



Complying With the Stage 1 Disinfectants and Disinfection Byproducts Rule: Basic Guide

One of the Simple Tools for Effective Performance (STEP) Guide Series

For Small Systems Adding Any Chemical Disinfectant

In addition to this guide, owners and operators of systems adding chlorine dioxide or ozone should obtain Supplement A of this guide or contact their state to learn about additional requirements of the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR). Owners and operators of conventional filtration systems should obtain Supplement B of this guide or contact their state for more information on how additional requirements of the Stage 1 DBPR apply to them.

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NOTICE: This guide is intended to aid you in complying with the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) published on December 16, 1998, under the Safe Drinking Water Act (SDWA). The SDWA provisions, the Stage 1 DBPR, and other EPA regulations described in this guide contain legally binding requirements. This document does not substitute for those provisions or regulations, nor is it a regulation itself. It does not impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based on the circumstances. EPA and state decision-makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. Any decisions regarding a particular community water system or non-transient non-community water system will be made based on the applicable statutes and regulations. Therefore, interested parties are free to raise questions and objections about the appropriateness of the application of this guide to a particular situation, and EPA will consider whether or not the recommendations or interpretations in this guide are appropriate in that situation based on the law and regulations. EPA may change this guidance in the future. To determine whether EPA has revised this guide and/or to obtain copies, contact the Safe Drinking Water Hotline at 1-800-426-4791.

Please note that the term “state” is used in this guide to refer to your Primacy Agency. The Primacy Agency for most systems is your state Drinking Water Agency. However, the Primacy Agency for systems located in the Navajo Nation is your tribal office, and the Primacy Agency for systems located on other tribal lands, in Wyoming, or in the District of Columbia is your EPA Regional office.

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**Additional copies of this Basic Guide, and its supplements, can be downloaded from EPA's
Safe Drinking Water Web site at www.epa.gov/safewater.**

You can also call the Safe Drinking Water Hotline at 800-426-4791 to request these documents.

Acronyms and Definitions

CCR - Consumer Confidence Report

CFR - Code of Federal Regulations

Compliance Samples - Required samples your system takes to comply with regulations. Compliance samples are identified in your monitoring plan. All compliance samples identified in your monitoring plan must be included in your compliance calculations, even if you take more than the minimum number of samples.

Conventional Filtration - A series of processes including coagulation, flocculation, sedimentation, and filtration that results in substantial particulate removal.

CWS - Community water system

DBP - Disinfection byproduct

DBP Precursor - Disinfection byproduct precursor

Enhanced Coagulation - Refers to the process of achieving improved disinfection byproduct precursor removal by using conventional treatment.

Enhanced Softening - Refers to the process of achieving improved disinfection byproduct precursor removal by using precipitative softening.

EPA - Environmental Protection Agency

GWUDI - Ground water under the direct influence of surface water

HAA5 - The sum of the concentration of the five haloacetic acids covered by the Stage 1 DBPR (monochloro-, dichloro-, and trichloro-acetic acid and monobromo- and dibromo-acetic acid)

LT1ESWTR - Long-Term 1 Enhanced Surface Water Treatment Rule

MCL - Maximum contaminant levels are the maximum permissible

level of a *contaminant* in water delivered to a consumer. MCLs are enforceable standards.

MRDL - Maximum residual disinfectant levels are the maximum permissible level of *disinfectant residuals* in water delivered to a consumer. MRDLs are enforceable standards.

MRT - Maximum residence time

NTNCWS - Non-transient non-community water system

Operational Samples - Samples your system takes not for compliance purposes, but to gain a better understanding of water quality. These samples should not be included in your compliance calculations.

Oxidant - Oxidants are most often used for the oxidation of reduced iron and manganese, destruction of taste and odor causing organic contaminants, and the destruction of synthetic organic contaminants. Many oxidants act as coagulant aids and are used as part of an overall program for the control of potentially harmful disinfection by-products.

PN - Public notification

Primacy Agency - The state agency that has been granted primary enforcement responsibility for administration and enforcement of primary drinking water regulations and related requirements applicable to public water systems within a state (40 CFR 142.2).

PWS - Public water system

RAA - Running annual average

Stage 1 DBPR - Stage 1 Disinfectants and Disinfection Byproducts Rule

State - Used in this guide to refer to your Primacy Agency. The

Primacy Agency for most systems is your state Drinking Water Agency. The Primacy Agency for systems located in the Navajo Nation is your tribal office, and the Primacy Agency for systems located on other tribal lands, in Wyoming, or in the District of Columbia is your EPA Regional office.

Subpart H - PWSs using surface water or ground water under the direct influence of surface water as a source.

SUVA - Specific ultraviolet absorption

TCR - Total Coliform Rule

TOC - Total organic carbon

TTHM - Total trihalomethanes (the sum of the four trihalomethanes covered by the Stage 1 DBPR: chloroform, bromoform, and dibromochloro- and bromodichloro-methane)

TNCWS - Transient non-community water system

WTP - Water treatment plant

Is This Guide for Me?

The Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) applies to water systems that add a chemical disinfectant such as chlorine, chloramines, chlorine dioxide, or ozone to their drinking water during any part of the treatment process for any purpose (e.g., taste, odor, color). EPA has developed three documents to address the requirements of the Stage 1 DBPR:

- The Basic Guide – for community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) that add a chemical disinfectant and serve fewer than 10,000 persons.
- Supplement A – for CWSs, NTNCWSs, and transient non-community water systems (TNCWSs) that use chlorine dioxide and CWSs and NTNCWSs that use ozone.
- Supplement B – for Subpart H CWSs and NTNCWSs that add a chemical disinfectant and use conventional filtration.

Stop!
If you do not add a chemical disinfectant to your water, the Stage 1 DBPR does not apply to your system.

Systems that will typically find these guides useful (if they add a chemical disinfectant) include:

- Small towns
- Rural water districts
- Tribal systems
- Manufactured housing communities
- Home owners' associations
- Small private systems
- Factories, religious institutions, and schools with their own water supplies

CWSs, NTNCWSs, and TNCWSs that use chlorine dioxide and CWSs and NTNCWSs that use ozone should obtain Supplement A of this guide or contact their state. Subpart H systems that add a chemical disinfectant and use conventional filtration should obtain Supplement B of this guide or contact their state. Contact information for Safe Drinking Water Act (SDWA) Primacy Agencies is provided in Appendix E. Tribal contact information is provided in Appendix F. If your system is a new system or if you are just starting to add a chemical disinfectant, you should work with your state to determine which requirements apply to you. Your state can also help you figure out how to calculate compliance with the Rule.

What Will I Learn?

As a drinking water system operator, your most important job is to protect the health of your customers. This guide will help you by providing information about:

- The health risks associated with disinfectants, disinfection byproducts (DBPs), and residual disinfectants;
- The monitoring requirements of the Stage 1 DBPR;
- How to determine if you are in compliance;
- What to report to the state and to your customers; and,
- How to maintain compliance through partnerships, treatment, and other options.

Table 1 outlines the requirements of the regulations and the systems to which they apply. It also indicates where you can find information on each disinfectant residual, byproduct, or precursor in this guide and its supplements. The appendices contain examples of compliance calculations and sample monitoring worksheets.

Table 1: Requirements of the Stage 1 DBPR

Disinfectant Residual, Byproduct, or Precursor	Systems Required to Monitor	Where to Find Information
Chlorine & Chloramine Residuals	CWSs and NTNCWSs using chlorine or chloramines for any purpose	Basic Guide Page 10
Chlorine Dioxide Residuals	All systems using chlorine dioxide for disinfection or oxidation	Supplement A
Total trihalomethanes (TTHM) & five haloacetic acids (HAA5)	CWSs and NTNCWSs adding any chemical disinfectant for any purpose	Basic Guide Page 13
Chlorite	CWSs and NTNCWSs using chlorine dioxide for disinfection or oxidation	Supplement A
Bromate	CWSs and NTNCWSs using ozone	Supplement A
DBP Precursors	CWSs and NTNCWSs using surface water or ground water under the direct influence of surface water (GWUDI) and conventional filtration	Supplement B

This guide describes the minimum federal requirements under the Stage 1 DBPR. Some states may have additional requirements and monitoring forms. Be sure to check your state's specific requirements. For state and tribal contact information, refer to Appendices E and F.

