Water and Wastewater Regulatory Compliance Corner
Revised Total Coliform Rule
Published July 21, 2021

Background

Drinking Water Regulation in America

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources—rivers, lakes, reservoirs, springs, and ground water wells.

SDWA authorizes the United States Environmental Protection Agency (EPA) to set national health-based standards for drinking water to protect against both naturally occurring and synthetic contaminants that may be found in drinking water. EPA, Tribal Nations, states, and water systems then work together to make sure that these standards are met.

Introduction to Regulation

To protect customers, the EPA has issued specific regulations and rules that water utility systems must follow to make sure they are providing safe drinking water. EPA issued the Revised Total Coliform Rule (RTCR) to improve public health from disease-causing microbial contaminants (i.e., bacteria, protozoa, and viruses). The US Centers for Disease Control and Prevention (CDC) tracks the number of waterborne disease outbreaks. The CDC data indicates that between 1980 and 1996, 401 waterborne disease outbreaks were reported in the United States. CDC data reflects that 750,000 people became ill from their drinking water during this time frame with the largest illness from a *Cryptosporidium* incident in Milwaukee, WI, that sickened 403,000 people. Meeting the requirements of this rule will help Tribal Nation operators to protect their citizens from potential waterborne illness.

Timeline of Regulation

1990: The Total Coliform Rule (TCR) became effective in 1990. The rule sets both a health goal (Maximum Contaminant Level Goal [MCLG]) and legal limits (Maximum Contaminant Levels [MCLs]) for the presence of total coliforms in drinking water.

2013: EPA published RTCR on February 13, 2013. This version strengthened TCR and provided more robust public health protection measures.

2014: Minor corrections were made to the RTCR.

Why is this important?

Coliforms is often used as an abbreviated term to describe Total Coliform and Fecal Coliform which represents the bacteria from warm-blooded animals, and is used as an indicator organism of disease-causing microorganisms (bacteria, protozoa, and viruses) in the water supply. The regular testing for coliforms in drinking water helps

water systems catch and assess any potential threats to public health efficiently and before an outbreak of disease occurs.

Coliform bacteria are present in the environment and feces of all warm-blooded animals which includes humans. Pathogenic bacteria of interest in drinking water are *Salmonella*, pathogenic *Escherichia coli (E. coli)*, *Shigella*, *Legionella*, and *Campylobacter*. *Salmonella typhi* causes typhoid fever, which has been virtually eradicated in the United States due to sanitation! Enteropathogenic *E. coli* causes gastroenteritis in humans most notably diarrhea, but certain pathogens of the family can cause kidney failure and death in susceptible individuals. *Shigella* causes bacillary dysentery that is usually not life threatening. *Campylobacter* infections result in diarrhea and vomiting. *Legionella* causes pneumonia like symptoms; infection of susceptible host occurs through inhalation of the bacteria from aerosols it is often found in cooling towers and colonizes in plumbing systems. An example of the aerosol route Legionella takes when infecting humans is through the mist from shower heads. Hence, the EPA released strict guidelines for starting up water systems at hotels that were shut down during the COVID-19 pandemic of 2020 and 2021 to project customers from *Legionella*.

Confirmation of *E. coli* in a water system indicates recent fecal contamination, which may pose an immediate health risk to anyone who consumes the water.

Health Effects of E. Coli

Diseases acquired from contact with contaminated water can cause:

- Gastrointestinal illness: stomach cramps, diarrhea, nausea, vomiting
- Infections of: skin, ears, respiratory system, wounds

Terms to know

Carcinogen: A substance capable of causing cancer in living tissue.

Community Public Water System (PWS): A system whose customers are full-time residents.

E. Coli: E. Coli is a subgroup of fecal coliform. Only a few strains cause health effects in humans.

Fecal Coliform: Types of total coliform that exist in feces. Labs test drinking water samples for total coliform. If total coliform is present, the lab also tests the sample for E. coli.

Indicator Organisms: Bacterial contamination in water is measured using indicator organisms, notable E. Coli and Enterococci are used as primary indicators of contamination in fresh and marine water quality, respectively, rather than the total coliform present.

Non-transient noncommunity PWS: An entity having its own water supply, serving an average of at least 25 persons who do not live at the location but who use the water for more than six months per year.

Parts per billion (PPB): µg/L or micrograms per liter
1 pound = 453,592,370 micrograms

Parts per million (PPM): mg/L or milligrams per liter

1 pound = 453,592 milligrams

Pathogen: Any disease-causing microorganism (bacteria, protozoa, virus).

Primacy agency: The body the Public Water System (PWS) reports to. In cases where Tribal Nations do not assume primacy, EPA serves as the primacy agency or in very few cases the state does.

