United States
Environmental Protection
Agency

Office of Water
(4606)

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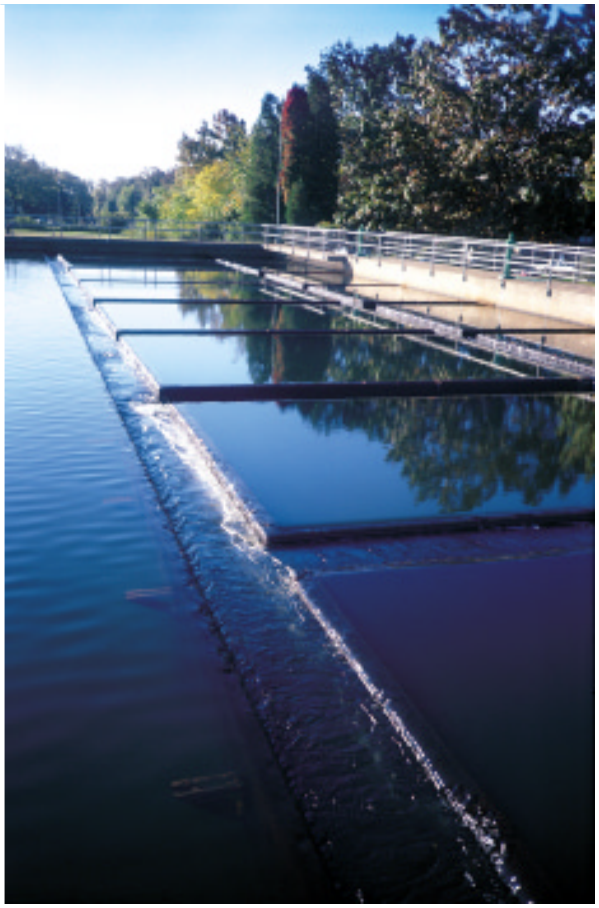
June 2001

A Small Systems Guide to the Total Coliform Rule

Monitoring Drinking Water to Protect Public Health



Printed on Recycled Paper

Who Is this Guide For?

This guide is designed for use by “community water systems” serving 3,300 or fewer persons. The term “community water systems” includes any systems (regardless of ownership) serving at least 25 year-round residents or 15 year-round service connections. Typical systems finding this guide useful include:

- Mobile Home Parks
- Home Owners Associations
- Small Towns
- Rural Water Districts
- Small Private Systems
- Tribal Systems

Additional copies of this guide may be obtained by calling the Safe Drinking Water Hotline at 1-800-426-4791. The guide also may be downloaded from EPA’s Safe Drinking Water Web site at www.epa.gov/safewater.

Contents

What Will I Learn from this Guide? 1
Ensuring Safe Drinking Water 2
The Total Coliform Rule 9
There Are Exceptions to Every Rule!!! 15
Monthly Monitoring Worksheets 16
TCR Monthly Monitoring Worksheets 17
Interpreting the Sampling Results 20
12-Month Supply of “Monthly Monitoring Worksheets” 32
Appendix A: Developing a Sample Siting Plan A-1
Appendix B: Sample Collection Techniques B-1

Disclaimer: This document does not substitute for EPA regulations, nor is this document regulation in itself. Thus, it cannot impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances.

What Will I Learn from This Guide?

This guide is intended to help small-system operators, like these operators of a small system serving an Alaska Native Village, comply with the Total Coliform Rule.

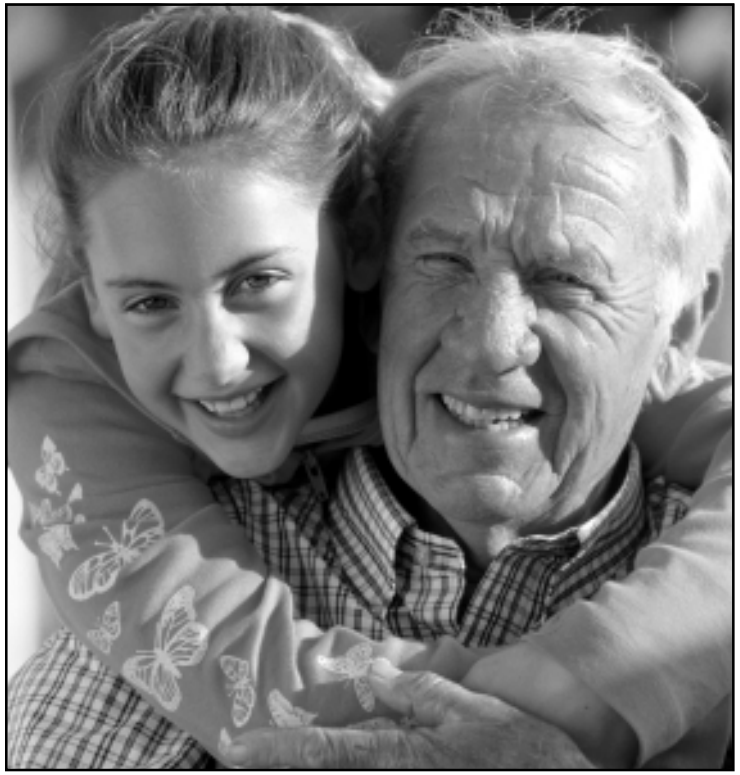
As a drinking water system operator, your most important job is protecting the health of your customers. This guide will help you do that job by providing information about:

- Reducing the risk of waterborne disease by providing multiple barriers of protection.
- The importance of monitoring drinking water to ensure its quality and protect public health.
- The monitoring you are required to do under the Total Coliform Rule.
- The steps you must take if your samples indicate the presence of coliform bacteria.
- A worksheet to help you keep track of the monitoring and follow-up you are required to do.

Appendices contain information about developing an effective plan for where to collect samples, as well as step-by-step instructions for sample collection.

This workbook describes minimum Federal requirements under the Total Coliform Rule. Some States may have specific or additional requirements and/or monitoring forms. Be sure to check with your State drinking water agency regarding their specific requirements. (Systems on Tribal lands, in Wyoming, or in the District of Columbia should check with their EPA Regional office.)

Ensuring Safe Drinking Water



Children, the elderly, and people with ailments are particularly susceptible to waterborne diseases.

Drinking water is one of the oldest known public health concerns. Preventing waterborne disease is one of the primary objectives of any drinking water system.

Although waterborne disease outbreaks are relatively uncommon in the United States, they do occur (see the tables on the following page). In most cases the results are diarrhea, cramps, nausea, and other symptoms. But in some cases—particularly among the young, the elderly, and ill people—waterborne diseases can lead to death.

The risk of waterborne disease is greatly reduced when the water system is designed and operated to provide multiple barriers of protection. The key barriers are:

- Source water protection
- Treatment
- Distribution system integrity
- Monitoring and public awareness

Selected Waterborne Disease Outbreaks in Small and Mid-size Systems in the U.S.: 1986 - 1998			
Location	**No. of Cases**	**Year of Outbreak**	**Cause of Illness**
Pennsylvania (Numerous Sites)	5,000	1987	Norwalk-like virus
Oregon	3,000	1992	*Cryptosporidium*
Texas	1,400	1998	*Cryptosporidium*
Texas	900	1988	*Shigella sonnei*
Arizona	900	1989	Norwalk-like virus
Pennsylvania	513	1987	*Giardia*
Missouri	485 (4 deaths)	1993	*Salmonella*
Missouri	243	1989	*E. coli*
Wyoming	157	1998	*E. coli*
Oregon	100	1997	*Giardia*
Minnesota	83	1998	*Shigella sonnei*
New York	50	1997	*Giardia*
New Mexico	32	1998	*Cryptosporidium*
Florida	7	1998	*Giardia*
Illinois	3	1998	*E. coli*

E. coli Outbreaks in Small and Mid-size Systems: 1999 and 2000			
Location	**No. of Cases**	**Year of Outbreak**	**Cause of Illness**
Walkerton, Ontario	Approx. 1,400 7 deaths	2000	*E. coli*
Washington County, NY	Approx 1,000 2 deaths	1999	*E. coli*

When livestock are allowed to feed near a drinking water well, the source water can possibly become contaminated with pathogens.

