Regulatory Analysis Form

(Completed by Promulgating Agency)

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INDEPENDENT REGULATORY REVIEW COMMISSION

IRRC Number: 3177

(1) Agency
Department of Environmental Protection

(2) Agency Number:
Identification Number: 7-521

(3) PA Code Cite: 25 Pa. Code, Chapter 109 (Safe Drinking Water)

(4) Short Title: Safe Drinking Water General Update and Fees

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(6) Type of Rulemaking (check applicable box):

- ☒ Proposed Regulation
- ☐ Final Regulation
- ☐ Final Omitted Regulation

- ☐ Emergency Certification Regulation;
  - ☐ Certification by the Governor
  - ☐ Certification by the Attorney General

(7) Briefly explain the regulation in clear and nontechnical language. (100 words or less)

The purpose of this proposed rulemaking is to:

1. Incorporate the remaining general update provisions that were separated from the proposed Revised Total Coliform Rule (RTCR) as directed by the Environmental Quality Board (EQB) on April 21, 2015, including revisions to treatment technique requirements for pathogens, clarifications to permitting requirements, and new requirements for alarms, shutdown capabilities, and auxiliary power.
2. Amend existing permit fees and add new annual fees to supplement state costs and address the funding gap ($7.5M).
3. Add new amendments to establish the regulatory basis for issuing general permits, and address concerns related to gaps in monitoring, reporting and tracking of back-up sources of supply.

(8) State the statutory authority for the regulation. Include specific statutory citation.

Section 4(a) and (c) of the Pennsylvania Safe Drinking Water Act, 35 P.S. § 721.4(a) and (c), and section 1920-A of the Administrative Code of 1929, 71 P.S. § 510-20(b).

(9) Is the regulation mandated by any federal or state law or court order, or federal regulation? Are there any relevant state or federal court decisions? If yes, cite the specific law, case or regulation as well as, any deadlines for action.

Section 1413 of the Federal Safe Drinking Water Act, 42 U.S.C. § 300g-2a, requires that, in order for the state to retain primary enforcement authority (primacy), the state must adopt drinking water regulations that are "no less stringent than" the national primary drinking water regulations. This section further requires states to adopt and implement a program that is consistent with federal requirements and meets minimum program elements. The federal drinking water primacy regulations at 40 CFR Part 142, Subpart B (Primary Enforcement Responsibility) set forth the program requirements that states must meet to retain primary enforcement responsibility. Furthermore, Section 5(a) of the Pennsylvania Safe Drinking Water Act, 35 P.S. § 721.5(a), requires the Department of Environmental Protection (DEP or Department) to adopt and implement a public water supply program which includes those program elements necessary to assume state primary enforcement responsibility under the federal act.

The U.S. Environmental Protection Agency (EPA) has evaluated the performance of the Department in meeting the requirements necessary to retain primacy. EPA's findings were documented in a letter dated December 30, 2016. See attached letter. The findings included the following:

- Programmatic requirements are not being met in a complete and timely manner. Minimum program requirements must be met for states to maintain primacy for the Safe Drinking Water Program.
- The Department's average of 149 public water systems (PWS) per sanitarian (field inspector) is more than double the Association of State Drinking Water Administrator's (ASDWA) national average. EPA cautions the Department that this kind of excessive workload is not sustainable and program performance will continue to suffer.
- The Department failed to meet the federal requirement for sanitary surveys (full inspections). Not completing sanitary survey inspections in a timely manner can have serious public health implications as major violations could be going unidentified.
- In November 2016, EPA conducted a file review of the Department's implementation of the Lead and Copper Rule. EPA is currently reviewing the information collected; EPA's report intends to highlight insufficient program personnel in its findings and recommendations.
- EPA is encouraged by the Department's proposed rulemaking to increase program funding and is hopeful that the Drinking Water Program will receive the necessary resources to improve program performance and reduce personnel shortfalls.
- A written action plan was due to EPA within 60 days of the letter (by February 28, 2017). The Department's response was sent on February 24, 2017. See attached letter. Failure to meet minimum program elements may jeopardize primacy.

In order to retain primacy, the Department must ensure it receives the necessary resources to improve program performance and reduce personnel shortfalls. This regulation is necessary to address the funding gap.

Other updates to Chapter 109 are not mandated by federal law. However, these updates are directly related to previously adopted federal regulations which need revisions to improve compliance and provide better clarity.

(10) State why the regulation is needed. Explain the compelling public interest that justifies the regulation. Describe who will benefit from the regulation. Quantify the benefits as completely as possible and approximate the number of people who will benefit.

Part I: General Updates

Source Water Protection and New Source Permitting Requirements

The Source Water Assessment and Protection Program amendments will support the protection of public drinking water sources, which will result in maintaining the highest source water quality available. Revisions include adding definitions relating to source water protection and requiring assessments for new sources as part of the permitting process. These revisions will not only protect public health but will also help to maintain, reduce or avoid drinking water treatment costs which occur when the best available source is not selected and protected.

Source water protection represents the first barrier to drinking water contamination. A vulnerable drinking water source puts a water utility and the community it serves at risk and at a disadvantage in planning and building future capacity for economic growth. Contamination of a community water system (CWS) source is costly for the water supplier and the public. For example, it is estimated that the total cost of the Walkerton, Ontario *E. coli* contamination incident was $64.5 million (*The Economic Costs of the Walkerton Water Crisis* by John Livernois, 2001). In addition to increased monitoring and treatment costs for the water system, there may be costs associated with containment or remediation, legal proceedings, adverse public health and environmental effects, reduced consumer confidence, diminished property values, and replacement of the contaminated source.

A Texas A&M study (1997) showed that water suppliers in source water areas with chemical contaminants paid $25 more per million gallons to treat drinking water than suppliers in areas with no chemical contaminant detections. The study also showed that for every four percent increase in source water turbidity (an indicator of water quality degradation from sediment, algae and microbial pathogens), treatment costs increase by one percent (Trust for Public Land, 2002). A study by the Pennsylvania Legislative Budget and Finance Committee (2013) stated, "(r)educing pollution inputs from pipes and land-based sources can reduce locality costs to treat drinking water sources to safe standards. Similarly, a study by the Brookings Institute suggested that a one percent decrease in sediment loading will lead to a 0.05 percent reduction in water treatment costs." Findings from source water assessments can support and enhance emergency response, improve land use planning and municipal decisions, complement sustainable infrastructure initiatives, and help prioritize and coordinate actions by federal and state agencies to better protect public health and safety.

The need to understand and update potential threats to public drinking water sources, as well as ways to minimize those threats, was underscored by the January 2014 chemical spill in West Virginia that impacted the drinking water for 300,000 people. Currently, of the 10.6 million people served by CWSs in Pennsylvania, 7.7 million people are covered by substantially implemented local source water protection programs. Substantial implementation is a term referenced in EPA work plans that indicates a measure of progress relative to source water protection efforts. These proposed amendments will help ensure that the remaining nearly three million people also benefit from local source water protection efforts.

The proposed changes relating to new sources of supply in Section 109.503 will more clearly define the existing requirements regarding the proper order of the permitting process for developing a new PWS source. These clarifications are needed to help ensure that the proper level of treatment is designed and installed in a timely manner; thereby resulting in less delay for permitting a new source that may be needed to meet public health protection requirements, or providing redundancy in the event of contamination of existing sources. These amendments should result in cost savings due to the avoidance of expensive permitting mistakes.

Surface Water and Groundwater Under the Direct Influence (GUDI) Filter Plants

The proposed amendments to surface water treatment requirements will benefit more than eight million Pennsylvanians who are supplied water by PWSs utilizing filtration technologies. The filtration amendments are designed to identify and correct problems at the plant before a turbidity exceedance occurs or escalates. The U.S. Environmental Protection Agency (EPA) describes turbidity as "a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (such as whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches." *National Primary Drinking Water Regulations*, EPA 816-F-09-004 (May 2009). These amendments will ensure that PWSs that consistently produce water that meets turbidity standards t are able to deliver safe and potable water to all users.

The proposed amendments are intended to reduce the public health risks related to waterborne pathogens and waterborne disease outbreaks. Costs related to waterborne disease outbreaks are extremely high. For example, as stated in the below-referenced article, the total medical costs and productivity losses associated with the 1993 waterborne outbreak of cryptosporidiosis in Milwaukee, Wisconsin was $96.2 million: $31.7 million in medical costs and $64.6 million in productivity losses. The average total cost per person with mild, moderate, and severe illness was $116, $475, and $7,808, respectively *Cost of illness in the 1993 Waterborne Cryptosporidium outbreak, Milwaukee, Wisconsin.* Corso, et al. Emerg Infect Dis [serial online] 2003 April. Available from: URL: http://wwwnc.cdc.gov/eid/article/9/4/02-0417.

Filter Plant Performance Requirements

Existing regulations at § 109.301(i) require turbidity monitoring of the combined filter effluent (CFE) once every four hours. This period of intermittent sample review allows the production of significant volumes of water that are not monitored for compliance with the maximum allowable turbidity limit. The proposed amendments for CFE turbidity monitoring will require continuous monitoring and recording of the results every 15 minutes. This will also enable operators to identify problematic water quality trends and respond more quickly with necessary process control adjustments.

Individual filter effluent (IFE) monitoring ensures that filter deficiencies are identified and corrected before a CFE turbidity exceedance occurs. Existing regulations require continuous IFE turbidity monitoring at conventional and direct filtration plants. The proposed amendments for IFE monitoring include all filtration types. In recent years, the Department has documented breakdowns in treatment of individual filters at filter plants not classified as conventional or direct. The likelihood of a breakdown in treatment or physical integrity of an individual filter is a concern regardless of the specific type of filter technology utilized. This explains the need for expansion of existing requirements.

Health effects associated with microbial contaminants tend to be due to short-term, single dose exposure rather than long-term exposure. Therefore, if a short duration single turbidity exceedance of the existing maximum allowable turbidity limit occurs and goes unnoticed, consumers are at risk of exposure to microbial pathogens. By requiring continuous monitoring and recording of the results at least every 15 minutes at both CFE and IFE locations for all filter plants, water suppliers will be better able to identify problems before an exceedance occurs and determine compliance with the maximum allowable turbidity limit at all times.

The proposed amendments lower IFE trigger levels to be consistent with CFE turbidity requirements. Exceeding an IFE trigger is not a violation; instead, it prompts the water supplier to investigate the cause of the problem and correct any deficiencies. If water suppliers are diligent, no violations should occur.

An additional revision will require all surface water filtration plants to implement a filter bed evaluation program that assesses the overall integrity of each filter to identify and correct problems before a turbidity exceedance or catastrophic filter failure occurs. Filters are the final barrier for removal of acute pathogens, and are therefore critical to public health protection. For many systems in Pennsylvania and across the country, this infrastructure is aging, and the revision to require a physical inspection once per year is a necessary minimum preventative action item.

All of these proposed filter plant performance provisions are part of a multi-barrier approach to ensure treatment is adequate to provide safe and potable water to all users.

Automatic Alarms and Shutdown Capabilities
Filter plants are complex and dynamic. In response to many circumstances, the water plant operator must take an immediate action to protect public health, such as when source water quality changes, chemical feed pumps malfunction, filters require backwashing, or other unforeseen circumstances occur. Water plant operators are often required to perform other duties, which leaves the operation of the water plant unattended, and which limits the operator's ability to respond immediately to treatment needs.

Automated alarms and shutdown capabilities play an important role in modern water treatment and public health protection. Many water suppliers have already taken advantage of readily available technology to reduce personnel costs while still providing safe water to their customers. The proposed amendments will ensure that all surface water filtration plants have the minimum controls in place to ensure that operators are immediately alerted to major treatment problems. The proposed amendments will also ensure that unmanned filter plants are automatically shut down when the plant is producing water that is not safe to drink, which prevents contaminated water from being provided to customers for extended periods of time. These alarms and shutdown capabilities will allow operators at both attended and unattended filtration plants to promptly respond to the water quality problems and treatment needs of the plant. The automated plant shut down is intended to prevent poor quality water from reaching customers, which will protect public health, reduce PWS costs related to corrective actions and issuing public notice, reduce costs to the community, and maintain consumer confidence.

Filter-To-Waste
The Department's Filter Plant Performance Evaluation (FPPE) program has evaluated approximately 1,250 filters since 1999. The results of these evaluations show that filters are most likely to shed turbidity, particles, and microbial organisms at the beginning of a filter run when the filter is first placed into service following filter backwash and/or maintenance. The proposed amendments will require all filter plants, that have the ability to filter-to-waste, to do so following filter backwash and/or maintenance and before placing the filter into service. Filtering to waste will reduce the likelihood of pathogens passing through filters and into the finished drinking water. The proposed amendments will

not require water suppliers without filter-to-waste capabilities or with undersized filter-to-waste capabilities to make a capital improvement.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions

The proposed revisions to system service and auxiliary power requirements will strengthen system resiliency and ensure that safe and potable water is continuously supplied to consumers and businesses. A continuous and adequate supply of safe drinking water is vital to maintaining healthy and sustainable communities.

Pennsylvania's PWS sources and treatment facilities are susceptible to emergency situations resulting from both natural and man-made disasters. Examples of emergencies from recent years include tropical storms, flooding, high winds, ice, snow, industrial chemical plant runoff, pipeline ruptures, and transportation corridor spills. These emergencies have resulted in significant impacts to consumers and businesses due to inadequate water quantity or quality, and the resulting water supply warnings and advisories. For example, in 2011, Hurricane Irene and Tropical Storm Lee caused flooding, water line ruptures, and power outages resulting in mandatory water restrictions and boil water advisories (BWA) at 32 PWSs in Pennsylvania. In 2012, Hurricane Sandy caused similar problems at 85 CWSs. Most of the impacted systems were small systems where redundancy and back-up systems were lacking. In comparison, systems with redundancy and adequate planning were able to maintain operations until the power was restored, with little negative impact to their customers. Countless incidents at individual CWSs have occurred due to localized emergencies, with interruptions in potable drinking water service that could have been prevented if adequate preparation and equipment were available.

In addition, numerous wastewater treatment plants were forced to send untreated sewage to Pennsylvania waterways during these major weather events. PWSs that use these waterways as a source of supply were at an increased risk due to extremely elevated turbidity levels and pathogen loading. Effectively treating drinking water during and after emergencies requires increased vigilance and operational control.

Water outages caused by power failures or other emergencies can cause additional adverse effects including:

- Lack of water for basic sanitary purposes, such as hand-washing and flushing toilets.
- Increased risk to public health when water systems experience a sharp reduction in supply, which can result in low or no pressure situations within the distribution system. Low pressure can allow intrusion of contaminants into distribution system piping from leaks, and backflow from cross connections.
- Dewatering of the distribution system can result in physical damage to pipes when the system is re-pressurized. This situation is exacerbated due to the nationwide problem with aging infrastructure.

These proposed amendments improve the reliability of service provided to all consumers by requiring the development of a feasible plan to consistently supply an adequate quantity of safe and potable water during emergency situations. More specifically, water suppliers will need to provide on-site auxiliary power sources (i.e. generators), or connection to at least two independent power feeds from separate substations; or develop a plan for alternate provisions, such as interconnections with neighboring water systems or finished water storage capacity. Ideally, water systems will implement a combination of options to improve their redundancy and resiliency.

Part II: Amended Permit Fees and New Annual Fees

Part II of the proposed amendments includes new annual fees and amended permit fees to supplement state costs and help to fill the funding gap (it is proposed to bring in $7.5 million which is half of the Commonwealth's share of Safe Drinking Water Program implementation costs).

These proposed fees are necessary to ensure adequate funding for the Department to carry out its responsibilities under the Safe Drinking Water Act. Pennsylvania is ranked third in the nation in terms of the number of PWSs, with 8,521 PWSs across the Commonwealth. The Department is responsible for regulating all PWSs and ensuring that safe and potable drinking water is continuously supplied to the 10.7 million customers they serve.

The Department's appropriations from the General Fund have decreased in recent years while the cost of staff salaries and benefits, as well as other operation costs, have increased. The result has been an overall decrease in staffing for the Safe Drinking Water Program of 25% since 2009. As discussed in more detail below, these staff reductions have led to a steady decline in the Department's performance of services necessary to ensure compliance with SDWA requirements. Based on the current funding level of $19.7 million, approximately $7.5 million in additional funding is necessary to increase staffing to provide necessary services.

The minimum services that the Safe Drinking Water Program must provide to administer the SDWA and its regulations include:

- Conducting surveillance activities, such as sanitary surveys and other inspections.
- Collecting and analyzing drinking water samples.
- Determining compliance with the regulations, a permit or order.
- Taking appropriate enforcement actions to compel compliance.
- Reviewing applications, plans, reports, feasibility studies and special studies.
- Issuing permits.
- Conducting evaluations, such as filter plant performance evaluations and other site surveys.
- Tracking, updating and maintaining water supply inventory, sample file, and enforcement data in various data management systems.
- Meeting and assuring compliance with all state and federal recordkeeping and reporting requirements.
- Conducting training.
- Providing technical assistance.
- Responding to water supply emergencies.

Failure to provide these services may result in an increased risk to public health as well as the loss of approval from EPA for the Department to serve as the primary enforcement agency for the administration of the Safe Drinking Water Program in Pennsylvania under Federal law.

The Board has the authority under Section 4(c) of the SDWA (35 P.S. § 721.4(c)) to establish fees for services that bear a reasonable relationship to the actual cost of providing the services. The Board must also consider the impacts of the proposed fees on small businesses as part of the regulatory analysis required by section 5 of the Regulatory Review Act (71 P.S. § 745.5). Sixty-eight percent of the water systems in the Commonwealth are considered small businesses.

The fees proposed in this rulemaking will provide the Department with funding necessary to properly administer the SDWA consistent with the actual cost of services provided in a manner that minimizes the adverse impact on water systems with fewer customers to bear the cost.

Recent Decline in Department Staff and Services

Program staffing and performance has steadily declined since 2009.

The number of sanitary surveys (full inspections) has steadily declined since 2009. The Federally mandated inspection frequency is every 3 years for CWSs and every 5 years for noncommunity water systems (NCWSs).

SDW Measure	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
No. Sanitary Surveys	3,177	2,271	2,553	2,310	2,181	2,415	1,847

(Source: Governor's Office Performance Measures, data source is Environment Facility Application Compliance Tracking System (eFACTS))

The number of overdue inspections has ranged from 448 to 703 in the last 6 years. Failure to conduct routine and timely inspections may mean that serious violations are not being identified. In 2015, all six DEP regions had overdue inspections. The range of overdue inspections was 2.4 % to 11.5 %. The total number of systems with overdue inspections was 542. The Federal Public Water System Supervision (PWSS) Grant and primacy measure for inspection frequency has not been met.

SDW Measure	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
No. Overdue Inspections	703	551	458	448	492	542

(Source: eFACTS and Pennsylvania Drinking Water Information System (PADWIS))

The reduction in staffing levels and inability to conduct routine and timely inspections because of funding shortfalls may be contributing to the overall declining trend in PWS compliance rates. For the last four years, the percentage of CWSs that met health-based drinking water standards fell short of the goal of 95%.

SDW Measure:	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
% of CWSs that Meet Health-based Drinking Water Standards	97%	97%	97%	91%	92%	92%	91%

(Source: Governor's Office Performance Measures, data source is PADWIS)

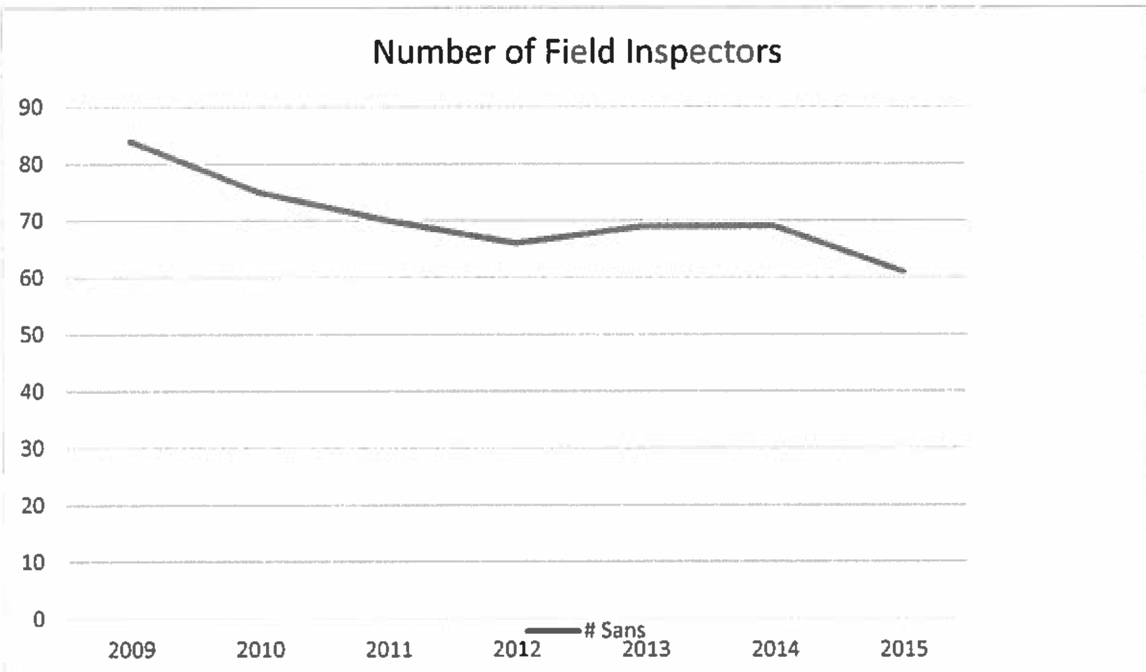
As per the Department's Annual Compliance Report for 2015, PWSs continue to exceed health-based maximum contaminant levels (MCL), maximum residual disinfectant levels (MRDL), and treatment technique (TT) requirements for arsenic, radionuclides, volatile organic chemicals, disinfection byproducts, nitrate/nitrite and pathogens; and for failure to adequately treat drinking water for contaminants such as lead.

The number of unaddressed violations has also continued to increase. In 2015, three of six DEP regions had more than 500 violations that had not been returned to compliance within 180 days or addressed through formal enforcement. (Note: Unaddressed violations are tracked over a five-year period because it generally takes several years to return MCL violations to compliance.)

SDW Measure:	FY 05-10	FY 06-11	FY 07-12	FY 08-13	FY 09-14	FY 10-15
No. Unaddressed Violations	4,298	4,746	5,536	6,849	6,353	7,922

(Source: PADWIS)

Performance is directly tied to the mandated workload and available resources for the Safe Drinking Water Program. Overall, staffing levels are down by 25% since 2009.



Thus, the Department's workload has steadily increased since 2009. As per a workload analysis, the recommended number of PWSs/sanitarian was determined to be 100-125 to ensure completion of mandated inspections, review of PWS self-monitoring data, compliance and enforcement determinations, maintenance of PADWIS and eFACTS, review of monitoring plans, emergency response plans, assessments, and waivers. In 2009, the Department's average workload was within the recommended range at 118 PWSs/sanitarian. In 2015, five of six DEP regions exceeded the recommended workload. The recommended workload has been exceeded in at least four of six DEP regions for the last three years. As per a 2012 Association of State Drinking Water Administrators (ASDWA) survey, the national range and average of PWSs/inspector is 45-140 and 67, respectively. All DEP regions far exceed the national average.

Region	No. PWSs			No. Sanitarians			Sanitarian Workload (No. PWSs/San)		
	2009	**2014**	**2015**	**2009**	**2014**	**2015**	**2009**	**2014**	**2015**
1 SERO	1,062	911	911	9	7	6	118	**130**	**152**
2 NERO	2,973	2,555	2,559	23	20	19	**129**	**128**	**135**
3 SCRO	2,596	2,400	2,408	21	14	13	124	**171**	**185**
4 NCRO	1,115	937	941	10	7	6	112	**134**	**157**
5 SWRO	879	680	694	10	8	6	88	78	105
6 NWRO	1,302	1,211	1,205	11	9	7	118	117	**158**
Totals	9,927	8,694	8,718	84	65	57	118 Avg.	**134 Avg.**	**153 Avg.**

Final numbers for FY 2016/2017 will be finalized by the end of August 2017. Currently, the number of sanitarians is 61. This workforce includes 43 sanitarians, 11 trainees and seven vacancies. Due to the ever-increasing complexity of the drinking water program, trainees are not considered adequately trained until they have at least two years of experience. In addition, due to a Department-wide complement reduction, it is unclear if or when the program will receive approval to fill the seven vacancies. As such, the actual available workforce is 54 sanitarians with a workload of 158 PWSs/sanitarian. Of those 54 sanitarians, 26 have four years or less of experience.

Performance issues and concerns have been well documented by EPA since 2009:

- EPA Region III PWSS Program Review for DEP Bureau of Water Standards and Facility Regulation (July 2009): identified the impacts of a 2008 hiring freeze that prevented the filling of vacancies to reach the full additional complement, and led to inadequate training of field staff. These problems continue today.
- EPA Region III Review of the Bureau of Safe Drinking Water (December 2012): identified that the Department was unsuccessful at retaining all allocated drinking water FTEs as of June 2009 due to budget cuts and increasing costs. Further, the report documented that the number of field inspectors was down by 20% since June of 2009. The report also found that as a result of staffing cuts, there was a backlog of required sanitary surveys (full inspections), and a backlog of Pennsylvania Drinking Water Information System (PADWIS) programming modifications and reports.
- Program performance is currently under review by EPA Region III. An EPA letter dated December 30, 2016 further documents the Department's poor performance. As per the letter, EPA's concerns include the following:
  - Programmatic requirements are not being met in a complete and timely manner. Minimum program requirements must be met in order for states to maintain primacy for the Safe Drinking Water Program.
  - PA DEP's average of 149 PWSs/sanitarian is more than double the ASDWA national average. EPA cautions DEP that this kind of excessive workload is not sustainable and program performance will continue to suffer.
  - PA DEP failed to meet the federal requirement for sanitary surveys. Not completing sanitary survey inspections in a timely manner can have serious public health implications as major violations could be going unidentified.

- In November 2016, EPA conducted a file review of PA's Lead and Copper Rule. EPA is currently reviewing the information collected. EPA intends to highlight insufficient program personnel in its findings and recommendations.
- EPA is encouraged by DEP's proposed rulemaking to increase program funding and is hopeful that the Drinking Water Program will receive the necessary resources to improve program performance and reduce personnel shortfalls.
- A written action plan was due to EPA within 60 days of the letter (by February 28, 2017). The Department sent a response to EPA on February 24, 2017. Failure to meet minimum program elements may jeopardize EPA's approval of the Department's authority to enforce the Federal law (primacy).

Part III: New General Updates

General Permits
These proposed amendments will establish the regulatory basis for the issuance of general permits for high volume, low risk modifications or activities to streamline the permitting process.

Requirements for NCWSs
These proposed amendments will clarify that noncommunity water systems (NCWS) that are not required to obtain a permit must still obtain Department approval of the facilities prior to construction and operation.

Address Gaps in Monitoring, Reporting and Tracking Back-up Sources
These proposed amendments will address concerns related to gaps in the monitoring, reporting and tracking of back-up water sources and entry points. As per Commonwealth and Federal regulations, all sources and entry points must be included in routine compliance monitoring to ensure water quality meets safe drinking water standards. Sources and entry points that do not provide water continuously are required to be monitored when used. However, monitoring requirements for back-up sources are not currently tracked, which means verifiable controls are not in place to ensure that all sources and entry points meet safe drinking water standards. Some of these sources have not been used in at least 5 years, and, therefore, the Department does not know the water quality for these sources. In addition, the treatment facilities and other appurtenances associated with these sources may have gone unused as well, and may no longer be in good working order. These amendments will ensure that all sources and entry points are monitored at least annually. PWSs will also be required to document in a comprehensive monitoring plan how routine compliance monitoring will include all sources and entry points.

These concerns were most recently highlighted in a 2010 report from EPA's Office of Inspector General entitled *"EPA Lacks Internal Controls to Prevent Misuse of Emergency Drinking Water Facilities"* (Report No. 11-P-0001). Note: The term "emergency" is often used to describe sources other than permanent sources. In Pennsylvania, some of these back-up sources have not been used in at least five years, and, therefore, the Department does not know the water quality for these sources.

In order to better understand the scope of the problem in Pennsylvania, the following data was retrieved from PADWIS.

Entry Points (EP)				
PWS Type	**Total No. EPs**	**No. Permanent EPs**	**No. Non-Permanent EPs**	**% Non-Permanent EPs**
CWSs	3,330	3,003	327	10%
Others	7,880	7,760	120	2%
Total	11,210	10,763	447	4%

An entry point is the place at which finished water representative of each source enters the distribution system. Routine compliance monitoring is not tracked at non-permanent entry points. Non-permanent entry points include seasonal, interim, reserve, and emergency entry points.

Based on the data, CWSs provide finished water to consumers through a total of 3,330 entry points, 327 (or 10%) of which are non-permanent. Therefore, as many as 10% of all entry points may not be conducting all required monitoring prior to serving water to consumers.

The numbers are even higher at the individual source level.

Water Supply Sources (wells, springs, surface water intakes, etc.)				
PWS Type	**Total No. Sources**	**No. Permanent Sources**	**No. Non-Permanent Sources**	**% Non-Permanent Sources**
CWSs	5,252	4,634	618	12%
Others	8,604	8,297	307	4%
Total	13,856	12,931	925	7%

For CWSs, as many as 12% of all sources may not be included in routine compliance monitoring, yet these sources can be used at any time.

The Department also reviewed the monitoring history of the 447 non-permanent entry points mentioned above.

Non-Permanent Entry Points (EP)			
PWS Type	**No. EPs**	**No. & % of EPs with No Monitoring Data (Since 1992)**	**No. of EPs with Some Monitoring Data**
CWSs	327	143 (44%)	184 (of these EPs, 47 were sampled in 2016, 37 were sampled during the 2012 – 2015 monitoring period, and the remaining101 were sampled prior to 2012.
Others	120	7 (6%)	113 (55 EPs have recent data (2016)).
Total	447	150 (34%)	

For CWSs, 143 (or 44%) of all non-permanent entry points have **no** monitoring data since 1992. Of the 184 entry points with some data, most of the data is 5 to 10 years old.

The use of unmonitored sources and entry points could adversely impact basic water quality, including pH, alkalinity, turbidity, corrosivity and lead solubility, dissolved inorganic carbon, and natural organic matter. Water suppliers may have limited information about how these sources or entry points will impact treatment efficacy and distribution system water quality. In addition, back-up or emergency sources may have poor water quality or MCL exceedances. The use of these sources without proper monitoring and verifiable controls could lead to an increased risk to public health.

Finally, treatment facilities and other appurtenances associated with these sources may also have gone unused, and may no longer be in good working order. Back-up sources and entry points with unknown water quality or that are no longer in good working order provide a false sense of security in terms of system resiliency and emergency response. While the Department understands that many facilities are not used on a 24/7 basis, these amendments will ensure that all permitted sources and entry points are monitored at least annually.

(11) Are there any provisions that are more stringent than federal standards? If yes, identify the specific provisions and the compelling Pennsylvania interest that demands stronger regulations.

There are several provisions in this proposal that are more stringent than federal requirements. The Department developed these provisions to better protect public health and to be consistent with existing Pennsylvania drinking water regulations.

Turbidity and Filtration Requirements

- Sections 109.202(c)(1)(i)(A)(V), 109.202(c)(1)(i)(C), 109.301(1)(i) and (iii), 109.301(2)(i), 109.602(f) through 109.602 (i), 109.701(a)(2), 109.701(e)(2)(v) through 109.701(e)(2)(viii), 109.703(b)(1), and 109.703(b)(5), are provisions which strengthen turbidity requirements and filtration monitoring and reporting requirements. These amendments are based on Department inspections and the evaluation of more than 1,250 filters through the Department's FPPE program. These evaluations have documented that existing requirements are not sufficient to prevent short duration turbidity spikes or the shedding of particles and microbial pathogens into the finished water, which puts consumers at risk of exposure to microbial pathogens. These amendments are part of a multi-barrier approach to ensure treatment is adequate to provide safe and potable water to all users.
- Sections 109.301(1)(iv), 109.301(2)(i) (D) and 109.1305(a)(1)(iii) require systems to notify the Department within 24 hours of the failure of continuous monitoring equipment and to repair/replace continuous monitoring equipment, regardless of system size, within 5 working days of equipment failure. These provisions will ensure timely repair and restoration of continuous monitoring equipment necessary to maintain adequate treatment of drinking water for public health protection.

Comprehensive Monitoring Plan Requirements

The comprehensive monitoring plan requirements under sections 109.303(i) and 109.717 are more stringent. However, the federal requirements under 40 CFR §§ 141.23 and 141.24 (relating to inorganic and organic chemical sampling and analytical requirements) require water systems to ensure that monitoring is representative of each source after treatment. The Department is simply using the comprehensive monitoring plan as the means to ensure that all sources are included in routine compliance monitoring.

System Resiliency Requirements

Proposed §§ 109.708(a) through (c) concerning auxiliary power is a more stringent provision that improves system resiliency and strengthens existing requirements related to the need for up-to-date and feasible emergency response plans. The frequency of unpredictable and erratic weather emergencies continues to increase. These proposed amendments will protect customers by improving the ability of their water supplier to provide a consistent supply of safe and potable water during the various emergency situations that have occurred in the past and which will inevitably arise at some point in the future. Note that wastewater treatment plants have been required to have a back-up power supply for many years. These proposed amendments will provide consistency in both the drinking water and wastewater industry.

Requirements for Responding to Significant Deficiencies

Section 109.716 includes proposed requirements for significant deficiencies. This section is more stringent because it combines the separate notification and corrective action requirements for surface water and ground water systems into one consistent protocol. These amendments are intended to simplify the requirements for responding to significant deficiencies, especially for systems with both surface water and groundwater sources. These amendments are also intended to ensure that corrective actions are taken as soon as possible to protect public health.

(12) How does this regulation compare with those of the other states? How will this affect Pennsylvania's ability to compete with other states?

Source Water Protection and New Source Permitting Requirements

Two other states in EPA Region III, West Virginia and Virginia, also require source water assessments for new sources. In Virginia, the goal is to have a source water assessment completed by Virginia drinking water program staff before the operations permit is issued. Under West Virginia's new statute on source water protection, an assessment is included as part of a local source water protection plan and must be completed by the water supplier prior to operation for a surface water source.

Regarding the development of local source water protection programs, Delaware and more recently, West Virginia, have requirements for source water protection by statute. Under these proposed amendments, the development of a local source water protection program will remain voluntary in Pennsylvania.

The source water aspects of the proposed regulation should not affect Pennsylvania's ability to compete with other states.

Pennsylvania has had a permitting program in place for many years and the permitting aspects of the proposed regulation should not affect Pennsylvania's ability to compete with other states.

Surface Water and GUDI Filter Plants

Turbidity Monitoring, Recording, and Reporting

Thirty states responded to a survey conducted by ASDWA on behalf of Pennsylvania. Twenty states require continuous turbidity monitoring and recording of CFE and fourteen states require continuous IFE monitoring and recording for all filtration types.

Automatic Alarms and Shutdown Capabilities

Based on the ASDWA survey, twelve states responded that they require filter plants to be attended at all times while in operation. Of the twelve states that require attended operation, seven have regulations that establish standards for plant automation, alarms and shutdowns. Pennsylvania's proposed amendments are less stringent than twelve other states since attended operation is not being required. In addition, the proposed amendments related to plant automation, alarms, and shutdown capabilities are less stringent than those standards suggested by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (also known as the 10 States Standards).

Annual Filter Inspection Program
All thirty states responding to the ASDWA survey require some of their filter plants to implement an annual filter inspection program. This proposed regulation is not expected to negatively affect Pennsylvania's ability to compete with other states because most PWSs have in-house filter inspection capabilities through their existing maintenance staff or certified water operator.

Filter-To-Waste
All thirty states responding to the ASDWA survey require some of their filter plants to filter-to-waste. This proposed regulation is not expected to negatively affect Pennsylvania because implementation is not expected to require any capital improvements.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions
The Department surveyed neighboring states regarding their requirements for system resiliency. Three nearby states, New Jersey, New York, and Connecticut, provided information regarding similar regulations and/or design standards they have in place. Department staff communicated with these states when developing proposed regulatory language. These proposed amendments are not expected to negatively affect Pennsylvania's ability to compete with other states because it will help ensure adequate quantity and quality is consistently provided to Pennsylvania homeowners and businesses during emergency situations.

New Annual Fees and Amended Permit Fees
At least 26 states charge annual fees to augment the cost of their Drinking Water Program, including the nearby states of Delaware, New Jersey, Ohio and Virginia. Some of these states charge a flat fee based on the PWS type and size. Other states charge a fee based on population served or the number of service connections.

Annual fees for these states range from $25 to $160,000 and are summarized below. Pennsylvania's fees range from $50 to $40,000.

