

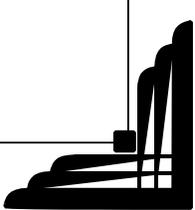
Disinfectants and
Disinfection Byproducts

Sample Monitoring Plan
Instructions & Template
for
Public Water Systems
Using Only Ground Water



Division of Drinking and
Ground Waters

April 2004



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Sample Monitoring Plan Instructions

Introduction

Welcome to one of the requirements stemming from the changes to the rules covering disinfectants and disinfection byproducts (D/DBPR). The D/DBPR is a complex rule, but these instructions and this template are designed to make it easier for you to remain in compliance. We encourage you to complete your sample monitoring plan as soon as possible and to contact Ohio EPA's Central Office (614-644-2752) if you have any questions about how to use this template. Additional information regarding this rule is available from Ohio EPA at:

- <http://www.epa.state.oh.us/ddagw/pubs.html#factsht>

and from U.S. EPA at:

- <http://www.epa.gov/safewater/mdbp/implement.html>



This template is for systems that use **only ground water** –including those that **purchase** only ground water, but which pages you need also depends on what kind of treatment you have. Use just the template pages pertinent to your

How to use this document:

1. Read the first box on this page.
2. Go to the Template Sections Checklist on page vi and identify the template pages you actually need.
3. Select your template pages. You *should* fill in all the shaded areas, but you **must** fill in the required information indicated in **bold**.
4. Make the map of your distribution system showing where you're going to take your samples and their sample monitoring point IDs (see page vii).
5. Send the map to your Ohio EPA district office representative.

Reporting your sampling results to Ohio EPA is discussed on page v.

If you get stuck, check out the rest of these instructions. If you're still stuck after that, call your district office representative.

Applicability

Rules 3745-81-23, 3745-81-24, and 3745-81-70 of the Ohio Administrative Code require community and non-transient non-community public water systems (PWSs) to develop sample monitoring plans for **bromate** and **chlorite**; **total trihalomethanes** and **haloacetic acids 5**; and **disinfectant residuals**. These sample monitoring plans must address at least the following:

- ✓ locations where samples will be taken,
- ✓ schedules for sampling,
- ✓ how compliance with maximum contaminant levels (MCLs) and maximum disinfectant residual levels (MRDLs) will be calculated, and
- ✓ must reflect the entire distribution system for PWSs that are consecutive systems or provide water to consecutive systems (where the provider agrees to conduct the monitoring for the consecutive system).

You may address all the disinfectants and disinfection byproducts pertinent to your system with a single plan.

This template shows in **bold** the elements required by the Ohio Administrative Code to be included in a sample monitoring plan. At a minimum, any plan you create must include these elements, which are what Ohio EPA will be looking for when we review your plan (this includes the cover page). “Fill in the blank” information is indicated with shading. This template also has additional information you may choose to include to make your final document more user-friendly for you and your staff.

Each constituent is addressed separately so you only have to use the pages that are pertinent to your facility. For example, if you do not use ozone, you do not need to include the pages for bromate. All of the sections included in the template are listed at the end of these instructions so you can see what all is available to you. There is a check box for each section on the list to make it easier for you to track the sections you need. These boxes are already checked for information all systems need to provide.

You must develop and include at least one **map** showing your sampling locations and the associated sample identifiers. You may indicate sampling locations for more than one sample constituent on a single map. You can also include more than one map if you find that helpful (for example, to improve clarity or because the distribution system will not fit conveniently on a single page, etc.).

Completing and Submitting the Plan

You must have your plan completed within 30 days of when your system is first scheduled to monitor for disinfectants and disinfection byproducts. You are not required to submit a copy of the plan to your district office unless your district office representative has requested it; in fact, for now you are only being requested to provide a copy of the map to your district office. But you must maintain a copy of the entire plan on-site and have it available for Ohio EPA review during the sanitary survey. The plan must also be available for review by the general public.

Changes to Your Plan

The requirements for trihalomethanes and haloacetic acids depend on the size of the population your system serves. So if your population changes, you may need to update your plan and monitoring practices.

You might also need to change your sampling frequency due to an exceedence of an MCL. If this occurs, update your plan to reflect the change. And if you had been required to submit your plan to Ohio EPA, you'll need to send in copies of any revised pages.