Ensuring Safe Drinking Water

To prevent waterborne disease, most systems add chlorine or other chemical disinfectants to their water to kill or inactivate the pathogens. Unfortunately, while chemical disinfectants are effective at controlling many harmful microorganisms, they can react with naturally-occurring organic materials in the water (DBP precursors). Disinfectants can also dissociate, or break down, into other chemicals. Both reactions can form unintended DBPs. This presents a dilemma for systems: they must add chemical disinfectants to reduce the risk of waterborne disease outbreaks, but at the same time carefully control their use in order to avoid producing harmful byproducts. Table 2 shows the relationship between DBP precursors, DBPs, and disinfectants.

Table 2: DBP Production*

Precursor in Water	Added Disinfectant	DBP
Organic Materials	Chlorine Chloramines	TTHM HAA5
Bromide	Ozone	Bromate
	Chlorine Dioxide	Chlorite

*Although disinfection can produce other DBPs besides those listed here, EPA does not yet regulate them due to a lack of information about their potential health effects.

To address this situation, EPA developed the Stage 1 DBPR in conjunction with the Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR), which regulates microbial contamination in Subpart H systems. Together, the LT1ESWTR and the Stage 1 DBPR strike a balance between protection from the acute health risks of microbial contamination and protection from the long-term health effects of chemical disinfectants and their byproducts. EPA expects that the forthcoming Ground Water Rule will expand regulation of microbial contamination to ground water systems.

Caution!

The Stage 1 DBPR and the LT1ESWTR are integrally related. Actions you take to comply with the Stage 1 DBPR might affect your responsibilities under the LT1ESWTR, and vice-versa. Check with your state for more information.

What Is the Stage 1 DBPR?

The Stage 1 DBPR describes what are allowable levels of microbial pathogens and chemical disinfectants. The Stage 1 DBPR regulates the allowable levels of disinfectants, DBPs, and DBP precursors in drinking water. Specifically, the Rule requires systems to:

- Meet the maximum residual disinfectant levels (MRDLs) for three chemical disinfectants: chlorine, chloramines, and chlorine dioxide (40 CFR 141.65). This guide only contains information on the requirements for chlorine and chloramines. See Supplement A for more information on chlorine dioxide.
- Meet the maximum contaminant levels (MCLs) for TTHM, HAA5, chlorite, and bromate (40 CFR 141.64). This guide only contains information on the requirements for TTHM and HAA5. See Supplement A for more information on chlorite and bromate.

Conventional systems are required to remove specified percentages of DBP precursors from their raw water (measured as Total Organic Carbon (TOC)) through enhanced coagulation, enhanced softening, or by meeting alternative compliance criteria (40 CFR 141.135). See Supplement B for more information on these requirements.

What Do I Have to Do and When Do I Have to Do It?

The Stage 1 DBPR went into effect for small systems on January 1, 2004. By this date, CWS or NTNCWS that add a chemical disinfectant should have begun complying with monitoring requirements and the MRDLs for the disinfectants (e.g., chlorine or chloramines). In addition, these systems should have begun complying with monitoring requirements and MCLs for the DBPs (e.g., TTHM and HAA5) (40 CFR 141.130(a),(b)). Depending on your treatment practices, you may have had to meet standards for additional disinfectant residuals and contaminants. Check Table 1 on page 4 to determine if additional requirements apply to your system.

To comply with the Stage 1 DBPR, small systems must develop a **monitoring plan**, **monitor** their water (i.e., collect samples), calculate **compliance**, and **report** to the state. This guide discusses all four activities.

All systems covered by any portion of the Rule had to develop a **monitoring plan** no later than **January 31, 2004**. In addition, Subpart H systems serving more than 3,300 persons had to submit their plan to the state by **April 10, 2004**, 10 days after the end of the first quarter following the effective date of the Rule (40 CFR 141.132(f)). Monitoring plans should now be complete and available for inspection by the state and the public. If you have not yet developed a monitoring plan, contact your state for assistance with developing the plan. Appendix C contains more information about monitoring plans.

To meet the treatment technique requirements, MRDLs, and MCLs that may apply to your system, you have to **monitor** the source and finished water you deliver to customers. All monitoring must be done under normal operating conditions (40 CFR 141.132(a)(1)). This guide discusses chlorine and chloramines monitoring requirements starting on page 10. Turn to page 13 for information on monitoring requirements for TTHM and HAA5.

Systems monitoring once a year or less often should use their single result to determine **compliance**. For systems monitoring more than once a year, compliance is based on a running annual average (RAA) of the monitoring results. RAAs are calculated for:

- Chlorine and chloramines by calculating an RAA of monthly averages, computed quarterly.
- TTHM and HAA5 by calculating an RAA of quarterly results (or average of results), computed quarterly.

For example, a ground water system serving 8,000 persons monitors for HAA5 (MCL = 0.060 mg/L). At the end of every quarter, the system calculates the RAA using the HAA5 sample result from that and the previous three quarters. To calculate the RAA, the system adds the four HAA5 results then divides the sum by the total number of samples (4).

Table 3. RAA Calculation

Quarter	Sample results used		Running annual average
	Sample taken	Sample result	
Q4 2004	Q1 2004	0.057	$\frac{0.057 + 0.029 + 0.064 + 0.081}{4} = 0.058$
	Q2 2004	0.029	
	Q3 2004	0.064	
	Q4 2004	0.081	
Q1 2005	Q2 2004	0.029	$\frac{0.029 + 0.064 + 0.081 + 0.037}{4} = 0.053$
	Q3 2004	0.064	
	Q4 2004	0.081	
	Q1 2005	0.037	

RAAs give systems a built-in flexibility: even if some individual samples exceed an MCL or MRDL, it is still possible to maintain compliance. EPA uses RAAs to determine compliance because the health risks of chlorine, chloramines, TTHM, and HAA5 are from long-term exposure, and a temporary exceedance does not create a health risk.

Detailed information on monitoring and determining compliance appears later in this guide. Appendix A includes examples of compliance calculations and completed monitoring worksheets. Blank monitoring worksheets are provided in Appendix B.

You must **report** sampling results to your state. If you are monitoring for chlorine and chloramines, you must report these results within 10 days of the end of each quarter in which you monitor. If you monitor for TTHM and HAA5 every quarter, you will also have to report TTHM and HAA5 results within 10 days of the end of each quarter. If you monitor for TTHM and HAA5 less often than quarterly, you only have to report these results within 10 days of the end of the quarters in which you collect your samples (40 CFR 141.134(a)). If you violate a monitoring requirement or an MCL or MRDL, you will also have to report to your customers. Page 22 has more information on reporting requirements.

You should contact your state with any questions on your Stage 1 DBPR compliance requirements. SDWA Primacy Agency contact information is provided in Appendix E and tribal contact information is provided in Appendix F. Appendix D lists some sources of additional information on disinfection and DBPs, and Appendix G lists other documents in the STEP Guide Series.

Chlorine and Chloramines

Monitoring Requirements for Chlorine and Chloramines

DO I HAVE TO MONITOR FOR CHLORINE AND CHLORAMINES?

Excessive amounts of chlorine and chloramines may have adverse health effects. All CWSs and NTNCWSs that add chlorine or chloramines as a disinfectant or an oxidant must monitor for chlorine and chloramine residuals (141.132(c)(1)). The MRDLs for chlorine and chloramines are listed in Table 4.

Remember: if you use chlorine or chloramines as an oxidant (rather than as a disinfectant), you still must monitor for chlorine and chloramine residuals.

HOW OFTEN DO I HAVE TO SAMPLE AND WHERE DO I TAKE THE SAMPLES?

Routine Monitoring

You must measure residual chlorine and chloramine levels at the same times and at the same locations that you take your routine coliform bacteria samples (40 CFR 141.132(c)(1)(i)). The Stage 1 DBPR requires that you monitor for chlorine and chloramines at the same time and locations as your coliform bacteria samples because they are representative of water quality throughout your system.

Table 4 provides the number of routine samples the TCR requires based on population served. Note that the minimum number of samples required by the TCR may be different than the number you currently take based on your TCR sampling site plan.

Table 4: Chlorine and Chloramines MRDLs

Disinfectant	MRDL
Chloramines*	4.0 mg/L
Chlorine*	4.0 mg/L

*as Cl₂

Table 5: Minimum Number of Required Routine Total Coliform Samples

Population Served	Routine Samples per Month	Chlorine and Chloramine Samples per Month
25 to 1,000 persons	1	1
1,001 to 2,500 persons	2	2
2,501 to 3,300 persons	3	3
3,301 to 4,100 persons	4	4
4,101 to 4,900 persons	5	5
4,901 to 5,800 persons	6	6
5,801 to 6,700 persons	7	7

Compliance

Compliance is based on an RAA of the monthly averages of all samples collected in the system. Compliance is calculated quarterly. Table 6 shows the quarters. Detailed information on monitoring and determining compliance appears later in this guide. Appendix A includes examples of compliance calculations and completed monitoring worksheets. Blank monitoring worksheets are provided in Appendix B.

