



Stage 2 DBP Compliance Monitoring Plan Guidance

***Prepared by
State of Vermont
Agency of Natural Resources
Department of Environmental Conservation
Drinking Water & Groundwater Protection Division***

***For Public Community and NTNC Water Systems
with a VSS Waiver or 40/30 Certification***

Creating a Stage 2 DBP Compliance Monitoring Plan (in a Nutshell)



Step 1: Collect and organize your DBP data. Data must be clearly related to a specific analyte (TTHM or HAA5) and sampling location as you will need to be able to compute a LRAA for each analyte at each location (in cases where there may be multiple sampling locations).

IMPORTANT NOTE: To ensure you are comparing apples to apples (so to speak) please make sure you use concentrations expressed in mg/L not µg/L. To convert from µg/L to mg/L, take the concentration expressed in µg/L and move the decimal point three (3) decimal places to the left.

Example: 0.5 µg/L = 0.0005 mg/L

Step 2: Calculate a LRAA for DBP data for each analyte at each sampling location.

Step 3: Compare the LRAA for multiple sampling sites for both TTHM and for HAA5 and select the highest TTHM LRAA and the highest HAA5 LRAA.

Step 4: Justification for your selection might simply be that the site selected had the highest LRAA or, if having reviewed your data and the criteria for selecting TTHM and HAA5 sites (or taking into account any changes to your distribution system) you decide it is warranted to try a new sampling site. (See site selection criteria on reverse)

Step 5: If your system will conduct Stage 2 DBP compliance monitoring on an annual basis (see reverse), then select a week (first, second, third or fourth) during the month of warmest water temperature (most usually August). If your system will conduct Stage 2 compliance monitoring on a quarterly basis, then select a week (first, second, third or fourth) and (here's where it becomes somewhat counterintuitive) select the month during the last quarter of 2013 which, by sampling every third month, ensures that you monitor during your month of warmest water. The table (at right) was constructed to help you determine your monitoring schedule. For example, if you must monitor on a quarterly basis and your warm weather month is August, your monitoring schedule for DBPs would include November 2013, February 2014, May 2014, and August 2014. In this way you would be sampling approximately every 90 days.

Month			Year
October	November	December	2013
January	February	March	2014
April	May	June	2014
July	August	September	2014

Step 6: Indicate the compliance calculation procedure you will use to determine compliance with the Stage 2 DBPR. For most, this is as simple as confirming whether your system is required to monitor DBPs on a quarterly OR an annual basis.

Step 7: Please indicate if your public water system is part of a combined distribution system. Should this be the case, then please indicate the WSID(s) for those part of the combined distribution system.

Step 8: Save completed digital plan form first to your computer's hard drive and then submit it together with a schematic of the distribution system with selected monitoring sites clearly identified to the Vermont Drinking Water & Groundwater Protection Division as file attachments with **Stage 2 DBP Compliance Monitoring Plan** in the subject line addressed to: doug.kievit-kylar@state.vt.us

IMPORTANT: Please forward completed plans by August 31, 2012. [Upon review systems will either be contacted with a request for additional information OR sent a letter of approval]

Monitoring Frequency & Locations

Monitoring frequency and sampling locations are determined by whether the system's source water is ground water or surface water (Subpart H) and the size of the population served. Please use the table at right to decide if your system must monitor on either an annual or quarterly basis and whether your system will be required to take individual TTHM and HAA5 samples at specific monitoring locations or dual sample sets (see footnotes).

NOTE: Only those systems in the largest population size category for each source water type must collect dual sample sets at each of the two (2) distribution system monitoring locations.

Source Water Type	Population Size Category	Monitoring Frequency ¹	Distribution System Monitoring Location		
			Total per monitoring period	Highest TTHM Locations	Highest HAA5 Locations
Subpart H	<500	yearly	2 ²	1	1
	500 - 3,300	every 90 days	2 ²	1	1
	3,301 - 9,999	every 90 days	2	1	1
Ground Water	<500	yearly	2 ²	1	1
	500 - 9,999	yearly	2	1	1

¹All systems must take at least one dual sample set during the month of highest DBP concentrations or warmest water temperature.

