Investigation of Disinfection Byproducts in Small Surface Water Filtration Plants in Pennsylvania

Michele Fuller, Joseph Chavez, Abbie Gongloff, and Nicole Yanich

Department of Environmental Protection
Bureau of Water Supply and Wastewater Management
P.O. Box 8467
Harrisburg, PA 17105-8467
717-772-4018
www.dep.state.pa.us

Abstract

In 2004, the Disinfection Byproducts (DBP) Rule will require small surface water filtration plants to comply with the regulated levels of 0.080 mg/L total trihalomethanes (TTHM) and 0.060 mg/L haloacetic acids (HAA5). Under this regulation, small surface water filtration plants that serve 500 to 10,000 people will be required to take samples quarterly and filtration plants serving less than 500 people will be required to take an annual sample.

To determine the full impact of the DBP Rule on Pennsylvania's small surface water filtration plants serving populations of less than 10,000, the Pennsylvania Department of Environmental Protection (department) collected samples at 167 plants across the state for TTHM and 156 plants for HAA5 analysis during the summers of 2000 and 2001. In 2001, 29 filtration plants were retested for TTHM and 23 plants were retested for HAA5. These filtration plants were retested due to their exceedence of 80 percent of the maximum contaminant level for TTHM.

Whenever possible, the goal was to collect TTHM and HAA5 sample sets. This means that the TTHM and HAA5 sample sets were collected at the same time and location. In addition, samples were collected at the location of maximum residence time in the distribution. The department's Bureau of Laboratories performed the analysis on these samples during both summers.

The results identify TTHM as the main contaminant of concern. Approximately 28 percent of Pennsylvania's small surface water filtration plants exceeded 80 percent of the Maximum Contaminant Level (MCL). These filtration plants may need assistance to comply with the future MCL for TTHM. The levels of TTHM in small surface water filtration plants were similar to those in medium and large filtration plants.

The levels of HAA5 in small surface water filtration plants were similar to those of the medium and large filtration plants. Four of the filtration plants out of 156 plants exceeded 80 percent of the MCL and may have trouble complying with the future MCL for HAA5.

By contrast, 47 percent of the filtration plants were under the TTHM level of 0.04 milligrams per liter of water (mg/L) and the HAA5 level of 0.03 mg/L. These systems may be eligible for reduced TTHM and HAA5 monitoring as outlined under the DBP Rule.

The results of the sampling program provided department staff with water quality information *before* the regulation takes effect. It also identified filtration plants that could have a potential to exceed the MCL as specified in the DBP Rule. Thus, department staff will have more time to work with the filtration plant staff to resolve problems through operational and/or infrastructure improvements. Without TTHM and HAA5 data beforehand, filtration plants may respond with inappropriate adjustments to treatment such as reducing disinfectant levels and

compromise inactivation of microbial pathogens. Furthermore, this is currently the only statewide study on the levels of TTHM and HAA5 in small surface water filtration plants in Pennsylvania and may set the stage on what other states can expect in terms of disinfection byproducts.

Introduction to Disinfection Byproducts

Natural organic material that is common in most streams, rivers and lakes, when combined with chlorine, can form disinfection byproducts (DBPs). DBPs are organic compounds known as total trihalomethanes[1] (TTHM) and haloacetic acids[2] (HAA5). Surface water filtration plants that treat water for human consumption often are not able to remove all of the organic material from the source water. As a result, the chlorine that is used to treat for disease-causing microorganisms reacts with the remaining organic material and forms DBPs in the filtration plant and throughout the distribution system. The primary DBP formed is trihalomethanes followed by haloacetic acids. Studies on animals have shown these byproducts to be carcinogenic with long-term exposure and may cause other short-term adverse health affects.

Currently, surface water filtration plants serving at least 10,000 people are required to test for TTHM. Starting in January 2002, these filtration plants also began monitoring for HAA5. In 2004, the Disinfection Byproducts Rule will require surface water filtration plants serving fewer than 10,000 people to sample for TTHM and HAA5. Staff at these smaller filtration plants will need to collect the samples at the maximum residence time (indicated by areas of low chlorine residual) in the distribution system. These areas usually occur at dead ends, storage tanks or other places where the water has long standing times in the distribution system. The Disinfection Byproducts Rule will require small water filtration plants to comply with the regulated maximum contaminant levels (MCL) of 0.080 mg/L TTHM and 0.060 mg/L HAA5. Under this regulation, filtration plants that serve 500 to 10,000 people will be required to take samples quarterly and plants serving less than 500 people will be required to take an annual sample.

Reduced TTHM and HAA5 monitoring is available to all surface water filtration plants serving over 500 people that meet specific requirements. To be eligible for reduced monitoring, the TTHM *and* the HAA5 running annual averages must be below 0.040 mg/L and 0.030 mg/L, respectively. In addition, the annual average for Total Organic Carbon cannot exceed 4.0 mg/L before treatment. If a filtration plant qualifies for reduced TTHM and HAA5 monitoring, under the DBP Rule, they will only need to obtain one sample set annually. This reduced monitoring would remain in place unless the annual result for TTHM exceeded 0.06 mg/L or HAA5 exceeded 0.045 mg/L, in which case the monitoring frequency would increase.

In preparation for the DBP regulation, the federal government will require small water filtration plants to perform preliminary TTHM and HAA5 sampling. This monitoring will begin in the summer of 2002 as part of the Long Term 1 Enhanced Surface Water Treatment Rule, and will set temporary trigger levels of 0.064mg/L for TTHM and 0.048mg/L for HAA5. Both of these

[1] For the purposes of this report, total Trihalomethanes (TTHM) of interest includes: Chloroform, Bromodichloromethane, Bromoform, and Dibromochloromethane. This group is currently regulated by EPA and more systems will be required to comply as described above.