Systems may temporarily need to increase chlorine and chloramine levels to address specific microbiological contamination problems caused by events such as distribution line breaks, storm water run-off, source water contamination, or cross-connection contamination. By basing compliance on an RAA rather than on individual sample results, EPA gives systems the flexibility to temporarily use higher-than-normal levels of disinfectants to address specific problems without falling out of compliance with the Stage 1 DBPR.

Increased Monitoring

Technically, there is no increased monitoring requirement for chlorine and chloramines. However, you must take one sample for chlorine or chloramines for every TCR sample you take. This means that if you are required to take repeat coliform samples because a routine sample is positive, you are also required to take additional chlorine or chloramines samples at the same time and same locations as the repeat TCR samples.

Reduced Monitoring

Reduced monitoring for chlorine and chloramines is technically not permitted under the Stage 1 DBPR. However, CWSs and NTNCWSs that serve 1,000 persons or fewer and have been allowed by the state to reduce TCR monitoring may also reduce monitoring for chlorine and chloramines to match their TCR monitoring schedule.

Table 6: Compliance Quarters

Months	Quarter
January - March	1
April - June	2
July - September	3
October - December	4

TTHM and HAA5

Monitoring Requirements for TTHM and HAA5

DO I HAVE TO MONITOR FOR TTHM/HAA5?

Because of the adverse health effects of the group of chemicals called TTHM and HAA5, all CWSs and NTNCWSs that add a chemical disinfectant must monitor for TTHM and HAA5 (40 CFR 141.132(b)). If you add an oxidant that is not a disinfectant such as potassium permanganate and **do not** add a disinfectant to the water, you are not required to monitor for TTHM and HAA5. The MCLs for TTHM and HAA5, as well as lists of the individual chemicals included in each regulated group, are listed in Table 7.

If you use a chemical disinfectant as an oxidant, you still must monitor for TTHM and HAA5, even if you are not using the chemical for disinfection.

HOW OFTEN DO I HAVE TO SAMPLE?

Routine and Increased Monitoring

How often you sample for TTHM and HAA5 depends on your system's size, source of water, number of treatment plants, and sampling results. Table 8 will help you determine how often you need to sample.

Remember that your TTHM and HAA5 monitoring requirements are tied together. If you exceed the MCL for **either** TTHM or HAA5, you must increase monitoring for **both** TTHM and HAA5.

Table 7: TTHM and HAA5 MCLs

Disinfection Byproduct	MCL (mg/L)
TTHM	0.080
Trichloromethane (Chloroform)	
Bromodichloromethane	
Tribromomethane (Bromoform)	
Dibromochloromethane	
HAA5	0.060
Monochloroacetic Acid	
Dichloroacetic Acid	
Trichloroacetic Acid	
Monobromoacetic Acid	
Dibromoacetic Acid	

Table 8: TTHM/HAA5 Routine and Increased Monitoring Frequency and Monitoring Locations*

DBP	MCL (mg/L)	System Type	Routine Monitoring Frequency	Routine Monitoring Location	Increased Monitoring Trigger	Increased Monitoring Frequency	Increased Monitoring Locations
TTHM and HAA5	0.080 (TTHM)	Subpart H systems serving from 500 to 9,999	1 sample per plant per quarter**	Location(s) representative of maximum residence time (MRT)	X	X	X
	0.060 (HAA5)	Subpart H systems serving < 500	1 sample per plant per year** during the month of warmest water temperature		A sampling result > 0.080 for TTHM or > 0.060 for HAA5	Quarterly, beginning the quarter following the trigger results	Same as routine
		Ground water systems serving < 10,000					

* 40 CFR 141.132(b)(1)(i).

** Multiple wells drawing water from a single aquifer may be considered one treatment plant for determining the minimum number of samples required (with state approval) (40 CFR 141.132(b)(1)(i)).

If you are required to sample once per year during the month of warmest water temperature and you exceed the MCL for either TTHM or HAA5, you must increase monitoring for both contaminants to once per quarter. An exceedance of the MCL does not trigger an MCL violation unless your result is so high that your RAA will exceed the MCL regardless of your monitoring results for the next 3 quarters. More information on calculating compliance is provided on page 20. To return to routine annual monitoring, you must achieve an RAA of no greater than 0.060 mg/L for TTHM and no greater than 0.045 mg/L for HAA5 after at least 1 year of monitoring. These levels are three-quarters (75 percent) of the MCL.

Reduced Monitoring

You may be able to reduce your monitoring frequency for TTHM and HAA5 (with prior written permission from the state). Criteria to qualify for reduced monitoring varies according to system type. Table 9 provides information on reduced monitoring requirements.

If you qualify for reduced monitoring, you may remain on reduced monitoring as long as your result or average of results does not exceed 0.060 mg/L for TTHM or 0.045 mg/L for HAA5 (i.e., 75 percent of the MCL). If your system exceeds **either** of these levels, you must return to a **routine monitoring schedule** for **both** contaminants in the quarter immediately following the monitoring period in which your system

exceeds either of these levels. If you operate a ground water system serving fewer than 10,000 persons and your reduced monitoring results exceeds **either** the MCL for TTHM or the MCL for HAA5, you must begin **increased monitoring** (i.e., once per quarter) for **both** contaminants in the quarter immediately following the monitoring period in which your system exceeds either of these levels. Remember, an exceedance of the TTHM or HAA5 MCL does not necessarily result in an MCL violation. The compliance section on page 20 provides more information on determining compliance.

Table 9: TTHM/HAA5 Reduced Monitoring Frequency and Monitoring Locations

System Type	Reduced Monitoring Trigger*			Reduced Monitoring Frequency	Reduced Monitoring Locations
	TTHM RAA	HAA5 RAA	Annual Average Source Water Total Organic Carbon (TOC)**		
Subpart H systems serving from 500 to 9,999	≤ 0.040 mg/L (i.e., 50 percent of the MCL) for 2 consecutive years***	≤ 0.030 mg/L (i.e., 50 percent of the MCL) for 2 consecutive years***	≤ 4.0 mg/L (before treatment)***	One sample per treatment plant per year during the month of warmest water temperature	Location of MRT
Subpart H systems serving < 500	Not eligible for reduced monitoring				
Ground water systems serving < 10,000	≤ 0.040 mg/L (i.e., 50 percent of the MCL) for 2 consecutive years***	≤ 0.030 mg/L (i.e., 50 percent of the MCL) for 2 consecutive years***	X	One sample per treatment plant per 3-year monitoring cycle**** during the month of warmest water temperature	Location of MRT
	≤ 0.020 mg/L (i.e., 25 percent of the MCL) for 1 year***	≤ 0.015 mg/L (i.e., 25 percent of the MCL) for 1 year***			

*Systems sampling more than once per year will use an RAA (calculated by averaging quarterly averages) while systems sampling only once a year will use the results for that month (single result or average of all results for that month).

**In general, only systems using conventional filtration are required to monitor for TOC. A Subpart H system serving from 500 to 9,999 persons and not using conventional filtration, however, must also monitor for TOC if the system wants to reduce TTHM/HAA5 monitoring. This monitoring is only required if a system wants to qualify for reduced monitoring.

***40 CFR 141.132(b)(1)(ii).

**** The 3-year cycle begins on the 1st of January after the system qualifies for reduced monitoring.

WHERE DO I TAKE THE SAMPLES?

If you serve fewer than 10,000 persons and you collect the minimum number of samples required for routine monitoring for TTHM and HAA5, you must take all these samples at the location or locations representative of the Maximum Residence Time (MRT).

The point of MRT for each plant is an *active* point (that is, the location is currently providing water to customers) in the distribution system where the water has been in the system the longest. This *active* point may not necessarily be the same as the *most distant* point from the treatment plant. Many factors can affect the location or locations determined to represent MRT, including the number of plants operating at the time of monitoring and seasonal variations in population.

