, from the Division of Drinking Water Management prior to sampling.

EQUIPMENT SET-UP FOR TAPS

1. Figure 2 illustrates the proper equipment set-up for sampling taps that are under pressure. Sampling equipment consists of a flow meter (3/4-inch), a filter housing, a one micron filter, garden hose, and various hose adapters and hose clamps.
2. The equipment is connected to a tap in the treatment plant, distribution system or well pump. Water under pressure flows from a clean section of garden hose through the filter apparatus first and then through the flowmeter at an approximate rate of one to four gallons per minute and preferably maintained near 2 GPM. Prior to sampling, thoroughly flush all rust, sediment and debris from the sample tap. Filter the following quantity of water:
 - a. Giardia Surveillance/SWIP - 300 to 2,000 gallons from the raw water tap.
 - b. FPPE - Two separate samples consisting of 500 to 2,000 gallons of finished water off the filter effluent tap over a period of time needed to include the various phases of the filter run and about 300 gallons of raw water prior to any chemical treatment.
3. After sampling, the filters are handled as in steps 6 and 7 above.

SAMPLE IDENTIFICATION AND SHIPPING

1. *Sample identification* - All samples must be properly labeled to prevent misidentification of samples. Use an indelible pen to mark the following information on the Whirl Pak bag of each sample:
 - a. Sample number (collector's number)
 - b. Date and time of collection
 - c. PWS name
2. *Sample shipment* - Samples must be placed on ice and shipped within 24 hours. **Always** use the appropriate sample submission sheet for either FPPE, SWIP, or Giardia.

CLEANING OF EQUIPMENT

1. The filter housing, hose connections, gaskets, and brass adapters must be thoroughly washed with dish detergent and the brush provided. Rinse well and allow them to air dry.
2. The garden hose will only be used once and then discarded as it cannot be properly cleaned.
3. Cleaning of the pump and water meter is not necessary as these are on the discharge side of the filter housing.

HELPFUL HINTS

1. An anchor (or any weight) is often needed to hold a sampling hose under the water. However, it is also undesirable for the hose end to be in the sediment. If this happens, a 500 ml plastic bottle tied above the hose opening will provide enough buoyancy to keep the hose off the bottom (see Figure 3).
2. The pump is limited in its ability to pump water vertically. If the intake platform is higher than 10 feet above the water surface a different sampling location should be used.
3. When priming the pump with water, make sure that the filter housing is higher than the pump. This prevents back flow through the pump and meter and possible contamination of the filter cartridge and housing.