²System is required to take individual TTHM and HAA5 samples (instead of dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. Only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location.

Selection Criteria for the Highest TTHM Site

You should choose your high TTHM site to represent areas in the distribution system where you expect to find higher levels of TTHM throughout the year as compared to other sites. Higher temperatures and increased residence time typically lead to higher TTHM concentrations. Low disinfectant residual usually indicates longer residence time sites. **Most typically, good TTHM monitoring sites are located near the ends of the distribution system, at or before the last group of customers.**

Selection Criteria for the Highest HAA5 Site

Your high HAA5 site should be chosen to represent areas in the distribution system where you expect to find higher levels of HAA5 throughout the year as compared to other sites. Higher temperatures and increased residence time can lead to higher HAA5 concentrations. However, HAA5 can biodegrade when disinfectant residual levels are low or non-existent. Therefore, a high HAA5 site will not necessarily be the site with the longest residence time. **Most typically, good HAA5 monitoring sites are located toward the center of your distribution system.**

Characteristics of High TTHM Sites

High TTHM sites are often located:

- Near the ends of the distribution system, at or before the last group of customers.
- In mixing zones where water from different sources combine within the distribution system.
- Downstream of storage facilities - especially those with a common inlet and outlet prior to the last fire hydrant.

Sample sites should not be located:

- At a dead-end where there are no customers.
- Immediately prior to booster disinfection.

Characteristics of High HAA5 Sites

High HAA5 sites are often located:

- In areas with low but existing disinfectant residual (generally, disinfectant residual levels should be consistently above 0.2 mg/L for chlorine or 0.5 mg/L for chloramine).
- Near the ends of the distribution system, at or before the last group of customers.
- In mixing zones where water from different sources combines within the distribution system..
- Downstream of storage facilities.
- Prior to the last fire hydrant.

Sample sites should not be located:

- At a dead-end where there are no customers.
- Immediately prior to booster disinfection.
- Where no disinfectant residual exists.
- Areas with biofilm problems.

Stage 2 DBP Compliance Monitoring Plan Guidance **(For public Community and NTNC water systems with a VSS Waiver or 40/30 Certification)**

If your system previously was granted either a Very Small System (VSS) Waiver or 40/30 Certification, your system has already satisfied the IDSE requirements of the Stage 2 Disinfection Byproduct Rule (DBPR). However, your system still needs to prepare a **Stage 2 DBP Compliance Monitoring Plan**. This plan must be completed before your system is required to begin Stage 2 DBPR compliance monitoring. Until that time your system will need to continue monitoring under the Stage 1 DBPR (see Table below).

If you are on IDSE Schedule:¹	You must begin Stage 2 DBPR monitoring:
Schedule 1	April 1, 2012
Schedule 2	October 1, 2012
Schedule 3	October 1, 2013
Schedule 4	October 1, 2013 if no Cryptosporidium monitoring required under LT2ESWTR. OR October 1, 2014 if Cryptosporidium monitoring is required under LT2ESWTR.

¹ Schedule for systems in a combined distribution system is based on that of the largest system in the combined distribution system.

If you received a 40/30 certification for the IDSE, or if you were not required to conduct an IDSE, you must still develop a Stage 2 DBP Compliance Monitoring Plan that includes:

- When and where you intend to monitor TTHM and HAA5 for Stage 2 DBPR compliance.
- What compliance calculation procedures you intend to use.
- Monitoring plan for any other systems in the combined distribution system.

If you received a very small system (VSS) waiver for the IDSE, you should continue to monitor at the same location for Stage 2 DBPR compliance monitoring *unless you have data showing that your highest TTHM and HAA5 concentrations occur at a different location.*

If you received a 40/30 certification or a very small system (VSS) waiver for the IDSE, or if you were not required to conduct an IDSE, you must develop a monitoring schedule for Stage 2 DBPR compliance. The Stage 2 DBPR requires that systems conduct monitoring during the peak historical month for TTHM levels or HAA5 levels or the month of warmest water temperature. This is referred to as the "Controlling Month." It is meant to represent the "worst case" conditions when DBPs are expected to be at their highest levels during the year. In Vermont, the "Controlling Month" is most often (but not always) August.