If you collect more than the minimum number of samples, at least one quarter (25 percent) of the samples must be collected at the location(s) representative of MRT. The remaining samples must be taken at locations representative of average residence time in the distribution system (40 CFR 141.132(b)(1)(i)). If you operate a system with multiple treatment plants, you may have more than one location of MRT or the MRT may vary from quarter to quarter, depending on which plants are operating. Contact your state for assistance in determining your location(s) of MRT.

Analysis, Compliance, and Reporting

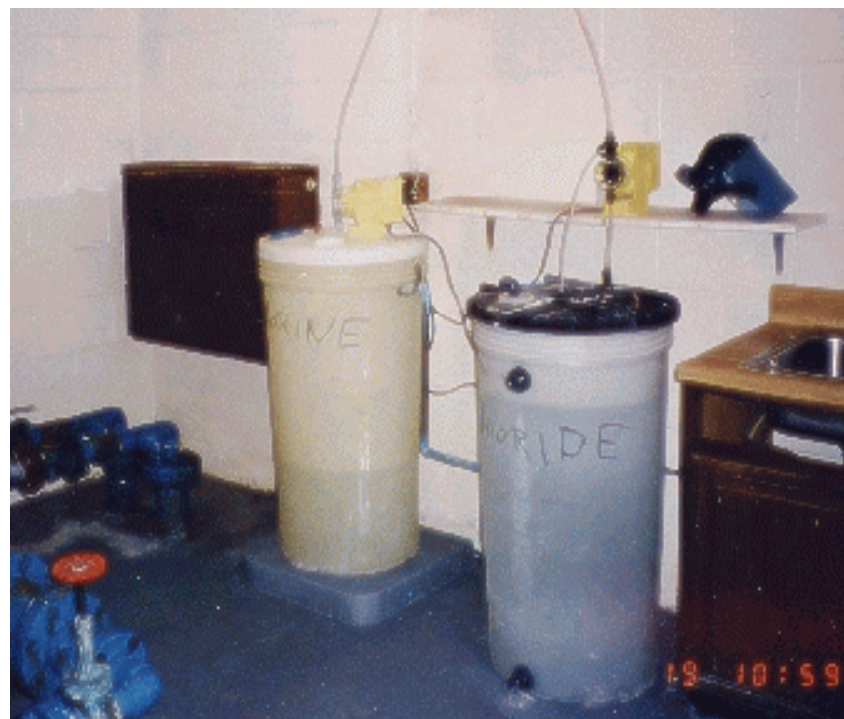
Who Must Analyze My Samples?

The Stage 1 DBPR specifies analytical methods for measuring each relevant water quality parameter covered by the Rule. You must use analytical methods specified in the Rule or otherwise approved by EPA to monitor and show compliance under the Stage 1 DBPR.

For more information on analytical methods, see 40 CFR 141.131 or refer to the *Stage 1 Disinfectants and Disinfection Byproducts Rule: Laboratory Quick Reference Guide* (EPA 816-F-02-021), available online at: www.epa.gov/safewater/publicoutreach/quickreferenceguides.html.

Only laboratories certified by EPA or your state can analyze samples for TTHM and HAA5. Contact your state for a list of certified labs.

EPA believes that samples for chlorine and chloramines can be adequately analyzed on-site by a party approved by EPA or the state. Your system operator may qualify. Contact your state for more information. State contact information is provided in Appendix E; tribal Contact information is provided in Appendix F.



A chemical feed pump with chemical storage (day tanks)

How Do I Determine Compliance?

Unless you are collecting samples for chlorine dioxide and chlorite or only collecting one sample a year, compliance is determined by calculating an RAA. How you calculate the RAA may differ for each disinfectant and DBP. Compliance calculations may change if your monitoring requirements change. In all cases, compliance is calculated at the end of each quarter, and you should use data collected for the last 12 months, not simply the current calendar year.

You must calculate RAAs for a contaminant or disinfectant at the end of every quarter in which you collect samples for that contaminant or disinfectant. If you are required to monitor **at least once a quarter** for a contaminant or disinfectant, calculate compliance **at the end of each quarter**. If you are required to monitor **less frequently than once a quarter**, calculate compliance **at the end of each quarter in which you collected samples**.

If any sample causes the RAA to exceed an MCL or MRDL, the system is in violation of the MCL or MRDL immediately. The system cannot wait until the end of the calendar year to assess an MCL violation. To illustrate this concept, the following example shows a system that has collected quarterly samples for TTHM in quarters 2, 3, and 4 of 2005 and quarter 1 of 2006. The results for the four quarterly samples the system has taken are as follows:

Quarter 2, 2005: 0.100 mg/L
Quarter 3, 2005: 0.100 mg/L
Quarter 4, 2005: 0.090 mg/L
Quarter 1, 2006: 0.090 mg/L

The system calculates its RAA at the end of the first quarter of 2006. The RAA (0.095 mg/L) violates the MCL (0.080 mg/L). The system has committed an MCL violation and must report to the state. It cannot wait until the end of the calendar year to assess its MCL violation.

TAKE NOTE!

- ▶ When you calculate your RAA, you must use all the compliance samples identified in your monitoring plan.
- ▶ If you do not collect all of the required samples, you have committed a monitoring violation. Take the average of the samples you have collected to determine if you have also violated an MCL or MRDL.
- ▶ Only include compliance samples in your compliance calculations. Do not include any additional operational samples your system takes in your calculations.

Table 10 presents compliance criteria and identifies MCL and MRDL violations. You can find detailed examples of how to calculate compliance in Appendix A of this document. Sample monitoring worksheets and instructions for completing the worksheets are in Appendix B.

Table 10: Determining Compliance

Chemical	Monitoring Frequency	Compliance is based on:	You have a MCL or MRDL violation if:
Disinfectant Residual			
Chlorine & Chloramines*	Monthly (Same time as TCR)	An RAA of monthly averages, computed quarterly. At the end of each quarter, average the monthly averages for the last 12 months to determine the RAA.	The RAA of monthly averages is > 4.0 mg/L.
Disinfection Byproduct			
TTHM & HAA5**	Quarterly	An RAA of quarterly results or quarterly averages, computed quarterly.	<ol style="list-style-type: none"> 1. The RAA is > 0.080 mg/L for TTHM or > 0.060 mg/L for HAA5; or, 2. If you have not yet collected 4 quarterly samples and any sampling result will cause your RAA to exceed the MCL.
	Less often than quarterly	An average of the sampling results taken in the last 12 months. For systems monitoring annually, compliance is based on the result of the annual sample or average of annual samples if more than one sample is taken. If the result is > MCL, the system must begin quarterly monitoring and determine compliance each quarter using an RAA of quarterly results.	You cannot violate the MCL while monitoring annually unless your sample, divided by four, is greater than the MCL. If you exceed the MCL while monitoring annually, but your sample, divided by four, is not greater than the MCL, you have not committed a violation, but must begin quarterly monitoring. You have committed an MCL violation anytime the sum of your results (or quarterly averages, if you are taking more than one sample per quarter) divided by 4 is > 0.080 mg/L for TTHM or > 0.060 mg/L for HAA5.

* 40 CFR 141.133(c)(1)

** 40 CFR 141.133(b)(1)

For compliance calculation examples, including the calculation of RAAs, see Appendix A.

What Do I Report to the State?

ROUTINE MONITORING REPORTS

All public water systems (PWSs) subject to the Stage 1 DBPR must report to their state. If you are monitoring for chlorine and chloramines, you must report within 10 days following the end of each quarter (40 CFR 141.134(a)).

If you are monitoring for TTHM and HAA5 every quarter, you must report to the state within 10 days following the end of each quarter. Under some conditions, you will monitor for TTHM and HAA5 annually or less frequently. You must report information on these contaminants in the routine sampling report within 10 days following the end of the quarter in which samples were collected (40 CFR 141.134(a)). For example, if you take an annual sample in August, you must report to the state by October 10, 10 days after the end of the third quarter.

Note that since you may not have to monitor for all contaminants every quarter, the contents of your routine sampling report may vary from quarter to quarter (i.e., you may not have to report results for TTHM and HAA5 every quarter, but you will still report chlorine and chloramines monitoring results every quarter). To illustrate this concept, the following example lists the information System A will include in its quarterly reports to the state in two consecutive quarters. System A monitors for chlorine every month and TTHM and HAA5 once a year. In the third quarter of 2005, the system collects chlorine samples in July, August, and September. In August, the month of warmest water temperature, System A collects its annual TTHM and HAA5 sample. System A's quarterly report for the third quarter includes its required information for chlorine and TTHM and HAA5. In the fourth quarter of 2005, the system collects chlorine samples in October, November, and December. It does not collect any TTHM and HAA5 samples. Its quarterly report for the fourth quarter only includes its required chlorine information.