Figure 1

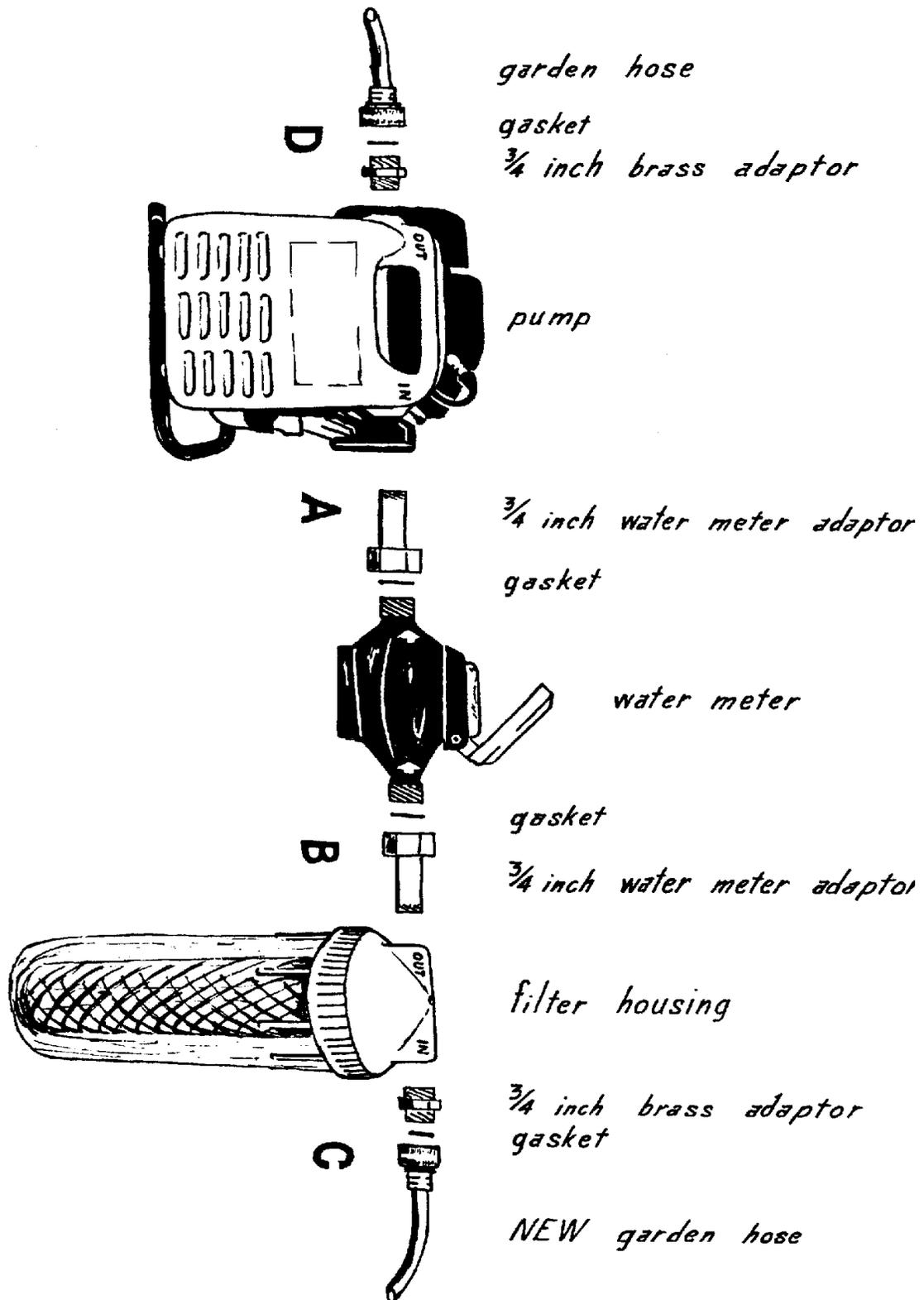


Figure 2