Routine Compliance Monitoring Requirements

The locations and frequencies required for routine compliance monitoring requirements for your system are listed in the table below. For all systems, at least one sample must be taken during the month of highest DBP concentration or warmest water temperature (most often August).

Source Water Type	Population Size Category	Monitoring Frequency ¹	Distribution System Monitoring Location		
			Total per monitoring period	Highest TTHM Locations	Highest HAA5 Locations
Subpart H	<500	yearly	2 ²	1	1
	500 - 3,300	every 90 days	2 ²	1	1
	3,301 - 9,999	every 90 days	2	1	1
Ground Water	<500	yearly	2 ²	1	1
	500 - 9,999	yearly	2	1	1

¹All systems must take at least one dual sample set during the month of highest DBP concentrations or warmest water temperature.

²System is required to take individual TTHM and HAA5 samples (instead of dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. Only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location.

- **Subpart H systems serving 3,301-9,999 and Ground water systems serving 500-999:** You are required to take dual samples (one for TTHM and one for HAA5) at the locations and frequencies listed in the table on this page.
- **Subpart H systems serving up to 3,300 people and Ground water systems serving fewer than 500 people:** You are required to take individual samples (instead of a dual sample set) at the locations and frequencies shown in the table above, so you will sample for TTHM at the location with representative high TTHM concentrations and sample for HAA5 at the location with representative high HAA5 concentrations. However, if the highest TTHM and HAA5 concentrations occur at the same location in your distribution system, you can collect a dual sample set at one location per monitoring period (see table footnote).

Monitoring Locations

You can determine the appropriate Stage 2 DBP monitoring locations by using TTHM and HAA5 data. If you haven't collected TTHM and HAA5 data before, you will need to use other knowledge about your system to select appropriate sites. For most, the site you've been monitoring to satisfy the requirements of the Stage 1 DBPR is identified as the Maximum Residence Time, or MRT site. For many, this is the only site for which you have DBP data. MRT sites are most often located at points in the distribution system where water has the longest time to form DBPs. Dead ends of the distribution system or storage tanks with low turnover rates are areas where the water has long standing times. You can also determine the location of an MRT site by identifying where chlorine residuals are lowest in the system, a good indicator of where potential MRT sites exist in your system.

Selecting your Stage 2 DBP Monitoring Sites from TTHM and HAA5 Data

If you monitored at several locations under the Stage 1 DBPR, you can use your existing TTHM and HAA5 data to determine where you should monitor. Start by calculating the Locational Running Annual Average (LRAA) for TTHM and HAA5 at each Stage 1 DBPR monitoring site.

Stage 2 Monitoring Site Selection Worksheet

The following worksheet is provided to help you organize your existing data. Several copies of the worksheet are provided. The first copy is followed by instructions on how to complete it. The second copy is an example. The third is a blank worksheet that you can use or photocopy.

Using the TTHM and HAA5 Planning Worksheets for the Stage 2 DBPR

This section provides step-by-step instructions on how to use the TTHM and HAA5 planning worksheet. Each step corresponds to a numbered section of the sample worksheet. Note that you are not required to use this worksheet; it is simply provided to help you organize your monitoring results.

Step #1 **Enter location of the sampling sites, including:**

- All Stage 1 DBPR sampling sites
- Any additional TTHM or HAA5 locations sampled

Step #2 **Enter the type of sampling site.**

For Stage 1 DBPR (all plants):

- Maximum Residence Time, or
- Additional Monitoring Site

Step #3 **Enter the four most recent monitoring results for each location.**

- If you have older data, you may also want to look at years with high TTHM and HAA5 levels (which often occur during warm weather or periods with high TOC) on another copy of this worksheet.
- Do not look at data collected earlier than the last treatment/distribution system change.
- If you monitor yearly, you will be looking at just one location.