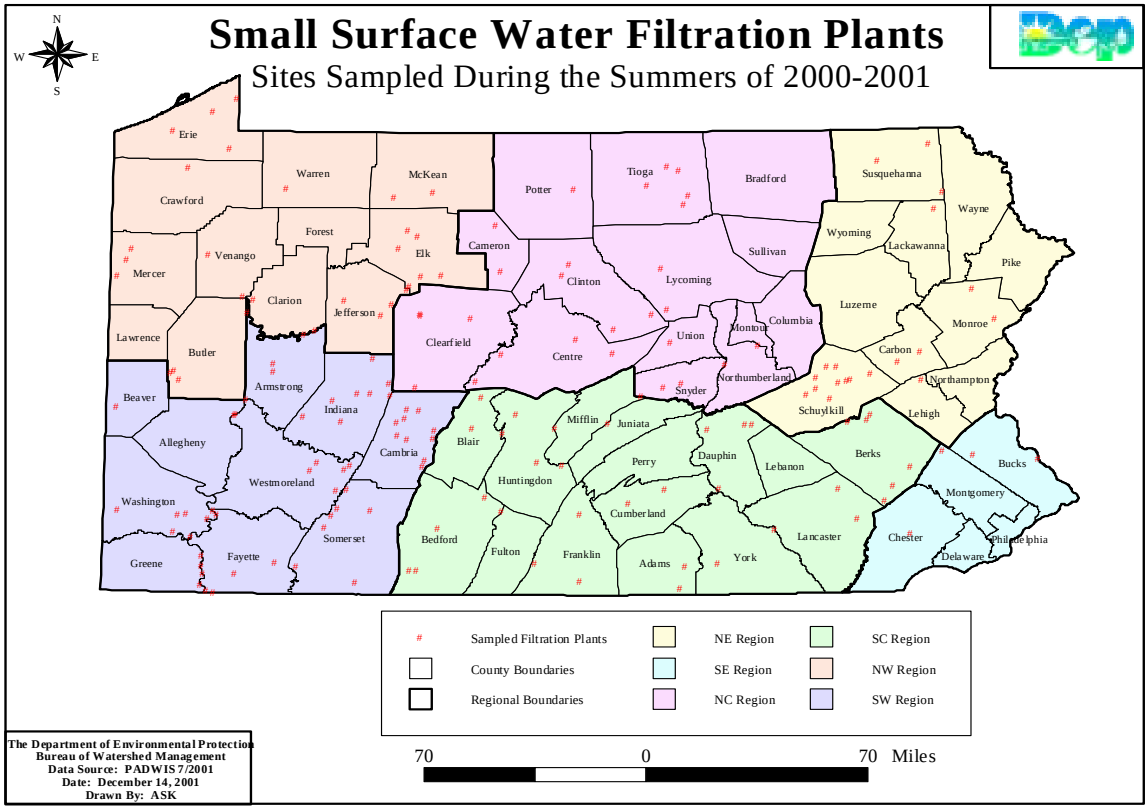
[2] For the purposes of this report, the five Haloacetic Acids, or HAA5, of interest include: Dibromoacetic Acid, Dichloroacetic Acid, Monobromoacetic Acid, Monochloroacetic Acid, and Trichloroacetic Acid. This group of contaminants is to be regulated by the EPA in the coming years as described above.

levels are 80 percent of their respective Maximum Contaminant Level (MCL) and will not cause violations. However, if sample results are above these levels, operators may need to perform additional calculations on disinfection levels at the filtration plant (see the online steps at http://www.dep.state.pa.us/dep/deputate/waterops/redesign/pages/DRWaterdisinfect).

Preliminary Sampling

To determine the full impact of the DBP Rule on Pennsylvania's small surface water filtration plants serving populations of less than 10,000, the Department of Environmental Protection (department) collected samples at 167 small surface water filtration plants across the state for TTHM and 156 plants for HAA5 analysis during the summers of 2000 and 2001 (see Figure 1 for a site map). In 2001, 29 filtration plants were retested for TTHM and 23 plants were retested for HAA5. These filtration plants were retested due to them exceeding 80 percent of the maximum contaminant level for TTHM.

Figure 1. Locations of small surface water filtration plants serving less than 10,000 people.



The purpose of the study was to alert filtration plants of current levels of TTHM and HAA5 and determine any possible compliance problems before the new regulation takes effect in 2004. The study also briefed operators on the monitoring procedures to familiarize them with how, where, when and what they are sampling for in the future. Samples for these DBPs were taken in the distribution system at the estimated area of maximum residence time.

Until now, only larger filtration plants were required to collect TTHM samples resulting in little or no data for TTHM and HAA5 at smaller filtration plants. The results of this sampling program provided department staff with water quality information *before* the regulation becomes effective. This gave the department the opportunity to identify plants that could have trouble complying with the DBP Rule and allow sufficient time to work with water system staff in resolving problems through operational and/or infrastructure improvements. Without TTHM and HAA5 data beforehand, filtration plants may be confronted with a potential violation of the DBP Rule in 2004 and respond with inappropriate adjustments to treatment. Even worse, operators could reduce disinfectant levels and compromise inactivation of *Giardia*, viruses and bacteria. This sampling program should help avoid these scenarios. In essence, the results of this analysis were used for a "screening survey" in preparation for the DBP Rule.

Distribution of Samples

Throughout the summer of 2000 and 2001, the interns sampled 167 small (less than 10,000 people) surface water filtration plants. Due to TTHM results exceeding 80 percent of the MCL (0.064 mg/L), 29 filtration plants sampled in 2000 were retested in 2001. At 23 of those plants, an HAA5 sample was also obtained. This resulted in a total of 196 TTHM samples and 179 HAA5 samples collected over both summers. Table 1 shows the distribution of TTHM and HAA5 samples obtained at the filtration plants.

Table 1. TTHM/HAA5 sampling at small filtration plants (< 10,000 people) during the summers of 2000 and 2001.

	TTHM	HAA5
TTHM and HAA5 Sample Sets	156	156
TTHM Only	11	0
Retested	29	23
Total samples	196	179

Table 2 shows the distribution of the filtration plants throughout Pennsylvania in each of the department's six regions.

Table 2. Distribution of small filtration plants by region.