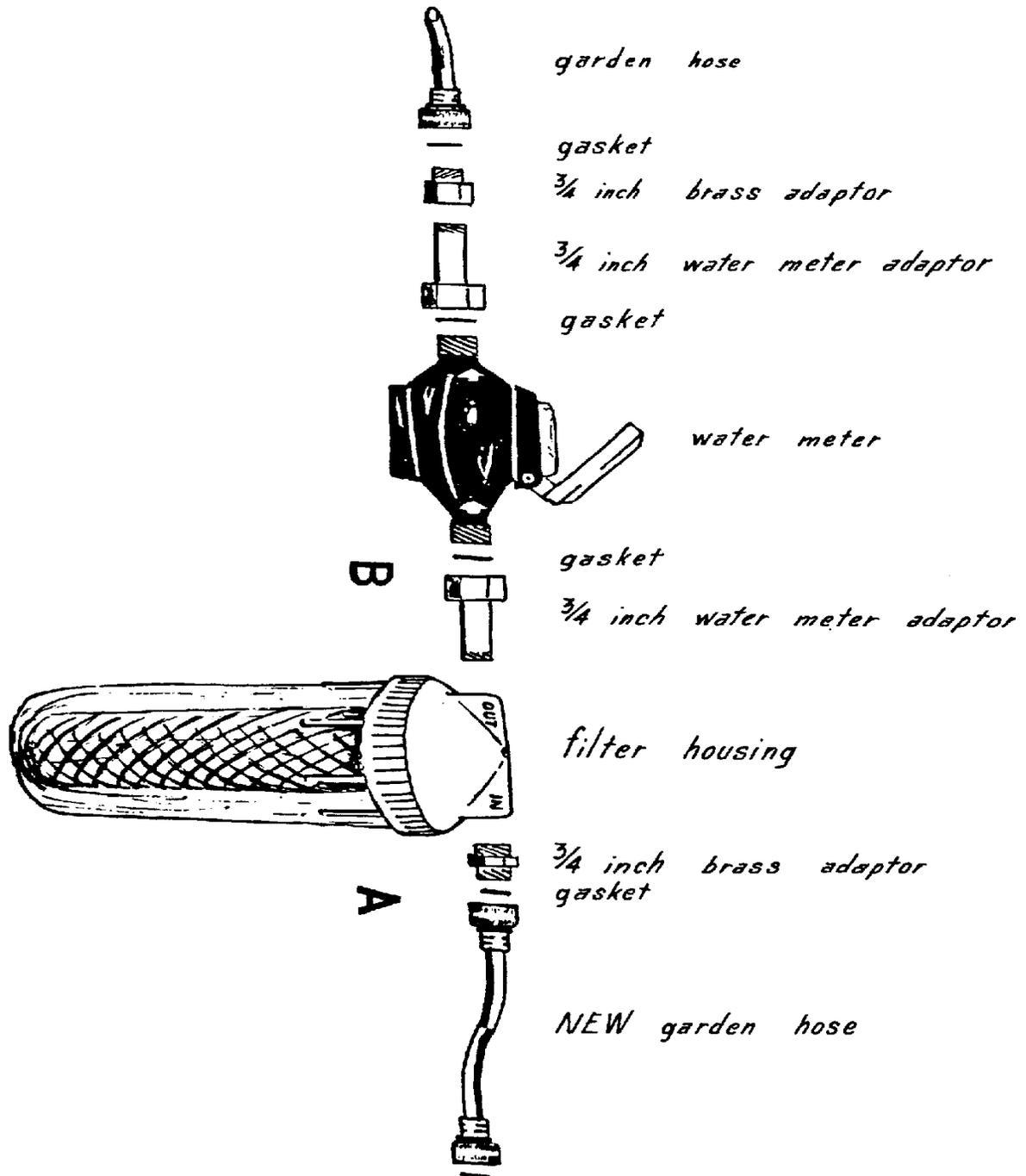
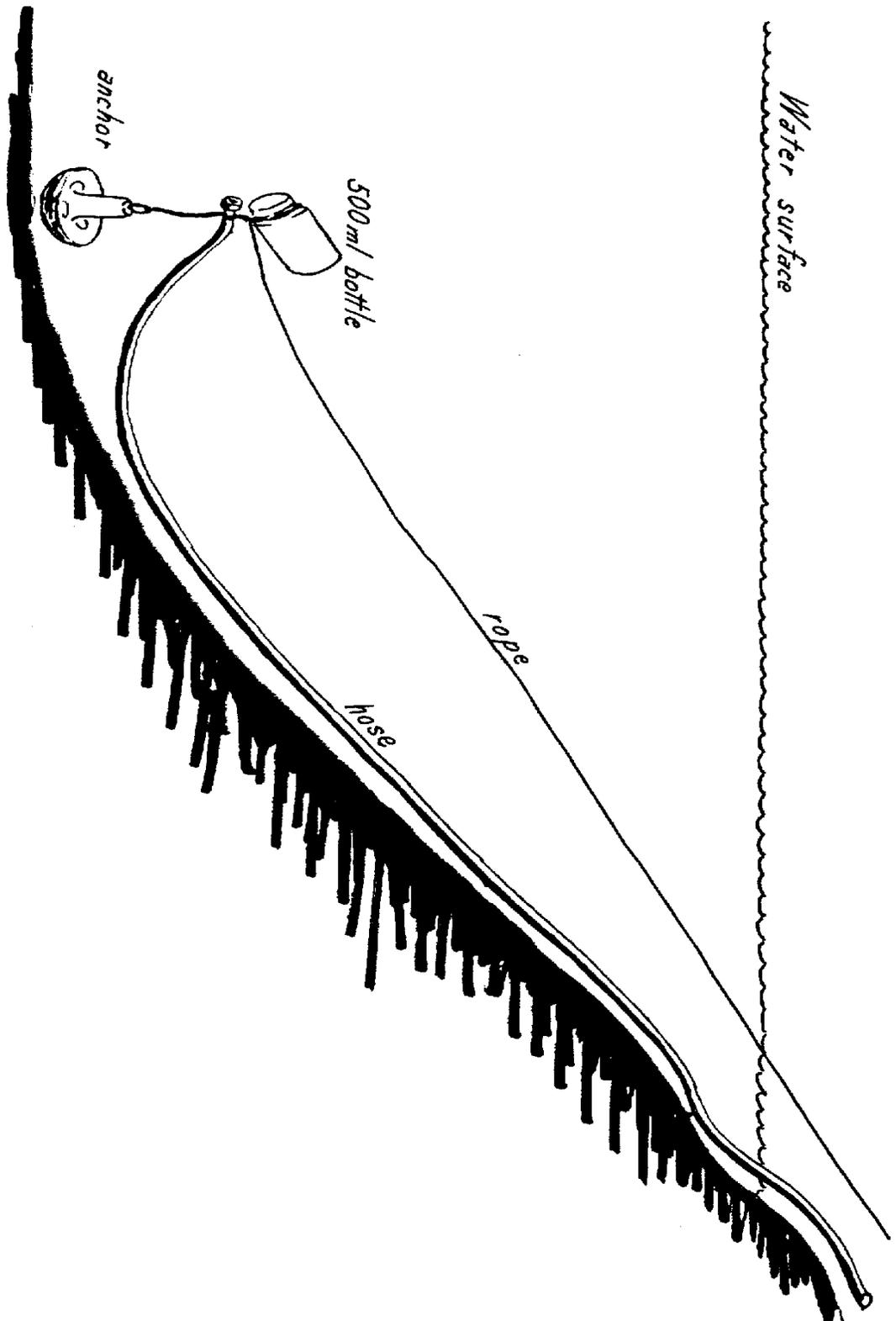


