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Coliform Sampling

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Poll Question:

Have you sampled for Total Coliform before?

- a) Yes, recently
- b) Yes, a long time ago
- c) No



Title 5 Handbook: 310 CMR15.303 1 (a)

Systems Failing to Protect Public Health and Safety and the Environment

If one or more of the following conditions is found by a System Inspector or Local Approving Authority, the system shall be upgraded....

Applies to All systems:

- Sewage backup
- Pumping more than 4 times a year
- Ponding, breakout
- Septic/tight tank is structurally unsound
- D-box static level
- SAS below the high groundwater table



Title 5 Handbook: 310 CMR15.303 1 (b)

Systems Failing to Protect Public Health and Safety and the Environment

If one or more of the following conditions is found by a System Inspector or Local Approving Authority, the system shall be upgraded....

Conditions for cesspools and privies:

- Cesspool/Privies within 100' of surface water...
- Cesspool/Privies within Zone I of public well
- Cesspool/Privies within 50' of private water supply well
- Between 50'-100' feet from a private water supply well
well water analysis



Title 5 Handbook: 310 CMR15.303 1 (c)

Systems Failing to Protect Public Health and Safety and the Environment

If one or more of the following conditions is found by a System Inspector or Local Approving Authority, the system shall be upgraded....

Systems with septic tanks and soil absorption systems:

- Septic Tank / SAS within 100' of surface water
- Septic Tank / SAS within Zone I of public well
- Septic Tank / SAS within 50' of private water supply well
- Between 50' – 100' feet from a private water supply well

Well Water Analysis

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310 CMR15.303 continued

Well Water Analysis

A well water analysis must be done by a Certified Laboratory to prove

- The absence of fecal coliform bacteria
- Ammonia-nitrogen $\leq 5ppm$
- Nitrate-nitrogen $\leq 5ppm$

Ammonia-nitrogen

- Measure of the amount of ammonia in the water.
- Typical ammonia-nitrogen levels in wastewater are 100-800 mg/l
- Ammonia at high levels
 - Poisonous to humans and
 - Upset the natural equilibrium in lakes and streams.
- Ammonia in lesser amounts results from degradation of organic matter
- Other sources: nitrogen-fertilizer, livestock operations, industrial processes

Nitrate-nitrogen

- Nitrate is a form of inorganic nitrogen
- Sources of excess nitrate: fertilizers, wastewater, animal wastes, industrial wastes, etc.
- Occurs naturally in soil and water
- High levels of nitrate in water can pose a potential health risk
 - Nitrate \Rightarrow Nitrite \Rightarrow absorbed into the blood - interferes with oxygen transfer “blue baby syndrome.”



Pathogenic organisms:

- Numerous pathogenic organisms in wastewater
 - Bacteria, Viruses, Protozoa, Helminths
- They are difficult to isolate and identify

Indicator organism  Coliform organism:

- Coliform is more numerous
- Easier to test for



Coliform:

- Rod shape bacteria
- Found in intestinal tract of humans & warm-blooded mammals
- Human discharge 100-400 billion /day

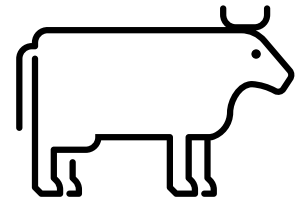
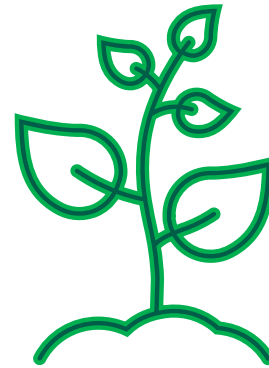
The presence of coliform organisms **INDICATES** that pathogenic organism may also be present.



Coliform bacteria in the environment:

Coliform bacteria are generally NOT harmful

- Animal and Human digestive tracts
- Plant and soil material
- Sediment
- Biofilms
- Untreated water
- Storm runoff