Source Water Protection

Doing everything possible to keep pathogens out of the source water is a good first line of defense.

Septic systems, livestock feeding operations, and the use of fresh manure as fertilizer are all potential sources of ground water contamination. Wells must be sited and constructed according to State codes in order to minimize the potential for contamination.

Surface water can become contaminated from many sources, including incomplete or ineffective wastewater treatment, stormwater runoff, agricultural feedlots, or simply the normal activity of wildlife in the watershed.

Multiple stages of treatment—including sedimentation, which is shown here—are used for sources such as surface waters, whose quality is variable.

Simple chlorination treatment for a small ground water system.

Treatment

Treatment to remove or inactivate pathogens (disease-causing microbes) may be necessary if the source water is vulnerable to contamination. Depending upon the nature of the source water, multiple levels of treatment may be required. Various types of filtration (with or without preliminary chemical treatment) and/or disinfection are commonly used.

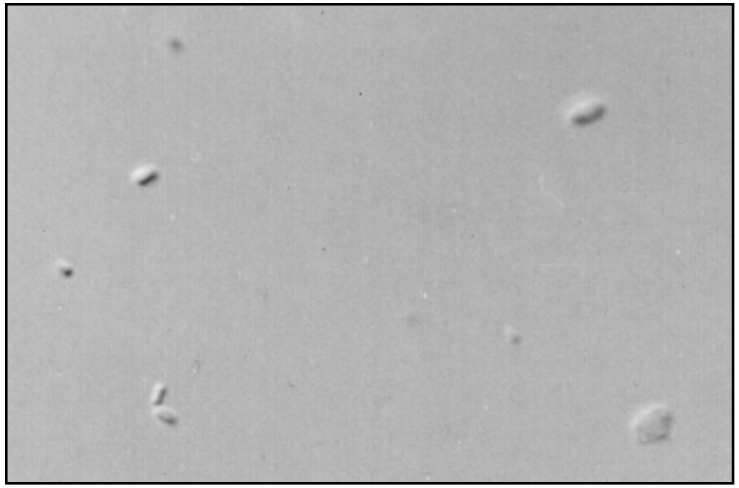
Repair or replacement of distribution system components can create a potential source of contamination.

Distribution System Integrity

Even if source water is treated to remove or inactivate pathogens, customers may still be at risk from contamination entering the distribution system. Examples of typical problems are:

- Inadequate water pressure in the pipes may allow fecal contamination to be sucked into (or backflow into) the distribution system.
- Improper distribution system repair or replacement can allow contamination to enter the system.
- Storage facilities with holes or other structural flaws can allow birds, rodents, and other animals to contaminate the water.

As a water system operator, you should devote special attention to identifying such problems in your distribution system and ensure that they are fixed.



As shown in this magnification, drinking water is not sterile. It contains many harmless bacteria. However, drinking water must be closely monitored for certain bacteria which could indicate that the system is vulnerable to the presence of pathogens (disease-causing microbes).

Monitoring and Public Awareness

The importance of regular monitoring cannot be overemphasized. So much of your water system is underground and hidden from view. The only way to be sure you are effectively protecting public health is to monitor the quality of water delivered to customer taps.

Many different pathogens may be present in water. It is not practical to test for them individually. Instead, we rely on monitoring for ***indicator organisms***. The indicator organisms we use for monitoring drinking water are total coliforms, fecal coliforms, and *Escherichia coli* (*E. coli*).

Total coliforms are a group of closely related bacteria that are generally harmless. They are natural and common inhabitants of the soil and ambient waters (such as lakes and rivers). They are usually not found in ground water that is free of surface water or fecal contaminants.

Total coliforms are inactivated by treatment or die off naturally in a manner similar to most bacterial pathogens and many viral pathogens. Therefore, ***if total coliforms are found in the distribution system, pathogens could also be present.***

When total coliforms are present, the system is vulnerable to pathogens, whether pathogens are actually present or not. Total coliform testing is relatively inexpensive and easy. Fecal coliforms are a subset of total coliforms. *E. coli* is a subset of fecal coliforms. Fecal coliforms and *E. coli* are good indicators of fresh fecal contamination and of the potential presence of waterborne pathogens associated with fecal contamination. Certain strains of *E. coli* are themselves pathogenic.

Regular coliform testing is essential to protecting the health of your customers. **Detection of total coliforms is a warning sign that your system may be vulnerable to fecal contamination.** You should attempt to determine the source of the total coliform contamination and address the problem.

Detection of fecal coliforms or *E. coli* is a danger alarm that your system is contaminated with fecal waste. You must take immediate steps to inform and protect your customers.

The next section of this workbook discusses the specific requirements of the Total Coliform Rule for monitoring as well as for the specific steps you must take if you detect total coliforms or fecal coliforms/*E. coli.*

The Total Coliform Rule

Samples to be analyzed for the presence of coliforms must be collected according to a written Sample Siting Plan.

The Total Coliform Rule (TCR) is the Federal regulation that sets maximum contaminant levels (MCLs*) and monitoring requirements for coliforms in drinking water. It requires every regulated system to periodically collect samples and analyze them for coliforms. The number of routine samples required each month depends on system size (see chart below). Samples must be collected according to a written “Sample Siting Plan.” Appendix A describes how to develop a sample siting plan. Appendix B describes sample collection techniques.

Population Served	Routine Samples per Month
25 - 1,000	1
1,001 - 2,500	2
2,501 - 3,300	3

*The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

As mentioned previously, the presence of total coliforms is a warning sign that your system is vulnerable to contamination. It does not necessarily mean that your system is fecally contaminated.

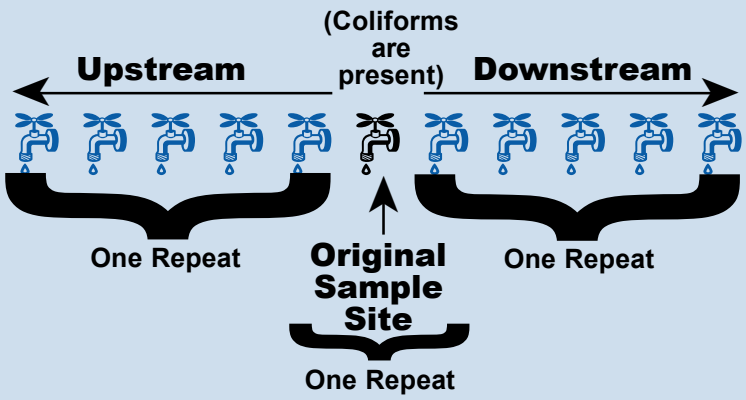
If any of your routine samples test positive for the presence of total coliforms, you must:

- Immediately collect a set of repeat samples per positive routine sample to assess the extent of the problem, and
- Collect 5 routine samples the next month.

For every total coliform-positive sample, a set of repeat samples must be collected **within 24 hours** of the system being notified of the positive result. The minimum number of repeat samples required is based on the number of routine samples collected. See the table below to determine the number needed.

Population Served	Repeat Samples per Positive Routine Sample
25 - 1,000	4
1,001 - 2,500	3
2,501 - 3,300	3

Repeat Samples



- One must be at same site as the routine sample.
- One must be within 5 service connections upstream.
- One must be within 5 service connections downstream.
- If a fourth repeat sample is required, the system should take the sample wherever it feels it will help identify the area of contamination.

