NOTICE OF FINAL RULEMAKING
ENVIRONMENTAL
QUALITY BOARD
[25 PA. CODE CH. 109]
Disinfection Requirements Rule

The Environmental Quality Board (Board) by this order amends Chapter 109 (relating to safe drinking water) to read as set forth in Annex A. The amendments will strengthen water system requirements relating to microbial protection and disinfection requirements.

The amendments also include minor clarifications to ensure consistency with and obtain or maintain primary enforcement authority for several Federal rules promulgated by the U.S. Environmental Protection Agency (EPA), including the Stage 2 Disinfectants/Disinfection Byproducts Rule (Stage 2 DBPR) (71 FR 388 (January 4, 2006)), Long Term 2 Enhanced Surface Water Treatment Rule (LT2) 71 FR 654 (January 5, 2006), and the Lead and Copper Rule Short-Term Revisions (LCRSTR) (72 FR 57782 (October 10, 2007)). Chapter 109 was previously amended to implement these Federal rules (*see* 39 Pa.B. 7279 (December 26, 2009) relating to Stage 2 DBPR and LT2, and 40 Pa.B. 7212 (December 18, 2010) relating to LCRSTR).

The amendments will protect public health through a multiple barrier approach designed to guard against microbial contamination by ensuring the adequacy of treatment designed to inactivate microbial pathogens and by ensuring the integrity of drinking water distribution systems.

Safe drinking water is vital to maintaining healthy and sustainable communities. Proactively avoiding incidents such as waterborne disease outbreaks can prevent loss of life, reduce the incidents of illness and reduce health care costs. Proper investment in public water system infrastructure and operations helps ensure a continuous supply of safe drinking water, enables communities to plan and build future capacity for economic growth, and ensures their long-term sustainability.

The disinfectant residual requirements in the distribution system will apply to all 1,949 community water systems and those noncommunity water systems that have installed disinfection (746) for a total of 2,695 public water systems. These public water systems serve a total population of 11.3 million people.

The CT/log inactivation monitoring and reporting requirements will apply to all 353 filter plants which are operated by 319 water systems.

This final-form rulemaking was adopted by the Board at its meeting of _____.

A. *Effective Date*

This final-form rulemaking is effective upon publication in the *Pennsylvania Bulletin*. Based on advisory committee and public comments, the final-form rulemaking includes the following deferred implementation dates:

- The submission of a sample siting plan is required six months after the effective date to allow time for development of the plan.

- The development of a nitrification control plan is required one year after the effective date.

- The amended monitoring, reporting, and treatment technique requirements for the disinfectant residual in the distribution system are required one year after the effective date to allow additional time for operational changes and to effectively increase disinfectant residuals to 0.2 milligrams per liter (mg/L) throughout the distribution system. If additional time is needed for capital improvements or to complete more substantial operational changes, a system-specific compliance schedule may be requested.

B. *Contact Persons*

For further information, contact Lisa D. Daniels, Director, Bureau of Safe Drinking Water, P. O. Box 8467, Rachel Carson State Office Building, Harrisburg, PA 17105-8467, (717) 787-9633; or William Cumings, Assistant Counsel, Bureau of Regulatory Counsel, P. O. Box 8464, Rachel Carson State Office Building, Harrisburg, PA 17105-8464, (717) 787-7060. Persons with a disability may use the Pennsylvania AT&T Relay Service at (800) 654-5984 (TDD users) or (800) 654-5988 (voice users).

C. *Statutory Authority*

The final-form rulemaking is being made under the authority of section 4 of the Pennsylvania Safe Drinking Water Act (35 P. S. § 721.4), which grants the Board the authority to adopt rules and regulations governing the provision of drinking water to the public, and section 1920-A of The Administrative Code of 1929 (71 P. S. § 510-20), which authorizes the Board to promulgate rules and regulations necessary for the performance of the work of the Department.

D. *Background and Purpose*

Amendments to surface water treatment regulations regarding monitoring and reporting

The amendments include new monitoring and reporting requirements to ensure compliance with existing treatment techniques regarding log inactivation and CT requirements. Log inactivation is a measure of the amount of viable microorganisms that are rendered nonviable during disinfection processes. CT is the product of residual disinfectant concentration (C) and

disinfectant contact time (T). The CT value is used to determine the levels of inactivation under various operating conditions.

Public water systems using surface water or groundwater under the direct influence of surface water (GUDI) sources have long been required to meet log inactivation and CT requirements for the inactivation of Giardia cysts and viruses. These existing treatment technique requirements are intended to ensure that water systems provide adequate and continuous disinfection for the inactivation of pathogens. The only way to ensure compliance with the existing treatment techniques is to measure and record the data elements that are needed to calculate CTs (that is, disinfectant residual, temperature, pH, flow, and volume) and report the results.

The amendments also clarify and strengthen the minimum residual disinfectant level at the entry point by adding a zero to the minimum level (0.20 mg/L). Water suppliers will be required to maintain a residual that is equal to or greater than 0.20 mg/L. Currently, levels of 0.15 mg/L or higher round up to 0.2 mg/L and are considered in compliance. A level of 0.20 mg/L is necessary due to the importance of meeting CTs and of maintaining an adequate disinfectant residual in the water entering the distribution system. Also, this level of sensitivity is consistent with existing requirements for the Groundwater Rule (0.40 mg/L) as specified in § 109.1302(a)(2) (relating to treatment technique requirements). Finally, this level of sensitivity is achievable using current instrumentation for the measurement of disinfectant residuals.

Amendments to disinfectant residual requirements in the distribution system

The amendments are intended to strengthen the distribution system disinfectant residual requirements by increasing the minimum residual in the distribution system to 0.2 mg/L free or total chlorine. The Department's previous disinfectant residual requirements for distribution systems had not been substantially updated since 1992 and required the maintenance of a detectable residual that was defined as 0.02 mg/L. The Department's previous treatment technique was not protective of public health because a residual of 0.02 mg/L is below the minimum reporting level of 0.1 mg/L and represents a false positive reading.

Maintenance of a disinfectant residual in the distribution system is:

- Required under the Federal Surface Water Treatment Rule (40 CFR Part 141, Subpart H) for all systems using surface water and GUDI sources and under Chapter 109 for all community water systems and those noncommunity water systems that have installed disinfection.
- Designated by the EPA as the best available technology for compliance with both the Total Coliform Rule (TCR) and the Revised TCR.
- Considered an important element in a multiple barrier strategy aimed at maintaining the integrity of the distribution system and protecting public health.
- Intended to maintain the integrity of the distribution system by inactivating microorganisms in the distribution system, indicating distribution system upset and controlling biofilm growth.

The preamble to the proposed rule (46 Pa.B. 857 (February 20, 2016)) included numerous studies, reports, and data in support of the minimum disinfectant residual of 0.2 mg/L in the distribution system. Additional studies, reports, and data were reviewed for this final-form rulemaking.

EPA published a Six-Year Review 3 (SYR 3) Technical Support Document for Microbial Contaminant Regulations in December 2016 (EPA, 2016). The 1996 Federal Safe Drinking Water Act amendments require EPA to periodically review existing national primary drinking water regulations and determine which, if any, needs to be revised. The purpose of the review, called the SYR, is to identify those regulations for which current health effects assessments, changes in technology, analytical methods, occurrence and exposure, implementation or other factors will improve or strengthen public health protection.