Region	Number of plants
Southeast	4
Northeast	20
Southcentral	33
Northcentral	29
Southwest	53
Northwest	28
Total plants	167

During each summer, two interns conducted the sampling and compiled the data. At each of these small filtration plants, the interns collected a TTHM and HAA5 sample set at the estimated maximum residence time in the distribution system. However, at 11 filtration plants and at 6 retested plants, only TTHM was collected due to instrumentation failure at the laboratory.

Materials and Methods

Prior to sampling, the interns contacted the responsible district sanitarians to confirm the filtration plant's operator name and phone number and to alert the sanitarians of the testing. Upon contacting the filtration plant operator, the interns explained the testing program and arranged a time and date to conduct the sampling. After this initial contact, nearly all the filtration plant operators personally accompanied the intern to the testing site. However, on occasion the intern conducted the testing independently. Sample sites were chosen based on discussions with the operators as to the location of the maximum residence time as indicated by the lowest chlorine residual. This ensured that the disinfectant had the longest reaction time with the organics in the water. Testing during the warm summer months at the maximum residence time should yield higher TTHM levels and possibly HAA5 than testing during any other time of year.

For TTHM testing, two 40 milliliter (mL) amber glass vials with Teflon septa containing 25 mg of ascorbic acid for dechlorination were used per sample location. The TTHM samples were fixed with pre-measured vials of 0.5 mL 1:1 hydrochloric acid for pH adjustment (pH<2.0). For HAA5 testing, two 60 mL amber glass vials with Teflon septa containing 6 mg of ammonium chloride for dechlorination were used per sample location. Legal seals were not required since the sample results are not compliance-oriented. Other equipment included organic-free water for field blanks, 500 mL plastic bottles, gloves, goggles, labels, sample submission forms, plastic bags and a waterproof marker. A cooler with sufficient ice was used to ensure samples remained at 4^{o}C from time of collection to analysis. EPA Method 524.2 requires analysis to be completed within 14 days of sample collection.

The sampling procedure included the following. The aerator and screen were removed from the faucet and the cold water turned on. The temperature of the water was allowed to reach a stable point (2 to 3 minutes) before obtaining the sample. With rubber gloves and goggles on, a 40 mL TTHM bottle was tapped on the top to settle ascorbic acid to the bottom, the cap was then removed and the bottle filled halfway with cold running water. The cap was replaced and the bottle gently inverted several times to dissolve the ascorbic acid. Once the ascorbic acid was dissolved, one 0.5 mL vial of hydrochloric acid was added and the bottle was filled until a convex meniscus was formed and then carefully recapped to avoid any air bubbles. The bottle was dried and a label was affixed to the outside. The bottle was then wrapped in a paper towel and placed in either a 500 mL plastic bottle (used when sending samples to the lab by courier) or placed in a plastic bag (when hand delivered) with a sample submission form and then placed inside the cooler. Using this technique, two 40 mL TTHM sample bottles were collected at each site.

Following the collection of the TTHM samples, two HAA5 sample bottles were collected at each site. The 60 mL bottles were tapped on the top to settle the ammonium chloride. They were then filled with cold water until a convex meniscus was formed and carefully recapped. The bottles were wiped dry so that a label could be affixed and then they were wrapped in a paper towel. Afterwards they were placed in either a 500 mL bottle (used when sending samples to the lab by courier) or a plastic bag (when hand delivered) with a sample submission form and then placed inside the cooler with ice to ensure samples remained at 4^{o}C from time of collection to analysis. EPA Method 552.2 requires an extraction to be performed within 14 days of sample collection.

All samples were either hand-delivered to the department's Bureau of Laboratories or sent to the lab by courier from the district/regional offices. At the lab, samples were placed under refrigeration until analysis by lab personnel.

The sample labels contained the following data: intern's ID number, sample sequence number, date, time, preservative/fixative added, sample location (filtration plant name) and sample analysis code (SAC). The sample submission forms contained the above data in addition to filtration plant address, sample location and sampler's signature and phone number. When the intern returned to the office the duplicate information was then entered into the Sample Information System, which allowed the lab to email the results to the individual collector. The Bureau of Laboratories analyzed samples using Standard Analysis Code "VOA2" (EPA Method 524.2) for TTHM and Standard Analysis Code "HAA" (EPA Method 552.2) for HAA5. In addition to samples, organic-free field blanks were collected weekly to ensure quality.

To collect all 375 samples from the 167 surface water filtration plants, each intern collected approximately five TTHM and five HAA5 sample sets per week between June and mid-August In addition, each intern collected one field blank for TTHM and one for HAA5 per week. The average weekly number of samples collected was 24 (ten TTHM, ten HAA5, and four blanks).

After receiving the sample results from the lab, the interns calculated the four disinfection byproducts composing the total trihalomethanes and the five byproducts that make up haloacetic acids. The results were then reported to the filtration plant operators, responsible sanitarians, and Filtration Plant Performance Evaluation staff by mail and email.

