TCEQ REGULATORY GUIDANCE
Water Supply Division
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Coliform Monitoring, Analyzing, and Reporting

Public Water Supply Supervision Program
Water Supply Division
Texas Commission on Environmental Quality

Coliform Monitoring, Analyzing, and Reporting

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RG-421
June 2021

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Glossary

Accredited laboratory: A laboratory that is accredited by TCEQ.

Analytical methods: Coliform analysis methods required by the US Environmental Protection Agency (EPA) and the National Primary Drinking Water Regulations as defined in 40 Code of Federal Regulations (CFR) Part 141 30 Texas Administrative Code (TAC) §290.119 adopts these federally mandated methods by reference.

Assessment source monitoring (ASM): Raw groundwater source monitoring required by TCEQ based on groundwater source susceptibility to fecal contaminants.

Boil Water Notice (BWN): Issued as a precaution or notification to protect consumers from drinking water that may have been contaminated with disease-causing organisms. Boil Water Notices are typically issued when an unexpected condition has caused a potential for biological contamination of potable drinking water in a public water system (PWS).

Chain of custody (COC): An unbroken trail of accountability that ensures the physical security of samples from sample collection until analysis.

Code of Federal Regulations (CFR): The rules and regulations published in the Federal Register by the federal government.

Compliance sample: Water samples collected to verify PWS adherence to the RTCR and the Groundwater Rule (GWR). Compliance samples associated with these rules include routine, repeat, and raw well source monitoring samples.

Comprehensive Compliance Investigation (CCI): An onsite review (also known as a sanitary survey) of PWSs by field investigators in the TCEQ regional offices. CCIs are used to collect information on a PWS's capacity to produce and deliver safe drinking water on a sustainable basis. They are also used to prevent and correct physical and operational weaknesses. CCIs are a proactive public health measure that can identify deficiencies in PWSs before contamination of public drinking water occurs.

Contamination: The presence of any foreign substance (organic, inorganic, radiological or biological) in water that tends to degrade its quality. This may constitute a health hazard or impair the usefulness of water.

Consecutive system: A PWS that receives some or all its raw water or finished water from one or more other PWSs.

Disinfectant: A chemical or a treatment which is intended to kill or inactivate pathogenic microorganisms in water.

Disinfection: A process which inactivates pathogenic organisms in the water by chemical oxidants or equivalent agents.

Distribution system: A system of pipes that carries potable water from a treatment plant to consumers. The term includes pump stations, ground and elevated storage

tanks, potable water mains, and potable water service lines and all associated valves, fittings, and meters, but excludes potable water customer service lines.

Drinking water: All water distributed by any agency or individual, public, or private for human consumption.

Entry Point: The point at which treated water enters the distribution system.

***Escherichia coli* (*E. coli* or EC):** One of several types of bacteria that normally inhabit the intestine of humans and animals. Some *E. coli* strains can cause disease under certain conditions. The presence of *E. coli* in drinking water indicates that potentially harmful bacteria may be present.

Fecal indicator: Microorganisms used to indicate the presence of fecal contamination. Examples include coliphage, enterococci, and *E. coli*.

Find and fix: Terminology applicable to the RTCR requiring PWSs to conduct coliform monitoring to "find" microbial contamination and "fix" any maintenance or operational defect that could allow contamination of the system.

Groundwater system: For the purposes of compliance with the RTCR and the GWR, a groundwater system is a PWS that provides, uses, or distributes any groundwater except if the groundwater is combined with surface water (or with groundwater under the direct influence of surface water) prior to treatment.

Groundwater corrective action plan: A plan approved by TCEQ documenting steps to address fecal contamination of a groundwater source or documenting steps to address a significant deficiency.

Groundwater Rule (GWR): Regulation requiring raw water sampling, periodic sanitary surveys, and corrective action in response to detection of viral indicators or the identification of significant deficiencies.

Groundwater system under the influence of surface water (GUI): A PWS that uses groundwater with some contact with surface water. These systems may have significant occurrence of micro and macro organisms. They may also exhibit fluctuations in water quality conditions such as turbidity and temperature.

Hold time: The maximum time that can elapse between sample collection and sample analysis. The Revised Total Coliform Rule (RTCR) defines the 30-hour hold time for coliforms in drinking water as "the time from sample collection to initiation of test media incubation."

Integrity monitoring: The monitoring of some aspect of filtrate water quality, such as turbidity, that is indicative of the removal of particulate matter.

Laboratory Accreditation Program: Group within TCEQ responsible for formal recognition of environmental laboratories meeting standards established by the National Environmental Laboratory Accreditation Program. The Lab Program is organized within the Laboratory and Quality Assurance Program at TCEQ. TCEQ Laboratory Accreditation Program staff can be contacted at 512-239-3754.

Level 1 Assessment (L1A): An evaluation to identify the possible presence of sanitary defects, defects in distribution system coliform monitoring practices, and (when possible) the likely reason the public water system prompted the assessment. Minimum elements include review and identification of atypical events that could affect distributed water quality or indicate that distributed water quality was impaired; changes in distribution system maintenance and operation that could affect distributed water quality (including, but not limited to water storage); source and treatment considerations affect distributed water quality, where appropriate; existing water quality monitoring data; and inadequacies in sample sites, sampling protocol, and sample processing.

Level 2 Assessment (L2A): An evaluation to identify the possible presence of sanitary defects, defects in distribution system coliform monitoring practices, and (when possible) the likely reason that the public water system triggered the assessment. A Level 2 Assessment provides a more detailed examination of the PWS than a Level 1 Assessment through a more comprehensive investigation and review of available information, additional internal and external resources, and other relevant practices. Minimum elements include review and identification of atypical events that could affect distributed water quality or indicate that distributed water quality was impaired; changes in distribution system maintenance and operation that could affect distributed water quality; source and treatment considerations that could affect distributed water quality, where appropriate; existing water quality monitoring data; and inadequacies in sample sites, sampling protocol, and sample processing.

Monitoring Plan: All PWSs are required to develop a monitoring plan, including all community, transient and non-transient water systems. Monitoring plans are a system-specific document that specifies water quality monitoring performed by the system is representative of water distributed to consumers and is consistent with regulatory requirements.

Milligrams per liter (mg/L): A unit of measurement of mass concentration that shows how many milligrams of a certain substance are present in one liter of liquid.

Microbial Reporting Form (MRF): TCEQ Form 10525 that meets federal and state reporting and quality control requirements related to the Safe Drinking Water Act. The MRF is required when reporting sample results to TCEQ for compliance with the RTCR and GWR. Use of this form is mandatory unless the laboratory is submitting data electronically to TCEQ via E2, in which case the lab may use an approved alternate form that captures all TCEQ required data. The completed form is sent to the laboratory with water samples.

Noncompliance samples: Sample types such as special or construction that are not used to determine compliance with RTCR or GWR. Monitoring results of these samples are not used to determine compliance with the RTCR EMCL or to determine if the treatment trigger has been exceeded.

Pathogenic: Bacterium, virus, or microorganism capable of causing disease.

Primacy: Relates to TCEQ's primary authority over Texas PWS compliance with the Safe Drinking Water Act (SDWA). EPA regulates the SDWA directly in states that do not have primacy.

Public Water System (PWS): A PWS provides potable water for the public's use through at least 15 service connections or serves at least 25 individuals for at least 60 days out of the year. The complete definition is found in rule at 30 TAC §290.38 (71).

Purchased water: Untreated or treated drinking water that a PWS purchases or receives from another entity.

Quality Assurance Project Plan (QAPP): QAPPs document how environmental data operations are organized, planned, implemented, and assessed. They also define in detail how specific quality assurance and quality control activities will be applied.

Raw water: Water prior to any treatment including disinfection that is intended to be used after treatment as drinking water.

Raw well sample: Sample collected prior to any treatment, including disinfection.

Rejected sample: A sample for which the laboratory is unable to report a valid analytical result. Reasons for rejection include, but are not limited to exceeded hold time, heavy bacterial growth, or insufficient sample information.

Replacement sample: A sample intended to replace a rejected sample. If, for any reason, the laboratory is unable to report a valid analytical result for a scheduled sample, the system must submit a replacement sample.

Representative sample site: A sample site which is expected to exhibit the average properties of the entire distribution system.

Representative well: Groundwater well that has been designated by the groundwater system as representative of another similar well or is representative of specific distribution sample sites. Representative wells must be listed in an approved Triggered Source Monitoring Plan. Representative wells and Triggered Source Monitoring Plans are intended to reduce sampling costs and logistical burdens on a PWS.

Revised Total Coliform Rule (RTCR): Federal regulation that established a maximum contaminant level in drinking water based on the presence or absence of *E. coli*, and uses *E. coli* and total coliforms to initiate a find and fix approach to prevent fecal contamination from entering the distribution system. It requires PWSs to identify sanitary defects and correct them.

Rule exception: As specified in 30 TAC 290.39(l), a PWS has the option of proposing an alternative method to meet a rule by requesting an exception when it is not possible for the PWS to meet a rule requirement. Alternative methods must be equally protective of public health. Exceptions are also required for approval to use innovative/alternate treatment technologies. Rule exceptions may be requested by representatives of PWSs, such as engineers, operators, or PWS owners.

Safe Drinking Water Information System (SDWIS): Electronic database that contains information about PWSs and their violations of EPA's drinking water regulations.

Sample Siting Plan (SSP): A plan used to develop and maintain sampling sites and a sampling schedule for PWS routine and repeat samples associated with the RTCR. Raw groundwater well information is also required for GWR purposes.

Sample type: Compliance sample types include routine and repeat (distribution) and samples. Non-compliance sample types include construction and special purpose samples.

Significant deficiency: Issues related to GWR that cause, or have the potential to cause, the introduction of contamination into water delivered to customers. This could include defects in design, operation, or maintenance of the source, treatment, or distribution systems. They could also be represented by the failure or malfunction of those systems.

Sodium thiosulfate: Chemical added to coliform sample bottles to neutralize residual chlorine after the sample is collected.

Special sample: Non-compliance samples used as a diagnostic tool for water systems to determine water quality and do not count toward RTCR or GWR compliance.

Standard Operating Procedure (SOP): A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and is approved for performing certain routine or repetitive tasks.

Surface water: Water from rivers, streams, creeks, lakes, and reservoirs used for drinking water.

Texas Administrative Code (TAC): A collection of all Texas state agency rules. There are 16 titles in the TAC. Each title represents a subject category and related agencies are assigned to the appropriate title. The TAC was created in 1977 by the Texas Legislature under the Administrative Code Act

Texas Drinking Water Watch (DWW): A database that allows public access to Texas PWS drinking water quality data, compliance data, and contact information.

The NELAC Institute (TNI) Standard: TNI is a nonprofit organization dedicated to data of known and documented quality. The TNI Standard is the nationally recognized environmental laboratory standard adopted by Texas. TCEQ evaluates accredited drinking water laboratories based on TNI Standards.

Total coliform (TC): A group of closely related bacteria, mostly harmless, that live in soil, water, and the intestines of small animals. This group of bacteria includes fecal coliform bacteria and other non-fecal bacteria that are very common in the natural world. The presence of these bacteria in drinking water indicates that potentially harmful bacteria may be present.

Total Coliform Rule (TCR): 1989 federal regulation that established a maximum contaminant level in drinking water based on the presence or absence of total coliforms. The TCR was replaced by the Revised Total Coliform Rule which became effective in Texas in 2016.

Treatment technique: A method used to treat drinking water for organisms such as Cryptosporidium, Giardia, and viruses.

Triggered source monitoring (TSM): Raw groundwater source monitoring required for systems not providing 4-log treatment of viruses when a routine distribution coliform sample is TC and/or EC positive.

Wholesale system: A PWS that delivers treated or raw water to another PWS. Delivery may be through a direct connection or through the distribution system of one or more consecutive systems.

4-log treatment: At least 99.99% (4-log) treatment of viruses using inactivation, removal, or an executive director-approved combination of 4-log virus inactivation and removal. The 4-log treatment must be able to be properly validated and achieved before the first connection of the specified water source.

Acronyms

CCI	Comprehensive Compliance Investigation
CCR	Consumer Confidence Report
CFR	Code of Federal Regulations
EC+	*E. coli* Positive
EMCL	*E. coli* Maximum Contaminant Level
EPA	United States Environmental Protection Agency
GWR	Groundwater Rule
GUI	Groundwater under the influence of surface water
ID	Identification
MCL	Maximum Contaminant Level
mg/L	Milligrams per Liter
mL	Milliliters
MRF	Microbial Reporting Form
NELAP	National Environmental Laboratory Accreditation Program
PN	Public Notice
PWS	Public Water System
QAPP	Quality Assurance Project Plan
RG	Regulatory Guide
RTCR	Revised Total Coliform Rule
SDWIS	Safe Drinking Water Information System
SOP	Standard Operating Procedure
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TC	Total Coliform
TC+	Total Coliform Positive
TNI	The NELAC Institute

Introduction

Microbial monitoring increases public health protection through the reduction of potential pathways of entry for fecal contamination into distribution systems. All public water systems (PWSs) must meet regulatory requirements related to microbial monitoring, reporting, compliance, and public notification to ensure the safety of public water supplies. These activities are required by Title 30, Texas Administrative Code (TAC), Subchapter F, Sections:

- 290.109: Microbial Contaminants
- 290.116: Groundwater Corrective Actions and Treatment Techniques

These two rules are referred to in this document as the Revised Total Coliform Rule (RTCR) and the Groundwater Rule (GWR). In addition to coliform monitoring, both rules contain requirements related to corrective action (under certain circumstances), reporting, and compliance. It is the PWS owner's responsibility to ensure its employees and others acting on its behalf (including the laboratory) comply with requirements described in this guidance.