Compliance with Maximum Contaminant Levels or Maximum Residual Disinfectant Levels

Instructions for determining compliance with maximum contaminant levels (MCLs) or maximum residual disinfectant levels (MRDLs) are also given in this template, including any arithmetic that may be involved. In some cases all that is needed is a direct comparison between the sample concentration and the applicable standard. For others, you will compare the standard to the average concentration of all the samples collected during the past year. If the latter, you will need to provide an example calculation.

The exception is that Ohio EPA will determine your compliance with the MCLs for total trihalomethanes and haloacetic acids, so this step is not shown in bold as a required element for your plan. But the calculation methodology is included in the plan if you track compliance with these MCLs yourself.

Average and Maximum Residence Times

These apply to chlorite, chlorine dioxide, total trihalomethanes, and haloacetic acids 5. Give some thought to the layout of your distribution system and provide a brief explanation of why you believe the locations you selected represent the average and maximum residence times. Ohio EPA recommends you select more than one location to represent each. That way, if your **primary** sampling site is not available during your sampling round, you can go to another. Make sure you will be able to access your sampling sites year round. Give each location a unique sample monitoring point

identification, even if you have more than one STU, and indicate it on your map(s). The convention for sample monitoring point identification is discussed in more detail on page vii.

Violation Types and Public Notification

Other things to keep in mind, although they are not specifically addressed in this template, are violations and occurrences that may cause you to have to post a public notice.

Violations include, but are not limited to:

- not developing a sample monitoring plan,
- not following your sample monitoring plan,
- exceeding an MCL or MRDL, and
- not reporting your disinfectant and disinfection byproducts data (includes skipping the reporting entirely or reporting after the deadline).

A public notice would be required as a result of:

- exceeding an MCL,
- exceeding the MRDL for chlorine dioxide,
- not monitoring,
- not using the appropriate monitoring methodology, or
- not reporting until after the deadline.

This list is not exhaustive. See also Ohio Administrative Code rule 3745-81-32.

Sample Submission Reports and Operating Reports

In most cases, the rate at which you report will be no more often than quarterly. Your laboratory data will be reported on Reports 5114, 5116, and/or 5022. Your certified laboratory is required to submit the total trihalomethanes and five haloacetic acids data to Ohio EPA Central Office on the 5022 form. Public water systems will submit monthly and quarterly operating reports to the appropriate Ohio EPA District Office.

Most systems will determine compliance quarterly, whether they are conducting sampling on a monthly or quarterly basis. You will report your compliance determinations on the appropriate monthly or quarterly operating reports.

Note that some systems will qualify for sampling for trihalomethanes and haloacetic acids only once per year. This information will be due by the tenth of October.

Template Sections Checklist

Table 1

Section	Constituent/Topic	Applicability	Include?
1	Cover Page	all systems	Y
2	Public Water System Information	all systems	Y
3	Map and Addresses	all systems	Y
4	Sample Collection and Analysis Personnel acceptable to perform DPD test kit analyses	all systems	Y
5	Bromate (OAC rule 3745-81-23) • Location and Schedule/Frequency • Compliance with the MCL	systems using ozone	
6	Chlorite (OAC rule 3745-81-23) • Location and Schedule/Frequency • Compliance with the MCL	systems using chlorine dioxide	
7	Total Chlorine (OAC rule 3745-81-70), • Location and Schedule/Frequency • Compliance with the MRDL	all systems	Y
8	Chlorine Dioxide (OAC rule 3745-81-70) • Location and Schedule/Frequency • Compliance with the MRDL	systems using chlorine dioxide	
9D*	Total Trihalomethanes and Haloacetic Acids 5 (OAC rule 3745-81-24) • Location and Schedule/Frequency • Compliance with the MCLs	Ground Water** systems serving populations ≥ 10,000	
9E*	Total Trihalomethanes and Haloacetic Acids 5 (OAC rule 3745-81-24) • Location and Schedule/Frequency • Compliance with the MCLs	Ground Water** systems serving populations < 10,000	

* 9A, 9B, and 9C are reserved.

** "Ground Water" systems are those that have only ground water as a source and treat their water with and combination of chlorine, chloramines, chlorine dioxide or ozone. This also includes systems that purchase only ground water.