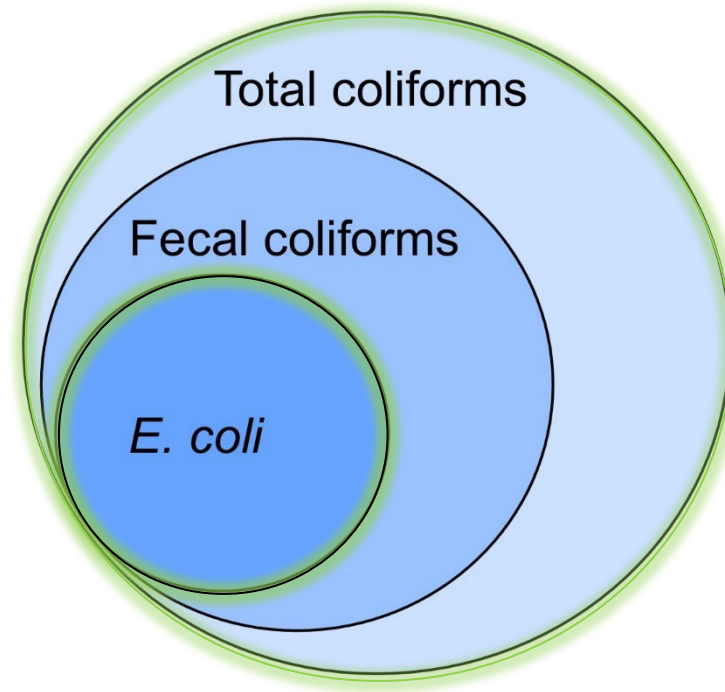


Total Coliform

vs.

E.coli:

- **Total Coliform** is a common microbe
- Not a health threat in itself
- It *may* indicate that other, more **dangerous bacteria** are present



- **E. coli** is a subset of total coliform & indicates fecal waste contamination
- *Found only in warm-blooded animals*
- Potential presence of waterborne pathogens associated with fecal contamination



Why total coliform?

- For drinking water, **total coliforms** are the standard test because their presence indicates contamination of a water supply by an outside source
- If the total coliform count is high, then it is very possible that harmful germs like viruses, bacterial and parasites might also be found in the water

How does total coliform get into a well?

- Leachate from the SAS
- Cracked well casing
- Cap not on tight
- Sub grade well top
- Surrounding grade creates a bowl
- Roots, bugs, dirt





Quality samples ensure public health

- Correct *collection procedures* and *site selection* are critical to reliable results
- Improper sampling is the most common reason for false positive results
 - Repeated sampling = extra time, effort, money
- Be sure to use a lab that is certified by the State for bacterial analysis





Private Well Guideline : MassDEP

For Existing Wells:

“Each year, preferably in the spring, all private wells, should be tested for total coliform bacteria and nitrate/nitrite. If Total Coliform bacteria is detected, the well water should be sampled for E.-coli to determine if wastewater has contaminated the well.”

Quiz:

When is coliform testing required?

- a) When your septic system is within 100' feet of surface water
- b) When you are in Zone 1 of a public well
- c) When you are within 50 feet of a private water supply well
- d) When you are between 50 and 100 feet from a private well supply



Avoiding sample contamination:

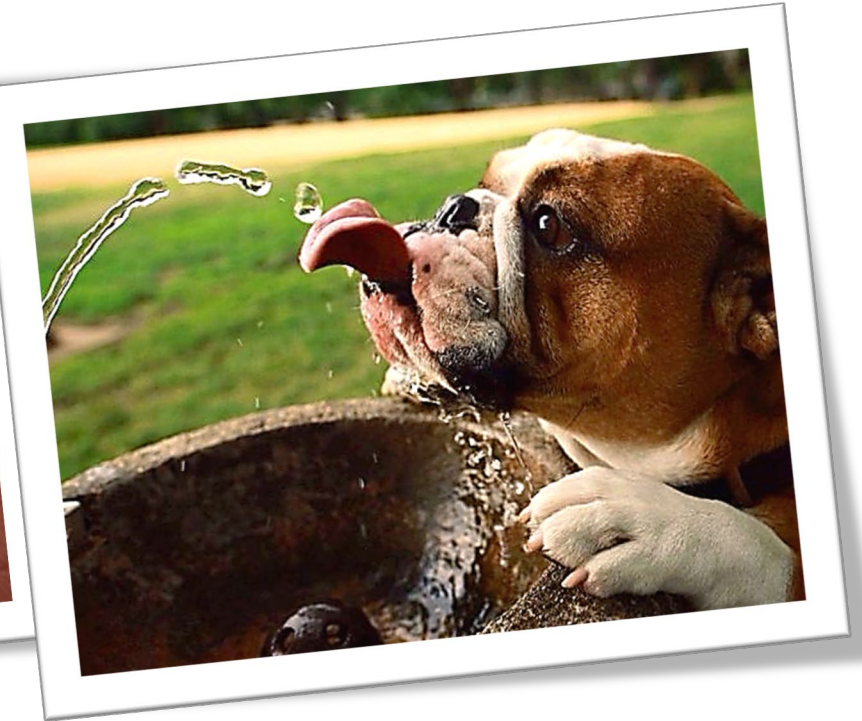
An ideal sampling faucet:

- Is indoors
- Is clean, in good repair, free of attachments
- Has independent hot and cold handles to run **ONLY** cold water for sample
(Water heaters can be laden with bacteria)
- Has a fixed faucet *(it does not swivel)*
- Is directly connected to the source



