

Revised Total Coliform Rule (RTCR) and Triggered Ground Water Rule (GWR) Challenges in EPA Region 8

October 22, 2025

WWQ-PCA - EPA Rule Training

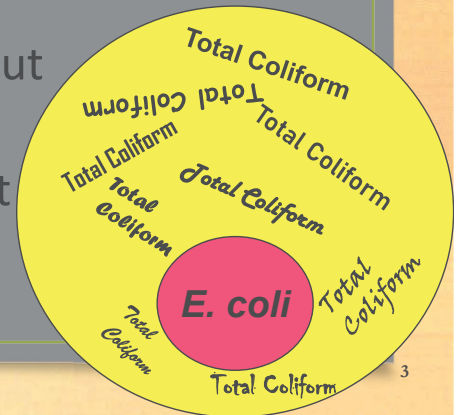
The policy views expressed in this presentation are those of the author and do not necessarily reflect the views of the U.S. Environmental Protection Agency.

THANK YOU!!!!

Providing bacteria-free
drinking water is a
critical job!

What are Total Coliform, *E. coli*, the Revised Total Coliform Rule (RTCR) and the Ground Water Rule?

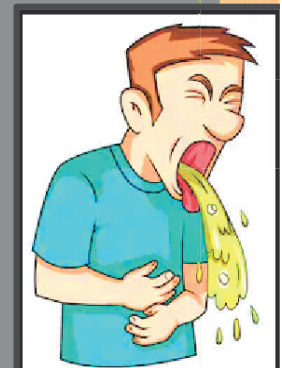
- Total coliforms (TC) is a group of bacteria that are used as a warning for potentially serious contamination in a water system.
- *E. coli* is one type of bacteria found within total coliforms, it almost always originates in human or animal guts.
- A water sample can be TC+ and EC-, but it can't be TC- and EC+.
- A TC+/EC- sample result indicates that there is a potential pathway for contamination in the water system.



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E. Coli Waterborne Disease Outbreaks

- The CDC defines a **waterborne disease outbreak** as occurring when at **least 2 persons** experience a **similar illness** after ingesting a specific **drinking water**... (Kramer *et al.* 1996).
- **Fecal** contamination, like *E. coli*, ... can make you sick with **diarrhea, abdominal discomfort, nausea, vomiting**, and other symptoms.
- Outbreaks are often **underreported** because a fecal test is required.
- **PREVENTION:** *E. coli* can be inactivated with water treatment like chlorine or UV.



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Overview

- Revised Total Coliform Rule (RTCR) Highlights
- Monthly & Triggered Monitoring
 - Sample Types
 - Important Information to Remember
- RTCR & GWR Implementation Challenges
- Assessments & Corrective Action
- TT & MCL Violations



E. coli

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Specific RTCR & Triggered GWR Problems in EPA Region 8!

- ➔ RTCR Sample Siting Plans
 - ➔ Not updated,
 - ➔ Not followed,
 - ➔ Sites not representative of water served,
 - ➔ No notification to EPA.
- ➔ Repeat samples not collected or late
- ➔ Triggered GWR source samples
 - ➔ Not collected,
 - ➔ Chlorine residual present,
 - ➔ No notification to wholesale water system.

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SOME TIPS ON HOW TO AVOID RTCR & TG GWR VIOLATIONS!

- ➔ Check Drinking Water Watch for your RTCR samples around the 8th of the month AFTER the monitoring period. Check for your Oct. sample around Nov. 8th. If it's not there, re-send it.
- ➔ Implement the manufacturer recommended cleaning and maintenance on all treatment units.
- ➔ Follow your RTCR sample siting plan.
- ➔ Label your samples correctly.
- ➔ Always collect triggered source samples after a routine TC+ result if the source water is classified as Ground Water.
- ➔ **If you have any questions CALL EPA!!!**

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Revised Total Coliform Rule Highlights

- Every water system must have a Sample Siting Plan that identifies routine, repeat, and triggered source samples.
- All Region 8 water systems are required to monitor for total coliforms (TC) monthly, according to their Sample Siting Plan.
- Monthly sample results are due to EPA by the 10th of the following month.
- For every routine TC+, system must collect 3 repeat samples and a TG GWR sample (if applicable) within 24 hours.