Every PWS is required to routinely monitor for the presence of coliform bacteria. The specific monitoring requirements for each system are based on the number of people the PWS serves. The GWR applies to all PWSs that use groundwater, except PWSs that combine all their groundwater with surface water prior to treatment or with groundwater under the direct influence of surface water.

The GWR builds on the RTCR by addressing the health risk associated with consuming water from a pathogen-contaminated source. The GWR requires follow-up monitoring of groundwater sources and corrective action when a significant deficiency has been identified or indicator bacteria has been found in the source sample. These requirements address the health risk associated with consuming water from a potential fecal-contaminated source. A groundwater system must conduct triggered source-water monitoring (TSM) when the system is notified of a total coliform–positive routine distribution sample. This monitoring allows the system to distinguish whether the positive sample was due to well contamination or a distribution-system problem.

This guide is not a substitute for the rules. It is the responsibility of the PWS owner to ensure its operation complies with applicable rules and regulations. If there appears to be a discrepancy between this guide and the rules, the rules take precedence over this guide.

Our Public Drinking Water[1] website has information about coliform monitoring and other drinking water resources.

For specific questions related to this guide, contact TCEQ by emailing TCRDATA@tceq.texas.gov or GWRDATA@tceq.texas.gov or by phone at 512-239-4691 and ask to speak with either the RTCR Program or the GWR Program.

[1] www.tceq.texas.gov/goto/pws

TCEQ Publications

To locate TCEQ publications, visit the TCEQ publications website.[2] TCEQ publications personnel can also help you find documents. Contact them in one of the following ways:

- Email order to PUBORDER@tceq.texas.gov
- Call 512-239-0028

Texas Rules Associated with This Guide

The state of Texas has primacy over the regulation of public drinking water. As such, TCEQ writes, adopts, and enforces Texas rules that are at least as stringent as the rules promulgated by the United States Environmental Protection Agency (EPA). Texas rules may be more specific than, or worded differently from EPA rules, so PWSs must be familiar with the Texas-specific rules.

PWSs must comply with the applicable rules pertaining to drinking water as contained in various parts of the Texas regulations. Important rules pertaining to coliform monitoring, in addition to the RTCR and the GWR include:

- 30 TAC Chapter 25: Environmental Testing Laboratory Accreditation and Certification. If you have questions about laboratory accreditation, contact the TCEQ Laboratory Accreditation Program at 512-239-3754.
- 30 TAC Chapter 30: Requirements for certification of water works operators. If you have questions about these requirements, contact TCEQ's Operator Licensing Section at 512-239-6153.
- 30 TAC Chapter 290, Subchapter D: Rules and regulations for public water systems related to requirements for water treatment plant design, operation, and maintenance. If you have questions about Subchapter D, contact Plan and Technical Review Section at 512-239-4691.
- 30 TAC Chapter 290, Subchapter F: Requirements regarding harmful or potentially harmful constituents for water systems that supply potable water in Texas. If you have questions about Subchapter F, contact the program area at 512-239-4691.
- 30 TAC Chapter 290, Subchapter H: Rules and regulations for community water systems related to Consumer Confidence Reports (CCR). If you have questions, contact a CCR coordinator at 512-239-4691.

Additional rule-related information is available on the Rules and Guidance for Public Water Systems[3] webpage.

[2] www.tceq.texas.gov/goto/publications
[3] www.tceq.texas.gov/goto/pws-rules

Section 1. Background Information

Microbial contamination is the greatest acute health risk to consumers who obtain their water from a PWS, therefore coliform monitoring is conducted as a relatively quick, easy, and cost-effective way to determine if drinking water is meeting federal and state standards. Coliforms are the preferred indicator bacteria used to identify the presence of microbial contamination.

Coliform bacteria (total coliforms or TC) are a group of bacteria that are ubiquitous in the environment and may be found in soil, on vegetation, and in lakes and rivers. Coliform bacteria, generally, are not harmful to humans; however, their presence in drinking water indicates that conditions in the water system can support the existence of disease-causing pathogens. The different kinds of coliform organisms that are tested for include total coliform, fecal coliform, and *Escherichia coli (E. coli).*

Escherichia coli (E. coli) is a type of coliform bacteria and one of several types of bacteria that normally inhabit the intestine of humans and animals. Some *E. coli* strains can cause disease under certain conditions. The RTCR requires that all positive total coliform (TC+) samples be analyzed for *E. coli*. The presence of *E. coli* bacteria in drinking water indicates that fecal matter and disease-causing organisms may be present. The RTCR sets limits on the presence of TC and *E. coli* in drinking water and requires immediate action if monitoring results indicate their presence.

Revised Total Coliform Rule

The Revised Total Coliform Rule (RTCR) is the revision to the 1989 Total Coliform Rule. It is a federal drinking water regulation [40 Code of Federal Regulations (CFR) Part 141, Subpart Y] and is implemented at the state level in most part via 30 TAC 290.109. The RTCR became effective in Texas on April 1, 2016 and all PWSs must comply with this rule.

The goal of the RTCR is to increase public health protection by reducing potential pathways for microbial contamination into the distribution systems of PWSs. The RTCR:

- Establishes a maximum contaminant level (MCL) for *E. coli,* and
- Uses coliform results to initiate a “find and fix” approach to prevent microbial contamination from entering the distribution system by identifying and fixing sanitary defects.

The key components of the RTCR are listed below:

- *E. coli* Maximum Contaminant Level (EMCL)
- Routine monitoring and repeat monitoring in response to routine samples that test positive for TC or *E. coli*

- Assessments and corrective action when monitoring results and/or treatment technique triggers show that PWSs are vulnerable to contamination
- Reporting
- Compliance

More information is available on the Revised Total Coliform Rule (RTCR)[4] webpage.

Revised Total Coliform Rule E. coli Maximum Contaminant Level Violations

A PWS is in violation of the *E. coli* Maximum Contaminant Level (EMCL) if any of the following situations occur:

- A total coliform positive (TC+) routine sample is followed by an *E. coli* positive (EC+) repeat sample
- An EC+ routine sample is followed by a TC+ or EC+ repeat sample
- Failure to collect all repeat samples after an EC+ routine sample
- A TC+ repeat sample is not analyzed for *E. coli*

> Note: An MCL is the legal limit set by EPA on the maximum amount of a substance allowed in finished drinking water before a PWS is cited for a violation. If the PWS exceeds the RTCR EMCL, the system must conduct an immediate corrective action. Tier 1 public notification (tiers of public notification are described in Section 7) is required within 24 hours of the violation.

Groundwater Rule

EPA issued the GWR in November 2006 to improve drinking water quality and provide protection from microbial contamination. The GWR is a national primary drinking water regulation specified in 40 CFR Part 141, Subpart S. The GWR came into effect in Texas on December 1, 2009 and is implemented at the state level in various sections of 30 TAC 290; but primarily 30 TAC 290.109 and 30 TAC 290.116.

Implementation of the GWR reduces the risk of illness from groundwater by identifying and targeting groundwater systems susceptible to microbial contamination and ensuring that corrective action is taken. By requiring groundwater systems to monitor raw groundwater (raw well) samples and correct significant deficiencies, the GWR provides increased protection against disease-causing bacteria, parasites, and viruses.

[4] www.tceq.texas.gov/goto/rtcr

The key components of the GWR are:

- Comprehensive Compliance Investigations (CCI) of PWSs look for significant deficiencies in key operational areas.
- Triggered source monitoring when a system identifies a positive sample during its Revised Total Coliform Rule routine distribution monitoring and assessment monitoring targeted at high-risk systems.
- Implementation of corrective actions by groundwater systems with a significant deficiency or evidence of source water fecal contamination to reduce the risk of contamination.
- Compliance monitoring for systems that are sufficiently disinfecting drinking water to ensure that the treatment is effective at removing pathogens.

More information is available on the GWR webpage.[5]

Types of Public Water Systems

A PWS provides potable water and serves at least 15 service connections or 25 individuals for at least 60 days out of the year. There are three different types of PWSs: community, nontransient noncommunity, and transient noncommunity. Water system types are important because rule requirements can vary depending on the type.

Community

A community PWS has a potential to serve at least 15 residential service connections or 25 residents on a year-round basis. Most municipalities meet this definition, as do some boarding schools and prisons.

Nontransient Noncommunity

A nontransient noncommunity PWS regularly serves at least 25 of the same persons at least six months out of the year. Many factories, schools, recreational vehicle parks with long-term residents, and other businesses fall under this category.

Seasonal Systems

A seasonal system is a noncommunity PWS which does not operate on a year-round basis and starts up and shuts down at the beginning and end of each operating season. Examples of seasonal PWSs include campgrounds, youth camps, state parks, some restaurants, and motels.

The RTCR includes very specific requirements for seasonal systems. These requirements involve the submittal of certified start-up procedures and a special

[5] www.tceq.texas.gov/goto/gwrule

coliform monitoring sample prior to serving water to the public each season. Seasonal System Start-up Procedures Checklist and Certification Form[6] (TCEQ-20892) includes additional information about seasonal systems and the Seasonal Start-up Procedure Checklist.

Transient Noncommunity

A transient noncommunity PWS serves at least 25 persons at least 60 days out of the year. Parks, some recreational vehicle parks, convenience stores, restaurants, and other businesses fall under this category.

Primary Water Source Types

The primary water source types include surface water, groundwater, groundwater under the influence of surface water (GUI), wholesale water, and purchased water. Water sources are important because rule requirements vary according to water source type. Source types are defined in the glossary at the beginning of this guide.

Additional information regarding water systems can be found in TCEQ Regulatory Guide (RG-496).[7]

Texas Drinking Water Watch

The public has access to TCEQ PWS data through the Texas Drinking Water Watch[8] (DWW). This website offers access to PWS information and coliform data including but not limited to the following:

- Water system detail such as county served, population, system type, and source
- Violations
- Enforcement actions
- Compliance schedules
- Chemical sample results
- Lead and copper sample results
- Coliform and *E. coli* sample results

[6] www.tceq.texas.gov/goto/20892
[7] www.tceq.texas.gov/goto/rg496
[8] www.tceq.texas.gov/goto/dww

Section 2. Compliance Coliform Monitoring

Types of Coliform Samples

Both the RTCR and the GWR require monitoring for the presence of coliform bacteria. Sample types used for determining adherence to the RTCR and GWR are termed compliance samples. Those not used for compliance determinations are termed noncompliance samples. Below is a list of sample types:

- Compliance Samples
  - Routine
  - Repeat
  - Raw well
- Noncompliance Samples
  - Special
  - Construction

The names of the sample types specified above correspond directly to the sample types specified on TCEQ's Microbial Reporting Form Microbial Reporting Form[9] (MRF) (TCEQ-10525). In addition to collecting coliform samples at locations specified in the SSP, PWSs must also record the sample type correctly on the MRF. This will ensure TCEQ properly "credits" the PWS for meeting their monitoring requirements when laboratories submit the results to TCEQ. The following sections describe the coliform sample types.

Routine Samples

Routine samples are collected by PWSs on a regular basis to monitor for the presence of TC and *E. coli* in the distribution system. The RTCR requires that all PWSs collect monthly routine coliform samples. Routine samples are sometimes referred to as "routine distribution" samples or just "distribution" samples.

Routine Sample Locations and Frequency

Routine coliform samples can be collected at a residential or commercial connection, a dedicated sampling station, or another designated compliance sampling site, as specified in the PWS's Sample Siting Plan. The sample site must be at or adjacent to an active service connection and be representative of water throughout the distribution system.

[9] www.tceq.texas.gov/goto/10525

The frequency for collecting routine samples is determined by the population served as provide in Table 1. Generally, PWS populations are taken from the comprehensive compliance investigation data and reflect the maximum number of persons served on any given day during the month. [30 TAC 290.109(d)(2)(A)(iii)]

Table 1. Sampling Frequency of Routine Samples Based on Population Served

Population Served	Number of Routine Samples per Month	Population Served	Number of Routine Samples per Month
1 to 1,000	1	59,001 to 70,000	70
1,001 to 2,500	2	70,001 to 83,000	80
2,501 to 3,300	3	83,001 to 96,000	90
3,301 to 4,100	4	96,001 to 130,000	100
4,101 to 4,900	5	130,001 to 220,000	120
4,901 to 5,800	6	220,001 to 320,000	150
5,801 to 6,700	7	320,001 to 450,000	180
6,701 to 7,600	8	450,001 to 600,000	210
7,601 to 8,500	9	600,001 to 780,000	240
8,501 to 12,900	10	780,001 to 970,000	270
12,901 to 17,200	15	970,001 to 1,230,000	300
17,201 to 21,500	20	1,230,001 to 1,520,000	330
21,501 to 25,000	25	1,520,001 to 1,850,000	360
25,001 to 33,000	30	1,850,001 to 2,270,000	390
33,001 to 41,000	40	2,270,001 to 3,020,000	420
41,001 to 50,000	50	3,020,001 to 3,960,000	450
50,001 to 59,000	60	3,960,001 or more	480

Systems that collect only one or a few samples per month are encouraged to collect samples early in the month to ensure adequate time in case “replacement” or “repeat” samples are required. PWSs that collect more than one sample per month are required to collect routine distribution samples at regular intervals throughout the month. Systems are encouraged to collect these samples early in the week, when possible, to prevent repeat sampling over weekends. Exceptions apply only to PWSs which use only purchased water, or groundwater not under the direct influence of surface water which serves 4,900 people or fewer. These PWSs may collect all required routine distribution coliform samples on a single day if they are taken from different sites.