Summary of Public Water System Fees Levied by Other States	
State	**Fee**
Alaska	18 AAC § 80.1910 Type: Fee for Service Examples: Sanitary survey - $398 to $585 for 1st source + $117 for each additional source, other inspections - $64/hour
Arkansas *	AC § 20-28-104(a) Type: Annual Fee CWSs and Nontransient NCWSs: Based on # connections $0.30/connection/month, minimum fee = $250 Transient NCWSs: $125

California	Title 22 CCR, Division 4, Chapter 14.5, § 64305 Type: Annual Fee CWSs: minimum $250 or $6/connection (fee per connection on declining tiered scale from $6 to $1.35) NTNCWSs: minimum $456 or $2/person TNCWSs: $800
Colorado	CRS § 25-1.5-209 Type: Annual Fee CWSs: Based on population Surface Water: ranges from $75 - $21,630 Ground Water: ranges from $75 - $4,450 Nontransient NCWSs: ranges from $75 - $4,450 Transient NCWSs: ranges from $75 - $3,960
Delaware *	16 Del. Code § 135(b)(1) Type: Annual Fee CWSs: Based on # service connections, ranges from $50 - $3,000 Nontransient NCWSs: $50 Transient NCWSs: $25
Florida	FAC § 62-4.053 Type: Annual Fee CWSs: Based on permitted design capacity Ranges from $100 – $6,000 Nontransient NCWSs: $100 Transient NCWSs: $50
Idaho	IAC § 58.01.08-010 Type: Annual Fee CWSs and Nontransient NCWSs: Based on # connections 1-20 $100 21-184 $5/connection, max. $735 185-3,663 $4/connection, max. $10,988 >3,664 $3/connection Transient NCWSs: $25
Indiana	IC § 13-18-20.5-2 Type: Annual Fee CWSs: Based on # connections - < 400 connections $350 ≥ 400 connections $0.95/connection Nontransient NCWSs: Based on population – ranges from $150 - $300 Transient NCWSs: Based on source water type – ranges from $100 - $200
Kansas	K.A.R. 28-15-12 Type: Annual Fee CWSs: Capped at $0.002 per 1,000 gallons of water sold
Louisiana *	Act 605 of 2016 Type: Annual Fee CWSs: Based on # connections, $12/connection

Maine	§ 10-144, CMR Chapter 231, § 1-A Type: Annual Fee Base Fee ($75) + ($0.45 (per capita rate) x (pop)) Cap = $30,000
Massachusetts	MGL, Chapter 21A, Section 18A Type: Annual Fee PWSs: Metered – minimum $20, $8.50/million gallons used Unmetered – $50 - $250 based on population
Michigan	MI SDWA, 1976, PA 399 Type: Annual Fee CWSs: Based on population, ranges from $400 - $134,000 Nontransient NCWSs: $575 Transient NCWSs: $135
Minnesota *	Minnesota Statutes 2009, § 144.3831 Type: Annual Fee CWSs: Based on # connections, $6.36/connection
Mississippi *	MS ST § 41-26-23 Type: Annual Fee CWSs: Based on # connections, $3.00/connection, cap = $40,000
Missouri *	RSMO § 640.100.8 Type: Annual Fee CWSs only: Based on # connections, whether connections are metered, and the size of the meters. $1.08 - $3.24/connection
Montana	ARM § 17.38.248 Type: Annual Fee CWSs: Based on # connections – $2.00/connection, Minimum fee = $100 Nontransient NCWSs: $100 Transient NCWSs: $50
New Jersey	NJAC § 7:10-15 Type: Annual Fee CWSs only: Based on population, and whether system has treatment. w/o treatment w/t 25-999 $60 $120 1,000-9,999 $360 $720 10,000-49,999 $790 $1,580 >50,000 $1,640 $3,280
North Carolina	NC ST § 130A-328 Type: Annual Fee CWSs: Based on population, fee ranges from $255 - $5,950 Nontransient NCWSs: $150

Ohio	R.C. § 3745.11 Type: Annual Fee CWSs: Based on sliding scale of # connections, min. $112 For 100 or more connections, fee ranges from $0.76 - $1.92/connection # Connections 278 (pop=750) $534 1,222 (pop=3,300) $2,346 3,704 (pop=10,000) $5,482 18,518 (pop=50,000) $20,370 92,592 (pop=250,000) $85,185 Nontransient NCWSs: ranges from $112 - $16,820 Transient NCWSs: ranges from $112 - $792
Oklahoma	OAC § 631-3-21 Type: Annual Fee All PWSs: Flat fee for inspections + Flat fee for SDWA activities + Lab costs GW $100 + $1,600 + SW $200 + $6,800 +
Rhode Island	R46-13-DWQ Type: Annual License Fee CWSs: Based on # connections – $1.50 per connection, ranges from $330 - $32,500 Nontransient NCWSs: $330 Transient NCWSs: $200
South Carolina	S.C. Code of Regulations R. 61-30.G(2) Type: Annual Fee CWSs and Nontransient NCWSs: 3 Components: Administration + Distribution Monitoring + Source Monitoring Costs for Admin only: # Connections Base amount + rate/tap Total Fee 278 (pop=750) $769 + $3.85/tap $1,839 1,222 (pop=3,300) $3,749 + $1.96/tap $6,144 18,518 (pop=50,000) $23,389 + $0.46/tap $31,907 92,592 (pop=250,000) $35,239 + $0.17/tap $50,979 Transient NCWSs: $275
Texas	30 TAC § 290.51 Type: Annual Fee CWSs and Nontransient NCWSs: Based on # connections – <25 $200 25-160 $300 ≥161 $4/connection Transient NCWSs: $100

Virginia	12VAC5-600-50 to 110 Type: Annual Fee CWSs: Based on # connections –$3/connection, cap = $160,000 # Connections 278 (pop=750) $834 1,222 (pop=3,300) $3,666 18,518 (pop=50,000) $55,554 92,592 (pop=250,000) $160,000 Nontransient NCWSs: $90
Washington	WAC 246-290-070 Type: Annual Fee Based on # connections – cap = $100,000 Base Fee + Per Connection Fee $100 + $1.05 to $1.30

* Indicates States where a portion of the annual fee goes towards monitoring costs in addition to administrative costs to run the drinking water program.

Overall, the proposed regulation should not put Pennsylvania at a competitive disadvantage with any other state. Rather, the amendments should enhance Pennsylvania's ability to compete with other states by improving public health protection, providing a consistent supply of high quality water, and promoting healthy and sustainable communities.

(13) Will the regulation affect any other regulations of the promulgating agency or other state agencies? If yes, explain and provide specific citations.

The amendments will be incorporated into the existing language of 25 Pa Code Chapter 109. Other than this incorporation, the amendments should not affect any existing or proposed regulations of DEP or any other state agency.

(14) Describe the communications with and solicitation of input from the public, any advisory council/group, small businesses and groups representing small businesses in the development and drafting of the regulation. List the specific persons and/or groups who were involved. ("Small business" is defined in Section 3 of the Regulatory Review Act, Act 76 of 2012.)

The draft proposed rulemaking was submitted to the Small Water Systems Technical Assistance Center (TAC) Advisory Board for review and discussion on November 14, 2016 and January 5, 2017. Comments and recommendations were received from TAC on January 23, 2017. The proposed rulemaking was also presented to stakeholders through a webinar on December 8, 2016. Email invitations to this webinar were sent to 6,248 water system owners and operators (all PWSs with an email address in PADWIS), and it was advertised on various Department and water industry websites. 325 registered attendees participated in the webinar, with some viewing the webinar with a group of other individuals. Therefore, total attendee participation was greater than 325 individuals.

(15) Identify the types and number of persons, businesses, small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012) and organizations which will be affected by the regulation. How are they affected?

One or more of these revisions will affect all PWSs as well as the people to which they provide water. Currently, there are 8,521 PWS that serve a total population of over 12 million

Pennsylvanians. Of the 8,521 PWSs, approximately 2,641 are owned by a municipality, an authority, the Commonwealth of Pennsylvania, the federal government, or another not-for-profit entity. The other 5,880 PWSs are either privately or investor owned.

A review of the USA Small Business Size Regulations under 13 CFR Chapter 1, Part 121 provides a standard for determining what constitutes a small business for the NAICS category relating to PWSs. A PWS falls within NAICS category 221310, Water Supply and Irrigation Systems, which comprises establishments primarily engaged in operating water treatment plants and/or operating water supply systems. The small size standard for this NAICS category is annual receipts of not more than $7.0 million.

For the 5,880 privately or investor owned PWSs, the Department has no way to estimate annual receipts. Therefore, the Department used the federal definition of a small water system in 40 CFR 141.2, which states that a small water system is "a water system that serves 3,300 persons or fewer". Under this regulatory package, a PWS owned by a private individual or investor serving less than or equal to 3,300 persons was considered to be a small business. In Pennsylvania, there are approximately 5,780 PWSs meeting these criteria and can be considered as a small business. 924 of these are CWSs.

The persons served by these PWSs will benefit from the proposed amendments, because strengthened turbidity, filtration and source water protection requirements will reduce the potential risk to human health, improved resiliency will ensure a continuous supply of safe and potable water, and collectively, the amendments will enable communities and businesses to plan and build future capacity for economic growth.

Some PWSs will be affected by the need to change operations or make capital improvements to comply with some of the proposed provisions. See response to questions (17) – (21) for more information about costs.

(16) List the persons, groups or entities, including small businesses, that will be required to comply with the regulation. Approximate the number that will be required to comply.

Source Water Protection and New Source Permitting Requirements

Regarding the proposed changes to the permitting requirements for new sources, based on historical permit submissions, approximately 30 CWSs per year will be required to comply.

Surface Water and GUDI Filter Plants

The 353 filter plants in Pennsylvania which are operated by 319 water systems will be required to comply with one or more of these amendments.

The approximate number of filter plants by ownership type is shown below:

181 Authorities
85 Investors
57 Municipalities
15 State Agencies
6 Water Associations
4 Other
3 Private Individuals
2 Federal Agencies

Of the 353 filter plants, 22 are considered to be small businesses. For the purposes of this regulatory package, a PWS owned by a private individual or investor serving less than or equal to 3,300 persons was identified as a small business.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions
The 1,952 CWSs in Pennsylvania will be required to comply with one or more of these amendments.

The approximate number of CWSs by ownership type is shown below:

476 Authorities
886 Investors
261 Municipalities
21 State Agencies
129 Water Associations
67 Other
106 Private Individuals
6 Federal Agencies

Of the 1,952 CWSs, 924 are considered to be small businesses. For the purposes of this regulatory package, a PWS owned by a private individual or investor serving less than or equal to 3,300 persons was identified as a small business.

1,618 CWSs serving <3300 customers will have 12 months to comply
186 CWSs serving from 3,301 – 10,000 customers will have 24 months to comply
148 CWSs serving greater than 10,000 customers will have 36 months to comply

New Annual Fees and Amended Permit Fees
All 8,521 PWSs will be required to comply with one or more of these proposed amendments. Of the 8,521 PWSs, approximately 5,780 may be considered to be small businesses. For the purposes of this regulatory package, a PWS owned by a private individual or investor serving less than or equal to 3,300 persons was identified as a small business.

(17) Identify the financial, economic and social impact of the regulation on individuals, small businesses, businesses and labor communities and other public and private organizations. Evaluate the benefits expected as a result of the regulation.

The expected benefits of this proposed regulation are (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; and (2) healthy and sustainable communities.

This regulation will provide a positive economic impact to individuals, small businesses and businesses that provide services to the drinking water industry.

Source Water Protection and New Source Permitting Requirements
PWSs will incur a cost when completing the source water assessment portion of the permitting process for new sources. However, the initial cost is minor compared to the ongoing costs that would result if the best available source is not developed or inadequate treatment is installed.

Source water protection represents the first barrier to drinking water contamination. A vulnerable drinking water source also puts a water utility and the community it serves at risk and at a disadvantage in planning and building future capacity for economic growth. Contamination of a CWS source is costly for the water supplier and the public. For example, it is estimated that the total cost of an *E. coli* contamination incident in Walkerton, Ontario was $64.5 million (*The Economic Costs of the Walkerton Water Crisis* by John Livernois, 2001). In addition to increased monitoring and treatment costs for the water system, there may be costs associated with containment and/or remediation, legal proceedings, adverse public health and environmental effects, reduced consumer confidence, diminished property values and replacement of the contaminated source.

A Texas A&M study (1997) showed that water suppliers in source water areas with chemical contaminants paid $25 more per million gallons to treat drinking water than suppliers in areas with no chemical contaminant detections. The study also showed that for every four percent increase in source water turbidity (an indicator of water quality degradation from sediment, algae and microbial pathogens), treatment costs increase by one percent (Trust for Public Land, 2002). A study by the PA Legislative Budget and Finance Committee (2013) stated, "(r)educing pollution inputs from pipes and land-based sources can reduce locality costs to treat drinking water sources to safe standards". Similarly, a study by the Brookings Institute suggested that a one percent decrease in sediment loading will lead to a 0.05 percent reduction in water treatment costs." Findings from the source water assessments can support and enhance emergency response, improve land use planning and municipal decisions, complement sustainable infrastructure initiatives and help prioritize and coordinate actions by federal and state agencies to better protect public health and safety.

<u>Surface Water and GUDI Filter Plants</u>

The financial impact to PWSs with filter plants includes the cost associated with installation of continuous monitoring equipment, installation of alarm and shutdown capabilities, implementation of a filter bed inspection program, and the cost associated with filtering to waste.

The proposed 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. For example, as stated in the below-referenced article, the total medical costs and productivity losses associated with the 1993 waterborne outbreak of cryptosporidiosis in Milwaukee, Wisconsin was $96.2 million: $31.7 million in medical costs and $64.6 million in productivity losses. The average total cost per person with mild, moderate, and severe illness was $116, $475, and $7,808, respectively *Cost of illness in the 1993 Waterborne Cryptosporidium outbreak, Milwaukee, Wisconsin. Corso PS, Kramer MH, Blair KA, Addiss DG, Davis JP, Haddix AC. Emerg Infect Dis [serial online] 2003 April. Available from: URL: <u>http://wwwnc.cdc.gov/eid/article/9/4/02-0417</u>*

<u>Strengthen Resiliency Through Auxiliary Power or Alternate Provisions</u>

The financial impact to CWSs will depend on which option they determine to be most feasible to comply with this proposed rulemaking. This may include the cost associated with installation of an emergency generator, developing an independent power feed from an alternate substation, developing interconnections with neighboring water systems, or designing and/or constructing additional finished water storage. Furthermore, cost estimates for each specific action will vary significantly depending on the size of the water system, as well as the level of deficiency of their existing capability to consistently provide adequate quantity and quality of water.

These proposed amendments will help reduce or avoid the significant impacts to consumers that result from inadequate water quantity or quality and the associated cost of consumption advisories and/or bulk water hauling. For example, in 2011 Hurricane Irene and Tropical Storm Lee caused flooding, water line ruptures, and power outages resulting in mandatory water restrictions and BWAs at 32 PWSs in Pennsylvania. In 2012, Hurricane Sandy caused similar problems at 85 CWSs. Most of the impacted systems were small systems where redundancy and back-up systems were lacking. In comparison, systems with redundancy and adequate planning were able to maintain operations until the power was restored, with little negative impact to their customers. Countless smaller incidents at individual CWSs have occurred due to localized emergencies, such as flooding, with interruptions in potable drinking water service that could have been prevented if adequate preparation and equipment were available.

Of the 1,952 CWSs expected to comply with the proposed regulation, 1,618 serve less than 3,300 customers.

Cost savings of avoiding interruption of continuous supply of safe and potable water were evaluated using the Water Health and Economic Analysis Tool (WHEAT) software developed by EPA. The Department ran the model for a scenario of a water system serving 2,500 customers and experiencing a water outage for two days. The model outcomes regarding economic consequences are summarized as follows:

- The value of water sales that would have occurred if there wasn't a disruption in water service is estimated to be $2,891.00.
- The value of additional operating costs incurred during the event, which may include bottled/replacement water, equipment, other remediation, or miscellaneous costs is estimated at $24,775.00.
- Total economic impact on the water utility due to the two-day outage (sum of the above losses) is estimated at $27,666.00.
- Regional economic consequences for this same event are estimated at $926,486. This is the total value of economic activity lost among businesses directly affected by the water service disruption, due to the contraction in business activity during the two-day event.

If the water utility complies with the proposed revisions, the potential cost savings for this two-day outage, offsetting the costs to install additional auxiliary power, emergency interconnections with neighboring water systems, and/or finished water storage, are summarized above. These costs would increase with each additional day that the water outage continues.

Additional costs savings to water systems and customers will be the prevention of dewatering of the distribution system piping and protection from damage to collapsed water lines (due to lack of ability to provide adequate quantity water to maintain positive pressure).

It is estimated that 250 boil water advisories (BWA) occur each year and that 25% or 63 BWAs are caused by water supply disruptions. The total annual cost savings to the regulated water systems is estimated at $1,742,958. However, the regional economic cost savings to businesses is estimated at more than $58 million. These cost savings will off-set the costs of improving system resiliency.

(18) Explain how the benefits of the regulation outweigh any cost and adverse effects.

Source Water Protection and New Source Permitting Requirements
The proposed amendments will support the protection of public drinking water sources resulting in maintaining the highest source water quality available. Protected source water reduces or avoids drinking water treatment costs.

Surface Water and GUDI Filter Plants
The proposed filtration requirements are designed to identify and correct problems at the plant before a turbidity exceedance occurs or escalates. The proposed alarm and shutdown capability amendments will ensure that operators are immediately alerted to major treatment problems. A plant producing water that is not safe to drink will automatically shut down when an operator is not immediately available. These proposed requirements will prevent violations, which will protect public health, avoid PWS costs related to correcting violations, and reduce costs to the community.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions
The proposed revisions to system service and auxiliary power requirements will strengthen system resiliency and ensure that safe and potable water is continuously supplied to consumers and businesses. A continuous and adequate supply of safe drinking water is vital to maintaining healthy and sustainable communities.

Pennsylvania's PWS sources and treatment facilities are susceptible to emergency situations resulting from both natural and man-made disasters. Examples of emergencies from recent years include tropical storms, flooding, high winds, ice, snow, industrial chemical plant runoff, pipeline ruptures, and transportation corridor spills. These emergencies have resulted in significant impacts to consumers and businesses due to inadequate water quantity or quality, and in water supply warnings and advisories.

Please refer to Question 17 for additional information.

(19) Provide a specific estimate of the costs and/or savings to the **regulated community** associated with compliance, including any legal, accounting or consulting procedures which may be required. Explain how the dollar estimates were derived.

Source Water Protection and New Source Permitting Requirements
Per DEP's records, approximately 30 new CWS sources are permitted each year. DEP estimates that an additional eight hours of work completed by a professional geologist will be needed to comply with the new source permitting amendments. This extra time will amount to approximately $1,176 per source permitted, based on current hourly rates charged by consulting firms.

Surface Water and GUDI Filter Plants
Turbidity Monitoring, Recording, and Reporting
Costs have been derived from vendors of HACH brand turbidimeters; the most commonly used turbidimeter in Pennsylvania. If the water supplier prefers a different brand of equipment, the cost may change. There could be some per instrument cost savings when multiple instruments are purchased. The following table, provided for illustrative purposes, shows costs related to installing and maintaining one HACH continuous monitoring and recording device:

White Light Turbidimeter (analog) and Chart Recorder (analog)

Items	Initial Cost for First Turbidimeter and Recorder	Estimated Annual Calibration and Maintenance Cost	Additional Turbidimeter and Recorder
HACH 1720E and SC200 (analog signal)	$2,881.00		$2,881.00
Calibration Cylinder	$ 89.00		
20 NTU StablCal x (4) Calibrations		$ 556.00	
Lamp Assembly Replacement		$ 62.00	
Chart Recorder- Duel Pen	$1,657.00		$1,657.00
Chart Recorder Paper		$ 60.00	
Chart Recorder Replacement Pens		$ 79.00	
Installation	$1,000.00		
Total (not including tax and shipping)	**$5,627.00**	**$ 757.00**	**$4,538.00**

Laser Turbidimeter (digital) and Chart Recorder (analog)

Items	Initial Cost for First Laser Turbidimeter and Recorder	Estimated Annual Calibration and Maintenance Cost	Additional Turbidimeter and Recorder
HACH TU5400 Laser Turbidimeter (includes flow sensor RFID, and System Check)	$6,142.00		$6,142.00
HACH SC200 (includes flow sensor input, RFID, and Modbus))	$2,596.00		$2,596.00
Maintenance/Calibration Kit (includes primary standards)		$1,100.00 ($349 to replace the primary standards that are included in the kit)	
Replacement Desiccant Cartridge		$ 17.00	
Chart Recorder- Duel Pen	$1,657.00		$1,657.00
Chart Recorder Paper		$ 60.00	
Chart Recorder Replacement Pens		$ 79.00	
Installation	$1,000.00		
Total (not including tax and shipping)	**$11,395.00**	**$ 1,256.00 (1st year) $ 505.00 (subsequent year)**	**$10,395.00**

Individual Filter Effluent (IFE) Monitoring

There are 353 filter plants in Pennsylvania of which 263 are currently required to continuously monitor and record their IFE and already have instrumentation installed. The proposed amendments will require the remaining 90 filter plants to comply with the IFE monitoring requirements of which 69 already have the needed instrumentation. Therefore, 21 filter plants will need to install one or more monitoring and recording device. The majority of these 21 filter plants only have two filters. The estimated cost, for a water supplier having two filters, to install IFE monitoring and recording equipment is expected to be $10,165 for white light turbidimeters or $21,790 for laser turbidimeters. The annual maintenance cost for the monitoring and recording equipment on two filters is estimated to be $757 for the white light turbidimeters or $505 for laser turbidimeters. The cumulative cost for the installation of the IFE monitoring and recording equipment at all 21 filter plants is estimated to be $213,465 for white light turbidimeters or $457,590 for laser turbidimeters. The cumulative cost for maintaining the monitoring and recording equipment at all 21 filter plants is estimated to be $15,897 per year for white light turbidimeters and $10,605 per year for laser turbidimeters.

Combined Filter Effluent (CFE) Monitoring

The majority of filter plants in Pennsylvania already continuously monitor and record their CFE. The exact number of filtration plants without this capability is not known, but based on a review of 90 filtration plants, it is estimated to be 15% of the 353 filter plants in the state. The estimated cost to install CFE monitoring and recording equipment is $5,627 per plant for white light turbidimeters and recorders or $11,395 per plant for laser turbidimeters and recorders. The annual maintenance cost for the monitoring and recording equipment is estimated to be $757 for the white light turbidimeters or $505 for laser turbidimeters. The cumulative cost for an estimated 52 filter plants to install continuous monitoring and recording equipment is estimated to be $292,604 for white light or $592,540 for laser turbidimeters. The cumulative cost for maintaining the monitoring and recording equipment at all 52 filter plants is estimated to be $39,364 per year for white light turbidimeters or $26,260 per year for laser turbidimeters.

Annual Filter Inspection Program

No significant additional costs are expected to be associated with implementation of a filter inspection program as this will be included in the duties of existing PWS staff.

Filter-To-Waste

No expected costs are associated with the proposed filtering to waste amendments.

Automatic Alarms and Shutdown Capabilities

The following information is provided as example cost estimates related to adding automated alarm and shutdown capabilities at a small surface/GUDI water filtration plant. The costs include the monitor/controller and alarm dial-out system. It is assumed that the existing filtration plant will already have the chlorine residual analyzer, turbidity analyzer and clear-well level transmitter. An estimated cost for the equipment installation is provided. However, systems could save costs if they install using in-house staff or local contract electrician.

The controller/monitor will include adjustable alarm set-points with time delay for a relay output which can be wired to the plant for shut down of the filter system upon the following conditions:

- High or Low Clear Well Level
- High or Low Entry Point Chlorine Residual
- High CFE Turbidity

The monitor/controller can be configured to send a pre-shut down warning to allow operators the opportunity to go to the plant to try to resolve the problem before reaching the shut-down set-point. If the process value reaches the shut-down set-point, the filter plant shut-down command will occur and a shut-down alarm message will be sent to the plant operator by text message, email or voice message. If the facility already has an alarm dialer with capacity for three additional alarm inputs, the alarm dialer can be eliminated from the package. A deduction is shown for this on each equipment option. If the system is staffed continuously, then only alarm capabilities are necessary. This can be accomplished for a lower cost, possibly not additional cost depending on the capability of existing filter plant SCADA equipment.

Option A – Monitor/Alarm System with Standard Dialup Phone Line and Phonetics Alarm Dialer

1) One alarm control device with analog inputs for the following:

- CFE Chlorine Residual
- CFE Turbidity
- Clear Well Level

2) One Phonetics eight-channel alarm auto-dialer with power supply and battery backup. Requires standard dial-up telephone line connected to alarm dialer. Provides voice message alarm only.

3) One System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.

4) Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.

5) Provide onsite operator training on maintenance and standardization of above equipment.

6) Four Operation and Maintenance (O&M) Manuals with complete Instruction Manuals for the above system.

Total System Price: $8,860.00
Delivery: 2-3 Weeks (standard delivery)
Estimated Installation Cost: $2,000.00
Deduct for use of Owner Furnished Alarm Dialer: ($1,400.00)

Option B – Monitor/Alarm System with Standard Dialup Phone Line and Alarm Dialer

1) One alarm control device with analog inputs for the following:

- CFE Chlorine Residual
- CFE Turbidity
- Clear Well Level

2) One eight-channel alarm auto-dialer with power supply and battery backup. Requires standard dial-up telephone line connected to alarm dialer. Provides voice message alarm only.

3) One System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation

by local electrical contractor.

4) Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.

5) Provide onsite operator training on maintenance and standardization of above equipment.

6) Four O&M Manuals with complete Instruction Manuals for the above system.

Total System Price: $9,980.00
Delivery: 2-3 Weeks (standard delivery)
Estimated Installation Cost: $2,000.00
Deduct for use of Owner Furnished Alarm Dialer: ($2,500.00)

Option C – Monitor/Alarm System with Cellular Alarm Dialer
1) One alarm control device with analog inputs for the following:

- CFE Chlorine Residual
- CFE Turbidity
- Clear Well Level

2) One cellular alarm notification system with eight-channel alarm input with power supply and battery backup. No dial-up telephone line is required. Provides text and email alarm notification.

3) One System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.

4) Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.

5) Provide onsite operator training on maintenance and standardization of above equipment.

6) Four O&M Manuals with complete Instruction Manuals for the above system.

Total System Price: $9,700.00
Delivery: 2-3 Weeks (standard delivery)
Estimated Installation Cost: $2,000.00

The Department estimates that 10% of the 353 filter plants in Pennsylvania will need to install a controller. The cumulative installation cost for an estimated 35 filter plants to comply with automated alarms and shutdown capability is estimated to be between $380,100 and $419,300.

<u>**Strengthen Resiliency Through Auxiliary Power or Alternate Provisions**</u>
All CWSs will be expected to review their existing emergency response plan and equipment to specifically develop a plan to provide a consistent supply of adequate quantity and quality of water during emergency situations. The Department estimates that 400 CWSs do not have an updated

emergency response plan. CWSs that do not have a functional generator or do not have existing capability to meet this requirement using the alternate provision options may need to purchase a generator. The generator should be adequately sized such that it can supply power to critical treatment components necessary to supply safe and potable water. Therefore, the cost of the generator will be proportional to the size of the system (e.g. less expensive for small systems). It is difficult to predict system specific costs because of the various options to comply with the proposed revisions. Estimates for small systems are $3,000 - $4,000 for the installation of a transfer switch, generator and concrete pad. Costs for medium and large systems could range from $50,000 - $200,000 per treatment plant. Not all systems will require auxiliary power. Some systems may already meet reliability criteria through storage or interconnections. Several mid-Atlantic states have already moved forward with mandatory requirements for auxiliary power supply including New Jersey, New York and Connecticut.

Please see Question 17 for additional information, including information related to potential cost savings.

New Annual Fees and Increased Permit Fees

The proposed annual fees and increased permit fees apply to all PWSs, including:

- CWSs = 1,952
- NTNCWSs = 1,088
- TNCWSs = 5,309
- Bottled, vended, retail and bulk water hauling systems (BVRB) = 172

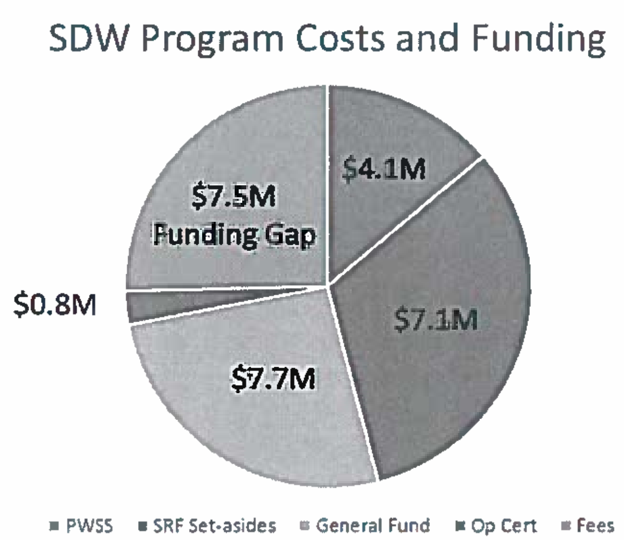
The annual fees range from $250 - $40,000 for CWSs, $50 - $1,000 for NCWSs, and $1,000 - $2,500 for BVRBs. The fees will most likely be passed on to the 10.7 million customers of these PWSs as a user fee. Per person costs are expected to range from $0.35 to $10 per year, depending on the water system size. The amended permit fees are indicated below.

Title	Current	Proposed
Annual Fees:		
Community Water Systems (CWS)	$ 0	$250 - $40,000
Nontransient Noncommunity Water Systems (NTNC)	$ 0	$100 - $ 1,000
Transient Noncommunity Water Systems (TNC)	$ 0	$ 50 - $ 500
Bottled Water Systems	$ 0	$ 2,500
Vended, Retail & Bulk Water Haulers	$ 0	$ 1,000
Permitting Fees (CWSs and NCWSs):		
Permit/Major Amendment	$ 750	$300 - $10,000
Minor Amendment	$ 0	$100 - $ 5,000
Operations Permit	$ 0	$ 50
Emergency Permit	$ 0	$ 100
Change in Legal Status	$ 0	$ 100
Permitting Fees (BVRBs):		
Permit/Major Amendment	$ 750	$500 - $10,000
Minor Amendment	$ 0	$100 - $ 1,000
Operations Permit	$ 0	$ 50
Change in Legal Status	$ 0	$ 100
Out-of-State Bottled Water	$ 100	$ 1,000

Emergency Permit	$ 0	$ 100
Noncommunity Water System		
Application for Approval		$ 50
4-log Permit		$ 50
Feasibility Study Fees:		
Feasibility Study	$ 0	$300 - $10,000
Monitoring Waiver Fees/Source:		
VOC Use	$ 0	$ 100
SOC Use	$100 - $2,000	$ 100
SOC Susceptibility	$100 - $2,000	$ 300
IOC	$ 0	$ 100

Current Safe Drinking Water Program Funding

The current funding available to administer the Safe Drinking Water Program from State and federal sources is $ 19.7 million (see chart below). The proposed fees are expected to generate approximately $7.5 million, which would allow the Safe Drinking Water Program to restore staffing levels and reverse the decline in services that has occurred since 2009. The proposed fees would provide nearly 50% of the Commonwealth's share of funding for the Safe Drinking Water Program. The remaining portion of the Commonwealth's share ($7.7 million) would be provided through annual General Fund appropriations. If General Funds do not keep pace with program costs, a funding gap could remain even with this proposed regulation.



Federal sources currently provide approximately $11.2 million to fund the Pennsylvania Safe Drinking Water Program, including:

- PWSS ($4.1 million) – used for personnel costs; lab costs; staff training
- State Revolving Fund (SRF) Set-asides ($7.1 million) – used for personnel costs; capability enhancement programs (training, technical assistance, optimization programs); source water assessment and protection; PADWIS; assistance grants/contracts

The Commonwealth currently provides approximately $8.5 million to fund the program through the following sources:

- General Fund appropriations (~$7.7 million) – used for personnel costs
- Operator Certification fees ($0.8 million) – used for Operator Certification Program implementation costs

With the addition of the $7.5 million expected to be generated from this proposed rulemaking, the funds available for the Safe Drinking Water Program would total $27.2 million.

Proposed New Annual Fee and Permit Fee Increases

The proposed fees apply to all 8,521 PWSs, which include 1,952 CWSs, 6,397 noncommunity water systems (NCWSs) and 172 bottled, vended, retail and bulk water hauling systems (BVRBs). The proposed new annual fees range from $250 - $40,000 for CWSs, $50 - $1,000 for NCWSs, and $1,000 - $2,500 for BVRBs. If passed on to their customers, these annual fees would result in an increase in cost ranging from $0.35 to $10 per year, depending on the water system size. These new annual fees, as well as the proposed increases in permit fees (explained further below), are expected to generate the $7.5 million necessary to restore staffing levels and to provide services required under the SDWA to the 8,521 public water systems in the Commonwealth and the 10.7 million customers they serve.

The proposed increased permit fees range from $100 to $10,000 depending on the population served and whether the permit is for major or minor construction. The prior permit fees ranged from $125 to $1,750. The proposed rulemaking provides for a review of the fee structure every three years to ensure that the fees continue to adequately supplement the cost of maintaining the program.

As provided in section 14 of the Safe Drinking Water Act (35 P.S. § 721.14), all fees would be paid into the State Treasury into a special restricted revenue account in the General Fund known as the Safe Drinking Water Account administered by the Department. The funds may only be used for such purposes as are authorized under the Act.

The following table summarizes the proposed annual fees for CWSs, which are based on population and range from $250 to $40,000. The per-person costs range from $0.35 to $10/person/year.

Proposed Community Water System Annual Fees (Based on Population)		
Population Served	**Annual Fee**	**Cost/Person/Year**
25 - 100	$250	$2.50 - $10.00
101 – 500	$500	$1.00 - $4.95
501 – 1,000	$1,000	$1.00 - $2.00
1,001 – 2,000	$2,000	$1.00 - $2.00
2,001 – 3,300	$4,000	$1.21 - $2.00
3,301 – 5,000	$6,500	$1.30 - $1.97
5,001 – 10,000	$10,000	$1.00 - $2.00
10,001 – 25,000	$20,000	$0.80 - $2.00
25,001 – 50,000	$25,000	$0.50 - $1.00
50,001 – 75,000	$30,000	$0.40 - $0.60
75,001 – 100,000	$35,000	$0.35 - $0.47
100,001 or more	$40,000	≤ $0.40

The Department analyzed the cost of providing services to administer the SDWA and its regulations. The cost of some services can be reasonably estimated, while the cost of other services depends on the specific circumstances and will vary widely. The table below summarizes the Department's costs of providing those services that can be reasonably estimated for CWSs serving various populations. The hourly rate was provided by the Department's fiscal office and includes salary, benefits, and in-direct costs (supplies, etc.).

Cost of Services That Can Be Estimated				
Activity	**Hours/Activity/Year for CWSs Serving the Following Population**			
	<750	**750-5,000**	**5,000-50,000**	**>50,000**
Conduct sanitary surveys	7.5	10	25	37.5
Conduct other inspections	2.5	3.3	5	10
Determine compliance	12	12	15	15
Maintain PADWIS/eFACTS	7.5	7.5	10	10
Review plans/reports	7.5	10	15	15
Provide technical assistance/ training	7.5	7.5	10	10
Total Hours	**44.5**	**50.3**	**80**	**97.5**
@ $49/hr =	**$2,180**	**$2,465**	**$3,920**	**$4,778**

Examples of other services and costs that involve variable circumstances and preclude a single estimate for the services include the following:

1. Sanitary surveys that take longer to conduct due to the complexity or size of the water system. Examples of actual hours expended and costs to complete more complicated sanitary surveys at large water systems (i.e., those serving populations > 50,000) are as follows:
    a. System A (population = 57,000): 40.5 hours at a cost of $1,984
    b. System B (population = 66,500): 40 hours at a cost of $1,960
    c. System C (population = 87,000): 49 hours at a cost of $2,401
    d. System D (population = 105,000): 60 hours at a cost of $2,940
    e. System E (population = 120,000): 60 hours at a cost of $2,940
    f. System F (population = 747,500): 103 hours at a cost of $5,047
    g. System G (population = 1.6 million): 124 hours at a cost of $6,076

2. Additional follow-up actions taken by the Department in response to a violation. When a drinking water standard is exceeded, Department staff are responsible for consulting with and providing direction to the water system; ensuring that public notice is complete, timely and repeated as needed; tracking, reviewing and approving follow-up and corrective actions (such as collecting confirmation or additional samples, repairing/replacing/installing water treatment, or taking contaminated sources off line); and determining when the system has returned to compliance.

    For example, in 2016, monitoring results for a large Pennsylvania water system indicated the 90th percentile lead value exceeded the action level established in the Lead and Copper Rule. This triggered lead service line replacement actions. Department staff spent at least 116.5 hours working to address this important issue. Services provided by the Department to achieve compliance included meetings, file reviews, drafting compliance documents, follow up action reviews and letters. The approximate cost for these services is $5,708.

3. Additional follow-up, corrective and emergency actions taken by the Department in response to a water supply emergency. Water supply emergencies occur each year and require substantial resources from the Department. The following are examples of emergencies and associated costs for services provided by the Department:

    a. In the Spring of 2011, unexpected damage to a very large water main resulted in a major leak, loss of significant water quantity and pressure. The result was closure of multiple businesses and government agencies in a large city within the Commonwealth for three days due to lack of potable water supply. This emergency spanned approximately five consecutive days with approximately 66,500 customers impacted. The Department provided a variety of onsite support services at the site of the break, and at the drinking water filtration plant. Department cost for services provided during this event equates to approximately160 hours of staff time and a cost of $7,840.

    b. During the Summer of 2012, significant construction delays in completing critical renovations and upgrades to a water filter plant threatened the ability to provide an adequate quantity of drinking water to approximately 210,000 customers. Department staff provided a variety of specialized engineering and operational support services over the course of several weeks. Total cost estimate of Department services provided during this event includes 600 hours of staff time costing approximately $29,400.

    c. In the Summer of 2015, runoff from a large fire at an industrial facility severely contaminated the intakes for two public water systems thereby rendering their normal source of surface water untreatable for almost three months. Together, the two public water suppliers impacted provided drinking water to approximately 43,000 customers. Several Department staff were involved in providing a wide variety of emergency support services, over the course of several months, to the water suppliers affected. Department cost estimates for this event include 515 staff hours ($25,235) and emergency sampling costs ($17,818). The total cost of Department services provided was approximately $43,053.

    d. In the winter of 2016, an equipment failure resulted in flooding at a surface water filtration plant which provides water to approximately 20,000 customers. This immobilized treatment and pumping capabilities for six consecutive days. The filter plant did not resume normal operations for approximately two weeks. Without combined efforts by the water system, the Department and neighboring water systems, 20,000 customers could have endured consecutive days without an adequate supply of water. Department services included coordination with neighboring water systems to identify alternate sources of water, emergency permit considerations, site assessments, engineering and operational support. Additionally, the Department loaned the public water system critical water quality monitoring equipment (valued at approximately $24,000) for approximately 10 weeks to help verify that safe water was consistently provided. The total cost estimate of Department services provided during this event also includes 300 hours of staff time, which cost approximately $14,700.

4. The cost of samples collected by the Department during inspections and filter plant performance evaluations, in response to complaint investigations, and to assess water quality and protect public health during water supply emergencies. These sampling costs range from $30 for inorganic analyses to $400 for pesticides to $1,200 for analysis of Cryptosporidium and Giardia

to $2,968 for a complete emergency sampling suite. Total Department lab costs average approximately $680,000 per year.

5. The costs associated with additional training when new regulations are promulgated. One example is the numerous training sessions that were developed and delivered in 2015 - 2016 to roll-out implementation of the Revised Total Coliform Rule (RTCR) adopted to conform to Federal requirements. This training included eight different training courses, workshops and webinars; that were presented 160 times across the Commonwealth; for a total of 482 hours of training. The cost to deliver 482 hours of training was $23,618.

6. The costs associated with specific follow-up actions established in new regulations. The federal RTCR became effective on April 1, 2016, and the Department and EPA shared enforcement of the federal rule until Pennsylvania's regulations were published as final (which occurred on Sept. 24, 2016). As part of the Department's enforcement responsibilities during this interim period, staff conducted Level 2 assessments at public water systems. A Level 2 assessment is triggered when a public water supply has an *E. coli* MCL violation or when two total coliform triggers occur during a 12-month period. During this interim period, Department staff completed 94 Level 2 Assessments at more than 85 regulated public water systems. These assessments identified over 400 defects that have already been, or are being, corrected thereby improving public health protection. Estimated costs for services provided by the Department were approximately $3,000 per assessment for a total cost of $282,000.

The additional costs described in items 1 – 4 above are more evident in medium and large water systems due to their size, age, complexity, and number of customers at risk. Because these additional costs are variable (*i.e.,* the costs are not incurred every year for every water system), it is not possible to establish an average cost for these services. However, these additional costs were considered when determining the annual fees for the medium and large water systems.