Figure 3



**GIARDIA CONTAMINATION
RESPONSE STRATEGY**

MARCH 1985

REVISED JANUARY 1994; FEBRUARY 1, 1998

PREPARED BY:

DIVISION OF DRINKING WATER MANAGEMENT
BUREAU OF WATER SUPPLY MANAGEMENT
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

GIARDIA CONTAMINATION

RESPONSE STRATEGY

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
RESPONSE ACTIONS	1
Imminent Threat Violations	1
Priority Violations	2
Documenting Response & Enforcement	2
COMMUNICATION WITH THE SUPPLIER	2
SUPPLIER'S REMEDIAL RESPONSE MEASURES	3
Immediate Protective Measures	3
Short-term Protective Measures	3
Long-term Protective Measures	3
SUPPLIER'S IMPLEMENTATION SCHEDULE	3
CT CALCULATIONS	4
REMOVING A BOIL WATER ADVISORY	4
<u>ATTACHMENTS</u>	
1. Model Public Notification Form	5
2. Documents for Cross Reference	6

INTRODUCTION

Samples for Giardia cyst analysis may be collected at the source water, treatment facility or distribution system of some public water systems, especially those using surface sources or sources directly influenced by surface water. For the most part, these samples are collected and analyzed by staff from the Department of Environmental Protection (DEP), although public water system personnel or consultants may also collect and analyze samples. In the process of analyzing the samples, laboratory staff will determine that a number of public water systems are contaminated by Giardia cysts. Regardless of who identified the contamination, the following document outlines a strategy for responding to Giardia contamination at public water systems using unfiltered surface water supplies or those using unfiltered groundwater sources under the direct influence of surface water. DEP reserves the discretion to deviate from this guidance if circumstances warrant such deviation.

RESPONSE ACTIONS

Giardia identification is confirmed when a microscopist identifies two of the three internal structures of a cyst. Giardia cysts are presumed to be viable and capable of causing giardiasis unless they have been properly disinfected. When a contamination is identified, four important decisions must be made. These are:

1. What public notification must be provided?
2. Should a boil water advisory be issued to the public?
3. What remedial response measures should the supplier be required to institute?
4. What conditions must be met before a boil water advisory can be lifted?

A. Imminent Threat Violations

When Giardia contamination is identified in the raw or finished water at a public water system, immediate actions may be necessary. A contaminated system shall be considered an imminent threat situation if proper CT levels are not in place. Public notification must be issued in accordance with the requirements and guidelines established in Chapter 109 of the Safe Drinking Water Regulations (SDWR) and in DEP's Public Notification Policy. If the water supplier refuses to issue public notification, DEP will do so at the supplier's expense through the Community Relations Coordinator and concurrently issue a field order. The public notification may take the following form when CT levels are not sufficient to inactivate cysts:

- Giardia contamination identified; conditions represent an imminent threat to public health; advise affected consumers to boil their water. (It may be possible to limit the boil water advisory to parts of the distribution system depending on system configuration and hydraulics.) See Attachment 1, Model Public Notification Form.