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Revised Total Coliform Rule Highlights

- Generally, a **Level 1 Assessment** may be triggered if a water system has two or more TC+s in one monitoring period (month).
- Multiple Level 1 Assessments in a rolling 12-month period become a **Level 2 Assessment**.
- An ***E. coli* (EC) MCL violation** occurs when there is a combination of EC and TC routine and repeat samples in the distribution system.
- **Treatment technique violations** are triggered when a required action is not completed on time.
- **Monitoring and Reporting violations** may be triggered if a sample result is not collected or received late.
- **Public Notification** is required with **all** violations.

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Triggered Ground Water Rule Highlights

- Only systems that use a groundwater source (including purchasing GW) are subject to the Ground Water Rule.
- If the system doesn't treat the water to 4-log inactivation of viruses a triggered GW source sample is required after any routine TC+ in the distribution system.
- Must be collected from the tap closest to the well/spring, preferably before any storage or pressure tanks.
- Must be collected at the same time as the three repeat RTCR samples from the distribution system.
- Must be collected from any GW source active at the time the TC+ sample was collected.
- Must be collected **BEFORE** any treatment, including filters, UV, chlorine, etc.

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Monthly & Triggered Monitoring

Revised Total Coliform Rule (RTCR) & Ground Water Rule (GWR) Sample Types



MONITORING: Sample Labeling

There is no such thing as a “Non-EPA” TC sample.

Revised Total Coliform Rule Sample Types:

- Routine (compliance)
- Repeat (compliance)
- Special Purpose (non-compliance)

Ground Water Rule (GWR) Sample Type:

- Triggered Ground Water Rule Source Sample (compliance)

MONITORING: Sample Siting Plan

Part 1: Chart

- Identifies monthly routine sample sites,
- Repeat sample sites, if Routine sample is TC+,
- Triggered GWR Source sample(s) site, if the Routine sample is TC+ (should specify that the sample be collected BEFORE treatment).

Part 2: Map

- Sample points,
- Storage tanks,
- Pressure zones,
- Treatment units,
- Well and/or spring sites, & consecutive connections (sources).

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PWS Name: EPA Water System		PWSID: 08xxxxxxx	_1_ (#) Sample(s)/month 01/02/2025
Month	Routine Sample Location	Repeat Sample Location	Triggered GWR source sample location (any sources running at the time of a routine TC+)
January	Unit #11 (DIST)	1) (Same as routine location)	GW -1 (WL01) – sample collected before the chlorinator.
	(within 5 taps upstream)	2) Unit #14 (DIST)	
	(within 5 taps downstream)	3) Unit #8 (DIST)	



PWS Name: EPA Water System		PWSID: 08xxxxxxx	_1_ (#) Sample(s)/month 01/02/2025
Month	Routine Sample Location	Repeat Sample Location	Triggered GWR source sample location (any sources running at the time of a routine TC+)
January	Unit #11 (DIST)	1) (Same as routine location)	GW -1 (WL01) – Notify Mr. Jones (406-xxx-xxxx) at MTxxxxxxx to collect triggered source samples within 24 hours.
	(within 5 taps upstream)	2) Unit #14 (DIST)	
	(within 5 taps downstream)	3) Unit #8 (DIST)	



MONITORING: Routine & Repeat samples

- All water systems must collect routine total coliform samples each month they serve water to the public.
 - The number of samples required under the RTCR is dependent on the population served, and/or
 - The number of independent sources/distribution systems.
- Collect a set of three (3) repeat samples for each (1) routine TC+. All repeats must be collected on the same day.
- Repeat samples are required within 24 hours after a TC+ routine sample result. Request for an extension must be in writing.
- After an ***E. coli* + (EC+)**, repeat samples **MUST** be taken within 24-Hours. No extensions allowed.



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WY and Tribal Revised Total Coliform Rule (RTCR) LABORATORY SAMPLE FORM

Sampler(s) Section (For field sampler use only):

Reminder: Collect RTCR samples every month. If you have a total coliform positive or an E. Coli-positive, you must collect three (3) REPEAT samples according to your Sample Siting Plan. For each positive ROUTINE sample, you must collect REPEAT samples from:
1) the same site as the positive ROUTINE sample, 2) a REPEAT sample from a site within 5 taps upstream from the positive sample, and
3) a REPEAT sample from a site within 5 taps downstream of the positive sample. You must also collect a ground water source sample from any wells or springs in use at the time the positive ROUTINE sample was collected. This is the triggered GWR sample. Write the correct Sample Point Code on the form below (e.g., DIST), which may be found in the yearly Monitoring and Reporting Requirements and the address where the sample was taken. Chlorine Residuals are required on routine and repeat samples.
You cannot use RTCR samples as a GWR source sample, or vice versa.