Step #4 **Calculate the LRAA for each sampling site.**

The LRAA calculation is the running annual average at each sampling location. $LRAA = (Q1+Q2+Q3+Q4)/4$

In situations where there is but a single sample result at a particular location, this result = the LRAA

Where there are multiple year results at a sample site, total the samples and divide by the number of samples = LRAA

Step #5 **Note which location has the highest LRAA.**

- Enter “Yes” in this column if that site has the highest LRAA for TTHM or HAA5, otherwise enter “No.”

Step #6 **Select Stage 2 DBP Compliance Monitoring Sites.**

- Select the location with the highest TTHM LRAA (Yes in Step 5) as your High TTHM site.
- Select the location with the highest HAA5 LRAA (Yes in Step 5) as your High HAA5 site.
- If your highest TTHM and HAA5 LRAAs occur at the same site, choose your second highest HAA5 LRAA as your High HAA5 site.
- Subpart H systems < 3,300 and ground water systems < 500 can take a dual sample set at one location if highest TTHM and HAA5 LRAAs occur at the same site (otherwise take one sample at two separate locations for High TTHM and High HAA5).

Explanation of Example TTHM and HAA5 Worksheet

This system is a NTNCWS that treats surface water at two plants and serves 5,000 people. Since the system is a NTNCWS that serves fewer than 10,000 people, it did not conduct an IDSE. Under Stage 1 DBPR, this system is required to take two samples per quarter at maximum residence time locations (one sample for each plant during each quarter).

On the example worksheet, the system recorded all the monitoring results from the last year. The system also included monitoring results from a third location that they sampled last year as part of a research project.

The system then calculated the LRAA for TTHM and HAA5 at each different monitoring site. For example:

Stage 1 #1 TTHM:

$$\text{LRAA} = \text{Q1} + \text{Q2} + \text{Q3} + \text{Q4} / 4$$

$$\text{LRAA} = (0.048 + 0.054 + 0.087 + 0.063) / 4$$

$$\text{LRAA} = 0.252 / 4$$

$$\text{LRAA} = 0.063 \text{ mg/L}$$

The system then compared the LRAA results for each site and noted which site had the highest LRAA.

The LRAA at Stage 1 site #2 was highest for TTHM, so the system will use this location as the Stage 2 High TTHM compliance monitoring site. The highest HAA5 LRAA was at the extra monitoring site, so the system will use this location as the Stage 2 High HAA5 compliance monitoring site.

IMPORTANT NOTE: To ensure you are comparing apples to apples (so to speak) please make sure you use concentrations expressed in mg/L not µg/L. To convert from µg/L to mg/L, take the concentration expressed in µg/L and move the decimal point three (3) decimal places to the left.

Example: 0.5 µg/L = 0.0005 mg/L

Selecting your Stage 2 DBP Monitoring Sites without Previous Data

If you do not have TTHM or HAA5 data or if you need to select more monitoring sites for Stage 2 DBPR than you have data for, you will have to use other knowledge about your system to identify one high TTHM and one high HAA5 location in your distribution system that are appropriate monitoring sites. Each site type has certain characteristics that will help you locate appropriate monitoring sites. You may also want to consider the following when selecting your Stage 2 monitoring sites:

- Geographic distribution of monitoring sites.
- Sites that are already used for compliance with other rules (e.g., Total Coliform Rule [TCR]).
- Site accessibility.

High TTHM Site

You should choose your high TTHM site to represent areas in the distribution system where you expect to find higher levels of TTHM throughout the year as compared to other sites. Higher temperatures and increased residence time typically lead to higher TTHM concentrations. Low disinfectant residual usually indicates longer residence time sites.

High HAA5 Site

Your high HAA5 site should be chosen to represent areas in the distribution system where you expect to find higher levels of HAA5 throughout the year as compared to other sites. Higher temperatures and increased residence time can lead to higher HAA5 concentrations. However, HAA5 can biodegrade when disinfectant residual levels are low or non-existent. Therefore, a high HAA5 site will not necessarily be the site with the longest residence time. Most typically, good HAA5 monitoring sites are located toward the center of your distribution system.