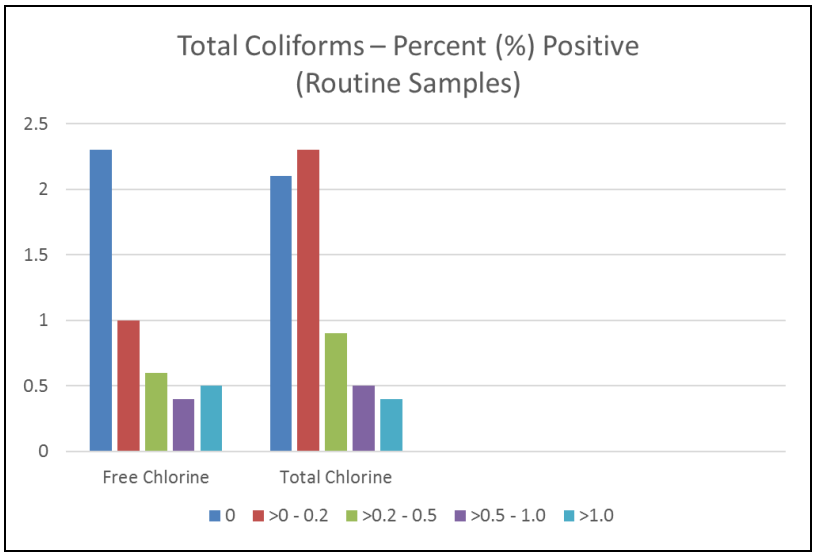
As part of the SYR 3, EPA requested compliance monitoring data from states/tribes from 2006 through 2011 regarding the presence/absence of total coliforms, *E. coli*, and fecal coliforms; and data for disinfectant residual levels in the distribution system. Microbial contaminant data from 34 states/tribes met the quality assurance/quality control criteria and are included in the SYR 3 microbial dataset.

Using the SYR 3 data, EPA conducted an occurrence analysis of microbial indicators paired with disinfectant residual data that are measured at the same time and location. The five bins of free and total chlorine residual concentrations are:

- Bin 1: Concentrations equal to 0 (“not detected or below detection limit”)
- Bin 2: Concentrations >0 and ≤0.2 mg/L
- Bin 3: Concentrations >0.2 mg/L and ≤0.5 mg/L
- Bin 4: Concentrations >0.5 mg/L and ≤1.0 mg/L
- Bin 5: Concentrations >1.0 mg/L

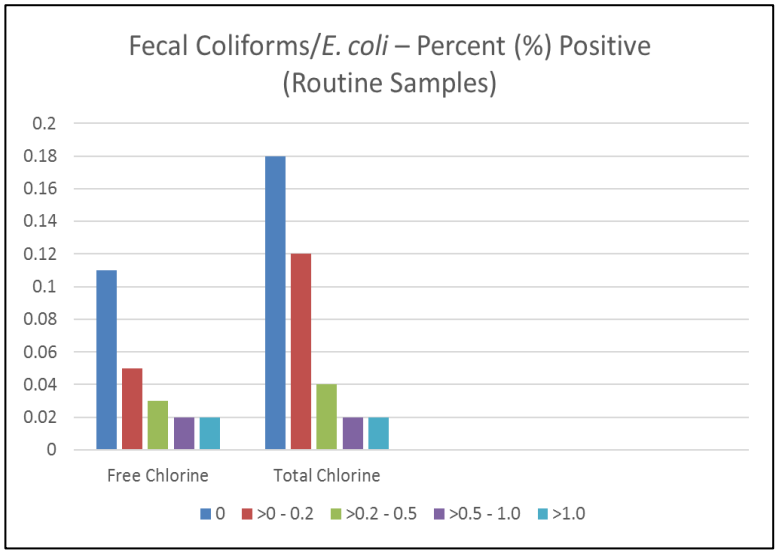
This represents the first national dataset available to evaluate microbial data as a function of disinfectant residual. More than five million samples were used for this analysis. The following figures represent a summary of EPA’s findings.

Figure 1. Summary of percent (%) positive routine total coliform samples for each bin of free and total chlorine residual concentrations (mg/L) from SYR 3 dataset (2006-2011). Dataset = 5.434 million samples.



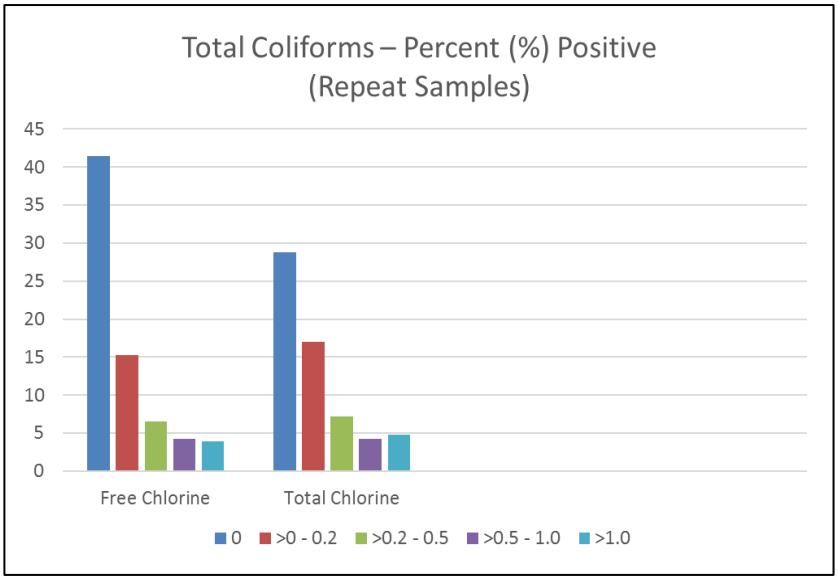
EPA found that for routine samples with free chlorine, the highest percentage of samples that were positive occurred when free chlorine was equal to 0 mg/L ("not detected"). The percentages dropped by more than half for the >0 – 0.2 mg/L bin, then appeared to flatten when free chlorine was >0.2 mg/L. The total coliform positive rate was less than 1% when chlorine residuals were greater than or equal to 0.2 mg/L of free chlorine. EPA found that the trend is similar for total chlorine routine samples except that for total coliforms, the percent of positive samples was slightly higher for the >0 – 0.2 mg/L bin than for the 0 mg/L bin.

Figure 2. Summary of percent (%) positive routine fecal coliform/E. coli samples for each bin of free and total chlorine residual concentrations (mg/L) from SYR 3 dataset (2006-2011). Dataset = 5.434 million samples.



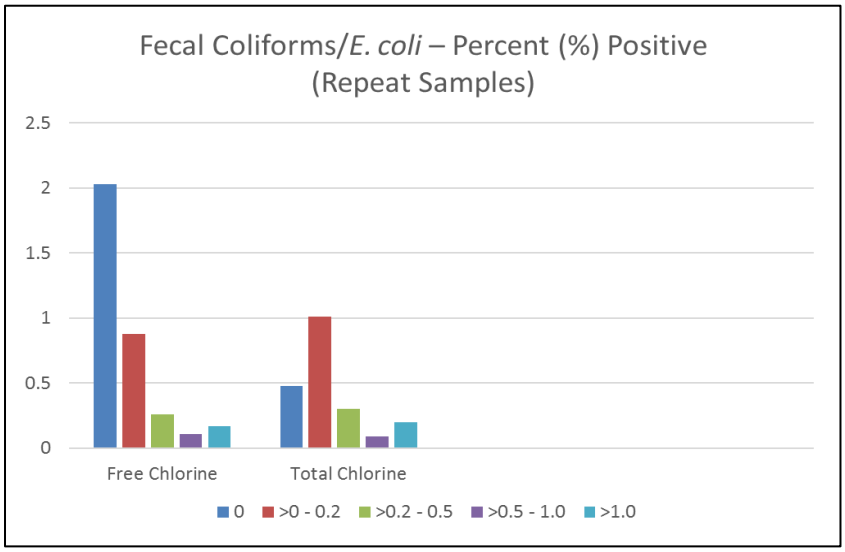
EPA found that the trend is similar for fecal coliforms/*E.coli* positive samples. For total chlorine routine samples, percent positive fecal coliform/E. coli results for the >0.2 mg/L – 0.5 mg/L bin were slightly higher than for the >0.5 mg/L – 1.0 mg/L bin and the >1.0 bin, indicating a possible tailing off of the positive occurrence at 0.5 mg/L for total chlorine compared to tailing at 0.2 mg/L free chlorine.

Figure 3. Summary of percent (%) positive repeat total coliform samples for each bin of free and total chlorine residual concentrations (mg/L) from SYR 3 dataset (2006-2011). Dataset = 5.434 million samples.