Water Haulers

When drinking water is distributed by tank or trailer, at least one sample per month from each tank shall be collected and submitted for microbial analysis for each month

of operation [30 TAC 290.109(d)(2)(A)(iii)]. Should a water hauler not be active throughout a monthly operating period, the owner should notify TCEQ through email at TCRDATA@tceq.texas.gov regarding the status of the system. This will ensure proper review of monthly required microbial sampling. Additional resources for water haulers include Public Water System Water Hauler Guidance[10] and Water Hauler Use Checklist.[11]

Repeat Samples

When a routine distribution sample is TC+ or EC+ the PWS must collect a set of three repeat coliform samples within 24 hours of being notified of the positive result. A set of three repeat coliform samples must be collected for each TC+ or EC+ routine distribution sample. PWSs must also collect raw well samples in accordance with GWR. If a PWS collects two routine distribution samples in a month that are TC+ or EC+ positive, the system must collect a total of six repeat samples from the locations described below (three for each positive sample). Figure 1 provides a flowchart of RTCR repeat sampling requirements. The PWS should keep the Repeats Poster[12] accessible in the event repeats are required.

> Note: TCEQ will only credit a PWS for routine samples in the month they were collected. For example, samples collected on May 1 will not be credited to the April requirement. The exception involves "replacement" samples collected to replace a rejected routine sample. Example: If a sample collected on July 31 is rejected, a replacement sample collected on August 2 will be credited to July's monitoring period.

Repeat Sample Locations

PWSs must collect a set of three repeat samples as listed in their Sample Siting Plan (SSP). Repeat samples must be collected at the following sample locations:

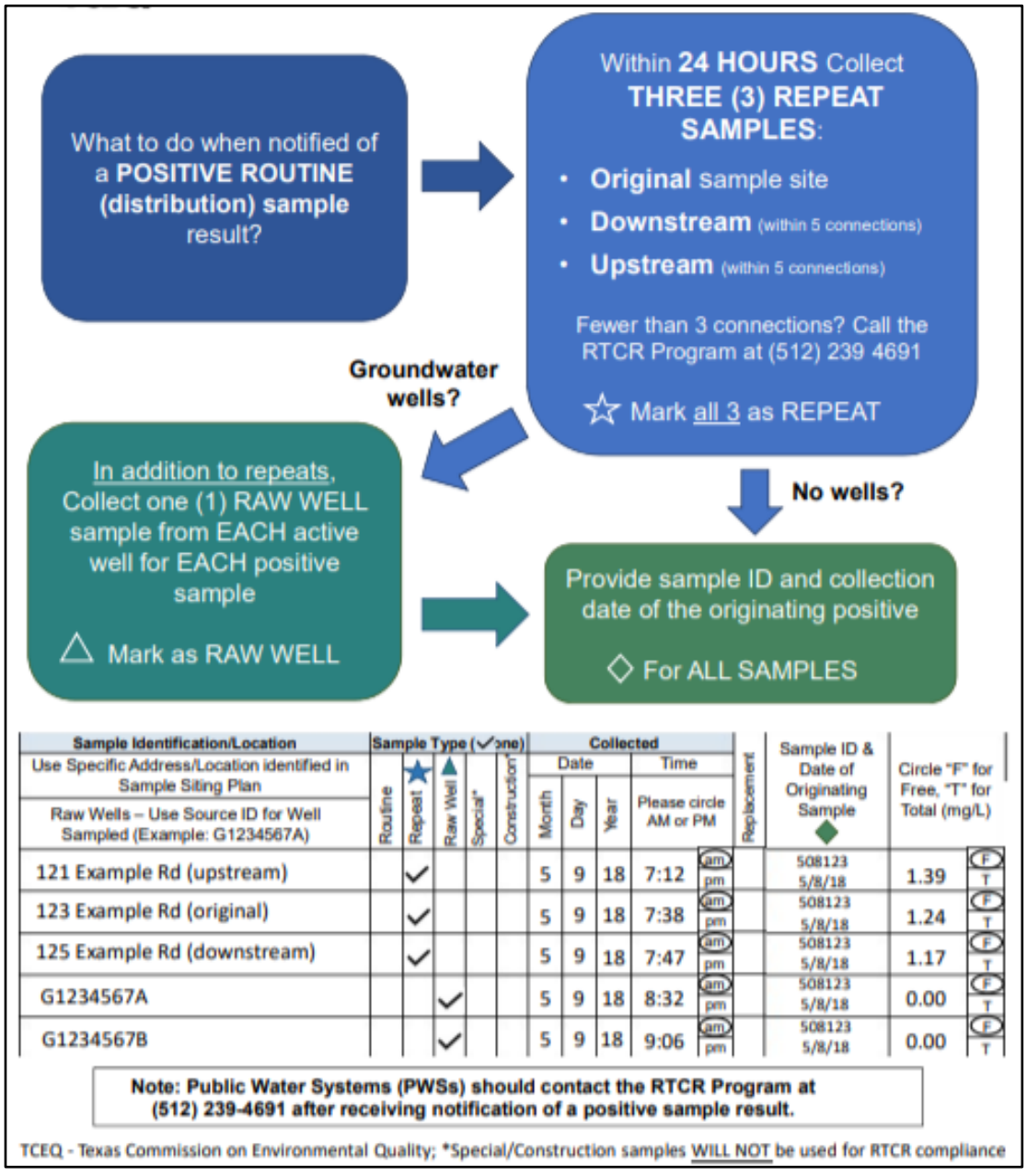
- One repeat sample from the original routine TC+ sample site.
- One repeat sample at a site within five connections upstream of the routine TC+ sample site.
- One repeat sample at a site within five connection downstream of the routine TC+ sample site.

> Note: "Within five service connections" upstream or downstream does not mean that a repeat must be collected at the fifth connection. A repeat sample may be collected at any of five service connections directly upstream and downstream from the original positive sampling site, as long as those sites are listed in the Sample Siting Plan.

[10] www.tceq.texas.gov/goto/hauler-guide
[11] www.tceq.texas.gov/goto/20919
[12] www.tceq.texas.gov/goto/rtcr-repeats

If the positive routine sample was collected at the end of the distribution system, or one service connection away; one repeat sample must be collected at that point and the other two repeat samples must be collected within five connections upstream of that point.

A PWS may propose other repeat sample sites in their SSP than those described above. These alternative sites can be fixed or situational; but must be representative of the initial TC+ location. They must be approved by TCEQ prior to sampling at an alternative site.



Sample Identification/Location	Sample Type (✓one)					Collected					Replacement	Sample ID & Date of Originating Sample ◆	Circle "F" for Free, "T" for Total (mg/L)	
Use Specific Address/Location identified in Sample Siting Plan	Routine	Repeat ★	Raw Well ▲	Special*	Construction*	Date			Time					
Raw Wells – Use Source ID for Well Sampled (Example: G1234567A)						Month	Day	Year	Please circle AM or PM					
121 Example Rd (upstream)		✓				5	9	18	7:12	am pm		508123 5/8/18	1.39	F T
123 Example Rd (original)		✓				5	9	18	7:38	am pm		508123 5/8/18	1.24	F T
125 Example Rd (downstream)		✓				5	9	18	7:47	am pm		508123 5/8/18	1.17	F T
G1234567A			✓			5	9	18	8:32	am pm		508123 5/8/18	0.00	F T
G1234567B			✓			5	9	18	9:06	am pm		508123 5/8/18	0.00	F T

Note: Public Water Systems (PWSs) should contact the RTCR Program at (512) 239-4691 after receiving notification of a positive sample result.

TCEQ - Texas Commission on Environmental Quality; *Special/Construction samples WILL NOT be used for RTCR compliance

Figure 1. Repeat Sample Requirements for Positive Routine Distribution Sample Results

Repeat Samples for Groundwater System with Only One Well

The Revised Total Coliform Rule [30 TAC 290.109(d)(4)(B)(iii)] provides an additional repeat sample monitoring option for certain groundwater systems. A groundwater system with one well and serving 1,000 people or fewer may use a raw well sample collected for GWR purposes as one of the three required repeat samples under the RTCR. A raw well sample collected from a raw groundwater source can be used to meet both the repeat requirements and the triggered source monitoring requirements. This is considered a dual-purpose sample.

> Note: Using a raw well sample as a RTCR repeat sample is risky because if the raw well sample is *E. coli*-positive (EC+) the system must conduct corrective action under the GWR and will also incur an *E. coli* Maximum Contaminant Level (EMCL) violation under the RTCR.

Positive Repeat Samples

If one or more repeat samples in the set is TC+, the PWS must collect an additional set of repeat samples within 24 hours of being notified of the positive result. These three samples will be collected at the same locations as the initial repeat sample set. The PWS must repeat this process at the same repeat locations until either *one* of the following occurs:

- One set of repeat samples does not have a TC+; or
- A coliform treatment technique trigger (described in Section 3) has occurred
  - The treatment trigger for PWSs collecting less than 40 routine samples per month occurs when two or more samples collected in a month are TC+
  - The treatment trigger for systems collecting 40 or more routine samples occurs when greater than 5.0% of the monthly routine samples are TC+

If one of these systems collects a sample which is TC+, but has not exceeded 5.0% TC+ limit, it will need to collect an additional set of repeat samples. The system must continue collecting sets of repeat samples until an entire set is negative for TC; to avoid the treatment technique trigger for failure to collect all required repeat samples.

> Note: When a PWS receives a positive repeat sample result, either EC+ or TC+, it is strongly encouraged to contact TCEQ by emailing RTCRPOS@tceq.texas.gov or calling 512-239-4691, as certain timeframes and conditions apply. It is especially important if the PWS is unable to collect repeat samples within 24 hours or its normal testing laboratory is closed. TCEQ can help identify an alternate lab.

Triggered Source Monitoring Samples

Raw groundwater samples are collected at groundwater sites prior to treatment, or from groundwater sources under the direct influence of surface water sources and are tested for coliforms (Figure 2).

Raw groundwater source monitoring under the GWR involves the collection of:

- Triggered source monitoring samples
- Regular compliance monitoring samples (for 4-log treatment systems)
- Assessment source monitoring samples

Triggered source monitoring allows the groundwater system to determine whether a routine positive sample was due to source issues, well contamination, or a distribution system problem. Groundwater systems must collect triggered source monitoring samples within 24 hours (in addition to repeat samples under RTCR when the following two conditions exist:

- The PWS is notified that a routine sample is TC+ or EC+
- The PWS does not provide at least 4-log treatment of viruses

Triggered source monitoring requires the collection and analysis of a raw groundwater sample(s) from each well in use at the time of the original routine positive sample. If a triggered source sample is EC+, the system must conduct an immediate corrective action. Tier 1 public notification (tiers of public notification are described in Section 7) is required within 24 hours of the originating routine TC+.

Systems with multiple groundwater wells may develop a Triggered Source Monitoring Plan (TSMP). If a system develops a TSMP describing the sources that feed each distribution sample site, and TCEQ approves it, then the triggered source monitoring can be limited to the well(s) feeding the TC+ distribution site. The TSMP can also identify representative wells if the system contains multiple wells in close proximity and constructed in a similar manner. The regulatory guide, How to Develop a Monitoring Plan for a Public Water System[13] (RG-384) provides additional information on TSMPs. For more information on submitting a TSMP, contact us at 512-239-4691 and ask for the Groundwater Rule Team.

> Note: For triggered source monitoring, there is a one-to-one relationship between the number of routine positives and the number of required source samples. For each routine distribution positive, at least one source sample must be collected from each well that was in use at the time of the original routine distribution positive sample. Example: If a PWS has two routine positives, two source water samples must be collected from each well that was in use at the time of the routine positive sample.

[13] www.tceq.texas.gov/goto/rg-384

Notification of Inactive Wells

A groundwater system may have multiple wells, with only some in use at the time of the originating routine TC+ or EC+ distribution sample. If this is the case, the system must document the wells which were not in use by completing the Groundwater Rule Notification of Inactive Well(s) for Triggered and Assessment Source Monitoring[14] (TCEQ Form 20891) located on the main Groundwater Rule[15] webpage. Systems should submit the completed form as soon as possible to TCEQ's GWR Program staff by email to GWRDATA@tceq.texas.gov. This will allow TCEQ to properly record the system's triggered source sample schedule; and PWSs can avoid a violation for not sampling all their wells during triggered source monitoring.