Characteristics of High TTHM Sites

High TTHM sites are often located:

- Near the ends of the distribution system, at or before the last group of customers.
- In mixing zones where water from different sources combine within the distribution system.
- Downstream of storage facilities - especially those with a common inlet and outlet prior to the last fire hydrant.

Sample sites should **not** be located:

- At a dead-end where there are no customers.
- Immediately prior to booster disinfection.

Characteristics of High HAA5 Sites

High HAA5 sites are often located:

- In areas with low but existing disinfectant residual (generally, disinfectant residual levels should be consistently above 0.2 mg/L for chlorine or 0.5 mg/L for chloramine).
- Near the ends of the distribution system, at or before the last group of customers.
- In mixing zones where water from different sources combines within the distribution system..
- Downstream of storage facilities.
- Prior to the last fire hydrant.

Sample sites should **not** be located:

- At a dead-end where there are no customers.
- Immediately prior to booster disinfection.
- Where no disinfectant residual exists.
- Areas with biofilm problems.

Monitoring Schedule

If you received a 40/30 certification or a very small system (VSS) waiver for the IDSE, or if you were not required to conduct an IDSE, you must develop a monitoring schedule for Stage 2 DBPR compliance. The Stage 2 DBPR requires that systems conduct monitoring during the peak historical month for TTHM levels or HAA5 levels or the month of warmest water temperature. This is referred to as the "Controlling Month." It is meant to represent the "worst case" conditions when DBPs are expected to be at the highest levels during the year. In Vermont, the "Controlling Month" is most often (but not always) August.

Since most small systems do not have TTHM or HAA5 data more than quarterly, it is recommended that you use water temperature to determine your controlling month. Although there are no regulations that require you to measure water temperature in your distribution system or sources, many systems collect this information for process control. Other systems may have temperature data at different points in the treatment plant. If your system measures the temperature of water leaving the treatment plant, consider averaging these data for each summer month to identify the month of warmest water temperature. No matter which data you use, calculate the average for each summer month to identify the month of warmest temperature. This is your controlling month.

All systems are required to monitor during their controlling month, regardless of system size or monitoring frequency. If you monitor yearly, you will sample yearly during this month. If you monitor quarterly, you will sample during this month and every 90 days before and/or after the peak historical month to meet your monitoring requirements.

Note: You do not have to sample at exactly the frequency required for your system. Sampling within the same week during each required month is sufficient. For example, if you are required to sample every 90 days, you could sample during the second week of every third month. If you are required to sample yearly, you could sample each year during the first week of your controlling month.

Month			Year
October	November	December	2013
January	February	March	2014
April	May	June	2014
July	August	September	2014

Stage 2 DBP Compliance Monitoring Plan Template

The following template is provided to help you draft your Stage 2 Compliance Monitoring Plan. A Stage 2 DBPR Compliance Monitoring Plan template is available in a digital form-fillable format on our Website or upon request to doug.kievit-kylar@state.vt.us

Stage 2 DBPR Monitoring Plan

Stage 2 Compliance Monitoring Site ID	Site Type	Justification	Projected Sampling Date (month/day/year) *			
			Period 1	Period 2	Period 3	Period 4
	<input type="checkbox"/> Highest TTHM <input type="checkbox"/> Highest HAA5 <input type="checkbox"/> Stage 1 DBPR <input type="checkbox"/> Other					
	<input type="checkbox"/> Highest TTHM <input type="checkbox"/> Highest HAA5 <input type="checkbox"/> Stage 1 DBPR <input type="checkbox"/> Other					

* *Period = monitoring period. Complete for the number of monitoring periods required for your system.*

Compliance Calculation Procedures

- Monitor yearly, compliance calculated as sample result < MCL for each location
- Monitor quarterly, compliance calculated as $LRAA = (Q1+Q2+Q3+Q4)/4 < MCL$ for each location
- Monitor more frequently than quarterly. Compliance calculated as follows:

Combined Distribution System Information

This PWS is part of a combined distribution system

If Checked: Monitoring Requirements have been reduced by State and monitoring plans for other systems are attached.