Repeat Sample Locations

One of the repeat samples must be collected from the original sample site; 1 within 5 service connections upstream; 1 within 5 service connections downstream; and for systems serving 25-1,000 persons a fourth repeat sample is required and should be collected from wherever the system believes it would best help identify the source or area of contamination.

The main reason for this repeat sampling is to determine whether the contamination is in the plumbing of an individual building or in the distribution system itself. If a repeat sample is total coliform-positive at the same service connection, but negative at upstream and downstream service connections, the State may investigate to determine if it is appropriate to waive the total coliform-positive sample as being a plumbing system problem in the individual building.

Note: If any routine or repeat sample is total coliform-positive, the positive sample is tested either for the presence of fecal coliforms or *E. coli*. The test is done automatically by the lab and does not require an additional sample.

A potential urgent health risk exists if any sample, routine or repeat, tests positive for fecal coliform/*E. coli.* When you are notified by your laboratory of any sample testing positive for fecal coliforms or *E. coli*, you must notify the State by the end of the day you are notified, or before the end of the next business day if the state office is closed.

Acute MCL

If you have a total coliform-positive routine sample followed by a fecal coliform or *E. coli*-positive repeat sample (or a fecal coliform or *E. coli*-positive routine sample followed by a total coliform-positive repeat sample), this is a serious potential health risk. This creates an **acute** violation of the MCL and you must:

- Notify the State by the end of the day you are notified, or before the end of the next business day if the state office is closed.
- Notify the public within 24 hours by television, radio, hand delivery, or other methods approved by the State.*
- Consider advising your customers to boil their water.

Monthly MCL

A less serious but still significant potential health risk exists if more than one sample (routine and/or repeat) in a month is total coliform positive. This creates a **monthly** MCL violation. When you are notified by your laboratory of the repeat or second routine total coliform-positive sample results, you must:

- Notify the State by the end of the next business day.
- Notify the public within 30 days by mail, hand delivery, or other methods approved by the State.*

*This guide contains information that reflects new U.S. EPA public notification requirements. See *Public Notification Requirements: A Quick Reference Guide* (document number EPA 816-F-00-023) for more information.

In the month following detection of total coliforms in any routine or repeat sample, you are required to collect five routine samples. If none of these tests positive for the presence of total coliforms, you may resume collecting your usual number of routine samples the next month.

A total coliform-positive sample is cause for concern. However, if a set of repeat samples that month and five routine samples the next month are all negative, and your other multiple barriers to contamination are in good shape, you can have confidence that your water is safe.

There Are Exceptions to Every Rule!!!

The Total Coliform Rule provides States with flexibility to alter certain requirements, on a case-by-case basis, in response to local circumstances. This guide is not designed to provide exhaustive detail on all the potential exceptions to the basic requirements we have thus far described. However, as a small system operator, you should be aware of the most significant possible exceptions.

1. **Invalidation of Total Coliform-Positive Samples.** Under certain limited and specific circumstances, the State may invalidate a sample. You should not interpret this flexibility to mean that total coliform-positive samples are not a serious matter! Rather, this flexibility exists to allow the State to invalidate a sample in those rare instances when it is justified to do so.

2. **Reduced Monitoring.** Systems serving 25-1,000 persons may, under very specific conditions, be allowed to collect 1 sample per quarter rather than 1 sample per month. States may only allow this reduced monitoring if a system has no history of coliform contamination and if it is supplied solely by a protected ground water source and is free of sanitary defects.

Monthly Monitoring Worksheets

This guide contains simple monthly monitoring worksheets to help you keep track of your Total Coliform Rule sampling and sample results. (While the monitoring worksheets presented here can be a useful management tool, system operators are reminded that the original laboratory results must be kept on file as well.) These worksheets can help you ensure that you collect the right number of routine samples each month. These worksheets will also help you ensure that you collect the appropriate number of repeat samples in the event that any routine samples are total coliform-positive. Finally, the worksheets will help you organize your follow-up if you have a monthly MCL violation (if you have more than one routine and/or repeat samples that are total coliform-positive) or you have an acute MCL violation (triggered by fecal coliform/*E. coli* positives).

The following pages explain how to use these worksheets. A series of examples is included showing how the worksheets would be filled out in various circumstances and what follow-up would be needed. Finally, a 12-month supply of blank worksheets is provided. Additional worksheets are available by calling the Safe Drinking Water Hotline at 1-800-426-4791 and requesting publication number EPA 816-R-01-017B.

It should be noted that some Primacy Agencies (typically the State regulatory agency, except in a few cases) may have their own monitoring worksheets that small community drinking water systems are required to complete. The worksheets contained in this section should not replace monitoring forms required by the Primacy Agency.

TCR Monthly Monitoring Worksheets

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year _____

1 Date Sample Collected	1 Routine Sample Location	2 Date Results Known	3 Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples: 4A Date Sample Collected	Repeat Samples: Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Repeat Samples: 4B Date Results Known	Repeat Samples: Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Repeat Samples: 4C Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
	1.		+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

5

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Using the TCR Monthly Monitoring Worksheets

This section presents instructions for completing the TCR Monthly Monitoring Worksheets. Each step presented here corresponds to a numbered section of the sample TCR worksheet on page 17.

Step #1

Enter date and location of routine sample

- Enter date when routine sampling occurred.
- Record specific location information (e.g., street address) for the routine sample location.
- The sample sites chosen must be representative of water throughout the distribution system according to a written Sample Siting Plan (see Appendix A).

Step #2

Indicate routine total coliform test result(s)

- Enter date when laboratory results became known to the system.
- Your laboratory will report whether total coliforms are present or absent in a given sample. Circle "+" if coliforms are present, or circle "-" if coliforms are absent.

Step #3

Indicate routine fecal (or *E. coli*) test result(s) (if applicable)

- Any routine total coliform test sample that indicates the presence of coliform will also be tested for the presence of fecal coliforms or *E. coli* by the laboratory.
- Lab analysis results for fecal coliform or *E. coli* will also be reported either present or absent in a given sample. Circle "+" if fecal coliforms or *E. coli* are present, or circle "-" if fecal coliforms or *E. coli* are absent. **Note: If a routine total coliform test sample indicates the absence of coliforms, neither "+" or "-" should be circled since a fecal coliform or *E. coli* test was <u>not</u> performed.**

Step #4

Repeat Sampling

- If **any one** of the routine total coliform samples shows the presence of coliforms, repeat samples are required. If you collect only one routine sample per month, then you must collect four repeat samples. If you collect two or three routine samples per month, then you must collect three repeat samples.

Step #4A

Enter date and location of *repeat* samples (if applicable)

- Enter date when routine sampling occurred. Note that repeat sampling is required **within 24 hours,** or the next business day, after the system is notified of the presence of total coliforms in any one of its samples. **All** repeat samples must be collected on the same day.
- Record specific location information (e.g., street address) for each repeat sample location.
- The repeat sample locations chosen must include one sample from the same tap as the original routine sample testing "present," one sample within five service connections upstream, one sample within five service connections downstream, and (if required) a fourth repeat sample taken anywhere in the distribution system. A description of these Repeat Sampling Sites should also be included in your Sample Siting Plan (see Appendix A).

Step #4B

Indicate *repeat* total coliform test results

- Enter date when laboratory results became known to the system.
- Lab analysis results for total coliforms will be reported as either present or absent in a given sample. Circle "+" if coliforms are present, or circle "-" if coliforms are absent.