The proposed annual fees could have been based solely on the costs for the services that could be estimated above. However, that approach would have resulted in a disproportionate impact on the smallest CWSs and would have failed to account for the additional costs incurred by the Department to provide services that cannot be readily estimated, such as those described above, which result in substantially higher costs for medium and large water systems. Thus, the proposed annual fees were developed, to the extent possible, to bear a reasonable relationship to the actual costs of the services provided while achieving a reasonable cost to the 10.7 million customers served. The following table shows the per person costs associated with the proposed annual fees as compared to the per person costs associated with annual fees based solely on the cost of services that can be estimated.

Annual Fees vs. Cost Per Person Per Year				
Population Served	**Proposed Annual Fee**	**Cost Per Person Per Year**	**Estimated Cost of Services**	**Cost Per Person Per Year**
25 - 100	$250	$2.50 - $10.00	$2,180	$21.80 - $87.20
101 – 500	$500	$1.00 - $4.95	$2,180	$4.36 - $21.58
501 – 1,000	$1,000	$1.00 - $2.00	$2,180	$2.18 - $4.35
1,001 – 2,000	$2,000	$1.00 - $2.00	$2,465	$1.23 - $2.46
2,001 – 3,300	$4,000	$1.21 - $2.00	$2,465	$0.74 - $1.23
3,301 – 5,000	$6,500	$1.30 - $1.97	$2,465	$0.49 - $0.75
5,001 – 10,000	$10,000	$1.00 - $2.00	$3,930	$0.39 - $0.78
10,001 – 25,000	$20,000	$0.80 - $2.00	$3,920	$0.16 - $0.39
25,001 – 50,000	$25,000	$0.50 - $1.00	$3,920	$0.08 - $0.16
50,001 – 75,000	$30,000	$0.40 - $0.60	$3,920	$0.05 - $0.08
75,001 – 100,000	$35,000	$0.35 - $0.47	$4,778	$0.05 - $0.06
100,001 or more	$40,000	$0.40 or less	$4,778	$0.05 or less

Other Annual Fees

Regarding the other annual fees in subsection (a), proposed fees for nontransient noncommunity water systems (NTNCWS) range from $100 to $1,000; annual fees for transient noncommunity water systems (TNCWS) range from $50 to $500; annual fees for bottled water systems are $2,500; and annual fees for vended, retail and bulk water systems are $1,000 (BVRB).

These proposed fees were determined using the same criteria as discussed above and are illustrated in the table below. The total hours for services that can be estimated were as follows:

- For NTNCWSs, the total hours ranged from 16 to 22 hours.
- For TNCWSs, the total hours ranged from 8 to 13 hours.
- For BVRBs, the total hours ranged from 21 to 26 hours.

Annual Fees vs. Cost Per Person Per Year				
Population Served	**Proposed Annual Fee**	**Cost Per Person Per Year**	**Estimated Cost of Services**	**Cost Per Person Per Year**
NTNCWSs:				
25 - 100	$100	$1.00 - $4.00	$784	$7.84 - $31.36
101 – 500	$250	$0.50 - $2.48	$784	$1.57 - $7.76
501 – 1,000	$500	$0.50 - $1.00	$784	$0.78 - $1.56
1,001 – 3,300	$750	$0.23 - $0.75	$1,078	$0.33 - $1.08
3,301 or more	$1,000	$0.30 or less	$1,078	$0.33 or less
TNCWSs:				
25 – 100	$50	$0.50 - $2.00	$392	$3.92 - $15.68
101 – 500	$100	$0.20 - $0.99	$392	$0.78 - $3.88
501 – 1,000	$200	$0.20 - $0.40	$392	$0.39 - $0.78
1,001 or more	$500	$0.50 or less	$392	$0.39 or less
BVRBs:				
Bottled	$2,500	N/A	$1,274	N/A
Vended	$1,000	N/A	$1,029	N/A
Retail	$1,000	N/A	$1,029	N/A
Bulk	$1,000	N/A	$1,029	N/A

The number of customers served will be based on the Department's public water system inventory, PADWIS, at the time of billing for annual fees.

The Department will allow quarterly payments for fees of $10,000 or more.

Permitting Fees for Community and Noncommunity Water System and for BVRBs
The proposed permitting fees were determined using a workload analysis. Costs were assigned based on the relative complexity of the permit review. Permit fees have not been increased since they were originally adopted in 1984.

The Department used the following milestones or steps in the permit review process (with time ranges in hours) to calculate the proposed fees:

- Administrative completeness review (1 hour)
- Technical review (range of 1 – 153 hours, average of 32 hours)
- Preparation of the construction permit (2 hours)
- Pre-operational inspection (1 – 3 hours)
- Preparation of the operation permit (1 hour)

A figure of $64 per hour was used for technical staff time.

Permitting Fees for General Permits
In this proposed rulemaking, fees for general permits will be established and will not exceed $500. The fee for each general permit will be based on a workload analysis prepared prior to issuance of a draft of the general permit for public comment and will reflect the Department's estimated cost for reviewing and approving coverage under the general permit.

Failure to Remit Fees
As requested by TAC, this section is proposed to add provisions for the addition of 6% interest for systems which do not pay their annual fees in a timely manner.

The interest charges are extra costs associated with the collection of overdue fees. Section 4(c) of the SDWA provides that Department fees are to ". . . bear a reasonable relationship to the actual cost of providing a service." The proposed interest charges relate to extra services necessary to collect overdue fees such as reminder notice mailings, NOV mailings, phone calls and emails to delinquent payers. The amount of interest actually charged will depend on how long it takes for the PWS to pay the overdue amount. The longer it takes to collect the fee, more services will be required of the Department to collect the overdue fee and the interest charges associated with that service.

This section would also allow the Department to suspend technical services, such as issuing monitoring waivers, plan approvals or permits, for water systems with delinquent fees in excess of 180 days.

(20) Provide a specific estimate of the costs and/or savings to the **local governments** associated with compliance, including any legal, accounting or consulting procedures which may be required. Explain how the dollar estimates were derived.

The only costs to local government will be costs incurred by systems that are owned and/or operated by local government. The cost estimates are based on the figures in question 19.

Source Water Protection and Permitting

Of the 30 new sources permitted each year, approximately 19 are expected to occur at local-government-owned systems. The cumulative cost paid to a professional geologist will amount to approximately $22,344 per year. These amendments should result in cost savings due to the avoidance of unnecessary water treatment (when sources are adequately protected), and the avoidance of costly permitting mistakes.

Surface Water and GUDI Filter Plants

Approximately two-thirds of all filter plants are owned and/or operated by local governments. The total cost to local government for the revisions associated with filter plants are as follows:

- There are nine plants that need to add equipment to comply with the IFE requirements. The initial expected cumulative cost for the nine plants is $91,485, or $10,165 per plant with a cumulative annual maintenance cost of $6,813, or $757 per plant.
- There are approximately 35 plants that need to add equipment to comply with the CFE requirements. The initial expected cumulative cost for the 35 plants is $196,945, or $5,627 per plant with a cumulative annual maintenance cost of $26,495, or $757 per plant.
- There are approximately 24 plants that need to add equipment to comply with the alarm and shutdown requirements. The initial expected cumulative cost for the 24 plants is $260,640, or $10,860 per plant.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions

All 1,952 CWSs are expected to review their existing emergency response plans to determine the adequacy of consistently providing adequate quantity and quality of water during emergency situations. Approximately 737 CWSs are owned and operated by local governments.

Please see Question 17 for additional information.

(21) Provide a specific estimate of the costs and/or savings to the **state government** associated with the implementation of the regulation, including any legal, accounting, or consulting procedures which may be required. Explain how the dollar estimates were derived.

The costs to state government will be those incurred by systems that are owned and/or operated by state government and the costs to the Department associated with implementing and administering the rule. The cost estimates are based on the figures in question 19.

Source Water Protection and New Source Permitting Requirements

State costs associated with administering these revisions are not expected to substantially increase or decrease.

Of the 30 new sources permitted each year, no more than one is expected to occur at any state-owned system. The approximate cost paid to a professional geologist will amount to approximately $1,176 per year.

Surface Water and GUDI Filter Plants
State costs associated with administering these revisions are not expected to substantially increase or decrease. The proposed amendments are intended to identify Tier 1 violations that previously would have gone unnoticed. As a result, staff time related to compliance and enforcement could increase. However, the proposed amendments are also intended to identify and correct water system deficiencies before they worsen to the point of a Tier 1 violation, which would result in a reduction of staff time spent on compliance and enforcement. Overall, the proposed amendments are expected to result in more efficient use of staff time.

15 filter plants are owned and/or operated by the Commonwealth of Pennsylvania. The total cost to the Commonwealth for these systems is estimated as follows:

- There are no IFE costs, because all state-owned filter plants already have IFE instrumentation.
- There are approximately 3 plants that need to add equipment to comply with the CFE requirements. The initial expected cost is $16,881, or $5,627 per plant with an annual maintenance cost of $2,271, or $757 per plant.
- There are approximately 2 plants that need to add equipment to comply with the alarm and shutdown requirements. The initial expected cost is $21,720, or $10,860 per plant.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions
After evaluation of both State costs and savings associated with administering these revisions, costs are not expected to substantially increase or decrease. The proposed amendments are intended to strengthen the capability of a water supplier to consistently provide adequate quantity and quality of water during emergency situations. As a result, staff time related to reviewing the revised portion of emergency response plans related to this proposed requirement may increase during the initial inspection cycle following the rule. However, by reducing the frequency and duration of emergency situations and associated health advisories, the proposed amendments should also decrease staff time responding to these type of events in the long run.

Approximately 21 CWSs are owned and/or operated by the Commonwealth of Pennsylvania; 18 of which serve less than 3,300 customers.

(22) For each of the groups and entities identified in items (19)-(21) above, submit a statement of legal, accounting or consulting procedures and additional reporting, recordkeeping or other paperwork, including copies of forms or reports, which will be required for implementation of the regulation and an explanation of measures which have been taken to minimize these requirements.

Source Water Protection and New Source Permitting Requirements
CWSs will only be required to update their source water assessment report if the annual water system evaluation identifies changes to actual or probable sources of contamination. To minimize the reporting burden, these reports are not required to be submitted to the Department. Also, wherever possible, modifications to existing report forms were used as a method to comply rather than creation of additional report forms.

Surface Water and GUDI Filter Plants

- PWSs that exceed the lower IFE triggers will have additional reporting requirements using existing forms.
- PWSs will be required to report log inactivation values on a monthly basis using existing forms.
- PWSs that experience a failure of alarm or shutdown equipment will be required to report the failure to the Department within 24 hours. This can be done verbally and using existing forms.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions

CWSs will be required to update their existing emergency response plans to include specific information on how they will meet the requirements of this section. To minimize the reporting burden and for maintaining security of sensitive documents, the system specific plans for providing a continuous supply of safe and potable water (Uninterrupted System Service Plan – USSP) will not be required to be reported to the Department; rather, this information will be kept onsite for Department review during inspections and/or emergencies. A USSP template will be provided to water suppliers to help facilitate development of the plans.

Comprehensive Monitoring Plan

PWSs will be required to submit a comprehensive monitoring plan using a template provided by the Department or an equivalent form.

(22a) Are forms required for implementation of the regulation?
Yes.

(22b) If forms are required for implementation of the regulation, **attach copies of the forms here.** If your agency uses electronic forms, provide links to each form or a detailed description of the information required to be reported. **Failure to attach forms, provide links, or provide a detailed description of the information to be reported will constitute a faulty delivery of the regulation.**

In most cases, information necessary for this regulation will not need to be reported using forms. Rather, systems will need to maintain information on-site for Department review during inspections. In the cases where new information will need to be reported, existing forms (already required) will be modified wherever possible to reduce reporting burden, as opposed to creating new forms.

§109.503(a)(1)(iii)(A) - Requires source water assessment of each new raw water source. Reporting forms will not be required. Source water assessment information will be included in a technical report (existing requirement) submitted as part of the permit application.

§109.503(a)(1)(iii)(B) – Requires pre-drilling plan for new ground-water sources.
Reporting forms will not be required. Submittal of a pre-drilling plan is an existing requirement (per the PWS Design Manual, Part II) to obtain a permit. The proposed modification simply clarifies when this information will need to be reported.

§109.503(a)(1)(iii)(E) – Requires a hydrogeologic report for new ground-water sources. Reporting forms will not be required. A hydrogeologic report is an existing requirement of the permit application process. The proposed modification simply clarifies when this information will need to be reported.

§109.705(a)(1)(iii) – Requires revision of the source water assessment if inspection of a source water protection area identifies changes to actual/potential sources of contamination. In order to reduce the reporting burden, water suppliers will not have to report information to the Department on a routine basis but would retain it on-site for review during inspections.

§109.713(b) – Requires submission of annual update for any CWS electing to obtain DEP approval of a voluntary local source water protection program. This does require a form. The existing form, Annual Wellhead Protection Program Update, will be revised for use with surface-water systems. An updated draft is attached.

The Uninterrupted System Service Plan (USSP) draft template is attached.

The Comprehensive Monitoring Plan draft template is attached.

(23) In the table below, provide an estimate of the fiscal savings and costs associated with implementation and compliance for the regulated community, local government, and state government for the current year and five subsequent years.

	Current FY 2016/17	FY +1 2017/18	FY +2 2018/19	FY +3 2019/20	FY +4 2020/21	FY +5 2021/22
SAVINGS:	**$**	**$**	**$**	**$**	**$**	**$**
Regulated Community	$00.00	$1,742,958	$1,742,958	$1,742,958	$1,742,958	$1,742,958
Local Government	See note #1	See note #1	See note #1	See note #1	See note #1	See note #1
State Government	See note #1	See note #1	See note #1	See note #1	See note #1	See note #1
Total Savings	$00.00	$1,742,958	$1,742,958	$1,742,958	$1,742,958	$1,742,958
COSTS:						
Regulated Community	$1,302,262	$2,044,863	$4,167,363	$4,167,363	$104,863	$104,863
Local Government	$494,859	$777,047	$1,583,597	$1,583,597	$39,847	$39,847
State Government	$13,022	$20,448	$41,673	$41,673	$1,048	$1,048
Total Costs	$1,302,262	$2,044,863	$4,167,363	$4,167,363	$104,863	$104,863
REVENUE LOSSES:						
Regulated Community	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0
Total Revenue Losses	$0	$0	$0	$0	$0	$0

Notes:

1. Cost savings include the potential water outages and/or boil water advisories (BWA) that may be avoided through increased system resiliency (installation of back-up power supply or other measures). The regional economic cost savings would be more than $58 million annually, and includes the total value of economic activity lost among businesses directly affected by the water service disruption, due to contraction in business activity during the water outage and/or BWA.

Cost savings to the regulated community include public water systems that are owned/operated by local or state government.

2. These provisions will not affect all systems every year. For the purposes of the table above, the one-time capital improvement/installation costs are included in the year in which installation is expected. For example, the back-up power supply costs are spread out over years FY +1 to FY +3. Current FY year includes all other one-time costs. Annual costs are included for each FY.
3. The new annual fees are not included in this table. The annual fees are expected to be passed on to consumers as a user fee.
4. Costs for the regulated community are the costs for all PWSs, which includes the cost to local and state government PWSs.
5. State government costs are the portion of the total costs for state government-owned PWSs (1% of all PWSs).
6. Local government costs are the portion of the total costs for local government-owned PWSs (38% of all PWSs).

(23a) Provide the past three-year expenditure history for programs affected by the regulation.

Program	FY -3 2013/14	FY -2 2014/15	FY -1 2015/16	Current FY 2016/17
Environmental Program Operations	$7,357,000	$6,972,000	$6,803,000	$4,777,000
Environmental Program Management	$710,000	$296,000	$334,000	$215,000
General Government Operations	$385	$0	$0	$0
Safe Drinking Water Act	$15,000	$51,000	$62,000	$32,000

(24) For any regulation that may have an adverse impact on small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012), provide an economic impact statement that includes the following:

(a) An identification and estimate of the number of small businesses subject to the regulation.
(b) The projected reporting, recordkeeping and other administrative costs required for compliance with the proposed regulation, including the type of professional skills necessary for preparation of the report or record.
(c) A statement of probable effect on impacted small businesses.
(d) A description of any less intrusive or less costly alternative methods of achieving the purpose of the proposed regulation.

Source Water Protection and New Source Permitting Requirements

(a) Of the 30 CWSs expected to permit at least one new source each year, 13 may be considered as being owned by a small business (as defined in Question 15).
(b) Administrative costs associated with these revisions are not expected to substantially increase.
(c) It is estimated to cost an additional $1,176.00 per source to be permitted.

(d) For the source water protection and permitting provisions, no alternative regulatory schemes were considered.

Surface Water and GUDI Filter Plants

(a) Of the 353 filter plants, 22 plants are considered as being owned by a small business (as defined in Question 15).
(b) Administrative costs associated with these revisions are not expected to substantially increase. Existing certified operators currently employed by these small systems can comply with the requirements.
(c) Most small systems with filter plants in Pennsylvania already have the instrumentation being required in these provisions. It is estimated that 3 plants will need to install some equipment to monitor for IFE and/or CFE or to meet the alarm requirements. If a system must install equipment for each of these requirements, the cost would equal $25,563 and have an annual maintenance cost of $757.
(d) For the surface water and GUDI provisions, no alternative regulatory schemes were considered.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions

(a) Of the 1,952 CWSs within the State, 924 are considered to be owned by a small business (as defined in Question 15).
(b) Administrative costs associated with these revisions are not expected to substantially increase.
(c) All small CWSs will be expected to review their existing emergency response plan and equipment to specifically develop a plan to provide a consistent supply of adequate quantity and quality of water during emergency situations. CWSs that do not have a functional generator or do not have existing capability to meet this requirement via the alternate provision options, will need to purchase a generator. The generator should be adequately sized such that it can supply power to critical treatment components necessary to supply safe and potable water. Therefore, the cost of the generator will be proportional to the size of the system (e.g. less expensive for small systems). It is difficult to predict system specific costs because of the various options to comply with the proposed revisions. Estimates for small systems are $3,000 - $4,000 for the installation of a transfer switch, generator and concrete pad. Not all systems will require auxiliary power. Some systems may already meet reliability criteria through storage or interconnections.
(d) The proposed regulation does include alternative regulatory schemes based on Advisory Committee input. Because various options and alternate provisions are included in these proposed amendments, it is difficult to predict cost estimates.

(25) List any special provisions which have been developed to meet the particular needs of affected groups or persons including, but not limited to, minorities, the elderly, small businesses, and farmers.

The amendments should have no effects on one particular group relative to another since it will apply to most of Pennsylvania's population served by PWSs. However, the Safe Drinking Water Program is prepared to develop special provisions or provide special services to accommodate any such group as the need arises.

(26) Include a description of any alternative regulatory provisions which have been considered and rejected and a statement that the least burdensome acceptable alternative has been selected.

Annual Fees - Other Alternatives Considered

One approach considered, based on how some other states have established annual fees, is establishing the fee based on the number of service connections associated with the CWS. The two options considered were:

1. Option #1: Annual fee based on the number of service connections (estimating the number of service connections, using a flat rate per connection, and no minimum or maximum fees).
2. Option #2: Annual fee based on the number of service connections (estimating the number of service connections, using a sliding scale rate per connection, and a minimum fee).

Alternate Option #1: Annual Fees Based on Flat Rate Per Number of Connections

The Department does not currently have accurate data on the number of service connections in PWSs in Pennsylvania. This is not a required field in the Federal or Commonwealth databases. To estimate the number of service connections, the population served by the CWS was divided by 2.7 persons per household. The estimated number of connections associated with CWSs within the Commonwealth range from 9 to almost 600,000, with total connections estimated to exceed 4.4 million. To base an annual fee on the number of connections, the $7.5 million needed was divided by the estimated number of total connections to derive a per connection fee of $1.70. This per connection fee would equate to an estimated per person cost of $0.63. When the per connection fee is multiplied by the estimated number of CWS connections, the total annual fee paid by CWSs would range from $15.30 to over $1 million (see table below). While this approach may achieve approximately the same cost per person, the annual fees would not bear a reasonable relationship to the actual cost of providing services to the CWSs. Therefore, this alternative approach to developing the proposed annual fee was not recommended.

Option #1: Annual Fees Based on Flat Rate/Connection vs. Cost of Providing Services

Population Served	# Service Connections	Annual Fee	Minimum Cost of Services	% of Cost of Minimum Services
25	9	$15.30	$2,180	<1 %
125	46	$78.20	$2,180	4 %
750	278	$472.60	$2,180	22 %
3,300	1,222	$2,077.40	$2,465	84 %
10,000	3,704	$6,296.80	$3,920	160 %
50,000	18,518	$31,480.60	$3,920	803 %
100,000	37,037	$62,962.90	$4,778	1,318 %
120,000	45,052	$76,588.40	$4,778	1,603 %
160,000	59,259	$100,740.30	$4,778	2,108 %
250,000	92,592	$157,406.40	$4,778	3,294 %
660,000	244,444	$415,554.80	$4,778	8,697 %
820,000	303,704	$516,296.80	$4,778	10,806 %
1,600,000	592,593	$1,007,408.10	$4,778	21,084 %

Alternate Option #2: Annual Fees Based on Sliding Rate with Minimum Fee

A second per connection option considered was to use a sliding scale fee per connection. As illustrated in the table below, the annual fees generated using a sliding scale would not bear a reasonable relationship to the actual costs of the services provided. Therefore, this alternative approach to developing the proposed annual fees was not recommended.

	Option #2: Annual Fees Based on Sliding Scale/Connection vs. Cost of Providing Services				
Population Served	**# Service Connections**	**Sliding Scale Fee Per Connection**	**Annual Fee**	**Minimum Cost of Services**	**% of Cost of Minimum Services**
25	9	Flat fee	$250.00	$2,180	11 %
125	46	Flat fee	$250.00	$2,180	11 %
750	278	$3.20	$889.60	$2,465	36 %
3,300	1,222	$3.20	$3,910.40	$2,465	150%
10,000	3,704	$3.00	$11,112.00	$2,465	450 %
50,000	18,518	$1.70	$31,480.60	$3,920	803%
100,000	37,037	$1.50	$55,555.50	$4,778	1,163 %
120,000	45,052	$1.50	$67,578.00	$4,778	1,414 %
160,000	59,259	$1.50	$88,888.50	$4,778	1,860 %
250,000	92,592	$1.50	$138,888.00	$4,778	2,907 %
660,000	244,444	$1.00	$244,444.00	$4,778	5,116 %
820,000	303,704	$1.00	$303,704.00	$4,778	6,356 %
1,600,000	592,593	$1.00	$592,593.00	$4,778	12,402 %

Source Water Protection and New Source Permitting Requirements

No alternative regulatory schemes were considered.

Surface Water and GUDI Filter Plants

Consideration was given to requiring plants to be manned during all hours of operation and to mandate shutdown capabilities for all filter plants. Based on feedback from TAC, plants are not being required to be manned at all times. And automatic alarms and shutdown capabilities are only being required for plants that are not manned 24/7.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions

The proposed regulation includes alternative provisions which resulted from Advisory Committee input.

(27) In conducting a regulatory flexibility analysis, explain whether regulatory methods were considered that will minimize any adverse impact on small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012), including:

a) The establishment of less stringent compliance or reporting requirements for small businesses;
b) The establishment of less stringent schedules or deadlines for compliance or reporting requirements for small businesses;
c) The consolidation or simplification of compliance or reporting requirements for small businesses;
d) The establishment of performance standards for small businesses to replace design or operational standards required in the regulation; and
e) The exemption of small businesses from all or any part of the requirements contained in the regulation.

a) For these provisions, no less stringent compliance or reporting requirements for small businesses were considered.
b) For these provisions, no less stringent schedules or deadlines for small businesses were considered.
c) For these provisions, neither consolidation nor simplification of compliance or reporting requirements for small businesses was considered.
d) For these provisions, no performing standards for small businesses to replace design or operational standards required in the regulation for small businesses were considered.
e) For these provisions, no exemptions for small businesses from all or any part of the requirements contained in the regulation were considered.

Other regulatory methods were not considered for this proposed rulemaking as the amendments included therein will apply to most of Pennsylvania's population served by PWSs. Further, the impact of this rulemaking – the provision of safe drinking water to the Pennsylvania populace – is unrelated to whether the regulation is implemented by small or large businesses. Ultimately, regulatory compliance puts all of the regulated community in the best position to prove that water is safe to drink; thereby providing necessary protection of public health.

(28) If data is the basis for this regulation, please provide a description of the data, explain <u>in detail</u> how the data was obtained, and how it meets the acceptability standard for empirical, replicable and testable data that is supported by documentation, statistics, reports, studies or research. Please submit data or supporting materials with the regulatory package. If the material exceeds 50 pages, please provide it in a searchable electronic format or provide a list of citations and internet links that, where possible, can be accessed in a searchable format in lieu of the actual material. If other data was considered but not used, please explain why that data was determined not to be acceptable.

<u>Surface Water and GUDI Filter Plants</u>
Historical Department inspection reports and FPPE evaluations of more than 1,250 filters.

The following items are included or attached:

<u>References related to Turbidity Standards</u>

(1) Huck, P.M. et al, 2002. *Effects of Filter Optimization on Cryptosporidium Removal.* Jour. AWWA, 94:6:97.

(2) Emelko, M.B. et al, 2003. *Cryptosporidium and Microsphere Removal During Late in Cycle Filtration*. Jour. AWWA, 95:5:173.

Documentation related to Continuous Turbidity Monitoring and Recording

(3) The link to HACH's product website from which cost information was gathered: http://www.hach.com/1720e-turbidimeter-with-sc200-controller-2-channel/product?id=7640457955

(4) A PowerPoint slide showing a filter profile which demonstrates that turbidity particles and pathogenic cysts that are stored during a filter run can be discharged during a very short period of time as a result of a hydraulic surge. This slide demonstrates the need for continuous turbidity monitoring as this type of filter break through would normally not be identified during 4-hour grab sampling.

(5) EPA Turbidity Provisions; Chapter 7 *Importance of Turbidity* cites and summarizes data, research, and case studies which demonstrate: outbreaks have occurred when turbidity values did not exceed 0.17 NTU or during short increases in turbidity; microbial organisms can be shielded from disinfection by larger organism or particles; and that most pathogens are removed when filter performance is less than 0.10 NTU.

Documentation related to Filter Plant Automation, Alarms and Shutdowns

(6) The results from an ASDWA survey of other states related to turbidity monitoring and plant automation.

(7) Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers *Policy Statement on Automated/Unattended Operation of Surface Water Treatment Plants*.

(8) West Virginia Department of Health's requirements on filter plant automation, alarms and shutdowns.

(9) The link to Raco Verbatim's product website from which cost information was gathered for alarms, phone dialers, and shutdown controllers: http://www.racoman.com/verbatim.html

(10) Cost proposal from Allied Control Services for equipment and installation cost for alarm and shutdown capabilities.

(11) HACH turbidimeter and recorder cost list.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions

Data regarding the number of CWSs without an up-to-date emergency response plan was obtained from PADWIS.

The Department reviewed the back-up power supply requirements for New York, Connecticut and New Jersey.

New Annual Fees

Fees were reviewed for all 50 states. The summary of other states' fees is incorporated into this regulatory analysis form.

(29) Include a schedule for review of the regulation including:

A. The length of the public comment period: 30 days

B. The date or dates on which any public meetings or hearings will be held: N/A

C. The expected date of delivery of the final-form regulation: December 2017

D. The expected effective date of the final-form regulation: April 2018

E. The expected date by which compliance with the final-form regulation will be required: April 2018

F. The expected date by which required permits, licenses or other approvals must be obtained: April 2018

(30) Describe the plan developed for evaluating the continuing effectiveness of the regulations after its implementation.

Certain provisions in § 109.301(1) and (2) are proposed to sunset in one year. Otherwise, the Board is not establishing a sunset date for this regulation, since it is needed for the Department to carry out its statutory authority. The Department will continue to closely monitor this regulation for its effectiveness and recommend updates to the Board as necessary.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DRAFT

Comprehensive Monitoring Plan

PART 1: GENERAL SYSTEM INFORMATION

PWS Name:			PWSID:
PWS Type:	☐ CWS ☐ NTNCWS ☐ TNCWS	Population Served:	
Mailing Address:			
Contact Person:			
Phone:		Email:	
Source Types: (check all that apply)	☐ Surface Water ☐ Ground Water ☐ GUDI – GW under direct influence of SW	☐ Purchased Surface Water ☐ Purchased Ground Water ☐ Purchased GUDI – GW under direct influence of SW	Is PWS selling finished water to any other public water system? ☐ Yes ☐ No

PART 2: SOURCE & ENTRY POINT (EP) INFORMATION

Availability and Type Codes

Availability Codes	Source Type Codes	
P = Permanent S = Seasonal E = Emergency *(purchased sources only)*	G = Groundwater W = Purchased GW S = Surface Water P = Purchased SW	GUDI = Groundwater Under Direct Influence (of SW) Z = Purchased GUDI

Table 2A – System-owned Sources

Source ID	Source Name	Source Availability	Source Type	EP ID	EP Name	EP Availability

Table 2B – Purchased Sources

Source ID	Source Name	Source Availability	Source Type	EP ID	EP Availability	Seller's PWS ID	Distribution Disinfectant Used by Seller

PART 3: NUMBER OF SAMPLES REQUIRED

EP ID	No. Sources	Source Contribution	Description of How Sources Used	No. Samples Req'd
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		
		☐ Alternated ☐ Blended ☐ Both ☐ N/A		

NOTES:

- If only 1 source contributes to EP or sources are blended at a consistent ratio, then only 1 sample/EP is needed for each set of compliance monitoring.
- If multiple sources are used that are alternated where each source is operated by itself, then the number of samples needed for each set of compliance monitoring is equal to the number of sources at that EP.
- If multiple sources are used that are alternated differently or that are blended at different ratios then describe how the sources are used and identify the number of samples that will be required for each set of compliance monitoring to ensure all sources are included.
  - If alternated, what conditions determine when the sources are switched (such as a set schedule)? Is the switchover automatic or manual?
  - If blended, how are the sources used and what conditions determine the blending ratio?

PART 4: TREATMENT INFORMATION

For *each* EP ID, check the appropriate box(es) for the contaminant(s) for which treatment has been installed. If no treatment has been installed, check the N/A box for that contaminant group.

EP ID	IOCs ☐ N/A	VOCs ☐ N/A	SOCs ☐ N/A
	☐ Antimony ☐ Cyanide ☐ Arsenic ☐ Fluoride ☐ Asbestos ☐ Mercury ☐ Barium ☐ Nitrate ☐ Beryllium ☐ Nitrite ☐ Cadmium ☐ Selenium ☐ Chromium ☐ Thallium **RADs ☐ N/A** ☐ Gross Alpha ☐ Radium 226 ☐ Radium 228 ☐ Uranium	☐ 1,1-Dichloroethylene* ☐ Benzene ☐ cis-1,2-Dichloroethylene ☐ Carbon Tetrachloride ☐ trans-1,2-Dichloroethylene* ☐ Dichloromethane ☐ 1,2-Dichloroethane* ☐ Ethylbenzene ☐ 1,1,1-Trichloroethane* ☐ Monochlorobenzene ☐ 1,1,2-Trichloroethane* ☐ Styrene ☐ 1,2,4-Trichlorobenzene ☐ Toluene ☐ 1,2-Dichloropropane ☐ Trichloroethylene* ☐ o-Dichlorobenzene ☐ Tetrachloroethylene* ☐ para-Dichlorobenzene ☐ Xylenes (total) ☐ Vinyl Chloride	☐ 2,4-D ☐ Endrin ☐ 2,4,5-TP ☐ EDB ☐ Alachlor ☐ Glyphosate ☐ Atrazine ☐ Heptochlor ☐ Benzo(a)pyrene ☐ Heptachlor epoxide ☐ Carbofuran ☐ Hexachlorobenzene ☐ Chlordane ☐ Hexachlorocyclopentadiene ☐ Dalapon ☐ Lindane ☐ Di(ethylhexyl)adipate ☐ Methoxychlor ☐ Di(ethylhexyl)phthalate ☐ Oxamyl (Vydate) ☐ DBCP ☐ PCBs ☐ Dinoseb ☐ Pentachlorophenol ☐ Dioxin ☐ Picloram ☐ Diquat ☐ Simizine ☐ Endothall ☐ Toxaphene
EP ID	**IOCs ☐ N/A**	**VOCs ☐ N/A**	**SOCs ☐ N/A**
	☐ Antimony ☐ Cyanide ☐ Arsenic ☐ Fluoride ☐ Asbestos ☐ Mercury ☐ Barium ☐ Nitrate ☐ Beryllium ☐ Nitrite ☐ Cadmium ☐ Selenium ☐ Chromium ☐ Thallium **RADs ☐ N/A** ☐ Gross Alpha ☐ Radium 226 ☐ Radium 228 ☐ Uranium	☐ 1,1-Dichloroethylene* ☐ Benzene ☐ cis-1,2-Dichloroethylene ☐ Carbon Tetrachloride ☐ trans-1,2-Dichloroethylene* ☐ Dichloromethane ☐ 1,2-Dichloroethane* ☐ Ethylbenzene ☐ 1,1,1-Trichloroethane* ☐ Monochlorobenzene ☐ 1,1,2-Trichloroethane* ☐ Styrene ☐ 1,2,4-Trichlorobenzene ☐ Toluene ☐ 1,2-Dichloropropane ☐ Trichloroethylene* ☐ o-Dichlorobenzene ☐ Tetrachloroethylene* ☐ para-Dichlorobenzene ☐ Xylenes (total) ☐ Vinyl Chloride	☐ 2,4-D ☐ Endrin ☐ 2,4,5-TP ☐ EDB ☐ Alachlor ☐ Glyphosate ☐ Atrazine ☐ Heptochlor ☐ Benzo(a)pyrene ☐ Heptachlor epoxide ☐ Carbofuran ☐ Hexachlorobenzene ☐ Chlordane ☐ Hexachlorocyclopentadiene ☐ Dalapon ☐ Lindane ☐ Di(ethylhexyl)adipate ☐ Methoxychlor ☐ Di(ethylhexyl)phthalate ☐ Oxamyl (Vydate) ☐ DBCP ☐ PCBs ☐ Dinoseb ☐ Pentachlorophenol ☐ Dioxin ☐ Picloram ☐ Diquat ☐ Simizine ☐ Endothall ☐ Toxaphene

PART 5: WAIVER INFORMATION

For *each* EP ID, check the appropriate box(es) for the contaminant(s) for which a waiver has been approved. If no waivers have been approved for that contaminant group, check the N/A box.

EP ID	IOCs ☐ N/A	VOCs	☐ N/A	SOCs	☐ N/A
	☐ Antimony	☐ 1,1-Dichloroethylene*	☐ Benzene	☐ 2,4-D	☐ Endrin
	☐ Arsenic	☐ cis-1,2-Dichloroethylene	☐ Carbon Tetrachloride	☐ 2,4,5-TP	☐ EDB
	☐ Asbestos	☐ trans-1,2-Dichloroethylene*	☐ Dichloromethane	☐ Alachlor	☐ Glyphosate
	☐ Barium	☐ 1,2-Dichloroethane*	☐ Ethylbenzene	☐ Atrazine	☐ Heptochlor
	☐ Beryllium	☐ 1,1,1-Trichloroethane*	☐ Monochlorobenzene	☐ Benzo(a)pyrene	☐ Heptachlor epoxide
	☐ Cadmium	☐ 1,1,2-Trichloroethane*	☐ Styrene	☐ Carbofuran	☐ Hexachlorobenzene
	☐ Chromium	☐ 1,2,4-Trichlorobenzene	☐ Toluene	☐ Chlordane	☐ Hexachlorocyclopentadiene
	☐ Cyanide	☐ 1,2-Dichloropropane	☐ Trichloroethylene*	☐ Dalapon	☐ Lindane
	☐ Fluoride	☐ o-Dichlorobenzene	☐ Tetrachloroethylene*	☐ Di(ethylhexyl)adipate	☐ Methoxychlor
	☐ Mercury	☐ para-Dichlorobenzene	☐ Xylenes (total)	☐ Di(ethylhexyl)phthalate	☐ Oxamyl (Vydate)
	☐ Selenium	☐ Vinyl Chloride		☐ DBCP	☐ PCBs
	☐ Thallium			☐ Dinoseb	☐ Pentachlorophenol
				☐ Dioxin	☐ Picloram
				☐ Diquat	☐ Simizine
				☐ Endothall	☐ Toxaphene

EP ID	IOCs ☐ N/A	VOCs	☐ N/A	SOCs	☐ N/A
	☐ Antimony	☐ 1,1-Dichloroethylene*	☐ Benzene	☐ 2,4-D	☐ Endrin
	☐ Arsenic	☐ cis-1,2-Dichloroethylene	☐ Carbon Tetrachloride	☐ 2,4,5-TP	☐ EDB
	☐ Asbestos	☐ trans-1,2-Dichloroethylene*	☐ Dichloromethane	☐ Alachlor	☐ Glyphosate
	☐ Barium	☐ 1,2-Dichloroethane*	☐ Ethylbenzene	☐ Atrazine	☐ Heptochlor
	☐ Beryllium	☐ 1,1,1-Trichloroethane*	☐ Monochlorobenzene	☐ Benzo(a)pyrene	☐ Heptachlor epoxide
	☐ Cadmium	☐ 1,1,2-Trichloroethane*	☐ Styrene	☐ Carbofuran	☐ Hexachlorobenzene
	☐ Chromium	☐ 1,2,4-Trichlorobenzene	☐ Toluene	☐ Chlordane	☐ Hexachlorocyclopentadiene
	☐ Cyanide	☐ 1,2-Dichloropropane	☐ Trichloroethylene*	☐ Dalapon	☐ Lindane
	☐ Fluoride	☐ o-Dichlorobenzene	☐ Tetrachloroethylene*	☐ Di(ethylhexyl)adipate	☐ Methoxychlor
	☐ Mercury	☐ para-Dichlorobenzene	☐ Xylenes (total)	☐ Di(ethylhexyl)phthalate	☐ Oxamyl (Vydate)
	☐ Selenium	☐ Vinyl Chloride		☐ DBCP	☐ PCBs
	☐ Thallium			☐ Dinoseb	☐ Pentachlorophenol
				☐ Dioxin	☐ Picloram
				☐ Diquat	☐ Simizine
				☐ Endothall	☐ Toxaphene

PART 6: SAMPLING INFORMATION

Monitoring Status & Frequency Codes

Monitoring Status Codes	Monitoring Frequency Codes	
I = Initial/Increased	A = Annual	3 = Triennial (every 3 years)
S = Standard/Routine	Q = Quarterly	9 = Every 9 years
R = Reduced	W = Waiver Approved	6 = Every 6 years (RADs only)

NOTE: Samples may be composited for IOCs, VOCs and SOCs (RADs samples may *not* be composited). If the population is greater than 3,300, compositing may only be done at sampling points within a single system. If the population is less than or equal to 3,300, samples may be composited among different systems. No more than 5 samples may be included in the composite sample.