Public Water System (PWS): A supply of piped water for human consumption that has at least 15 service connections or serves 25 or more persons 60 or more days each year.

Sanitary defect: A defect that could provide a pathway of entry for microbial contamination into the water distribution system or that indicates a failure in a barrier that is already in place.

Total coliform: Large collection of different kinds of bacteria.

Transient noncommunity (PWS): an establishment having its own water system, where an average of at least 25 people per day visit and use the water occasionally or for only short periods of time.

Revised Total Coliform Rule

RTCR Components

The RTCR assists PWS to analyze and manage coliform in the water by breaking mitigation down into five comprehensive components.

- Determining and maintaining effective monitoring for coliform bacteria
- Setting effective and reasonable contaminant levels
- Assessment and corrective action to mitigate any coliform problems that may impact public health
- Maintaining a timely reporting and record keeping schedule
- How to navigate violations and communication with customers

Monitoring

Public water systems must regularly monitor for the presence of total coliforms and E. coli in their water based on an EPA or Tribal Nation approved sampling plan.

SAMPLING SITE PLAN

The water system must develop a sample site plan that identifies when and where the samples will be taken. Samples must be taken in a location that is representative of the water quality in the distribution system. The EPA has provided a template for developing a RTCR Siting Plan here.

TAKING COMPLIANCE SAMPLES

After developing a sampling plan, systems must take samples on a regular basis and have them tested for the presence of total coliforms. This is a routine sample.

Repeat samples are follow-up samples that water systems are required to take each time a routine sample is positive for total coliforms.

WHEN TAKING ROUTINE TC SAMPLE

IF ...	THEN ...
Routine sample is TC-	Continue with routine monitoring
Routine sample is TC+	For each TC+: • Take 3 repeat samples • Systems on quarterly or annual monitoring: Take 3 routine samples the following month from the TC+ location
Repeat sample is TC+	Make sure lab tests for *E. Coli*

For systems with only a single service connection, the drinking water primacy agency may allow the system to take the repeat samples over period of three consecutive days (one sample for each day) or collect a larger volume repeat sample(s) in one or more sample containers of any size, as long as the total volume collected is at least 300 ml.

SENDING SAMPLES TO THE LABORATORY

1. Systems must send their samples to a laboratory certified by the primacy agency for testing.
2. Send the sample(s) as soon as possible, keeping in mind that the laboratory must start the tests within 30 hours of sample collection.
3. Maintain proper technique for shipping

a. EPA encourages (but does not require) that samples be shipped below 10°C (50°F). This temperature may be achieved by carefully packing the water samples in ice.
b. Care should be taken when packing samples to avoid freezing. The laboratory may invalidate frozen samples.

RTCR SAMPLING REQUIREMENTS THAT APPLY TO DIFFERENT CATEGORIES OF PWSS

PWS Category	RTCR Requirement
All Public Water Systems (PWS)	• Prepare sampling plan for the community, receive approval from Primary Agency. • Monitor according to EPA or Tribal Nation approved sampling plan. • Conduct repeat monitoring for any TC+ sample. • Every sample must be analyzed for total coliform bacteria and, if TC+, the sample must be analyzed for E. Coli. • Conduct either Level 1 or Level 2 assessment when required to address identified sanitary defects.
NCWSs serving 1,000 or fewer people and only using ground water	• Conduct routine quarterly monitoring, collecting a minimum of one sample per quarter, reduced monitoring is no less frequent than annually, and increased monitoring could be either monthly or quarterly. • NCWSs on a reduced monitoring schedule must increase the frequency of monitoring the month following any positive TC+ event. • NCWSs on annual monitoring must participate in recurring annual site visits by the EPA or Tribal nation or an annual voluntary Level 2 assessment to remain on annual monitoring. • NCWSs on quarterly or annual monitoring must conduct additional routine monitoring the month following one or more TC+ samples (with or without a Level 1 trigger). • The Tribal Nation must conduct a special monitoring evaluation during each sanitary survey (usually conducted by EPA each three years) to review the status of the NCWS (including its distribution system), and determine whether the system is on an appropriate monitoring schedule.
PWSs serving 1,000 or fewer people and using only ground water	• Conduct routine monthly monitoring, collecting a minimum of one sample per month, reduced monitoring is no less frequent than quarterly, and increased monitoring for those systems monitoring quarterly is monthly. • The Primacy Agency (EPA or Tribal Nation) must conduct a special monitoring evaluation during each sanitary survey to review the status of the PWS (including its distribution system) and determine whether the system is on an appropriate monitoring schedule. • PWSs on quarterly monitoring must conduct additional routine monitoring the month following one or more TC+ samples (with or without a Level 1 trigger). • PWSs on quarterly monitoring must be in compliance with certified operator requirements and must increase to monthly monitoring the month after the system loses its certified operator.
Seasonal System	• Conduct routine monthly monitoring, except for seasonal NCWSs serving 1,000 or fewer people that use only ground water (use above standards). • Demonstrate completion of a Tribal-approved start-up procedure. • Seasonal systems on annual monitoring must participate in a recurring annual site visit by the EPA or Tribal Nation (Primacy Agency) or an annual voluntary Level 2 assessment to remain on annual monitoring. • The Primacy Agency may exempt any seasonal system from some or all the start-up requirements, if the entire distribution system remains pressurized during the entire period that the system is not operating.
PWSs serving more than 1,000 people	• Conduct routine monthly monitoring. PWSs must collect a minimum number of samples based on the population served (see Table 2-2). PWSs must collect samples at regular intervals throughout the month. • Ground water systems serving 1,001 to 4,900 people may collect all required samples on a single day if they are taken from different sites.