Step #4C

Indicate *repeat* fecal coliform or *E. coli* test results

- Any repeat sample that shows the presence of coliforms will also be tested for the presence of fecal coliforms or *E. coli* by the laboratory.
- Lab analysis results for fecal coliforms or *E. coli* will be reported as either present or absent in a given sample. Circle "+" if fecal coliforms or *E. coli* are present, or circle "-" if fecal coliforms or *E. coli* are absent. **Note: If a repeat total coliform test sample indicates the absence of coliforms, then neither "+" or "-" should be circled since a fecal coliform or E. coli test was <u>not</u> performed.**

Step #5

Immediate follow-up actions

- Certain **immediate** follow-up actions need to be undertaken based on the sample results (both routine and repeat).

A. Notification.

If more than one sample (routine and/or repeat) in a month are total coliform-positive, you must notify the State by the end of the next business day and notify the public within 30 days.

If ANY sample (routine or repeat) tests positive for fecal coliforms or *E. coli*, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliforms or *E. coli*, or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed) and notify the public WITHIN 24 HOURS.

B. Problem Identification.

If the cause of the coliform contamination is not known, the repeat samples should be used to help identify the source of the problem. The cause of the coliform contamination could be in the treatment process itself, or somewhere in the distribution system.

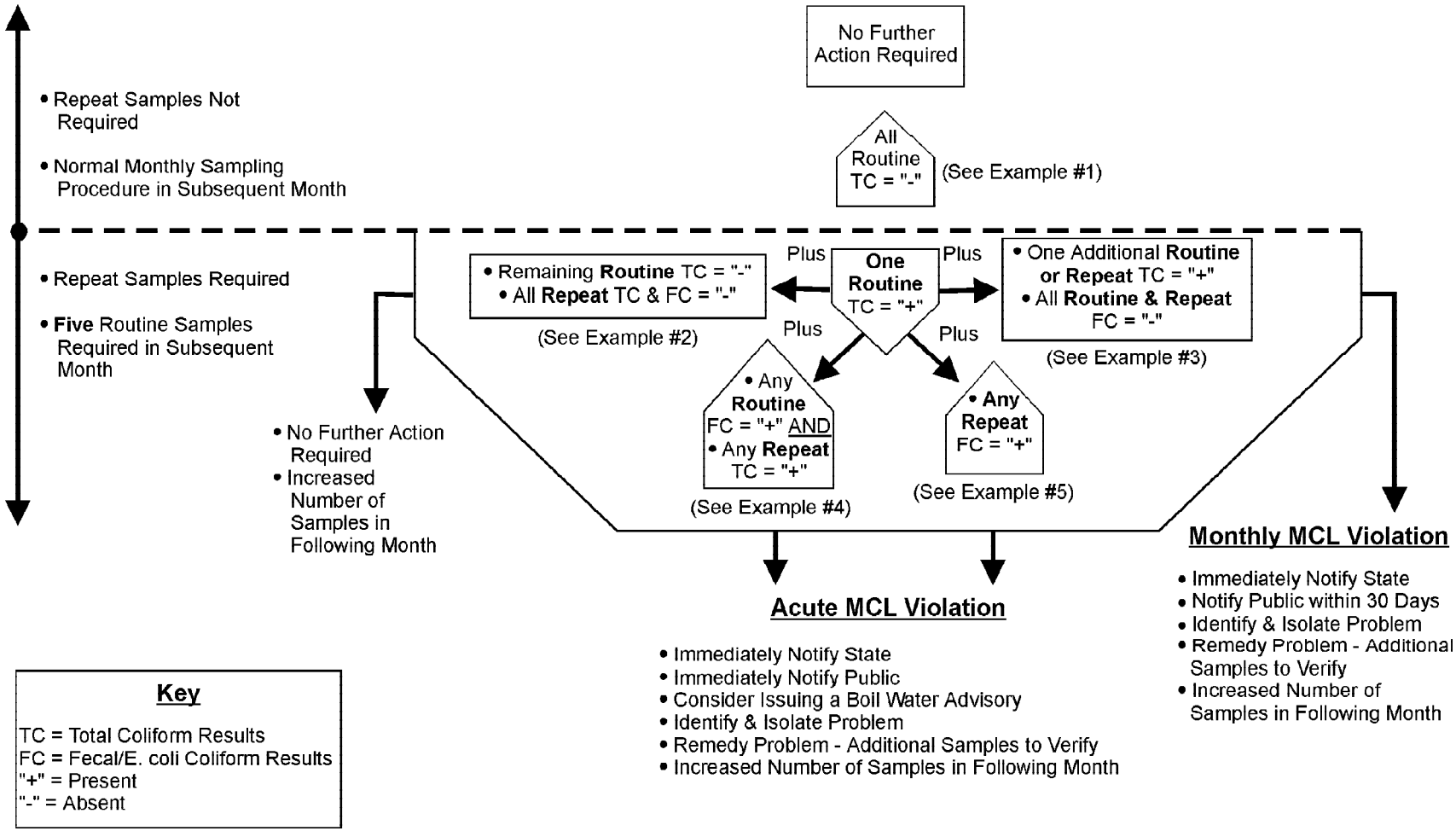
C. Corrective Measures Taken.

Any corrective actions or measures taken by the small community drinking water system **prior to or after** repeat testing should be noted.

- Record the follow-up actions taken in the space provided on the monitoring worksheets.

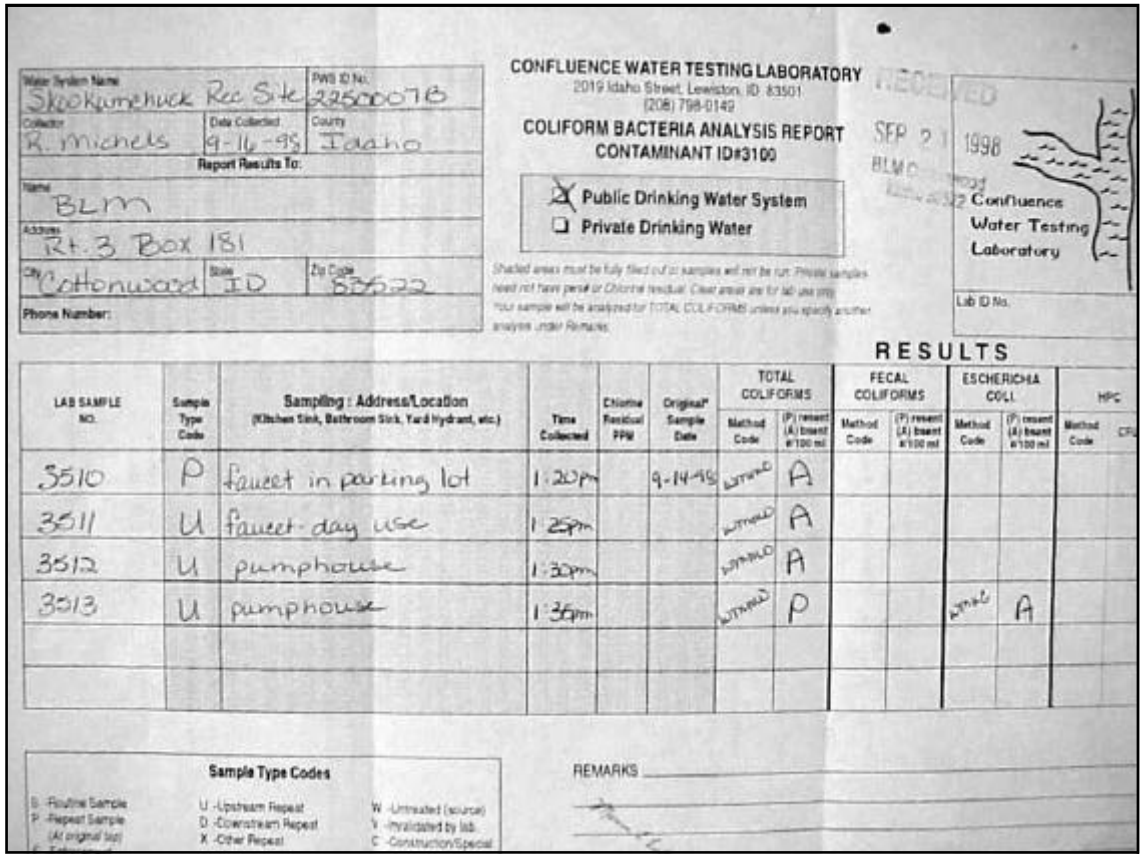
Interpreting the Sampling Results

The sample monitoring result diagram below illustrates the possible results of total coliform sampling. As mentioned previously, a possible result of total coliform testing is the violation of MCLs, either monthly or acute. The examples in the following section should be used with the sample monitoring diagram as a guide to how to interpret the results.