PWS
info

Public Water System (PWS) Name:		Sampler's Name:	
PWS Identification Number (PWSID):		Cell Phone Number:	
PWS Street Address:	City:	State:	Zip Code:
Comments:			

Sample
info

Sample Collection		Sample Point Address (Found on your Sample Siting Plan)	Chlorine Residual (circle one) Total or Free mg/L	RTCR Sample Type - Check One		
Date	Time			☐ ROUTINE - First set of required samples collected during a month.	☐ REPEATS - samples required AFTER any routine sample is positive.	☐ SPECIAL - Is a non-compliance sample that may be collected, for example, to determine if disinfection is adequate after pipe replacement or repair or to find a source of contamination. It is also used for the Seasonal Startup Checklist required sampling and daily sampling required by an Emergency Administrative Order. It cannot be used to determine compliance with the maximum contaminant level.
				☐ Routine	☐ Repeat	☐ Special
				☐ Routine	☐ Repeat	☐ Special
				☐ Routine	☐ Repeat	☐ Special
				☐ Routine	☐ Repeat	☐ Special

Sampler(s) name (Print)	Sampler(s) signature:	Date signed:
-------------------------	-----------------------	--------------

Chlorine
Residual



MONITORING: Triggered Groundwater Source Sample (Ground Water Rule)

- Triggered groundwater source sample(s) are required when there is a routine TC+ result in the distribution system.
- This sample(s) confirms if the groundwater source itself is the source of contamination.
- Triggered source samples must be taken **BEFORE** any treatment and before the storage tank or pressure tank from each well that was running at the time of the routine TC+.
- If your system purchases water from another GW system and you get a TC+ you are required to notify the wholesale system and have them collect the TG GWR sample within 24 hours. Failure to do so will result in a violation.

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MONITORING: Triggered Groundwater Source Sample (Ground Water Rule)

- If your system has more than one well, you must or email EPA and tell us which wells were active at the time the TC+ sample was collected. Failure to do so will result in a monitoring violation.
- If you use multiple wells that combine before treatment, you may take your samples from a combined tap. This must be **clearly** marked on the sample and lab form **and reported to EPA.**
- If the GWR sample tap is near the pressure tank, make sure the pump is running when you collect the sample so that you get water from the well and not stagnant water from the pressure tank.

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MONITORING: Triggered Groundwater Source Sample (Ground Water Rule) *E. coli*

- If the triggered source water sample is *E. coli positive* you will have to collect 5 more samples from the well or spring **immediately (within 24 hours)**.
- **EC+** triggered source samples require a Corrective Action Plan (CAP) to address the contaminated source water:
 - Install disinfection to 4-log inactivation of viruses,
 - Find and remove the source of contamination, or
 - Obtain a different source of water.



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MONITORING: SPECIAL PURPOSE SAMPLES



- Samples labeled as Special purpose (for total coliform) cannot and will not count towards monthly compliance.
- Special purpose samples cannot be changed to ROUTINE samples after they are analyzed.
- Special samples are required if an Emergency Administrative Order is issued or in a loss of pressure situation.
- Special samples must be reported to EPA if they are collected. Make sure it is clear they are **Special** samples.

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***E. COLI* (EC) MCL VIOLATION REQUIREMENTS:**

YOU MUST notify EPA within 24 hours.

- Because it's related to an *EC+*, you may be required to issue a **boil water advisory** and provide an alternative source of water.
- Hand deliver public notification.
- An Emergency Administrative Order (EAO) may be issued by the EPA Enforcement Division.

Within 30 days, complete the following requirements:

- Participate in a Level 2 Assessment, and
- "Find and fix" all sanitary defects identified by EPA.

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WHEN TO CONTACT EPA:

- **When the lab reports an *E. coli* positive result.**
- When the lab reports a total coliform positive result.
- If you have more than one well running at the time the TC+ sample was collected.
- If your triggered source sample will be collected ANYWHERE other than a tap directly after the well before any storage or treatment.
- Samples are missing in Drinking Water Watch.
- Any other time!