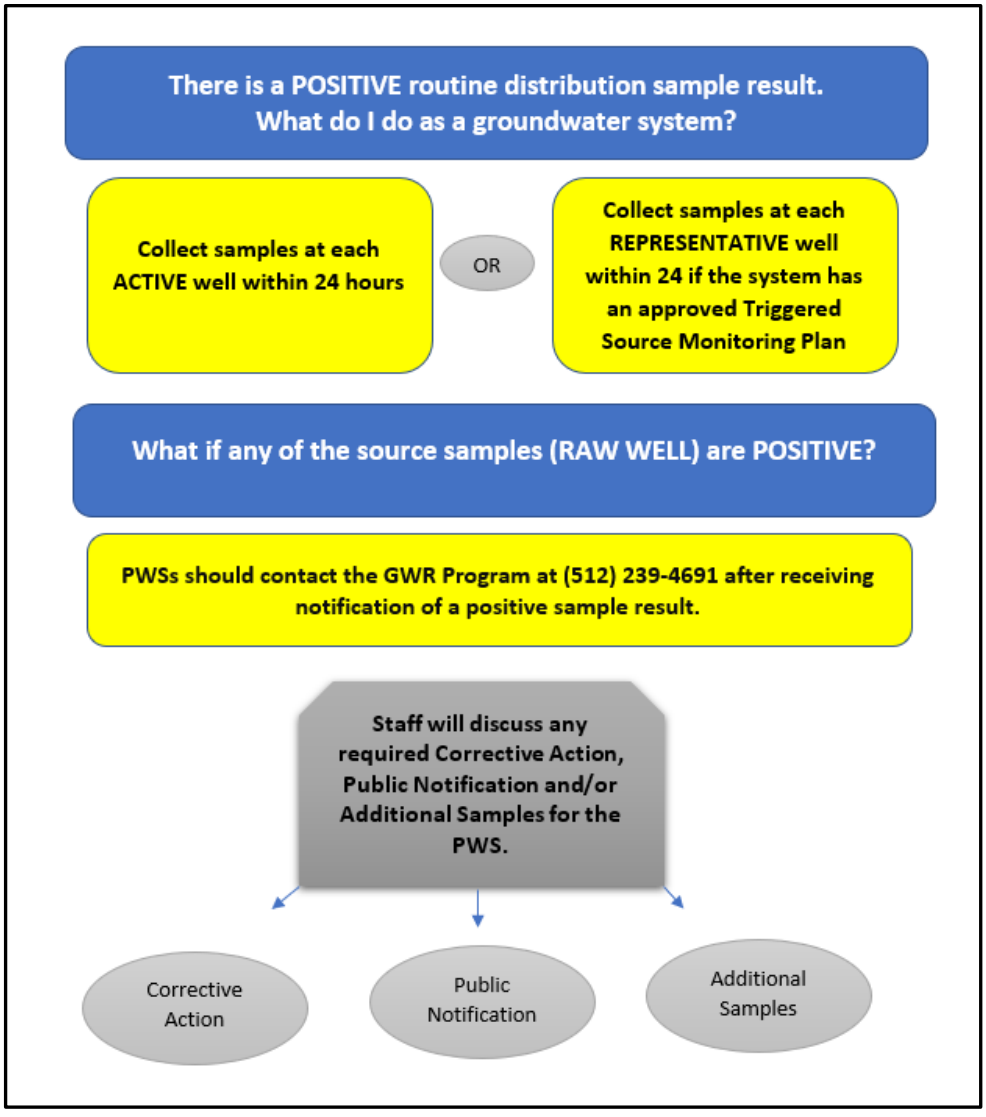


Figure 2. Raw Well Sample Requirements for Positive Routine Distribution Sample Results

[14] www.tceq.texas.gov/goto/20891
[15] www.tceq.texas.gov/goto/gwrule

Consecutive and Wholesale Groundwater System Requirements

Consecutive and wholesale groundwater systems must comply with triggered source monitoring requirements (Figure 3). Consecutive groundwater systems receiving drinking water from a wholesaler or a water hauler are required to notify the wholesale system within 24 hours of being notified of a positive routine sample. The wholesale groundwater system must conduct triggered source monitoring within 24 hours of notification.

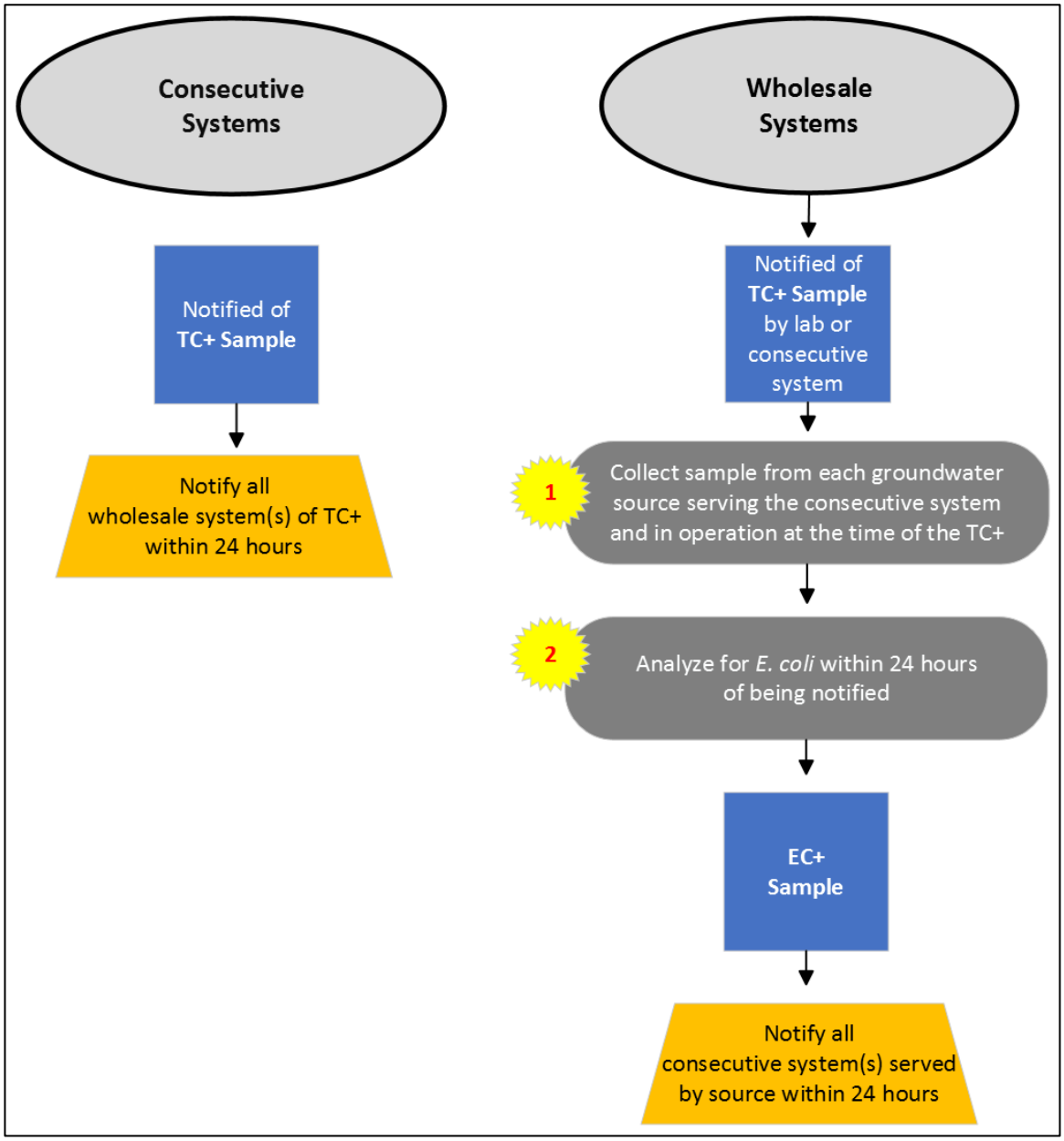


Figure 3. GWR Triggered Source Water Monitoring Requirements for Consecutive and Wholesale Systems

Compliance Monitoring

Groundwater systems that provide at least 4-log treatment (at least 99.99% inactivation or removal) of viruses from a groundwater source can notify TCEQ of this treatment and once approved, are not required to conduct triggered source monitoring. Instead, they must conduct compliance monitoring to ensure that the treatment technology installed is reliably inactivating and removing contaminants. Compliance monitoring requires the measurement of disinfectant residuals to ensure adequate concentrations are maintained. Disinfectant residuals must be measured and recorded each day the source serves the public. It may also involve monitoring the effectiveness of the membrane filtration system or another alternative treatment. Monitoring must be conducted at sites designated in the PWS's monitoring plan.

Systems can claim 4-log treatment by providing a Concentration-Time (CT) Study for approval by TCEQ and then maintain 4-log treatment through daily or continuous residual monitoring (depending on population) and documenting this using the Groundwater Monthly Operating Report[16] (TCEQ-20362, 4-log GWMOR).

Additional information on CT Studies and 4-log GWMOR on the TCEQ webpage at Concentration-Time Study for Water Treatment Plants.[17]

Assessment Source Monitoring Samples

Systems with the risk factors listed below may be required to conduct monthly assessment source water monitoring. TCEQ may evaluate the need for assessment source water monitoring on a case by case basis. The following risk factors will be considered in targeting high-risk systems:

- Wells in karst, fractured bedrock, gravel, or other sensitive aquifers
- Wells in shallow, unconfined aquifers
- Wells in aquifers with thin or no confining layer
- Presence of potential sources of fecal contamination
- Depth and location of the groundwater source
- Wells previously identified as having fecal contamination

Additional information about assessment source monitoring is located on the TCEQ Groundwater Rule[18] webpage.

Information specifically related to assessment source monitoring due to TCEQ rule exceptions is located at on the TCEQ webpage at Requesting an Exception to Rules and Regulations for Public Water Systems.[19]

[16] www.tceq.texas.gov/goto/20362
[17] www.tceq.texas.gov/goto/ct-study
[18] www.tceq.texas.gov/goto/gwrule
[19] www.tceq.texas.gov/goto/pws-exception

Special Samples and Construction Samples

PWSs may collect special purpose coliform samples, in addition to routine, repeat, and raw well samples. These special purpose sample types are referred to as noncompliance samples and can be classified as "special samples" or "construction samples" depending on their purpose.

The purposes for special samples include, but are not limited to the following:

- To rescind a boil water notice
- To collect investigative samples (raw or distribution) because the system may have a suspicion that contamination or a problem exists within the water system
- To meet seasonal system requirements, as part of the state-approved seasonal start-up procedures
- Following well disinfection per a GWR corrective action

Construction samples are collected for new water main installations which require one coliform sample for every 1,000 feet of line installed. They are also collected for all PWS repairs and installations that may impact the quality of the drinking water.

Special samples and construction samples cannot be used by TCEQ to determine compliance with the EMCL, to determine if the RTCR treatment technique trigger has been exceeded, or to determine routine monitoring compliance. Sample collectors must assign the correct sample type to these samples on the MRF to ensure TCEQ does not use the results for RTCR or GWR compliance purposes. Systems are unable to change sample types from compliance to noncompliance and vice versa.

Monitoring Requirements and Procedures

Sample Siting Plans and Monitoring Plans

Sample Siting Plans

All PWSs must develop and maintain a Sample Siting Plan (SSP) that includes a coliform sample collection schedule and coliform sampling sites representative of water in the distribution system. SSPs must be included with a PWS's monitoring plan.

SSPs contain the following information:

- Routine and repeat coliform sample site locations
- Additional routine sample sites if the PWS collects more than the minimum number of required routine microbial samples or wishes to rotate between sample sites
- Any standard operating procedure (SOP) which specifies either alternative fixed locations or criteria for selecting repeat sampling sites on a situational basis

- A distribution system map, schematic, or series of maps which identify the location of all routine sample sites, water mains and distribution lines, water storage facilities, pressure plane boundaries, entry point source locations, etc.
- All groundwater sources and any associated sampling points

PWSs must update their SSP and maps as needed to identify the most current routine and repeat sampling sites and sample collection schedule. Copies of updated SSP and maps must be maintained on-site at the PWS for inspection purposes for five years.

Water systems that treat surface water (SW) or groundwater under the direct influence of surface water (GUI) must submit their monitoring plan upon development and after revision. Therefore, upon revision, updated SSPs for SW and GUI systems should be submitted to TCEQ. Groundwater and purchase water systems are not required to send a copy of the SSP to TCEQ, but must keep the plan on file for review by the TCEQ investigator during routine comprehensive compliance investigations, or must provide a copy of the SSP to TCEQ upon request. A copy of the plan should be kept at a central location.

Monitoring Plans

All PWSs are required to develop, maintain, and update a monitoring plan. These plans must include a SSP for microbial monitoring. In addition, monitoring plans must include the identification of analytical laboratory(ies) and the analytical procedures used. The monitoring plan must also include, as applicable, any groundwater source water monitoring plan to specify well sampling for triggered source monitoring.

All PWSs must retain a copy of their monitoring plan at each treatment site and in a central location. Monitoring plans must be updated when requirements or protocols change. Systems that treat surface water or GUI are required to send a copy of their monitoring plan to TCEQ for review and approval. Systems that use groundwater or purchased water are not required to send a copy of the monitoring plan to TCEQ, but must keep the plan on file for review by the TCEQ investigator during routine CCI, or must provide a copy of the plan to TCEQ upon request. A copy of the plan should be kept at each treatment plant, as well as a central location. PWSs are required to have a copy of the monitoring plan available during appointments with TCEQ's Chemical Sample Collection Contractor. The Public Water System Monitoring Plans[20] webpage includes a Monitoring Plan Template, TCEQ submittal address, and revision information. Information about monitoring plans is also included in How to Develop a Monitoring Plan for a Public Water System (RG-384).[21]

Selecting a Testing Laboratory

It is important for the PWS to select a laboratory that follows TCEQ drinking water requirements related to accreditation, analysis, and reporting of coliform bacteria. The

[20] www.tceq.texas.gov/goto/pws/monitoringplan
[21] www.tceq.texas.gov/goto/monitoringplan

coliform testing laboratory must be NELAP accredited for all methods it uses to analyze coliform compliance samples (routine, repeat, and raw well samples). Samples that are analyzed at unaccredited laboratory(ies) cannot be used for compliance and may result in a violation for the PWS.

In selecting a testing laboratory, PWSs should confirm the laboratory's knowledge of, and adherence to TCEQ's Quality Assurance Project Plan (QAPP) Guidance for Collection, Analysis and Reporting for Microbial Contaminants Under the Revised Total Coliform Rule Addendum #4. Failure of the laboratory to meet the terms of the QAPP (e.g., sample receipt, analytical methods, reporting protocols, etc.) may result in the rejection of compliance results by TCEQ, resulting in a violation for the PWS. The Public Water System Supervision Program[22] webpage has the QAPP and laboratory adherence information.