Sample Monitoring Point Identifiers

Table 2

ID	Meaning	Analyte
MRxxx*	Maximum residence time**	TTHMs and HAA5
RDxxx	Representative of distribution	TTHMs and HAA5
EPxxx	Entry point	bromate; daily routine chlorite and chlorine dioxide
DSxxx	Distribution system	distribution system total chlorine
FCxxx	Near first customer	distribution system chlorite and chlorine dioxide
ATxxx	Average residence time	distribution system chlorite and chlorine dioxide
MTxxx	Maximum residence time**	distribution system chlorite and chlorine dioxide
IPxxx	Intermediate plant***	as needed

* An example format is "MR001" or "MR002." You may have several locations representative of the maximum residence time, or near the first customer, etc., so use a **different** number for each location. Show each on your map.

Do not repeat any sample monitoring point identification, even if you have more than one STU. For example, if you have two STUs with three possible sampling locations for average residence time for each STU, you will have sample monitoring point identifications "AT001" through "AT006."

Do not reuse any sample monitoring point identification, even if a sampling location ceases to be available. For example, if you started with "AT001" through "AT006" but you can no longer get to "AT005," your new replacement location becomes "AT007."

** "Maximum residence time" has two possible sample monitoring point IDs. **Use "MRxxx" for total trihalomethanes and haloacetic acids 5 only.** "MTxxx" is only for chlorite and chlorine dioxide.

*** Intermediate plant is used for any location in the plant between the raw and finished water.

The **Template** follows....

Disinfectants/Disinfection Byproducts Sample Monitoring Plan

for

System:

PWSID:
STUID(s):

Date:

Revision date:

Drafted by:

Date Compliance was Required:

Section 2. Public Water System Information

A. **Address:**

B. **Person in Responsible Charge:**

C. Personnel responsible for D/DBP sampling:

D. **Source Water (check one):**

- Ground Water (not purchased from another public water system)
- Purchased Ground Water

E. **Population Served:**

Section 4. Sample Collection and Analysis for D/DBPR

OAC rule 3745-81-27 Analytical techniques.

Constituent	Jar type*	Jar size*	Preservative	Holding time	Analytical Method(s)	
Bromate	G or P	100 mL	none	28 days	U.S. EPA Method 300.1	
Bromide	G or P	100 mL	none	28 days	U.S. EPA Method 300.0 U.S. EPA Method 300.1	
Chlorite at entry point	G or P	500 mL	none	analyze immediately	S.M., 19th ed, Section 4500-ClO ₂ E	
Chlorite in distribution	G or P	500 mL	none, 4°C	analyze immediately	U.S. EPA Method 300.0 U.S. EPA Method 300.1	
			ethylene-diamine (EDA)	14 days		
Total chlorine	G or P	500 mL	none	analyze immediately	free or total	S.M., 19th ed, Section 4500-Cl D, F, or G
					total	S.M., 19th ed, Section 4500-Cl E or I
					free	S.M., 19th ed, Section 4500-Cl H
					free, total, or combined	ASTM Method D 1253-86 S.M., 19th ed, Section 4500-Cl D, F, or G
Chlorine Dioxide	G or P	500 mL	none	analyze immediately	S.M., 19th ed, Section 4500-ClO ₂ D or E	
Total trihalomethanes**	two 40- or 60-mL VOC vials, lids with TFE-lined septa		Na ₂ S ₂ O ₃ , 4°C	14 days	U.S. EPA Method 502.2 U.S. EPA Method 524.2 U.S. EPA Method 551.1	

Constituent	Jar type*	Jar size*	Preservative	Holding time	Analytical Method(s)
Haloacetic acids**		two 40- or 60-mL amber VOC vials, lids with TFE-lined septa	100 mg/L NH ₄ Cl, 4°C	14 days to extraction, 7 days to analysis (or 14 days to analysis at -10°C)	U.S. EPA Method 552.1 U.S. EPA Method 552.2
			65 mg NH ₄ Cl, 4°C	9 days to extraction, 21 days to analysis (at -11°C)	S.M., 19th ed, Section 6251B

G Glass
P Polyethylene

* Information on sample containers is provided as a guideline. Check with your certified laboratory for appropriate sample containers. The sample cell with you DPD colorimeter is an acceptable container for total chlorine analysis.

** Flush tap for about 10 minutes prior to sample collection, reduce flow to about 500 mL/min for sample collection, do not rinse vials with sample, no air bubbles in vials for total trihalomethanes.