Table 4A – Inorganic Chemicals (IOCs) *Year Waiver Expires:* _______

EP ID	Monitoring		Year Due	Sampling Schedule	Included in Composite?	EPs Included in Composite Sample
	Status	Frequency				

NOTE: Compliance monitoring for contaminants for which treatment has been installed must be conducted at least annually, unless increased monitoring is required. For *each* EP, identify in a separate row any individual contaminants that are on a monitoring frequency that is different from the group frequency.

Table 4B – Volatile Organic Chemicals (VOCs) *Year Waiver Expires:* _______

EP ID	Monitoring		Year Due	Sampling Schedule	Included in Composite?	EPs Included in Composite Sample
	Status	Frequency				

NOTE: Compliance monitoring for all VOCs must be conducted at least annually if any VOC removal treatment has been installed or if any VOCs were previously detected, unless increased monitoring is required.

Table 4C – Synthetic Organic Chemicals (SOCs)

Year Waiver Expires:_______

EP ID	Monitoring		Year Due	Sampling Schedule	Included in Composite?	EPs Included in Composite Sample
	Status	Frequency				

NOTES: Compliance monitoring for contaminants for which treatment has been installed or that were previously detected must be conducted at least annually unless increased monitoring is required. For *each* EP, identify in a separate row any individual contaminants that are on a monitoring frequency that is different from the group frequency.

Table 4D – Radiological Chemicals (RADs)

EP ID	Contaminant	Monitoring		Year Due	Sampling Schedule
		Status	Frequency		
	Gross Alpha				
	Ra 226/228				
	Uranium				
	Gross Alpha				
	Ra 226/228				
	Uranium				
	Gross Alpha				
	Ra 226/228				
	Uranium				

NOTE: Compliance monitoring for contaminants for which treatment has been installed must be conducted at least annually, unless increased monitoring is required.

PART 5: ATTACHMENTS

Attachment 1 – *Coliform Sample Siting Plan*
Attachment 2 – *Disinfectants/Disinfection Byproducts Monitoring Plan*
Attachment 3 – *Lead & Copper Sample Siting Plan*

3900-FM-BSDWxxxx xx/20xx

Date Received ______________

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF SAFE DRINKING WATER

ANNUAL SOURCE WATER PROTECTION PROGRAM UPDATE

THIS FORM SHOULD BE COMPLETED IN ORDER TO MAINTAIN APPROVED STATUS OF A LOCAL SOURCE WATER PROTECTION PROGRAM.

REPORT FOR CALENDAR YEAR: JAN. 1 TO DEC. 31, ______ (Fill in ***previous*** year)

RETURN BY **MARCH 31** TO THE SAFE DRINKING WATER PROGRAM MANAGER AT THE REGIONAL OFFICE THAT SERVES YOUR COUNTY (See list on page 2)

1. System Name		**2. System Address**
3. PWSID#	**4. Municipality**	**5. System Phone #**
6. Source ID(s) # / Well ID(s) #		**8. County**
8. Contact Person Name		**9. Contact Person Address**
10. Contact Person Phone #		**11. E-mail Address**

Please answer the following questions as completely as possible, and include additional pages if necessary.

1. List any major changes in source water withdrawal, including new or abandoned sources.
2. Please describe any land use changes within the source water protection area.
3. List any new contaminant sources including the type, amount, and distance from each water source. Locate the contaminant source(s) on a map as well as the water source and attach to this form.

4. Include any contaminant sources that are no longer a threat to the water supply. Please explain. Locate the contaminant source(s) on a map and please attach to this form.

5. Describe resources that have been applied to the source water protection program (budget items, in-kind sources, materials, etc.).

6. Are you complying with your management implementation schedule? ☐ **Yes** ☐ **No**
If not, please explain:
Describe any management techniques that have been implemented.

7. Include future plans and implementation dates for the upcoming year.

8. Signature	9. Title	9. Date

DEP REGIONAL OFFICES		
Northwest Region - SDW 230 Chestnut St. Meadville, PA 16335-3481 814-332-6899 ***Counties:*** *Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango and Warren*	**Northcentral Region - SDW** 208 W. Third St., Suite 101 Williamsport, PA 17701 570-327-3636 ***Counties:*** *Bradford, Cameron, Clearfield, Centre, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga and Union*	**Northeast Region - SDW** 2 Public Square Wilkes-Barre, PA 18711-0790 570-826-2511 ***Counties:*** *Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne and Wyoming*
Southwest Region - SDW 400 Waterfront Drive Pittsburgh, PA 15222-4745 412-442-4051 ***Counties:*** *Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington and Westmoreland*	**Southcentral Region - SDW** 909 Elmerton Ave. Harrisburg, PA 17110 717-705-4708 ***Counties:*** *Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry and York*	**Southeast Region - SDW** 2 E. Main Street Norristown, PA 19401 484-250-5900 ***Counties:*** *Bucks, Chester, Delaware, Montgomery and Philadelphia*

***Note*: CWS should incorporate this template into their existing Emergency Response Plan.**

DRAFT

Uninterrupted System Service Plan (USSP) Template

Pennsylvania's Community Water System (CWS) sources and treatment facilities are susceptible to emergency situations resulting from both natural and man-made disasters. Examples of emergencies include tropical storms, flooding, high winds, ice, snow, industrial chemical plant runoff, pipeline ruptures, and transportation corridor spills. Chapter 109.708 (a) – (c) amendments are focused on improving the reliability of service provided to all consumers by requiring the development of a feasible plan to consistently supply an adequate quantity of safe and potable water during emergency situations. This Uninterrupted System Service Plan (USSP) Template is provided to help develop this important plan. To minimize the reporting burden and for maintaining security of sensitive documents, the completed USSP will not be required to be reported to the Department; rather, this information should be incorporated into existing Emergency Response Plans and kept onsite for Department review upon request.

I.General Information

PWS Name:	**PWSID #:**
Critical Facility Name:	**Critical Facility Capacity:** MGD
Critical Facility Description:	**Average Daily Demand:** MGD
Critical Facility Address:	**Available Finished Storage:** MG
Completed By (Name):	**Hours of Finished Storage:**
Date Completed:	**Date(s) Updated:**

II. Plan to Provide Uninterrupted System Service

Please complete all of the below sections which your CWS is prepared to utilize to provide adequate quantity and quality of water during emergency situations. Systems are encouraged to be prepared to utilize as many methods as possible to maximize their capability to provide uninterrupted system service for each critical operational facility. The most effective plans carefully consider both the duration of time needed to switchover to a particular system service option as well as the efficacy of each option to provide adequate quantity of safe and potable water. Developing detailed Standard Operating Procedures (SOPs) for utilizing each alternative is critical to insuring efficient and effective implementation during emergency situations. When determining hours of operation or adequacy of finished water storage, systems should consider finished water volumes necessary to maintain adequate operating pressures throughout all portions of the distribution system. A separate template should be completed for each critical facility utilized by the CWS. For the purposes of this template, "critical facility" is defined as any facility necessary to supply adequate quantity and quality of water (e.g. water treatment plants, raw and finished water pump stations, finished water storage tanks, booster chlorination facilities, etc).

(A) Auxiliary Power	Connection to at least two independent power feeds from separate substations

Description of Auxiliary Power	SOP to Utilize Auxiliary Power

Additional production capacity provided via this auxiliary power:	MGD
Additional hours of operation provided by this auxiliary power:	Hours
Amount of time needed to switchover to this auxiliary power option:	Hours
Date this auxiliary power was last tested:	
Critical CWS staff needed to utilize this option:	
Critical external staff needed to utilize this option: 24/7 phone numbers for all critical staff: 1. Name and Number 2. Name and Number 3. Name and Number	

(B) Auxiliary Power	On-site auxiliary power sources – permanent generators

Description of Equipment	SOP to Utilize Equipment

Additional production capacity provided via this auxiliary power:	MGD
Additional hours of operation provided by this auxiliary power:	Hours
Amount of time needed to switchover to this auxiliary power option:	Hours
Date this auxiliary power was last tested:	
Critical CWS staff needed to utilize this option:	
Critical external staff needed to utilize this option: 24/7 phone numbers for all critical staff: 1. Name and Number 2. Name and Number 3. Name and Number	

(C) Auxiliary Power	Off-site auxiliary power sources – portable generators (PaWARN or Rental)
Description of Equipment	**SOP to Utilize Equipment**

Additional production capacity provided via this auxiliary power: MGD	
Additional hours of operation provided by this auxiliary power: Hours	
Amount of time needed to switchover to this auxiliary power option: Hours	
Date this auxiliary power was last tested:	
Critical CWS staff needed to utilize this option:	
Critical external staff needed to utilize this option: **24/7 phone numbers for all critical staff:** **1. Name and Number** **2. Name and Number** **3. Name and Number**	

(D) Alternate Provisions	Finished Water Storage Capacity
Description of Storage	**SOP to Utilize Storage**

Additional quantity of finished water provided by this alternate provision: MGD	
Additional hours of finished water supply provided by this alternate provision: Hours	
Amount of time needed to switchover (valves) to this alternate provision: Hours	
Date finished water storage capacity was last relied upon during an emergency:	
Critical CWS staff needed to utilize this option:	
Critical external staff needed to utilize this option: **24/7 phone numbers for all critical staff:** **1. Name and Number** **2. Name and Number**	

3. Name and Number

(E) Alternative Provision	Interconnection #1 with neighboring water system
Description of Interconnection	**SOP to Utilize Interconnection**

Additional finished water supply provided via this interconnection: gpm and psi
Additional hours of operation provided by this interconnection: Hours
Amount of time needed to switchover (valves) to this interconnection: Hours
Date this interconnection was last tested under actual operating pressures:
Critical CWS staff needed to utilize this option:
Critical external staff needed to utilize this option: 24/7 phone numbers for all critical staff: 1. Name and Number 2. Name and Number 3. Name and Number

(F) Alternative Provision	Interconnection #2 with neighboring water system
Description of Interconnection	**SOP to Utilize Interconnection**

Additional finished water supply provided via this interconnection: gpm and psi
Additional hours of operation provided by this interconnection: Hours
Amount of time needed to switchover (valves) to this interconnection: Hours
Date this interconnection was last tested under actual operating pressures:
Critical CWS staff needed to utilize this option:
Critical external staff needed to utilize this option: 24/7 phone numbers for all critical staff:

1. Name and Number
2. Name and Number
3. Name and Number

(G) Alternative Provision	"Other" - CWS should include other alternative provisions they have identified as valuable to maintaining uninterrupted system service
Description of Alternate Provision	**SOP to Utilize Alternate Provision**

Additional production capacity provided via this option:	MGD
Additional hours of operation provided by this option:	Hours
Amount of time needed to switchover to this option:	Hours
Date this option was last tested:	
Critical CWS staff needed to utilize this option:	
Critical external staff needed to utilize this option: 24/7 phone numbers for all critical staff: 1. Name and Number 2. Name and Number 3. Name and Number	

III. Training Review and Update

The following staff have been trained on implementation of the USSP:

- Name/ Training Date

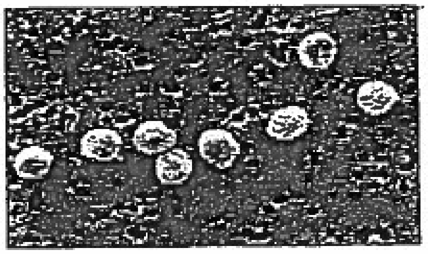
During the training, the SOPs to implement were reviewed and updated as necessary, along with the overall USSP.

Next scheduled training / update: Date:

USSP Completed By Signature:	Date:
USSP Reviewed By Signature:	Date:

microbial pathogens

Physicochemical removal of protozoan pathogens is receiving increased attention because of the difficulty of chemically inactivating these organisms, particularly *Cryptosporidium parvum*. Most research examining the removal of these and other pathogens by filtration has been conducted under steady-state conditions with optimized pretreatment. This study evaluated the removal of *Cryptosporidium* and changes in surrogate parameters at various points in the filter cycle and under nonoptimal conditions at two pilot plants with different coagulation regimes. The study found a reproducible 2-log difference in *Cryptosporidium* removals between the two locations under optimal conditions, with similar low effluent turbidity levels and particle counts. Either suboptimal coagulation or the early stages of breakthrough at the end of a filter run produced substantial deterioration of *Cryptosporidium* removal capability. Filter ripening or the imposition of a hydraulic step generally had much less effect on removals.



EFFECTS OF filter operation on *Cryptosporidium* removal

BY PETER M. HUCK,
BRADLEY M. COFFEY,
MONICA B. EMELKO,
DANIELLE D. MAURIZIO,
ROBIN M. SLAWSON,
WILLIAM B. ANDERSON,
JOHN VAN DEN OEVER,
IAN P. DOUGLAS,
AND CHARLES R. O'MELIA

The primary goal of drinking water suppliers is to protect public health by providing water that is free of microbial and chemical contaminants. The emergence of parasitic protozoa such as *Giardia lamblia* and *Cryptosporidium parvum* as etiological agents of waterborne disease has prompted renewed evaluation of the efficacy of water treatment processes. Increasingly stringent regulations for drinking water quality will require effective removal of these organisms. Although disinfection or inactivation plays a crucial role in this regard, physical removal is also important. The multibarrier approach to pathogen removal suggests that where granular media filtration is used, it must be effective.

It is well-known that filter effluent turbidity and particle counts may vary in the different phases of a typical filter cycle and as a result of operational events. During ripening, both turbidity and particle counts are elevated. As the filter becomes loaded toward the end of a cycle, particles may begin to break through. Hydraulic surges can increase filter effluent turbidity and particle counts. Coagulation upsets result in suboptimal pretreatment and may consequently cause an increase in filter effluent turbidity and particle concentrations.

A full report of this project, Filter Operation Effects on Pathogen Passage *(catalog number 90874), is available from AWWA Customer Service (1-800-926-7337). Reports are free to AWWA Research Foundation subscribers by calling 303-347-6121.*

TABLE 1 Major raw water quality and operating parameters at Ottawa and MWDSC*

Parameter†	Ottawa	MWDSC
Raw water quality		
Alkalinity—*mg/L as $CaCO_3$*	19–23	107–134
pH	7.1–7.4	7.7–8.4
Temperature—°C	1–24	13–25
TOC—*mg/L*	~5	2.6–2.9
Turbidity—*ntu*	1.0–2.7	0.4–2.4
Coagulant dose		
Alum‡—*mg/L*	38	5
SiO_2—*mg/L*	2	NA§
Cationic polymer—*mg/L*	NA	1.5
Coagulation/filtration pH	5.9–6.1	7.7–8.0
Rapid mix		
G—s^{-1}	In-line	600
HDT—min	NA	1.7
Flocculation		
G for stages 1, 2, and 3—s^{-1}	60, 40, 20	75, 50, 25
HDT—*min*	30	20
Sedimentation		
HDT—*min*	100	80
Filtration		
Filtration rate—*gpm/sq ft (m/h)*	2.6 (6.35)	4.0 (9.8)
Media depth		
Anthracite—*mm (in.)*	457 (18)	508 (20)
Sand—*mm (in.)*	279 (11)	203 (8)
Media size		
Anthracite—*mm*	1.07	1.0–1.1
Sand—*mm*	0.52	0.43–0.50
Media uniformity and coefficient		
Anthracite	1.35	<1.65
Sand	1.32	<1.65

*MWDSC—Metropolitan Water District of Southern California
†$CaCO_3$—calcium carbonate, TOC—total organic carbon, SiO_2—activated silica, *G*—velocity gradient, HDT—hydraulic detention time
‡As dry alum
§NA—not applicable

The objective of this study was to establish whether known increases in filter effluent turbidity and particles under these nonoptimal conditions also implied elevated *C. parvum* oocyst levels in filter effluents. Specifically, the study assessed the degree of pathogen and surrogate removal that can be reasonably expected from "benchmark" filtration systems (i.e., relatively standard design) under optimized operation and the following conditions: suboptimal coagulation, filter ripening, turbidity and particle breakthrough (end-of-run), and hydraulic surges.

BACKGROUND

The literature on *C. parvum* removal by filtration (particularly under nonoptimal conditions) is relatively limited, but studies on the removal of surrogates and of *Giardia* offer useful insights.

Influence of operational factors. Adequate chemical pretreatment during coagulation and flocculation is critical for maintaining good particle removal during filtration (Patania et al, 1995; Tobiason & O'Melia, 1988). For *Giardia* cysts, several investigations have demonstrated little (<1 log) to no removal by granular activated carbon filters (Patania et al, 1995), sand and dual-media filters (Al-Ani et al, 1986), and tri-media filters (Horn et al, 1988) during no-coagulation conditions. A study of a pilot-scale direct filtration plant found that mean *Giardia muris* cyst removals decreased by ~ 1–2.5 log during suboptimal and minimal coagulation, compared with removals under optimal operating conditions (Logsdon et al, 1981). Similar decreases in cyst removal as a result of suboptimal coagulation have been demonstrated at other direct (Ongerth & Percoraro, 1995) and conventional pilot plants (Patania et al, 1995).

Other researchers showed that large changes in flow rate caused deterioration of filtered water quality by the detachment of previously retained particles (Tuepker & Buescher, 1968; Cleasby et al, 1963). The degree of deterioration was related to the magnitude and rapidity of the rate change and was independent of the duration of the disturbance. Effects of increased flow rates on *Giardia* removal have been observed; however, the increases in cyst passage were considerably higher than the increases in turbidity (Logsdon et al, 1981).

Logsdon and colleagues (1981) reported that *Giardia* cyst passage through filters was significantly higher during ripening than during stable operation, even at low effluent turbidity levels. Similar findings were obtained at two pilot plants (Patania et al, 1995), but the differences between stable filter operation and ripening were less dramatic. At a third pilot plant, *Giardia* removals during ripening were comparable to those achieved during stable filter operation (Patania et al, 1995).

Possible sources of breakthrough in filters include particles that pass through directly from the influent (nonattachment) or particles that become detached (Lawler et al, 1995). According to some researchers (Moran et al, 1993; Ginn et al, 1992), both nonattachment and detachment occur during breakthrough conditions. As particle detachment and nonattachment increase, increased pathogen passage through filters would also be expected.

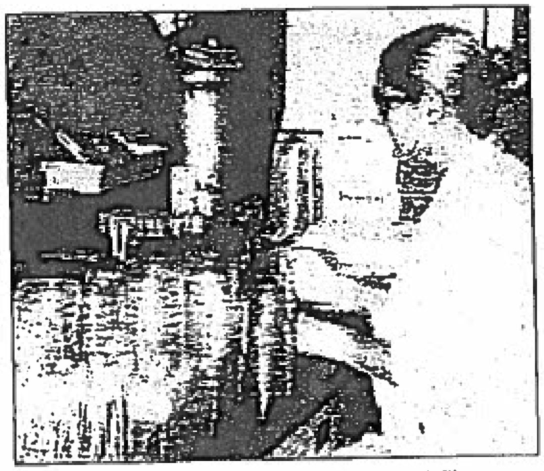
Logsdon et al (1981) demonstrated that turbidity breakthrough at the end of a filter cycle (when filter effluent turbidity was > 0.4 ntu) could be accompanied by a substantial passage of *Giardia* cysts, even if the cysts were not present in the filter influent. A considerable increase in cyst passage was also observed during early breakthrough conditions when filter effluent turbidity was just above 0.2 ntu. Patania et al (1995) also reported lower *Giardia* removal through filters during breakthrough.

Removal of surrogates. Several pilot- and full-scale studies have demonstrated that organism-sized particles and turbidity are approximate indicators of pathogen removal but not reliable surrogates (Nieminski & Ongerth, 1995; LeChevallier & Norton, 1992). Plummer and co-workers (1995) reached similar conclusions about turbidity, as well as ultraviolet absorbance at 254 nm and dissolved organic carbon. Patania and colleagues (1995) indicated that achieving a goal of 0.1 ntu was indicative of effective cyst–oocyst removal. Although the risk of *Cryptosporidium* passage appeared to increase with increasing filtrate turbidity in several studies (Hall & Croll, 1996; Hall et al, 1995; Nieminski & Ongerth, 1995), other researchers did not observe significant oocyst passage during the first hour of operation after backwash when filter effluent turbidity was high (filter ripening) (Fuller et al, 1995).

Bacillus spores were found to demonstrate a significant correlation with *Cryptosporidium* removal at both pilot and full scale (Scott et al, 1997). Other studies also found that aerobic spores were indicative of treatment efficiency but did not conclude that the spores were adequate surrogates for oocyst removal (Swertfeger et al, 1999; Nieminski & Bellamy, 1998; Lytle et al, 1996).

Removal of *C. parvum*. A number of studies have investigated *C. parvum* oocyst removals by granular media filtration at or near optimized stable operating conditions. Full-scale removals have been reported at levels from 2–3 log (e.g., Kelley et al, 1995; Nieminski & Ongerth, 1995) to > 4 log (e.g., Baudin & Laîné, 1998). Pilot-scale data have suggested that filters can achieve oocyst removals of 2–3 log (e.g., Fox et al, 1998; Kelley et al, 1995; West et al, 1994), 3–4 log (Yates et al, 1997a), and > 5 log (e.g., Patania et al, 1995; LeChevallier et al, 1991a). Differences in analytical reliability, processed sample volume, method detection limits, and influent microorganism concentrations can all contribute to the reported differences in the *Cryptosporidium* removal capacities of filters.

Patania et al (1995) examined conventional filtration, low-rate surface filtration, and in-line filtration at pilot scale and demonstrated that filtration was ineffective for oocyst removal without chemical pretreatment. Other pilot-scale studies also indicated that suboptimal coagulation conditions decrease oocyst removal by filters by



Inactivated *Cryptosporidium* oocysts and *Bacillus subtilis* spores seeded in the experiments were enumerated in the laboratory.

at least 1 log (e.g., Dugan et al, 1999; Charles et al, 1995; Ongerth & Pecoraro, 1995). Results reported earlier from the current study showed a substantial negative effect of suboptimal coagulation (Coffey et al, 1999).

Cryptosporidium removals of > 3 log have been maintained during filter ripening, despite a decrease in removals when compared with stable operation (e.g., Swaim et al, 1996). Several pilot-scale studies have indicated that oocyst removals decrease by ~ 0.5–1 log during filter ripening (e.g., Swaim et al, 1996; Hall et al, 1995; Patania et al, 1995). These findings were confirmed at full scale by Baudin and Laîné (1998), who demonstrated ~ 1-log deterioration in oocyst removals during ripening.

Two studies concluded that oocyst removals are comparable during turbidity breakthrough and stable filter operation (Baudin & Laîné, 1998; Patania et al, 1995). Patania and co-workers (1995) noted that the filter effluent turbidity increased by only ~ 0.1 ntu during their evaluation of breakthrough. Those authors speculated that oocyst removal might have deteriorated if sampling had continued beyond this point. Huck et al (1999) reported a substantial deterioration in performance during breakthrough.

Bench-scale studies have indicated that formalin-inactivated oocysts and viable oocysts of *C. parvum* are comparably removed by both dual- and tri-media filters (Emelko, 2001). This finding is significant, because studies in which oocysts are spiked (typically pilot-scale investigations) use inactivated oocysts for safety reasons.

METHODS AND RESEARCH PLATFORMS

Experimental design. The experiments in this study were conducted at two pilot plants—one in Ottawa, Ont., and the other at the Metropolitan Water District of Southern California (MWDSC) treatment plant in La Verne, Calif. These locations represented two basic types of

TABLE 2 Summary of removals and filter effluent quality during stable operation

Date	Research Platform	Log Removal Mean ± Standard Deviation			Filter Effluent Value Mean ± Standard Deviation	
		C. parvum	*B. subtilis*	Particles*	Particles *number/mL*	Turbidity *ntu*
8/6/98	Ottawa	4.9 ± 0.21		3.2 ± 0.29	3.7 ± 2.9	0.02 ± 0.00
9/9/98	Ottawa	5.7 ± 0.08		3.8 ± 0.10	0.9 ± 0.2	0.02 ± 0.00
9/23/98	Ottawa	5.8 ± 0.03		2.8 ± 0.24	8.7 ± 5.6	0.03 ± 0.00
10/6/98	Ottawa	5.8 ± 0.15		4.6 ± 0.18	0.2 ± 0.1	0.02 ± 0.00
3/9/99	Ottawa	5.2 ± 0.38	2.1 ± 0.14	4.1 ± 0.10	0.4 ± 0.1	0.03 ± 0.00
5/31/99	Ottawa	5.6 ± 0.20	4.6 ± 0.05	3.7 ± 0.18	1.2 ± 0.6	0.03 ± 0.00
7/27/99	Ottawa	5.6 ± 0.02	4.5 ± 0.24	3.0 ± 0.22	5.1 ± 1.5	0.04 ± 0.00
1/19/00	Ottawa	5.3 ± 0.38	4.2 ± 0.01	†	4.8 ± 0.6	0.03 ± 0.00
7/16/98	MWDSC‡	2.6 ± 0.07	2.0 ± 0.13	2.2 ± 0.09	6.3 ± 1.2	0.05 ± 0.00
7/28/98	MWDSC	3.3 ± 0.07	2.7 ± 0.26	2.6 ± 0.04	4.5 ± 0.4	0.05 ± 0.00
8/18/98	MWDSC	4.1 ± 0.65	2.3 ± 0.17	3.4 ± 0.04	1.5 ± 0.2	0.05 ± 0.00
9/22/98	MWDSC	3.8 ± 0.16	1.9 ± 0.46	2.8 ± 0.01	5.2 ± 0.2	0.05 ± 0.00
9/29/98	MWDSC		3.2 ± 0.37	3.3 ± 0.14	3.1 ± 0.4	0.05 ± 0.00
10/27/98	MWDSC	3.2 ± 0.15	2.3 ± 0.17	2.5 ± 0.14	10 ± 3.2	0.05 ± 0.00
11/24/98	MWDSC		2.1 ± 0.86	2.0 ± 0.02	32 ± 1.4	0.05 ± 0.00
12/15/98	MWDSC	2.9 ± 0.11	1.8 ± 0.06	1.8 ± 0.02	37 ± 1.8	0.05 ± 0.00
2/9/99	MWDSC	2.1 ± 0.15	1.9 ± 0.07	2.2 ± 0.01	21 ± 1.7	0.06 ± 0.00
3/9/99	MWDSC	2.4 ± 0.18	1.9 ± 0.04	2.9 ± 0.07	3.9 ± 0.6	0.05 ± 0.00
4/27/99	MWDSC	2.9 ± 0.29	1.9 ± 0.06	2.2 ± 0.02	27 ± 1.2	0.05 ± 0.00
	Ottawa average	5.5 ± 0.37	3.8 ± 1.07	3.6 ± 0.63	3.1 ± 3.5	0.03 ± 0.01
	MWDSC average	3.0 ± 0.66	2.2 ± 0.52	2.5 ± 0.50	13.8 ± 12.6	0.05 ± 0.00

*Log net decrease from raw water to filter effluent
†Plant influent data not available
‡MWDSC—Metropolitan Water District of Southern California

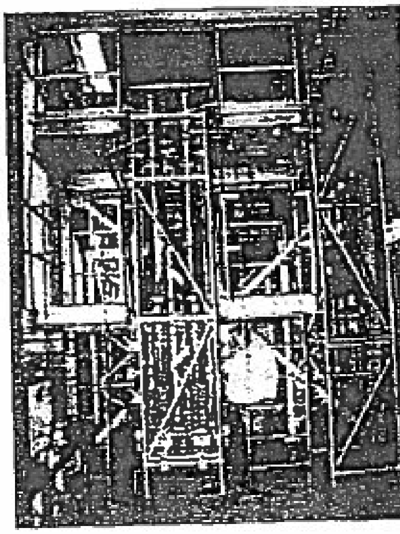
coagulation: a relatively high dosage for combined total organic carbon (TOC) and particle removal (Ottawa River water) and a relatively low dosage optimized for particle removal (MWDSC-treated Colorado River water). Inactivated *C. parvum* oocysts and pure-cultured *Bacillus subtilis* spores were seeded at both locations. Removals of turbidity and particles were also monitored. These experiments were designed to document pathogen removal from benchmark systems and were part of a larger study (Huck et al, 2001). In the investigations reported in this article, no attempt was made to improve pathogen removal or mitigate adverse conditions.

The conditions investigated were stable filter operation, suboptimal coagulation, ripening, breakthrough, and hydraulic step. In addition, control experiments were performed to evaluate losses of seeded organisms to the pilot-plant filters and appurtenances. The study also examined several subconditions within suboptimal coagulation and breakthrough. End-of-run experiments were performed at MWDSC because it was not possible to actually achieve breakthrough in that pilot plant. Experiments for each of the principal conditions were conducted at least in triplicate at each location.

Research platforms and experimental approach. Table 1 summarizes major raw water quality and operating parameters for the two locations. Both of the pilot plants received water that was low in turbidity and particles, with averages in the range of ~ 5,000 particles/mL (>2 µm). Major differences between the raw waters included alkalinity and temperature (Ottawa's lowest temperature was much colder than MWDSC's). Each pilot plant was operated to mimic as closely as possible the full-scale treatment plant at the same location.

The filters at both pilot plants featured media depths and sizes typical of the utilities' full-scale plants (and typical of many existing treatment plants). The operational mode chosen was conventional treatment with dual-media filtration. At MWDSC, the benchmark filter design contained 508 mm (20 in.) of anthracite over 203 mm (8 in.) of sand. At Ottawa, the filter design contained 457 mm (18 in.) of anthracite over 279 mm (11 in.) of sand. At MWDSC, the backwashing regime consisted of chlorinated water with surface wash. At Ottawa, chlorinated water and air-scouring were used.

The Ottawa pilot plant used a high coagulant dose of ~ 40 mg/L alum and 2 mg/L activated silica to achieve removal of both TOC and particles. The MWDSC pilot plant used a low coagulant dose of 5 mg/L alum and 1.5 mg/L cationic polymer for particulate removal only. At both pilot plants, chlorine (~2 mg/L) was added at rapid mix as a preoxidant. Because of Ottawa's higher coagulant dosage and lower alkalinity, coagulation pH was lower (~ 6 compared with ~ 8 at MWDSC). The optimized coagulation conditions were selected to meet the 0.1-ntu turbidity goal of the Partnership for Safe Water, a voluntary treatment optimization program sponsored by AWWA and the US Environmental Protection Agency.



Pilot-scale dual-media filters were used in this research.

At each pilot plant, rapid mix was followed by three-stage tapered flocculation. The overall flocculation hydraulic detention times (HDTs) were 30 min at Ottawa and 20 min at MWDSC. HDTs of the sedimentation step were 100 min at Ottawa and 80 min at MWDSC. Further operating details for the pilot plants are described in Huck et al (2001).

The pilot-scale filters in both locations were seeded with jar-coagulated suspensions of ~ 10^8 formalin-inactivated *C. parvum* and ~ 10^7–10^9 *B. subtilis* spores. Except for three experiments described separately, microorganisms were seeded into the filter influent, using a procedure established by members of the project team in previous investigations (Yates et al, 1997a; Yates et al, 1997b). This seed location was selected to minimize significant losses of microorganisms in upstream unit processes and to better characterize their removal during filtration. The data collected from the seeding experiments consisted of replicate samples (either four or five) taken from the filter influent and filter effluent at each location. The filter influent and filter effluent data were normally collected over a 1-h period when the seed suspension was added at the filter influent. A single-factor, analysis of variance (ANOVA) statistical test[1] was used to interpret the data, which were pooled from the replicate experiments at each location.

Detailed study data and the results of limited seeding of *G. lamblia*, MS-2 bacteriophage, and *Escherichia coli* at MWDSC are described elsewhere (Huck et al, 2001). In this article, the authors calculate and discuss changes (i.e., net decrease) in particle counts as a result of treatment. The changes are not referred to as particle removals because they are calculated using the plant influent (rather than the filter influent as in the case of the seeded microorganisms) and the filter effluent. (Filter influent particle counts were not measured for technical reasons.) Because coagulation, flocculation, and sedimentation can all affect particle counts, a general quantitative relationship would not necessarily be expected between the change in particle counts from raw to finished water and the removal of seeded microorganisms by filtration alone.

Seeding protocols. The seed suspension of oocysts or spores was diluted to 1.5 L with preoxidized influent water and jar-coagulated under coagulant and mixing conditions that mimicked pilot-scale treatment. The jar-coagulated organisms were then seeded directly into the influent of the filter by a peristaltic pump for 60 min. During seeding, the seed suspension was constantly agitated with a magnetic stirrer to ensure steady distribution of the organisms during the procedure.

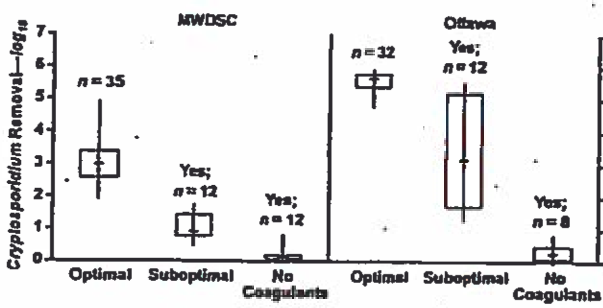
The targeted seeded influent concentration for *Cryptosporidium* was ~ 10^5 oocysts/L. Samples were collected in sterile bottles containing sodium thiosulfate. Filter effluent samples were collected in 1-L Wheaton bottles from the continuously running effluent line. Filter influent samples were collected in 250-mL amber bottles from the water column directly above the filter media using a continuous recirculation peristaltic pump.

Analytical methods. ***C. parvum.*** *C. parvum* oocysts were obtained from a commercial laboratory.[2] For each test, ~ 10^8 oocysts were obtained—already inactivated with 5% formalin. Prior to seeding, a small portion of the stock suspension was removed for enumeration using a hemacytometer.[3]

Filter influent samples were analyzed in sample volumes of 10 mL and filter effluent samples in volumes of 500 mL (or less if the filter effluent turbidity was elevated). Oocysts were collected by direct vacuum filtration of the sample through 27 mm (1.06 in.) diameter, 0.45-µm-pore-size polycarbonate membranes. Standard immunofluorescent assay techniques were used to stain the samples. Slides of Ottawa samples were analyzed at the University of Waterloo, Ont.; slides from MWDSC were shipped to a commercial laboratory[4] for presumptive microscopic analysis. As a procedural check, recovery experiments were performed at both locations using both filter influent and effluent water matrixes. The measured *Cryptosporidium* levels reported here were not adjusted by the recovery.

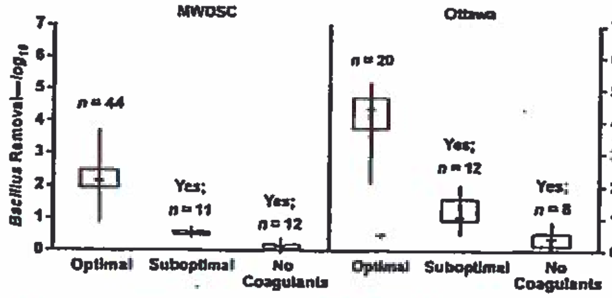
B. subtilis. The analysis for *B. subtilis*[5] was performed according to a previously described method (Rice et al, 1996). This method generally consisted of filtration of samples onto 47 mm (1.8 in.), 0.45-µm gridded cellulose acetate membranes[6] and growth at 37°C for 24 h on plates of nutrient agar with trypan blue (0.015 g/L).

FIGURE 1 Effect of coagulation on filters' removal of *Cryptosporidium parvum*



MWDSC—Metropolitan Water District of Southern California, n—number of data points. "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level.

FIGURE 2 Effect of coagulation on filters' removal of *Bacillus subtilis*



MWDSC—Metropolitan Water District of Southern California, n—number of data points. "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level.

Spores were identified by their blue color. Typically, duplicate sample volumes of 0.1 and 1.0 L were used to enumerate filter influent and effluent, respectively.

Particle counting. Each particle-counting instrument was calibrated by the manufacturer according to ASTM (American Society for Testing and Materials) F 658-87 and met the resolution requirements of USP (US Pharmacopeia) 788. The calibration was verified on site using commercially available, calibrated, monodisperse polymer microspheres.[7] The particle counters[8] measured total particles from 2 to 150 µm, with the data reported as cumulative particles ≥ 2 µm.

Turbidity. Turbidity was monitored using online turbidimeters that were calibrated using dilute formazin solutions as specified by the manufacturer. Calibration was checked by comparison with a bench-top turbidimeter with an accuracy of ± 2%, using standards of 0.80 and 6.6 ntu. MWDSC and Ottawa testing used the same model of turbidimeter[9] at plant influent, filter influent, and filter effluent locations. An additional turbidity meter[10] was used at the filter effluent sampling location in Ottawa. Filter influent turbidity at Ottawa was measured by grab samples analyzed with a handheld turbidimeter.[11]

Head loss. Differential pressure transducers continuously measured head loss at the MWDSC and Ottawa pilot plants. Additional details about methods and the quality assurance–quality control program may be found elsewhere (Huck et al, 2001).

RESULTS

Controls. As noted previously, a control experiment was performed at each location to quantify the possible losses of seeded microorganisms to the pilot-plant systems. In these experiments, no media were in the filters, and no coagulant was added. As was standard practice, the microorganisms were seeded in the filter influent. Thus, these experiments were designed to give an indication of possible adsorption of seeded microorganisms on surfaces within the pilot plant, including any sample tubing.

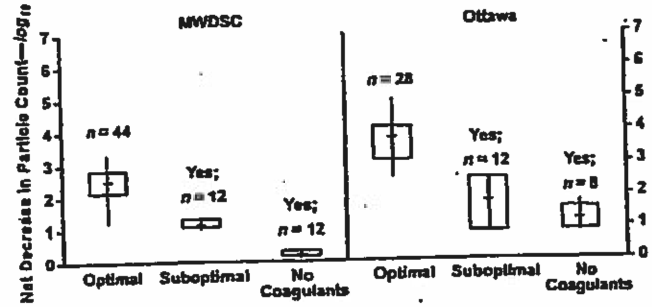
In both locations, the removals of *C. parvum* and *B. subtilis* in the control experiments without media were < 0.10-log units (Huck et al, 2001). These results convincingly demonstrated that losses of seeded microorganisms to the pilot-plant apparatus were essentially negligible. Therefore, the removals attributed to filtration under each of the tested operating conditions could be attributed to the filters themselves.

Stable filter operation. The purpose of these experiments was to document the best removals that could be obtained under optimal conditions in each location. Seeding and sampling were conducted in the early-to-middle portion of the filter cycle, after ripening was complete. Because these experiments provided a baseline for comparison, they were conducted periodically throughout the experimental program. In all, eight stable operation experiments were conducted at Ottawa and eleven at MWDSC. In addition, several stable operation experiments were conducted in which seeding was performed at the rapid mix. These results are discussed separately.