You should develop a relationship with a back-up laboratory to ensure samples can be analyzed in the event that your primary lab is unavailable, or you need immediate analysis for repeats, replacements, specials, or construction samples.

For questions concerning accredited laboratories, call 512-239-3754 or email LABPRGMS@tceq.texas.gov. The NELAP Laboratory List[23] is an updated list of TCEQ accredited laboratories and fields of accreditation.

Confirmation Analysis

If any microbial sample is TC+, the laboratory is required to do further testing to determine if *E. coli* is present. It is very important that the PWS discuss this requirement with the laboratory to ensure it complies; otherwise, the PWS may incur an EMCL violation.

Sample Bottles and Documentation

Sample Bottles

Sample collectors must use laboratory-supplied bottles to collect coliform samples. Laboratory-supplied bottles are typically 120 milliliters (mL), plastic, and disposable, with a 100 mL graduation mark. Each bottle provided by the laboratory must be sterile and contain sodium thiosulfate in either powder, pill, or liquid form to neutralize at least five milligrams per liter (mg/L) of residual chlorine.

[22] www.tceq.texas.gov/goto/pwss
[23] www.tceq.texas.gov/goto/certified_labs

Sample Documentation

Sample Labels

Sample collectors are required to record the following information on the sample bottle when they collect their coliform samples.

- PWS Identification (ID) Number
- Date and time sample was collected
- Sample collector's initials
- Address/location where the sample was collected
- Any other information specifically requested by the analyzing lab

The laboratory may provide sample labels with their bottles. Alternatively, PWSs may develop their own labels, or write the sample label information directly on the bottle. These alternatives are all acceptable if all items in the bulleted list above are included.

Microbial Reporting Form

The Microbial Reporting Form (MRF) (TCEQ Form 10525) must be completed by the sample collector, when samples are collected, and provided to the laboratory with the sample bottle(s). The most current version of TCEQ's MRF and the instructions for completing it are available at the RTCR[24] webpage and Appendix A. The testing laboratory may customize the TCEQ MRF to add their name/logo, contact information, and laboratory ID number, etc. For this reason, PWSs should get the MRF and instructions from their testing laboratory rather than TCEQ's website.

It is the sample collector's responsibility to fill out the MRF correctly and completely. Sample collectors are encouraged to review the MRF with their laboratory when samples are dropped off for analysis. If sample collectors fill out the MRF incorrectly or incompletely, the PWS may not receive credit for the sample results which may result in a violation for the PWS.

It is extremely important that sample collectors mark only one of the following sample types on the MRF when they collect their samples:

- Routine
- Repeat
- Raw Well
- Special
- Construction

All the sample types described above may also be replacement samples. Replacement samples are collected "in place" of any of the sample types described above when they have been previously collected; delivered to the laboratory; and subsequently rejected

[24] www.tceq.texas.gov/goto/rtcr

or invalidated. Replacement samples must be collected within 24 hours of notification of the rejected sample.

If a sample is replacing a previously collected sample, the sample collector should check the replacement sample indicator on the MRF as well as the sample type. PWSs should also record the sample ID and sample collection date of the original rejected sample in the space provided. This will tie the two samples together and ensure the PWS gets credit for the original sample.

> Note: Replacement samples should not be confused with repeat samples, which are collected in response to coliform positive routine samples.

Chain-of-Custody (COC) Form

COC involves activities related to the handling of samples from the time of collection to the delivery of samples to laboratory personnel for analysis. Documentation ensuring that proper handling has occurred throughout these activities is part of the custody record, which provides a mechanism for tracking samples through sample collection, processing, and analysis.

A sample is "in custody" when:

- The sample is in the sample collector's possession
- The sample was in the sample collector's possession and then secured by the sample collector to prevent tampering
- The sample is placed in a designated secure area

Sample custody begins immediately after a sample is collected. The sample collector is responsible for the preservation and integrity of the sample(s) until that responsibility is transferred to the sample courier or testing laboratory and documented on the COC form.

A COC form is used to document the information identifying the sample and record the relinquishing and receiving individuals and associated information. Sample identifier, analysis requested, and date and time, is indicated on the COC form for each sample.

TCEQ designed its MRF to meet the state and federal document requirements of COC forms. However, some testing laboratories may still require that a separate COC form be completed, in addition to the MRF. If this is the case, the laboratory will provide the PWS with a COC form to complete. The sample collector is responsible for filling out, dating, and signing the appropriate portion of the COC form. A copy of the completed COC form should be retained by the sample collector.

Sample Collection

Occupational License Requirement for Sample Collectors

Individuals collecting coliform samples for PWSs must comply with occupational licensing requirements. There are four classes of licensed water works operators: A, B, C, and D. Sample collectors must have at least a class D operator license to collect coliform samples at a community or nontransient noncommunity system. Transient noncommunity systems are not required to have a licensed operator if they use only groundwater or purchase treated water.

To become a licensed PWS operator, an applicant must complete the required course training, meet the required education and experience requirements, complete the TCEQ application and pay the fee, and pass the applicable exam (minimum score of 70 percent). Specific information for each license level is available on the TCEQ Water Operator Licensing Requirements[25] webpage.

TCEQ's Occupational Licensing and Registration Division of the Office of Waste implements the agency program for licensing PWS operators. The Water Supply Division assists with aspects of operator licensing in coordination with the Office of Compliance and Enforcement by identifying, whenever possible, operators misusing their licenses.

If you don't remember your water operator license number, or if you are searching for a licensed water operator in your area, the How to Find a Licensed Water Operator[26] webpage provides guidance on searching the licensing database. The Occupational Licensing[27] webpage has information on licensing and training courses. For general information on operator license requirements, contact the TCEQ Occupational Licensing and Registration Division at 512-239-6133.

Sample Collection Procedure

The following steps ensure the proper collection of compliance coliform samples. PWSs should have written SOPs for sample collection which incorporate these steps.

1. Locate the sample site/faucet as specified on the PWS's Sample Siting Plan. Select a sample tap with the following features:
   - Has an outlet at least 12–18 inches above the ground or floor to minimize splash back.
   - Is constructed of materials that will allow it to be heated with a torch or cleaned with a strong chlorine solution.
   - Has a downward-pointing outlet.
   - Is not located in or near tall grass or shrubs.
   - Does not have any attachment such as a water hose.

[25] www.tceq.texas.gov/goto/pws-ntk
[26] www.tceq.texas.gov/goto/pws/findlicense
[27] www.tceq.texas.gov/licensing

2. Let the water run out of the faucet for several minutes (three–five minutes is recommended). This is called flushing. Flush until there is a change in water temperature. In the summer, water from the main will feel colder when thoroughly flushed. In the winter, water may feel warmer.
3. Measure the disinfectant residual to ensure it is at or above the minimum of 0.2 mg/L free chlorine or 0.5 mg/L total chlorine.
4. Record the residual level on the MRF.
5. Disinfect the faucet outlet by flaming in and around the hose bib with a torch for several seconds to ensure the destruction of any bacteria. The faucet may also be disinfected by spraying it with a strong chlorine-bleach solution. The flame method is better however, because it takes less time to kill bacteria. If using bleach, keep the solution in contact with the outlet for several minutes.
6. Collect the sample. Using a pencil-sized stream of water (approximately ¼ inch diameter), fill the bottle slightly above the 100 milliliter (mL) fill line. The discharge from the faucet should be a smooth stream, not a spray. Direct the stream downward to the inside of the bottle to make sure it does not splash. Do not rinse the bottle before collecting the sample. The pill, powder, or liquid inside is a sodium thiosulfate, sample preservative and should not be removed. Do not over- or under-fill the bottle. Sample collectors must leave ample air space in the bottle; approximately one inch, depending on the collection bottle type. This way, the laboratory can mix the sample, by shaking, prior to determining the absence of a disinfectant residual, and running the analysis.
7. Record the sample location, the date and time of sample collection, and other required information on the sample label, the MRF, and the COC form, as applicable.
8. Deliver the sample(s) to the laboratory as soon as possible to ensure sample hold time is not exceeded. The maximum sample hold time for coliform samples is 30 hours from sample collection until analysis.

   Guidance for microbial sample collection can be found at Microbial Sample Collection Standard Operating Procedures.[28]

Sample Collection Precautions

A few extra sampling precautions will help ensure accurate sample results. These precautions include the following:

- Keep a few extra sample bottles on hand in case of improper sampling. Never use sample bottles that appear damaged or open.
- Wash your hands before collecting the samples. Sterile gloves can also be used when collecting samples.

[28] www.tceq.texas.gov/goto/bactcollectionsop

- Store unused bottles in a cool, dry area and do not subject the bottles to high heat, damp conditions, direct sunlight, or contact with contaminants. Refer to the laboratory about bottle expiration dates.
- Use caution when collecting samples on windy or rainy days. Coliform bacteria are present in soil, so dust or wind-blown debris can contaminate your sample. Rainwater dripping from a roof may also contaminate the sample.
- Samples should be collected from active connections that are always accessible. The best option is to use a sample station that is solely used by the PWS for water quality sampling. Another option is a hose bib–type faucet located outdoors that does not leak. Do not use a faucet located in a restroom, kitchen, or area where food (particularly raw meat) is prepared. Do not collect samples from a drinking fountain. Avoid faucets with vacuum breakers.
- Do not touch the bottle or cap, blow into the inside of the bottle or cap, place the cap on the ground or hold the bottle upside down. Treat the bottle with care because it is sterile. Improper handling can contaminate the bottle and cause positive results.
- Do not store or transport compliance samples with non-potable water samples, especially wastewater samples.
- Keep the samples cool during transport to the laboratory by storing them on reusable cooler packs. If you must store a sample on ice, you may place it in a plastic bag and ensure that the top of the bottle is not submerged in the melting water. The water can infiltrate the bottle and contaminate the sample. Warm temperatures allow bacteria to multiply. If you are going to hold the sample before delivery to the laboratory, refrigerate it.
- If the sample collector is suspicious that the sample was contaminated due to sample collector error, discard the sample, and collect a new one for analysis.

Disinfectant Residual Measurements

Sample collectors are required to measure the residual disinfectant concentration (free chlorine or chloramine measured as total chlorine) in the field at the sampling site before they collect a coliform sample for compliance purposes. If chlorine is used for disinfection, the free chlorine residual must be measured. If chlorine and ammonia (chloramines) are used, the total chlorine residual must be measured. The disinfectant measurement results must be recorded in the space provided on the MRF at the time the measurement is taken.

A disinfectant residual should always be detected at routine and repeat sample sites. If a disinfectant residual is not detected, flush the tap for a few more minutes. If a disinfectant residual is still not detected, TCEQ suggests the PWS collect the sample and mark it as “special” on the MRF for investigative purposes. Lack of a disinfectant residual indicates a problem that the PWS should identify and repair immediately before collecting additional samples. If a sample collector cannot get a disinfectant residual, the PWS should investigate the situation and, if needed, communicate with TCEQ if the situation cannot be resolved. If the issue is representative of the sample

site, the sample may be marked as routine; remember, routine samples will be used for compliance purposes.

> Note: Raw well samples should never have a disinfectant residual. The disinfectant residual should still be measured to confirm that the water is, in fact, "raw" and contains no disinfectant. The collector should then indicate a residual of 0.0 mg/L on the MRF. If there is any disinfectant present when collecting a raw well sample then the operator should flush the well until a residual is no longer present, then collect the sample. In some cases, after disinfecting a well, there may be disinfectant present if the well was not properly flushed.

Color Comparators and Colorimeters for Measuring Disinfectant Residuals

Free chlorine and chloramine residuals (measured as total chlorine) must be measured to a minimum accuracy of plus or minus 0.1 mg/L with every coliform sample. All residuals should be analyzed by methods and entities approved by TCEQ and identified in the system's monitoring plan.

Color comparators may be used for measuring the chlorine residual in the distribution system only. Requirements for color comparators include:

- Using reagents that have not expired
- Using sample cells that are not discolored or stained
- Proper storage in a cool, dark location where it is not subjected to conditions that would result in staining or UV damage

Chlorine colorimeters should be used within their intended range(s), analysis should be performed with appropriate, clean sample vials and with unexpired reagents. If a sample reads above the instrument's range, the sample should be diluted with chlorine-free water, the reading taken, and the resulting residual calculated. Do not dilute samples if reading in within the instruments intended range.

Sample collectors must ensure they follow the manufacturer's instructions for their specific chlorine test kit(s).

Additional information on disinfectant residual measurements including other available methods are detailed in Monitoring, Analyzing, and Reporting of Free Chlorine and Chloramines[29] (TCEQ RG-407).

> Note: When TCEQ field investigators perform Comprehensive Compliance Investigations (CCI) of PWSs, they will check to ensure that disinfectant residuals are measured correctly.

[29] www.tceq.texas.gov/goto/rg-407

Delivery of the Sample(s) to the Laboratory for Analysis

Following sample collection, delivery personnel (e.g., sample collectors or couriers) should transport samples to the laboratory as quickly as possible to avoid exceeding sample hold times. Each laboratory should have a sample acceptance policy that is NELAP accredited and available to the PWS. The preferred method for sample transportation is to hold samples in coolers at less than10˚C (50˚F) during transit to the laboratory. At the laboratory, delivery personnel relinquish custody of the samples to laboratory personnel. Laboratory personnel inspect the sample(s) and sample documentation at the time of receipt for any issues necessitating sample rejection (see Rejected Samples section). Laboratory personnel also measure and record the sample temperature and confirm the absence of a disinfectant residual. After the laboratory inspects and approves the sample and sample documentation, both the sample delivery personnel and the laboratory representative will sign and date the MRF and the COC (if applicable) with the date and time it was delivered.