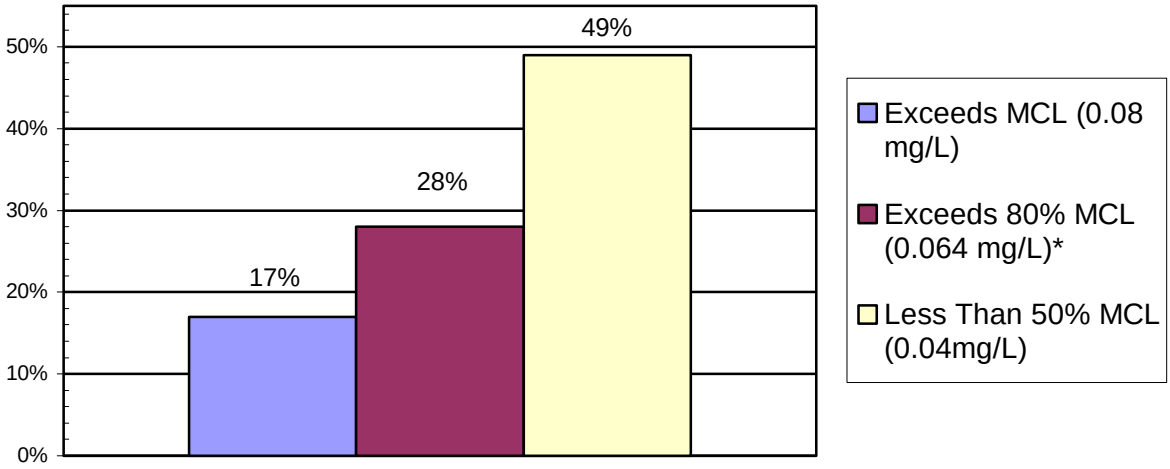
TTHM Results

Under the Long Term 1 Enhanced Surface Water Treatment Rule, the objective of the applicability monitoring will involve setting a temporary trigger level of 80 percent of the future MCL. Therefore, for the purpose of this report, all filtration plants exceeding both 0.064 mg/L (80 percent of 0.08 mg/L) and 0.08 mg/L MCL will be considered in excess. These plants will be referred to as two separate groups: one group, consisting of *only* the filtration plants above the MCL of 0.08 mg/L, and one group consisting of the *all* the plants over 80 percent of the MCL (Figure 2). Filtration plants with levels below 50 percent of the MCL are significant and comprise a third group (Figure 2). These filtration plants may qualify for a reduced monitoring program. Note that filtration plants falling between 50 percent and 80 percent of the MCL are not addressed. For the purpose of this report, analysis of the results is based on the most current sampling data of the 167 filtration plants. In the case of the 29 systems that were retested, only data from 2001 was used for this report.

There were 47 filtration plants (28%) that exceeded 80 percent of the MCL. Of those 47 plants, 28 (17%) exceeded the MCL of 0.08 mg/L while 19 filtration plants exceeded the 80 percent trigger level but were below the MCL. Figure 3 plots the filtration plants in Pennsylvania that had TTHM levels greater than the MCL, while Figure 4 plots the all the plants above 80 percent of the MCL.

There were 81 out of 167 filtration plants (49%) that are less than 50 percent of the MCL. These filtration plants may qualify for reduced monitoring.

Figure 2. Percentage of small surface water filtration plants that fell within proposed TTHM trigger levels.



*Includes filtration plants that exceeded the MCL

Figure 3. Locations of small surface water filtration plants that exceeded the TTHM MCL of 0.08mg/L.

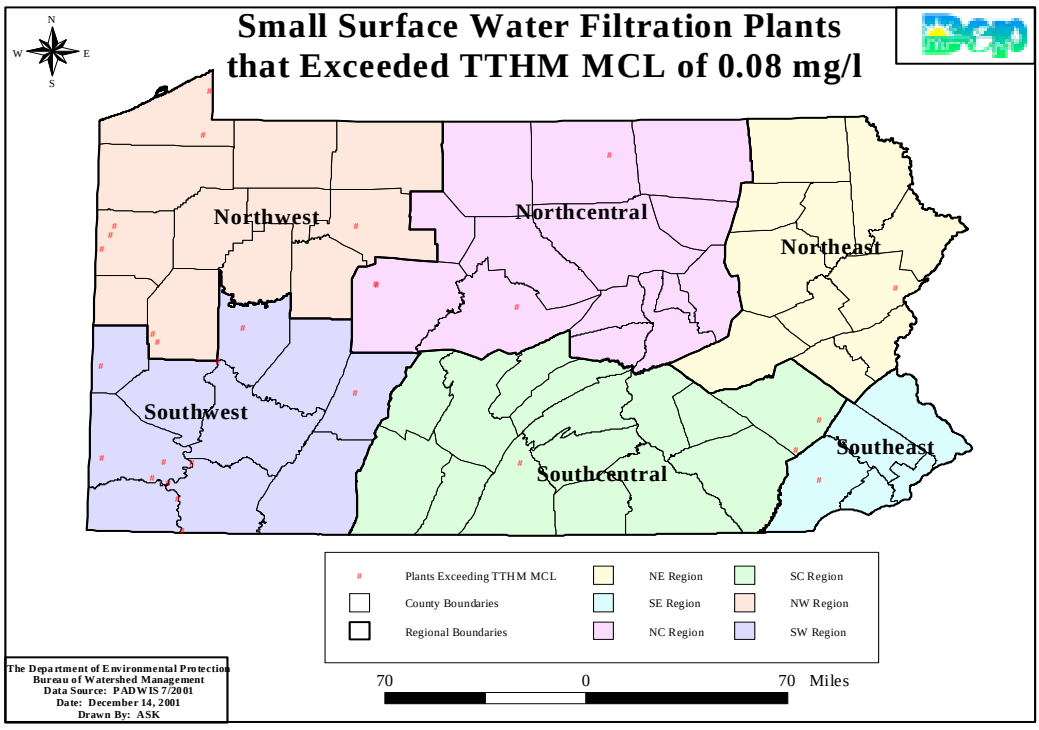


Figure 4. Locations of small surface water filtration plants that exceeded 80 percent of the MCL, 0.064 mg/L.

