Coliform Sample Collection

Purpose

• Public water systems must ensure their drinking water is safe from disease-causing organisms
• Coliforms in water may indicate that other, more dangerous pathogens such as *E. coli* are present
• Proper Coliform sample collection is critical to protect public health

Learning Objectives

• Explain why coliform sampling is important for a public water system
• Summarize the purpose of a sample siting plan, and discuss proper coliform sample collection procedures
• Identify factors, conditions, and common issues that can lead to undesirable results when collecting samples
• Recognize the challenges in collecting a valid coliform sample
Agenda

• Purpose of Coliform sample collection
• Coliform sample collection best practices
• Collection process and contamination risks
• Common issues and undesired results
• Collection and monitoring responsibilities
• Colilert® Test
• Summary
• Additional resources

Where are coliforms found?

• Coliform bacteria naturally occur in:
  – Animal and Human digestive tracts (feces)
  – Plant and soil material
  – Sediment
  – Biofilms
  – Untreated water

Coliform Sampling: Why?

• Total coliforms in a Public Water System:
  – Are an indicator of pathogen contamination
  – Are a warning sign that your system may also be vulnerable to fecal contamination
Coliform Sampling: Why? (cont.)

- Total Coliform (TC)
  - Not necessarily a health threat in itself
  - Indicates other potentially harmful bacteria
  - A very common microbe
  - Should be absent if chlorine residual is adequate.

Coliform Sampling: Why? (cont.)

- E. coli
  - A subset of total coliform; indicates fecal waste contamination from mammals (humans, cows, etc.)
  - Found only in mammal feces

Coliform Sampling: Best Practices

Correct and proper collection of total coliform samples is absolutely critical in protecting public health.
Coliform Sampling: Best Practices (cont.)

- Improper sampling is the most common reason for positive results (false positive)
  - Repeated sampling = extra time, effort, money
  - May lead to unnecessary MCL violation and subsequent corrective measures

Knowledge Checkpoint

Why should you be concerned if Total Coliforms are found in your PWS?

a. It means the chlorine residual is too high
b. It could signify other dangerous pathogens
c. It definitively indicates water contamination
d. You must notify the public to boil their water
Sampling Step 1: Assemble Supplies

- 125 ml sterilized plastic bottle
- Dechlorination agent (do not rinse out bottle)
- Label and lab form (chain of custody form)

Preparation and Handling

- Wash your hands
- Try to keep hands bacteria free for the collection process
- Think STERILE! Assume hands are dirty even after washing

Preparation and Handling (cont.)

- Wear clean clothing
- Watch for contamination sources:
  - nearby activities
  - soil disturbances
  - sewer lift stations
  - animals/manure
Preparation and Handling (cont.)

- Avoid talking and disturbing the air while collecting (sneezing/coughing)
- Smoking during sample collection is not advised. If it is TC+ it will be you who has to recollect

Sampling Step 2: Go to Sampling Location(s)

Sample Tap “Do’s”:

- Tap should be clean (disinfected), in good repair, free of attachments
- Sample cold water only
  - Valves that control hot and cold independently
  - Water heaters can be laden with bacteria

Sampling Step 2: Go to Sampling Location(s) - continued

Sample Tap “Do’s” (continued):

- Use a line directly connected to the main
- Sample indoors, when possible
Sampling Step 2: Go to Sampling Location(s) - continued

Sample Tap “DON'Ts” – Tap should NOT be:
• Outdoors
• Too close to the bottom of the sink
• Swivel-type with a single valve for both hot and cold water

Sampling Step 2: Go to Sampling Location(s) - continued

Sample Tap “DON'Ts” – Tap should NOT be:
• Leaking or on a leaking pipe
• Threaded in the interior
• Upward flowing

Sampling Step 2: Go to Sampling Location(s) - continued

Sample Tap “DON'Ts” – Tap should NOT be:
• Located in a room of questionable sanitary conditions
• Attached to any household point-of-entry or point-of-use devices (e.g., aerators)
• Drinking fountains
Knowledge Checkpoint

You have completed the 1st step of the process required to begin collecting your coliform sample(s)

You are ready to begin the 2nd step.

How do you know where the correct sampling location is?

Assemble sampling supplies

Go to the sampling location

Keep your faucets maintained – no spray

Types of Faucets to Avoid

• Swivel-type faucets with a single valve for hot and cold water
Types of Faucets to Avoid (cont.)

- Faucets close to or below ground level
- Outdoor faucets

Types of Faucets to Avoid (cont.)

- Faucets that point upward

Types of Faucets to Avoid (cont.)