Table 11 shows the information that must be included in your routine sampling report, depending on how often you monitor.

NOTE:

To make sure that you can report to the state within 10 days of the end of a monitoring period, you should allow enough time for the lab to perform the analysis and for you to receive the results and complete the compliance calculations. You should also allow enough time to take a replacement sample should the original be misplaced or mishandled.

MCL, MRDL, AND MONITORING VIOLATIONS

If you violate an MCL for TTHM or HAA5 or an MRDL for chlorine or chloramines, you must notify the state within 48 hours. In addition, you must provide Tier 2 public notice to your customers within 30 days (40 CFR 141.203(b)(1)). If you violate a TTHM, HAA5, chlorine, or chloramines monitoring requirement (i.e., you fail to take a required sample), you must report to your customers within 1 year. Information on public notification (PN) requirements is included in the next section of this guide. Check with your state for more information.

Table 11: Routine Sampling Report Information

Disinfectant Residual	Monitoring Frequency	If You Sample, You Must Report:
Chlorine & Chloramines*	Same as TCR	<ol style="list-style-type: none"> 1. The number of samples taken during each month of the last quarter 2. The monthly average of all samples taken in each month for the last 12 months 3. The average of the monthly averages for the last 12 months 4. Whether the MRDL was violated
DBP	Monitoring Frequency	If You Sample, You Must Report:
TTHM & HAA5**	Quarterly or more frequently	<ol style="list-style-type: none"> 1. Number of samples taken in the last quarter 2. Location, date, and analytical result of each sample taken that last quarter 3. Average of all samples taken that last quarter (quarterly average) 4. Annual average of quarterly averages for the last 4 quarters 5. Whether the MCL was violated
	At least once a year	<ol style="list-style-type: none"> 1. Number of samples taken during the previous 12 months 2. Location, date, and result of each sample taken during the previous 12 months 3. Average of all samples taken over the previous 12 months 4. Whether the MCL was violated
	Less than once a year	<ol style="list-style-type: none"> 1. Location, date, and result of each sample taken 2. Whether the MCL was violated

* 40 CFR 141.134(c)

** 40 CFR 141.134(b)

What Do I Report to My Customers?

Letting your customers know what is happening with their water system is part of your legal responsibility. In addition, informed customers are more likely to understand the need for new treatment systems, infrastructure changes, and rate increases. While you should try to communicate with your customers on a regular basis, you **must** provide information in the following situations:

ROUTINE CONSUMER CONFIDENCE REPORTS

By July 1 of every year, you must make a consumer confidence report (CCR) available to your customers (40 CFR 141.152(b)). This report is designed to provide a “snapshot” of the quality of the water supplied by your system over the past year. In your CCR, you must tell your customers about any violations, the actions you took to fix the violations, and any potential health effects resulting from the violations. You can find more information about CCRs on EPA’s CCR Web site, www.epa.gov/safewater/drinkingwaterquality/index.html.

PUBLIC NOTIFICATION IN THE CASE OF A VIOLATION

If you have a TTHM or HAA5 MCL violation or a chlorine or chloramines MRDL violation, you must provide Tier 2 public notice: that is, you must let your customers know within 30 days by using at least one of a variety of PN methods (40 CFR 141.203(b)(1)).

Unless otherwise directed by your state, you must provide notice to each customer receiving a bill, to other service connections to which your system delivers water, and to other people regularly served by your system who would not otherwise receive notice (e.g., house renters, students, nursing home patients, prison inmates). You must use at least one of a variety of PN methods. You can deliver the notice door-to-door or send it via mail. If you operate a non-community water system, you can also post the notice in a public place. If any of your customers will not receive the notice through mail, door-to-door delivery, or postings, you must also use other methods, like a newspaper or radio announcement, to reach these customers (40 CFR 141.203(c)). Within 10 days of notifying your customers, you must submit to the state both a certification that you have fully complied with the PN regulations and a copy of the PN.

REMEMBER!

You must send your state copies of all PNs sent to your customers for Stage 1 DBPR monitoring, MCL, and MRDL violations. The copies must be sent with a letter stating that you have met all the requirements of the Public Notification Rule. This must be done **within 10 days** of sending out a public notice.

All monitoring violations must be reported to the state and to your customers. Generally, monitoring violations require Tier 3 public notice: that is, you must notify your customers within 12 months of the violation. You may include the notification in your CCR if it is published in time to satisfy the 12-month deadline. Your state has the discretion to impose more stringent PN requirements. Check with your state for more information.

All PNs must include the following specific health effects language for the appropriate contaminant or residual (40 CFR Subpart Q, Appendix B):

- **Chlorine:** “Some people who use water containing chlorine well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chlorine well in excess of the MRDL could experience stomach discomfort.”
- **Chloramines:** “Some people who use water containing chloramines well in excess of the MRDL could experience irritating effects to their eyes and nose. Some people who drink water containing chloramines well in excess of the MRDL could experience stomach discomfort or anemia.”
- **TTHM:** “Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience problems with their liver, kidneys, or central nervous system, and may have an increased risk of getting cancer.”
- **HAA5:** “Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.”

How Can I Achieve and Maintain Compliance?

Although the Stage 1 DBPR dictates water quality standards for disinfectant residuals and DBPs, systems have choices in how to meet those requirements. Modifying treatment processes, changing your source water, and forming a partnership with another system are some of the most common ways to comply with the Stage 1 DBPR.

MODIFYING TREATMENT

Some practical ways of reducing DBP formation include:

- Decreasing contact time and/or the concentration of disinfectant (as long as adequate microbial protection is maintained!)
- Changing disinfectants or using chloramines as a secondary disinfectant in conjunction with chlorine
- Adjusting the pH of your water

CHANGING YOUR SOURCE WATER

If high levels of DBP precursors in your source water lead to high levels of DBPs in your treated water, you may want to consider blending your current source water with water from a source with lower DBP precursor levels. The lower levels of DBP precursors in the blended water may lower your levels of DBPs and help you comply with the Rule.

Another alternative is abandoning your source and developing a new one. Developing a new water source is expensive, but it may in some cases be the most cost-effective way to lower DBP levels in the long run. Before changing water sources, however, consider that a new water source may have lower levels of DBP precursors but higher levels of other contaminants. In addition, switching from a ground water source to a surface water or GWUDI source will subject your system to additional regulations.

Caution!

Restructuring and source water changes should only be undertaken after a careful study of what the changes will mean for your system and in consultation with your state. The resulting adjustments may directly impact the effectiveness of the disinfection process, increase risk of microbial contamination, and affect your ability to comply with other rules such as the LT1ESWTR, the TCR, and the Lead and Copper Rule.

PARTNERSHIPS WITH OTHER WATER SYSTEMS

Small water systems face many of the same technical challenges larger systems face, but often lack their resources. Working with other water systems (e.g., joining with one or more communities to form a consolidated system, consolidating management, or purchasing water from another established system) may allow you to lower costs, simplify management, and more consistently provide your customers with safe drinking water.

How Can Stage 1 DBPR Requirements Affect Compliance with Other Rules?

Changes you make to address DBP formation and disinfectant levels may also lead to changes in water characteristics that could negatively affect your compliance with other regulations. For example, if you operate a Subpart H system, a disinfectant residual of zero may keep you in compliance with the Stage 1 DBPR but will put you out of compliance with the Surface Water Treatment Rule (SWTR). This is because the SWTR requires surface water or GWUDI systems to maintain some residual level of disinfectant in the distribution system to ensure adequate disinfection of pathogens.

The challenge for you is to find the level of disinfection that allows you to comply simultaneously with all applicable rules. This section of the guide addresses some simultaneous compliance issues you should consider while implementing the Stage 1 DBPR at your system. For more information, refer to EPA's *Microbial Disinfectant Byproduct Simultaneous Compliance Manual*, available online at www.epa.gov/safewater/mdbp/implement.html.

LEAD AND COPPER RULE

Under the Lead and Copper Rule (LCR), exceedances of the lead and copper action levels trigger specific compliance actions, which include employing corrosion control practices. The three basic approaches for achieving corrosion control include pH/alkalinity adjustment, corrosion inhibitor addition, and calcium hardness adjustment. Increasing pH to comply with the corrosion control treatment requirement can increase TTHM levels. A higher pH may also cause systems to increase their disinfectant concentration and/or contact time to remain in compliance with the LT1ESWTR. A higher disinfectant dosage and/or concentration time may also increase DBP formation.