Types of faucets to avoid

- Internal threads
- Leaking
- Swivel-type
- Fountains (upward facing)
- Outdoor
- Close to/below ground level
- Hoses



Indoor contamination:

- Unsanitary conditions
- Water splash-back
- Taps located too close to the bottom of the sink
- Faucets
- Smoke, dust
- House point-of-entry devices (water softeners, treatment systems)
- Point-of-use devices (aerators, filters)



Outdoor contamination:

- Unsanitary conditions
- Nearby activities
- Soil disturbances
- Pollen, dirt
- Sewer/septic
- Animals/manure
- Weather events: precipitation, wind



Handling techniques

- Handle the sample bottle with washed hands and/or use nitrile gloves (powder free)
- “Clean” is free from dirt, marks or stains but can contaminate
- Think **STERILE** – free from bacteria or microorganisms.
- Avoid disturbing the air (sneezing, coughing, movements)





Total Coliform Sampling Procedures:

Assemble your supplies:

- ✓ Sterile 125 ml plastic bottles provided by lab (bring extra)
 - Sealed wrapping intact
 - MAY contain a dechlorination agent (do not rinse out)
 - Still can use if sample is not chlorinated
- ✓ Chlorine test kit
- ✓ Labels
 - Bottle label & Chain of Custody
 - Pen and permanent marker
- ✓ Gloves
- ✓ Clean clothes



Remove aerator, strainer, or hose

- These can trap sediment or particulates
- Biofilms can form

**Note the sample bottle has not been opened yet*



Disinfect tap, wash hands

Disinfect sample tap:

- Rinse with scent- free bleach (1:10 solution)
- Or rinse with isopropyl alcohol

Think STERILE :

- Wash hands, if you have not done so and/or...
- Use nitrile gloves (avoid touching unnecessary things)
- Avoid cross-contamination of the sample





Run cold water for 3-5 minutes

- Must sample water that is representative of conditions of the water source
- Flush for extra time if unsure to avoid sampling stagnant water from the service line
- Sample when water temperature stabilizes



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Fill out label & lab form

- Use waterproof/permanent ink on bottle label
 - Use fine tip
 - No gel pens, ball point pens
- Write clearly on all paperwork
- Note your concerns
- Fill out all fields completely
 - *Sample location(s): kitchen, upstairs bathroom etc.



Check chlorine residual

- Know what the chlorine residual is expected to be (zero?)
 - SHOCK CHLORINATION? (bleach)
- Test immediately – Chlorine dissipates quickly



Chlorine residual



Measurement of Chlorine Residual

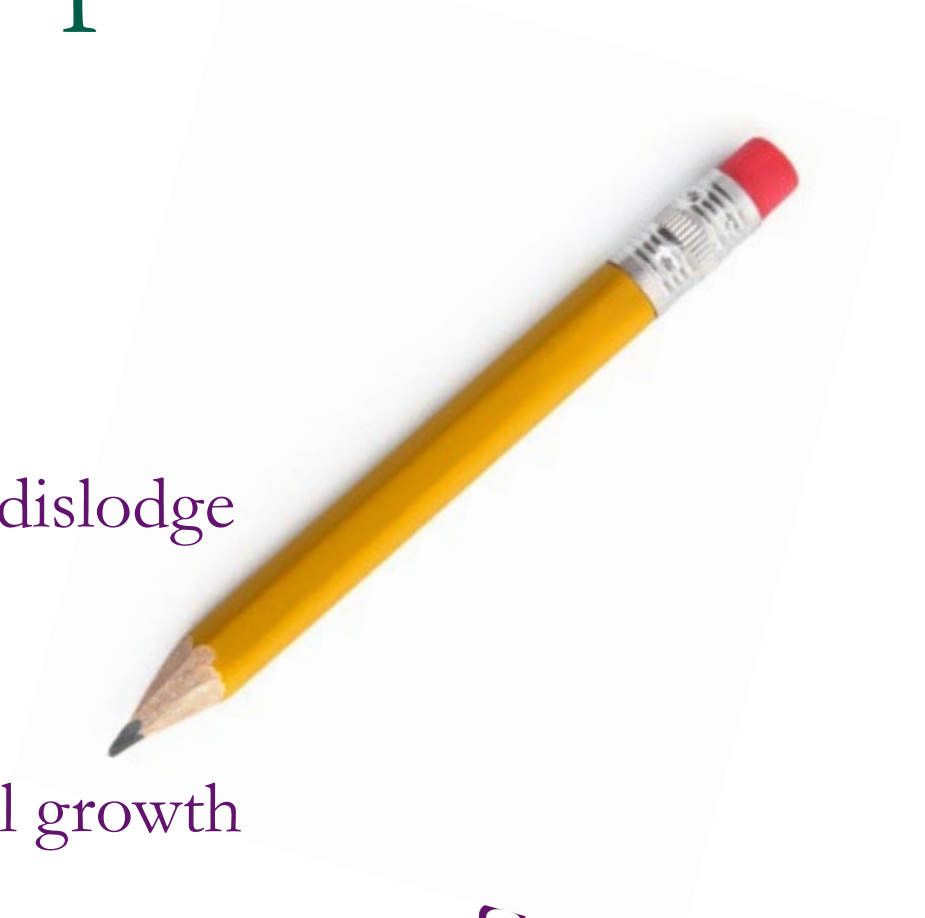
Rural Community Assistance Partnership- RCAP • 24K views • 4 years ago