- Faucets in places highly prone to contaminations
- Examples: janitor’s closet, public rest rooms, etc.
Sampling Step 3: Remove Aerator, Strainer, or Hose

- Can trap sediment or particulates
- Biofilms can form in a hose

Sampling Step 4: Disinfect tap and wash hands

- Disinfect sample tap:
  - cleaning solution or disinfecting wipes, or…
  - torch faucet for 10 seconds or less
- Think sterile! Always:
  - wash hands, and/or…
  - use nitrile gloves
  - avoid cross-contamination of the sample

Sampling Step 5: Open Cold Water for 2-3 Minutes

- Must get water that is representative of conditions in the water main
- When temperature stabilizes is a good guide
Sampling Step 6: Fill out Label, Tag, and Lab Form

• In waterproof ink
• Write clearly

Sampling Step 7: Adjust Flow to Width of a Pencil

• You want a steady, controlled flow
• Don’t change the flow once you start sampling (could dislodge microbial growth)

Sampling Step 8: Check Cl2 residual

• Check Cl2 residual prior to TC sample collection:
  – If low Cl2 residual, abort TC sampling and correct low residual problem first
  – Correct low Cl2 residual by flushing, turning up chlorine feed rate, and/or waiting a day
  – Be sure to record Cl2 residual on sample bottle and chain of custody form
Sampling Step 9: Remove the Bottle Cap

- Be careful not to touch the inside of the bottle or bottle cap.
- Do not lay the cap down or put it in your pocket.
- STERILE, STERILE, STERILE!!!!

Activity: Sampling Steps 1-9

For steps 1-9 below, list at least one factor or condition per step that could cause undesirable sampling results.

Sampling Step 10: Fill Bottle

- Fill bottle to the shoulder, ¼” from top
- Don’t rinse bottle; this can lead to negative results
Sampling Step 11: Place Cap on Bottle and Screw Down Tightly

Think **STERILE**

Sampling Step 12: Turn Tap Off and Replace Aerator, Strainer, or Hose

Sampling Step 13: Check the Information on the Label
Sampling Step 14: Complete any Additional Lab Forms

- Chain of custody
- Make sure to write clearly in ink

Chain of Custody

Sample Sign in Sheet

- Who Transported Sample
- Date and Time of Delivery/drop off
- Number of Samples dropped off

Sampling Step 15: Ice & Send to Lab for Processing Within 30 Hours

- Refrigeration recommended; Cooler with blue ice
- The quicker it gets to the lab the better
- Use a certified laboratory for analysis
Activity: Sampling Steps 10-15

For steps 10-15 below, list at least one factor per step that could cause undesirable sampling results (note that this flowchart moves from right to left)

Helpful Hints

• Sample early in the week or month
• Avoid sampling in the rain
• If you feel something went wrong, resample
  - Bottles are cheap; false positive samples are not

Common Issues that can lead to undesired results

Improper Sampling Techniques
• Not Flushing the Tap
• Improper Handling of Bags
• Exceed 30 Hour Holding Time
Who’s Responsible??

The WATER SYSTEM PERSONNEL are responsible for ensuring that all water samples are collected during the correct compliance period.

Failure to Monitor

• Utility is responsible for ensuring that the results go to the regulatory agency
• Violation occurs if no sample taken or reported
  – Includes Public Notice and other measures

Laboratory Results

• You will be notified by Region/District or Lab if you have a TC+ Sample
• Collect Repeats and Triggered Source samples within 24 hours or as scheduled
• May require corrective action be taken to resolve contamination
Colilert® Test

1. Collect proper sample
2. Add one sample pack
3. Cap and shake
4. Incubate 35°C for 24 hours
5. Read results
   - Negative: Less yellow than comparator
   - Positive total coliform: Yellow equal or greater
   - Positive E. coli: yellow and fluorescence

Do-it Yourself???

Quantifying Results
Activity: TC+ Discussion

Who has experienced a TC+ event?

What was the solution?

Localization

- Discussion:
  - What local conditions or factors in your area have specifically influenced your Coliform sample collection practices?

Summary

- Water system personnel responsible for coliform sample collection can effectively protect public health by:
  - recognizing the importance of a sample siting plan
  - following proper coliform sample collection procedures
  - being aware of common issues that may challenge collection efforts and produce undesirable sample results
Online Resources

• A Small Systems Guide to the Total Coliform Rule
  http://www.epa.gov/ogwdw/disinfection/tcr/pdfs/small-tcr.pdf

• AWWA Video: Reliable Coliform Sampling for Water Systems