Best practices for Public Water Systems:

- Have your sampling plan in an accessible place. Keep it up to date.
- Have sampling kits available and ready to use when you need to sample your water routinely and stock them when sampling completed to be ready for an emergency.
- Contact your Primacy Agency if you have any questions about RTCR requirements.

Best Practices for Seasonal Systems:

- Check with your drinking water primacy agency to determine what start-up procedures you need to complete ahead of your opening for the season.
- Submit your certification of completion of start-up procedures as required by your drinking water primacy agency.
- Contact your drinking water primacy agency if you have any questions about RTCR requirements, they are there to help!

Contaminant Levels

MCLG FOR E. COLI

The MCLG for *E. coli* is set at zero. There is no safe level of E. Coli in drinking water

MCL FOR E. COLI

The MCL for E. coli is the highest level that is allowed in the drinking water based on the results of the routine sample and its associated repeat samples. The system is out of compliance with the MCL if:

- The system has an EC+ repeat sample following a TC+ routine sample.
- The system has a TC+ repeat sample following an EC+ routine sample.
- The system fails to take all required repeat samples following an EC+ routine sample.
- *E. coli* analysis is not completed when any repeat sample tests positive for total coliforms.

BEST PRACTICES FOR COMPLIANCE

- Always take three repeat samples within 24 hours of being notified that your routine sample is total coliform-positive.
- Make sure that your laboratory is testing for *E. coli* when a sample is TC+.
- Contact your drinking water primacy agency if you have any questions about the requirements.

Assessment and corrective action

The RTCR requires an assessment or an investigation of the water system when certain conditions occur. There are two levels of assessments.

A Level 1 assessment is a basic examination of the system. The Level 2 assessment is a more comprehensive and more in-depth examination of the system compared to a Level 1 assessment.

IF ...	THEN ...
Two or more TC+ samples in the same sampling period.	Level 1 assessment is triggered; can be conducted by an operator of the public water system.
Not all required repeat samples are collected after a routine TC+ sample.	
An E. Coli MCL violation occurs.	Level 2 assessment is triggered; must be conducted by someone approved by the drinking water primacy agency, which could be primacy agency staff or a third party such as an engineering consultant with operating experience.
A second Level 1 assessment is triggered within a rolling 12-month period.	
For systems on an annual monitoring frequency, a Level 1 assessment is triggered in two consecutive years.	

CONDUCTING A LEVEL 1 OR LEVEL 2 ASSESSMENT

All assessments must be completed within 30 days after learning of the triggered event.

Conducting an assessment

Step	Action	
1. Location of the positive sample	1. Assess and review sample(s) 2. Assess and review sampling site(s) 3. Assess and review sampling procedures	
2. Distribution area positive samples	Review 1. Operational data and water quality data 2. Operational activities and unusual activities	Assess 1. Distribution system components 2. Storage facilities
3. Treatment facilities	Assess treatment facility (for example, disinfection station) closest to the location of the positive sample for chemical supply (check percentage: is the hypochlorite aged and percent activity reduced; equipment status (feed pumps, etc.)	
4. Source Water	Assess wells, springs, or surface water for contamination – check source water protection plan – are all protections in place as designed?	

TREATMENT TECHNIQUE (TT) VIOLATION

A system incurs a coliform TT violation when any of the following occurs:

- A system fails to conduct a Level 1 or Level 2 assessment within 30 days after learning that it has exceeded the trigger.
- A system fails to correct any sanitary defect found through either a Level 1 or 2 assessment within 30 days or in accordance with a schedule acceptable to EPA.
- A seasonal system fails to complete state-approved start-up procedures prior to serving water to the public.