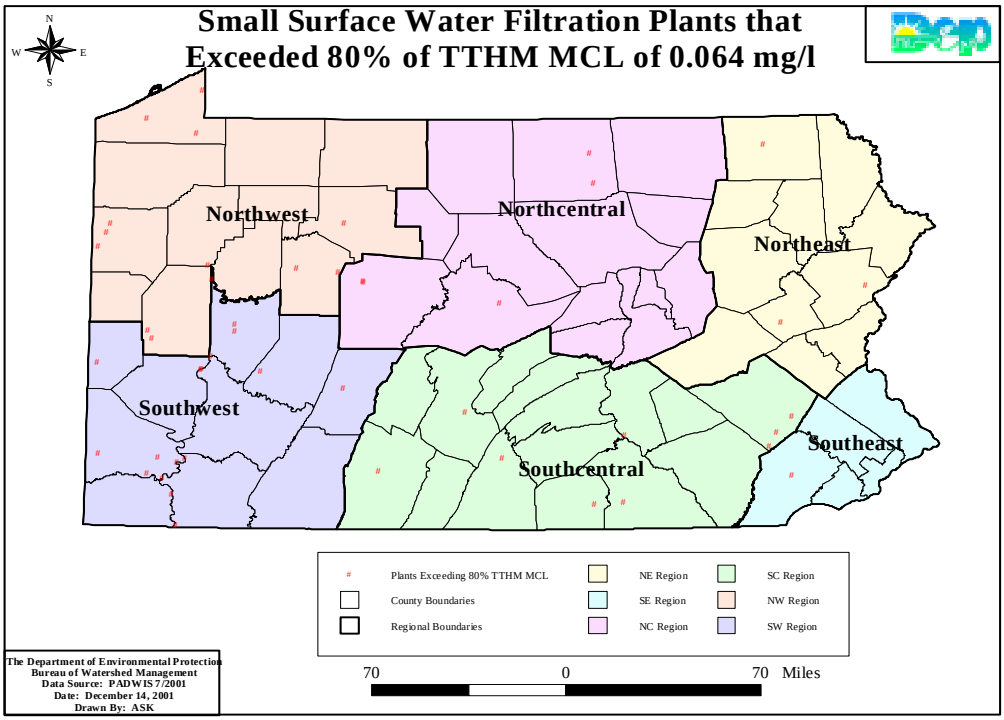


Table 3 separates all the sample results into six of the department's regions in Pennsylvania. The chart displays the number and percentage of small surface water filtration plants within each group for each region. This data classifies all filtration plants above the MCL, above 80 percent of the MCL, and all plants below 50 percent. The chart does not include the number and percentage of filtration plants that fall above 50 percent of the MCL but below 80 percent of the MCL.

Table 3. The number and percentages of small surface water filtration plants in each of the department's regions that fell within "trigger levels" established in future regulations.

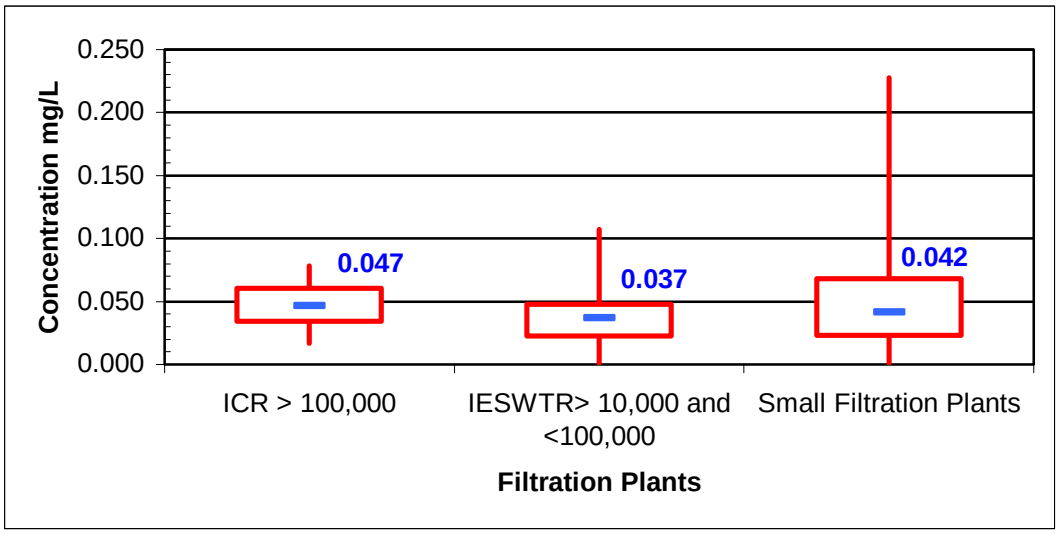
	Filtration Plants >MCL		Filtration Plants > 80% of MCL*		Filtration Plants < 50% of MCL	
Region	Number	Percent	Number	Percent	Number	Percent
Southeast	1	25%	1	25%	2	50%
Northeast	1	5%	3	15%	11	58%
Southcentral	3	9%	9	27%	16	48%
Northcentral	4	13%	5	17%	21	72%
Southwest	11	20%	17	32%	20	37%
Northwest	8	28%	12	42%	11	39%

*Includes the filtration plants that exceeded the MCL

Figure 5 is a box and whiskers diagram[3] that compares TTHM data of three different sized surface water filtration plants in Pennsylvania. There were 167 small surface water filtration plants serving less than 10,000 people. The TTHM data was collected during the summers of 2000 and 2001. There were 123 filtration plants that serve between 10,000 and 100,000 people. This TTHM data was collected under the Interim Enhanced Surface Water Rule (IESWTR) from January1999 to March 2000. There were 20 filtration plants that serve greater than 100,000 people. This TTHM data was collected under the Information Collection Rule (ICR) from July 1997 to December 1998.

The small surface water filtration plants' maximum TTHM value is higher than both the IESWTR and ICR maximums. However, Figure 5 demonstrates that the majority of the small filtration plants' values are below 0.1 mg/L, with about 72 percent of the data lying below the MCL of 0.08mg/L.

Figure 5. Comparison of TTHM data collected from small filtration plants, medium filtration plants (IESWTR), and large filtration plants (ICR). The line in the center of the box and nearby number is the median value for each size filtration plant.