As expected, EPA found that the percentage of positive total coliform samples was much higher overall for repeat samples than for routine samples. More than 40% of repeat total coliform samples were positive when free chlorine was 0 mg/L, compared to a slightly lower repeat total coliform positive occurrence of ~29% when the total chlorine was 0 mg/L. Similar to routine samples, repeat total coliform positive occurrence declined as free and total chlorine residual increased, with a flattening of occurrence at 0.5 mg/L for both free and total chlorine residuals.

Figure 4. Summary of percent (%) positive repeat fecal coliform/E. coli samples for each bin of free and total chlorine residual concentrations (mg/L) from SYR 3 dataset (2006-2011). Dataset = 5.434 million samples.



EPA found that the trend is similar for fecal coliforms/*E.coli* positive samples.

In summary, based on an assessment of 5.434 million samples, EPA determined:

- A lower rate of both total coliform and fecal coliform/*E. coli* positives occurs as the free or total chlorine residual increased to higher levels.

- This relationship between chlorine residuals and occurrence of total coliform and fecal coliform/*E. coli* positives was similar to results reported by the Colorado Department of Public Health and Environment (Ingels, 2015). In addition, this relationship is consistent with the findings of LeChevallier et al. (1996) which stated that disinfectant residuals of 0.2 mg/L or more of free chlorine, or 0.5 mg/L or more of total chlorine, are associated with reduced levels of coliform bacteria. Both of these studies were previously discussed in the preamble to the proposed rule.

- A detectable concentration of disinfectant residual in the distribution system may not be adequately protective of public health due to microbial pathogens. This is based on concerns about analytical methods and the potential for false positives (Wahman and Pressman, 2015). According to EPA, maintaining a disinfectant residual above a set numerical value in the distribution system may improve public health protection from a variety of pathogens.

EPA's concerns about the analytical methods and the potential for false positives is consistent with information provided by HACH©, the leading manufacturer of field test equipment. HACH© provided information to the TAC Board during the development of the proposed rulemaking that supported a minimum reporting level for a disinfectant residual of 0.1 mg/L. Details about this data were included in the preamble to the proposed rule.

This determination is also consistent with a detection limit study that was performed by Aqua Pennsylvania in 2015 in conjunction with the Philadelphia Water Department and Corona Environmental Consulting. A summary of these experiments was included in Aqua Pennsylvania's public comments. According to Aqua Pennsylvania:

- Aqua's laboratory conducted 199 determinations for total chlorine residual by the N,N Diethyl-1,4 Phenylenediamine Sulfate (DPD) method using the HACH Pocket Colorimeter II.
- 7 spike concentrations were used: 0.02 mg/L to 0.65 mg/L total chlorine
- While method performance generally improved as spike concentration increased, performance did not clearly degrade at a specific concentration. The range of 0.1 to 0.2 mg/L was not unreasonable as a minimum reporting level.
- These data should be viewed as one piece of information on the topic. A much larger project and national discussion of a "true detectable residual" is needed.

In order to ensure that the Department's disinfectant residual requirements are adequately protective of public health and are achievable using currently available analytical methods, the Department has retained the level of 0.2 mg/L as a numeric standard. This level represents a standard this is above the minimum reporting level of 0.1 mg/L. Due to EPA's rules of rounding for compliance determinations, disinfectant residual levels ≥ 0.15 mg/L will round up to 0.2 mg/L and will be in compliance with the numeric standard.

State data

At least 23 states have promulgated more stringent requirements when compared to the Commonwealth's previous standard of 0.02 mg/L. Nineteen of these states have disinfectant residual requirements that are ≥ 0.2 mg/L. The following table includes a summary of other states' requirements, including whether the state allows compliance with the heterotrophic plate count (HPC) standard of 500 as an Alternative Compliance Criteria (ACC).

State	**Minimum Distribution System Residual (mg/L)**	**Allows HPC as ACC**
Alabama*	0.2 (free), 0.5 (total)	No
Colorado*	0.2 (free or total)	Yes
Delaware	0.3 (free)	No
Florida*	0.2 (free), 0.6 (total)	No
Georgia	0.2 (free)	Yes
Illinois*	0.2 (free), 0.5 (total)	No
Indiana	0.2 (free), 0.5 (total)	No
Iowa	0.3 (free), 1.5 (total)	Yes
Kansas*	0.2 (free), 1.0 (total)	No
Kentucky*	0.2 (free), 0.5 (total)	No

Louisiana*	0.5 (free or total)	No
Minnesota	0.1 (free or total)	No
Missouri	0.2 (total)	Yes
Nebraska	SW-0.2 (free), 0.25 or 0.5 (total); GW-0.1 (free)	Yes
Nevada	0.05 (free or total)	No
New Jersey*	0.05 (free or total)	Yes
North Carolina*	0.2 (free), 1.0 (total)	Yes
Ohio*	0.2 (free), 1.0 (total)	No
Oklahoma	0.2 (free), 1.0 (total)	No
Tennessee*	0.2 (free)	No
Texas*	0.2 (free), 0.5 (total)	No
Vermont	0.1 (free)	No
West Virginia*	0.2 (total)	No

* States with mandatory disinfection

Of the 19 states with disinfectant residual requirements ≥ 0.2 mg/L, only six of these states retained the alternative compliance criteria for HPC. The Board requested comment on references to studies, reports, or data that provide supporting evidence that an HPC <500 provides an equivalent level of public health protection when compared to a disinfectant residual of 0.2 mg/L. One citation was provided. However, the EPA document that was referenced was an unpublished draft document. Because of the lack of available studies on this issue and the fact that the majority of states (68%) listed above do not allow the use of HPC as an ACC, the Board has reaffirmed the decision to not allow the use of HPC as an ACC.

The disinfectant residual requirements aim to strike a balance between improving microbial inactivation while limiting adverse impacts on disinfection byproduct (DBP) formation. Water systems can meet more stringent disinfectant residual requirements and still comply with DBP requirements as evidenced by a review of TCR and DBP compliance data from other states (EPA, ECHO web site). The preamble to the proposed rule included graphs that compared the percentage of CWSs with violations for the TCR and DBPs in Alabama, Tennessee, West Virginia, Illinois, Kentucky, Kansas, North Carolina, and Ohio with the compliance rates in Pennsylvania. From 2011 to 2014, the large majority of states requiring disinfectant residual levels ≥ 0.2 mg/L had better TCR compliance rates than the Commonwealth (that is, had lower percentages of CWSs with TCR MCL violations). Some of these states were also able to maintain low rates of DBP violations as well.

A disinfectant residual serves as an indicator of distribution system contamination and the effectiveness of distribution system best management practices. Best management practices include flushing, storage tank maintenance, cross-connection control, leak detection, and effective pipe replacement and repair practices. The effective implementation of best management practices will help water suppliers comply with the disinfectant residual treatment

technique by lowering chlorine demand and maintaining an adequate disinfectant residual throughout the distribution system. These same practices also help to control DBP formation.

Water systems that have participated in the Department's Distribution System Optimization Program have shown great success in utilizing operational changes and other lower cost options to maintain simultaneous compliance with adequate disinfectant residual levels and DBPs. Below are several case studies from the program.

System A: This system serves 13,000 customers through 2,974 connections, uses free chlorine, has one standpipe, and a distribution system storage capacity of 1.25 million gallons.

- *Historical problems:* This system experienced an upward trend in Trihalomethane (THM) levels leading to drinking water locational running annual average (LRAA) MCL exceedances in two consecutive quarters and hydraulic dead-ends in portions of the distribution system requiring significant flushing to maintain a detectable residual.

- *Technical assistance efforts:* Department and system staff conducted in-plant water quality profiling (disinfectant residual, Total Organic Carbon, pH, DBPs), distribution system investigative sampling, in-tank water quality monitoring, and storage tank continuous disinfectant residual monitoring for one month.

- *Evaluation findings:* The evaluation found significant in-plant DBP formation, and high levels of THMs and low disinfectant residuals associated with stratification of standpipe.

- *Remedies:* The system decreased the pre-filtration chlorine feed rate to reduce in-plant THM formation resulting in a return to compliance with the LRAA MCL and increased the frequency and duration of routine distribution system flushing in problematic areas to maintain a minimum residual of 0.20 mg/L free chlorine. The system is currently evaluating the benefit of additional measures including the use of a mixing aeration system for the standpipe and automatic flushing units in problematic areas of the distribution system.