In addition, any change a system makes to its treatment process to comply with the Stage 1 DBPR that leads to altered water chemistry (e.g., increased disinfectant doses, enhanced coagulation, or a change in disinfectants) may impact the corrosion rate and release of lead or copper.

TOTAL COLIFORM RULE

The TCR and the Stage 1 DBPR are closely related, not only because chlorine and chloramine monitoring requirements are tied to TCR monitoring requirements, but also because microbial contamination (including coliform bacteria contamination) is generally controlled by using disinfectants. An increase in microbial levels could require higher levels of disinfectants. Although the Stage 1 DBPR contains built-in flexibilities to allow you to address microbial contamination events, if you use high enough levels of disinfectants for long enough periods of time, you could commit an MRDL violation.

Remember!

You will have to collect additional samples for chlorine and chloramines whenever you are required to collect additional samples for total coliform as a consequence of a total coliform-positive sample.

Maintaining microbial protection through the use of secondary disinfection while keeping DBP and disinfectant concentrations below new MCLs and MRDLs could present a problem for systems with very long residence times (i.e., days).

LONG-TERM 1 ENHANCED SURFACE WATER TREATMENT RULE

The Stage 1 DBPR strives to minimize the formation of DBPs and keep disinfectants at safe levels. On the other hand, the LT1ESWTR aims to protect customers from exposure to pathogens by ensuring an adequate level of disinfection. Although most systems will be able to comply with both rules simultaneously, you may face additional LT1ESWTR requirements depending on how you choose to comply with the Stage 1 DBPR requirements. For instance, if you want to attempt to comply with the Stage 1 DBPR MCLs and MRDLs by making a significant change to your treatment practices, you are required under the LT1ESWTR to consult with your state prior to doing so. Check with your state for more information.

What Resources Can I Use to Comply with the Stage 1 DBPR?

You may find that you need outside assistance to comply with the Stage 1 DBPR. Some water systems may decide that an investment in infrastructure is necessary to comply with the Stage 1 DBPR. Other systems may need to find other resources, such as training and technical assistance. There are a number of agencies and organizations that can help you fill these needs. Some of these agencies are listed below. Your state may also have additional sources of assistance for which your system may qualify. Contact your state or tribe for more information. Contact information is provided in Appendices E and F.

Major Providers of Financial Assistance to Drinking Water Systems		
Name of Program	Description	Contact Information
Drinking Water State Revolving Fund (DWSRF)	These state-administered loans enable water systems to finance infrastructure improvements, provide training, and fund source water protection activities.	www.epa.gov/safewater/dwsrf/#contact Safe Drinking Water Hotline at (800) 426-4791
Rural Utilities Service (RUS) Water and Wastewater Loan and Grant Program	This program offers loans and grants to develop water and waste-disposal systems in rural areas to reduce user costs.	www.usda.gov/rus/water/states/usamap.htm (202) 720-9540
State-specific programs	Your state may offer additional funding programs.	See Appendix E for state contact information
Tribal-specific programs	EPA gives grants (not loans) to tribes through the DWSRF Tribal Set-Aside program for improvements to water systems that serve tribes. States and the Indian Health Service may provide additional financial assistance.	See Appendix F for tribal contact information

Other Potential Sources of Financing or Financial Assistance for Drinking Water Systems		
Name of Program	Description	Contact Information
Community Development Block Grants (CDBG)	This program offers grants to disadvantaged cities, urban counties, and states to develop viable communities.	www.hud.gov/offices/cpd/communitydevelopment/programs/stateadmin/stateadmincontact.cfm (202) 708-1112
Public Works and Infrastructure Development Grants	These grants help distressed communities overcome barriers that inhibit the growth of their local economies.	www.doc.gov/eda/HTML/1c_regloffices.htm (202) 482-5081
National Bank for Cooperatives Loan Program (CoBank)	CoBank provides loans to larger, credit-worthy rural utilities.	www.cobank.com (800) 542 -8072
Rural Community Assistance Corporation (RCAC)	RCAC provides loans to rural utilities in 11 western states to help meet the financing needs of rural communities and disadvantaged populations.	www.rcac.org/programs/serv-financial.html (916) 447-2854
Small Business Administration (SBA)	SBA helps small businesses get low-interest loans.	www.sba.gov (800) 827-5722
Local Commercial Banks	Banks in your community can offer loans to help finance capital improvements. Although interest rates may not be as favorable as other options, it may be easier for you to negotiate a loan through a local bank.	Talk to your city clerk about what banks in your area most closely match your needs.

Before you apply for funding, find out what each source will pay for and what information they will need to consider in your application. Ask about local matching fund requirements, application procedures, what makes a project “fundable,” and special program requirements and restrictions. Ask to see applications from previously funded projects. Get an idea of what information is required for an application; most lending and granting agencies will want to see financial statements such as budgets, income statements, and cash flow documents.

Appendices

Appendix A: Compliance Determination Examples

The following examples are designed to help you understand the requirements of the Stage 1 DBPR. Monitoring examples, including a detailed narrative of monitoring activities for each contaminant, are provided, followed by portions of completed monitoring worksheets showing sampling results and compliance calculations. Blank copies of the monitoring worksheets are provided in Appendix B for your use. Please note that the completed worksheets that accompany the examples are abbreviated versions of the blank copies provided.

Remember:

- 1) Compliance is calculated separately for the TTHM MCL and the HAA5 MCL.
- 2) Monitoring locations and schedules are identical for both groups.
- 3) Increased monitoring triggered by one of the sample results (e.g., TTHM) would apply to TTHM and HAA5.

The monitoring requirements listed in these examples correspond to the type of system described in each example, and may be different than the requirements for your system.

CHLORINE AND CHLORAMINES

Example #1: A Ground Water CWS Monitoring for Chlorine (Monthly)

This example discusses how a ground water CWS serving 2,000 persons would calculate compliance with the chlorine MRDL based on 12 months of sampling results.

This ground water system serving 2,000 persons uses chlorine for disinfection. According to its TCR sampling site plan, it collects two samples per month for total coliform bacteria. Therefore, the system is required to collect two chlorine disinfectant residual samples per month. The samples must be collected at the same time and locations as the coliform samples (based on the system's TCR sampling site plan). On April 18, 2005, the system collects its monthly samples for April of 2005. The system calculates the monthly average by adding the values of samples taken (1.2 mg/L and 1.0 mg/L) and dividing by the total number of samples (2). The result (1.1 mg/L) is the system's average for that month. No further action is required.

In May, the system increases the level of chlorine in the water to address a source water contamination problem. The system's samples in May (4.5 mg/L and 5.1 mg/L) and the monthly average (4.8 mg/L) exceed the MRDL (4.0 mg/L). Because compliance is based on an RAA calculated every quarter, and not on individual monthly results, the system has not yet committed a violation.

June marks the end of the second quarter of 2005. After the system collects its two routine samples and calculates the monthly average, it must also calculate an RAA using the monthly averages for the last 12 months. The monthly averages for April, May, and June (shown on the worksheet) are 1.1 mg/L, 4.8 mg/L, and 1.3 mg/L. The monthly averages for July 2004 through March 2005 are as follows: 1.1 mg/L, 1.0 mg/L, 1.5 mg/L, 1.1 mg/L, 1.2 mg/L, 1.3 mg/L, 1.1 mg/L, 1.5 mg/L, and 1.0 mg/L. The system calculates compliance by adding the monthly averages for the last 12 months and dividing by the number of monthly averages (12):

$$\frac{1.1+1.0+1.5+1.1+1.2+1.3+1.1+1.5+1.0+1.1+4.8+1.3 \text{ mg/L}}{12} = \frac{18.0\text{mg/L}}{12} = 1.5 \text{ mg/L} \leq \text{MRDL}$$

The RAA is less than the MRDL. The system is in compliance, even though one monthly average (May 2005) exceeded the MRDL. The Rule includes this flexibility to allow systems to address specific microbiological contamination problems caused by events such as distribution line breaks, source water contamination, or cross connection contamination without creating an MRDL violation. No further action is required other than submitting the routine monitoring report due by the 10th of the month following the end of the quarter. In this example, after the second quarter of 2005, the routine report to the state is due on or before July 10, 2005.