B. Priority Violations

A priority violation occurs if the supplier makes no reasonable attempt to institute short-term protective measures. When Giardia contamination is identified in the raw or finished water, appropriate CT verification and/or implementation is a critical safeguard in these instances. Where disinfection practices have not been adequate to inactivate Giardia cysts and the system is on a boil water advisory, DEP may provide the public water supplier up to 60 days to attain adequate CT levels at the first customer in the system.

C. Documentation and Enforcement

At all Giardia-contaminated public water systems, DEP shall document response measures and progress of improvements on inspection forms. DEP will issue a field order if the supplier fails to provide a boil water advisory when an imminent threat exists. In all documents, efforts should be made to implement and document remedial measures that provide short-term protection for public health and measures that include the preferred long-term solution to a contamination problem. Other violations of the SDWR will intensify or change DEP's response to Giardia contamination.

DEP will take more progressive enforcement action if the supplier does not make reasonable attempts to comply with short-term protective measures. Failure to respond to enforcement action will result in further action that requires the supplier to implement the necessary short-term and long-term response measures.

COMMUNICATION WITH THE SUPPLIER
--

The objective of the Giardia Contamination Response Strategy is to reduce the risk of waterborne giardiasis for the system's customers. When a Giardia cyst contamination has been confirmed, DEP shall quickly notify and inform the supplier so that immediate and short-term public health protective measures can be implemented.

1. The regional/district staff shall notify the public water supplier operator or municipal/company administrators and explain what immediate measures must be taken to protect the consumers.
2. DEP shall request the supplier to provide, within 60 days, a plan for "Short-Term Protective Measures" and, where necessary, for "Long-Term Protective Measures".
3. DEP shall provide an opportunity for the supplier to enter into a consent order and agreement. If negotiations to sign the consent order and agreement are not proceeding in good faith, or if after enforcement action, the supplier remains uncooperative, the Region shall prepare an order.

SUPPLIER'S REMEDIAL RESPONSE MEASURES

When a Giardia contamination has been established, the public water supplier will be required to implement a remedial measures program designed to provide an adequate and reliable level of public health protection. In imminent threat situations, the supplier will keep the public notified regarding the problem. All remedial programs, where appropriate, will address immediate, short-term and long-term measures and will be fashioned from the following:

1. **Immediate Protective Measure** is a boil water advisory, used mostly when DEP identifies an imminent threat.
 - a. The boil water advisory is for emergency protection of consumers until suitable short-term measures can be implemented.
 - b. A boil water advisory is not necessary if an imminent threat does not exist or if appropriate CTs have been instituted. An optional public announcement may be used to inform customers of the problem and to explain what measures are in place to protect them.
2. **Short-Term Protective Measure(s)** to remove/inactivate cysts. These short-term measures can be:
 - a. Verification of the CTs and confirmation that necessary CTs are in place.
 - b. Increase the disinfectant level to obtain appropriate CTs. The supplier shall flush the distribution system in order to remove previously contaminated water from the system and replace it with water containing the appropriate CT levels.
3. **Long-Term Protective Measures** are used when facilities require major modifications to protect public health. These include:
 - a. Construction and use of a well-operated water treatment plant.
 - b. Permanent abandonment of the contaminated source. "Abandonment" means relinquishing the source permit and establishing a physical air gap between the contaminated source and the distribution system.
 - c. Development of other water sources and/or interconnection with another water system.

SUPPLIER'S IMPLEMENTATION SCHEDULE

The supplier's remedial response measures must adhere to the following time deadlines:

1. A boil water advisory must be issued within 4 hours of notification by DEP (section 109.402(c)).
2. Short-term protective measures should be in place within 60 days of original notification
3. The long-term protective measures must be in place no later than 48 months of

original problem identification, depending on the nature and extent of the modifications (section 109.202(c)).

CT CALCULATIONS

"CT" is the nomenclature for representing disinfection inactivation potential. "C" is the disinfectant level in mg/l, and "T" is the effective contact time in minutes. The SDWR mandates a 3 "log" removal and inactivation of Giardia lamblia cysts (section 109.202(c)).