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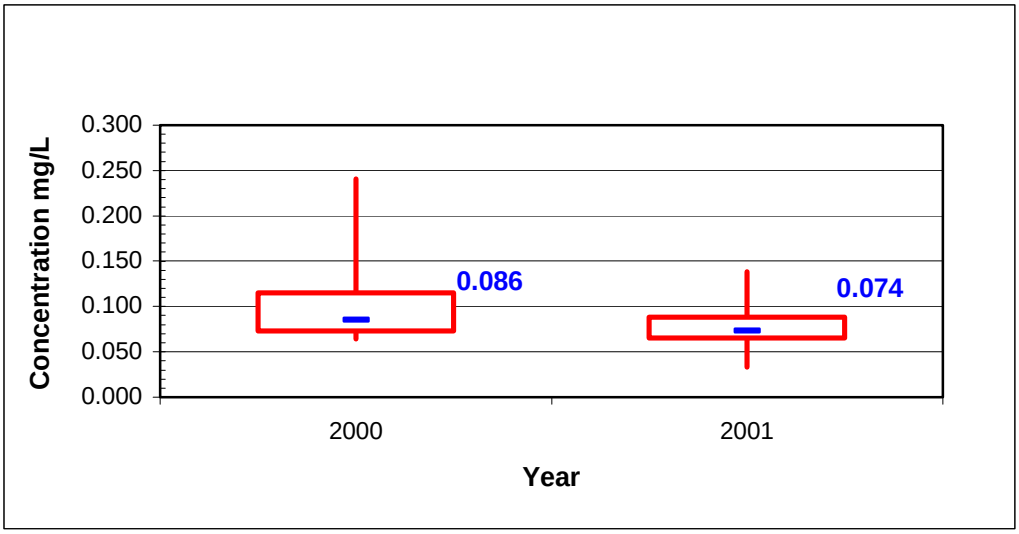
The TTHM results comparison with IESWTR and ICR provide assurance that the small filtration plants' TTHM levels are similar to those of larger filtration plants. Keep in mind, the IESWTR and ICR filtration plants are required to test quarterly, therefore delivering a yearly average, while the small filtration plant data was collected only during the summer months when TTHM levels are typically higher.

As previously mentioned, 29 filtration plants were retested in 2001. In 2000, 20 of the 29 plants exceed the MCL and the other 9 filtration plants were below the MCL but exceeded the 80 percent trigger level. In 2001, 9 of the 29 plants exceeded the MCL, 13 filtration plants were below the MCL but exceeded the 80 percent trigger level and the other 7 were below the 80 percent trigger level. Figure 6 compares the data from the two summers. This reduction could

[3] A Box and Whisker display is a graphic representation of five key data points: maximum value, minimum value, median, 25th percentile, and 75th percentile. The upper line represents the top 25 percent of the data. The lower line represents the lower 25 percent of the data. The box represents the middle 50 percent of the data (the data that lies between the 25th and 75th percentile). The line in the box represents the median value.

have been a result of internal improvements at the filtration plant or changes in climatic conditions.

Figure 6. Comparison of TTHM results of the 29 retested small surface water filtration plants. The line in the center of the box and nearby number is the median value for each year.



It is important to note that 20 of 196 TTHM samples (10%) collected were subject to quality assurance notations on the lab report. These notations included low surrogate recovery, excessive holding time and values outside the instrument calibration range. Before and during the analysis of all TTHM samples, the Bureau of Laboratories performed quality control analysis as prescribed by EPA Method 524.2. The quality control analysis concluded with acceptable results. Therefore, these samples were included when the data was compiled.

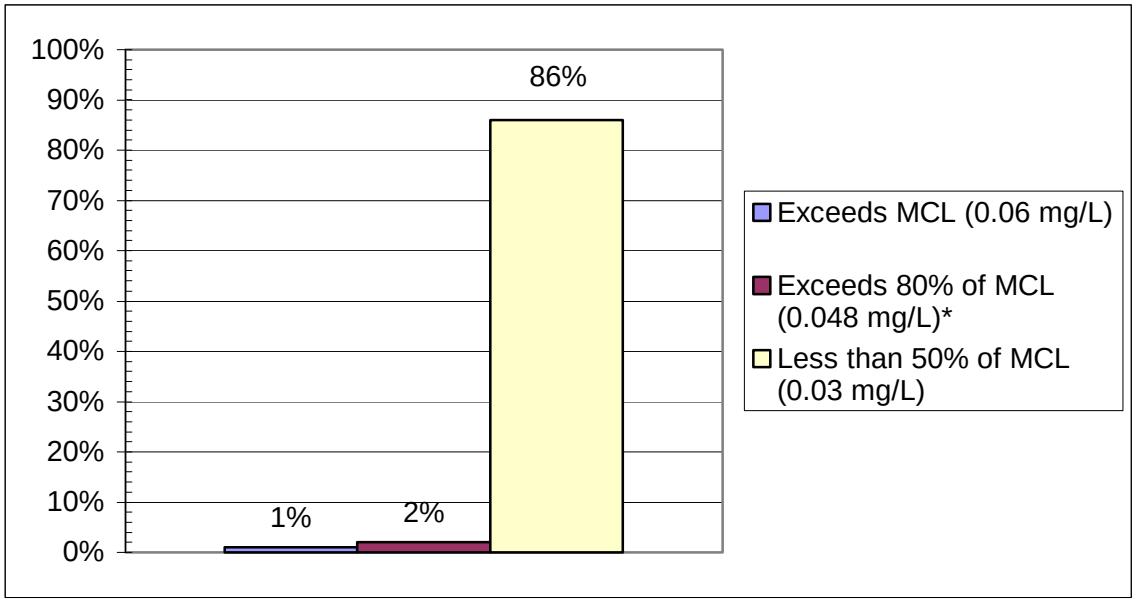
HAA5 Results

There were 156 filtration plants that had samples analyzed for HAA5, with 23 plants from 2000 resampled in 2001. Thus, a total of 179 samples were obtained and analyzed during the summers of 2000 and 2001. As with TTHM, HAA5 has trigger levels at 80 percent and 50 percent of the MCL. Filtration plants falling between the 50 percent and 80 percent of the MCL are not addressed separately. There were four filtration plants (2%) that exceeded 80 percent of the MCL (0.048 mg/L). Of those four, two filtration plants exceeded the MCL and two exceeded 80 percent of the MCL but were below the MCL. As Figure 7 demonstrates, 86 percent of the filtration plants were below the trigger level of 50 percent of the MCL (0.03 mg/L). The two filtration plants exceeding the MCL are located in the southwest region. Of the two filtration plants that exceeded 80 percent of the MCL, but were less than the MCL, one is located in the southwest region and the other is located in the southcentral region. In the case of the 23 systems that were resampled for HAA5, only data from 2001 was used for this report. Two of the filtration plants with high HAA5 results also had high TTHM results. The other two filtration plants with high HAA5 results did not have high TTHM results.