Sample Routine Test Results

This is a typical report that a water system would receive. The results from this report would be used to complete a monthly monitoring worksheet.



Water System Name: Skookumchuck Rec Site
PWS ID No.: 22500078
Collector: R. Michels
Date Collected: 9-16-95
County: Idaho

Report Results To:

Name: BLM
Address: Rt. 3 Box 181
City: Cottonwood
State: ID
Zip Code: 83522
Phone Number:

CONFLUENCE WATER TESTING LABORATORY
2019 Idaho Street, Lewiston, ID 83501
(208) 798-0142

COLIFORM BACTERIA ANALYSIS REPORT
CONTAMINANT ID#3100

☒ Public Drinking Water System
☐ Private Drinking Water

Shaded areas must be fully filled out or samples will not be run. Private samples need not have pH or Chlorine residual. Clear areas are for lab use only. Your sample will be analyzed for TOTAL COLIFORMS unless you specify another analysis under Remarks.

RECEIVED SEP 21 1998 BLM

Confluence Water Testing Laboratory

Lab ID No.

RESULTS

LAB SAMPLE NO.	Sample Type Code	Sampling: Address/Location (Kitchen Sink, Bathroom Sink, Yard Hydrant, etc.)	Time Collected	Chlorine Residual PPM	Original* Sample Date	TOTAL COLIFORMS Method Code	TOTAL COLIFORMS (P) present (A) absent @100 ml	FECAL COLIFORMS Method Code	FECAL COLIFORMS (P) present (A) absent @100 ml	ESCHERICHIA COLI Method Code	ESCHERICHIA COLI (P) present (A) absent @100 ml	HPC Method Code	HPC CFU
3510	P	faucet in parking lot	1:20pm		9-14-95	MTF	A						
3511	U	faucet - day use	1:25pm			MTF	A						
3512	U	pumphouse	1:30pm			MTF	A						
3513	U	pumphouse	1:35pm			MTF	P			MTF	A		

Sample Type Codes

S -Routine Sample
P -Repeat Sample (At original site)
U -Upstream Repeat
D -Downstream Repeat
X -Other Repeat
W -Untreated (source)
V -Invalidated by lab.
C -Construction/Special

REMARKS

Example #1 Explanation

This system serves between 25 and 1,000 persons and thus collects one routine sample per month.

The example is for the month of August 2001. The total coliform laboratory result shows that coliforms are absent. No further action is required. Normal routine testing will continue in the following month.

Examples of Total Coliform Test Results

Example #1: Population served by small community drinking water system = 25 to 1,000 persons. One routine sample per month.

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year August 2001

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Date Sample Collected	Repeat Samples: Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Repeat Samples: Date Results Known	Repeat Samples: Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
8/6/01	1. 123 Main Street	8/9/01	+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Example #2 Explanation

This system serves between 1,001 and 2,500 persons and thus collects two routine samples per month.

The example is for the month of September 2001. One routine total coliform sample indicated the presence of coliforms, so repeat sampling was done. The three repeat samples indicated no further total coliform, fecal coliform, or *E. coli*-positive result.

The number of routine samples is increased to **FIVE** for the month of October. If all five October routine total coliform samples show that total coliforms are absent, then the system can resume its normal two routine samples per month schedule in November.

Examples of Total Coliform Test Results

Example #2: Population served by small community drinking water system = 1,001 to 2,500. Two routine samples per month.

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year September 2001

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Date Sample Collected	Repeat Samples: Location (• One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).)	Repeat Samples: Date Results Known	Repeat Samples: Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
9/10/01	1. 456 North Street	9/12/01	+ / -	+ / -	9/13/01	1.1 456 North Street	9/17/01	+ / -	+ / -
					9/13/01	1.2 452 North Street	9/17/01	+ / -	+ / -
					9/13/01	1.3 460 North Street	9/17/01	+ / -	+ / -
						1.4 (d)		+ / -	+ / -
9/10/01	2. 789 South Street	9/12/01	+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Example #3 Explanation

This system serves between 2,501 and 3,300 persons and thus collects three routine samples per month.

The example is for the month of October 2001. One of the three routine total coliform samples showed the presence of coliforms, but the corresponding fecal result showed the absence of fecal coliforms. Since one routine total coliform sample indicated the presence of coliforms, repeat sampling was done.

Three repeat samples were collected as follow-up to the routine sample. Two of the three repeat samples showed the presence of total coliforms, but fecal coliforms were absent from these samples. This constitutes a monthly MCL violation since more than one sample (routine and/or repeat) showed that total coliforms are present. The system must immediately notify the State and also notify the public within 30 days.

The number of routine samples is increased to **FIVE** for the month of November. If all five November routine total coliform samples show that total coliforms are absent, then the system can resume its normal three routine samples per month schedule in December.

Examples of Total Coliform Test Results

Example #3: Population served by small community drinking water system = 2,501 to 3,300. Three routine samples per month.

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year October 2001

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Date Sample Collected	Repeat Samples: Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Repeat Samples: Date Results Known	Repeat Samples: Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
10/9/01	1. 135 East Street	10/11/01	+ / -	+ / -	10/11/01	1.1 135 East Street	10/15/01	+ -	+ -
					10/11/01	1.2 129 East Street	10/15/01	+ -	+ -
					10/11/01	1.3 143 East Street	10/15/01	+ -	+ / -
						1.4 (d)		+ / -	+ / -
10/9/01	2. 79 West Street	10/11/01	+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
10/9/01	3. 234 Main Street	10/11/01	+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Example #4 Explanation

This system serves between 25 and 1,000 persons and thus collects one routine sample per month.

The example is for the month of November 2001. The routine total coliform laboratory result showed that both total coliforms and fecal coliforms are present. Upon receiving these results on November 7, 2001, the system immediately notified the State that it had detected the presence of fecal coliforms in the routine sample. Repeat sampling was done.

Four repeat samples were collected as follow-up to the routine sample. Two of the four repeat samples showed that total coliforms were present. Fecal coliforms were absent from the repeat samples. This constitutes an acute MCL violation since there are fecal coliforms present in a routine sample and total coliforms are present in a repeat sample. The system must immediately (within 24 hours of knowing laboratory results) notify the State and the public.

The number of routine samples is increased to **FIVE** for the month of December. If all five December routine total coliform samples show that total coliforms are absent, then the system can resume its normal one sample per month schedule in January 2002.

Examples of Total Coliform Test Results

Example #4: Population served by small community drinking water system = 25 to 1,000. One routine sample per month.

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year November 2001

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Date Sample Collected	Repeat Samples: Location (• One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).)	Repeat Samples: Date Results Known	Repeat Samples: Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
11/5/01	1. 600 North Street	11/7/01	+ / -	+ / -	11/8/01	1.1 600 North Street	11/9/01	+ / -	+ / -
					11/8/01	1.2 610 North Street	11/9/01	+ / -	+ / -
					11/8/01	1.3 594 North Street	11/9/01	+ / -	+ / -
					11/8/01	1.4 (d) 604 North Street	11/9/01	+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Example #5 Explanation

This system serves between 1,001 and 2,500 persons and thus collects two routine samples per month.