System B: This system serves 8,600 customers through 3,175 connections, uses chloramines for secondary disinfection, has two standpipes, three ground level tanks and a distribution system storage capacity of 4.755 million gallons.

- *Historical problems:* This system had difficulty maintaining a disinfectant residual throughout high and low-pressure zones.

- *Technical assistance efforts:* Department and system staff conducted a chloramine dosing and hold study, entry point hold study, distribution system investigative sampling, in-tank water quality monitoring, storage tank turnover analysis, and storage tank continuous disinfectant residual monitoring for one month.

- *Evaluation findings:* The evaluation found uneven chlorine dosing at the end of the sedimentation basin, poor control and monitoring of ammonia dosing prior to the entry point, highly reactive monochloramine residual degraded completely within 48 hours,

poor mixing performance and excessive storage tank turnover time (~15 days), trace disinfectant residual in both standpipes, and areas of non-detect monochloramine residual in both pressure zones.

- *Remedies:* The system developed a weir system to increase mixing at the chlorine dosing location in the sedimentation basins, began routine testing of ammonia strength and feed rates, began routine grab sample monitoring of free ammonia and monochloramine to achieve more precise ammonia dosing, increased flushing of problematic areas of the distribution system to maintain monochloramine residual of 1.0 mg/L, modified operations of storage tanks to decrease turnover time by ~50%, removed the standpipe from service to decrease excessive storage capacity by one million gallons, and began system-wide flushing of the distribution system in coordination with free chlorine burns in order to minimize transitional mixing zones. The system is currently evaluating the benefit of automatic flushing units in problematic areas of the distribution system.

System C: This system serves 6,000 customers through 2,900 connections, uses free chlorine, and has 2 ground level storage tanks.

- *Historical problems:* This system had difficulty maintaining a disinfectant residual throughout the distribution system.

- *Technical assistance efforts:* Department and system staff conducted distribution system investigative sampling.

- *Evaluation findings:* The evaluation found that extremities within the distribution system had free chlorine residuals <0.10 mg/L, and required significant flushing to maintain residuals >0.20 mg/L.

- *Remedies:* The system performed a flushing study to identify locations for installation of automatic flushing units and installed three automatic flushing units to create an artificial demand in areas of low disinfectant residuals.

System D: This system serves 7,800 customers through 4,382 connections, uses free chlorine, has 2 ground level storage tanks, and a distribution system storage capacity of 4.5 million gallons.

- *Historical problems:* This system had difficulty maintaining disinfectant residuals at the master meters of consecutive systems.

- *Technical assistance efforts:* Department and system staff conducted in-tank water quality monitoring, storage tank turnover analysis, and storage tank continuous disinfectant residual monitoring for one month.

- *Evaluation findings:* The evaluation found poor mixing performance and excessive storage tank turnover (15 – 22 days), and significant impact from storage tanks on disinfectant residuals in areas of influence.

- *Remedies:* The system modified operation of storage tanks to decrease turnover time and stratification as well as decrease degradation of disinfectant residuals.

System E: This system serves 25,500 customers through 9,300 connections, uses free chlorine, has five ground level storage tanks, one elevated tank and a distribution system storage capacity of 7.25 million gallons.

- *Historical problems:* This system had low disinfectant residuals at the master meter from the selling system, and had difficulty maintaining residuals in portions of the distribution system.

- *Technical assistance efforts:* Department and system staff conducted a master meter hold study, in-tank water quality monitoring, storage tank turnover analysis, and storage tank continuous disinfectant residual monitoring for one week.

- *Evaluation findings:* The evaluation found rapid degradation of free chlorine residual due to the purchase of chloraminated water at the master meter, poor mixing performance and excessive storage tank turnover (7 – 8 days), and significant impact of storage tanks on disinfectant residual in areas of influence.

- *Remedies:* The system increased communication with the selling system, modified its residual boosting strategy at the master meter and increased monitoring, and modified its operation of storage tanks to decrease turnover time and stratification as well as decrease degradation of disinfectant residual.

System F: This system serves 10,000 customers through 4,927 connections, uses free chlorine, has four ground level tanks, one elevated tank, and one stand pipe, and has a distribution system storage capacity of 3.2 million gallons.

- *Historical problems:* This system had difficulty maintaining disinfectant residuals throughout the distribution system during summer and early fall.

- *Technical assistance efforts:* Department and system staff conducted a storage tank turnover analysis and distribution system and storage tank continuous disinfectant residual monitoring for two weeks.

- *Evaluation findings:* The evaluation found significant impact from storage tanks on the disinfectant residual in areas of influence and that storage tank operations were based on plant production rather than distribution system water quality data.

- *Remedies:* The system increased water quality data collection in the distribution system, modified storage tank operation based on water quality data, and removed a storage tank from service to reduce total distribution system capacity.

System G: This system serves 33,000 customers through 15,000 connections, uses free chlorine, has four ground level storage tanks, one standpipe and has a distribution system storage capacity of six million gallons.

- *Historical problems:* This system had difficulty maintaining disinfectant residuals throughout the distribution system during summer and early fall.

- *Technical assistance efforts:* Department and system staff conducted a storage tank turnover analysis and storage tank continuous disinfectant residual monitoring for two weeks.

- *Evaluation findings:* The evaluation found poor mixing performance and excessive storage tank turnover time (~ 8 days).

- *Remedies:* The system installed mixing systems in storage tanks where stratification was observed to homogenize water quality.

System H: This system serves 18,000 customers through 8,200 connections, uses free chlorine, has three ground level storage tanks and one elevated tank, and has a distribution system storage capacity of 4.75 million gallons.

- *Historical problems:* This system had elevated THM and HAA levels.

- *Technical assistance efforts:* Department and system staff conducted a storage tank turnover analysis and storage tank continuous disinfectant residual monitoring at multiple locations over three months.

- *Evaluation findings:* The evaluation found significant impact from storage tanks on disinfectant residuals in areas of influence and poor mixing performance and excessive storage tank turnover time (6.2 – 12.5 days).

- *Remedies:* The system installed mixing systems in storage tanks where stratification was observed to homogenize water quality and modified storage tank operation to decrease turnover time.

Water suppliers can obtain more information about these distribution system assessment and optimization tools from the Department's website, using the keyword: Distribution System Optimization.

The Board requested comment on several aspects of the proposed rulemaking, including:

1. Additional studies and reports related to detection limits for free and total chlorine residual analysis in the field.

   The Board received one study and the data were used to inform decisions about the minimum reporting level.

2. Studies, reports or data that support a disinfectant residual of 0.1 mg/L, or any other disinfectant residual that is equally protective of public health.

The Board received disinfectant residual and microbial data from six water systems. Here is a summary of the data:

System A: Large system; provided summary disinfectant residual data from 2004-2014; of the 36,500 samples analyzed, only ~3% of the samples were ≤0.15 mg/L total chlorine residual

System B: Large system; provided summary data for last five years; for the 14 total coliform positive samples reported, the disinfectant residual ranged from 0.02 – 1.35 mg/L, with an avg. = 0.67 mg/L

System C: Large system; uses chloramines; provided disinfectant residual and coliform data from 2008-2015; for the 2011-2015 time period, 7,363 disinfectant residual samples were analyzed with only 128 (1.7%) <0.15 mg/L

System D: 33,000 disinfectant residual records were analyzed from 2013-2016; only 332 (or 1%) <0.15 mg/L

System E: Medium system; provided a summary of free chlorine residual data for 2014-2015; in 2014, six dead end samples <0.15 mg/L; in 2015, all results >0.15 mg/L

System F: Large system; uses chloramines, provided 25,000 sample results from 2012-2016; 99.7% of samples ≥0.2 mg/L; only 0.3% of samples <0.2 mg/L; 59 positive total coliform samples with no correlation between residual

To summarize, data from these medium and large water systems indicate that a very small percentage (0.3 – 3%) of these historical disinfectant residuals would not have met a disinfectant residual requirement of 0.15 – 0.2 mg/L. These systems are well-positioned to meet a disinfectant residual of 0.2 mg/L.

Finally, the Board did not receive any studies or reports that support an alternate disinfectant residual of 0.1 mg/L.