This video will cover taking a good chlorine sample and methods for analysis. Effective measurement of chlorine residual is ...



Adjust flow to width of a pencil

- You want a steady, controlled flow
- Do not adjust the flow during collection
 - Speeding up or slowing down flow could dislodge microbial growth
- Do not swivel the faucet head
 - Bending the hose could dislodge microbial growth





Remove the bottle cap

- Do not use the bottle if the seal is broken
- Be careful NOT to touch the inside of the bottle or the bottle cap.
- Do not lay the cap down or put it in your pocket.

Right hand? – left hand?

- STERILE, STERILE, STERILE!!!!

Fill bottle & secure cap

- Fill in one attempt
- Fill to the shoulder: $\frac{1}{4}$ " from top, or "fill line"
- Do NOT over-fill or rinse; (dechlorination agent)
- Secure cap – only touch the outside of the bottle and cap



Turn off tap and replace aerator, strainer or hose

- If aerator, strainer, or hose is not reconnected or replaced appropriately (cross threaded), it may lead to future contamination
- Gloves can now be removed



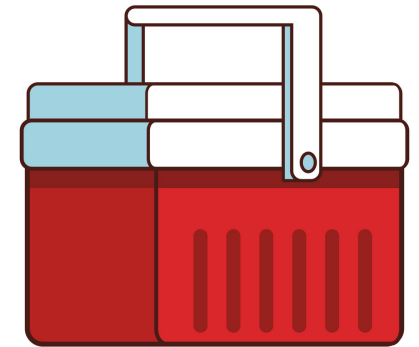


Compare the information on the label & chain of custody

- ID
- Sample location
- Date
- Time
- Is the Chain of Custody filled out Completely?
- Did the samples change hands before the lab?

Cool, send to lab for processing

- Bag the sample, use blue ice/cold packs (*loose ice may melt*)
- Cool to 40°F or cooler to dampen biological growth
- Must arrive at the lab within 30 hours
- Use a certified laboratory for analysis
 - Samples incubated for 24 hours



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Find a Certified Lab

MassDEP Certified Labs Database:

» <http://eeaonline.eea.state.ma.us/DEP/Labcert/Labcert.aspx>



Extra tips

- Not 100% confident? Throw the sample out. Bottles are cheap, false positives are not (repeat sampling)
- Check lab hours: Lab may not accept on a Friday? (will need to be read on Saturday)
- EXTRA: “Field Blanks” identify errors/contamination in sample collection/analysis.
- EXTRA: “Field Duplicates” estimate sampling and analysis precision



Nitrate & ammonia sampling

- Use the same handling techniques as total coliform sampling
- Obtain sample bottle from lab
 - Plastic bottle preserved with Sulfuric Acid (H_2SO_4)
 - Do not rinse the bottle, do not over-fill
- Use nitrile gloves to protect hands in case accidental contact with preservative (eye protection too)
- Fill bottle to within 1 inch from the top
- Cool on ice to less than 40°F
- Lab must receive sample within 28 days



Quiz:

If Total Coliform bacteria are found in a well:

- a) It definitively indicates septic contamination
- b) It could signify other dangerous pathogens
- c) The well must be abandoned
- d) All of the above

Quiz:

The dechlorination powder must be rinsed out if no chlorine is present.

- a) True
- b) False

Quiz:

Contamination can come from internally threaded faucets.

a) True

b) False



Resources

- **Video:** Coliform Sampling Best Practices *by RCAP*
https://youtu.be/K_l294gppAk
- Quick Guide To Drinking Water Sample Collection *by EPA*
https://www.epa.gov/sites/production/files/2015-11/documents/drinking_water_sample_collection.pdf
- Quick Reference Guides- Drinking Water *by EPA*
<https://www.epa.gov/dwreginfo/drinking-water-rule-quick-reference-guides>
- **Video:** Measurement of Chlorine Residual *by RCAP*
<https://youtu.be/hC-IrykgJNc>
- RCAP Solutions: Individual Well Program
<http://www.rcapsolutions.org/private-wells/>

Questions?



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