The example is for the month of December 2001. One of the routine samples showed that total coliforms are present. Fecal coliforms were absent from the routine samples. Repeat sampling was done.

Three repeat samples were collected as follow-up to the routine sample. Two of the three repeat samples showed the presence of total coliforms, with one sample also showing that fecal coliforms are present. This constitutes an acute MCL violation since fecal coliforms are present in a repeat sample. The system must immediately (within 24 hours of knowing laboratory resuls) notify the State and the public.

The number of routine samples is increased to FIVE for the month of January 2002. Should all January routine total coliform samples show that total coliforms are absent, then the system can resume its normal two samples per month schedule in February.

Examples of Total Coliform Test Results

Example #5: Population served by small community drinking water system = 1,001 to 2,500. Two routine samples per month.

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year December 2001

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Date Sample Collected	Repeat Samples: Location (• One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).)	Repeat Samples: Date Results Known	Repeat Samples: Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Repeat Samples: Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
12/3/01	1. 402 East Street	12/5/01	+ / -	+ / -	12/6/01	1.1 402 East Street	12/7/01	+ / -	+ / -
					12/6/01	1.2 410 East Street	12/7/01	+ / -	+ / -
					12/6/01	1.3 396 East Street	12/7/01	+ / -	+ / -
						1.4 (d)		+ / -	+ / -
12/3/01	2. 500 West Street	12/5/01	+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

12-Month Supply of “Monthly Monitoring Worksheets”

Systems can use the monitoring worksheets on the following pages to track the results of laboratory analyses of their coliform samples. These forms can be a useful management tool, helping operators ensure they remain in compliance with TCR monitoring requirements and identifying potential problem areas that require special attention.

Systems are reminded that the analytical results reported by their laboratories also must be kept on file. Some State agencies may have their own monitoring forms, which small community drinking water systems are required to complete. The forms that follow should not replace monitoring forms required by the State agency.

Additional blank worksheets may be obtained by calling the Safe Drinking Water Hotline at 1-800-426-4791 and requesting publication EPA 816-R-01-017B.

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year _____

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples				
					Date Sample Collected	Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
	1.		+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year _____

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples				
					Date Sample Collected	Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
	1.		+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year _____

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples				
					Date Sample Collected	Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
	1.		+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year _____

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples				
					Date Sample Collected	Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
	1.		+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
						4.2		+ / -	+ / -
						4.3		+ / -	+ / -
	5.		+ / -	+ / -		5.1		+ / -	+ / -
						5.2		+ / -	+ / -
						5.3		+ / -	+ / -

(a) If more than one sample (routine and/or repeat) in a month is total coliform positive, you must notify the State by the end of the next business day and notify the public within 30 days.

(b) If ANY sample tests positive for fecal coliforms or *E. coli* you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed).

(c) If a routine total coliform-positive sample is followed by a repeat sample that tests positive for fecal coliform or *E. coli,* or a routine sample that tests positive for fecal coliforms or *E. coli* is followed by a repeat total coliform-positive sample, you must notify the State THE DAY YOU RECEIVE THE RESULTS (or the next day if the State office is closed), and notify the public WITHIN 24 HOURS.

(d) Note: Fourth repeat sample for systems taking one routine sample per month.

Immediate Follow-up Actions.

A. Notification B. Problem Identification C. Corrective Measures Taken

Total Coliform Rule — Monthly Monitoring Worksheet

Month and Year _____

Date Sample Collected	Routine Sample Location	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)	Repeat Samples				
					Date Sample Collected	Location • One must be at same site as routine. • One must be within 5 taps upstream. • One must be within 5 taps downstream. • One additional sample anywhere within the distribution system (if a fourth repeat sample is required).	Date Results Known	Total Coliform Result (a,c) (Circle "+" if present, "-" if absent)	Fecal Coliform or *E. coli* Result (b,c) (Circle "+" if present, "-" if absent)
	1.		+ / -	+ / -		1.1		+ / -	+ / -
						1.2		+ / -	+ / -
						1.3		+ / -	+ / -
						1.4 (d)		+ / -	+ / -
	2.		+ / -	+ / -		2.1		+ / -	+ / -
						2.2		+ / -	+ / -
						2.3		+ / -	+ / -
	3.		+ / -	+ / -		3.1		+ / -	+ / -
						3.2		+ / -	+ / -
						3.3		+ / -	+ / -
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						3.3		+ / -	+ / -
	4.		+ / -	+ / -		4.1		+ / -	+ / -
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Appendix A

Developing a Sample Siting Plan[1]

[1]Text adapted from John Potts, “Coliform Sampling Plans Reduce Errors,” Oregon.*PIPELINE*, spring 1994.

Introduction

The TCR requires each small community drinking water system to sample for coliforms according to a written plan, which must be made available to the Primacy Agency, typically the State drinking water agency. Having a written sample collection protocol helps ensure that all sampling is done correctly, even when assignments of water system personnel change.

The plan specifies where in the distribution system routine samples will be drawn in order to ensure that they are “representative” of the water supplied to every customer. Representative samples that accurately reflect the quality of the finished water are crucial because, if coliforms are in the water supply, they may not be found uniformly throughout the distribution system. The sampling plan also designates repeat sampling sites to be used if a sample drawn from a routine sampling point tests positive for coliforms. Remember, the purpose of sampling is not to draw “clean” samples, but to identify any coliform contamination so it can be dealt with promptly. Because of this, it is important to identify dead ends and trouble spots in the distribution system for sampling locations.

Developing a Sampling Plan

The details of a sampling plan depend on the characteristics of the system for which it is developed and on the requirements of the Primacy Agency. (Contact your Primacy Agency for its complete requirements. A list of Primacy Agencies can be found at the end of this section.) Factors to consider when preparing a site sampling plan include:

- The location and type of water sources, treatment facilities, storage tanks, pressure stations, and service connections.
- The location of dead-end pipes, main and branch lines, loops, and other aspects of the piping system’s configuration.
- Cross connection hazards and shared connections.
- Areas of low water pressure and slow water movement.
- Varying population densities.
- Hydrants (for flushing schedule).

A Basic Site Sampling Plan

A basic site sampling plan may have three components: a map of the distribution system; a narrative description of the plan; and a maintenance program.

Distribution system map: This map provides the layout of the distribution system and shows:

- All water sources and their entry points into the distribution system.
- The area served by each water source (if the water from the various sources is not combined prior to distribution).
- Treatment facilities, such as filtration and disinfection.
- Storage tanks and reservoirs.
- Pressure reducing stations.
- Booster pump stations.
- Pressure zones.
- *Routine* sampling sites.
- *Repeat* sampling sites.
- Interconnections and critical valves.
- Pipe material and size.
- Hydrant locations.
- Location of blowoffs/flushing points.
- Dead-end mains and/or known trouble areas.

Plan narrative: The description of the site sampling plan includes:

- Water system name and contact person(s).
- Water system seven-digit identification number.
- Water source name(s).
- Storage/reservoir volume.
- Treatment plant description (process used, source[s] treated, location, etc.).
- Total population served.
- Number of service connections.
- Number and area of pressure zones, with population and service connections in each zone.
- Description of sampling rotation within a community, area, etc. This is especially important if the site plan incorporates large areas such as rural water systems.