3. References to studies, reports or data that provide supporting evidence that an HPC <500 provides an equivalent level of public health protection when compared to a disinfectant residual of 0.2 mg/L.

   The Board received one reference to an unpublished draft document. However, the document was unavailable and could not be used. The Department is not aware of any other studies or reports that provide evidence that an HPC <500 provides equivalent public health protection.

4. Anticipated costs to comply with the proposed disinfectant residual requirements.

   The Board received cost information from four water systems. Cost information in the order and RAF were updated accordingly.

5. Whether a deferred effective date of six months after final promulgation is warranted in order to provide water systems with additional time to make any necessary operational changes. The anticipated length of time needed to increase disinfectant residuals and whether capital improvements are anticipated to meet the proposed requirements.

   The Board received multiple comments on the need for deferred effective dates, and the dates were amended accordingly.

6. The compliance determination, especially for small systems.

   The Board received several comments on the compliance determinations and all comments were taken into consideration.

The final-form rulemaking was presented to the TAC Board on July 13 and August 24, 2017. The TAC Board made nine recommendations, six of which were incorporated into this final-form rulemaking. Section E includes more information about the TAC Board's recommendations. The recommendation regarding averaging additional grab sample measurements from a sampling location will be included in Department guidance on system monitoring. Regarding the 2 remaining recommendations, one recommendation was to delay any new regulation update to Chapter 109 until the Safe Drinking Water Program is at full complement and current regulations are uniformly enforced. The Board is taking steps to provide the Department with additional funds through fee increases and believes that proceeding with this final-form rulemaking now is in the public interest because of the compelling public health benefits discussed in previous sections of this order. The remaining recommendation is for the Department to conduct a disinfection byproduct evaluation to determine the impacts of increasing the chlorine residual in the distribution system using data only from Pennsylvania water systems. The Department will continue to track and analyze TCR and DBP compliance rates as these amendments are implemented to determine whether simultaneous compliance is being achieved.

The Independent Regulatory Review Commission (IRRC) submitted several comments. To summarize, IRRC recommended the following:

1. The EQB should continue to work with the regulated community to develop a schedule for implementing this rule that adequately protects the health, safety, and welfare of the public, while at the same time, minimizing the fiscal impact it will have on water systems.

   Response: The Department worked with TAC to develop an implementation plan for the final-form rulemaking. Most provisions will be deferred for one year following the effective date of the regulation. In addition, compliance schedules will be used to allow more time for capital improvements or to implement more complex operational changes.

2. In the final-form Preamble and Regulatory Analysis Form (RAF), the Board should provide specific estimates of all the costs associated with compliance and an explanation of how the estimates were derived. In addition, the Board should provide further explanation concerning the benefits of the regulation as compared to the costs.

Response: The Department has updated the cost information in this preamble/order and the RAF based on comments received. Updated information includes costs to the regulated community, as well as potential savings from the prevention of public health crises due to waterborne illnesses.

3. In the Preamble to the final-form regulation, the Board should explain the reasonableness of requiring weekly monitoring, and how the potential benefits outweigh any costs associated with it.

   Response: After considerable discussion, the TAC Board issued final recommendations that the weekly monitoring frequency should be retained for two reasons: (1) weekly monitoring helps ensure continuous disinfection and improves public health protection, and (2) the collection of at least four samples per month allows a water system to have one sample below the minimum level and still be in compliance. If systems were to take fewer than four samples per month, any one sample below the minimum level would put the system out of compliance immediately. Finally, it was determined that weekly monitoring should not be a hardship because water system personnel are already on-site on a daily basis collecting daily entry point samples. These same personnel would be able to grab a weekly disinfectant residual sample within the distribution system.

4. In the Preamble to the final-form regulation, the Board should explain what specific public health issue is being addressed by the proposed disinfectant residual that is not currently being handled by the Revised Total Coliform Rule or isn't a premise plumbing concern. The Board should also explain what measures exist to safeguard against increases in DBPs.

   Response: Based on an assessment of 5,434,000 samples, EPA found that a lower rate of both total coliform and fecal coliform/*E. coli* positives occurred as the free or total chlorine residual increased to higher levels. This relationship between chlorine residuals and occurrence of total coliform and fecal coliform/*E. coli* positives was similar to results reported by the Colorado Department of Public Health and Environment (Ingels, 2015). In addition, this relationship is consistent with the findings of LeChevallier et al. (1996) which stated that disinfectant residuals of 0.2 mg/L or more of free chlorine, or 0.5 mg/L or more of total chlorine, are associated with reduced levels of coliform bacteria. (Note: Both of these studies were previously discussed in the preamble to the proposed rule.) Based on this data, EPA determined that a detectable concentration of disinfectant residual in the distribution system may not be adequately protective of public health due to microbial pathogens. This is based on concerns about analytical methods and the potential for false positives (Wahman and Pressman, 2015). According to EPA, maintaining a disinfectant residual above a set numerical value in the distribution system may improve public health protection from a variety of pathogens.

   Regarding the ability of water systems to increase disinfectant residual levels to 0.2 mg/L and still meet DBP limits, data from other states shows that simultaneous compliance can be achieved with both rules. In addition, several case studies were described in this order regarding systems that have participated in the Department’s Distribution System

Optimization Program. These systems have been able to achieve simultaneous compliance by implementing operational changes and other lower cost measures.

The Department continues to believe that the large majority of systems will be able to achieve compliance with both rules because: (1) the large majority of systems already deliver water that meets disinfectant residual levels of ≥0.15 mg/L, and (2) for the remaining systems that do not currently meet a residual of ≥0.15 mg/L throughout the distribution system, many will be able to meet the requirement through operational changes or lower cost measures.

5. The fiscal analysis provided in the RAF indicates that the total estimated cost to the regulated community is $823,500. The regulated community believes DEP has overestimated the number of water suppliers that would be in compliance with the proposed residual and has underestimated capital and operational costs. For example, Philadelphia Water estimated $25 million dollars in capital costs and $2.5 million dollars in annual operating and maintenance costs. The Borough of Carlisle estimates capital costs ranging from $115,000 to $190,000 to potentially comply with a 0.2 mg/L free chlorine requirement. As the Board develops the final-form regulation, we ask that they reach out to the regulated community to gain a better understanding of the potential costs associated with the new requirements and to include those revised costs in the RAF submitted with the regulatory package.

   Response: The Department has updated the cost information in the order and RAF based on comments received.

6. In the Preamble to the final-form rulemaking, we ask the Board to explain why public notification is needed when the minimum disinfectant residual is not maintained in the distribution system and why the benefits of such a notice outweigh any potential costs associated with such notice.

   Response: The Federal rule, 40 CFR 141.203(a), requires Tier 2 Public Notice (PN) for failure to meet the disinfectant residual treatment technique in the distribution system. Pennsylvania must be at least as stringent as the Federal rule. However, these amendments are not anticipated to substantially increase the number of Tier 2 PNs. A violation does not occur unless the water system fails to meet the minimum level in more than 5% of samples for two consecutive months. The Department would expect that most water systems will be able to make operational changes (i.e., increase flushing, etc.) after the first monthly failure and improve water quality ahead of the next monthly monitoring period. It should be the exception, not the norm, that water systems fail to meet the minimum level for two consecutive months.

7. We note that the Board has asked for comments with references to studies, reports or data comparing whether HPC less than 500 provides the same level of public health protection as a disinfectant residual of 0.2mg/L. In the Preamble to the final-form rulemaking, we ask the Board to explain its rationale for removing this provision. We will consider the Board's response to comments and any changes made to this subsection in our review of the final-form regulation to determine whether it is in the public interest.

Response: No references or studies were provided by the public. The Department has not found any studies that HPC is an equivalent standard when compared to a disinfectant residual level of 0.2 mg/L. The majority of states with disinfectant residual standards of 0.2 mg/L or greater do not use HPC as an ACC. For these reasons, the Department is not allowing the use of HPC for compliance purposes. However, water suppliers are encouraged to continue to use HPC as an operational parameter to help inform proper operation of distribution systems.