It is not usual for water systems to experience high levels of one DBP but low levels of another. The variance in this data could be explained by differing pH values of the water at the treatment plant or in the distribution system. Studies have shown that the pH level of the water affects the formation of TTHM and HAA5. For example, between pH 5 and 9.4, TTHM and

HAA5 have similar formation. Below pH 5, TTHM has a lower formation rate than HAA5; by contrast, above pH 9.4, TTHM has a higher formation rate than HAA5 (Singer 1999). The Pennsylvania study did not involve a pH analysis at the sample collection point, so the authors can only rely on previous research regarding the effects of pH on TTHM and HAA5 formation.

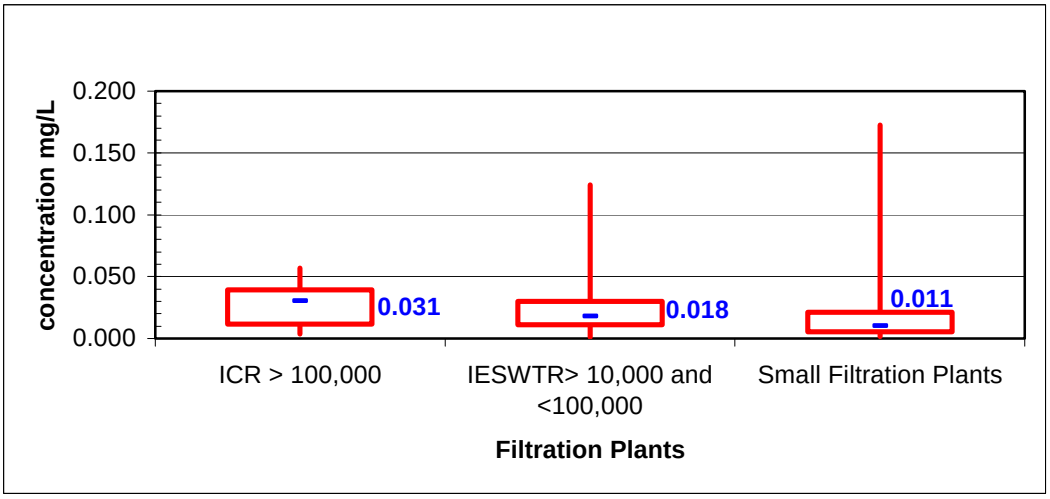
Figure 7. Percentage of small water filtration plants that fell within proposed HAA5 trigger levels.



*Includes filtration plants that exceeded the MCL

Figure 8 is a box and whiskers diagram of HAA5 that compares small water filtration plants with IESWTR and ICR filtration plants. The small water filtration plants' maximum HAA5 value is higher than the larger filtration plants. However, Figure 10 demonstrates that the majority of the data is below the 50 percent trigger level and is similar to IESWTR and ICR filtration plants.

Figure 8. Comparison of HAA5 data collected from small filtration plants, medium filtration plants (IESWTR) and large filtration plants (ICR). The line in the center of the box and nearby number is the median value of each size filtration plant.



It is important to note that 58 out of 179 HAA5 samples (32.5%) collected were subject to quality assurance notations on the lab report. The quality assurance notations included: excessive holding time, low surrogate recovery and sample not meeting minimum quality control requirements.

The surrogate is a means of assessing method performance in every analysis from extraction to final chromatographic performance. If a sample has a low surrogate recovery, a calibration check should be performed. Typically, if the calibration check is acceptable, the extract should be re-analyzed. If the re-analyzed extract fails then all data should be reported as suspect and it may be necessary to extract another aliquot of sample. The large number of samples collected in a short amount of time did not enable re-extractions, and so some of these samples received a low surrogate recovery notation. Furthermore, none of these samples were used for regulatory compliance.

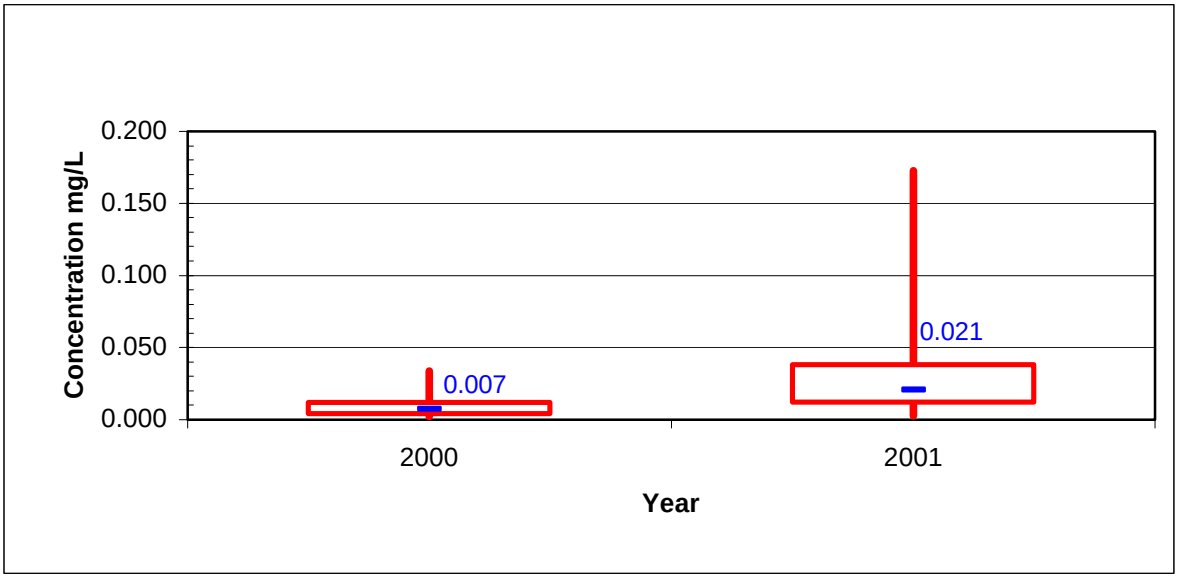
Before and during the analysis of all HAA5 samples, the department's Bureau of Laboratories performed quality control analysis as prescribed by EPA Method 552.2. The quality control analysis concluded with acceptable results. Therefore, these samples were included when the data was compiled. Furthermore, the HAA5 study included 32 field blanks and none of these field blanks had any detects for the five species that comprise HAA5