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IMPLEMENTATION CHALLENGES

RTCR Implementation Challenges

- **One-time Sample Site Change** - What if you can't access the location on the Sample Siting Plan?
 - Return to the site on a day when you will have access,
 - Sample at a nearby location, or
 - Use an outdoor faucet that has been thoroughly flushed, cleaned, and disinfected, **and**
 - **Email Jamie (me) immediately** and include 1) where the sample was supposed to be collected, 2) where it was collected and 3) why it was collected there.
- **Permanent Sample Site Change** - What if a sample site went out of business or someone moved?
Revise and resubmit your entire sample plan.

RTCR Implementation Challenges

- **Labeling Samples** – The RTCR site name must include the actual location where the sample was collected. SP0# is not an acceptable sample site for total coliform samples.
- **Incomplete Chain of Custody (Sample Form)** – If there is no PWSID on the lab form then EPA will not accept the result. Other items often missing include the sample date, sample time, and sample type (routine, repeat, or special purpose). It will result in a monitoring violation.
- **Reporting Results Late to EPA** – Be clear with your lab about who is sending results to EPA and when. Check Drinking Water Watch. Late results may result in a reporting violation.

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TRIGGERED GROUND WATER RULE IMPLEMENTATION CHALLENGES

GWR Implementation Challenges

- **Multiple Sources** – If there is more than one water source it is your responsibility to tell EPA which wells were running at the time of the TC+. Failure to do so will result in a **VIOLATION**.
- **Labeling Samples** – The Triggered GWR sample must be labeled as the Triggered sample, it can't be labeled as a Repeat.
- **Sample Location** – The purpose of the TG GWR source sample is to characterize the source water, not the water in the storage tank or the pressure tank.

BEFORE ANY TREATMENT!

- **Sample Timing** – If you don't take your repeat samples on time, after a TC+, it triggers an Assessment. If you don't take your triggered source water samples on time it results in a **VIOLATION**.

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Consecutive Systems (Buying Water)

- Consecutive water systems are those that buy some or all their water from another public water system.
- Still required to collect monthly routine TC samples.
- If the consecutive system has a routine TC+,
 - Must notify the wholesale system (one selling the water) that triggered source samples are required within 24 hours.
 - Also has own groundwater source, must collect triggered source samples from own sources too.
- Notify EPA, in writing, that the wholesale system was notified to collect the triggered source sample. Failure to do so will result in a violation.

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Wholesale Systems (Selling Water)

- Wholesale water systems are those that sell some or all their water to another public water system.
- If a consecutive system notifies you of a TC+, you have 24 hours to collect triggered source samples. Be sure to write on the lab paperwork that the sample(s) are for the consecutive system and include the PWSID.
- If the wholesale system has a routine TC+, EPA recommends notifying the consecutive system(s) of the TC+ so they can plan accordingly.
- If the wholesale system has a triggered source sample that is ***E. coli positive*** (EC+) they are REQUIRED to notify the consecutive system (and EPA) within 24 hours.

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ASSESSMENTS & CORRECTIVE ACTIONS

PURPOSE OF ASSESSMENTS

- Find and fix the problem!
- The RTCR requires PWSs to investigate the entire water system when there are multiple TC+ or EC+ in the distribution system. The problems found are called “sanitary defects”.
- A **sanitary defect** is an issue that could provide a path for microbial contaminants, like total coliforms, to enter the distribution system OR it indicates a failure in a protective barrier that is already in place.

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TYPES OF ASSESSMENTS

- The type of Assessment required is dependent on the severity and frequency of the problem:
- **Level 1 Assessment** - a basic assessment completed by the PWS.
- **Level 2 Assessment** - a more detailed assessment conducted by an EPA-approved third party.
- Failure to complete an Assessment and/or correct a sanitary defect is a **treatment technique (TT) violation**.

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RTCR ASSESSMENTS VS. SANITARY SURVEYS

An RTCR Assessment is REACTIVE
and a Sanitary Survey is PROACTIVE!

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Disinfection Matters!

There were 21 Level 2 Assessments conducted in EPA Region 8 in 2024 & 2025 (so far):

- 52% of Level 2 Assessments were in CWSs
- 100% had groundwater sources
- 3 systems used disinfection – and it was broken at the time of the Assessment.
- 3 systems were required to install disinfection

Often, once a system begins disinfection, if it is properly monitored and maintained, the TC+ results usually end (not 100%).