Maintenance program: This section of the site sampling plan identifies:

- The minimum number of *routine* samples required per monitoring period.
- The number of *routine* sample sites needed to represent all distribution areas and all areas of concern.
- The location of all *routine* sampling sites needed to cover all areas in the distribution system. (The address of each site should be listed here, and the sites should be identified on the distribution system map.)
- Sample collection schedule (for systems that collect more than one sample per month). Samples should be collected at regular intervals, not all on the same day.
- Monthly rotation cycle (if applicable). It is desirable to rotate through each sample site three or four times a year.
- A description of the five *routine* sampling sites that will be used for *routine* sampling the following month after the presence of coliforms has been confirmed.
- A brief description of the sample collection techniques used. This will help avoid false positives due to improper collection techniques.
- The schedule for flushing the distribution system's lines. This procedure is vital in reducing the possibility of coliform and biofilm buildup. Systems that have dead-end lines should flush regularly.
- The name and telephone number of the person who prepared the site sampling plan.
- The date the site sampling plan was prepared (and revision date if applicable).

Sampling Sites

Sampling sites specified in the sampling plan should be selected carefully throughout the distribution system to represent the varying conditions that occur there. (See Figure 1 on the next page for examples.) It is especially important to identify and include in the sampling plan areas that may adversely affect the microbiological quality of the water. These include cross connections, varying population densities, low-pressure zones, sites of deteriorating water mains, shared connections, and areas of low-velocity water movement.

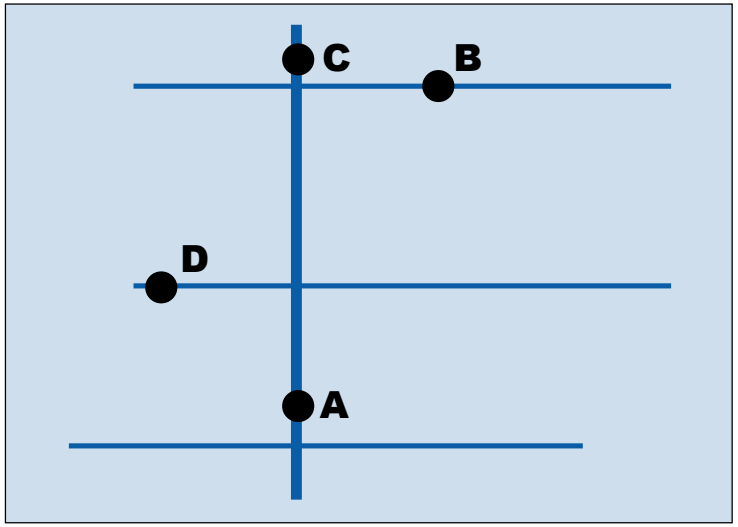
Customers' faucets and specially installed sampling taps are the two most common types of sampling sites. Customer faucets may not always be

conveniently accessible. Also, samples from a customer's faucet may not accurately reflect distribution system conditions, for reasons that have to do with the customer's plumbing, which are not under the water supplier's control. If customers' faucets are to be used, each faucet should be examined carefully to ensure its suitability. Some examples of **undesirable** conditions are:

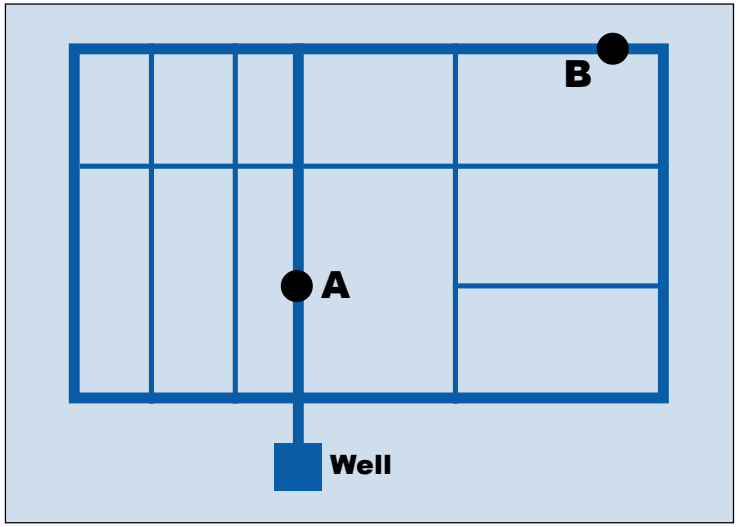
- Swivel-type faucets that have a single valve for hot and cold water.

Figure 1

Examples of Sampling Locations Based on System Characteristics



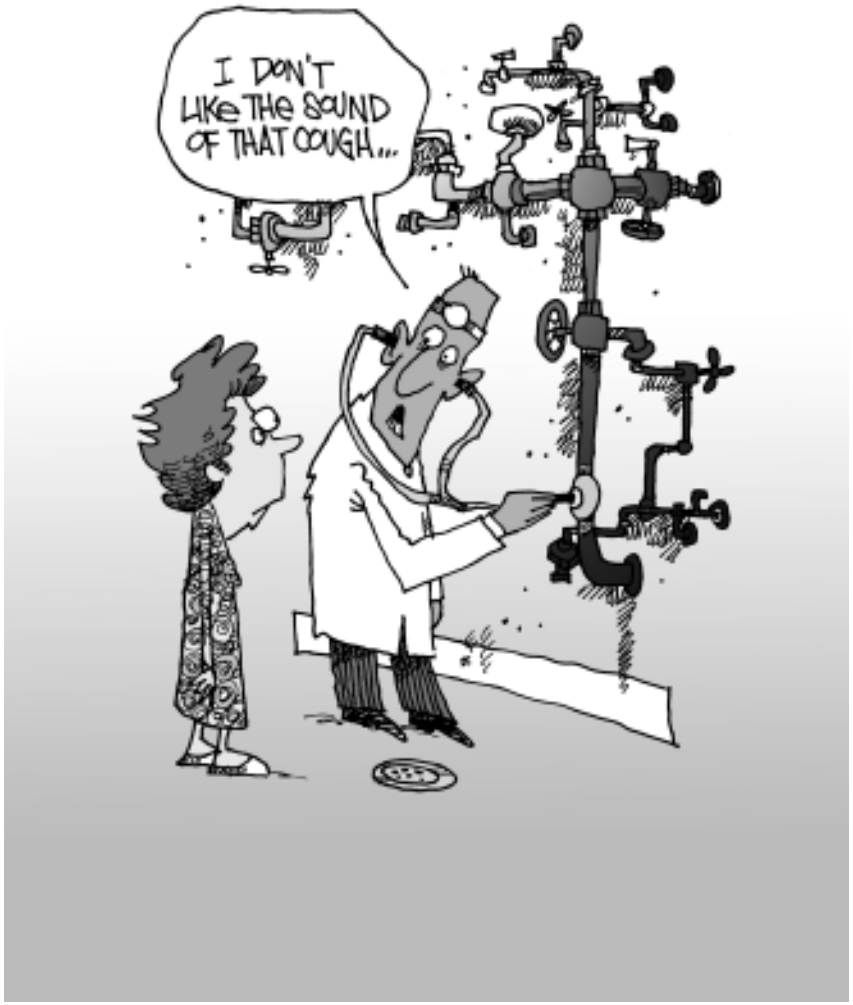
Providing samples that are representative of all the conditions in a system that has a number of branch lines with dead-ends, such as this one, might require four sampling locations: **A** gives a sample representative of conditions along the distribution system's main line. **B** provides a sample that represents conditions along one of the branch lines. Samples taken at **C** show conditions near the dead-end of the main line, while samples from **D** are representative of conditions near the dead-end of a branch line. (Adapted from *A Guide to Bacteriological Sampling of Public Water Supplies,* Virginia Department of Health, January 7, 1998.)



Looped distribution systems such as this one allow water to flow freely in all directions. In this system, only two sampling locations are necessary to provide samples representative of the main loop (**A**) and the branch loop (**B**) conditions. (Adapted from *A Guide to Bacteriological Sampling of Public Water Supplies,* Virginia Department of Health, January 7, 1998.)