Table 2 summarizes the results for the stable operation experiments. The most striking finding was the > 2-$\log_{10}$ difference in *C. parvum* removals between the two locations, despite essentially the same effluent turbidity values and very similar (and low) filter effluent particle counts. At Ottawa, 5.5 ± 0.4 $\log_{10}$ removal of *C. parvum* was obtained, whereas at MWDSC, 3.0 ± 0.7 $\log_{10}$

removal was observed. The filter influent concentrations in both locations were similar: approximately 10^6/L in Ottawa and 10^5–10^6/L at MWDSC. *C. parvum* was always found in the filter effluent samples at MWDSC, typically at concentrations of at least 100 oocysts/L. At Ottawa, filter effluent *C. parvum* concentrations were usually < 10 oocysts/L. Often a count of zero was obtained for the 500-mL sample volume normally examined. Because of the high observed removals, the Ottawa experimental protocols and data were carefully scrutinized during the study, and nothing was found to suggest that the results were anomalous.

FIGURE 3 Effect of coagulation on net decrease in particle count from raw water to filter effluent



MWDSC—Metropolitan Water District of Southern California, n—number of data points. "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level.

The reasons for the difference in *C. parvum* removals between the two locations are not definitively known, and the experimental program was not designed to identify them. Differences in raw water quality and coagulation may be important. Although the two filter designs were quite similar, small differences may play a role. The matter merits further investigation.

Although there was some variation in removals calculated on the basis of individual influent–effluent sample pairs, the calculated removals from run to run were quite reproducible, as indicated by the relatively low overall standard deviations. The Ottawa experiments included runs at low temperature. No deterioration in performance was observed at temperatures as low as 1°C (Huck et al, 2001).

Removals of *B. subtilis* were 3.8 ± 1.1 log_{10} in Ottawa and 2.2 ± 0.5 log_{10} at MWDSC; in both locations, removals were lower than those for *C. parvum*. Although *B. subtilis* removals were substantially higher in Ottawa, the difference between the two locations was not as great as the difference for *C. parvum*. In both locations, the seeded concentration of *B. subtilis* was lower than that of *C. parvum*. Although *B. subtilis* spores were invariably detected in the filter effluent samples at Ottawa and always at MWDSC, it is possible that the lower seeded concentrations contributed to lower observed removals.

However, it appears that *B. subtilis* gives a conservative indication of a filter's ability to remove *C. parvum* under stable operating conditions. It also appears that to at least some extent, differences in *B. subtilis* removals in different filters indicate variations to be expected in *C. parvum* removals. Furthermore, the removals of *B. subtilis* during stable operation in Ottawa, which were 1.6 log_{10} higher than removals at MWDSC, lend credence to the substantially higher removals of *C. parvum* observed in Ottawa. Overall reproducibility of the calculated *B. subtilis* removals was almost as good as for *C. parvum*.

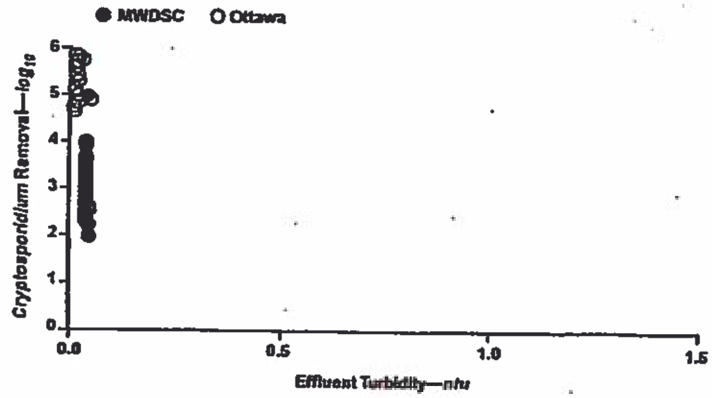
Table 2 also summarizes changes in particle count (≥ 2 µm) and particle filter effluent concentrations for the two locations. In Ottawa, the mean net decrease in particle count (from raw water to filter effluent) during the stable operation experiments was 3.6 ± 0.6 log_{10}, whereas at MWDSC, it was 2.5 ± 0.5 log_{10}. Mean filter effluent particle numbers in the two locations were approximately 3/mL in Ottawa and 14/mL at MWDSC. The MWDSC average was influenced by several runs with effluent particle numbers > 20/mL. Although raw water values were roughly similar in both locations (on the order of 5,000/mL), it should be noted that different particle counters were used. Furthermore, many of the filter effluent particle counts were at or near the detection limit of the instrument, particularly in Ottawa.

Given these qualifications, it is not possible to quantitatively compare the net decrease in particle count determined for stable operation in this study to *C. parvum* removals under the same conditions. However, different observed net decreases in particle counts in different filters (with roughly similar influent particle counts) may be indicative of differences in *C. parvum* removals by these filters.

It is questionable whether the observed different filter effluent particle counts in Ottawa and MWDSC represent a real difference. Given the substantial difference in *C. parvum* removal at the two locations, however, it is possible that small differences in particle counts may be indicative of measurable differences in the *C. parvum* removal capability of the two treatment systems. Certainly in the breakthrough experiments discussed later in this article, small increases in effluent particle counts late in the run in Ottawa signaled a much greater deterioration in the filter's ability to remove *C. parvum*.

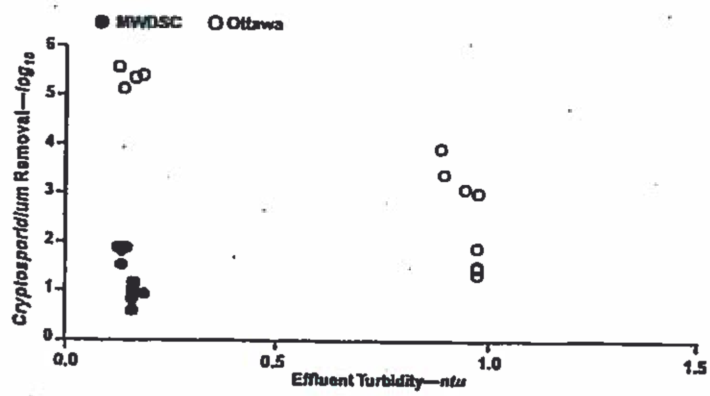
Table 2 also shows filter effluent turbidity values for the two locations. As with the particle data, the values shown correspond to the times at which the microorganism samples were taken. Log removals for turbidity are

FIGURE 4 *Cryptosporidium parvum* removal versus filter effluent turbidity (optimal coagulation conditions)



MWDSC—Metropolitan Water District of Southern California

FIGURE 5 *Cryptosporidium parvum* removal versus filter effluent turbidity (suboptimal coagulation conditions)



MWDSC—Metropolitan Water District of Southern California

not calculated because they are limited by the relatively low influent values and also by the fact that many filter effluent values are very close to the instrument detection limit. In all but one stable operation experiment, filter effluent turbidity was ≤ 0.05 ntu. The mean filter effluent turbidity was 0.03 ntu in Ottawa and 0.05 ntu at MWDSC. Both of these values were considered to be indicative of excellent filtration performance; in fact, it could be argued that there is no meaningful difference between the overall average values obtained in the two locations. If there is a real difference, it is extremely subtle and could not be reliably used to predict the differences in *C. parvum* removal observed at the two locations.

In two experiments at MWDSC and one at Ottawa, microorganisms were seeded at the rapid mix in the pilot plant rather than being jar-coagulated offline and seeded at the filter influent. In these experiments, filter influent concentrations of *C. parvum* at both locations were at least several orders of magnitude lower than usual because of substantial losses through the sedimentation step and because the seed was dispersed over a longer period of time. In these runs, *C. parvum* removals were much lower (1.3 $\log_{10}$) at MWDSC, although reproducibility there was not good (Huck et al, 2001). Oocysts were detected in all filter effluent samples.

Removals could not be quantified in Ottawa, because a count of zero oocysts was obtained for all filter effluent samples. Filter influent oocyst counts increased and then decreased during the experiment, as would be expected, with a maximum value of 710 oocysts/L. On the basis of the maximum influent value, removal at Ottawa was at least 2.6 $\log_{10}$. Filter influent concentrations of *B. subtilis* spores were low in Ottawa and close to normal levels at MWDSC. In Ottawa, removals were much lower than normal (1.1 $\log_{10}$), and low numbers of spores were detected in the filter effluent. At MWDSC, the calculated removals were the same as for normal stable operation. Overall, the results of the small number of experiments involving seeding at the rapid mix are not considered an accurate reflection of oocyst removal capabilities of the filters in either pilot plant.

Coagulation impairment. Two basic types of impaired coagulation experiments were performed: no coagulation and suboptimal coagulation. Results were then compared with the stable operation (i.e., optimal) results discussed earlier. As noted previously, the optimum coagulant dosage in Ottawa was nearly eight times greater than at MWDSC, and the coagulation pH was lower (~ 6 at Ottawa versus ~ 8 at MWDSC).

No coagulation. These experiments simulated a worst-case condition of total coagulant failure. They also served as additional controls to determine microorganism losses through the pilot-plant facilities. In these tests, coagulation was discontinued; the filter was then backwashed prior to beginning the no-coagulant run in which microorganisms (which also received no coagulant) were seeded. Previous seeding of *C. parvum* oocysts at MWDSC's pilot plant had indicated a loss of ~ 0.3 log (50%) of oocysts when no chemicals were added to the water (Yates et al, 1997a; Yates et al, 1997b).

At Ottawa, an additional experiment was conducted in which the activated silica feed was discontinued, but otherwise coagulation remained as normal. This run simulated a coagulant aid failure and was conducted to investigate whether the use of activated silica was an important factor in the high observed removal of *C. parvum* oocysts under optimal coagulation conditions. Several different short-term loss-of-coagulant scenarios were also tested in Ottawa (Huck et al, 2001).

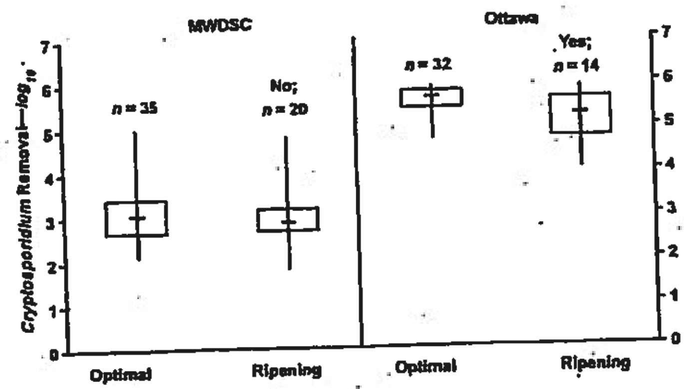
Suboptimal coagulation. These experiments determined how pathogen passage was affected by changes in coagulation conditions (without a change in raw water quality). The coagulant dosage (alum and polymer at MWDSC; alum and activated silica at Ottawa) was reduced 40–65% from optimum in an attempt to achieve a targeted suboptimal turbidity of 0.2–0.3 ntu. In some tests, however, the target effluent turbidity was exceeded. The suboptimal coagulant dosage was also applied in the jar coagulation of the microorganism seed suspensions.

Figures 1 and 2 summarize the removal of seeded *C. parvum* and *B. subtilis* at Ottawa and MWDSC. Figure 3 summarizes the net decrease in particles at both locations. The box-and-whisker plots in these figures represent the minimum, 25th percentile, median, 75th percentile, and maximum values for removals. Results for the various partial coagulation scenarios in Ottawa are discussed later.

Each removal is expressed as the $\log_{10}$ difference between paired sets of data taken at the filter influent and filter effluent. The net decrease for particle counts was calculated the same way, using raw water and filter effluent values, as noted previously. The number of data points used in the statistical comparisons (single-factor ANOVA) is shown on the figures. The "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level.

In general, similar trends were seen for all three parameters at both locations. Suboptimal coagulation had a substantial adverse effect on removal or net decreases. At both MWDSC and Ottawa, significantly greater $\log_{10}$ removals or net decreases were obtained during optimized coagulation (i.e., 2–4 h into the filter cycle when effluent turbidity was ≤ 0.10 ntu) than during suboptimal coagulation or coagulant failure. At both locations, average *C. parvum* removals were reduced by just over 2 $\log_{10}$ under suboptimal coagulation.

FIGURE 6 Effect of ripening on filters' removal of *Cryptosporidium parvum*



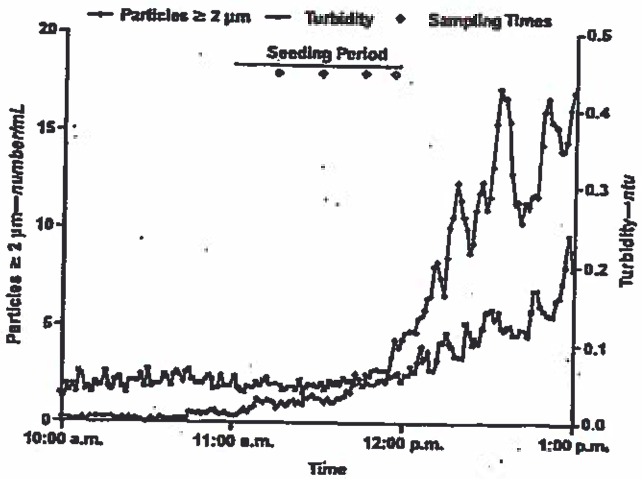
MWDSC—Metropolitan Water District of Southern California, n—number of data points. "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level; "No" indicates the mean was not statistically different.

All differences were statistically significant at the 1% level ($\alpha = 0.01$) as well as at the 5% level. Removals of *C. parvum* were higher than those of *B. subtilis* under suboptimal conditions, as was the case under optimal conditions. The differences in *B. subtilis* removals between suboptimal and optimal conditions were also substantial and were statistically significant ($\alpha = 0.01$). The difference in net decrease in particle counts in both locations was also statistically significant compared with optimal conditions. The essentially zero removals of both organisms for the no-coagulant condition again confirmed that seeded organisms were not being lost in the pilot plants and demonstrated the crucial importance of at least some level of coagulation for rapid filters.

At MWDSC, suboptimal coagulation resulted in an average effluent turbidity of 0.16 ntu, well below the level of 0.3 ntu specified by the Interim Enhanced Surface Water Treatment Rule (IESWTR). At Ottawa, the coagulant reduction resulted in an average effluent turbidity of 0.56 ntu. The suboptimal coagulation experiments at Ottawa varied more substantially than at MWDSC, most noticeably in terms of *C. parvum* removal and filter effluent turbidity. This reflected the greater difficulty in hitting the target suboptimal conditions in Ottawa and may indicate that such regimes are very vulnerable to underdosing (close to the coagulant demand).

The relationship between seeded *C. parvum* or *B. subtilis* and net decrease in particle count was examined under all of the coagulation conditions (Coffey et al, 1999). At MWDSC, *C. parvum* and *B. subtilis* removals were highly correlated to decrease in particles (R^2 values of 0.87 and 0.82, respectively). At Ottawa, the strength of the correlation was not as high (R^2 values of 0.60 for

FIGURE 7 Turbidity and particle response of filter during onset-of-breakthrough experiment at Ottawa pilot plant on Jan. 21, 1999



Although it is possible that some silica remained in the filter from previous runs, this finding suggests that the use of silica (which was one difference between Ottawa and MWDSC) was not responsible for the very high *C. parvum* removals seen under optimal coagulant conditions in Ottawa.

Results of these experiments indicate that even at filter effluent turbidity levels < 0.3 ntu, substantial deterioration of filtration performance may result if coagulation is not optimized. *C. parvum* removals were more sensitive to coagulation conditions than turbidity removals were. The sensitivity of turbidity for measuring coagulation effects on *C. parvum* removal may depend on the coagulation regime. Filter effluent particle monitoring may provide a more sensitive measure of coagulation performance and *C. parvum* removal. Plants using a relatively high alum dose (such as Ottawa) may be able to provide some reduced level of *C. parvum* removal by filtration during a short-term (several-hour) coagulant feed failure. (A short-term coagulation failure was not tested at MWDSC.)

C. parvum and 0.25 for *B. subtilis*). The elevated filter effluent particle counts observed under suboptimal coagulation conditions are tabulated in Huck et al (2001).

Figures 4 and 5 show the effect of coagulation condition on filter effluent turbidity and *C. parvum* removal; *C. parvum* removals are shown for individual influent–effluent data pairs. In Figure 4 (optimal conditions), turbidity was always < 0.1 ntu. Although Ottawa's *C. parvum* removals were almost always greater than MWDSC's, in each location the removals calculated from individual influent–effluent sample pairs varied considerably, a fact that underlines the need for replication in this type of work.

As shown in Figure 5 (suboptimal coagulation conditions), filter effluent turbidity was in the range of 0.1–0.2 ntu in all MWDSC experiments of this type. Some Ottawa data were available for this range, but in other Ottawa experiments, the effluent turbidity was closer to 1 ntu. When turbidity was 0.1–0.2 ntu, Ottawa *C. parvum* removal did not appear to decrease, whereas MWDSC *C. parvum* removal did. This would suggest that the sensitivity of turbidity for monitoring coagulation effects on *C. parvum* removal may be site-specific and perhaps dependent on the coagulation regime used. It is possible that particle counts may be a more sensitive indicator of poor coagulation performance.

When coagulant was absent for only a short duration in Ottawa (several hours prior to and during seeding), *C. parvum* removals were seriously impaired (by several log units) but at least 2-log removal did occur (Huck et al, 2001). *B. subtilis* removals were reduced by about the same extent under this condition. The absence of activated silica for the entire run had essentially no effect on the removal of either organism (Huck et al, 2001).

Ripening. Ripening experiments were conducted at both locations. The seeding period in Ottawa was only 30 min because the filter typically ripened to stable operating conditions of filter effluent turbidity levels < 0.1 ntu and particle concentrations < 5–10 particles/mL during that time. The duration of ripening in the MWDSC filter was similar (~30–40 min). Microorganisms were seeded for 1 h at MWDSC. In Ottawa, samples were collected at 5-min intervals during ripening, whereas at MWDSC samples were generally taken at 10, 20, 40 and 60 min.

As expected, both traditional performance measures (turbidity and particle counts) and filter effluent microorganism concentrations varied during the ripening period. At Ottawa, peak filter effluent turbidity and particle counts during ripening ranged from 0.41 to 0.69 ntu and 91 to 840 particles/mL, respectively, and the durations of the ripening period were generally comparable among the three experiments conducted. The ripening pattern at MWDSC was generally similar to that in Ottawa. For the most part, *C. parvum* trends tracked changes in filter effluent turbidity and particle counts, i.e., filter effluent oocyst levels decreased as the ripening period progressed. However, specific particle count or turbidity values were not necessarily correlated with specific filter effluent *C. parvum* concentrations (Huck et al, 2001).

The box-and-whisker plots and statistical comparisons for *C. parvum* (Figure 6) were based on the entire ripening period. On this basis, ripening did not result in dramatic differences in overall removals relative to stable (optimized) filtration. At Ottawa, *C. parvum* removals during ripening were $5.1 \pm 0.7 \log_{10}$ (mean ± standard deviation); at MWDSC, they were $2.9 \pm 0.6 \log_{10}$. Ottawa removals were $0.5 \log_{10}$ lower than during stable operation, whereas at MWDSC, removals were only $0.1 \log_{10}$ lower. At Ottawa, the difference was statistically significant at the 5% level, whereas at MWDSC, it was not. The Ottawa result was consistent with previous studies (Swaim et al, 1996; Hall et al, 1995; Patania et al, 1995), which demonstrated a 0.5–1.0-$\log_{10}$ deterioration in oocyst removal during filter ripening. The MWDSC result was consistent with other studies (e.g., LeChevallier et al, 1991b) that did not yield statistically different oocyst removals between ripening and stable filter operation.

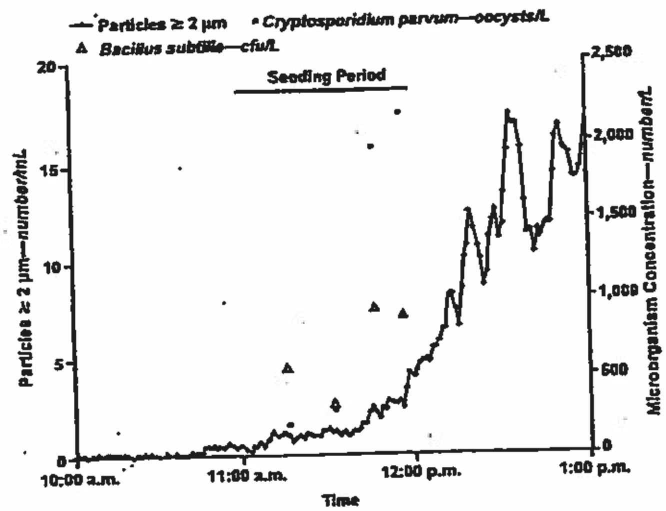


FIGURE 8 Particle and microorganism response of filter during onset-of-breakthrough experiment at Ottawa pilot plant on Jan. 21, 1999

However, when only early ripening at MWDSC was considered (sample times of 10, 20, and 40 min), the difference in oocyst removals between stable filter operation and ripening became statistically significant at the 5% level (results not shown). In general, the ripening data in this investigation suggest a brief, minimal-to-moderate increase in *C. parvum* passage through the filters that was concurrent with elevated filter effluent turbidity and particle counts. It should be noted that these experiments were designed to evaluate the passage of oocysts present in the filter influent during ripening, not the passage of oocysts that might be present in the backwash remnant water. The latter would be significant on a site-specific basis but could lead to increased oocyst passage during ripening in some instances.

Trends in *B. subtilis* removal during ripening were qualitatively comparable to those observed for *C. parvum* (Huck et al, 2001). At Ottawa, *B. subtilis* removals during ripening were lower and significantly different (5% level) from those achieved during stable operation. The same result was found for *B. subtilis* at MWDSC, where the difference for *C. parvum* had not been statistically significant at the 5% level. For *B. subtilis*, however, the differences between stable operation and ripening were substantially greater than for *C. parvum* in both locations. This suggests that *B. subtilis* spores are probably not good quantitative surrogates for *C. parvum* oocyst removal by filtration.

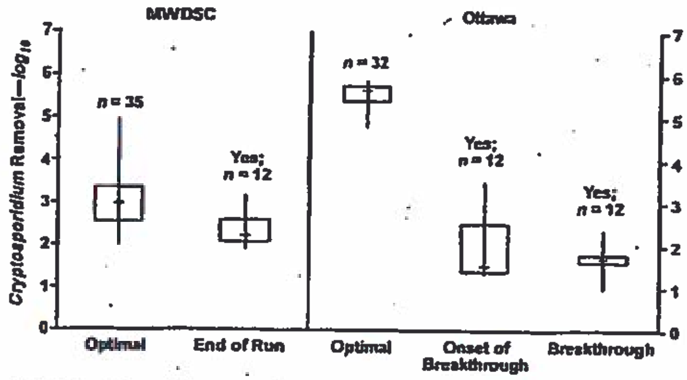
The net decrease in particle counts was also lower during ripening at both Ottawa and MWDSC, when compared with stable filter operation. Although not large, this difference (based on the entire ripening period) was statistically significant at the 5% level at both locations. The actual differences ($0.5 \log_{10}$ at Ottawa and $0.2 \log_{10}$ at MWDSC) were comparable to the decreases in *C. parvum* removal.

Breakthrough. All of the breakthrough experiments conducted at MWDSC and Ottawa were performed after periods of stable operation. In both locations, jar-coagulated *C. parvum* oocysts and *B. subtilis* spores were seeded into the filters for 1h; samples were collected at 15, 30, 45, and either 55 or 60 min after the start of seeding.

At MWDSC, neither turbidity nor particle breakthrough could be achieved for technical reasons. Therefore, the experiments were performed as "end-of-run" experiments at ~ 72 h into the filter cycle. In Ottawa, breakthrough experiments were originally intended to be conducted when filter effluent turbidity exceeded 0.2 ntu. Because breakthrough was difficult to predict, seeding and sampling commenced in all cases when filter effluent turbidity levels were greater than ~ 0.4 ntu.

An additional set of experiments, termed "onset-of-breakthrough," was conducted at Ottawa. Filter effluent turbidity levels of < 0.3 ntu were targeted because the IESWTR requires filter effluent turbidity levels < 0.3 ntu in greater than 95% of measured samples. The first onset-of-breakthrough experiment at Ottawa was conducted on Jan. 21, 1999, when filter effluent turbidity levels were increasing but were still < 0.1 ntu. (In fact, this experiment was intended to be a stable operation experiment and only captured onset-of-breakthrough fortuitously.) Because of the striking results obtained in this experiment, two additional such experiments were performed at Ottawa on Dec. 20 and Dec. 22, 1999. In these two runs, filter effluent turbidity levels were 0.2–0.3 ntu. In these latter

FIGURE 9 Effect of breakthrough, onset-of-breakthrough, and end-of-run conditions on filters' removal of *Cryptosporidium parvum*



MWDSC—Metropolitan Water District of Southern California, n—number of data points. "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level.

experiments, jar-coagulated *B. subtilis* spores were seeded for 1 h, and then *C. parvum* oocysts were seeded for 1 h as breakthrough commenced. Samples were collected only during the hour of *C. parvum* seeding.

Filter effluent turbidity and particle concentrations during the end-of-run experiments at MWDSC were similar to those obtained during the stable filter experiments. Furthermore, the filter effluent turbidity levels and particles remained constant throughout the end-of-run seeding period at MWDSC.

In contrast, the onset-of-breakthrough that occurred in Ottawa was a very dynamic period, particularly for *C. parvum*. In the January 1999 breakthrough experiment (Figure 7), the filter effluent turbidity was 0.04–0.07 ntu, and particle counts ranged from 0.3 to 4.3 particles/mL during the seeding and sampling period. Although these might be considered modest changes, they were accompanied by a drastic reduction in the filter's ability to remove incoming *C. parvum* oocysts (Figure 8). An increase in filter effluent *B. subtilis* concentrations was also observed, but it was not as severe as the increase in filter effluent oocyst concentrations (Figure 8). In general, the onset-of-breakthrough experiments at Ottawa demonstrated a relatively modest degradation of the traditional performance parameters that was accompanied by tremendous increases in filter effluent *C. parvum* concentrations. These data suggested that small increases in particle counts during early breakthrough could signal substantially increased noncapture of oocysts.

In the breakthrough experiments at Ottawa, both filter effluent turbidity and particle counts continued to change rapidly (Huck et al, 2001). The elevated turbidity and particle counts were accompanied by high filter effluent *C. parvum* concentrations (generally > 10^4 oocysts/L).

By seeding *B. subtilis* first and then *C. parvum* during the actual sampling, the December 1999 onset-of-breakthrough experiments at Ottawa were designed to investigate whether the passage of oocysts through the filter during early breakthrough conditions was largely a function of nonattachment. (The high effluent oocyst concentrations observed would suggest this.) Although the high concentration of spores observed in the filter effluent pointed to some detachment, this interpretation was unclear because during sampling more spores were present in the filter influent than in the effluent.

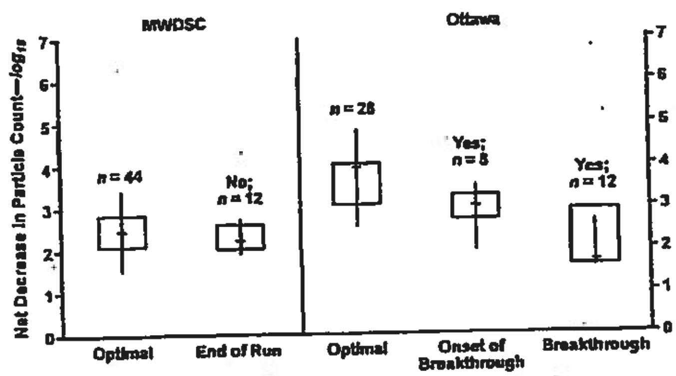
Median removals of *C. parvum* during end-of-run conditions were significantly different (at the 5% level) than during stable operation at MWDSC (Figure 9). However, no significant differences in net decrease in particle count were observed (Figure 10).

At Ottawa, median *C. parvum* removals during the onset-of-breakthrough and breakthrough experiments were substantially lower and statistically different (5% level) than during stable operation (Figure 9). These results were consistent with the statistically significant differences (5% level) observed for the net decrease in particle counts (Figure 10).

In Ottawa, results for *B. subtilis* paralleled those for *C. parvum*, with removals during the onset-of-breakthrough and breakthrough periods significantly lower (at the 5% level) than during stable operation (Huck et al, 2001). At MWDSC, the end-of-run *B. subtilis* removals, although also statistically different from those for stable operation at the 5% level, were actually somewhat higher (0.5 log_{10}) than during stable operation. The reason for this result is not known, but it may be because of the fact that very low filter effluent *B. subtilis* numbers were observed in one of the three end-of-run experiments.

Oocyst removal during end-of-run conditions at MWDSC was ~ 0.6 log_{10} lower than during stable operation. In Ottawa, the onset-of-breakthrough and breakthrough oocyst removals were ~ 3.5 log_{10} and 4 log_{10} lower, respectively, than during stable operation. Ottawa results were in general agreement with other research (Logsdon et al, 1981) demonstrating that turbidity breakthrough at the end of a filter cycle could be accompanied by considerable passage of *Giardia* cysts. The Ottawa onset-of-breakthrough results were very different from those obtained by other researchers (Patania et al, 1995). In that study of *Giardia* and *C. parvum* passage through filters during breakthrough, effluent turbidity levels increased from 0.1 to 0.2 ntu or higher. Those researchers found that whereas *Giardia* removal was ~ 0.5 log_{10} lower during breakthrough, no difference was observed

FIGURE 10 Effect of breakthrough, onset-of-breakthrough, and end-of-run conditions on net decrease in particle count from raw water to filter effluent



MWDSC—Metropolitan Water District of Southern California, n—number of data points. "Yes" designation indicates that the mean for a given condition was statistically different from the optimal or stable operation condition at the 5% level. "No" indicates the mean was not statistically different.

in *C. parvum* removals during stable operation versus breakthrough. It is possible that other factors, such as chemical pretreatment, may affect the degree of pathogen passage that occurs during early breakthrough filtration.

Hydraulic step. Each of the hydraulic step experiments consisted of a 25% increase in filtration rate that took place over a period of < 1 min and was imposed during stable (optimized) operating conditions. This higher rate was maintained throughout the remainder of the filter cycle.

C. parvum and *B. subtilis* were seeded in the filter influent over an extended period of time (5 h at Ottawa and 8 h at MWDSC), and the hydraulic step was imposed immediately after the seeding period. Thus, oocysts appearing in the effluent would result from detachment rather than noncapture. Results from these experiments (three replicates in each location) were variable, even though the protocol remained the same, including the point in the filter cycle at which the step was applied. Because of space limitations, results are discussed only briefly here.

In the first experiment in Ottawa, the filter effluent turbidity and particle concentration temporarily increased to 0.37 ntu and 297 particles/mL, respectively. This increase was accompanied by a substantial increase in oocyst levels, with effluent concentrations of *C. parvum* reaching 4,412 oocysts/L (Huck et al, 2001).

The hydraulic step had much less effect in the second experiment. Although particle concentration peaked at ~ 400/mL, the filter effluent turbidity increased only slightly and no appreciable changes in filter effluent *C. parvum* concentrations were observed. A third hydraulic step experiment was performed, but turbidity and particle data were not available because of difficulties with the data acquisition system. Filter effluent oocyst concentrations were slightly elevated (a maximum value of 76 oocysts/L).

The similar experiments at MWDSC were more reproducible. In general, filter effluent turbidity was ~ 0.05 ntu, and the particle concentration ranged from 8 to 24 particles/mL. The filter effluent *C. parvum* concentrations generally decreased after the completion of seeding, despite the implementation of the hydraulic step. Thus, the hydraulic step for the most part had little effect on filter effluent concentrations at MWDSC.

B. subtilis results in both locations generally followed the same trend as for *C. parvum* (Huck et al, 2001). Except for the one experiment in Ottawa, the data suggested that little detachment of microorganisms occurred as a result of a 25% increase in flow. The reasons for the lack of effect and for the variable results in Ottawa are not understood. It may be that the effect of the flow change was sensitive to the exact way in which it was imposed. This variability may be higher at pilot scale than at full scale.

Ottawa results showed that particle counts were not directly indicative of oocyst passage through filters as a result of a hydraulic step (Huck et al, 2001). The results also suggested that turbidity might be a better indicator of the effect of a hydraulic step, but the authors believe firm conclusions cannot be based on these limited experiments.

The variation in observed results underlines the need for further investigation, so that the potentially severe effects of hydraulic changes on *C. parvum* passage (as observed during the first Ottawa experiment) can be minimized.

CONCLUSION

The authors' detailed investigation of *Cryptosporidium* removal by granular media filtration in two different waters led to the following conclusions.

- Under optimal operating conditions, *Cryptosporidium* removals exhibited a 2-log difference between two pilot plants operated to produce similar low effluent turbidity values (< 0.1 ntu) and particle counts (< 20/mL). Removals in one location were ~ 5 $\log_{10}$ units, whereas those in the other location were ~ 3 $\log_{10}$ units. Coagulation regimes at the two plants differed significantly, but the reasons for the 2-log variation are not completely understood.
- At the end of a filter run, the authors observed a substantial deterioration (several $\log_{10}$ units) in oocyst removal capability, even in the early stages of breakthrough when filter effluent particle counts had just begun to rise. At this stage, turbidity had not always increased.

This period appeared to be a particularly vulnerable one for filter operation.

• Suboptimal coagulation also substantially reduced *Cryptosporidium* oocyst removals (again by an average of several log_{10} units), even at turbidity levels that were < 0.3 ntu.

• Under the conditions of this study, a hydraulic step (sudden increase in loading) had little effect on filter effluent oocyst concentrations, except in one out of the six experiments performed. These differing results occurred despite the fact that the same percentage increase in flow was always imposed. However, turbidity and particle counts did increase in some experiments. It was expected that the hydraulic step would have a greater effect on oocyst concentrations. The reasons for the observed variability are not currently understood. Therefore, hydraulic step effects should be investigated further.

• Compared with suboptimal coagulation or breakthrough, only minimal or moderate deterioration (0.5 log_{10} units or less) of *Cryptosporidium* removal was observed during filter ripening under the conditions of these experiments.

• Various surrogate parameters (i.e., turbidity, particle counts, and *B. subtilis* spores) provided only qualitative indications of the filters' ability to remove *C. parvum* oocysts under the various conditions tested. However, for a given plant or filter, increases in turbidity or particularly particle counts during a filter cycle or as a result of an operational event may signal substantial deterioration in *Cryptosporidium* removal capability. This was evident, for example, in the early breakthrough experiments at Ottawa.

On the basis of the findings of this study, the authors have also developed specific guidance for water providers.

• To avoid deterioration of pathogen removals attributable to suboptimal coagulation conditions, utilities should carefully consider the effects of reducing coagulant dosage. Utilities should not accept filter effluent turbidity levels of 0.2–0.3 ntu.

• To avoid breakthrough, plants should specify a maximum head loss and run time for washing filters and consider using particle counters to monitor for early breakthrough.

• Water providers need to minimize the effect of ripening. Strategies could include filter-to-waste, recycling filter effluent during ripening, storing filter effluent produced during ripening for backwash water (if facilities are available), or adding coagulants to backwash water or filter influent during ripening.

• To avoid the effect of a hydraulic step (sudden increase in loading), utilities should minimize the magnitude and rate of filter flow changes.

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FOOTNOTES

[1]Microsoft Excel 97, Version SR-2, Microsoft Corp., Redmond, Wash.
[2]Waterborne Inc., New Orleans, La.
[3]Petroff-Hausser Bacterial Counting Chamber, Hausser Scientific Corp., Horsham, Pa.
[4]CH Diagnostic & Consulting Services Inc., Loveland, Colo.
[5]ATCC 6051, obtained from American Type Culture Collection, Rockville, Md.
[6]66278, Pall Gelman Corp., Ann Arbor, Mich.
[7]Duke Scientific Corp., Palo Alto, Calif.
[8]At MWDSC, PCX particle counter, Met One, Grants Pass, Ore.; at Ottawa, IBR particle counter, IBR, Grass Lake, Mich.
[9]Hach 1720C, Hach Co., Loveland, Colo.
[10]Model 7997/201, ABB, Calgary, Alta.
[11]Hach 2100P, Hach Co., Loveland, Colo.

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BY MONICA B. EMELKO,
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AND IAN P. DOUGLAS

Pilot-scale studies were performed to evaluate *Cryptosporidium parvum* oocyst removal by a dual-media filter during optimized, end-of-run, and breakthrough operating conditions. Oocyst-sized polystyrene microspheres were also evaluated as surrogates for *C. parvum* removal by filtration. At optimal conditions, the pilot-scale filter consistently achieved ~5-log removal of *C. parvum* and microspheres. During end-of-run operation when filter effluent turbidity levels were <0.1 ntu, median oocyst removals deteriorated to ~3 log. During early (0.1–0.3 ntu) and late (>0.3 ntu) breakthrough, filtration oocyst removals deteriorated to ~2.1 and ~1.4 log, respectively. Microsphere removals by filtration were similar to oocyst removals during both stable and challenged operating periods, suggesting that microspheres are useful surrogates for investigating *C. parvum* removal.

Cryptosporidium and microsphere removal during late in-cycle filtration

Water samples are processed for *Cryptosporidium* analysis.

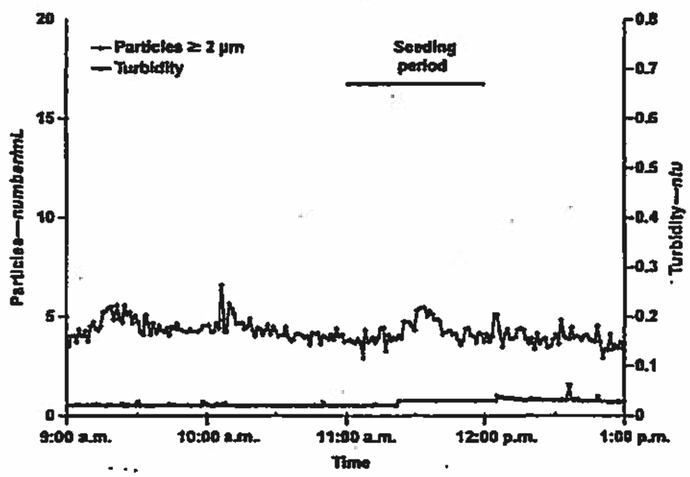
Several types of surrogates for viable *Cryptosporidium parvum* oocysts have been evaluated, including surrogates for occurrence, disinfection, and removal. Parameters that have been investigated as potential surrogates for cyst and oocyst removal by drinking water treatment processes have included turbidity, particle counts, heterotrophic plate counts, aerobic spores (typically *Bacillus subtilis*), ultraviolet absorbance at 254 nm, dissolved organic carbon, and polystyrene microspheres. Many of these parameters, such as turbidity and particle counts are reliable indicators of treatment performance, but they do not aid in quantitatively assessing oocyst removal by water treatment processes (Huck et al, 2002; Huck et al, 2001; Emelko, 2001; Hall et al, 1995; Nieminski & Ongerth, 1995; Ongerth & Pecoraro, 1995). Oocyst-sized fluorescent polystyrene microspheres have shown promise as surrogates for oocyst removal by filtration (Emelko et al, 1999; Swertfeger et al, 1999); however, further information is necessary to determine the range of conditions during which microsphere removal is a reliable surrogate for oocyst removal.