If appropriate personnel are not present at the laboratory to receive the samples, they must be locked in a designated area of the laboratory to prevent tampering. Sample delivery personnel should document on either the MRF or the COC, where and how the samples were delivered and secured. Sample delivery personnel should confirm the sample acceptance procedures with the laboratory for after-hours delivery to ensure a process is in place.

Rejected Samples

Samples that are improperly collected, handled, and/or documented by the sample collector or courier may be rejected by the laboratory. If the testing laboratory rejects a sample, the PWS will need to collect a replacement sample within 24 hours of being notified of the rejected sample.

The reasons a laboratory may reject a sample at the time of sample receipt include, but are not limited, to the following:

- Sample bottle broken in transit
- Sample bottle leaked in transit
- Disinfectant present in sample (***Note:*** *The sodium thiosulfate in the sample bottle should neutralize any residual disinfectant that is within the standard concentration range.)*
- No field disinfectant residual measurement documented on the MRF
- Sample hold time exceeded
- Excessive volume
- Insufficient volume
- Frozen sample
- Insufficient sample documentation

- Invalid sampling site
- Invalid sampling protocol

Most of the sample rejection reasons specified above are self-explanatory. However, some of the reasons are associated with frequently encountered issues as described below. Sample collectors should take the necessary steps to address these issues to avoid having to collect replacement samples and/or violations. Appendix B provides the rejection and invalidation codes used by the laboratory.

Insufficient Sample Documentation

Sample collectors frequently neglect to fill out the MRF completely before they deliver samples to the laboratory.

Examples of missing documentation include the following:

- Field measured disinfectant residual
- Sample identification/location
- PWS name and identification (ID) number
- Sample collector name
- Sample type
- Date and/or time of sample collection

TCEQ requires that the laboratories include the information listed above when the sample results are submitted. If this information is missing from the MRF at the time of sample receipt, the laboratory is authorized by TCEQ to reject the sample(s) outright. For this reason, it is very important for sample collectors to take extra time and precautions when completing sample documentation. In certain circumstances, TCEQ may approve a change request for inaccurate information on the MRF. PWS change requests are evaluated and approved or denied by TCEQ; submittal of a request does not guarantee an approval.

> Note: The disinfectant residual is an item that cannot be recorded in the laboratory if missing from the MRF at the time of sample delivery. TCEQ requires that laboratories always reject compliance samples without a documented field measured disinfectant residual recorded at the time of sample delivery.

Sample Type Incorrect: Sample collectors must document the “sample type” correctly on the MRF at the time of sample collection. Incorrectly identifying the “sample type” is a common issue. All sample types may also be replacement samples if they have previously been rejected.

Compliance coliform samples include:

- Routine
- Repeat
- Raw well

Noncompliance sample types include:

- Special
- Construction

If a sample type is not checked, is checked incorrectly, or more than one sample type is checked, then the laboratory will request that the sample collector check the appropriate sample type while still on site at the laboratory. If this error is not corrected by the sample collector at the time of sample receipt, then the laboratory will reject the applicable sample and request a replacement.

Disinfectant Residual Present in Sample: Sample collectors should ensure they do not pour or rinse out the sodium thiosulfate preservative in the sample container when they collect the sample. The preservative in the sample container provided by the testing laboratory is designed to remove all disinfectant from the sample after it is collected. The laboratory is required to check all compliance samples (i.e., routine, repeat, and raw well) for the absence of a disinfectant residual before it is analyzed. If a disinfectant residual is detected, the laboratory must reject the sample.

Sample Hold Time: Sample hold time refers to the amount of time a sample can be kept after sample collection until it is analyzed by the laboratory. The time from sample collection to analysis for coliform samples cannot exceed 30 hours. To avoid hold time issues, sample collectors should always deliver samples to the laboratory as soon as possible after they are collected.

If sample collectors deliver samples to the laboratory late in the day, the laboratory will review the collection time to determine if samples can be analyzed the next day. Laboratories may store samples overnight in a refrigerator if incubation begins within 30 hours of sample collection. If laboratories are not able to meet the sample hold time requirement, they must reject the sample. It is the PWS's responsibility to work with the laboratory, and vice versa, to ensure hold times are met.

Invalid Sampling Site: It is the PWS's responsibility to ensure samples are collected at valid sampling sites identified in the system's Sample Siting Plan. However, if a laboratory identifies an error related to an invalid sampling site, as indicated by the example in the next paragraph, it must reject the sample(s).

Raw well source identification (ID) numbers are often reported incorrectly to TCEQ on the MRF. Instead of recording the correct ID number, sample collectors will incorrectly record an address or just "Well A", "Well B", etc. Groundwater Well ID Numbers always begin with the letter G, followed by the seven-digit PWS ID, then the letters, "A", "B", "C", etc. to indicate well identification. For example, G2270034C. Well ID numbers can be found in Texas Drinking Water Watch under Water System Facilities.

Sample Volume: When collecting a sample, sample collectors are required to fill the bottle over the 100 mL fill line, leaving ample air space in the bottle (approximately one inch). If a sample bottle is too full to allow for proper mixing, the laboratory can choose to pour the entire sample into a larger sterile container, mix properly, and proceed with the analysis. Alternatively, the laboratory may reject the sample.

Sample Temperature: Laboratories are required to measure and document sample temperature at the time of sample receipt. To ensure the temperature of samples remain optimal during transport, the preferred method for sample transportation is to hold samples in coolers at less than 10˚C (50˚F). There is not a requirement for thermal preservation or a temperature criterion which applies to these samples. The laboratory has the authority, however, to consider the condition of transported samples and question their validity where temperatures are elevated, such that they might affect microbial concentrations in the sample (if any are present).

> Note: Frozen samples are rarely a problem in Texas; however, the laboratory will immediately reject samples that are received with ice in them.

Interpretation of Sample Results and Further Action

Total Coliform / E. coli Absent

To determine whether the sample results are negative for either total coliform or *E. coli*, review the MRF or other report form provided by the laboratory. The desired sample result is "absent" for both total coliform and *E. coli.* If sample results are negative, it also indicates that no coliform organisms were detected. A properly maintained and disinfected water system should produce negative sample results. "Absent" is synonymous with "not found" and "negative."

Total Coliform / E. coli Present

To determine whether a sample result is either TC+ or EC+, review the MRF or other report form provided by the laboratory. Positive sample results are reported as total coliform present. Laboratories are required to test each TC+ sample further for the presence of *E. coli. E. coli* may be checked present or absent depending on the outcome of additional testing. "Positive" is synonymous with "found" and "present."

Testing laboratories are required to report TC+ and EC+ results to both TCEQ and the PWS on the same day and as soon as possible after results are determined.

To report positive results to TCEQ, laboratories are required to use the RTCR Microbial Monitoring Positive Result Report Form[30] (TCEQ-20894) (Appendix C). Laboratories are also required to call the PWS informing them of the positive result. Please make sure you provide a current, valid phone number to your laboratory so that they can efficiently reach you in the event of a positive sample result.

When a routine sample result is TC+ or EC+, the PWS system must collect a set of three repeat distribution coliform samples within 24 hours of being notified of the positive result. Groundwater systems must also conduct triggered source monitoring to collect at least one raw well sample from each well that was in use at the time of the

[30] www.tceq.texas.gov/goto/20894

distribution positive. To ensure the correct steps are taken, contact TCEQ as soon as possible after being notified of a TC+ or EC+ result.

> Note: Although the laboratory is tasked with reporting positive sample results to TCEQ, it is the PWS's responsibility to ensure this reporting occurs.

Public Water System Invalidation Requests

Under certain circumstances, the PWS may request TCEQ invalidate a TC+ sample result. These circumstances include:

- The repeat sample results indicate that the TC+ sample resulted from a domestic or other non-distribution system plumbing problem.
- There is substantial evidence to believe that the TC+ sample result is due to a circumstance or condition which does not reflect water quality in the distribution system.
- There is substantial evidence that a TC+ groundwater source sample is not related to source water quality.

For TCEQ to invalidate a TC+ sample result related to the circumstances described above, the PWS must submit a written request by completing the RTCR Positive Sample Invalidation Request[31] (TCEQ-20629) in a timely fashion. The PWS must provide detailed supporting documentation with the completed form, including the determined cause of the TC+ result.

PWS invalidation requests are evaluated and approved or denied by TCEQ. Submittal of a request does not guarantee approval. EC+ sample results are not eligible to be invalidated.

PWSs must continue to collect all required samples under the RTCR while TCEQ is considering the invalidation request. Do not discontinue sampling unless told to do so by TCEQ or until all required sampling under the RTCR is completed.

If sample invalidation is granted, the PWS is responsible for collecting a replacement sample within the same month of the invalidated sample or the system may receive a monitoring violation. If a PWS is requesting to invalidate a sample result from a previous month and the invalidation of that sample results puts the system's number of routine samples below its required minimum sample number, the system may also receive a violation. To avoid monitoring violations, a PWS should contact TCEQ immediately if it knows or suspects invalid sample results.

[31] www.tceq.texas.gov/goto/20629

Section 3. Treatment Technique Triggers, Assessment, and Corrective Action

To protect public health, the RTCR requires that PWSs take actions when certain conditions occur that indicate possible microbial contamination.

These conditions are referred to as treatment technique triggers. The RTCR requires that PWSs conduct either a Level 1 or Level 2 Assessment, depending on the trigger. If sanitary defects are detected, the PWS must correct or "fix" them.

This section summarizes the RTCR requirements related to treatment technique triggers, assessments, and corrective actions. Additional information is located on the RTCR[32] webpage.

Revised Total Coliform Rule Treatment Technique Triggers

The RTCR specifies two levels of assessments based on coliform monitoring results. Level 1 and Level 2 assessments are triggered by different circumstances as explained in the following sections.

Level 1 Treatment Technique Triggers

A Level 1 Assessment may be triggered when any of the following conditions occurs:

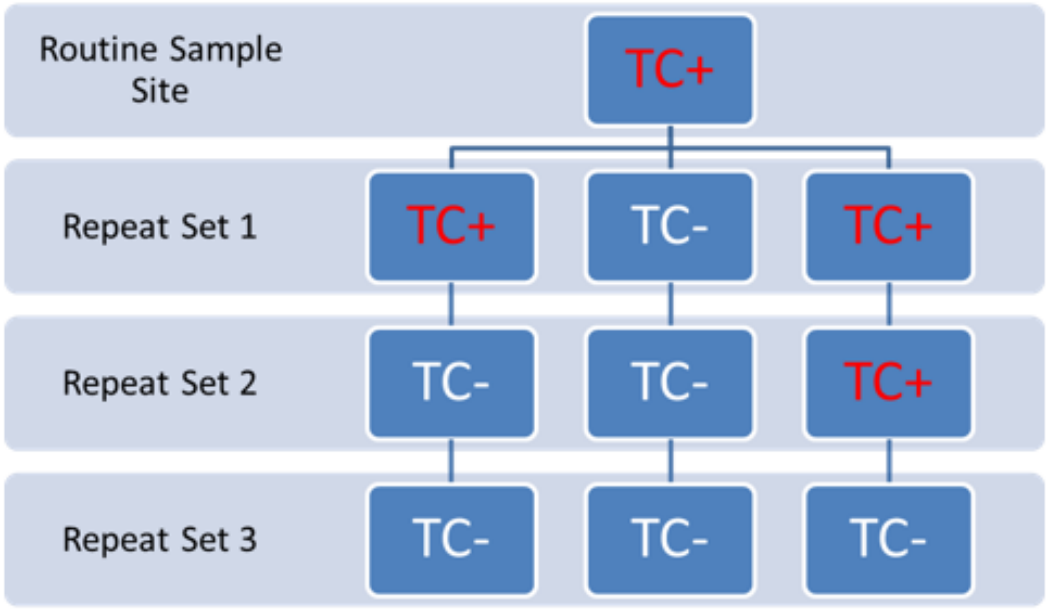
- When a PWS which collects 40 or more distribution samples per month has more than 5.0% TC+ samples collected in a month (Figure 4)
- When a PWS which collects fewer than 40 distribution samples per month has two or more TC+ samples collected in a month (Figure 5)
- When a PWS fails to collect all required repeat samples after a TC+ result

Level 2 Treatment Technique Triggers

A Level 2 Assessment is triggered when any of the following conditions occurs:

- An EMCL (*E. coli* Maximum Contaminant Level) violation
- A second Level 1 treatment technique trigger occurs within a rolling 12-month period

[32] www.tceq.texas.gov/goto/rtcr



For systems that collect 40 or more coliform samples each month, the system will continue to collect repeat samples until they exceed the 5.0% assessment trigger or until one full set of repeats is total coliform-negative (TC-).

The system in this example collects 80 routine samples each month and collected a total of 89 samples (80 routine & 9 repeat) in this instance. The system reported 4 total coliform-positive (TC+) samples which would not exceed the 5.0% trigger (89 x 0.05 = 4.45) System would exceed the trigger at 5 TC+ samples.

The system did not trigger an assessment but ceased repeat sampling after a full set of repeats were TC-.