There have been studies conducted on the effectiveness of EPA Method 552.2. One study has shown that using the current conditions for methylation, complete methylation of trihaloacetic acids, Dalapon and the surrogate 2.3-dibromopropionic acid does not occur. This may possibly have an effect on the analysis of the trihaloacetic acids (Xie et al 2000). The authors of Pennsylvania's DBP study point this out to illustrate the current difficulties in the HAA5 analysis and that this, among other problems, may have contributed to the quality control notations.

Despite the number of samples with quality assurance notations, the results were used when compiling the data. As Figure 8 indicates, the small water filtration plants have similar trends as the larger filtration plants. This indicates that very few surface water filtration plants will have trouble complying with the MCL for HAA5**.**

As previously mentioned, 23 filtration plants were retested in 2001. In 2000, all but one of these filtration plants were below the 50 percent trigger level. The one plant not below the 50 percent trigger level was between the two trigger levels of 50 percent and 80 percent of the MCL. In 2001, there were two filtration plants that exceeded the MCL and no plants with data between the MCL and the 80 percent trigger level. Only fifteen filtration plants were below the 50 percent trigger level. Figure 9 compares the data from the two summers. There are several possibilities that could account for the differences between the two years. These include but are not limited to: internal changes within the system, climatic conditions, or quality assurance concerns.

Figure 9. Comparison of HAA5 results of the 23 retested small surface water filtration plants. The line in the center of the box and nearby number is the median value of each filtration plant.



Conclusions

In the course of this study, the department has introduced Pennsylvania's small surface water filtration plants to the concepts of TTHM and HAA5 monitoring. The study introduced preliminary guidelines and sampling procedures to small water filtration plant personnel. Department staff were alerted to filtration plants that may have the potential to exceed the MCL when the Disinfection Byproducts Rule takes effect in 2004.

TTHM has been identified as the main contaminant of concern. Out of 167 filtration plants, 47 (28%) exceeded the 80 percent trigger level. Of those 47 plants, 28 (17%) exceeded the MCL of 0.08 mg/L. These filtration plants may need assistance prior to 2004. The data collected from this study, for the most part, was a one-time sample collected under conditions (warmest months of the year) believed to result in the worst-case scenario. Under the regulation, surface water filtration plants serving between 500 and 10,000 will collect quarterly samples that will be averaged. This annual average will determine if a filtration plant exceeds the MCL. When comparing small surface water filtration plants with medium (IESWTR) and larger (ICR) surface water filtration plants, in Pennsylvania, the levels of TTHM are similar. This could indicate that if small surface water filtration plants follow the same pattern, their annual average should be similar to this one time sample.

Of the 29 filtration plants that were retested for TTHM from 2000 to 2001, the data indicates an overall reduction of the filtration plants that exceeded the 80 percent trigger level from 29 to 23 plants. This reduction could have been a result of internal improvements at the system or changes in climatic conditions.

Even though TTHM was identified as the main contaminant of concern, there were four small surface water filtration plants (2%) out of 156 filtration plants that exceeded the 80 percent trigger level for HAA5. Of those four, two filtration plants exceeded the MCL of 0.06 mg/L.

These filtration plants may require assistance to meet the MCL. However, filtration plants serving between 500 and 10,000 people would be subjected to the same annual average procedure as TTHM. It is also possible that the HAA5 samples from these filtration systems are fine but were influenced by quality assurance concerns. When comparing small water, medium, and large water filtration plants in Pennsylvania, the levels of HAA5 are similar. This would indicate that very few small surface water filtration plants would have any difficulty in complying with the HAA5 MCL contained in the DBP Rule effective in 2004.

When comparing the data of the 23 filtration plants retested from 2000 to 2001, there were differences resulting in a wider range of HAA5 values. This range could be contributed to the fact that about one-third of the 2001 data was subjected to quality assurance concerns, as described in the report.

The results from 79 of 167 (47%) filtration plants fell below the 50 percent trigger level for TTHM level of 0.04 mg/L *and* the HAA5 level of 0.03 mg/L. As a result, these filtration plants may be eligible for reduced monitoring status in the future. However, systems will need to conduct their own TTHM and HAA5 monitoring in 2004 and have an annual average of source water Total Organic Carbon levels of 4.0 mg/L or less, as required by the DBP Rule, in order to qualify for reduced monitoring. This percentage may include systems serving less than 500 people who are only required to test annually and are not subject to reduced monitoring provisions.

Above all, the most important issue with the upcoming regulation is to ensure that drinking water is properly disinfected to kill pathogens, but without excess creation of harmful DBPs. Moving the site where disinfectant is added to change reaction time with organics, changing the type of disinfectant used, and changing certain factors, such as pH, in the disinfection process itself are some methods water filtration plants can employ to balance DBP and pathogen control. The early detection of these possible compliance problems permits department staff to work with water filtration plant operators in order to improve water quality before a violation of the new regulation. Water filtration plants should be certain to communicate with their regional Department of Environmental Protection staff before making any changes pending a permit amendment that might be needed.

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About the authors: Michele Fuller is an Environmental Science major at Susquehanna University. Joseph Chavez is a Wildlife and Fisheries Science major at Penn State University. Abbie Gongloff is an Environmental Science major at Juniata College and Nicole Yanich is an Environmental Studies major at the University of Pittsburgh. They completed this research under employment of the Department of Environmental Protection, P.O. Box 8467, Harrisburg, Pennsylvania, 17105-8467. For additional information, contact Phil Consonery at 717-772-4018 or epfiltration@state.pa.us