Filtration is an inherently dynamic process. Several studies have indicated that *C. parvum* removal by filtration deteriorates during vulnerable periods of operation such as suboptimal coagulation (Huck et al, 2002; Huck et al, 2001; Emelko et al, 1999; Patania et al, 1995). The Interim Enhanced Surface Water Treatment Rule (IESWTR) requires that combined filter effluent turbidity must be ≤0.3 ntu in at least 95% of the measurements taken each month (USEPA, 1998). The Long-term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) may offer 0.5-log credit for treatment systems that maintain 95th percentile combined filter effluent turbidity levels <0.15 ntu (USEPA, 2000). Limited infor-

TABLE 1 Summary of experimental conditions

Experimental Condition	Description
Stable operation	Period of consistent filter effluent turbidity, <30 h of filter operation, filter effluent turbidity levels: ~0.05 ntu consistently
End-of-run	Period at the end of a filter cycle during which subtle changes in filter effluent turbidity are noticed, filter effluent turbidity levels: <0.1–0.1 ntu
Early breakthrough	Period at the end of a filter cycle during which increasing filter effluent turbidity levels are observed, filter effluent turbidity levels: 0.1–0.3 ntu
Late breakthrough	Period at the end of a filter cycle during which increasing filter effluent turbidity levels are observed, filter effluent turbidity levels: >0.3 ntu

FIGURE 1 Filter effluent turbidity and particle concentration ≥2 µm during a stable filter operation experiment



(Patania et al, 1995). These data suggested that increased *C. parvum* passage could also be expected during breakthrough, especially at filter effluent turbidity levels exceeding 0.2 ntu.

Pilot-scale investigations of *C. parvum* removal by filtration during turbidity breakthrough when filter effluent turbidity levels increased from 0.1 to 0.2 ntu or higher did not yield substantial differences between oocyst removals during stable operation and breakthrough (Patania et al, 1995). In replicate experiments, oocysts were detected in almost all of the samples collected during the stable operation and breakthrough experiments at the particular pilot plant where turbidity breakthrough was investigated (Patania et al, 1995). Similar results were obtained during two full-scale investigations, which showed little, if any, deterioration in oocyst removals during filter breakthrough at either of the plants investigated (Baudin & Lainé, 1998). Those authors indicated that oocyst removal during breakthrough at both plants depended on the filtration rate. Fluctuating filter influent oocyst concentrations during the stable operation experiment, unspecified filter effluent turbidity levels during the breakthrough experiments, and insufficient oocyst recovery information made it difficult to draw inferences from the oocyst removal data collected during these breakthrough and stable operation experiments (Baudin & Lainé, 1998).

mation is available regarding pathogen passage through filters during end-of-run and early breakthrough filtration when filter effluent turbidity levels are increasing but remain <0.15 and 0.3 ntu, respectively (as specified by the LT2ESWTR and IESWTR, respectively).

One study demonstrated that turbidity breakthrough at the end of a filter cycle (when filter effluent turbidity was >0.4 ntu) can be accompanied by considerable passage of *Giardia* cysts through a filter (Logsdon et al, 1981). A considerable increase in cyst passage was observed during early breakthrough conditions when filter effluent turbidity was just >0.2 ntu (Logsdon et al, 1981). Another study also investigated *Giardia* passage through filters during breakthrough when effluent turbidity levels increased from 0.1 to 0.2 ntu or higher. Those researchers found that *Giardia* removal was ~0.5 log lower during breakthrough than during stable operation

The removal of *C. parvum* oocysts and oocyst-sized fluorescent polystyrene microspheres during end-of-run, early breakthrough, and late breakthrough filtration (as defined in Table 1) relative to optimized filtration was investigated during the research reported in this article. The stable experiments were performed to determine the maximum removals that could be obtained by pilot-scale filtration under optimal conditions (filter effluent turbidity levels consistently ~0.05 ntu). They also provided a baseline against which the other operating conditions were compared. Included in these baseline data are *C. parvum* removal data from stable operation experiments that are reported elsewhere (Huck et al, 2002; Huck et al, 2001). End-of-run operation describes the period from which subtle changes in the baseline filter effluent turbidity (~0.05 ntu) and particle counts were noticed and filter effluent turbidity increased to ~0.1 ntu. The next part of the filter cycle was early breakthrough filtration during the period when filter effluent turbidity levels were increasing from ~0.1 to ~0.3 ntu. The last investigated portion of the filter cycle was late breakthrough, during which filter effluent turbidity levels continued to increase from ~0.3 ntu. With the exception of late breakthrough, all of the experimental conditions occurred during periods of filter operation that were in compliance with the IESWTR. The current research is from a study (Emelko, 2001) focused on defining oocyst removals by filtration during vulnerable periods and relating them to removals during optimal treatment.

MATERIALS AND METHODS

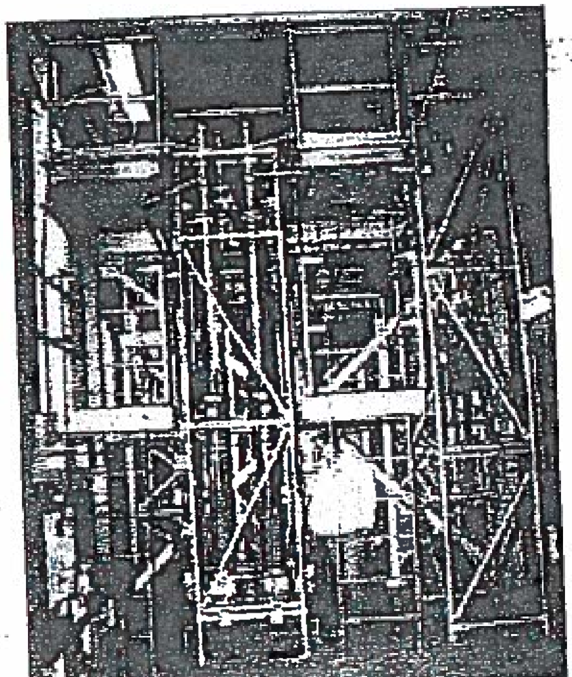
Pilot-scale investigations were performed at the Britannia Pilot Plant in Ottawa, Ont. The pilot plant was conventionally operated with in-line coagulant injection, three-stage mechanical flocculation (velocity gradient [G] of 60, 40, and 20 s^{-1} in stages 1, 2, and 3, respectively), and plate settling. The raw water was from the Ottawa River and required a relatively high coagulant dose (~40 mg/L alum and 2 mg/L activated silica) for combined total organic carbon (5–7 mg/L) and particle removal (~3 ntu, ~5,000 particles ≥2μm/mL). Chlorine (2 mg/L) was added at rapid mix as a preoxidant.

One of the pilot-scale, dual-media filters of 152 mm (6 in.) diameter was seeded with jar-coagulated suspensions of 10^8 formalin-inactivated *C. parvum* oocysts and 10^8 carboxylated polystyrene microspheres. The filter contained media depths and sizes typical of many existing treatment plants. The design included 457 mm (18 in.) of anthracite (effective size [ES] = 1.07 mm [0.042 in.], uniformity coefficient [UC] = 1.35) and 279 mm (11 in.) of sand (ES = 0.515 mm [0.02 in.], UC = 1.32). The filter was operated in a constant rate mode at 6.6 m/h (2.7 gpm/sq ft). The backwashing regime consisted of chlorinated water and air-scour applied in a collapse-pulsing mode (Amitharajah et al, 1991).

The optimized coagulation conditions were selected to meet the 0.1-ntu turbidity goal of the Partnership for Safe Water, a voluntary treatment optimization program sponsored by the US Environmental Protection Agency and AWWA. The nonoptimal conditions targeted turbidity levels at the upper range of compliance with the IESWTR requirements of 0.3 ntu. The pilot-scale studies were performed to evaluate the oocyst removal capacity of a dual-media filter during optimized (period of consistent filter effluent turbidity of ~0.05 ntu), end-of-run (period at the end of filter cycle during which filter effluent turbidity increases from <0.1 to 0.1 ntu), early turbidity and particle breakthrough (period at the end of filter cycle during which filter effluent turbidity increases from 0.1 to 0.3 ntu), and late turbidity and particle breakthrough (period at the end of filter cycle during which filter effluent turbidity is >0.3 ntu) operation.

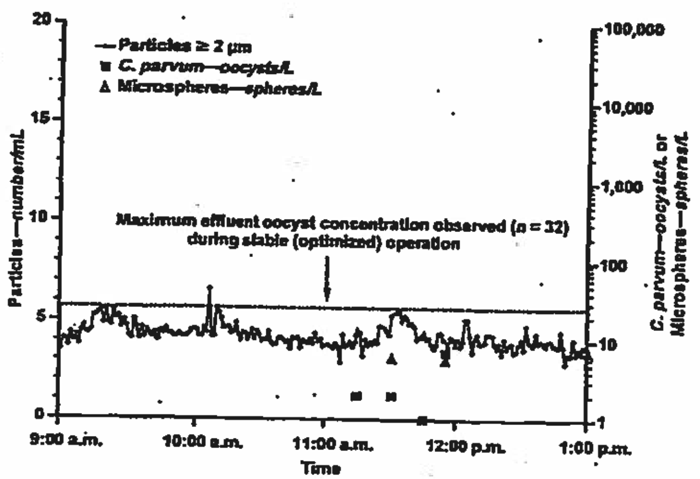
Seeding protocol. Both formalin-inactivated oocysts (mean concentration of 6.5×10^5 oocysts/L at filter influent) and oocyst-sized fluorescent polystyrene microspheres (mean concentration of 6.1×10^5 microspheres/L at filter influent, 4.675-μm diameter[1]), were jar-coagulated in a 2-L beaker. The coagulant dosages and rapid-mixing/flocculation times (1.2 s/30 min) were the same as those used in the pilot plant. The microspheres and oocysts were jar-coagulated in the same container and were therefore concurrently added to the filter influent. A peristaltic pump[2] was used to add the feedstock to the pilot-plant filter influent water. The seed suspensions were introduced into the filter influent water ~75 cm (2.5 ft) above the filter media. To facilitate filter influent sampling while minimizing losses to the sampling device, a second peristaltic pump[2] was continuously operated to recirculate filter influent water from ~5 cm (2 in.) above the surface of the filter media to the top of the water column within the filter.

Sample collection. Samples for microorganism and microsphere analyses were collected at the filter influent and effluent locations. The filter influent location was 5 cm (2 in.) above the surface of the filter media; the effluent was collected at the column exit immediately after passage through the support gravel (upstream of the turbidimeter and particle counter). Prior to the seeding experiments, 1-L negative controls were collected at the filter influent and effluent locations. The influent and effluent samples were collected in 250-mL and 1-L glass bottles, respectively. All sampling containers were washed, auto-



The pilot-scale investigations in this study were performed at a pilot plant that was conventionally operated with in-line coagulant injection, three-stage mechanical flocculation, and plate settling.

FIGURE 2 Filter effluent particle (≥2 µm), *C. parvum*, and microsphere concentrations during a stable filter operation experiment



claved, and rinsed with a buffered detergent solution (1× phosphate-buffered saline [PBS] with final concentrations of 0.1% sodium dodecyl sulfate, 0.1% polyoxyethylene sorbitan monooleate,[3] and 0.01% silicone polymer foam depressor,[4] and final pH of 7.4) prior to use.

The pilot-scale experiments evaluating optimal operation were performed during the early to mid-portion of the filter cycle after at least 4 h of filter operation. The end-of-run, early breakthrough, and late breakthrough experiments were conducted after periods of stable operation during which filter effluent turbidity levels were continuously <0.1 ntu. Filter influent and effluent samples were collected at 15, 30, 45, and 55 min after the start of seeding.

***C. parvum* analysis.** The *C. parvum* oocysts used during the seeding experiments were obtained from a commercial laboratory,[5] were bovine in origin, and were provided in a clean, purified form. For each experiment, 10^8 oocysts were obtained. They were inactivated with 5% formalin (final concentration) in 1× PBS with 0.01% polyoxyethylene sorbitan monolaureate[3] to prevent oocyst clumping. All microorganism stocks were refrigerated at 4°C in the dark until use.

Prior to *C. parvum* seeding, the stock suspension was vortexed, and a small portion of the suspension (<100 µL total) was removed to enumerate the oocyst concentration. The stock concentration was determined by averaging triplicate counts with a hemocytometer[6] and light microscopy.[7] The entire grid (1 mm² [0.001 sq in.]) was used for oocyst enumeration.

C. parvum oocysts were measured in the feedstock suspensions and the filter influent and effluent samples. Filter influents were analyzed in 10-, 5-, and 2.5-mL volumes. Filter effluents were analyzed in volumes ranging from 5 mL to 1 L, depending on the operating condition studied. Sample volumes were chosen to yield between 10 and 2,000 oocysts.

All of the samples were filtered through 25-mm, 0.40-µm polycarbonate membranes.[8] The filter membranes were placed on top of 25-mm, 8.0-µm nitrocellulose support membranes[9] placed on a manifold[10] and maintained at a vacuum of 125 mm (5 in.) of mercury. Weights held the membranes in place. Two millilitres of 1% bovine serum albumen (BSA) were passed through the filter membranes. Samples were then directly filtered on the manifold. The glassware that had contained the samples was then rinsed with the buffered detergent solution. The detergent rinse was followed by an additional 2 mL of BSA that was also filtered through the membranes; this was followed by a standard immunofluorescence assay.[11] If necessary, the membranes were kept wet with 1× PBS and covered until sample mounting on slides. Presumptive microscopic analysis for *C. parvum* enumeration was performed at 400× magnification at the University of Waterloo.[7] Recovery data from the filter influent and effluent water matrixes yielded a mean oocyst recovery of 75% and a relative standard deviation of 16%.

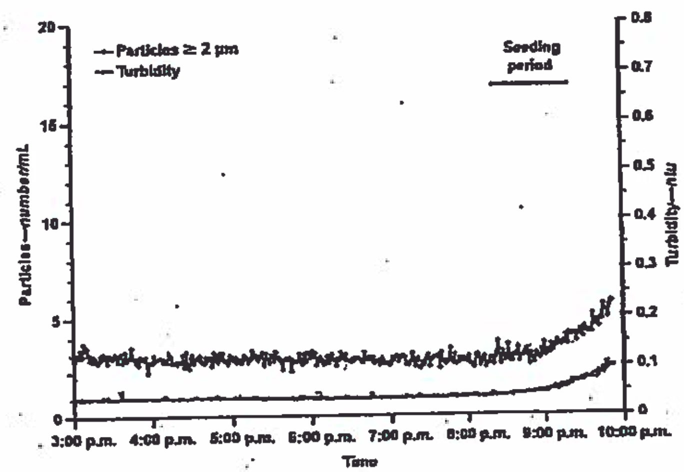
Microsphere analysis. Oocyst-sized fluorescent polystyrene microspheres[1] were used as nonbiological surrogate indicators for *C. parvum* removal. The microspheres had an average diameter of 4.675 ± 0.208 µm and a density of 1.045 g/mL. The dye is a proprietary chemical that is hydrophobic (to prevent dye leaching from the particles into the aqueous phase) and has maximum excitation at 458 nm and maximum emission at 540 nm, similar to fluorescein isothiocyanate (FITC), which is used for *C. parvum* analysis. Material provided by the manufacturer indicated that the microspheres did not contain any hazardous components.

The manufacturer provided the polystyrene microspheres in suspensions of 2.5% aqueous solids in deionized water. Neither biocides nor stabilizers were added to the suspensions. The microspheres were stored at 4°C until use. The weight-to-volume packaging allowed for the calculation of the particle concentration by a method provided by the manufacturer. The concentration of a stock suspension of 4.675-µm microspheres was 4.5 × 10^8 spheres/mL.

Microspheres were concentrated and enumerated by the same filtration method used for *C. parvum* (described earlier). The microspheres were readily distinguishable from the FITC-stained oocysts. Although they were approximately the same diameter, the microspheres appeared larger than the oocysts because of the halo effect associated with the strong intensity of the dye, which permitted for microsphere enumeration at 100x magnification. Microspheres were enumerated concurrently with *C. parvum* oocysts at 400x magnification (FITC-stained oocysts did not fluoresce with enough intensity for enumeration at 100x magnification). Experiments previously reported (Emelko et al, 1999) indicated >90% recovery of microspheres using the concentration and enumeration method described earlier. It is hypothesized that the >90% recoveries originally reported (from seven replicate samples in a recovery study) were due to retention of microspheres on the micropipette tip used to dose the suspension for the recovery study. Given the very small volumes of stock microsphere suspensions (<200 µL) necessary for the seeding investigations, small droplets of the stock suspensions could affect recovery study outcomes. During the current investigation, three recovery experiments each included five high-microsphere concentrations (typical of filter influent samples) and 10 low-microsphere concentrations (typical of filter effluents) for a total of 45 samples. Although the microsphere recovery data demonstrated slightly higher variation than oocyst recovery data, mean microsphere recoveries were 75%.

Particle counts and turbidity. A standard protocol was used to verify the calibration of the particle counters using commercially available, calibrated, monodisperse polymer microspheres.[12] Each particle-counting instrument was calibrated by the manufacturer. The particle counters[13] measured total particles from 2 to 150 µm, with the data reported as total particles ≥2 µm. Turbidity was monitored at plant and filter influent and filter effluent locations using online turbidimeters[14] that were calibrated using dilute formazin solutions. An additional turbidimeter[15] was also used at the filter effluent location.

FIGURE 3 Filter effluent turbidity and particle concentration ≥2 µm during an end-of-run experiment



RESULTS

One experiment evaluating stable (i.e., optimized) filtration conditions was performed; it included concurrent seeding of polystyrene microspheres and *C. parvum*. Two experiments investigated end-of-run operation, three investigated early breakthrough filtration, and two were performed during late breakthrough filtration. These results are discussed together with seven additional stable operation experiments that were performed without polystyrene microspheres and from which *C. parvum* removals were reported elsewhere (Huck et al, 2002; Huck et al, 2001).

As shown in Figure 1, filter effluent turbidity and particle concentrations ≥2µm were consistently low (~0.04 ntu and <6 particles/mL, respectively) during the stable operation experiment investigating oocyst and microsphere removals; this type of performance was observed during all of the stable operation experiments. The stable experiments were performed to determine the best removals that could be obtained under optimal conditions at the Ottawa pilot plant; they also provided a baseline against which the other operating conditions were compared. Eight experiments (32 samples) of *C. parvum* removal are discussed; as indicated previously, one of these experiments (four samples) also investigated microsphere removal.

C. parvum removals by the pilot filter during stable (optimized) operation ranged from 4.7 to 5.8 log, with a median oocyst removal of 5.6 log (32 paired samples). Filter effluent particle (≥2µm), oocyst, and microsphere concentrations during the stable operation experiment are provided in Figure 2. Microsphere removals during stable operation ranged from 4.7 to 5.1 log, with a median microsphere removal of 4.9 log. The filter influent oocyst and microsphere concentrations during the stable operation experiment were similar, 4.6×10^5 oocysts/L and 6.5×10^5 microspheres/L on average. Overall, *C. parvum* concentrations in the filter effluent were typically <10 oocysts/L during stable operation, with several nondetects during the experiments performed with oocysts only.

Two experiments (eight samples total) investigating *C. parvum* and microsphere removal during end-of-run filtration were performed. The filter effluent turbidity and particle concentration ≥2 µm during an end-of-run experiment are provided in Figure 3. The filter effluent turbidity was low (~0.04 ntu) at the start of these experiments, increased to 0.13 ntu by the end of the seeding period in the first experiment, and was 0.06 ntu at the end of the second experiment.

FIGURE 4 Filter effluent particle (≥2 µm), *C. parvum*, and microsphere concentrations during an end-of-run experiment

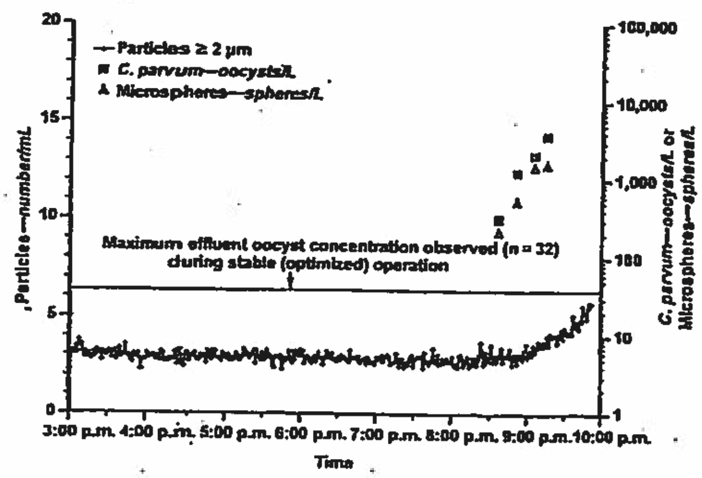
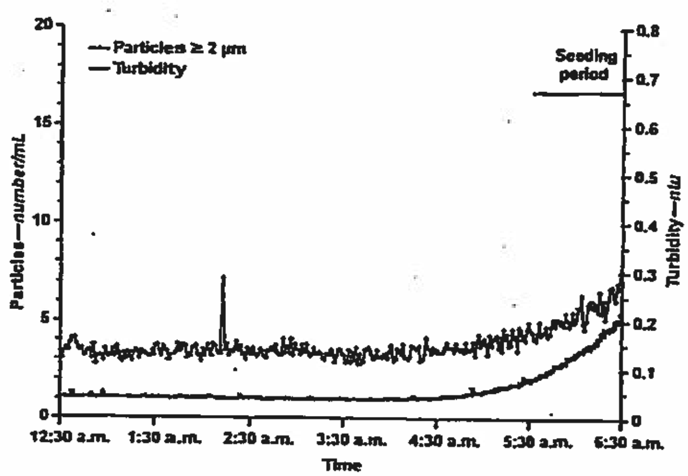


FIGURE 5 Filter effluent turbidity and particle concentration ≥2 µm during an early breakthrough experiment



Although the filter effluent turbidity levels and particle concentrations increased only slightly during the end-of-run experiments, they were accompanied by considerably elevated filter effluent *C. parvum* and microsphere concentrations relative to those obtained during stable operation. Filter effluent particle (≥2 µm), oocyst, and microsphere concentrations during an end-of-run experiment are given in Figure 4. *C. parvum* removals by the pilot filter during end-of-run filtration ranged from 1.8 to 3.3 log, with a median oocyst removal of 2.4 log (eight samples). Microsphere removals during end-of-run ranged from 1.8 to 3.1 log, with a median microsphere removal of 2.4 log. The filter influent oocyst and microsphere concentrations during the end-of-run experiments were similar, with mean concentrations of 6.8×10^5 oocysts/L and 5.6×10^5 microspheres/L. Both *C. parvum* and microspheres were found in all of the filter effluent samples during the end-of-run experiments.

Three experiments (12 samples) investigating *C. parvum* and microsphere removal during early breakthrough were performed; the seeding period and filter effluent turbidity and particle concentrations ≥2µm during one of these experiments are provided in Figure 5. The filter effluent turbidity was low (0.04–0.08 ntu) at the start of these experiments and increased to ~0.2 ntu by the end of the experiments. The increased filter effluent turbidity levels and particle concentrations during early breakthrough at Ottawa were also accompanied by increased filter effluent *C. parvum* and microsphere concentrations relative to those obtained during stable operation.

Typical filter effluent oocyst and microsphere data for an early breakthrough experiment are given in Figure 6. *C. parvum* removals by the pilot filter ranged from 1.7 to 2.8 log during early breakthrough, with a median oocyst removal of 2.1 log (12 samples). Microsphere removals during early breakthrough also ranged from 1.7 to 2.8 log, with a median microsphere removal of 2.1 log. The filter influent oocyst and microsphere concentrations during the early breakthrough experiment were similar, with mean concentrations of 6.6×10^5 oocysts/L and 5.7×10^5 microspheres/L. Both *C. parvum* and microspheres were found in all the filter effluent samples collected during the early breakthrough experiments.

The seeding period and filter effluent turbidity, and oocyst and microsphere concentrations during one of the late breakthrough experiments are shown in Figure 7. Two experiments (eight samples) investigating *C. parvum* and microsphere removal during late breakthrough were performed. The filter effluent turbidity was consistently 0.25–0.3 ntu at the start of these experiments. The elevated filter effluent turbidity levels during late breakthrough were accompanied by high filter effluent *C. parvum* and microsphere concentrations relative to those obtained during the stable operation experiments. *C. parvum* removals by the pilot filter during the late breakthrough experiments ranged from 1.3 to 1.8 log, with a median oocyst removal of 1.4 log (eight samples). Microsphere removals during late breakthrough ranged from 1.3 to 2.0 log, with a median microsphere removal of 1.5 log. The filter influent oocyst and microsphere concentrations during these experiments were similar, with mean concentrations of 6.9×10^5 oocysts/L and 6.8×10^5 microspheres/L. Both *C. parvum* and microspheres were found in all of the filter effluent samples during the late breakthrough experiments.

The *C. parvum* and polystyrene microsphere removal data are summarized in a box-and-whisker plot (Figure 8). These data clearly indicate a substantial deterioration in both oocyst and microsphere removals during end-of-run, early breakthrough, and late breakthrough filtration; moreover, overall oocyst and microsphere removals generally continued to decrease as filter effluent turbidity levels and particle concentrations increased during these successive operating periods.

The box-and-whisker plot also indicates a relatively good correlation between *C. parvum* oocyst and polystyrene microsphere removals during the variety of operating conditions investigated (Figure 8). The relationship between oocyst and microsphere removals by the pilot filter was highly linear, as indicated in Figure 9, with a coefficient of determination (R^2) of 0.96. There are considerably fewer data points in the >4-log removal range that corresponds to the stable operation investigations. Although the data in Figure 9 clearly indicate a linear relationship between *C. parvum* and oocyst-sized microsphere removals in the 1.0–3.5-log removal range, more data are necessary to confidently extend this relationship into the 3.5–5.5-log removal range. Although the stable operation oocyst and microsphere removals were not as similar as those obtained during the other operating conditions, the data in Figure 8 and Figure 9 suggest that polystyrene microsphere removals were good and often conservative indicators of *C. parvum* removals by filtration. Further investigations are necessary to determine whether this relationship holds during stable operation and other nonoptimal operating periods such as suboptimal coagulation.

FIGURE 6 Filter effluent particle (≥2 µm), *C. parvum*, and microsphere concentrations during an early breakthrough experiment

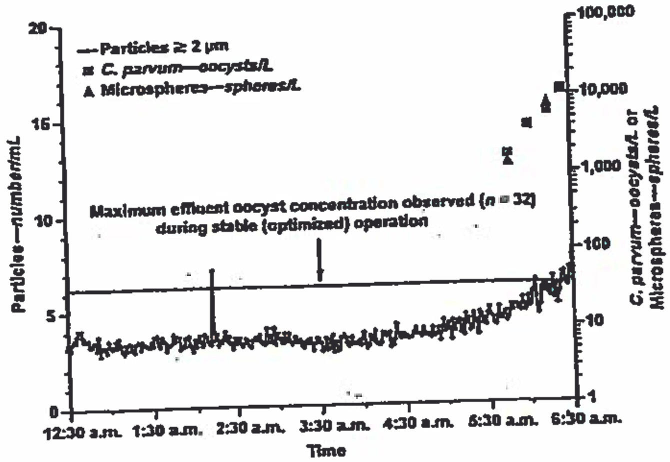
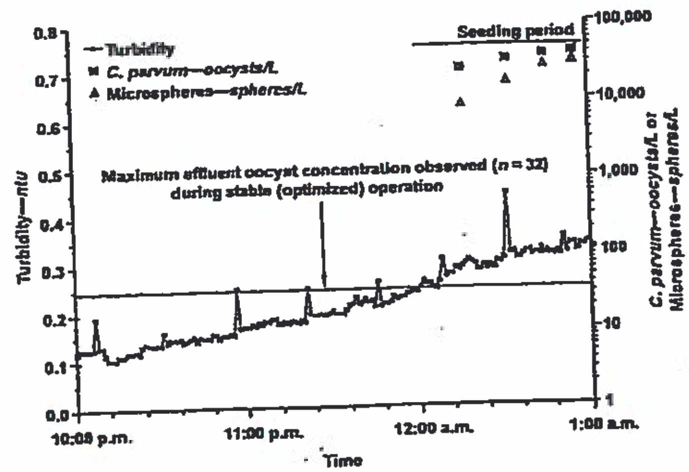


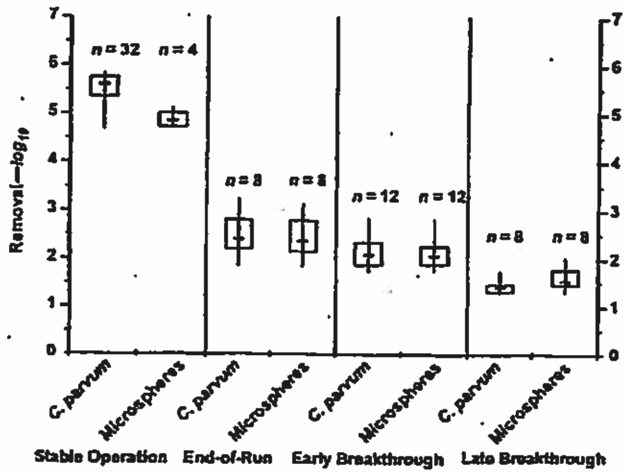
FIGURE 7 Filter effluent turbidity, seeding period, *C. parvum*, and microsphere concentrations during a late breakthrough experiment



DISCUSSON

Considerable deterioration in *C. parvum* and polystyrene microsphere removal during end-of-run filtration when filter effluent turbidity levels were increasing but still <0.1 ntu was not expected given other data that have been provided in the literature (Baudin and Lainé, 1998; Patania et al, 1995). Nonetheless, the data collected dur-

FIGURE 8 Box-and-whisker plot of *C. parvum* and microsphere removal by the pilot-scale dual-media filter



n—number of influent/effluent paired samples

ing this research indicated that end-of-run, early breakthrough, and late breakthrough filtration all represent operating periods during which *C. parvum* removals can be substantially compromised relative to those obtained during optimized filtration (Figure 8). This result is in agreement with the late breakthrough filtration performance deterioration reported by Huck et al (2002; 2001). In the current investigation, the pilot-scale dual-media filter consistently achieved ~5-log removal of *C. parvum* oocysts during stable (optimized) filtration; similar levels of oocyst-sized polystyrene microspheres were observed during stable operation. During end-of-run operation when filter effluent turbidity levels demonstrated the first signs of increasing (but still were <0.1 ntu), *C. parvum* removal deteriorated to ~3 log. Oocyst and microsphere removals decreased to even lower levels during early breakthrough and late breakthrough filtration. The deterioration in removals of incoming *C. parvum* and oocyst-sized microspheres during end-of-run and breakthrough filter operation relative to stable operation is quite obvious in Figure 8. A relative deterioration between removals during end-of-run and early or late breakthrough is less obvious. More experimentation would help to elucidate whether these differences are significant.

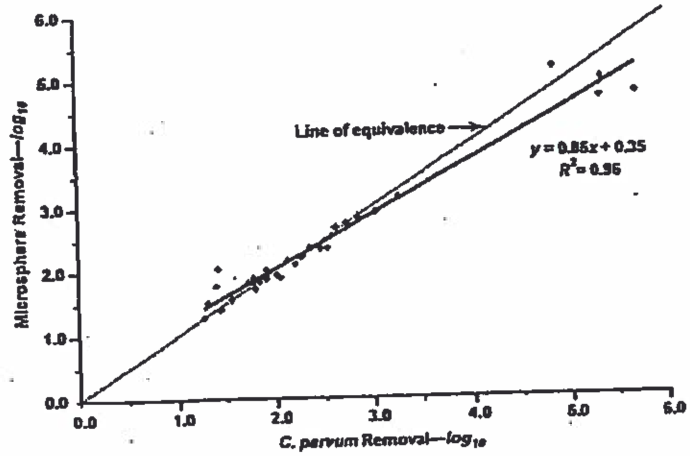
The high *C. parvum* and microsphere concentrations that were found in the filter effluents even after only 15 min of seeding suggested that the passage of oocysts through the filter during the end-of-run, early breakthrough, and late breakthrough filtration periods is largely a function of nonattachment rather than of detachment. This conclusion, though far from incontrovertible, is in general agreement with other studies that suggest nonattachment is an important mechanism of particle passage through filters during breakthrough operation (Moran et al, 1993; Ginn et al, 1992). The current experiments, however, were designed to assess the removals of microorganisms that were introduced to the filter from the influent water late in the filter cycle. The experiments were not designed to investigate detachment during end-of-run and breakthrough filtration.

The end-of-run and early breakthrough filtration data clearly indicated a substantial deterioration in *C. parvum* removal by filtration during operating conditions that were in compliance with the 0.3-ntu filter effluent turbidity requirement of the IESWTR. From an operational perspective, these data might challenge the appropriateness of an upper turbidity limit of 0.3 ntu for all points in the filter cycle. This work suggests merit in placing filters out of service at an earlier point in the filter cycle (perhaps when effluent turbidity levels are still <0.1 ntu) to ensure maximum pathogen removal. An important question not answered by the current investigation is when the deterioration in *C. parvum* removal (relative to stable operation) "begins" during a filter cycle. Is it an ongoing, slow deterioration, or does it happen somewhat abruptly toward the end of a filter cycle? An equally important, related question is whether filter effluent turbidity and particle concentration measurements indicate when this deterioration in *C. parvum* removal commences.

The substantial reduction in *C. parvum* removal during the end-of-run and breakthrough experiments relative to the optimized filtration experiments should be considered in the context of the experimental conditions. Because filter influent *C. parvum* concentrations are not typically in the range of the 10^5 oocysts/L used during these experiments, the removal data collected during this investigation should not be used to quantitatively predict differences in oocyst removals at various points in the filter cycle in full-scale plants. However, they do indicate the potential for substantial deterioration in the removal of incoming *C. parvum* oocysts as early as the end-of-run period.

The largest deterioration in oocyst and microsphere removals was expected during the later portions of the filter cycle when filter effluent turbidity levels were high (~0.3 ntu). The early and late breakthrough findings were in general agreement with the findings of other researchers that showed that turbidity breakthrough at the end of a filter cycle could be accompanied by considerable passage of *Giardia* cysts (Logsdon et al, 1981). The early breakthrough results, however, were different from those obtained during other investigations of *Giardia* and *C. parvum* passage through filters during breakthrough when effluent turbidity levels increased from 0.1 to 0.2 ntu or higher. Patania et al (1995) found that although *Giardia* removal was ~0.5 log lower during breakthrough relative to stable operation, no difference between *C. parvum* removals during stable operation and breakthrough was observed. It is possible that other factors such as chemical pretreatment, which has been demonstrated as critical for optimizing *C. parvum* removal by filtration (Huck et al, 2002; Huck et al, 2001; Patania et al, 1995), may affect the degree of pathogen passage that occurs during early breakthrough filtration.

FIGURE 9 Relationship between *C. parvum* and microsphere removal by the pilot-scale dual-media filter



Commensurate with the findings of several other studies (Nieminski & Ongerth, 1995; Patania et al, 1995), the elevated filter effluent *C. parvum* concentrations during operation late in the filter cycle (i.e., end-of-run, early breakthrough, and late breakthrough) were generally associated with increasing filter effluent total particle counts ≥2 µm and turbidity. This relationship does not hold for all operating conditions, however. As well, the current investigation supported the general conclusions of previous studies that suggested that oocyst-sized polystyrene microsphere removals may be good surrogates for *C. parvum* removal by filtration (Emelko et al, 1999; Swertfeger et al, 1999). A good linear relationship between oocyst and microsphere removals by filtration was provided in Figure 9. From this figure, it is clear that the relationship between oocyst and microsphere removals by filtration is weakest at the highest removals that occurred during stable (optimized) filtration. Only limited *C. parvum* and microsphere data in the 3.5–5.5-log removal range were available. Only one stable operation experiment could be performed with microspheres and should be repeated to better discern whether this apparent deviation from an otherwise highly linear relationship is due to experimental drift. The slightly more variable microsphere recovery also might have affected these results.

As has been discussed previously, the microsphere findings are particularly important because no reliable surrogates for the removal of *C. parvum* during water treatment exist at this time. The microspheres offer several advantages for use over oocysts in treatment process evaluations such as those reported in this study. The microspheres cost substantially less than oocysts, do not require antibody staining, do not pose the public health threats of *C. parvum* (although they could not necessarily be introduced into full-scale plants), are resilient during treatment, and may possibly lend themselves to automated enumeration. As shown earlier, the microspheres also appear to be removed at levels that are comparable to oocyst removals (or slightly lower in the case of stable operation), thereby suggesting that they are generally conservative surrogates that can be used for investigating *C. parvum* removals in treatment process evaluations.

CONCLUSIONS

1. Microsphere removals by filtration were comparable to oocyst removals during both stable and challenged operating periods, suggesting that microspheres may be useful surrogates for investigating *C. parvum* removal.

2. At optimal conditions, the pilot-scale filter consistently achieved >4.5-log removal of *C. parvum* and microspheres. These results were similar to previously reported *C. parvum* removal data (Huck et al, 2002; Huck et al, 2001).

3. During end-of-run operation when filter effluent turbidity levels were <0.1 ntu, median oocyst removals deteriorated to ~3 log.

4. Relative to stable operation, substantial deterioration in *C. parvum* removal can occur during early (operating conditions that were in compliance with the 0.3-ntu filter effluent turbidity requirement of the IESWTR) and late breakthrough filtration. During these periods, observed oocyst removals were 2.1 and 1.4 log, respectively. The early breakthrough data demonstrated that oocyst removals of <2 log could be obtained when in compliance with the 0.3-ntu filter effluent turbidity requirement of the IESWTR. These findings suggested that placing filters out of service prior to reaching a 0.3-ntu (or even lower) filter effluent turbidity is one opera-

tional strategy for maximizing *C. parvum* and potentially other pathogen removal by filtration.

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FOOTNOTES

[1]Fluoresbrite™ carboxylated YG microspheres, Polysciences Inc., Warrington, Pa.

[2]Masterflex Standard Drive and Easy Load II Pump Head With PharMed™ Precision Tubing, Labcor, Concord, Ont.

[3]Tween 80, Tween 20, J.T. Baker Chemical Co., Philadelphia, Pa.

[4]Sigma Antifoam A, Sigma-Aldrich Corp., St. Louis, Mo.

[5]University of Arizona, Dept. of Veterinary Science, Tucson, Ariz.

[6]Petroff-Hausser Bacterial Counting Chamber, Hausser Scientific Corp., Horsham, Pa.

[7]Zeiss Axioskop 2, Empix Imaging, Mississauga, Ont.

[8]Nuclepore Polycarbonate Membranes, Corning, Acton, Mass.

[9]MF Millipore Membrane Filters, Millipore Canada Ltd., Nepean, Ont.

[10]320 NM Filter Assembly, Hoefer Scientific, San Francisco, Calif.

[11]Hydrofluor™ Combo *Cryptosporidium* and *Giardia* kit, Strategic Diagnostics, Newark, Del.

[12]Duke Scientific Corp., Palo Alto, Calif.