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LEVEL 2 ASSESSMENT FINDINGS

- Sanitary defects found during Level 2 Assessments include:
 1. Broken treatment or inadequate maintenance of treatment units,
 2. Poor sampling technique,
 3. Dirty storage tanks,
 4. Leaks in the distribution system/unreported pressure loss,
 5. Problems with sanitary seals on wells and storage tanks,
 6. Missing #24 mesh, and
 7. Holes or openings in the well or spring box.

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Questions?

Jamie Harris

US EPA Region 8

Mail code: 8WD-SDR

1595 Wynkoop Street

Denver CO 80202-1129

Phone: 1-800-227-8917 ext. 312-6072

Direct: 303-312-6072

Fax: 303-312-7517

Email: harris.jamie@epa.gov

R8 website: <https://www.epa.gov/region8-waterops>



Email sample results to R8DWU@epa.gov,
not to individual rule managers!

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Resources

- **Reporting Public Drinking Water System Results in Wyoming and Tribal EPA Region 8** <https://www.epa.gov/region8-waterops/reporting-public-drinking-water-system-results-wyoming-and-tribal-epa-region-8> (Search Term: Reporting Results EPA Region 8)
- **Information on Maintaining or Restoring Water Quality in Buildings With Low or No Use** <https://www.epa.gov/coronavirus/information-maintaining-or-restoring-water-quality-buildings-low-or-no-use> (Search term: EPA Restoring Water Quality in Buildings)
- **Revised Total Coliform Rule (RTCR) Commonly Used Forms** <https://www.epa.gov/region8-waterops/reporting-forms-drinking-water-systems-wyoming-and-tribal-lands-epa-region-8#rtcr>
- **A Guide to Reading Your Revised Total Coliform Rule (RTCR) Level 2 Assessment** <https://www.epa.gov/region8-waterops/wyoming-public-water-systems-newsletter-2020>

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Resources

- **Revised Total Coliform Rule Lab Sampling Form** <https://www.epa.gov/region8-waterops/revised-total-coliform-rule-lab-sampling-form> (Search Term: EPA total coliform lab form)
- **RTCR and GWR Sample Labeling Instructions** <https://www.epa.gov/region8-waterops/rtcr-and-gwr-sample-labeling-instructions> (Search Term: GWR Sample Labeling)
- **EPA Region 8 Drinking Water Unit Tech Tips: Follow-up to a Total Coliform Positive Sample** <https://www.epa.gov/region8-waterops/epa-region-8-drinking-water-unit-tech-tips-follow-unsafetotal-coliform-positive> (Search Term: Follow-up to an Unsafe Total Coliform)
- **Best practices to collect a total coliform water sample (You Tube video)** https://www.youtube.com/watch?v=k_l294gppak (Search Term: Coliform Sample Best Practice)

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Resources

- ▶ **Required Information for Total Coliform Lab Reports for the Revised Total Coliform Rule (RTCR)** <https://www.epa.gov/region8-waterops/wyoming-public-water-systems-newsletter-2020>
- ▶ **What's in a Sample Bottle Name? How to Properly Label a Nitrate Sample and a Total Coliform Sample** <https://www.epa.gov/region8-waterops/wyoming-public-water-systems-newsletter-2020>

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(SOME) RTCR VIOLATIONS

(Treatment Technique and MCL Violations)

TREATMENT TECHNIQUE VIOLATION

- A treatment technique violation happens when an action is required (besides monitoring) and it's not done. Some examples include:
 - A Level 1 Assessment is not completed and sent to the EPA, or
 - A system fails to complete a sanitary defect corrective action identified in an Assessment.
- The PWS is required to notify the public (Tier 2 PN) within 30 days when a treatment technique violation occurs.

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E. coli MCL Violation Description

Routine sample	AND	Repeat sample
(1) TC+		EC+
(2) EC+		TC+
(3) EC+		Fails to take <u>all</u> required repeat samples
(4) TC+		TC+ (but not analyzed for <i>E. coli</i>)



SOME TIPS ON HOW TO AVOID RTCR & TG GWR VIOLATIONS!