Example #1 Worksheet

Chlorine/Chloramines Monitoring Worksheet							
MRDL for Chlorine: 4.0 mg/L				MRDL for Chloramines: 4.0 mg/L			
Monthly Sample Number and Type	Date Sample Collected	Sample Location	Results	Monthly Average	Compliance Calculation	Follow-up Action Taken	Date Report Sent to State
<i>Enter appropriate number and type</i>	<i>Day, month and year</i>	<i>Consult your TCR Sampling Site Plan</i>	<i>Used for monthly avg.</i>	<i>Used for RAA</i>	<i>Running annual avg. computed quarterly (Circle if above MRDL)</i>	<i>Check appropriate box</i>	<i>Routine or violation notice</i>
1 <input checked="" type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines	4/18/05	7 Water St.	1.2 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
2 <input checked="" type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines	4/18/05	12 Main St.	1.0 mg/L	1.1 mg/L		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
1 <input checked="" type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines	5/23/05	34 High St.	4.5 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
2 <input checked="" type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines	5/23/05	7 Water St.	5.1 mg/L	4.8 mg/L		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
1 <input checked="" type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines	6/18/05	27 South Rd.	1.5 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
2 <input checked="" type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines	6/18/05	11 Post Rd.	1.1 mg/L	1.3 mg/L	$(1.1+1.0+1.5+1.1+1.2+1.3+1.1+1.5+1.0+1.1+4.8+1.3 \text{ mg/L})/12 = 1.5 \text{ mg/L}$	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	Routine: 6/19/05

* Results from previous months' monitoring

Example #2: A Surface Water CWS Monitoring for Chloramines (TCR Repeat Samples)

This example will show how a surface water system serving 750 persons using chloramines to maintain a distribution system disinfectant residual will increase chloramine sampling based on increased required TCR monitoring in the distribution system after a total coliform-positive sample result.

This surface water system serving 750 persons uses chloramines and, according to its TCR monitoring plan, collects one sample per month for total coliform bacteria. It is therefore required to sample for chloramines once a month at the same time and location. On June 14, 2005, the system collects its routine monthly chloramine sample at the same time and location in the distribution system as its TCR sample. The chloramine result is 0.5 mg/L. Although the chloramine result is below the MRDL (4.0 mg/L), the system's TCR routine sample is total coliform-positive. This means that the system will have to collect a set of repeat total coliform bacteria samples within 24 hours of the positive result (typically, this means within 24 hours of being notified of a total coliform-positive result). Since the system only collects one sample per month, it will have to collect at least four repeat samples and will also have to collect four additional chloramine samples.

The system takes its additional total coliform and chloramine samples on June 16, 2004 (24 hours after the lab notifies the system of the coliform-positive result). The samples are taken at:

- The original sample location – one repeat samples
- Within five service connections upstream – one repeat sample
- Within five service connections downstream – one repeat sample
- Another location in the distribution system – one repeat sample

The system will use the four additional chloramine samples (2.8 mg/L, 2.8 mg/L, 2.4 mg/L, and 2.7 mg/L) in addition to the original routine chloramine sample (five total) to calculate its monthly chloramine average:

$$\frac{0.5 + 2.8 + 2.8 + 2.4 + 2.7 \text{ mg/L}}{5} = \frac{11.2 \text{ mg/L}}{5} = 2.2 \text{ mg/L}$$

The system will use 2.2 mg/L as the monthly average for calculating an RAA (as illustrated in example #1).

Note that the system will have to collect at least five total coliform bacteria samples the following month, based on TCR requirements. Thus, the system will also have to collect five chloramine samples at the same times and locations and calculate a monthly average as illustrated above.

Example #2 Worksheet

Chlorine/Chloramines Monitoring Worksheet							
MRDL for Chlorine: 4.0 mg/L				MRDL for Chloramines: 4.0 mg/L			
Monthly Sample Number and Type	Date Sample Collected	Sample Location	Results	Monthly Average	Compliance Calculation	Follow-up Action Taken	Date Report Sent to State
<i>Enter appropriate number and type</i>	<i>Day, month and year</i>	<i>Consult your TCR Sampling Site Plan</i>	<i>Used for monthly avg.</i>	<i>Used for RAA</i>	<i>Running annual avg. computed quarterly (Circle if above MRDL)</i>	<i>Check appropriate box</i>	<i>Routine or violation notice</i>
1 <input type="checkbox"/> Chlorine <input checked="" type="checkbox"/> Chloramines	6/14/05	27 Green St.	0.5 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
2 <input type="checkbox"/> Chlorine <input checked="" type="checkbox"/> Chloramines	6/16/05	27 Green St.	2.8 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
3 <input type="checkbox"/> Chlorine <input checked="" type="checkbox"/> Chloramines	6/16/05	25 Green St.	2.8 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
4 <input type="checkbox"/> Chlorine <input checked="" type="checkbox"/> Chloramines	6/16/05	15 Green St.	2.4 mg/L	N/A		<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
5 <input type="checkbox"/> Chlorine <input checked="" type="checkbox"/> Chloramines	6/16/05	40 Green St.	2.7 mg/L	2.5 mg/L		<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	Routine – 7/10/05

TTHM AND HAA5

Example #3: A Ground Water CWS Monitoring for TTHM (Routine to Increased Monitoring)

This example shows how a ground water system using chlorine that serves fewer than 500 persons responds to an MCL exceedance during routine annual monitoring at the location of MRT in the distribution system. Although it will not be discussed in detail in this example, the system will also monitor for HAA5 and adjust the HAA5 monitoring schedule to match any changes that occur to the TTHM monitoring schedule based on sample results. In addition, the system will monitor for chlorine. For the purposes of this example, assume that the system collects all appropriate companion HAA5 samples and that all the sample results are less than the MCL for HAA5.

This ground water system serves fewer than 500 persons, has only one plant, uses chlorine and must monitor for TTHM and HAA5 once a year at the location of MRT. The system collects its routine MRT samples on August 23, 2005 because August is its month of warmest water temperature. Since the TTHM result (0.052 mg/L) is less than the MCL for TTHM (0.080 mg/L), no further action is required except to report to the state by October 10, 2005 (10 days after the end of the quarter in which the sample was taken).

The following year, however, the system's routine MRT sample (taken on August 14, 2006) for TTHM is 0.091 mg/L, which is above the MCL. Regardless of its HAA5 sample result, the system must immediately begin quarterly monitoring for both TTHM and HAA5. The routine annual sample (taken on August 14, 2006) becomes the first quarterly result and will be used to calculate the RAA.

To assess its compliance status for TTHM, the system assumes that the next three quarterly results will be "zero" (a "best case scenario") to calculate its RAA:

$$\text{RAA} = \frac{0.091\text{mg/L (Q1)} + 0.000 \text{ (est. Q2)} + 0.000 \text{ (est. Q3)} + 0.000 \text{ (est. Q4)}}{4} = 0.023 \text{ mg/L} \leq \text{MCL}$$

The system must increase monitoring frequency for both TTHM and HAA5 to quarterly because its routine annual TTHM sample (0.091 mg/L) exceeded the MCL (0.080 mg/L), but the system does not conduct any other follow-up (except to send in a routine monitoring report) because there is no *violation* of the MCL, since violations are based on the RAA. The sample from August 14, 2006 counts as the first quarterly sample used to calculate the RAA.

Example #3 Worksheet

TTHM/HAA5 Monitoring Worksheet						
MCL for TTHM: 0.080 mg/L			MCL for HAA5: 0.060 mg/L			
Monitoring Period	Date Sample Collected	Sample Location	Results	Compliance Calculation	Follow-up Action Taken	Date Monitoring Report Sent to State
<i>Enter appropriate period</i>	<i>Day, month, and year</i>		<i>Circle if above MCL</i>	<i>RAA computed quarterly (circle if above MCL)</i>	<i>Check appropriate box</i>	<i>Routine or violation</i>
Annual	8/23/05	12 State Street (MRT)	0.052 mg/L	0.052 mg/L	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input type="checkbox"/> Increase Monitoring	Routine: 10/5/05
Third quarter 2006	8/14/06	12 State Street (MRT)	0.091 mg/L	$\frac{0.091 + 0.000 + 0.000 + 0.000}{4} = 0.023$	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input checked="" type="checkbox"/> Increase Monitoring	Routine: 9/5/06
					<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input type="checkbox"/> Increase Monitoring	
					<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input type="checkbox"/> Increase Monitoring	

Example #4: A Ground Water CWS Monitoring for TTHM (Increased to Routine Monitoring)

This example shows how the ground water system in example #3 qualifies to return to routine annual monitoring after an MCL exceedance caused it to increase monitoring to once per quarter. Although it will not be discussed in this example in detail, the system will also monitor for HAA5 and adjust the HAA5 monitoring schedule to match any changes that occur to the TTHM monitoring schedule based on sample results. In addition, the system will monitor for chlorine. For the purposes of this example, assume that the system collects all appropriate companion HAA5 samples and that all the sample results are less than the MCL for HAA5.