[13]IBR Water Particle Counting System Model PWCSD, Inter Basic Resources Inc., Grass Lake, Mich.

[14]Hach Model 1720C, Hach Co., Loveland, Colo.

[15]ABB Model 7997/201, ABB, Calgary, Alta.

[16]To whom correspondence should be addressed

If you have a comment about this article, please contact us at journal@awwa.org.

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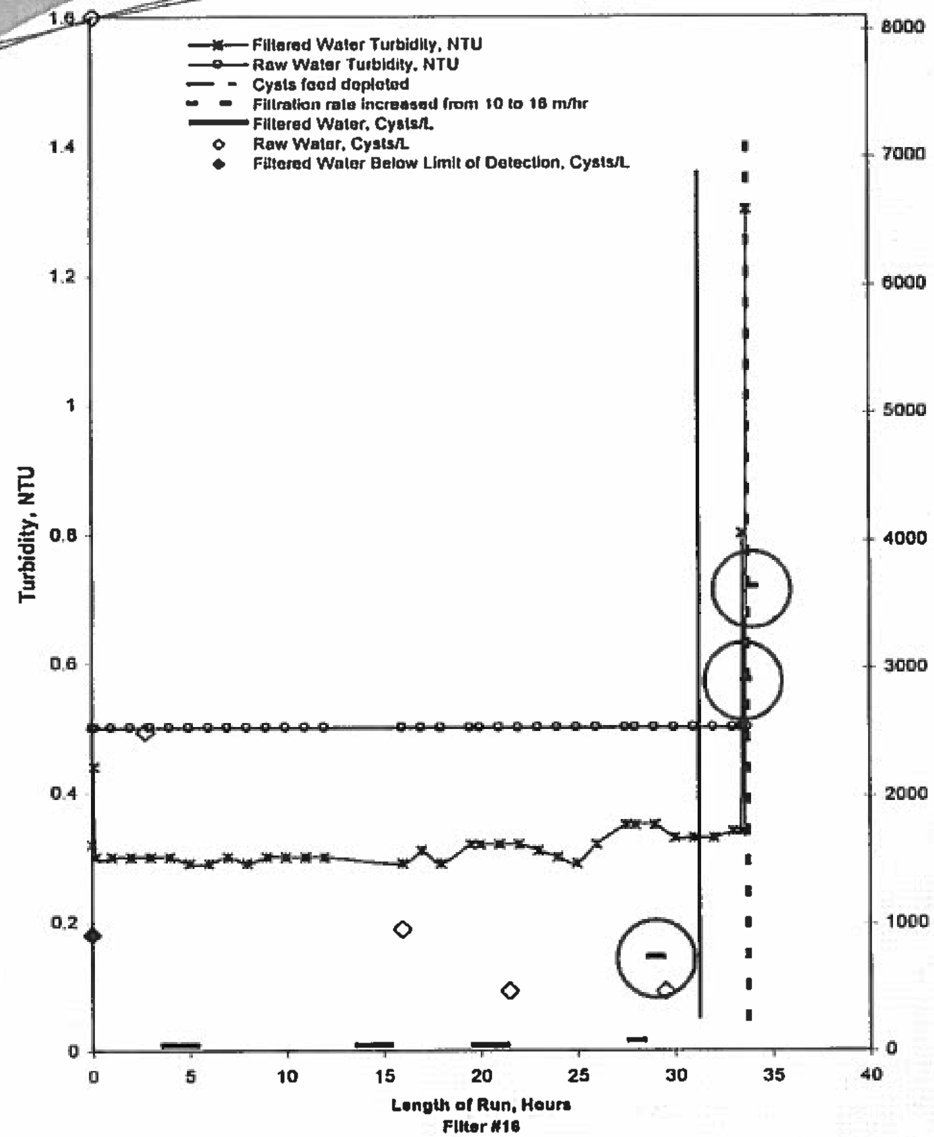


Turbidity breakthrough at the end of a filter run discharges cysts stored during the entire run. (Source: "Filter Operations and Maintenance Guidance Manual" [2002] adapted from Logsden et. al. 1981)

7. IMPORTANCE OF TURBIDITY

7.1 Overview

Section 2 of this guidance manual is included to present an overview on the definition and sources of turbidity. Understanding turbidity, its causes and sources, and the significance to human health will provide the background on which the new turbidity standards are based.

7.2 Turbidity: Definition, Causes, and History as a Water Quality Parameter

Turbidity is a principal physical characteristic of water and is an expression of the optical property that causes light to be scattered and absorbed by particles and molecules rather than transmitted in straight lines through a water sample. It is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microscopic organisms. Typical sources of turbidity in drinking water include the following (see Figure 7-1):

- Waste discharges;
- Runoff from watersheds, especially those that are disturbed or eroding;
- Algae or aquatic weeds and products of their breakdown in water reservoirs, rivers, or lakes;
- Humic acids and other organic compounds resulting from decay of plants, leaves, etc. in water sources; and
- High iron concentrations which give waters a rust-red coloration (mainly in ground water and ground water under the direct influence of surface water).
- Air bubbles and particles from the treatment process (e.g., hydroxides, lime softening)

Simply stated, turbidity is the measure of relative clarity of a liquid. Clarity is important when producing drinking water for human consumption and in many manufacturing uses. Once considered as a mostly aesthetic characteristic of drinking water, significant evidence exists that controlling turbidity is a competent safeguard against pathogens in drinking water.

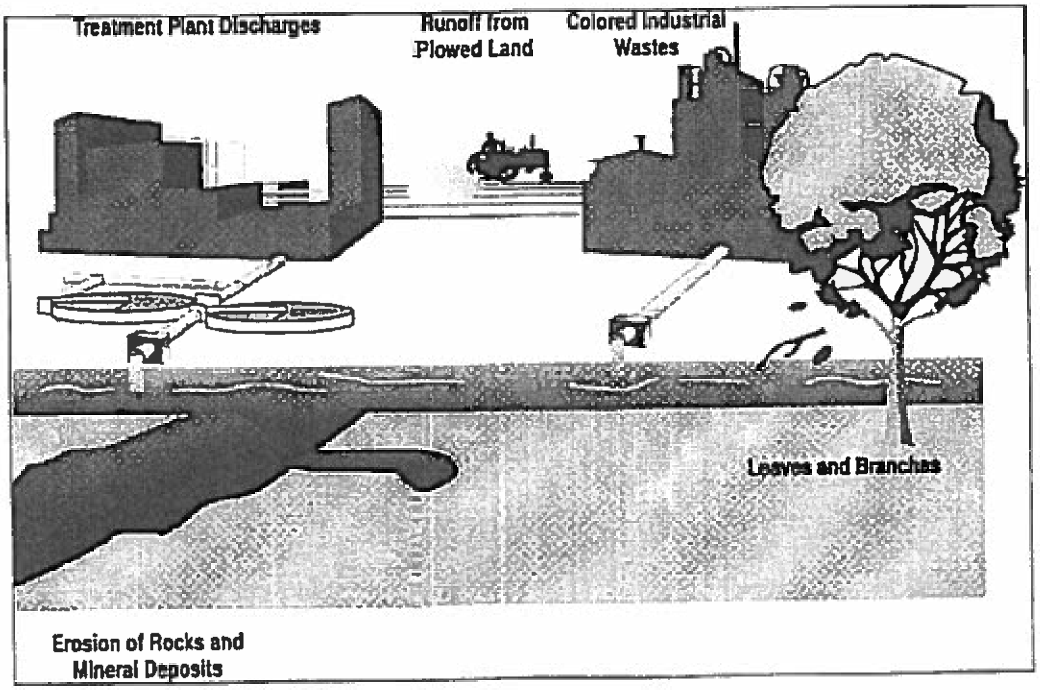
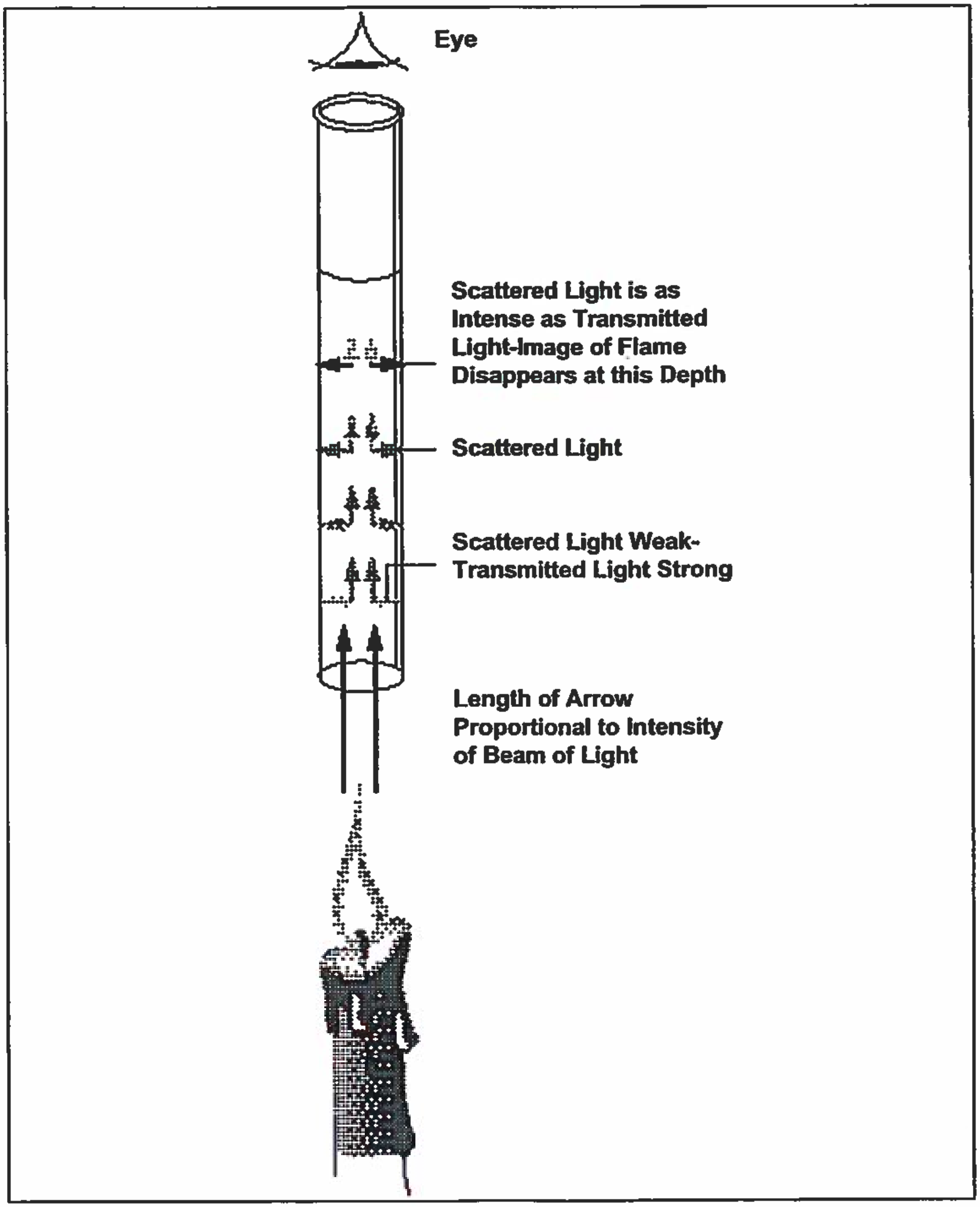


Figure 7-1. Typical Sources of Turbidity in Drinking Water

The first practical attempts to quantify turbidity date to 1900 when Whipple and Jackson developed a standard suspension fluid using 1,000 parts per million (ppm) of diatomaceous earth in distilled water (Sadar, 1996). Dilution of this reference suspension resulted in a series of standard suspensions, which were then used to derive a ppm-silica scale for calibrating turbidimeters.

The standard method for determination of turbidity is based on the Jackson candle turbidimeter, an application of Whipple and Jackson's ppm-silica scale (Sadar, 1996). The Jackson candle turbidimeter consists of a special candle and a flat-bottomed glass tube (Figure 7-2), and was calibrated by Jackson in graduations equivalent to ppm of suspended silica turbidity. A water sample is poured into the tube until the visual image of the candle flame, as viewed from the top of the tube, is diffused to a uniform glow. When the intensity of the scattered light equals that of the transmitted light, the image disappears; the depth of the sample in the tube is read against the ppm-silica scale, and turbidity was measured in Jackson turbidity units (JTU). Standards were prepared from materials found in nature, such as Fuller's earth, kaolin, and bed sediment, making consistency in formulation difficult to achieve.



Source: Sadar, 1996.

Figure 7-2. Jackson Candle Turbidimeter

In 1926, Kingsbury and Clark discovered formazin, which is formulated completely of traceable raw materials and drastically improved the consistency in standards formulation. Formazin is a suitable suspension for turbidity standards when prepared accurately by weighing and dissolving 5.00 grams of hydrazine sulfate and 50.0 grams of hexamethylenetetramine in one liter of distilled water. The solution develops a white hue after standing at 25°C for 48 hours. A new unit of turbidity measurement was adopted called formazin turbidity units (FTU).

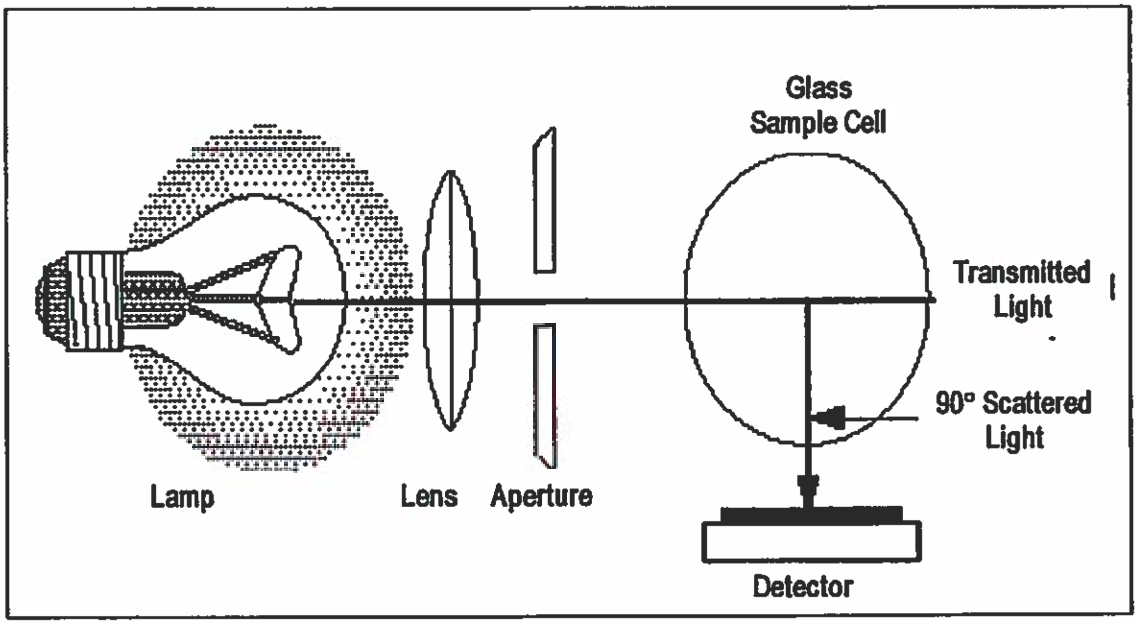
Even though the consistency of formazin improved the accuracy of the Jackson Candle Turbidimeter, it was still limited in its ability to measure extremely high or low turbidity. More precise measurements of very low turbidity were needed to define turbidity in samples containing fine solids. The Jackson Candle Turbidimeter is impractical for this because the lowest turbidity value on this instrument is 25 JTU. The method is also cumbersome and too dependent on human judgement to determine the exact extinction point.

Indirect secondary methods were developed to estimate turbidity. Several visual extinction turbidimeters were developed with improved light sources and comparison techniques, but all were still dependent of human judgement. Photoelectric detectors became popular since they are sensitive to very small changes in light intensity. These methods provided much better precision under certain conditions, but were still limited in ability to measure extremely high or low turbidities.

Finally, turbidity measurement standards changed in the 1970's when the nephelometric turbidimeter, or nephelometer, was developed which determines turbidity by the light scattered at an angle of 90° from the incident beam (Figure 7-3). A 90° detection angle is considered to be the least sensitive to variations in particle size. Nephelometry has been adopted by *Standard Methods* as the preferred means for measuring turbidity because of the method's sensitivity, precision, and applicability over a wide range of particle size and concentration. The nephelometric method is calibrated using suspensions of formazin polymer such that a value of 40 nephelometric units (NTU) is approximately equal to 40 JTU (AWWARF, 1998). The preferred expression of turbidity is NTU.

7.3 Turbidity's Significance to Human Health

Excessive turbidity, or cloudiness, in drinking water is aesthetically unappealing, and may also represent a health concern. Turbidity can provide food and shelter for pathogens. If not removed, turbidity can promote regrowth of pathogens in the distribution system, leading to waterborne disease outbreaks, which have caused significant cases of gastroenteritis throughout the United States and the world. Although turbidity is not a direct indicator of health risk, numerous studies show a strong relationship between removal of turbidity and removal of protozoa.



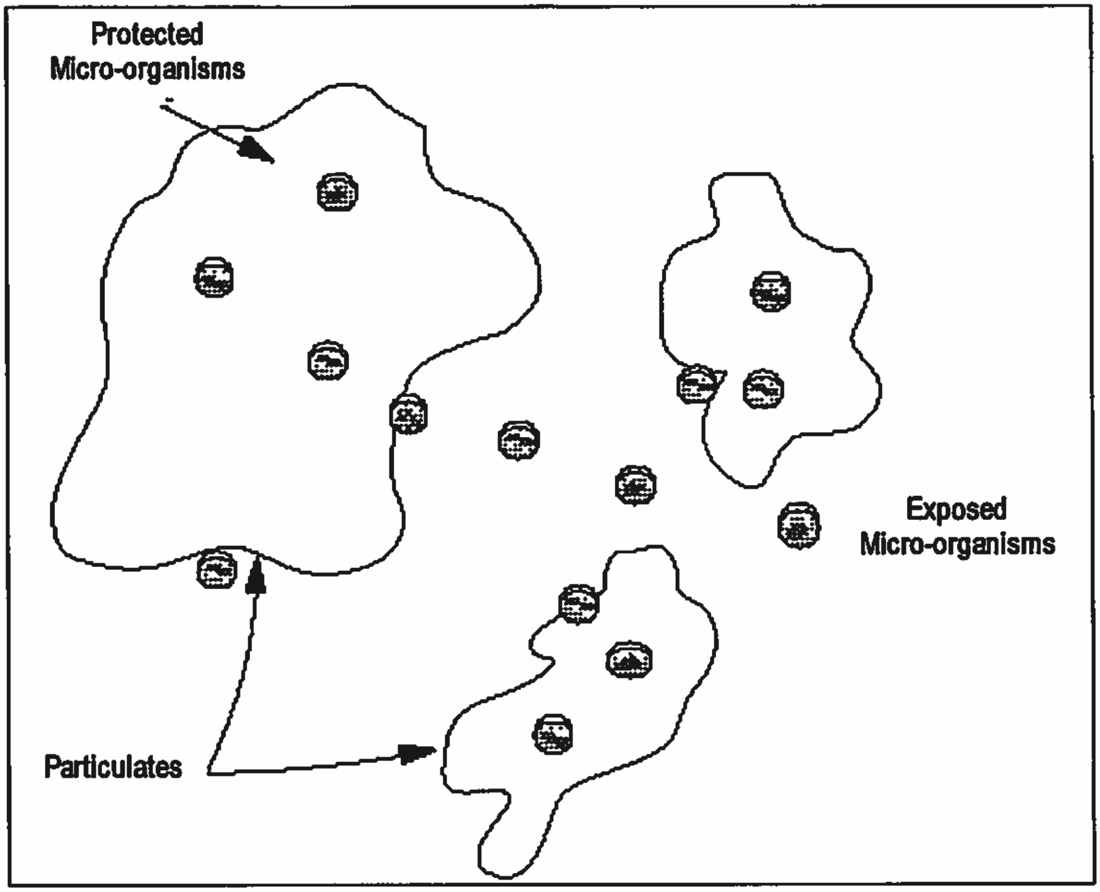
Source: Sadar, 1996; photo revised by SAIC, 1998.

Figure 7-3. Nephelometric Turbidimeter

The particles of turbidity provide "shelter" for microbes by reducing their exposure to attack by disinfectants (Figure 7-4). Microbial attachment to particulate material or inert substances in water systems has been documented by several investigators (Marshall, 1976; Olson et al., 1981; Herson et al., 1984) and has been considered to aid in microbe survival (NAS, 1980). Fortunately, traditional water treatment processes have the ability to effectively remove turbidity when operated properly.

7.3.1 Waterborne Disease Outbreaks

Notwithstanding the advances made in water treatment technology, waterborne pathogens have caused significant disease outbreaks in the United States and continue to pose a significant problem. Even in developed countries, protozoa have been identified as the cause of half of the recognized waterborne outbreaks (Rose et al., 1991). The most frequently reported waterborne disease in the United States is acute gastrointestinal illness, or gastroenteritis (Huben, 1991). The symptoms for this disease include fever, headache, gastrointestinal discomfort, vomiting, and diarrhea. Gastroenteritis is usually self-limiting, with symptoms lasting one to two weeks in most cases. However, if the immune system is suppressed, as with the young, elderly and those suffering from HIV or AIDS, the condition can be very serious and even life threatening. The causes are usually difficult to identify but can be traced to various viruses, bacteria, or protozoa.



Source: LeChevallier and Norton, 1991.

Figure 7-4. Particles of Turbidity May Provide Protection for Microorganisms

Giardia and *Cryptosporidium* are the two most studied organisms known to cause waterborne illnesses. These two protozoa are believed to be ubiquitous in source water, are known to occur in drinking water systems, have been responsible for the majority of waterborne outbreaks, and treatments to remove and/or inactivate them are known to be effective for a wide range of waterborne parasites (LeChevallier and Norton, in Craun, 1993). *Giardia* and *Cryptosporidium* have caused over 400,000 persons in the United States to become ill since 1991, mostly due to a 1993 outbreak in Milwaukee, Wisconsin.

Giardia and viruses are addressed under the 1989 SWTR. Systems using surface water must provide adequate treatment to remove and/or inactivate at least 3-log (99.9%) of the *Giardia lamblia* cysts and at least 4-log (99.99%) of the enteric viruses. However, *Cryptosporidium* was not addressed in the SWTR due to lack of occurrence and health effects data. In the mid-1980's, the United States experienced its first recognized waterborne disease outbreak of cryptosporidiosis (D'Antonio et al., 1985). It was soon discovered that the presence of *Cryptosporidium* in drinking water, even in very low concentrations, could be a significant health hazard (Gregory, 1994). In 1993, a major outbreak of cryptosporidiosis occurred even though the system was in full compliance with the SWTR. Several outbreaks caused by this pathogen have been reported (Smith et al., 1988; Hayes at al., 1989; Levine and Craun, 1990; Moore et al., 1993; Craun, 1993). The ESWTR's primary focus is to establish treatment requirements to further address public health risks from pathogen occurrence, and in particular, *Cryptosporidium*.

Table 7-1 displays several instances of past outbreaks of cryptosporidiosis in systems using surface water as a source, along with general information about the plant and turbidity monitoring. In three out of four of the cases displayed in the table (Milwaukee, Jackson County, and Carrollton), turbidity over 1.0 NTU was occurring in finished water during the outbreaks.

Table 7-1. Cryptosporidium Outbreaks vs. Finished Water Turbidity

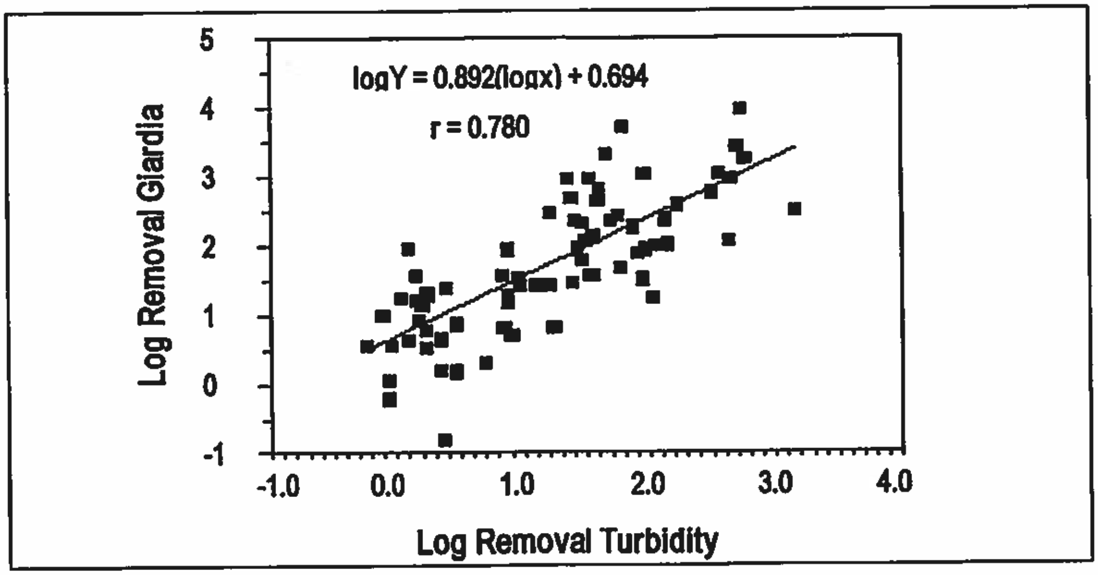
Location of Outbreak	Year	General Plant Information	Turbidity Information
Las Vegas, Nevada (CDC, 1996)	1993-1994	No apparent deficiencies or problems with this community system; SWTR compliant; system performed pre-chlorination, filtration (sand and carbon), and filtration of lake water; outbreak affected mostly persons infected with the human immunodeficiency virus (HIV)	The raw water averaged 0.14 NTU between January 1993 and June 1995, with a high of 0.3 NTU; the maximum turbidity of finished water during this time was 0.17 NTU.
Milwaukee, Wisconsin (CDC, 1996, Logsdon, 1996)	1993	Community system; SWTR compliant; however, deterioration in source (lake) raw-water quality and decreased effectiveness of the coagulation-filtration process	Dramatic temporary increase in finished water turbidity levels; reported values were as high as 2.7 NTU. (Turbidity had never exceeded 0.4 NTU in the previous 10 years.)
Jackson County, Oregon (USEPA, 1997)	1992	Poor plant performance (excessive levels of algae and debris); no pre-chlorination before filtration	Earlier in the year when outbreak occurred, filtered water had averaged 1 NTU or greater.
Carrollton, Georgia (USEPA, 1997, Logsdon, 1996)	1987	Conventional filtration plant; sewage overflowed into water treatment intake, followed by operational irregularities in treatment; filters were placed back into service without being backwashed.	Filtered water turbidity from one filter reached 3 NTU about three hours after it was returned to service without being washed.

7.3.2 The Relationship Between Turbidity Removal and Pathogen Removal

Low filtered water turbidity can be correlated with low bacterial counts and low incidences of viral disease. Positive correlations between removal (the difference between raw and plant effluent water samples) of pathogens and turbidity have also been observed in several studies. In fact, in every study to date where pathogens and turbidity occur in the source water, pathogen removal coincides with turbidity/particle removal (Fox, 1995).

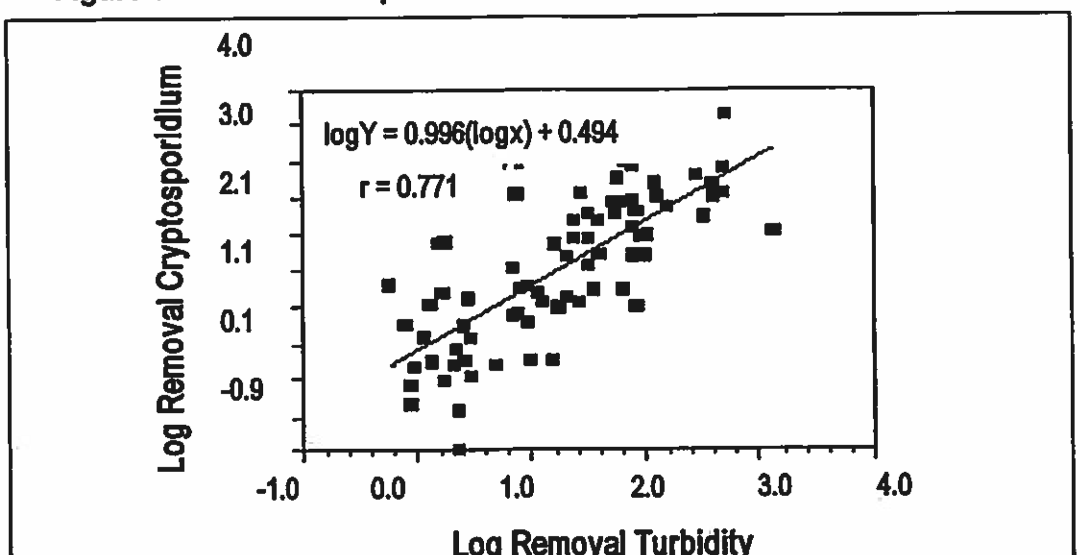
As an example, data gathered by LeChevallier and Norton (in Craun, 1993) from three drinking water treatment plants using different watersheds indicated that for every log removal of turbidity, 0.89 log removal was achieved for the parasites *Cryptosporidium* and *Giardia* (Figures 7-5 and 7-6). Of course, this exact relationship does not hold for all treatment plants. Table 7-2 lists several other studies in addition to LeChevallier and Norton's, and their conclusions on the relationship of turbidity to protozoan removal.

All studies in Table 7-2 show turbidity as a useful predictor of parasite removal efficiency. This evidence suggests that although a very low turbidity value does not completely ensure that particles are absent, it is an excellent measure of plant optimization to ensure maximum public health protection.



Source: LeChevallier and Norton, 1991.

Figure 7-5. Relationship Between Removal of *Giardia* and Turbidity



Source: LeChevallier and Norton, 1991.

Figure 7-6. Relationship Between Removal of *Cryptosporidium* and Turbidity

Table 7-2. Studies on the Relationship between Turbidity Removal and Protozoa Removal

Reference/Study	Discovery/Conclusion on Turbidity
Patania et al., 1995*	Four systems using rapid granular filtration, when treatment conditions were optimized for turbidity and particle removal, achieved a median turbidity removal of 1.4 log and median particle removal of 2 log. The median cyst and oocyst removal was 4.2 log. A filter effluent turbidity of less than 0.1 NTU or less resulted in the most effective cyst removal, by up to 1.0 log greater than when filter effluent turbidities were greater than 0.1 NTU (within the 0.1 to 0.3 NTU range).
Nieminski and Ongerth, 1995*	Pilot plant study: Source water turbidity averaged 4 NTU (maximum = 23 NTU), achieving filtered water turbidities of 0.1-0.2 NTU. *Cryptosporidium* removals averaged 3.0 log for conventional treatment and 3.0 log for direct filtration, while *Giardia* removals averaged 3.4 log for conventional treatment and 3.3 log for direct filtration. Full scale plant study: Source water had turbidities typically between 2.5 and 11 NTU (with a peak level of 28 NTU), achieving filtered water turbidities of 0.1-0.2 NTU. *Cryptosporidium* removals averaged 2.25 log for conventional treatment and 2.8 log for direct filtration, while *Giardia* removals averaged 3.3 log for conventional treatment and 3.9 log for direct filtration.
Ongerth and Pecoraro, 1995*	Using very low-turbidity source waters (0.35 to 0.58 NTU), 3 log removal for both cysts were obtained, with optimal coagulation. (With intentionally suboptimal coagulation, the removals were only 1.5 log for *Cryptosporidium* and 1.3 log for *Giardia*.)
LeChavallier and Norton (in Craun, 1993)	Data gathered from three drinking water treatment plants using different watersheds indicated that for every log removal of turbidity, 0.89 log removal was achieved for *Cryptosporidium* and *Giardia*.
Nieminski, 1992	A high correlation (r^2=0.91) exists between overall turbidity removal and both *Giardia* and *Cryptosporidium* removal through conventional water treatment.
Ongerth, 1990	*Giardia* cyst removal by filtration of well-conditioned water results in 90% or better turbidity reduction, which produces effective cyst removal of 2-log (99%) or more.
LeChavallier et al., 1991*	In a study of 66 surface water treatment plants using conventional treatment, most of the utilities achieved between 2 and 2.5 log removals for both *Cryptosporidium* and *Giardia*, and a significant correlation (p=0.01) between removal of turbidity and *Cryptosporidium* existed.
LeChavallier and Norton, 1992*	In source water turbidities ranging from 1 to 120 NTU, removal achieved a median of 2.5 log for *Cryptosporidium* and *Giardia* at varying stages of treatment optimization. The probability of detecting cysts and oocysts in finished water supplies depended on the number of organisms in the raw water; turbidity was a useful predictor of *Giardia* and *Cryptosporidium* removal.
Foundation for Water Research, 1994*	Raw water turbidity ranged from 1 to 30 NTU, and *Cryptosporidium* removal was between 2 and 3 log. Investigators concluded that any measure which reduces filter effluent turbidity should reduce risk from *Cryptosporidium*.
Hall et al., 1994	Any measure which reduces filtrate turbidity will reduce the risk from *Cryptosporidium*; a sudden increase in the clarified water turbidity may indicate the onset of operational problems with a consequent risk from cryptosporidiosis.
Gregory, 1994	Maintaining the overall level of particulate impurities (turbidity) in a treated water as low as possible may be an effective safeguard against the presence of oocysts and pathogens.
Anderson et al., 1996	In a pilot plant study, the removal of particles > 2 m was significantly related to turbidity reduction r=0.97 (p<0.0001); the removal of *Cryptosporidium* oocysts may be related to the removal of *Giardia*, r=0.79 (p<0.14); the reduction of turbidity may be related to the removal of *Giardia* cysts, r=0.67 (p<0.13) and *Cryptosporidium* oocysts (p<0.08)

- as discussed in EPA's Notice of Data Availability (USEPA, 1997)

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1. Does your state require surface water filtration plants to continuously monitor and record their combined filter effluent turbidity?

- Answered: 30
- Skipped: 0

Answer Choices–	Responses–	
Yes	66.67% 20	
No	33.33% 10	
Total		30

Comments(13)

Yes for membranes. No for all others. For conventional, direct, and DE: required at least every 4 hours; or, once/day for systems serving 500 or fewer persons if approved by the director. For slow sand: every 4 hrs can be reduced to once/day if approved by the director. In lieu of CFE, could monitor IFEs and record average.

1/24/2014 10:22 AM View respondent's answers

Surface water sytems serving 500 or fewer people may grab sample once per day if approved by the State. Slow sand filtration systems may grab sanple once per day if approved by the State.

1/21/2014 11:01 AM View respondent's answers

We only require systems to conduct continuous monitoring of turbidity in the combined filter effluent if they serve fewer than 10,000 people, have only two or fewer filters and choose to monitor turbidity in the combined filter effluent rather than monitor turbidity at individual filters.

1/16/2014 5:51 PM View respondent's answers

Minimum required is 1 reading each 4 hours of operation.

1/10/2014 12:55 PM View respondent's answers

No, we require one grab sample every four hours for combined filter effluent turbidity.

1/9/2014 12:52 PM View respondent's answers

Alabama requires each filter to be monitored and recorded on a continuous basis. Compliance is determined on each individual filter. One filter may cause a violation, even if the combined filter effluent still meets federal standards. Alabama has no CFE limits, all limits are IFE.

1/9/2014 11:37 AM View respondent's answers

Community - The majority of MN Community Surface Water Systems are monitoring CFE continuously; taking grab sample every 4 hours is acceptable. MDH has no plan to require continuous CFE monitoring. NonCommunity - Not for population <500

1/9/2014 7:49 AM View respondent's answers

Systems using conventional or direct filtration must continually monitor individual filter effluent turbidity and record individual filter effluent turbidity every 15 minutes. For conventional and direct filtration systems with only one filter, the combined filter effluent turbidity, by default, must be continuously monitored and recorded every 15 minutes.

1/8/2014 7:48 PM View respondent's answers

At least 15 minute monitoring must be recorded. Systems that serve less than 500 pop can do daily monitoring if requested.

1/8/2014 1:20 PM View respondent's answers

Almost all system have continuous monitoring; however, the Reg.s allow collecting grab samples at 4 hour increments and doing a bench test.

1/8/2014 9:45 AM View respondent's answers

310 CMr 22.20F (6)(a)

1/7/2014 3:00 PM View respondent's answers

Individual filters are continuously monitored.

1/7/2014 1:06 PM View respondent's answers

Our State Regulations require continuous monitoring of CFE but these regs don't explicity state how the reporting should be done (ie do they just report on the four hour mark or report the number of 15 minute intervals in a month) so we have systems that report inconsistently.

1/7/2014 10:58 AM View respondent's answers

2. Does your state require surface water filtration plants using Slow Sand, Diatomaceous Earth, or alternative filtration to continuously monitor and record their individual filter effluent turbidity?

- **Answered: 30**
- **Skipped: 0**

Answer Choices–	Responses–
Yes	46.67% 14
No	53.33% 16
Total	30
Comments(14)	

1/10/2014 12:55 PM View respondent's answers

ASDWA Survey

No, we require one grab sample every four hours for individual filter effluent turbidity for systems that use Slow Sand or Diatomaceous Earth. Individual filter turbidity monitoring for systems that use alternative filtration is set on a system-specific basis but cannot be less than one grab sample every four hours.

1/9/2014 12:52 PM View respondent's answers

Alabma only has conventional (high rate) filtration and membrane filtration. Slow sand and others are not allowed on surface water sources.

1/9/2014 11:37 AM View respondent's answers

Community - Minnesota does not have systems using slow sand or diatomaceous earth filters. Alternative filtration systems (using UF) are required to continuously monitor and record effluent turbidity of each UF Train/Skit. Noncommunity - Not for population <500

1/9/2014 7:49 AM View respondent's answers

Systems using membrane filtration must conduct continuous individual filter effluent monitoring at least every 15 minutes on each individual unit, if not conducting continuous direct integrity testing of the membrane units.

1/8/2014 7:48 PM View respondent's answers

We recommend. Bags and Cartridges typically only monitor with grab samples.

1/8/2014 6:19 PM View respondent's answers

Slow sand and alternative filtration may reduce sampling frequency with State approval.

1/8/2014 3:20 PM View respondent's answers

It is a case by case decision but for membranes we require each bank have a monitor via permit condition, not in regulation.

1/8/2014 1:20 PM View respondent's answers

310 CMr 22.20D (4)(b)2

1/7/2014 3:00 PM View respondent's answers

Currently we require IFE turbidity monitoring for membrane filtration plants

1/7/2014 1:42 PM View respondent's answers

We don't have any functing slow sand filters it the state.

1/7/2014 1:39 PM View respondent's answers

Two trains or less not required to do IFE monitoring

1/7/2014 11:03 AM View respondent's answers

We several plants that use membrane filtration.