- ➔ Check Drinking Water Watch for your RTCR samples around the 8th of the month AFTER the monitoring period. Check for your Oct. sample around Nov. 8th. If it's not there, re-send it.
- ➔ Implement the manufacturer recommended cleaning and maintenance on all treatment units.
- ➔ Follow your RTCR sample siting plan.
- ➔ Label your samples correctly.
- ➔ Always collect triggered source samples after a routine TC+ result if the source water is classified as Ground Water.
- ➔ **If you have any questions CALL EPA!!!**

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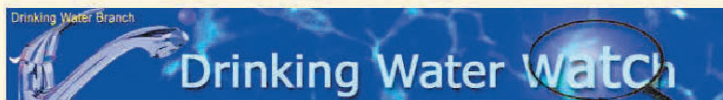
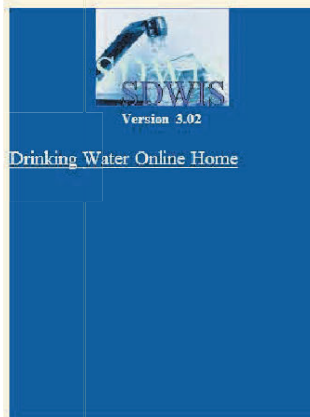
Drinking Water Watch Online

Internet Search Term: Region 8 EPA Drinking Water Watch

- No password needed.
- Check sample results for all reported analytes.
- Give EPA about a week to enter results after you received them from your lab.
- Check annual monitoring and reporting requirements.
- Send all data to R8DWU@epa.gov with the PWSID and contaminant in the subject line.

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Drinking Water Watch Online



Region 8 Public DWW

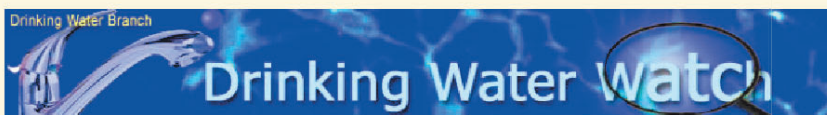
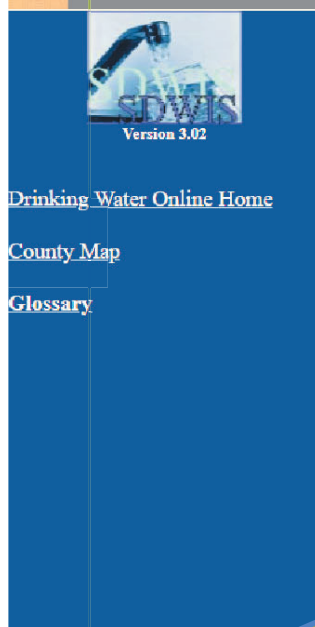
Make A Selection
Wyoming
Region 8 Tribes

Submit

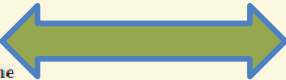
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Drinking Water Watch Online



Public Water Supply Systems Search Parameters

Water System No. 
Water System Name
Principal County Served
Water System Type
Primary Source Water Type

Sample Search Parameters

Sample Class
Sample Collection Date Range
(The Sample Search always produces results for the last 2 years, unless you provide a specific date range.)
  To 

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Links

[Water System Facilities and Schematics](#)
[Sample Schedules, Reminders, and ChemRad Sample Form](#)
[Coliform/Microbial Sample Results](#)
[Coliform Sample Summary Results](#)
[Lead And Copper Sample Summary Results](#)
[Chem/Rad Samples/Results](#)
[Chem/Rad Samples/Results by Analyte](#)
[Violations/Enforcement Actions](#)
[Site Visits](#)
[Milestones](#)

Return Links

[Water Systems](#)
[Water System Search](#)
[County Map](#)

Glossary

Drinking Water Branch

Water System Details

Water System No. : WY56
 Water System Name :
 Principal County Served : LARAMIE
 Status : A
 Federal Type : C
 State Type : C
 Primary Source : GW
 Activity Date : 05-01-1978

Points of Contact

Name	Job Title	Type	Phone	Address
	OWNER	OW	307	
	CONTRACT OPERATOR	DO	847	
	CONTRACT OPERATOR	EC	847	
	CONTRACT OPERATOR	AC	847	

Annual Operating Periods & Population Served

Start Month	Start Day	End Month	End Day	Population Type	Population Served
1	1	12	31	R	50