BEST PRACTICES IN PREPARING FOR ASSESSMENTS

- Determine who can conduct a Level 1 and Level 2 assessment and have systems and procedures in place to hire them quickly (emergency engineering firm contracts, etc.).
- Be familiar with the EPA's required forms and submittals.
- Create a standard operating procedure (SOP) for what to do when sampling results trigger an assessment.
- Understand which data source(s) to use to fill out the various sections of the form.
- Contact your drinking water primacy agency if you have any questions about the requirements.

Violation Reporting and Record keeping to Primacy Agency

Systems need to report certain information to their drinking water primacy agencies within a required timeframe and keep certain records. The table below lists the items to report and the required timing. If reports and timelines are missed that is a violation of the Safe Drinking Water Act. All staff need to understand how to and have access to information to make timely reports to the Primacy Agency.

Report	Time frame
Monitoring results	• Within the first 10 days following either the end of the month the monitoring was completed • End of the required monitoring period, whichever is sooner.
EC+ routine samplec	• By the end of the day when the system is notified of an *E. coli*-positive routine sample. • If primacy agency office is closed, report by end of next day, always leave a message on the day of the event even if the office is closed as it shows good faith.
E. coli MCL violation	• By the end of the day when the system learns of an E. coli MCL violation.

Report	Time frame
Coliform treatment technique violation	• No later than the end of the next business day after the system learns of the violation. • The public must be notified within 30 days.
Monitoring violation	• Within 10 days after the system learns of the violation. • The public must be notified within a year of the violation (typically in the annual consumer confidence report).
Completed assessment form	• Within 30 days after learning that the system has triggered an assessment.
Corrective action(s) not completed when assessment form was submitted	• When corrective action is completed.
Seasonal systems – certification of completion of start-up procedure	• Prior to serving water to the public.
Certification of compliance with public notice requirements	• Within 10 days of completing the public notification. If social media is used the PWS must document the notifications for Primacy Agency review.
Failure to comply with any of the requirements of the RTCR not already mentioned above	• Within 48 hours of failing to comply with the requirement.

Violation Reporting to the Customer

PWSs incur violations if they do not comply with the requirements of the RTCR.

Public Notice (PN) is required for violations incurred. Within required timeframes, the PWS must use the required health effects language and notify the public if the PWS did not comply with certain requirements of the RTCR. The type of PN depends on the severity of the violation.

The violation level is determined by the causation as shown below:

IF ...	THEN ...
• Routine total coliform-positive; repeat *E. coli*-positive • Routine *E. coli*-positive; repeat total coliform-positive • Routine *E. coli*+; system fails to take all repeat samples • Repeat total coliform-positive; sample not tested for E. coli	Tier 1 violation (PN issued within 24 hours)
• System fails to conduct the required assessment within required timeframe after exceeding a trigger. • System fails to complete required corrective action within required timeframe after identifying a sanitary defect. • Seasonal system fails to complete primacy agency approved start-up procedure prior to serving water to the public.	Tier 2 violation (PN issued within 30 days)
Monitoring • System fails to collect all required routine or additional routine samples in a compliance period. • Routine total coliform-positive; sample not tested for *E. coli* Reporting • System fails to submit monitoring report or completed assessment form after properly conducting monitoring or assessment in a timely manner. • System fails to notify its primacy agency of an E. coli-positive sample in a timely manner. • Seasonal system fails to submit certification of completion of a primacy agency-approved start-up procedure	Tier 3 violation (PN issued within a year)

WHAT GOES IN A PUBLIC NOTICE?

1. Description of the violation or situation, including the contaminant(s) of concern, and the contaminant level(s).
2. When the violation or situation occurred (e.g., date the sample was collected or was supposed to be collected).
3. Any potential adverse health effects from the violation or situation

4. The population at risk, including subpopulations that may be particularly vulnerable if exposed to the contaminant in their drinking water.
5. Whether alternate water supplies should be used.
6. Actions consumers should take, including when they should seek medical help, if known.
7. What you are doing to correct the violation or situation.
8. When you expect to return to compliance or resolve the situation.
9. Your name, business address, and phone number, or those of a designee of the public water system (PWS) as a source of additional information concerning the notice.
10. A statement encouraging notice recipients to distribute the notice to others, where applicable.

HOW DO I DISTRIBUTE A PUBLIC NOTICE?

You must use at least one of the following methods to deliver the notice to consumers:

- Radio
- Television
- Hand or direct delivery
- Posting in high-visibility locations - if Level 1 (most serious) violation
- Another method approved in writing by the EPA (the regulation is a bit dated so gaining written approval to utilize social media for communication is important)

MINIMUM NUMBER OF TOTAL COLIFORM SAMPLES PER MONTH FOR PWSS SERVING MORE THAN 1,000 PEOPLE

Population Served	Minimum number of samples per month
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20