S.M. Standard Methods for Examination of Water and Wastewater (either 18th or 19th edition, unless specified)

ASTM American Society for the Testing of Materials

USGS United States Geological Survey

U.S. EPA Methods can be found in:

Methods for the Determination of Inorganic Substances in Environmental Samples

Methods for the Determination of Metals in Environmental Samples–Supplement I

Methods for the Determination of Organic and Inorganic Compounds in Drinking Water

Methods for the Determination of Organic Compound is Drinking Water-Supplements I, II, III

Personnel acceptable to perform test kit analysis:

Laboratory(ies):

Section 5. Bromate, for systems using Ozone
 OAC rule 3745-81-23(L)

Locations and Schedule/Frequency

Check: **routine (monthly)** or **reduced (quarterly)** monitoring for bromate.

Monitoring Type	Frequency	Location
Routine	one sample per <i>month</i> for each treatment plant in the system using ozone	entry to the distribution system (while the ozonation system is operating under normal conditions)
Reduced	one sample per <i>quarter</i> for each treatment plant in the system using ozone	entry to the distribution system (while the ozonation system is operating under normal conditions)

For reduced monitoring, determine the annual average source water bromide concentration (add together the last 12 consecutive months of *bromide* results. Then divide by 12). If the average bromide concentration is less than 0.05 mg/L, this system qualifies for reduced monitoring. A sample calculation of the average, showing all results used, is provided below:

$$(0.05 + 0.04 + 0.05 + 0.06 + 0.03 + 0.02 + 0.02 + 0.01 + 0.03 + 0.02 + 0.01 + 0.01) \div 12 = 0.03 \text{ mg/L Br}$$

Compliance with the MCL for Bromate

1. Determine average concentration for each month.
Add together the concentrations of all bromate samples per plant during the month*. Divide by the total number of samples. An example calculation, using all results available, is provided below:

Monthly average =

$$(0.012 + 0.009) \div 2 = 0.011 \text{ mg/L bromate}$$

Note: If you are only sampling once per month, the monthly average is the result of the individual sample.

2. Determine the average concentration for the year.
Have available the averages for the twelve most recent consecutive months. Add them together. Divide by 12. An example calculation is provided below:

Running annual average =

$$(0.011 + 0.012 + 0.009 + 0.007 + 0.013 + 0.005 + 0.006 + 0.011 + 0.005 + 0.012 + 0.005 + 0.008) \div 12 = 0.009$$

3. Compare the annual average from Step 2 to the MCL of 0.01 mg/L.

* The average includes all samples taken, even if the number of samples taken is greater than that required by the OAC. Any value that is less than the detection limit is treated as a zero for the compliance calculations.

Section 6. Chlorite, for systems using Chlorine Dioxide
OAC rule 3745-81-23(M)

Entrance to the Distribution System

Location: Shown on map.

Schedule/Frequency: Daily.*

- * If the concentration of a daily sample exceeds the MCL,
 - a. sample the **next day** in the distribution system at the locations described below and as shown on the map;
 - b. **monthly** sampling in the distribution system will be required.

In the Distribution System

Location: Shown on map at these 3-sample set locations:

- a. near the first customer,
- b. a location representative of the distribution (average residence time), and
- c. a location representative of the maximum residence time.

The **justification** for the selection of the locations representing the average and maximum residence time is:

**Average residence time takes into account number of persons served, different sources of water, and different treatment methods. Ohio EPA recommends selecting more than one location for both the maximum and average residence times, although the back-up locations are only to be used when the primary site is unavailable.

Schedule/Frequency: Check [] routine (monthly) or [] reduced (quarterly).

To *qualify* for reduced monitoring in the distribution system, there must be one year's worth of samples in which no concentrations exceed the MCL, at either the entrance to the distribution system or within the distribution system. (Daily monitoring at the entrance to the distribution system cannot be reduced).

To *remain* on reduced monitoring, all individual sample concentrations must be less than the MCL, at both the entrance to the distribution system and within the distribution system.

Compliance with the MCL for Chlorite

Compliance with the MCL for chlorite is based on the arithmetic average of any three sample set in the distribution system. A system is in compliance if the average is less than or equal to the MCL of 1.0 mg/L.

Section 7. Total Chlorine, all systems using chlorine or chloramines; OAC rule 3745-81-70

Location(s): As shown on map, within the distribution system at the same place where routine and repeat (but not special purpose) samples for total coliform are taken.

Schedule/Frequency: At the same time as all routine and repeat (but not special purpose) total coliform samples.