8. The Board states these revisions are in response to EPA comments to obtain primacy for Long Term 2 Enhanced Surface Water Treatment Rule. Water dispensing unit (WDU) operators commented that adding the HPC test alongside the Total Coliform test is duplicative and adds unnecessary costs. They further point out the drinking water standard for HPC is geared toward public water systems treating non-potable surface water or GUDI and that it should not apply to WDUs which receive already treated municipal water. We ask the Board to explain in the RAF and Preamble of the final-form regulation the reasonableness of requiring water dispensing units to meet the same disinfection residual requirements as public water systems.

   Response: The EPA recognizes bulk water hauling and vended water systems as public water systems under the Safe Drinking Water Act and its regulations. Vended water systems that use purchased surface water must comply with the various surface water treatment rules. Systems using surface water must maintain a disinfectant residual in the water delivered to consumers. Since most vended water systems strip chlorine out of the water to improve taste, these systems are unable to comply with the Federal and state requirements. These systems generally retreat the water with ultraviolet (UV) or ozone, which do not provide a residual. Therefore, the only option for these systems is to monitor for and comply with the HPC alternative compliance criteria.

9. The EPA submitted comments that identify several instances where the Bottled Water and Vended Water Systems, Retail Water Facilities, and Bulk Water Hauling Systems (BVRB) monitoring provisions are inconsistent with Federal regulations and must be changed to obtain primacy. The EPA also seeks clarification on the BVRB entry point residual. We will review the Board 's response to the EPA's comments and any changes made to this section in our review of the final-form rulemaking to determine whether it is in the public interest.

   Response: Revisions have been made to ensure consistency with Federal rules and to maintain primary enforcement authority. Refer to Section E for more information about the revisions.

References

Colorado Department of Public Health and Environment (April 2014). "Draft—Minimum Distribution System Disinfectant Residuals: Chlorine Residual Values Reported from Within Drinking Water Distribution Systems."

DEP, Pennsylvania Drinking Water Information System online database.

EPA (December 2016). "Six-Year Review 3 Technical Support Document for Microbial Contaminant Regulations." EPA 810-R-16-010.

EPA, Enforcement and Compliance History Online database.

LeChevallier, M. W., et al. (1996). "Full-Scale Studies of Factors Related to Coliform Regrowth in Drinking Water." *Applied and Environmental Microbiology*, 62(7), p. 2201.

Wahman, D. G. and Pressman, J. G. (2015). "Distribution System Residuals—Is 'Detectable' Still Acceptable for Chloramines." *Journal—American Water Works Association*, 107(8), p. 53.

E. *Summary of Changes to the Proposed Rulemaking*

§ 109.202. State MCLs, MRDLs and treatment technique requirements

Clause (c)(1)((ii)(B) was edited for consistent use of the phrase "residual disinfectant concentration."

Paragraph (c)(4) was renumbered as § 109.202(c)(6) and edited for consistent use of the phrase "residual disinfectant concentration."

Paragraph (c)(5) was renumbered as § 109.202(c)(7) and edited for consistent use of the phrase "residual disinfectant concentration."

The proposed revision to paragraph (d) was not included because it was codified in the Revised Total Coliform Rule (46 Pa.B. 6005 (September 24, 2016)).

§ 109.301. General monitoring requirements

Clause (1)(i)(D) was amended in response to public comments to clarify that the existing disinfectant residual requirements for filtered surface water and GUDI systems will remain in effect until one year after the effective date of this final-form regulation.

Clause (1)(i)(E) was added in response to public comments to defer the compliance date of the new disinfectant residual requirements until one year after the effective date of this final-form regulation.

Subclauses (1)(i)(E)(II)-(IV) were edited for consistent use of the phrase "residual disinfectant concentration."

Subclause (1)(i)(E)(V) was added in response to TAC comments to allow the use of on-line analyzers for disinfectant residual monitoring and recording in the distribution system. On-line analyzers are permitted so long as the units are validated for accuracy.

Subparagraphs (1)(v) and (vi) were amended in response to public comments to clarify that water suppliers shall calculate the log inactivation at least once per day during expected peak hourly flow.

Clause (2)(i)(E) was amended in response to public comments to clarify that the existing disinfectant residual requirements for unfiltered surface water and GUDI systems will remain in effect until one year after the effective date of this final-form regulation.

Clause (2)(i)(F) was added in response to public comments to defer the compliance date of the new disinfectant residual requirements until one year after the effective date of this final-form rulemaking.

Subclauses (2)(i)(F)(II)-(IV) were edited for consistent use of the phrase "residual disinfectant concentration."

Subclause (2)(i)(F)(V) was added in response to TAC comments to allow the use of on-line analyzers for disinfectant residual monitoring and recording in the distribution system. On-line analyzers are permitted so long as the units are validated for accuracy.

Clause (6)(vii)(D) was amended to correct a misspelled word.

Paragraph (13) was edited for consistent use of the phrase "residual disinfectant concentration" throughout the paragraph.

Clauses (13)(i)(A) and (B) were amended in response to public comments to defer the effective date of the new disinfectant residual requirements until one year after the effective date of this final-form regulation.

Clauses (13)(i)(A) – (C) were renumbered as §§ 109.301(13)(i)(B)(I) – (III).

Subclause (13)(i)(B)(I) was amended to correct a cross-reference.

Subclause (13)(i)(B)(IV) was added to clarify that compliance determinations will be made in accordance with § 109.710.

Subclause (13)(i)(B)(V) was added in response to TAC comments to allow the use of on-line analyzers for disinfectant residual monitoring and recording in the distribution system and to be consistent with §§ 109.301(1)(i)(E)(V) and 109.301(2)(i)(F)(V). On-line analyzers are permitted so long as the units are validated for accuracy.

§ 109.408. Tier 1 public notice—categories, timing and delivery of notice

Paragraph (a)(2) (relating to Tier 1 public notice—categories, timing and delivery of notice) was amended to correct a Chapter 109 cross-reference to include both subclause IV and V.

Subparagraph (a)(6)(iii) was amended for consistent use of the phrase "residual disinfectant concentration" and in response to public comments to clarify that Tier 1 public notice is required for a failure to maintain the minimum entry point disinfectant residual for more than four hours and either a failure to calculate the log inactivation, or a failure to meet the minimum log inactivation for more than four hours.

§ 109.701. Reporting and recordkeeping

Paragraph (a)(8) was amended to clarify and renumber the requirements relating to submission of the sample siting plan, for consistent use of the phrase "residual disinfectant concentration," and incorporate comments from TAC to identify several items to be included in the sample siting plan including whether mixing zones exist, the system implements a free chlorine burn, and whether the system uses on-line analyzers. This section was also amended to add certain reporting requirements related to these sample siting plan items.

§ 109.710. Disinfectant residual in the distribution system

Paragraphs (a) and (b) were amended and (c) was added in response to public comments to defer the compliance date of the new disinfectant residual requirements until one year after the effective date of the final-form regulation.

Subparagraphs (c)(1)--(5) and (d)(1)—(5) were added in response to TAC comments to address measurements for mixing zones and free chlorine burns, and to clarify when free or total or both chlorine residual should be monitored.

Paragraphs (b)--(d) were renumbered as §§ 109.710(d) -- (f).

Paragraph (d) was amended for consistent use of the phrase "residual disinfectant concentration."

Paragraph (e) was amended in response to TAC comments to allow additional monitoring to be included in the compliance calculations.

Subparagraphs (e)(1) and (2) were amended in response to TAC comments to allow additional monitoring to be included in the compliance calculations, to clarify that public water systems that use surface water or GUDI sources must comply with the federal and state treatment technique requirement of no more than 5% of samples out of compliance.

Subparagraphs(e)(3) and (4) were renumbered as §§ 109.710(e)(4) and (5) and a new subparagraph (e)(3) was added in response to TAC comments to clarify how compliance will be determined when both free and total disinfectant residual measurements are reported.

Subparagraph (e)(5) was amended to correct a cross-reference.

Subparagraph(e)(6) was added in response to TAC and public comments to clarify that the Department may approve an alternate compliance schedule if the water supplier submits a

written request with supporting documentation within one year of the effective date of this final-form regulation.