Monthly Samples	5.0% Trigger	Number of Samples that would Exceed
40	2	3
50	2.5	3
60	3	4
70	3.5	4
80	4	5
90	4.5	5
100	5	6

Figure 4. Level 1 Assessment Trigger for Systems Collecting 40 or More Samples

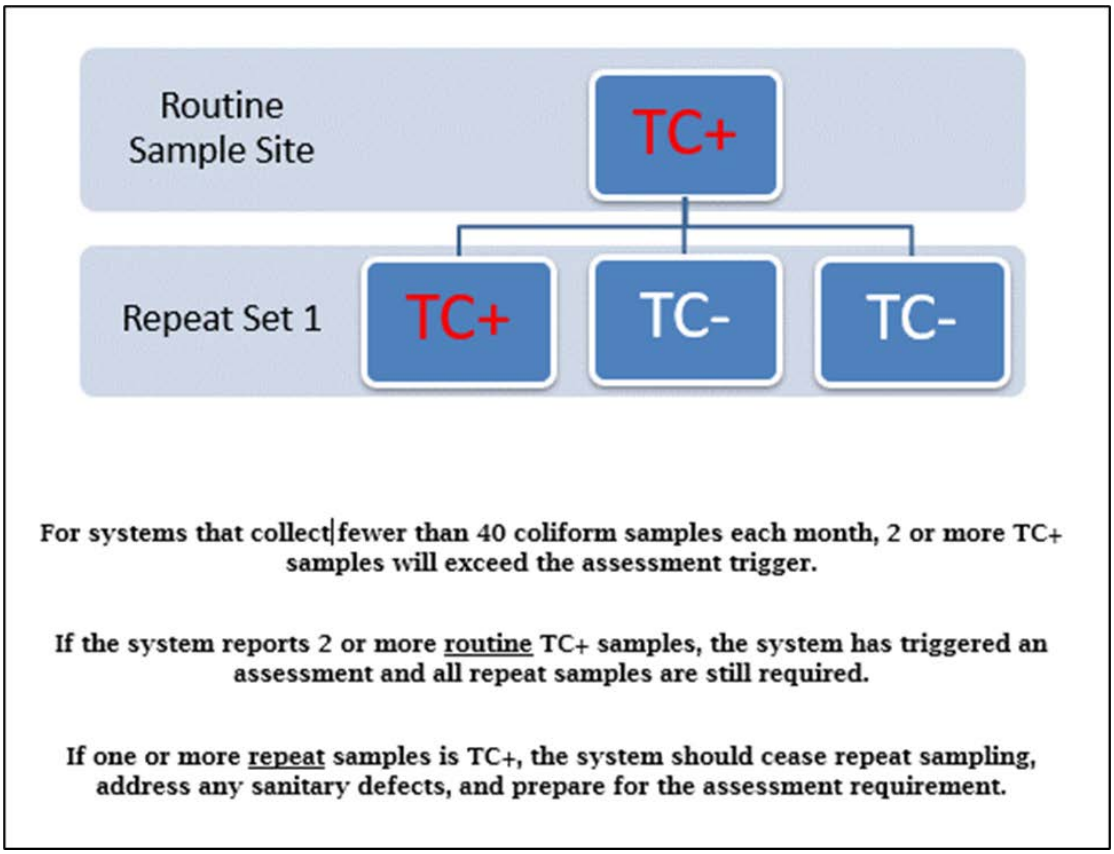


Figure 5. Level 1 Assessment Trigger for Systems Collecting Fewer than 40 Samples

Revised Total Coliform Rule Assessment and Corrective Action

All PWSs must conduct either a Level 1 or a Level 2 Assessment after exceeding the treatment triggers described above. Both types of assessments must be conducted by individuals qualified to identify sanitary defects and develop corrective actions in consultation with TCEQ. A Level 1 Assessment is an examination of the system to identify the possible presence of sanitary defects, defects in coliform monitoring, and the likely reason the system triggered the assessment. A Level 2 Assessment is a more detailed examination of the system than a Level 1 Assessment through the use of a more comprehensive investigation and review of available information including all relevant internal and external resources.

Level 1 and Level 2 Assessments are used to identify “sanitary defects.” A sanitary defect is defined as a defect in a water system that could provide a pathway for microbial contamination into the distribution system or is indicative of a failure or imminent failure in a barrier that is already in place.

Examples of sanitary defects include:

- Cracks or holes in well casings
- Low distribution pressure
- Failure to maintain the minimum required disinfectant levels in the distribution system
- Deteriorated infrastructure

If an assessment identifies sanitary defects, the PWS must indicate on the TCEQ assessment form the corrective actions taken and/or the timeframe for completing future corrective actions. PWSs must submit completed assessment forms to TCEQ within 30 days of triggering the assessment.

> Note: The terms "sanitary defects" and "significant deficiencies" are often confused. Sanitary defects apply to the RTCR as described above. Significant deficiencies apply to the GWR.

The Level 1 and Level 2 Assessment forms are located on the RTCR[33] webpage. If you have any questions about the treatment technique triggers or the assessment form contact a TCEQ RTCR staff member at TCRDATA@tceq.texas.gov.

Section 4. Groundwater Corrective Actions

The GWR's goal is to protect public health by completing corrective actions when a raw groundwater source sample is EC+ or when a significant deficiency has been identified during a comprehensive compliance investigation.

Comprehensive Compliance Investigations and Significant Deficiencies

TCEQ regional offices conduct comprehensive compliance investigations (CCIs) of all new and existing groundwater systems to identify and diagnose significant deficiencies within the system including those that could make a system susceptible to fecal contamination. Significant deficiencies cause, or have the potential to cause, the introduction of contamination into water delivered to groundwater system customers. TCEQ regional staff conduct CCIs to evaluate the eight elements of a sanitary survey.

[33] www.tceq.texas.gov/goto/rtcr

The eight elements of a sanitary survey are:

- Source
- Treatment
- Distribution system
- Finished water storage
- Pumps, pump facilities, and controls
- Monitoring, reporting, and data verification
- System management and operation
- Operator compliance with state requirements

Following the initial CCI, TCEQ conducts investigations of community systems every three years and noncommunity systems every five years. If TCEQ identifies a significant deficiency during a CCI, the groundwater system must take corrective action.

Corrective Action

When a groundwater system has a significant deficiency as identified by a CCI or an EC+ groundwater source sample, it is required to implement a TCEQ-approved corrective action plan. Possible corrective actions include:

- Groundwater source disinfection
- Elimination of the coliform positive groundwater source by providing an alternate source of water
- Identify and eliminate the source of contamination
- Additional treatment, for example 4-log treatment
- Assessment source monitoring
- Any other action that will correct all significant deficiencies

PWSs must consult with the TCEQ GWR regarding appropriate corrective action and have an approved groundwater corrective action plan in place within 30 days of receiving notification from a laboratory of the TC+ or EC+ result or a significant deficiency. Within 120 days of receiving written notification from a laboratory of the TC+ or EC+ or receiving written notification from TCEQ of a significant deficiency, the PWS must complete corrective action or follow the approved corrective action plan and schedule.

The Groundwater Rule[34] webpage has more information related to corrective action sanitary surveys and significant deficiencies.

[34] www.tceq.texas.gov/goto/gwrule

Section 5. Reporting

Both the RTCR and the GWR require PWSs to report, notify, and/or submit certain items and information to TCEQ within required timeframes. Table 2 has most common reporting requirements for RTCR. Table 3 has the most common reporting requirements for GWR. PWSs should refer to the rules and contact TCEQ as additional requirements may apply. Record-keeping requirements are in 30 TAC 290.46(f).

Table 2. Revised Total Coliform Rule Reporting Requirements

Item	Reporting and/or Record-Keeping Requirements
Sample Siting Plan Template (TCEQ-20900)	Prepare and update Sample Siting Plans, as required. SSPs should be maintained at the PWS and available to TCEQ upon request. Surface water and GUI systems should submit with their monitoring plan upon creation or revision.
Microbial Monitoring Results	Ensure the laboratory provides TCEQ with the monitoring results within the first ten days of the month following the monitoring period.
Positive *Microbial* monitoring results and form (TCEQ-20894)	Ensure the laboratory provides TCEQ with TC+ and EC+ (or other approved fecal indicator) monitoring results before the end of the day that the laboratory learns of the results.
Positive sample invalidation request (TCEQ-20629) and associated documentation	Submit when requesting that TCEQ invalidate a coliform positive distribution sample result.
Level 1 Assessment form (TCEQ- 20901)	Submit as soon as practical, but no later than 30 days after the PWS exceeds a Level 1 treatment technique trigger, or 30 days after all routine and repeat monitoring was required to be completed, whichever is earlier.
Level 2 Assessment form (TCEQ-20769)	Submit as soon as practical, but no later than 30 days after the PWS exceeds a Level 2 treatment technique trigger.
Notification of completed corrective action	Notify TCEQ when scheduled corrective actions identified in Level 1 or Level 2 Assessments are completed. Provide documentation such as (but not limited to) pictures, operating reports, maintenance reports, or work orders to demonstrate the sanitary defects were corrected.

Table 3. Groundwater Rule Reporting Requirements

Report	PWS Reporting Requirement
Groundwater Source Monitoring Results	Ensure the laboratory provides TCEQ with the monitoring results within the first ten days of the month following the monitoring period.
Groundwater Corrective Action Plan	Consult with TCEQ and have an approved corrective action plan in place within 30 days of receiving written notification of the positive groundwater source sample or the significant deficiency.
Notification of completed corrective action or compliance with the corrective action plan and schedule	Submit notification within 30 days of completing corrective action. Provide documentation to demonstrate the significant deficiencies were corrected or the groundwater contamination was addressed.
Notification of a failure to meet compliance monitoring requirements	Submit as soon as possible, but no later than the end of the next business day when a groundwater system fails to meet compliance monitoring requirements (associated with 4-log treatment) if the situation is not restored within four hours. Email notification to GWRDATA@tceq.texas.gov.

Section 6. Compliance and Public Notification

A PWS that does not comply with requirements specified in either the RTCR or the GWR is in violation of the rules and may need to notify the public [30 TAC 290.122: Public Notification]. Notification timeframes are critical, especially for acute violations. If a PWS knows or suspects it has a violation and needs assistance, it should contact TCEQ immediately by emailing TCRDATA@tceq.texas.gov or GWRDATA@tceq.texas.gov or by phone at 512-239-4691 to confirm what rules and requirements apply and what actions should be taken.

The RTCR and GWR requirements related to compliance violations and public notification (PN) are summarized in this section. Additional information and resources related to drinking water compliance and PN are located at Public Notice Language for Drinking Water Compliance.[35]

[35] www.tceq.texas.gov/goto/pws/notices

Revised Total Coliform Rule Compliance Violations

Specific violations related to the RTCR are provided in Table 4 according to the tier under which each fall.

Table 4. Revised Total Coliform Rule Violations and Reasons

Violation (Tier)	Reason for Violation
EMCL Violations (Tier 1) Requires a boil water notice	• A TC+ routine sample followed by an EC+ repeat sample • An EC+ routine sample followed by a TC+ repeat sample • Failure to collect all required repeat samples following an EC+ routine sample • Failure to test for *E. coli* when any repeat sample is TC+
Treatment Technique Violations (Tier 2)	• Failure to complete a TCEQ-approved start-up procedure prior to serving water to the public • Failure to conduct the required assessment or corrective actions within the required timeframe when a system is required to complete a Level 1 or Level 2 Assessment
Monitoring Violations (Tier 3)	• Failure to collect every required routine sample in a compliance period • Failure to ensure the laboratory tests for *E. coli* following a total coliform-positive routine sample • Failure to monitor raw groundwater source water
Reporting Violations (Tier 3)	• Failure to report the results of compliance monitoring tests to TCEQ or failure to report in the required time frame • Failure to complete a required PN according to 30 TAC 290.122 or certify that notification has been performed • A seasonal PWS fails to maintain or submit certification of completion of start-up procedures to TCEQ

Groundwater Rule Compliance Violations

Specific violations related to the GWR are provided in Table 5 according to the tier under which each one falls.

Table 5. Groundwater Rule Violations and Reasons

Violation (Tier)	Reason for Violation
Treatment Technique Violations (Tier 2)	• Failure to complete corrective action in accordance with TCEQ-approved corrective action plan or any required interim measures. • Failure to comply with TCEQ-approved corrective action plan and schedule. • Groundwater PWS subject to the requirements 4-log treatment of viruses' failure to maintain at least 4-log treatment of viruses, if the failure is not corrected within four hours.
Monitoring Violations (Tier 3)	• Failure to conduct required disinfectant compliance monitoring or membrane system integrity monitoring. • Failure to conduct triggered source monitoring Failure to conduct assessment source monitoring.
Reporting Violations (Tier 3)	• Failure to report the results of the disinfectant or membrane system integrity monitoring. • Failure to issue a required PN or certify that the PN has been performed.

Public Notice Tiers

TCEQ PN rules include three categories, or tiers. Each tier has different methods and time frames to implement the PN depending on the potential for human health effects as defined below.

Tier 1

Tier 1 violations or situations have significant potential to cause serious adverse effects on human health as a result of short-term exposure. Tier 1 applies to acute violations or situations such as EMCL violations and detections of *E. coli* or other fecal indicators in raw groundwater source samples. The PWS must issue a Tier 1 PN for the violation or situation within 24 hours, in one or more of the manners provided in Table 6.

Table 6. Tier 1 Public Notification

Community	• Publish the notice to the radio and television stations serving the area served by the PWS. • Publish the notice in a daily newspaper of general circulation in the area served by the system. If the area is not served by a daily newspaper of general circulation, notice shall instead be issued by direct delivery or by continuous posting in conspicuous places within the area served by the system. Other methods of delivery may include electronic delivery or alert systems (e.g., reverse 911).
Noncommunity	• Direct delivery or by continuously posting the notice in conspicuous places within the area served by the water system. Other methods of delivery may include electronic delivery or alert systems (e.g., reverse 911).

PWSs with an EMCL violation must include a boil water notice in their PN. Cases of EC+ raw groundwater sources samples require Tier 1 public notification but not a boil water notification.