Compliance with the MRDL for Total Chlorine

1. Each month, add together the chlorine concentrations of all samples taken during the month at the total coliform sampling locations.* Divide by the total number of samples. An example calculation in which total chlorine was determined five times in a month is provided below:

Monthly average =

$$(0.9 + 1.1 + 0.2 + 0.8 + 1.8) \div 5 = 1.0 \text{ mg/L Cl}_2$$

Note: If you are only required to collect one routine total coliform sample per quarter and that sample is negative, i.e., safe, there will only be one total chlorine value to report. Report that value as the average for both the month and the quarter.

2. At the end of each quarter, determine the quarterly average. Add together the averages for the three months in the quarter. Divide by 3. An example calculation is provided below.

Quarterly average =

$$(1.0 + 1.2 + 0.6) \div 3 = 0.9 \text{ mg/L Cl}_2$$

3. At the end of each quarter, determine the running annual average. Have available the averages for the four most recent consecutive quarters. Add them together. Divide by 4. An example calculation is provided below.

Running annual average =

$$(0.9 + 1.2 + 1.9 + 1.5) \div 4 = 1.4 \text{ mg/L Cl}_2$$

4. Compare the annual average for Total Chlorine to the MRDL of 4.0 mg/L.

* The average includes all samples taken, even if the number of samples taken is greater than that required by the OAC. Any value that is less than the detection limit is treated as a zero for the compliance calculations.

Section 8. Chlorine Dioxide, for systems using Chlorine Dioxide
OAC rule 3745-81-70

Entrance to the Distribution System

Location: Shown on map.

Schedule/Frequency: Daily.*

* If the concentration of a daily sample exceeds the MRDL, sample the **next day** in the distribution system at the locations described below and as shown on the map.

In the Distribution System, as needed

Location: Shown on map. Sampling locations are based on the use of chlorine dioxide or chloramines, or chlorine with or without booster chlorination.

Schedule/Frequency:

Check as appropriate:

- A. Chlorine dioxide or chloramines are used to maintain a disinfectant residual in the distribution system.
- B. Chlorine is used to maintain a disinfectant residual in the distribution system and there is **no** booster chlorination.

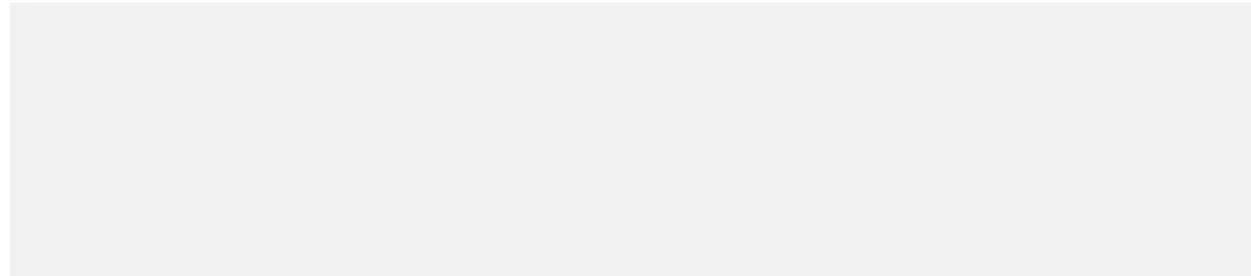
If A or B is checked, **three** samples will be taken the next day **near the first customer**. Samples will be taken at intervals of at least 6 hours.

- C. Chlorine is used to maintain a disinfectant residual in the distribution system and there is booster chlorination.

If C is checked, samples will be taken in **3-sample sets** at these locations the next day:

- a. near the first customer,
- b. a location representative of the distribution (average residence time), and
- c. a location representative of the maximum residence time.

The **justification** for the selection of the locations representing the maximum and average residence time is:



**Average residence time takes into account number of persons served, different sources of water, and different treatment methods. Ohio EPA recommends selecting more than one location for both the average and maximum residence times, although the back-up locations are only to be used when the primary site is unavailable.

Compliance with the MRDL for Chlorine Dioxide

Compliance is maintained when:

- A. No **two** consecutive daily sample concentrations, taken at the entrance to the distribution, exceed the MRDL of 0.8 mg/L (as ClO₂).
- B. No **one** distribution system sample concentration exceeds the MRDL when the concentration of the previous day's entry point sample exceeds the MRDL.