§ 109.716. Nitrification control plan

Section 109.715 was renumbered as § 109.716 because a new § 109.715 (relating to seasonal systems) was added by the Revised Total Coliform Rule (46 Pa.B. 6005 (September 24, 2016)).

Subsection 109.716(a) was amended in response to TAC comments to defer the compliance date of the nitrification control plan until one year after the effective date of this final-form regulation.

§ 109.1003. Monitoring requirements

Clause (a)(1)(ix)(A) was amended to cross-reference the monitoring requirements in 109.301(12)(ii) in response to EPA comments to be at least as stringent as the federal Stage 2 DBPR for bulk hauling, retail and vended water systems that meet the conditions of paragraph (D) or (E) (i.e. systems that meet the definition of a community or nontransient noncommunity water system).

Subclauses (a)(1)(ix)(C)(I) – (IV) were added in response to EPA comments to include language that is at least as stringent with the federal Stage 2 DBPR that identifies the MCL compliance calculations for total trihalomethanes (TTHM) and five haloacetic acid compounds (HAA5) to obtain primary enforcement authority for the Stage 2 DBPR.

Subparagraph (a)(1)(xi) was amended to revise the editor's note for this final-form rulemaking. This subparagraph was also amended and proposed clauses (a)(1)(xi)(A) – (C) were deleted in response to EPA comments to include language that is at least as stringent as the federal rule that identifies the MRDL compliance calculations for chlorine dioxide.

Subclause (a)(1)(xii)(B)(II) was amended to be consistent with existing language in § 109.301(12)(iv)(B)(II) that identifies the specific requirements to qualify for reduced bromate monitoring to be at least as stringent as the Federal Stage 2 DBPR.

Subparagraphs (a)(1)(xiii) and (xiv) were amended to revise the editor's notes for this final-form rulemaking, for consistent use of the phrase "residual disinfectant concentration," and in response to EPA comments that the entry point residual disinfectant concentration should be 0.20 mg/L be consistent with subparagraph (xiii) and § 109.202(c).

Subparagraph(a)(2)(iv) was amended to clarify when compliance is required based on the effective date of this final-form regulation.

Paragraph (b)(2) was amended in response to EPA comments that daily chlorite measurements may be conducted by a person meeting the requirements of § 109.1008(c) to be consistent with § 109.304(c).

Paragraphs (d) and (e) were amended in response to EPA comments for clarity to cross-reference the monitoring requirements in § 109.301 to be at least as stringent as the federal rules for bulk hauling, retail and vended water systems that meet the definition of a community or nontransient noncommunity water system.

§ 109.1008. System management responsibilities

Paragraphs (g) and (h) were renumbered as paragraphs (i) and (j) because new paragraphs (g) and (h) were added by the Revised Total Coliform Rule (46 Pa.B. 6005 (September 24, 2016)).

F. *Benefits, Costs and Compliance*

Benefits

The amendments will affect all 1,949 community water systems and those noncommunity water systems that have installed disinfection (746) for a total of 2,695 public water systems. These public water systems serve a total population of 11.3 million people.

The amendments are intended to reduce the public health risks and associated costs related to waterborne pathogens and waterborne disease outbreaks. Costs related to waterborne disease outbreaks are extremely high. In 2008, a large Salmonella outbreak caused by contamination of a storage tank and distribution system and no disinfectant residual within the municipal drinking water supply occurred in Alamosa, CO. The outbreak's estimated total cost to residents and businesses of Alamosa using a Monte Carlo simulation model (10,000 iterations) was approximately $1.5 million (range: $196,677—$6,002,879) and rose to $2.6 million (range: $1,123,471—$7,792,973) with the inclusion of outbreak response costs to local, state and nongovernmental agencies and City of Alamosa healthcare facilities and schools. This investigation documents the significant economic and health impacts associated with waterborne disease outbreaks and highlights the potential for loss of trust in public water systems following these outbreaks. See "Economic and Health Impacts Associated with a Salmonella Typhimurium Drinking Water Outbreak—Alamosa, CO, 2008," http://www.ncbi.nlm.nih.gov/pubmed/23526942.

Communities in this Commonwealth will benefit from: (1) the avoidance of a full range of health effects from the consumption of contaminated drinking water such as acute and chronic illness, endemic and epidemic disease, waterborne disease outbreaks, and death; (2) the continuity of a safe and adequate supply of potable water; and (3) the ability to plan and build future capacity for economic growth and ensure long-term sustainability.

Compliance Costs

Disinfectant residual monitoring at the entry point

It is estimated that 114 out of 352 plants (or ~ 30%) may be using paper chart recorders. Paper chart recorders can record measurements to two decimal places provided the proper scale and resolution is used. In cases where the requisite scale and resolution are not possible, an upgrade

to electronic recording devices would cost approximately $1,500. It is estimated that 10% of these systems or 11 systems may need to upgrade to electronic recording devices. The estimated cost is 11 systems x $1,500 = $16,500.

This cost should not be prohibitive for filter plants, and the use of electronic devices offers several advantages. Advantages of using electronic recording devices include improved data reliability, faster and more comprehensive data analysis, better data resolution, elimination of the need for interpolating trace values from a chart, cost savings through the elimination of consumables (pens and chart paper), and reductions in errors associated with transferring analog data to a spreadsheet for recordkeeping or reporting purposes.

Disinfectant residuals in the distribution system

It is anticipated that the large majority of water systems will be able to comply with this requirement with little to no capital costs because many of these systems are already meeting a disinfectant residual of ≥0.15 mg/L. Within the Commonwealth, 1,949 CWSs are required to provide and maintain disinfection treatment. Of these systems, 1,298 (67%) are required to collect only one disinfectant residual measurement each month. An additional 232 systems are only required to collect two measurements each month. In total, 1,530 systems (79%) are only required to collect one or two disinfectant residual measurements each month; which means the average result reported each month for the large majority of systems is essentially the same as the actual sample results.

The Department reviewed the summary data (distribution system disinfectant residual average result values) from Jan 2012-May 2017 for the 1,949 CWSs.

- During this period, 165,328 average result values were reported; of these records, 154,623 average result values (93.5%) were at or above 0.15 mg/L.
- For the systems that are required to conduct only one or two measurements each month, 136,743 average result values were reported; of these records, 126,406 average result values (92.4%) were at or above 0.15 mg/L.
- For the systems that only conduct one measurement each month, 116,900 average result values were reported; of these records, 107,366 (91.8%) were at or above 0.15 mg/L.

The below table shows the number of CWSs and the number of average result summary records submitted for each population group.

CWS Disinfectant Average Result by Population Category

Population Group	No. Samples Required	No. PWSs	Total POPL[1]	Total No. Records	No. Results < 0.15	No. Results >= 0.15
< 25[2]	1	9	172	300	14	286
25-1,000	1	1290	311,515	116,600	9,520	107,080
1,001-2,500	2	231	381,322	19,843	803	19,040
2,501-3,300	3	86	255,069	6,292	168	6,124
3,301-4,100	4	28	103,784	2,534	65	2,469
4,101-4,900	5	37	164,629	2,518	11	2,507
4,901-5,800	10	27	145,425	1,752	0	1,752
5,801-6,700	15	22	137,596	1,672	1	1,671
6,701-7,600	20	22	156,720	1,246	0	1,246
7,601-8,500	25	22	178,117	1,194	22	1,172
8,501-12,900	30	46	469,925	3,311	34	3,277
12,901-33,000	35	69	1,436,581	4,333	66	4,267
> 33,000	≥ 40	60	7,628,402	3,733	1	3,732
Total	**-----**	**1,949**	**11,369,257**	**165,328**	**10,705**	**154,623**

[1]Total POPL is the total population served for the population category, based on the CWS population in PADWIS. The Revised Total Coliform Rule required water systems to submit a revised sampling plan which included updated population numbers in accordance with existing EPA guidance. The CWS population served includes nontransient and transient consumers.

[2]These CWSs triggered applicability under the SDWA because each system provides water to 15 or more service connections.

An additional 621 noncommunity water systems with disinfection treatment are currently required to maintain a disinfectant residual in the distribution system. Of these 621 water systems, 598 (96%) are only required to collect one or two residual measurements each month; 554 (89%) are only required to conduct one measurement each month.