Reduced Monitoring

Your system can qualify for reduced monitoring if you **meet all three** of the following criteria:

- The LRAA is < 0.040 mg/L for TTHM at **all** monitoring locations,
- The LRAA is < 0.030 mg/L for HAA5 at **all** monitoring locations, and
- The source water annual average TOC level (before any treatment) is < 4.0 mg/L at each treatment plant treating surface water or ground water under the direct influence of surface water.

Reduced monitoring requirements:

Source Water Type	Population Size Category	Reduced Monitoring Frequency	Distribution System Monitoring Location per Monitoring Period
Subpart H	<500	-	Monitoring may not be reduced.
	500 - 3,300	yearly	One TTHM and One HAA5 sample: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 measurement; one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and quarter.
	3,301 - 9,999	yearly	Two dual sample sets: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement.
Ground Water	<500	every third year	One TTHM and One HAA5 sample: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement; one dual sample set if the highest TTHM and HAA5 measurements occurred at the same location and quarter.
	500 - 9,999	yearly	One TTHM and one HAA5 sample: one at the location and during the quarter with the highest TTHM single measurement, one at the location and during the quarter with the highest HAA5 single measurement; one dual sample set per year if the highest TTHM and HAA5 measurements occurred at the same location and quarter.

You may remain on reduced monitoring as long as samples remain below the following levels:

- Each TTHM sample is less than or equal to 0.060 mg/L, and
- Each HAA5 sample is less than or equal to 0.045 mg/L, and
- The source water annual average TOC level (before any treatment) is <4.0 mg/L at each treatment plant treating surface water or ground water under the direct influence of surface water.

Increased Monitoring

If you monitor yearly (or less frequently if on reduced monitoring), you must begin increased monitoring and sample every 90 days if:

- Any TTHM sample > 0.080 mg/L, or
- Any HAA5 sample is > 0.060 mg/L.

Note that this is not an immediate violation. However, your system is in violation of the Stage 2 MCLs if the TTHM or HAA5 LRAA exceeds the MCL after four quarters of sampling.

You may return to **routine monitoring** from increased monitoring when all of the following criteria are met:

- You have conducted increased monitoring for at least four quarters, and
- LRAA for **every** monitoring location is < 0.060 mg/L for TTHM, and
- LRAA for **every** monitoring location is < 0.045 for HAA5.

Compliance Determination and MCL Violations

Compliance with the TTHM and HAA5 MCLs for Stage 2 DBPR is based on your monitoring results at each monitoring location.

If you monitor once per quarter:

- Compliance is based on the LRAA of monitoring results, calculated quarterly.
- You must make compliance calculations beginning with the end of the fourth quarter of monitoring and continue calculations after each quarter.
- If you fail to complete four consecutive quarters of monitoring, you must calculate compliance with the MCL based on the average of the available data from the most recent four quarters.
- If you take more than one sample per quarter at a monitoring location, you must average all samples taken in the quarter at that location to determine a quarterly average to be used in the LRAA calculation.
- If the LRAA at any location exceeds the MCL, you are in violation.
- Failure to monitor will be treated as a monitoring violation for the entire period covered by a locational running annual average compliance calculation for the Stage 2 MCLs.

If you monitor once per year:

- Compliance is based on the value of the yearly samples at each location.
- You must make compliance calculations beginning with the first compliance sample taken after the compliance date.
- If any sample exceeds the MCL, you are not immediately in violation. You must begin increase monitoring immediately (monitor quarterly at each location).

- If any sample exceeds the MCL and you are on reduced monitoring, you must begin increased monitoring immediately (monitor quarterly at each location).
- Failure to monitor will be treated as a monitoring violation for the entire period covered by a locational running annual average compliance calculation for the Stage 2 MCLs.