Section 9D. Total Trihalomethanes and Haloacetic Acids 5 for Ground Water Systems serving Populations of at least 10,000

OAC rule 3745-81-24(D)

Location(s): As shown on map, at location(s) representing the maximum residence time.

The **justification** for the selection of the location(s) representing the maximum residence time is:

Ohio EPA recommends selecting more than one location for the maximum residence time, although the back-up locations are to be used only when the primary site is unavailable.

Schedule/Frequency:

Check: **routine (quarterly)** or **reduced (annual)** monitoring for TTHMs/HAA5.

Monitoring Type	Frequency
Routine	one sample per quarter per treatment plant or bulk supplier
Reduced	one sample per year per treatment plant or bulk supplier, taken during the July 1 to September 30 quarter (schedule will revert to quarterly sampling for both TTHMs and HAA5 if the concentration of either exceeds its respective MCL)

Number of treatment plants or bulk suppliers (= number of samples/quarter):

Compliance with the MCLs for TTHMs and HAA5 for Ground Water Systems serving Populations of at least 10,000

Ohio EPA will determine compliance with the MCLs for systems monitoring with one sample per year by comparing the sample result (per treatment plant or bulk supplier) for TTHMs to 0.080 mg/L and the annual average for HAA5 to 0.060 mg/L.

Ohio EPA will calculate compliance with the MCLs for systems required to monitor quarterly. The methodology is described below if you choose to calculate it yourself and is the same for either TTHMs or HAA5. You are not required to report these calculations to Ohio EPA.

1. Determine the quarterly average.
Have available the concentrations for **all** samples collected during the current quarter (per treatment plant or bulk supplier). Add them together. Divide by the total number of samples.

Quarterly average =

2. Determine the average concentration for the year.
Add the results for the four most recent consecutive quarters. Divide by 4.

Running annual average =

3. Compare the annual average for TTHM to 0.080 mg/L.
Compare the annual average for HAA5 to 0.060 mg/L.

MCL Violation (OAC rule 3745-81-24(D)(13) and (14))

If either of the running annual averages exceeds its respective MCL, you will have to issue a public notice and notify the director of Ohio EPA.

Monitoring Violation (OAC rule 3745-81-24(D)(14))

A monitoring violation will occur if monitoring is not conducted in accordance with this sample monitoring plan. Failure to follow this plan for a particular quarter will affect the entire year.

Section 9E. Total Trihalomethanes and Haloacetic Acids 5 for Ground Water Systems serving Populations of fewer than 10,000

OAC rule 3745-81-24(D)

Location(s): As shown on map, at location(s) representing the maximum residence time.

The **justification** for the selection of the location(s) representing the maximum residence time is:

Ohio EPA recommends selecting more than one location for the maximum residence time, although the back-up locations are to be used only when the primary site is unavailable.

Schedule/Frequency:

Check: **routine (annual)** or **reduced (triennial)** monitoring for TTHMs/HAA5.

Monitoring Type	Frequency
Routine*	one sample per year per treatment plant or bulk supplier, taken during the July 1 to September 30 quarter
Reduced*	one sample per treatment plant or bulk supplier per three year cycle taken during the July 1 to September 30 quarter, with the three-year cycle starting on the January 1 following the quarter in which the system qualifies for reduced monitoring

*For both routine and reduced monitoring, schedule will change to *quarterly* sampling for both TTHMs and HAA5 if the concentration of either exceeds its respective MCL

Number of treatment plants or bulk suppliers (= number of samples/year):

Compliance with the MCLs for TTHMs and HAA5 for Ground Water Systems serving Populations fewer than 10,000

Ohio EPA will determine compliance with the MCLs for systems monitoring with either one sample per year or one sample every three years by comparing the sample result (per treatment plant or bulk supplier) for TTHMs to 0.080 mg/L and the annual average for HAA5 to 0.060 mg/L.

If you are required to conduct **quarterly** monitoring due to an exceedence of the MCL for either TTHMs or HAA5, and you choose to calculate compliance, the methodology is described below (it's the same for either TTHMs or HAA5). You are not required to report these calculations to Ohio EPA.

1. Begin by determining the average concentration for the quarter. Have available the concentrations for **all** samples collected during the four most recent consecutive quarters (per treatment plant or bulk supplier). Add them together. Divide by the total number of samples.

Running annual average =

2. Compare the annual average for TTHM to 0.080 mg/L.
Compare the annual average for HAA5 to 0.060 mg/L.