Therefore, the Department believes it is appropriate to use the average result data, and that the data indicate that most water systems are already in compliance with these minimum disinfection residual requirements.

Systems may need to increase the frequency of or improve the effectiveness of existing operation and maintenance best management practices, such as flushing, storage tank maintenance, cross-connection control, leak detection, and effective pipe replacement and repair practices, to lower chlorine demand and meet disinfectant residual requirements at all points in the distribution system.

Some systems with very large and extensive distribution systems may need to install automatic flushing devices, tank mixers or booster chlorination stations to achieve ≥ 0.15 mg/L (which rounds to 0.2 mg/L) at all points in the distribution system. As a result of public comments, the Department revised its capital expense estimates and added annual operational expense estimates as follows:

Type of Facility	Capital Expenses	Annual Expenses
Automatic flushing device	$2,500	$750
Tank mixer	$75,000	
Booster chlorination station	$250,000	$10,000

It is estimated that 25% of community water systems serving over 25,000 people, or ~20 systems, may need to install automatic flushing devices, tank mixers or booster chlorination stations. Of these 20 systems:

- 12 water systems may need to install up to ten automatic flushing devices for capital costs of up to $25,000 and annual expenses of up to $7,500 per system. The total cost for 12 systems is estimated to be up to $300,000 in capital costs and up to $90,000 in annual expenses.

- Four water systems may need to install up to two tank mixers for capital costs of up to $150,000 per system. The total cost for four systems is estimated to be up to $600,000 in capital costs.

- Four systems may need to install up to four booster chlorination stations for capital costs of up to $1,000,000 and annual expenses of up to $40,000 per system. The total cost for four systems is estimated to be up to $4,000,000 in capital costs and up to $160,000 in annual expenses.

Costs for small systems are not expected to increase because most small systems are already maintaining adequate disinfectant residuals (0.40 mg/L) as required by the Groundwater Rule. Further, with regard to operating costs, it is unlikely costs to small systems would increase because Section 109.304 specifies that certain parameters (including turbidity and disinfectant residuals) may be analyzed by an appropriately certified operator or a person using a standard operator procedure as specified in the Water and Wastewater Systems' Operator Certification Act. Small water systems that are required to install and maintain disinfection (under either the Surface Water Treatment Rule (SWTR) or the Groundwater Rule (GWR)) are currently required to measure the disinfectant residual at the entry point at least once per day, so a procedure is in place for conducting daily disinfectant residual measurements. The weekly distribution system measurements may be conducted by the same person.

Total estimated costs to the regulated community are as much as $4,900,000 in capital costs and up to $250,000 in annual operational expenses. Capital costs are one-time costs expected to be split over the first three years. Annual operational expenses are not expected to begin until year 2.

Estimate of Fiscal Savings and Costs						
	Current FY	FY +1	FY +2	FY +3	FY +4	FY +5
Savings:	$	$	$	$	$	$
Regulated community	0	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Local & state costs	0	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
Total savings	0	2,600,000	2,600,000	2,600,000	2,600,000	2,600,000
Costs:		$	$	$	$	$
Regulated community	0	1,630,000	1,880,000	1,880,000	250,000	250,000
Local & state costs	0	0	0	0	0	0
Total costs	0	1,630,000	1,880,000	1,880,000	250,000	250,000

However, these costs are offset by the avoidance of waterborne disease outbreaks. If even one waterborne disease outbreak is avoided each year, the cost savings to the regulated community (residents and businesses) is estimated at $1.5 million, with an additional $1.1 million in savings to local, state and nongovernmental agencies, healthcare facilities and schools.

Compliance Assistance Plan

The Safe Drinking Water Program utilizes the Commonwealth's Pennsylvania Infrastructure Investment Authority (PENNVEST) Program to offer financial assistance to eligible public water systems. This assistance is in the form of a low-interest loan, with some augmenting grant funds for hardship cases. Eligibility is based upon factors such as public health impact, compliance necessity and project/operational affordability.

The Safe Drinking Water Program has established a network of regional and Central Office training staff that is responsive to identifiable training needs. The target audience in need of training may be either program staff or the regulated community.

In addition to this network of training staff, the Bureau of Safe Drinking Water has staff dedicated to providing both training and outreach support services to public water system operators. The Department's web site also provides timely and useful information for treatment plant operators.

Finally, the Department also provides various tools and technical assistance to water systems through the Distribution System Optimization Program. The goal of distribution optimization is to sustain the water quality leaving the plant throughout all points in the distribution system. To further define distribution system optimization, "optimization" refers to improving drinking water quality to enhance public health protection without significant capital improvements to the water treatment plant or distribution system infrastructure.

The distribution system is the last "barrier" for protecting public health, meaning the physical and chemical barriers that have been established are necessary to protect the public from intentional or unintentional exposure to contaminants after the water has been treated. Distribution system optimization focuses on two primary health concerns related to water quality within the distribution system—microbial contamination and DBP formation.

If implemented, distribution system optimization will lead to increased public health protection through increased monitoring and operational oversight, resulting in improved physical protection and improved water quality for all customers.

Paperwork Requirements

Paperwork requirements include: electronic reporting of log inactivation values on a monthly basis using existing formats; electronic reporting of additional disinfectant residual levels measured in the distribution system using existing formats; development of a disinfectant residual sample siting plan; and development of a nitrification control plan.

G. *Sunset Review*

The Board is not establishing a sunset date for these regulations since they are needed for the Department to carry out its statutory authority. The Department will continue to closely monitor these regulations for their effectiveness and recommend updates to the Board as necessary.

H. *Regulatory Review*

Under section 5(a) of the Regulatory Review Act (71 P. S. § 745.5(a)), the Department submitted a copy of the proposed regulation and RAF to IRRC and to the Chairpersons of the House and Senate Environmental Resources and Energy Committees on the same date, February 11, 2016, that it submitted the proposed regulation to the Legislative Reference Bureau for publication in the *Pennsylvania Bulletin*.

Under section 5(c) of the Regulatory Review Act, IRRC and the Committees were provided with copies of the comments received during the public comment period, as well as other documents when requested. In preparing these final-form regulations, the Department has considered all comments from IRRC, the Committees and the public.

Under section 5.1(j.2) of the Regulatory Review Act (71 P.S. § 745.5a(j.2)), on _____ these final-form regulations were deemed approved by the House and Senate Committees. Under section 5.1(e) of the Regulatory Review Act, IRRC met on _____, and approved the final-form regulations.

I. *Findings of the Board*

The Board finds that:

(1) Public notice of proposed rulemaking was given under sections 201 and 202 of the act of July 31, 1968 (P.L. 769, No. 240) (45 P.S. §§ 1201 and 1202) and regulations promulgated thereunder at 1 Pa. Code §§ 7.1 and 7.2.

(2) A public comment period was provided as required by law, and all comments were considered.

(3) These regulations do not enlarge the purpose of the proposals published 46 Pa.B. 857 (February 20, 2016).

(4) These regulations are necessary and appropriate for administration and enforcement of the authorizing acts identified in Section C of this order.

J. *Order of the Board*

The Board, acting under the authorizing statutes, orders that:

(a) The regulations of the Department of Environmental Protection, 25 Pa. Code Chapter 109, are amended by amending §§ 109.1, 109.202, 109.301, 109.303, 109.408, 109.701, 109.710, 109.1002, 109.1003, 109.1004, 109.1008, 109.1103, 109.1107, 109.1202, 109.1302 and adding § 109.716 to read as set forth in Annex A.

(b) The Chairperson of the Board shall submit this order and Annex A to the Office of General Counsel and the Office of Attorney General for review and approval as to legality and form, as required by law.

(c) The Chairperson of the Board shall submit this order and Annex A to the IRRC and the Senate and House Environmental Resources and Energy Committees as required by the Regulatory Review Act.

(d) The Chairperson of the Board shall certify this order and Annex A, as approved for legality and form, and deposit them with the Legislative Reference Bureau, as required by law.

(e) This order shall take effect immediately upon publication in the *Pennsylvania Bulletin*.

PATRICK McDONNELL,
Chairperson