





1

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"Improving Rural Quality of Life"

2

Coliform Sampling

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3

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



5

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



6

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 near

- 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

Well Water Analysis



7

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 $\leq 5ppm$



8

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



9

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."



10

Pathogenic organisms:

- Numerous pathogenic organisms in wastewater
 - Bacteria, Viruses, Protozoa, Helminths
 - They are difficult to isolate and identify
- Indicator organism \longleftrightarrow Coliform organism:
- Coliform is more numerous
 - Easier to test for



11

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.



12

Coliform bacteria in the environment:

Coliform bacteria are generally NOT harmful

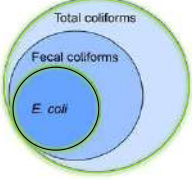
- Animal and Human digestive tracts
- Plant and soil material
- Sediment
- Biofilms
- Untreated water
- Storm runoff



13

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

RCAP Solutions

14

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

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15

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



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16

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



17

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.”



18

Avoiding sample contamination:

20

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



21

Types of faucets to avoid

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



22

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)



23

Outdoor contamination:

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



24

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)



25

Total Coliform Sampling Procedures:

26

Assemble your supplies:

- ✓ Sterile 125 ml plastic bottles provided by lab (bring extra)
 - Sealed wrapping intact
 - Contains 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



27

Remove aerator, strainer, or hose

- These can trap sediment or particulates
- Biofilms can form



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



28

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



29

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



30

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.



31

Check chlorine residual

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



32

Chlorine residual



Measurement of Chlorine Residual
Rural Community Assistance Partnership- RCAP • 25K views • 4 years ago
This video will cover taking a good chlorine sample and methods for analysis. Effective measurement of chlorine residual is ...



33

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



34

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!!!!



35

Fill bottle & secure cap

- Fill in one attempt
- Fill to the shoulder: 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



36

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



37

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?



38

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



39

Find a Certified Lab

MassDEP Certified Labs Database:

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



40

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



41

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 no 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



42

Resources

- **Video:** Coliform Sampling Best Practices by RCAP
https://youtu.be/K_I294ppAk
- 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/dwrcginfo/drinking-water-rule-quick-reference-guides>
- **Video:** Measurement of Chlorine Residual by RCAP
<https://youtu.be/hC3rykqjNc>
- RCAP Solutions: Individual Well Program
<http://www.rcapsolutions.org/private-wells/>



46

Questions?



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47