- Faucets that have leaky packing material around the stem.
- Faucets that supply areas, such as janitorial or commercial sinks, where bacterial contamination is likely.
- Faucets close to or below ground level.
- Faucets that point upward.
- Faucets that have threads on the inside of their spouts.
- Faucets that have aerators. (If such faucets are to be used, the aerators must be removed before a sample is collected.)

To avoid the problems inherent with customer faucets, many water suppliers collect water samples for coliform analysis from special taps connected directly to distribution pipes. These special taps can be simply a faucet at the end of a riser pipe connected to the distribution line, or a more sophisticated manufactured sampling station installed at the water meter or into the distribution main.



Safe Drinking Water Act Primacy Agencies

Alabama	Department of Environmental Management Water Supply Branch
Alaska	Division of Environmental Health Drinking Water and Wastewater Program
Arizona	Department of Environmental Quality Water Quality Division
Arkansas	Department of Health Division of Engineering
California	Department of Health Services Division of Drinking Water and Environmental Management
Colorado	Department of Public Health and Environment Drinking Water Program
Connecticut	Department of Public Health Water Supplies Section
Delaware	Health and Social Services Division of Public Health
District of Columbia	U.S. EPA Region 3
Florida	Department of Environmental Protection Drinking Water Section
Georgia	Department of Natural Resources Environmental Protection Division
Hawaii	Department of Health Environmental Management Division
Idaho	Department of Health and Welfare Division of Environmental Quality
Illinois	Environmental Protection Agency Division of Public Water Supplies
Indiana	Department of Environmental Management Office of Water Management
Iowa	Department of Natural Resources Water Supply Section
Kansas	Department of Health and Environment Bureau of Water
Kentucky	Department for Environmental Protection Division of Water
Louisiana	Department of Health and Hospitals Division of Environmental & Health Services
Maine	Department of Human Services Division of Health Engineering
Maryland	Department of the Environment Public Drinking Water Program
Massachusetts	Department of Environmental Protection Drinking Water Program
Michigan	Department of Environmental Quality Drinking Water & Radiological Protection Division
Minnesota	Department of Health Drinking Water Protection Section
Mississippi	Department of Health Division of Water Supply
Missouri	Department of Natural Resources Division of Environmental Quality
Montana	Department of Environmental Quality Public Water Supply Section
Nebraska	Department of HHS Regulation & Licensure
Nevada	Department of Human Resources Bureau of Health Protection Services
New Hampshire	Department of Environmental Services Water Supply Engineering Bureau
New Jersey	Department of Environmental Protection Environmental Regulation
New Mexico	Environment Department Drinking Water Bureau
New York	Department of Health Bureau of Public Water Supply Protection
North Carolina	Department of Environment and Natural Resources Public Water Supply Section
North Dakota	Department of Health
Ohio	State Environmental Protection Agency Division of Drinking & Ground Water
Oklahoma	Department of Environmental Quality Water Quality Division
Oregon	Department of Human Resources Drinking Water Program
Pennsylvania	Department of Environmental Protection Bureau of Water Supply Management
Rhode Island	Department of Health Office of Drinking Water Quality

South Carolina	Department of Health & Environmental Control Bureau of Water
South Dakota	Department of Environment & Natural Resources Division of Environmental Regulation
Tennessee	Department of Environment & Conservation Division of Water Supply
Texas	Natural Resource Conservation Commission Water Utilities Division
Utah	Department of Environmental Quality Division of Drinking Water
Vermont	Department of Environmental Conservation Water Supply Division
Virginia	Department of Health Division of Water Supply Engineering
Washington	Department of Health Drinking Water Division
West Virginia	Bureau for Public Health Office of Environmental Health Services
Wisconsin	Department of Natural Resources Bureau of Water Supply
Wyoming	U.S. EPA Region 8 Wyoming Drinking Water Program

Note: States in **boldface** type have prepared guidance on Sampling Siting Plans for systems to use in complying with the monitoring requirements of the TCR.

If you have any questions on who your Primacy Agency is, call the U.S. EPA Hotline at 1-800-426-4791.

Appendix B

Sample Collection Techniques

Adapted From EPA's "Pocket Sampling Guide for Operators of Small Water Systems" (EPA 814-B-92-001)

For More Information

Copies of the “Pocket Sampling Guide for Operators of Small Water Systems” (EPA 814-B-92-001) on which this appendix is based are available from the Environmental Resource Information Center (ERIC). The cost is $8.56 plus $4.00 shipping and handling. ERIC’s telephone number is 1-800-276-0462. The ERIC document number for the sampling guide is G-654.

Sample Containers

Many different sizes and types of sampling containers may be used for collecting coliform samples. Bottles should be obtained from labs only, and most labs supply a 125-mL sterilized, plastic bottle, but you may ask for larger volume plastic or glass bottles so long as they have been sterilized. Some labs will wrap the bottle in paper to protect it from contamination. Glass-stoppered bottles sometimes have foil covering the top for protection. A few labs may even furnish a single-service, sterilized, polyethylene bag or bottle containing sodium thiosulfate. The sodium thiosulfate ($Na_2S_2O_3$) is a dechlorinating agent which also stops the disinfection action of chlorine during the sample's transit to the laboratory, thus providing a more representative picture of the samples microbial content when the sample was taken.

Remember, you are sampling the water to determine what the water is like coming out of the consumer's tap at the time you took the sample, and not what it is like during transit to the laboratory. **Do not rinse contents from the container!**

Sample Procedure

The lab that supplies the sampling containers normally provides instructions with the kit for the type of monitoring you are doing. Refer to those instructions when provided.

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

1. **Assemble all of the sampling supplies before you begin.** A dechlorinating agent is needed and may need to be furnished (if not already supplied with the containers) when sampling chlorinated waters (such as those found in the distribution system). The containers are sterilized, so handle them carefully. **Wash your hands thoroughly before handling supplies.**

2. **Go to the sampling location(s) specified in the sampling plan.** Representative sampling locations are located in the distribution system and are accessible during normal business hours. Examples may include hospitals, city buildings, pump stations, and restaurants. The tap should be clean, free of attachments (hoses, etc.), and in good repair (no leaks). If possible, avoid drinking fountains and faucets that have swivel necks.

3. **If possible, remove any aerators, strainers, or hoses that are present**, because they may harbor bacteria. (You may not be able to remove the aerator or find a non-swivel faucet.)

4. **Open the *cold* water tap for about 2 to 3 minutes before collecting the sample.** (You may want to time this step–3 minutes is a long time.) This clears the service line.

5. **Fill out label, tag, and lab form in waterproof ink.** Make sure the label is dry before writing on the label.

6. **Adjust the flow to about the width of a pencil.** Check for steady flow. Do not change the water flow once you have started sampling. It could dislodge microbial growth.

The following steps describe collection procedures using both the bottle and the bag.

7. **Remove the bottle cap (stopper, etc.), or open the plastic bag.** Be careful not to touch the inside with your fingers. Then position the bottle or bag 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 a pocket! Also, take care not to contaminate the sterile bottle (or bag) or cap with your fingers or permit the faucet to touch the inside of the bottle or bag.

DO NOT RINSE OUT THE BOTTLE OR BAG BEFORE COLLECTING THE SAMPLE!

8. **Fill the bottle to the shoulder or to about 1/4 inch from the top.** If using a plastic bag sampling container, fill it to the marked fill line.

9. **Place the cap on the bottle and screw it down tightly.** If using a plastic bag, pull the wire tabs and whirl the bag three times for a tight seal. Samples should be iced immediately, if possible.

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

11. **Check that the information on the label is correct.**

12. **Complete any additional lab forms that came with the sample bottle,** including the chain-of-custody form (if required), with the necessary information.

13. **The samples must reach the laboratory within 30 hours of collection.** It is recommended that all samples be refrigerated or iced using “blue” ice (cooled to about 4° to 10° C). All samples received in the laboratory must be analyzed on the day of receipt.