The system continues to collect quarterly monitoring samples for TTHM and HAA5 at the location of MRT in the distribution system. On October 22, 2006 the system collects its second TTHM quarterly sample. Using its TTHM samples from August and October, the system calculates its RAA. To assess its compliance status, the system assumes that the next two quarterly results will be “zero” (a “best case scenario”) to calculate its RAA:

$$\text{RAA} = \frac{0.091\text{mg/L (Q1)} + 0.021 \text{ (Q2)} + 0.000 \text{ (est. Q3)} + 0.000 \text{ (est. Q4)}}{4} = 0.028 \text{ mg/L} \leq \text{MCL}$$

The RAA is below the TTHM MCL. No further action is required other than to report to the state within 10 days of the end of the quarter. The system reports to the state on December 2, 2006.

The system continues to collect quarterly samples at the point of MRT in the distribution system for the next 2 quarters. At the end of 1 full year of quarterly monitoring (second quarter of 2007), the system can calculate its RAA for TTHM with actual results for all 4 quarters:

$$\text{RAA} = \frac{0.091\text{mg/L (Q1)} + 0.021 \text{ (Q2)} + 0.034 \text{ (Q3)} + 0.049 \text{ (Q4)}}{4} = 0.049 \text{ mg/L} \leq \text{MCL}$$

The system’s RAA for TTHM (0.049 mg/L) is below the MCL (0.080 mg/L). The system has not committed an MCL violation. To return to routine annual monitoring (one sample per plant per year during the month of warmest water temperature), the system’s RAA must be less than or equal to 0.060 mg/L. The RAA (0.049 mg/L) is low enough to qualify the system to return to a routine monitoring schedule (you can assume for this example that the RAA for HAA5 was also less than or equal to the trigger level of 0.045 mg/L). The system contacts the state for approval to return to routine monitoring, and the state grants approval. The system will resume routine annual monitoring at the location of MRT during the month of warmest water temperature (August) in 2007.

Example #4 Worksheet

TTHM/HAA5 Monitoring Worksheet						
MCL for TTHM: 0.080 mg/L				MCL for HAA5: 0.060 mg/L		
Monitoring Period	Date Sample Collected	Sample Location	Results	Compliance Calculation	Follow-up Action Taken	Date Monitoring Report Sent to State
<i>Enter appropriate period</i>	<i>Day, month, and year</i>		<i>Circle if above MCL</i>	<i>RAA computed quarterly (circle if above MCL)</i>	<i>Check appropriate box</i>	<i>Routine or violation</i>
Third quarter 2006	8/14/06	12 State Street (MRT)	0.091 mg/L	$\frac{0.091 + 0.000 + 0.000 + 0.000}{4} = 0.023$	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input checked="" type="checkbox"/> Increase Monitoring	Routine: 9/5/06
Fourth quarter 2006	10/22/06	12 State Street (MRT)	0.021 mg/L	$\frac{0.091 + 0.021 + 0.000 + 0.000}{4} = 0.028$	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input type="checkbox"/> Increase Monitoring	Routine: 12/2/06
First quarter 2007	1/1/07	12 State Street (MRT)	0.034 mg/L	$\frac{0.091 + 0.021 + 0.034 + 0.000}{4} = 0.037$	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input type="checkbox"/> Increase Monitoring	Routine: 3/1/07
Second quarter 2007	5/23/07	12 State Street (MRT)	0.049 mg/L	$\frac{0.091 + 0.021 + 0.034 + 0.049}{4} = 0.049$	<input checked="" type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public <input type="checkbox"/> Increase Monitoring	Routine: 7/2/07

Appendix B: Sample Monitoring Worksheets

The following worksheets are designed to help you keep track of your Stage 1 DBPR monitoring and record the results from both routine and follow-up monitoring (where applicable). The worksheets can help you ensure that you collect the right number of routine samples in each monitoring period and that you calculate compliance correctly. The worksheets will also remind you of corrective actions you will have to take if you violate the MCL or MRDL. While these worksheets can be a useful management tool, system operators should also keep the original laboratory results on file.

Each worksheet includes an explanation of how to complete it and how to use it to calculate compliance. Review the examples in Appendix A to help you understand how the worksheets would be used in real-world situations.

Some states may have their own monitoring worksheets that small drinking water systems are required to complete. The worksheets contained in this section are presented as learning tools, and *should not* replace monitoring forms required by the state.

Chlorine/Chloramines Monitoring Worksheet Instructions

Step #1A Note when you took the sample.

In the column labeled "Monthly Sample Number and Type," number your monthly samples (e.g., 1 = first sample, 2 = second sample). You can determine how many samples you must take each month by looking at your TCR sample site plan.

In the column labeled "Date Sample Collected," record the day, month, and year you took each sample.

Step #1B Choose the chemical.

Check the box next to the chemical tested for in each sample.

Step #2 Record where you took the sample.

In the column labeled "Sample Location," record where you collected each sample. There should be a location to match each location listed on your TCR Sample Site Plan.

Step #3A Record result.

In the column labeled "Results," record the analytical results, including units of measure.

Step #3B Calculate monthly average.

At the end of each month, you will have to calculate your monthly average. To calculate your monthly average, add results for all samples taken that month and divide by the total number of samples for the month. Enter the resulting monthly average in the column labeled "Monthly Average" next to the final monthly sample.

Step #3C Calculate RAA.

At the end of each quarter, calculate your RAA by summing your last 12 monthly averages and dividing by 12 (if you failed to sample in a month, divide by the number of months in which you have sampled). Enter this value in the column labeled "Compliance Calculation." Compare this result to the MRDL. If the average is > MRDL, circle the result as an indicator that you have violated the MRDL.

Step #4 Indicate follow-up action taken.

Specific follow-up actions need to be taken if your RAA is > MRDL or if you fail to take a sample (a monitoring violation). You must also report to the state within 10 days of the end of every quarter in which you collected samples. In the column labeled "Follow-up Action Taken:"

- ▶ Check "Notify the State" if you took all your required samples, your RAA does not exceed the MRDL, and you only need to routinely report to your state.
- ▶ Check "Notify the State" **AND** "Notify the Public" if you failed to take a required sample.
- ▶ Check "Notify the State" **AND** "Notify the Public" if your RAA of monthly averages is > MRDL. Notify the state within 48 hours and your customers within 30 days.
- ▶ If the RAA is ≤ MRDL, check "Notify the State" to indicate the submission of your routine report.

Step #5 Report to state.

All systems must report to their state. In the column labeled "Date Report Sent to State," enter the day, month, year, and type of report (routine or violation).

- ▶ Systems monitoring for chlorine and chloramines must report within 10 days after the end of each quarter in which samples were collected.
- ▶ Systems that have committed an MRDL violation must report to the state within 48 hours.

Chlorine/Chloramines Monitoring Worksheet

MRDL for Chlorine: 4.0 mg/L

for Chloramines: 4.0 mg/L

Monthly Sample Number and Type	Date Sample Collected	Sample Location	Results (a)	Monthly Average (b)	Compliance Calculation (c)(d)	Follow-up Action Taken	Date Report Sent to State
<i>Enter appropriate number and type</i>	<i>Day, month and year</i>	<i>Consult your TCR sampling site plan</i>	<i>Used for monthly avg.</i>	<i>Used for running annual avg.</i>	<i>Running annual avg. computed quarterly (Circle if above MRDL)</i>	<i>Check appropriate box</i>	<i>Routine or violation notice</i>
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	
<input type="checkbox"/> Chlorine <input type="checkbox"/> Chloramines						<input type="checkbox"/> Notify the State <input type="checkbox"/> Notify the Public	

- (a) If you fail to take a required sample, you have committed a monitoring violation and must notify the state and your customers.
 (b) Use all of your results for the month to calculate your monthly average.
 (c) Use your last twelve monthly averages to calculate your RAA.
 (d) If your RAA exceeds the MRDL, you have committed an MRDL violation and must notify the state within 48 hours and your customers within 30 days.