Tier 2

Tier 2 violations or situations have the potential to cause serious adverse effects on human health. These violations include failure to conduct and/or submit Level 1 or Level 2 Assessment by the due date. The PWSs must issue a Tier 2 PN as soon as possible, but in no case later than 30 days after the violation is identified, in one or more of the manners provided in Table 7.

Table 7. Tier 2 Public Notification

Community	• Mail or other direct delivery to each customer receiving a bill, and to other service connections to which water is delivered; and • Any other method determined to reach other persons regularly served by the PWS if they might not receive the notice by mail or other direct delivery (i.e., house renters, apartment dwellers, university students, nursing home patients, prison inmates, etc.). These methods may include, but are not limited to newspaper postings, posting in a conspicuous location, internet postings, electronic delivery, etc.
Noncommunity	• Posting the notice in conspicuous locations throughout the distribution system frequented by persons served by the system, or by mail or direct delivery to each customer and service connection (where known); and • Any other method determined to reach other persons regularly served by the PWS if they might not receive the notice by mail or other direct delivery (i.e., house renters, apartment dwellers, university students, nursing home patients, prison inmates, etc.). These methods may include, but are not limited to newspaper postings, posting in a conspicuous location, internet postings, electronic delivery, etc.

Tier 3

Tier 3 applies to other violations and situations that do not have a direct impact on human health (e.g., failure to maintain records for seasonal start-up procedures and seasonal start-up procedures certification form). The first Tier 3 PN can be issued in the same way as a Tier 2 PN, no later than one year after the violation is identified. The extra time gives the community PWSs an opportunity to consolidate these notices and send them with their annual Consumer Confidence Report (CCR).

Public Notice Contents

The content of a PN varies, depending on the severity of the health threat involved. Each PN may include items (as applicable) from the list below.

- A clear and readily understandable explanation of the violation, significant deficiency, or situation that led to the notification
- Date the violation, significant deficiency, or situation occurred or the date the significant deficiency was identified
- Description of potential adverse health effect (especially to vulnerable populations) and mandatory language, as applicable
- Actions the PWS is taking to correct the violation or situation, and when it expects to return to compliance. For groundwater PWSs with significant deficiencies, the notice must contain TCEQ-approved plan and schedule for correction of the significant deficiency, including interim measures, progress to date, and any interim measures completed
- Whether alternative drinking water sources should be used, and what other actions consumers should take, including when they should seek medical help, if known
- Name, business address, and telephone number for consumers to contact the PWS owner, operator, or representative for additional information concerning the notice
- Multilingual language, as appropriate. The multilingual notice must explain the importance of the notice or provide a telephone number or address where consumers may contact the system to obtain a translated copy of the notice or assistance in the appropriate language
- A statement to encourage the notice recipient to distribute the public notice to other persons served

PWSs must submit signed Certificates of Delivery, proof the PN was delivered to customers, to TCEQ with 10 days of distribution.

Public Notice Language for Drinking Water Compliance[36] has documents that include instructions for notifying customers of violations, public notice templates, and Certificates of Delivery.

[36] www.tceq.texas.gov/goto/pws/notices

Boil Water Notice

In response to EMCL violations, PWSs must issue a boil water notice in addition to the EMCL PN. The boil water notice is the most urgent form of PN. Boil water notices instruct consumers to boil their water for at least two minutes before using (e.g., cooking or consumption) or to use bottled water. Public Notice Language for Drinking Water Compliance[37] has documents that include instructions for notifying customers about boil water notices, templates for boil water notices (in English and Spanish), and how to rescind an advisory.

Consumer Confidence Reports

All community PWSs must prepare and distribute a CCR (also known as a water quality report) to their customers every year, by July 1.

The CCR provides consumers with information about the quality of their drinking water from the prior calendar year. The CCR summarizes information about the source(s) of water used, chemical results, microbial results, lead and copper results, compliance with drinking water rules, educational health information, water system contact information, and public participation opportunities.

The CCR may be used by community PWSs for Tier 3 public notices under the following conditions:

- The CCR is provided to consumers no later than 12 months after the PWS learns of the violation.
- The Tier 3 notice contained in the CCR follows the requirements in 30 TAC 290.272 related to the content, delivery, and recordkeeping of CCRs.

The Consumer Confidence Report[38] webpage has background information on the CCR, guidance, and instructions for report preparation. How to Complete Your Consumer Confidence Report[39] includes the TCEQ CCR Generator and an instructional video.

[37] www.tceq.texas.gov/goto/pws/notices
[38] www.tceq.texas.gov/goto/ccr
[39] www.tceq.texas.gov/goto/ccr-instructions

Appendix A. Microbial Reporting Form (10525) and Instructions

How to Complete the Microbial Reporting Form (MRF, #10525)

The Microbial Reporting Form (MRF) is required when reporting sample results to TCEQ for compliance with the Revised Total Coliform Rule (RTCR) and Ground Water Rule (GWR) only. Use of this form is mandatory unless the laboratory is submitting data electronically to TCEQ via E2, in which case the lab may use an alternate form that has been approved by the TCEQ and captures all the required data.

1. Fill in the Public Water System (PWS) ID number, PWS Name and County. **Only one PWS per form** and shipping/transport container. (All samples on the form must be transported in the same container)
2. Fill in the Name, Mailing Address, Phone Number and Fax Number (if available) of the person to whom the sample results should be reported.
3. Fill in the sample collector's information including: Name, signature and association with the system. (If other is marked, please indicate in what capacity the sampler is associated with the system). Community and Non-Transient Non-Community PWSs should also fill in the operator's license number. **Samples will not be accepted by TCEQ if the form is not signed by the sampler or if the sampler name is missing.**
4. Complete the required **Sample Identification/Location** for each sample.
    a. Under **Sample Identification/Location**, document the sample sites as listed in RTCR Sample Siting Plan. Use specific addresses or locations; DO NOT use generic site numbers. For raw well samples, ensure the appropriate Source ID (e.g. G1234567A) is documented to avoid sample/data rejection. If you do not know the Source ID please contact TCEQ or visit the Drinking Water Watch (DWW) website under "Facilities". DWW link: http://dww2.tceq.texas.gov/DWW/
    b. Check the appropriate box for **Sample Type.** *Check only one box.* (Mandatory)
        - Compliance sample types include Routine (Distribution), Repeat or Raw Well. *Special and Construction samples WILL NOT be used for compliance.*
        - Non-Compliance sample types are Construction and Special. These types of samples are for water systems to use after construction work or for special investigation purposes and will not be used for TCEQ compliance.
        - If more than one sample type is checked, the sample will be rejected. Changes to sample type are not allowed after custody has been relinquished to the lab.
    c. Fill in the **Date** the sample was collected. Fill in the **Time** of sample collection and circle AM or PM. Date and time are mandatory.
    d. If the sample collected replaces a previously rejected sample, check the box under "Replacement".
        - Repeat samples, replacement samples, and triggered raw samples must have the originating sample ID and *collection* date filled in next to the replacement indicator box.
    e. A **Chlorine Residual** must be measured and recorded for each *compliance* sample collected in the field to prevent sample/data rejection. Fill in the measured residual in mg/L. Indicate the type of residual measured by circling "F" for Free or "T" for Total (Chloramines). **Compliance samples without a chlorine residual measured in the field at the time of collection will be rejected.**
5. Return the completed MRF to the laboratory with the water sample(s).
    a. Complete the Chain of Custody (COC) area by filling in the appropriate "Relinquished By" field(s) and date(s). The laboratory should complete the "Received By (Lab)" fields. The COC area of the form requires signatures, *initials are not acceptable.*
        - In the event the water system uses a courier, or someone other than the sampler delivers the water samples to the lab, the sampler will **sign** and date in the "Relinquished By" fields when turning over the samples to that courier who will **sign** and date the "Received By" field. The sampler or courier should complete the "Relinquished By" fields upon delivery of the samples to the laboratory.
        - Laboratories may opt to use a separate COC form. In this case both the MRF and separate COC must be submitted to the TCEQ together.
6. Use of this form is mandatory for compliance samples. TCEQ reserves the right to not accept samples / results from unapproved or modified forms. (Labs may customize the form to add their name/logo, contact information, and laboratory ID number in the upper right part of the form)
7. Double check the completed form for accuracy before relinquishing custody to the laboratory. **Labs are not authorized to make changes to the form under any circumstance.** Only the TCEQ can authorize changes *under limited circumstances* after the MRF is submitted to the lab or after analysis is completed.

Updated 11/27/2019

TCEQ Microbial Reporting Form

TCEQ Form 10525
08/2017

Water System Identification & Sample Collection Information (Please type or use block print)

Public Water System ID: (Must be 7 digits; include all zeros) TX

Public Water System Name:

County:

Test Results must meet all accreditation / certification requirements unless stated otherwise.

TCEQ Laboratory ID:

Report Results To:

Name:

Address:

City:

State: Zip Code:

Phone #: Other Contact:

Sampler Name (Print): Signature:

Operator License #: ☐ Owner ☐ Operator Other:

Falsification of this form or tampering with water samples is a crime punishable under state and/or federal law. (Texas Penal Code, Title 8, Chapter 37.10) By signing this form, the sampler acknowledges that samples were collected according to the systems established sample collection procedures, and that all information is accurate.

SHADED AREA FOR LABORATORY USE ONLY

Sample Iced? ☐ Yes ☐ No

Temperature °C

Corrected Temp

Relinquished By (Sampler): Date / Time:

Received By (Courier, if applicable): Date / Time:

Relinquished By (Courier): Date/ Time:

Received By (Lab): Date / Time:

Lab Comments:

Tested By:

Laboratory Approval:

Report to Client By:

Incubation Date & Time

Begin: Date: Time:

End: Date: Time:

Date: Time:

Date: Time:

Sample Identification/Location	Sample Type : (√ one)						Collected				Chlorine Residual	Rejection Code (if applicable) - Please Resubmit	Lab Results								Laboratory Sample ID Number
							Date			Time			Test Method:		Chlorine √		Total Coliform		E. Coli		
Use Specific Address / Location identified in Sample Siting Plan	Routine (Distribution)	Repeat	Raw Well	Special *	Construction *	Month	Day	Year	Please circle AM or PM	Replacement	Sample ID & Date of Originating Sample (All Repeat, Replacement, & Triggered Raw Samples)	Circle "F" for Free, "T" for Total. (mg/L)			Absent	Present	Absent	Present	Absent	Present	
Raw Wells - Use Source ID for Well Sampled (Example: G1234567A)									am pm			F T									
									am pm			F T									
									am pm			F T									
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Form instructions: www.tceq.texas.gov/drinkingwater/microbial/revised-total-coliform-rule * Special and Construction samples are NOT FOR COMPLIANCE

Lab Rejected Code (LR) - Document Reason:

Appendix B. Rejection and Invalidation Codes Used by the Laboratory

Laboratories may reject samples upon receipt under certain conditions, as described in the Sections *Rejected Samples* and *Insufficient Sample Documentation*. Provisions in the RTCR also allow the laboratory to invalidate coliform sample results (including groundwater source monitoring results) if the laboratory used an improper sample procedure or the sample was deemed "unsuitable for analysis."

If a laboratory rejects a sample or invalidates a sample result, it documents the reason on the MRF as specified in the Rejection Reasons and Code table. In these cases, the laboratory will also assign the sample(s) a laboratory ID number and report the occurrence to TCEQ. This will enable replacement samples to be tied back to the original sample and ensure the PWS gets proper monitoring credit. If PWSs are confused about why the laboratory used a certain code, they should contact the laboratory directly for additional information.

If samples or sample results are rejected, PWSs must collect replacement samples within 24 hours of being notified of a rejected sample or an invalidated sample result.

Table B.1. Rejection Reasons and Codes

Rejection Reason	Code
Broken in transit	BR
Chlorine present (in sample)	CL
Exceeded hold time	EH
Excessive volume	EV
Frozen sample	FR
Heavy Bacterial Growth	HB
Insufficient sample information	IN
Invalid sampling point	BP
Invalid sampling protocol	IP
Lab rejected	LR[1]
Lab Accident	LA
Leaked in transit	LT
No field measured chlorine residual (on form)	NC
Heavy silt or turbidity present	ST
Volume Insufficient	VO

[1] LR is a generic rejection code. If the laboratory reports the rejection code LR, it should specify the reason in the space provided at the bottom of the form. Contact the laboratory if this additional information is not recorded.

Appendix C. Laboratory Positive Result Form (TCEQ-20894)

Clear Form

Laboratory POSITIVE Result Form

Revised Total Coliform Rule and Groundwater Rule

Instructions

- Use a new form for each Public Water System (PWS) sample with a total coliform and/or *E. coli* POSITIVE result.
- Fill out the information as it appears on the Microbial Reporting Form (MRF).
- Immediately send all POSITIVE results to RTCRPOS@tceq.texas.gov or fax to 1-800-252-0237. Include the positive result form, MRF, and analytical results. Limit to one PWS sample per email.
- For questions regarding this form or positive results, contact the Revised Total Coliform Rule Program at RTCRPOS@tceq.texas.gov or (512) 239-4691.

Laboratory Information

Laboratory Name	Laboratory ID	Sent By
Date	Time	Laboratory Phone Number

Sample Information

Laboratory Sample ID	PWS ID Number
Sample Collection Location	PWS Name

Sample Results

Total Coliform POSITIVE	*E. Coli* POSITIVE	Analytical Results Attached (required)	MRF Attached (required)
☐	☐	☐	☐

PWS Reporting Information

Successful Verbal Contact	Left Voicemail	No Voicemail Available	PWS Contact Name	PWS Contact Phone Number
○	○	○		

Email Form

Form – 20894 (1/30/2021)