Service Connections

Type	Count	Meter Type	Meter Size Measure
RS	24	UM	0

Sources of Water

Name	Type Code	Status
WELL	WL	A

Service Areas

Code	Name
R	MOBILE HOME PARK

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Drinking Water Watch Online

Sample Collection Date From To

Type	Lab Sample No.	Collection Date & Time	Sampling Point	Sample Location	Presence/Absence Indicator	Free CL Res	Tot CL Res	Analyte Code	Analyte Name	Monitoring Period Begin Date	Monitoring Period End Date	Laboratory
RT	S2209048-001	09-05-2022 14:15:00	DIST	DISTRIBUTION SYSTEM	A			3100	COLIFORM (TCR)	09-01-2022	09-30-2022	PACE ANALYTICAL SERVICES - SHERIDAN
RT	S2209048-001	09-05-2022 14:15:00	DIST	DISTRIBUTION SYSTEM	A			3014	E. COLI	09-01-2022	09-30-2022	PACE ANALYTICAL SERVICES - SHERIDAN
RT	S2208005-001	08-01-2022 06:00:00	DIST	DISTRIBUTION SYSTEM	A			3100	COLIFORM (TCR)	08-01-2022	08-31-2022	PACE ANALYTICAL SERVICES - SHERIDAN
RT	S2208005-001	08-01-2022 06:00:00	DIST	DISTRIBUTION SYSTEM	A			3014	E. COLI	08-01-2022	08-31-2022	PACE ANALYTICAL SERVICES - SHERIDAN
RT	S2207199-001	07-12-2022 16:30:00	DIST	DISTRIBUTION SYSTEM	A			3100	COLIFORM (TCR)	07-01-2022	07-31-2022	PACE ANALYTICAL SERVICES - SHERIDAN
RT	S2207199-001	07-12-2022 16:30:00	DIST	DISTRIBUTION SYSTEM	A			3014	E. COLI	07-01-2022	07-31-2022	PACE ANALYTICAL SERVICES - SHERIDAN

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Remember!!!

- **Sample Bottles:** Only use bottles supplied by an EPA-certified lab. **Keep extra bottles** on hand if repeats or re-samples are necessary.
- **30-Hour Holding Time:** If from sample collection until **the lab begins analysis** of the sample. Results from samples over the holding time **WILL NOT BE ACCEPTED BY EPA!!!**
- **Chain of Custody: WRITE NEATLY!** If you do not include the **PWSID, sample type, date & time** the sample was collected, **date & time** the lab received the sample and the **sample location** you may receive a failure to monitor violation because EPA could not track your sample(s) results correctly.

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<https://www.shutterstock.com/image-illustration/throw-156251270>



- https://www.google.com/search?q=image+usfs+handpump&enUS810US810&ssrf=ALeKk03Tp6fT4qpPcyO87BilB7UWWQ:1618926306553&tbm=isch&source=iu&ictx=1&cfQuM%252CIA5gUWASQ11iEM%252C_&vet=1&usg=AI4_-kRNqSui5QzSdmyyVCBgllscheq8A&sa=X&ved=2ahUKEwjImq27-ozwAhUPG80KHfzPApsQ9QF6BAGNEAE&biw=1280&bih=891#imgsrc=12bYWPTeEiHA2M

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Background info for Slide 6

Waterborne disease outbreak

- Total coliforms are common in ambient water and may be injured by environmental stresses such as... water treatments like chlorine disinfection. **Federal Register** /Vol. 75, No. 134 /Wednesday, July 14, 2010 / Proposed Rules **40929**
- Fecal contamination and waterborne pathogens can cause a variety of illnesses, including acute gastrointestinal illness (AGI) with diarrhea, abdominal discomfort, nausea, vomiting, and other symptoms. **Federal Register** / Vol. 75, No. 134 / Wednesday, July 14, 2010 / Proposed Rules
- The CDC defines a waterborne disease outbreak as occurring when at least two persons experience a similar illness after ingesting a specific drinking water (or after exposure to recreational water) contaminated with pathogens (or chemicals) (Kramer *et al.* 1996), or when one person experiences amoebic meningoencephalitis after similar waterborne exposure. RTCR FR 2012-31205 Final p. 10274
- Underreporting occurs because most waterborne outbreaks in community water systems are not recognized until a sizable proportion of the population is
- ill (Perz *et al.* 1998; Craun 1996), perhaps 1 percent to 2 percent of the population (Craun 1996). RTCR FR 2012-31205 Final p. 10274