The CT requirements for inactivation of Giardia cysts is provided in the Environmental Protection Agency's ¹ "Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems". When referring to the tables, use the following guidance for calculating CTs:

1. Proper CT levels shall be maintained for the anticipated "worse-case" parameters, such as pH, temperature and peak flow for the duration of the short-term response (usually less than 60 days). Background information for these parameters can be obtained from plant records for the same time period of the previous year.
2. The information in the tables should not be extrapolated above free chlorine concentrations of 3.0 mg/l or below 0.4 mg/l.
3. When calculating CTs, detention times can be established with a conservative "rule of thumb" fraction representing the ratio of T_{10} and the theoretical detention time (presented in Appendix C of the "Guidance Manual"). The water supplier may also choose to perform tracer studies in lieu of the "rule of thumb" fractions.

CONDITIONS FOR REMOVING A BOIL WATER ADVISORY

Once the appropriate CT levels have been achieved, the boil water advisory may be lifted upon approval by DEP. Before a public water supplier can lift the advisory, the distribution system and storage facilities must be cleaned, disinfected and flushed. Flushing should occur until DEP verifies and documents that increased disinfectant levels have been achieved throughout the system, or to the extent practical without further aggravating operational problems. Increased disinfectant levels can be verified by comparing them to past monitoring results at specific points in the distribution system. The goal is to remove previously contaminated water from the system and replace it with water containing the appropriate CT levels. For other information that may apply in lifting advisories, refer to the document "Field Related Compliance" in the Safe Drinking Water Staff Handbook (field).

Systems on a boil water advisory shall not have the advisory removed simply because water temperatures have increased. In other words, the supplier must be prepared to attain the CT value to inactivate Giardia cysts under "worse case" conditions (i.e. low temperatures, high flow rates, high pH ranges) anticipated within the time frame needed to achieve adequate CT levels.

¹ March 1991 edition

ATTACHMENT 1

* MODEL PUBLIC NOTIFICATION FORM

Residents in the (geographic area) , who use water provided by the (PWS) , are advised to boil all water before use for drinking and food preparation. The water should be heated to a rolling boil for at least one minute.

The (PWS/DEP) announced today that samples collected by the (DEP, PWS, etc.) from the (raw or finished water) at the (name of water source) on (date) were contaminated with Giardia cysts.

The Giardia cyst is known to infect the human digestive tract and can cause a severe intestinal illness. The symptoms of the illness vary with individuals, and can result in persistent diarrhea, nausea, abdominal cramps, weight loss, and sometimes dehydration. Up to 7 percent of the human population and many domestic and wild animals carry the Giardia organism and are suspected of introducing it into rivers, streams, and reservoirs.

The (PWS) has taken steps to minimize the contamination problem, including both short and long-term actions to protect the public health and prevent an outbreak of giardiasis. The short-term actions will enable DEP to lift the boil water advisory and include:

(Here discuss what short-term measures will be implemented, including requirements to lift the boil water advisory).

The (PWS) will also evaluate long-term measures, including:

(Here discuss what long-term measures will be implemented).

In the interim, residents in the (geographical area) are cautioned not to use road-side springs or other questionable drinking water sources, as these are often contaminated with the Giardia organism.

Updates on the status of the Giardia contamination problem and the (PWS) efforts to improve protection to consumers will be issued on a (daily, weekly, monthly) basis. Customers can also contact (PWS contact person) at (phone number) . Additional information can be obtained by contacting the local DEP office at (phone number) .

* For use as an example and subject to change based on each particular circumstance.

ATTACHMENT 2

Reference Documents

Guidance Manual for Compliance with the Filtration and Disinfection Requirements Eor PWSs Using Surface Water Sources, March 1991, USEPA (information on CT Levels, tracer studies, rule-of-thumb fractions).

"Filter Plant Performance Evaluation Response Strategy", September 1991, Rev. 1994 (information on response to surface water treatment plant evaluations).

"Sampling Instructions for Giardia and Microscopic Particulate Analysis", January 1993 (information on sample collection methods for Giardia/MPA).

"Field Related Compliance", September 1993 (guidelines for using enforcement actions in the field).

Pennsylvania Code, Title 25 Environmental Protection, Chapter 109 Safe Drinking Water (DEP's regulations concerning public water systems).