1/7/2014 10:58 AM View respondent's answers

3. If you answered yes to question 2, do you require these plants to report individual filter trigger level exceedances and conduct any followup actions?

- Answered: 14
- Skipped: 16

Answer Choices–	Responses–
Yes	92.86% 13
No	7.14% 1
Total	14

Comments(5)

All surface water treatment plants are required to report the highest daily turbidity from each filtration unit on their monthly operational report. Membranes have a turbidity limit of 0.15 NTU. Please see ADEM Admin. Code r. 335-7-10-.06(10) for details. Regulations can be downloaded from www.adem.alabama.gov under regulations and then click on Division 7.

1/9/2014 11:37 AM View respondent's answers

Community - for conventional, direct filtration and low-pressure membrane filtration systems
Noncommunity - , for conventional/direct filtration.

1/9/2014 7:49 AM View respondent's answers

-na-

1/8/2014 6:19 PM View respondent's answers

Exceedance report similar to conv or direct but via permit so case by case.

1/8/2014 1:20 PM View respondent's answers

NA

1/7/2014 3:00 PM View respondent's answers

4. Does your state require surface water treatment plants to be attended during operation?

- Answered: 30
- Skipped: 0

Answer Choices–	Responses–
Yes	40% 12
No	60% 18

ASDWA Survey

Answer Choices–	Responses–
Total	30
Comments(14)	

Operators must be in contact with the plant via alarms/dialers while the plant is in operation if the operators are not at the plant.

1/23/2014 3:35 PM View respondent's answers

GWUDI plants may be operated remotely if the plant has monitoring equipment and alarms or automatic shutdown capability in place

1/21/2014 11:01 AM View respondent's answers

it is strongly recommended that plants be attended during operation

1/10/2014 3:03 PM View respondent's answers

However, public water supply systems must have the appropriate level of operator certification and the facility must be under their control irrespective of whether or not the facility is physically attended.

1/10/2014 12:55 PM View respondent's answers

We have no specific prohibition against unattended surface water plants and have adopted the Ten States Standards Policy Statement for these types of systems.

1/9/2014 12:52 PM View respondent's answers

But not continuously. They need to be on site at least once per day. However, of the 23 community surface water systems at least 20 of them have personnel on site while the plant is in operation.

1/9/2014 7:49 AM View respondent's answers

Systems using conventional or direct filtration must have a high turbidity alarm with an auto dial or auto plant shutdown, if the plant operates with no operator present.

1/8/2014 7:48 PM View respondent's answers

We have no specified requirements in our State Sanitary Code but we do have a general due care and diligence for the operation of a treatment plant requirement.

1/8/2014 3:20 PM View respondent's answers

But can be remotely attended in certain situations where there is 24-hour manned video and SCADA surveillance of all operations.

1/8/2014 11:25 AM View respondent's answers

However, we acknowledge that some small systems may not have continuous attendance. We also recognize that this problematic.

1/8/2014 9:45 AM View respondent's answers

If remote SCADA is in place, then physical presence is not required during night operation.

1/7/2014 3:00 PM View respondent's answers

401 KAR 8:030 has the following language for surface water treatment plants "...in direct responsible charge of the plant and shall be present at the water treatment plant or performing

system-related duties"; 401 KAR 8:030 further defines "system-related duties" (e) System-related duties shall be for: 1. Class IIA, Class IIIA, and Class IVA water systems, duties related to the operation and maintenance of the water treatment plant; or 2. Class IA-D water systems, duties related to the operation and maintenance of the water treatment plant and distribution system.

1/7/2014 1:42 PM View respondent's answers

Must be attended unless process alarms with auto-dial and/or auto-plant shutdown on pH, turbidity and disinfectant are in place and operational.

1/7/2014 1:06 PM View respondent's answers

Minimum 1/day inspection

1/7/2014 11:03 AM View respondent's answers

5. If you answered yes to question 4, do you allow water systems to apply for an exception?

- Answered: 12
- Skipped: 18

Answer Choices–	Responses–
Yes	58.33% 7
No	41.67% 5
Total	12

Comments(9)

GWUDI systems may be operated remotely. Non-Community surface supplies may apply for exemption from operator in attendance rules.

1/21/2014 11:01 AM View respondent's answers

The exception is for surface systems which serve less than 10,000 persons and which utilize automated operation systems which monitor system operation, record all required readings, notify the operator in the event of a system upset or failure, and allow the operator to remotely control or shut down the system.

1/10/2014 4:03 PM View respondent's answers

-na-

1/8/2014 6:19 PM View respondent's answers

We allow some MF plants treating a high quality raw water source to operate for short periods of time unattended if the proper controls are in place to alarm staff or shut down the plant in the event of a treatment failure.

1/8/2014 2:05 PM View respondent's answers

See above.

1/8/2014 11:25 AM View respondent's answers

However, some large utilities do follow the Recommended Standards Procedure for Automated/Unattended Operation of Surface Water Treatment Plants Policy

1/8/2014 9:45 AM View respondent's answers

SCADA capability--night operation only

1/7/2014 3:00 PM View respondent's answers

401 KAR 8:030 has language regarding "alternate staffing plans" 6. A public water system may propose an alternate staffing plan to the staffing requirement established in this paragraph. a. The proposal shall be submitted to the cabinet and shall thoroughly explain the alternate proposal. b. The proposal shall demonstrate: (i) A necessity for the water system to vary from the requirement in this paragraph; and (ii) An equal level of protection of human health and the environment. c. The cabinet shall not approve an alternate proposal that does not propose that a duly certified operator in direct responsible charge operate a water treatment plant, in accordance with KRS 223.210. Since February 2010, KY DOW has approved alternate staffing plans for 20 operators.

1/7/2014 1:42 PM View respondent's answers

Membrane Filtration systems are the exception - these do not require operator attendance at all times.

1/7/2014 11:21 AM View respondent's answers

6. What state do you represent?

- **Answered: 30**
- **Skipped: 0**

Connecticut

1/24/2014 1:24 PM View respondent's answers

Rhode Island

1/24/2014 10:22 AM View respondent's answers

Nebraska

1/23/2014 3:35 PM View respondent's answers

Tennessee

1/21/2014 11:01 AM View respondent's answers

WV

1/20/2014 8:17 AM View respondent's answers

New Mexico

1/16/2014 5:51 PM View respondent's answers

Maine

1/15/2014 1:24 PM View respondent's answers

Louisiana

ASDWA Survey

1/10/2014 4:03 PM View respondent's answers

Idaho

1/10/2014 3:03 PM View respondent's answers

Kansas

1/10/2014 12:55 PM View respondent's answers

Montana

1/9/2014 12:52 PM View respondent's answers

Alabama

1/9/2014 11:37 AM View respondent's answers

Minnesota

1/9/2014 7:49 AM View respondent's answers

Oregon

1/8/2014 7:48 PM View respondent's answers

Alaska

1/8/2014 6:19 PM View respondent's answers

Colorado

1/8/2014 3:46 PM View respondent's answers

New York

1/8/2014 3:20 PM View respondent's answers

Michigan

1/8/2014 2:05 PM View respondent's answers

California

1/8/2014 1:20 PM View respondent's answers

Missouri

1/8/2014 12:06 PM View respondent's answers

Iowa

1/8/2014 11:25 AM View respondent's answers

Vermont

1/8/2014 10:17 AM View respondent's answers

Illinois

1/8/2014 9:45 AM View respondent's answers

Massachusetts

1/7/2014 3:00 PM View respondent's answers

Kentucky

1/7/2014 1:42 PM View respondent's answers

Utah

1/7/2014 1:39 PM View respondent's answers

Arkansas

1/7/2014 1:06 PM View respondent's answers

Virginia

1/7/2014 11:21 AM View respondent's answers

New Hampshire

1/7/2014 11:03 AM View respondent's answers

New Jersey

1/7/2014 10:58 AM View respondent's answers

7. What is your contact information?

- Answered: 30
  - Skipped: 0

Tom Chyra Thomas.chyra@ct.gov 860-509-7333

1/24/2014 1:24 PM View respondent's answers

amy.parmenter@health.ri.gov 401-222-7771

1/24/2014 10:22 AM View respondent's answers

Elizabeth Esseks elizabeth.esseks@nebraska.gov 402-471-1010

1/23/2014 3:35 PM View respondent's answers

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1/21/2014 11:01 AM View respondent's answers

Charles.h.robinette@wv.gov

1/20/2014 8:17 AM View respondent's answers

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1/16/2014 5:51 PM View respondent's answers

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1/15/2014 1:24 PM View respondent's answers

Caryn.Benjamin@la.gov or 225-342-6157

1/10/2014 4:03 PM View respondent's answers

Suzanne Scheidt, Analyst IDEQ Coeur d'Alene Regional Office 2110 Ironwood Parkway Coeur d'Alene ID 83814 208-666-4624

1/10/2014 3:03 PM View respondent's answers

ASDWA Survey

785-296-5516

1/10/2014 12:55 PM View respondent's answers

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1/9/2014 12:52 PM View respondent's answers

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1/9/2014 11:37 AM View respondent's answers

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1/9/2014 7:49 AM View respondent's answers

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1/8/2014 7:48 PM View respondent's answers

Vanessa Wike, 907 269-7636

1/8/2014 6:19 PM View respondent's answers

3036923258

1/8/2014 3:46 PM View respondent's answers

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1/8/2014 3:20 PM View respondent's answers

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1/8/2014 2:05 PM View respondent's answers

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1/8/2014 1:20 PM View respondent's answers

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1/8/2014 12:06 PM View respondent's answers

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1/8/2014 11:25 AM View respondent's answers

Thomas Brown Operations Secion Supervisor DrinkingWater and Groundwater Protection Division tom.brown@state.vt.us. 802-371-7610

1/8/2014 10:17 AM View respondent's answers

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1/8/2014 9:45 AM View respondent's answers

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ASDWA Survey

1/7/2014 3:00 PM View respondent's answers

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1/7/2014 1:42 PM View respondent's answers

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1/7/2014 1:39 PM View respondent's answers

Lance Jones lance.jones@arkansas.gov 501-661-2623

1/7/2014 1:06 PM View respondent's answers

Susan E Douglas, PE Director of Technical services Office of Drinking Water Virginia Department of Health susan.douglas@vdh.virginia.gov 804-864-7490

1/7/2014 11:21 AM View respondent's answers

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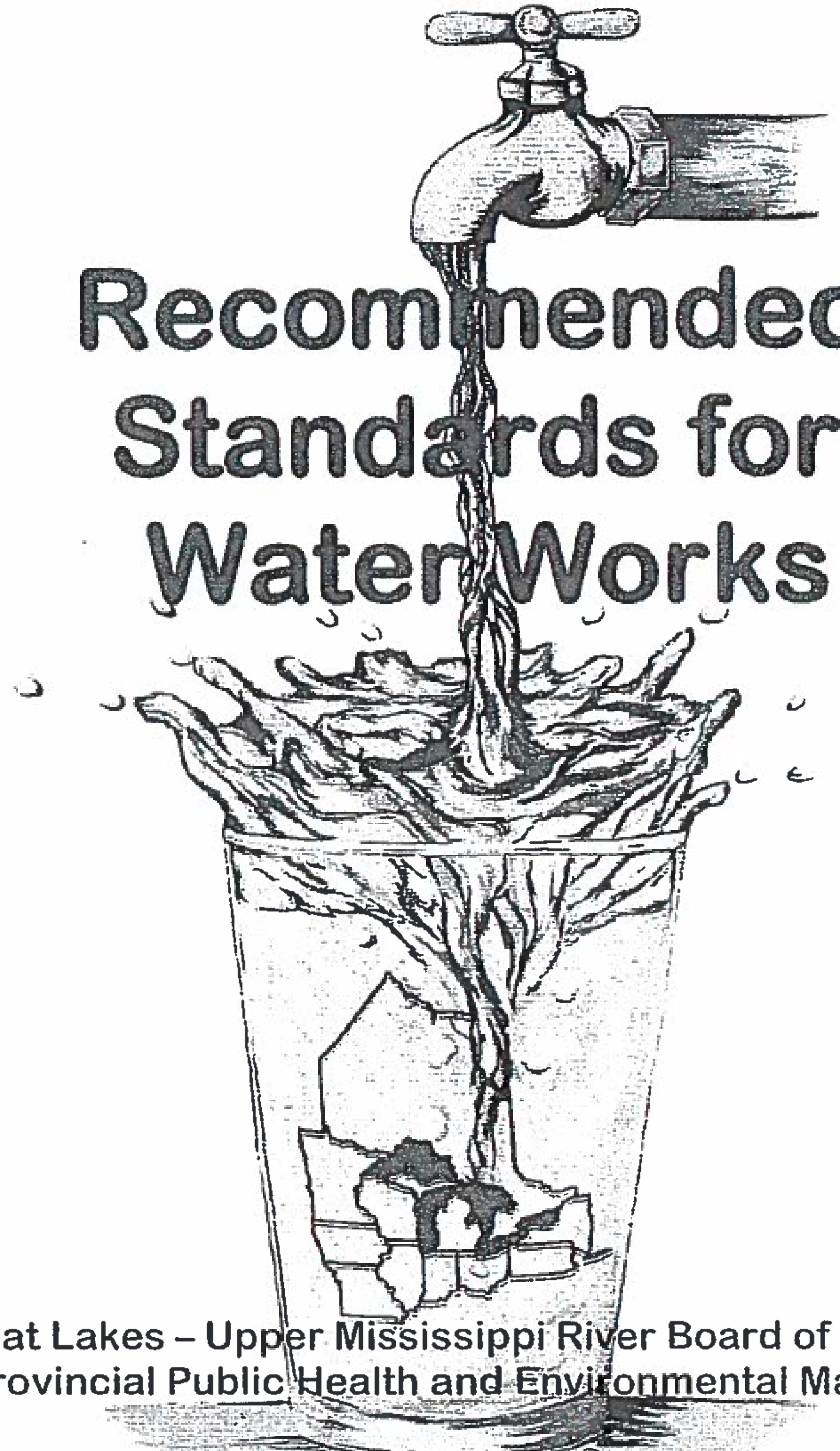
1/7/2014 11:03 AM View respondent's answers

Karen Fell 609-292-5550

1/7/2014 10:58 AM View respondent's answers

2012 Edition



Recommended Standards for Water Works

Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers

Illinois Indiana Iowa Michigan Minnesota Missouri
New York Ohio Ontario Pennsylvania Wisconsin

POLICY STATEMENT ON
AUTOMATED/UNATTENDED OPERATION OF SURFACE WATER TREATMENT PLANTS

Recent advances in computer technology, equipment controls and Supervisory Control and Data Acquisition (SCADA) Systems have brought automated and off-site operation of surface water treatment plants into the realm of feasibility. Coincidentally, this comes at a time when renewed concern for microbiological contamination is driving optimization of surface water treatment plant facilities and operations and finished water treatment goals are being lowered to levels of <0.1 NTU turbidity and <20 total particle counts per milliliter.

Review authorities encourage any measures, including automation, which assist operators in improving plant operations and surveillance functions.

Automation of surface water treatment facilities to allow unattended operation and off-site control presents a number of management and technological challenges which must be overcome before an approval can be considered. Each facet of the plant facilities and operations must be fully evaluated to determine what on-line monitoring is appropriate, what alarm capabilities must be incorporated into the design and what staffing is necessary. Consideration must be given to the consequences and operational response to treatment challenges, equipment failure and loss of communications or power.

An engineering report shall be developed as the first step in the process leading to design of the automation system. The engineering report to be submitted to the reviewing authorities must cover all aspects of the treatment plant and automation system including the following information/criteria:

1. Identify all critical features in the pumping and treatment facilities that will be electronically monitored, have alarms and can be operated automatically or off-site via the control system. Include a description of automatic plant shut-down controls with alarms and conditions which would trigger shut-downs. Dual or secondary alarms may be necessary for certain critical functions.

2. Automated monitoring of all critical functions with major and minor alarm features must be provided. Automated plant shutdown is required on all major alarms. Automated startup of the plant is prohibited after shutdown due to a major alarm. The control system must have response and adjustment capability on all minor alarms. Built-in control system challenge test capability must be provided to verify operational status of major and minor alarms. The computer system must incorporate cyberspace security to protect the confidentiality and integrity of transmitted information and deter identity theft through such means as placing routers and "firewalls" at the entry point of a sub network to block access from outside attackers.

3. The plant control system must have the capability for manual operation of all treatment plant equipment and process functions.

4. A plant flow diagram which shows the location of all critical features, alarms and automated controls to be provided.

5. Description of off-site control station(s) that allow observation of plant operations, receiving alarms and having the ability to adjust and control operation of equipment and the treatment process.

6. A certified operator must be on "standby duty" status at all times with remote operational capability and located within a reasonable response time of the treatment plant.

7. A certified operator must do an on-site check at least once per day to verify proper operation and plant security.

8. Description of operator staffing and training planned or completed in both process control and the automation system.

9. Operations manual which gives operators step by step procedures for understanding and using the automated control system under all water quality conditions. Emergency operations during power or communications failures or other emergencies must be included. A backup battery shall be provided for the control system.

10. A plan for a 6 month or more demonstration period to prove the reliability of procedures, equipment and surveillance system. A certified operator must be on-duty during the demonstration period. The final plan must identify and address any problems and alarms that occurred during the demonstration period. Challenge testing of each critical component of the overall system must be included as part of the demonstration project.

11. Schedule for maintenance of equipment and critical parts replacement.

12. Sufficient finished water storage shall be provided to meet system demands and CT requirements whenever normal treatment production is interrupted as the result of automation system failure or plant shutdown.

13. Sufficient staffing must be provided to carry out daily on-site evaluations, operational functions and needed maintenance and calibration of all critical treatment components and monitoring equipment to ensure reliability of operations.

14. Plant staff must perform, as a minimum, weekly checks on the communication and control system to ensure reliability of operations. Challenge testing of such equipment should be part of normal maintenance routines.

15. Provisions must be made to ensure security of the treatment facilities at all times. Incorporation of appropriate intrusion alarms must be provided which are effectively communicated to the operator in charge.

Adopted April, 1997
Revised April, 2012

The West Virginia Legislative Rule Title 64 Bureau for Public Health Series 4 (64CSR4) specifies adequate operator coverage requirements. The additional exceptions allowable by this policy are for Class II – IV public water systems (PWS) only and are based on proven automation. This policy covers unattended operation with or without remote monitoring and does not allow for remote treatment changes. Systems operating unattended under previous approvals based on the 1993 version of DW-36 must work towards these requirements in cooperation with the Environmental Engineering Division (EED).

To evaluate requests for automated/unattended operations, a proposal must be submitted to the EED central office for review and approval. Equipment used or to be installed to meet the requirements of this procedure must comply with the PWS design standards (64CSR77). Functionality of the automated system must also be demonstrated to EED for final approval.

In considering any proposal, the criteria listed below are to be followed:

1. Identify all critical features in the pumping and treatment facilities that will be electronically monitored and/or have alarms. These critical features will include, but are not limited to:
   a. Water storage facility's high and low levels at the treatment plant and in the distribution system;
   b. Any instrumentation or equipment related to pH (if system is controlled by adding caustic), turbidity, chlorine residual, and required selective ions within specific ranges;
   c. Chlorine gas leaks and tank pressure changes;
   d. Distribution system pressure loss;
   e. Fire;
   f. Intrusion;
   g. Power failures;
   h. Critical pumps, motors and generator failures; and,
   i. Chemical feed tank volumes to prevent any over or underfeed situations.

2. Provide a plant flow diagram which shows the location of all critical features and automated controls.

3. Provide a description of all alarm features. These alarm features will include, but not be limited to:

   a. Alarm set points; and,

   b. Automatic actions as a result of an alarm. For example, switch to back-up equipment, notify supervisor via auto-dialer, shutdown of individual equipment, and plant-wide shutdown.

4. Names, titles, and telephone numbers of individuals who will be notified in the event of an alarm/shutdown event.

5. Operation and maintenance manual available that includes description of treatment, control and pumping equipment, necessary maintenance and schedule, and a troubleshooting guide for typical problems.

6. Define the intended period(s) of unattended operations.

7. The plant must retain the capability for on-site operator intervention of all treatment plant equipment and process functions.

For surface and groundwater under the direct influence water treatment plants:

It is recommended that an operator be present at the plant at all times due to the variable nature of most surface water sources in West Virginia. However, if it is desirous to obtain an exception to operate the plant without an operator present at all times, it is mandatory that the following items be installed:

1. Dual turbidimeters and recorders on combined filter effluent. If either analyzer is outside of a specified range, automatic system shutdown shall occur. The systems shall also be equipped with provision to shutdown the plant when turbidity exceeds 70% of the applicable 95th percentile value, as per the chart below (systems may self-impose more stringent shutdown limits):

Filtration Technology	95th Percentile (NTU)	Shutdown Trigger (NTU)
Conventional	0.3	0.20
Direct	0.3	0.20
Diatomaceous Earth	1.0	0.70
Slow Sand	1.0	0.70
Membrane	0.15	0.10
Other Technologies	TBD	TBD

2. Dual chlorine residual analyzers and recorders on the high service pump effluent. The system shall be equipped with provisions to shut down the entire plant if either analyzer indicates the free chlorine demand increases above a predetermined level or if the free chlorine residual drops below the pre-determined set amount needed to maintain adequate disinfection (log removal) in the treatment plant and/or an active total chlorine residual in the extremes of the distribution system of 0.20 mg/L, as required by 64CSR3.

3. An alarm system/auto-dialer to immediately alert the responsible parties in the event of a system shutdown.

It will also be mandatory the system does not operate unattended for more than 8-hours in a given 24-hour period. Unattended startup of the plant is prohibited after shutdown. All laws, rules and regulations of the Department remain in effect.

<u>**For groundwater source water treatment plants:**</u>

It is mandatory the system is equipped with continuous chlorine analyzers, recorders, and controls as in number 2 above. A system auto-dialer (number 3 above) is also required. Maximum unattended timeframes will be determined by EED on a case-by-case basis.

In addition to the proposal, the following requirements apply to all systems:

1. To be considered for an exception, the system shall have demonstrated automated operation for a minimum of 12-months continuous operation with a properly certified operator present at all times. The system should be able to run without operational problems and without any monitoring or Maximum Contaminant Level (MCL) violations during this time and thereafter. The system must submit documentation of any deviations or occurrences [during the proposed period(s) of unattended operations as defined earlier] requiring operator intervention monthly with the system Monthly Operational Report (MOR). Any reasons for plant shutdown will be submitted to EED with the MOR, and will continue this practice after approval. This documentation will be required for each intended period of unattended operations. Any operation intervention during this period must be noted, regardless of the reason for this intervention. If no interventions or shutdowns are required for any operation period, this will need to be noted on the log that is submitted with the MOR.

2. Exceptions for automated operation will normally be valid until the next scheduled sanitary survey. Any system granted this exemption will continue to submit documentation of any deviation or occurrences that result in a system shutdown or require operation intervention with its MOR. The district office personnel will review and determine that all personnel, equipment, instrumentation and systems perform as originally approved. To be eligible for renewal, the system must be in full compliance with all regulatory requirements from the time of the original or renewed exception approval. At all times, all operators must be properly certified by the EED.

3. If the Chief Operator resigns or otherwise leaves the system, the system must immediately notify the EED. The exception for automated operation becomes null and void if the district office deems it necessary. The system may reapply with a written request to the EED when operations again meet specific criteria of this memorandum necessary for the consideration of an exception issuance.

4. The EED reserves the right to revoke an exception at any time it has been determined the automated system is not fully functional, or meeting operational, monitoring, reporting and/or MCL requirements. If an exception is revoked, reinstatement of exception would require the system to reapply for an exception for

automated operation and the district office staff would have to review operational procedures to insure that the system has rectified any and all problems resulting in revocation.

References	WV 64 CSR 3, Public Water Systems WV 64 CSR 4, Public Water Systems Operators WV 64 CSR 77, Public Water Systems Design Standards
History	Replaces original memo of April 12, 1993.
Attachments	DW-36 Checklist

DW-36 Checklist

This checklist was developed to assist systems with operator exception requests for automated public water systems.

Basic Information:

1. Is this an ☐ initial ☐ renewal or ☐ reinstatement request?

2. Date Proposal Received by EED Central Office: ______________________
EED Staff Reviewing Checklist: ______________________

3. Does the PWS understand they must retain the capability for on-site operator intervention of all treatment plant equipment and process functions? ☐ Yes ☐ No

4. PWSID#: WV________________ PWS Classification: ☐ II ☐ III ☐ IV
PWS Source Water: ☐ Purchased ☐ GW ☐ GWUDI ☐ SW
Date of last sanitary survey: ______________________
Frequency of sanitary surveys for this system: ☐ 3 years ☐ 5 years
District Office:
☐ Beckley ☐ Kearneysville ☐ Philippi ☐ St. Albans ☐ Wheeling
DO Contact Person: ______________________

Proposal Information:

1. What are the critical features in the pumping and treatment facilities that will be electronically monitored and/or have alarms?

____
____
____
____

2. Was a plant flow diagram which shows the location of all critical features and automated controls provided? ☐ Yes ☐ No Comments:

____
____

3. Were descriptions provided for all alarm features, including set points and automatic actions? ☐ Yes ☐ No Comments:

____
____

4. Were the names, titles, and telephone numbers of individuals who will be notified in the event of an alarm/shutdown event provided? ☐ Yes ☐ No

5. Is an operation and maintenance manual available that includes description of treatment, control and pumping equipment, necessary maintenance and schedule, and a troubleshooting guide for typical problems? ☐ Yes ☐ No

6. What are the intended period(s) of unattended operations?

____

____

For GWUDI or SW sources only:

1. Are there dual turbidimeters & recorders on combined filter effluent? ☐ Yes ☐ No
   a. Do these have automatic system shutdown if either analyzer is outside of a specified range? ☐ Yes ☐ No

2. Are there dual chlorine residual analyzers and recorders on the high service pump effluent? ☐ Yes ☐ No
   a. Do these have automatic system shutdown if either analyzer is outside of a specified range? ☐ Yes ☐ No

3. Does an alarm system/autodialer immediately alert the responsible parties in the event of a system shutdown? ☐ Yes ☐ No

4. Does the system understand they may not operate unattended for more than 8 hours in a given 24 hour period? ☐ Yes ☐ No

For GW sources only:

1. Are there dual chlorine residual analyzers and recorders on the high service pump effluent? ☐ Yes ☐ No
   a. Do these have automatic system shutdown if either analyzer is outside of a specified range? ☐ Yes ☐ No

2. Does an alarm system/autodialer immediately alert the responsible parties in the event of a system shutdown? ☐ Yes ☐ No

3. What is the maximum unattended timeframe determined by EED? ______

Demonstration Information:

1. Did the PWS demonstrate automated operation for a minimum of 12-months continuous operation with a properly certified operator present at all times? ☐ Yes ☐ No

2. Were there operational problems during this time? ☐ Yes ☐ No

If yes, describe:

3. Were there any monitoring or MCL violations during this time? ☐ Yes ☐ No
If yes, describe:

4. Did the system submit the following required documentation for unattended operations with their MOR:

a. Any deviations or occurrences requiring operator intervention? ☐ Yes ☐ No

b. Any reason(s) for plant shutdown? ☐ Yes ☐ No

Note: If no intervention or shutdown occurs during a period of unattended operation, it must still be noted in MOR.

Recommendation Information:

The following EED staff recommend ☐ approval or ☐ denial of the issuance of an operator exception for an automated public water system on the date noted:

DO Name Printed	Signature	Date

EED Name Printed	Signature	Date

Renewal Information:

1. Did the DO Contact Person review and determine all personnel, equipment, instrumentation and systems perform as originally approved? ☐ Yes ☐ No

2. Is the PWS in full compliance with all regulatory requirements from the time of the original exception? ☐ Yes ☐ No Attach any needed comments.

The following EED staff recommend ☐ approval or ☐ denial of the renewal of an operator exception for an automated public water system on the date noted:

DO Name Printed	Signature	Date

EED Name Printed	Signature	Date

Revocation/Reinstatement Information:

1. Does EED staff recommend revocation of an exception based on determination the automated system is not fully functional, or meeting operational, monitoring, reporting and/or MCL requirements? ☐ Yes ☐ No

2. Does EED staff recommend reinstatement of a revoked exception based on the system reapplication for an exception for automated operation and the district office staff review of operational procedures to insure that the system has rectified any and all problems resulting in revocation? ☐ Yes ☐ No

DO Name Printed	Signature	Date

EED Name Printed	Signature	Date

PLEASE COMPLETE FORM THOROUGHLY &
INCLUDE ANY SUPPORTING INFORMATION WITHIN OR ATTACHED

SUBMIT TO:

Office of Environmental Health Services
Environmental Engineering Division
ATTN: Certification & Training Program Manager
350 Capital Street Room 313
Charleston, WV 25301
Phone: (304) 558-2981
Fax: (304) 558-4322

Raco Mfg. & Engineering Co., Inc
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Fax: 510-658-3153
Toll-free: 800-722-6999
Email: sales@racoman.com
Website: http://www.racoman.com

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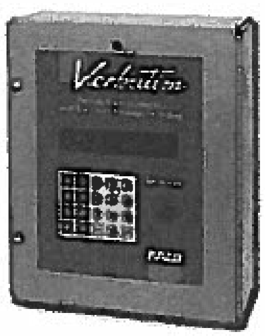
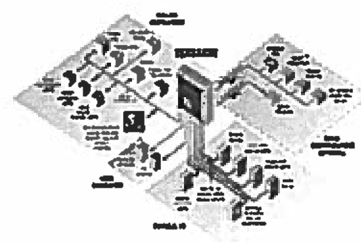
RACO Verbatim®, the long-standing first choice of the industry, offers pace- setting functionality and expandability– Its an autodialer alarm system, a remote monitoring system, a supervisory control system, a SCADA system, and a PLC net work interface–in one compact package.

With an expandable, modular bus architecture and up to 32 digital inputs, 16 analog inputs, and 8 digital control outputs, the system can monitor flow, level, pressure, temperature, pH, and other types of sensors, as well as control remote electrical devices.





Results 1 - 5 of 5

Model Number	Digital Alarm Inputs	Optional Analog Alarm Inputs	Optional Digital Outputs	Optional PLC Addresses	PLC Protocols	Phone Numbers Dialed	Battery Backup Time	Warranty	List Price
300VSS-4C	4	1 4 8 16	4 8	32 64 96	DF1 & Modbus connection via RS-232 [optional]	16	20 hours	5 years	$2,095.00
301VSS-8C	8	1 4 8 16	4 8	32 64 96	DF1 & Modbus connection via RS-232 [optional]	16	20 hours	5 years	$2,350.00
302VSS-16C	16	1 4 8 16	4 8	32 64 96	DF1 & Modbus connection via RS-232 [optional]	16	20 hours	5 years	$3,250.00
303VSS-24C	24	1 4 8 16	4 8	32 64 96	DF1 & Modbus connection via RS-232 [optional]	16	20 hours	5 years	$3,895.00

304VSS-32C	32	1 4 8 16	4 8	32 64 96	DF1 & Modbus connection via RS-232 [optional]	16	20 hours	5 years	$4,650.00

Results 1 - 5 of 5

ALLIED CONTROL SERVICES, INC.
611 GARFIELD AVE. • P.O. BOX 234 • WEST POINT, PA 19486
Phone: 215-699-2855
Fax: 215-699-9030

Rockwell Automation Recognized System Integrator | Alliance integration partner with Schneider Electric | UL 508A / 698A Registered Firm | csia control system integrators association

January 20, 2017

Mr. Kevin Anderson
Pennsylvania DEP
400 Market Street
10th Floor RCSOB
Harrisburg, PA 17105

Reference: Surface Water Treatment Plant Effluent Monitor/Alarming and Shut Down System

Dear Kevin,

Per your request, we offer the following proposal for the new SWTP Combined Filter Effluent Monitoring and Alarming System with SWTP shut down. The system includes costs for the monitor/controller and alarm dial-out system. It is assumed that the existing SWTP will have the required chlorine residual analyzer, turbidity analyzer and clear-well level transmitter. An estimated cost for the equipment installation is provided.

The controller/monitor will include adjustable alarm set-points with time delay for a relay output which can be wired to the plant for shut down of the filter system upon the following conditions:

High or Low Clear Well Level
High or Low CFE Chlorine Residual
High or Low CFE Turbidity

The monitor/controller can be configured to send a pre-shut down warning to allow operators the opportunity to go to the plant to try to resolve the problem before reaching the shut-down set-point. If the process value reaches the shut-down set-point, the filter plant shut-down command will occur and a shut-down alarm message will be sent to the plant operator by text message, email or voice message.

If the facility already has an alarm dialer with capacity for three additional alarm inputs, the alarm dialer can be eliminated from the package. A deduct is shown for this on each equipment option.

Option A – Monitor/Alarm System with Standard Dialup Phone Line and Phonetics Alarm Dialer

Item	Qty	Description
1	1	ACS PlantGuard Controller with analog inputs for the following: *CFE Chlorine Residual *CFE Turbidity *Clear Well Level
2	1	Phonetics 8-channel alarm auto-dialer with power supply and battery backup. Requires standard dial-up telephone line connected to alarm dialer. Provides voice message alarm only.

3	1	System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.
4	-	Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.
5	-	Provide onsite operator training on maintenance and standardization of above equipment.
6	4	O&M Manuals with complete Instruction Manuals for the above system.

Total System Price: $8,860.00
Delivery: 2-3 Weeks ARO

Estimated Installation Cost: $2,000.00
Deduct for use of Owner Furnished Alarm Dialer: ($1,400.00)

Option B – Monitor/Alarm System with Standard Dialup Phone Line and RACO Alarm Dialer

Item	Qty	Description
1	1	ACS PlantGuard Controller with analog inputs for the following: *CFE Chlorine Residual *CFE Turbidity *Clear Well Level
2	1	RACO 8-channel alarm auto-dialer with power supply and battery backup. Requires standard dial-up telephone line connected to alarm dialer. Provides voice message alarm only.
3	1	System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.
4	-	Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.
5	-	Provide onsite operator training on maintenance and standardization of above equipment.
6	4	O&M Manuals with complete Instruction Manuals for the above system.

Total System Price: $9,980.00
Delivery: 2-3 Weeks ARO

Estimated Installation Cost: $2,000.00
Deduct for use of Owner Furnished Alarm Dialer: ($2,500.00)

Option C – Monitor/Alarm System with Cellular Alarm Dialer

Item	Qty	Description
1	1	ACS PlantGuard Controller with analog inputs for the following: *CFE Chlorine Residual *CFE Turbidity *Clear Well Level
2	1	ACS cellular alarm notification system with 8-channel alarm input with power supply and battery backup. No dial-up telephone line is required. Provides text and email alarm notification.
3	1	System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.
4	-	Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.
5	-	Provide onsite operator training on maintenance and standardization of above equipment.
6	4	O&M Manuals with complete Instruction Manuals for the above system.

Total System Price: $9,700.00
Delivery: 2-3 Weeks ARO

Estimated Installation Cost: $2,000.00

Please give me a call at 1-800-441-4844 if you have any questions.

Sincerely,

Paul C. Mamzic
President

PCM/

Shopping Cart

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Order List (0) | Quote List (7) | Items for Later (0)

Remove All Items

	Product #	Product Name	Quantity	USD Unit Price	Total Price	Availability ?	
	LXV404.99.51532	SC200 Universal Controller, 100-240 V AC (North America power cord) with one digital sensor input, one analog flow sensor input, MODBUS RS232 & RS485 and two 4-20mA outputs	Update	$2,596.00	$2,596.00	Ships within 1 week	
	LZY807.97.00002	Maintenance Kit for TU5300 sc and TU5400 sc Laser Turbidimeter	Update	$1,100.00	$1,100.00	Call for ship date	
	LZY876	Desiccant Cartridge for TU5300 sc and TU5400 sc Laser Turbidimeter	Update	$16.64	$16.64	Available	
	LXV445.99.23212	TU5400 sc Ultra-High Precision Low Range Laser Turbidimeter with Flow Sensor, RFID, and System Check, EPA Version	Update	$6,142.00	$6,142.00	Available	
	2843100	Chart Recorder Paper — 7-DAY 0-100 PK/100	Update	$59.85	$59.85	Available	
	2842900	Chart Recorder, 10" Round Dual Pen	Update	$1,657.00	$1,657.00	Call for ship date	
	2843200	Chart Recorder Green Replacement Pens.	Update	$70.45	$70.45	Available	
				Subtotal	$11,648.94		

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Taxes and shipment charges are not included on the subtotal shown in this page. Shipping charges will be included on the checkout and order summary pages. You will be charged state taxes for your state. Taxes are determined prior to shipment and stated in your invoice.

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Hazardous Items

Items with this mark may be considered hazardous under some shipping conditions. If necessary, we will change your selected shipping method to accommodate these items.

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Order List (0) | Quote List (7) | Items for Later (0)

Remove All Items

	Product #	Product Name	Quantity	USD Unit Price	Total Price	Availability ?	
	2976100	1720E Turbidimeter with sc200 Controller, 1 Channel	Update	$2,881.00	$2,881.00	Call for ship date	
	2660153	Stablcal® Turbidity Standard, 20.0 NTU, Bottle (1 L)	Update	$139.00	$556.00	Ships within 3 days	
	4415300	1720 Series Calibration Cylinder, 1 L	Update	$88.69	$88.69	Available	
	1895000	Lamp Assembly for 1720D and 1720E Low-range Turbidimeters	Update	$62.00	$62.00	Available	
	2842900	Chart Recorder, 10" Round Dual Pen	Update	$1,657.00	$1,657.00	Call for ship date	
	2843100	Chart Recorder Paper — 7-DAY 0-100 PK/100	Update	$59.85	$59.85	Available	
	2843200	Chart Recorder Green Replacement Pens,	Update	$78.45	$78.45	Available	
				Subtotal	$5,382.99		

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Copy below is hereby approved as to form and legality.
Attorney General

By: Amy M. Elliott
(Deputy Attorney General)

AUG 04 2017
DATE OF APPROVAL

☐ Check if applicable
Copy not approved. Objections attached.

Copy below is hereby certified to be true and correct copy of a document issued, prescribed or promulgated by:

DEPARTMENT OF ENVIRONMENTAL PROTECTION
ENVIRONMENTAL QUALITY BOARD

(AGENCY)

DOCUMENT/FISCAL NOTE NO. 7-521

DATE OF ADOPTION MAY 17, 2017

BY Patrick McDonnell

TITLE PATRICK MCDONNELL
ACTING CHAIRMAN

EXECUTIVE OFFICER CHAIRMAN OR SECRETARY

Copy below is hereby approved as to form and legality
Executive or Independent Agencies

BY Marisa G. Z. Lehr

MAY 24 2017
DATE OF APPROVAL

(Deputy General Counsel)
(~~Chief Counsel - Independent Agency~~)
(Strike inapplicable title)

☐ Check if applicable. No Attorney General Approval or objection within 30 days after submission.

NOTICE OF PROPOSED RULEMAKING

DEPARTMENT OF ENVIRONMENTAL PROTECTION
ENVIRONMENTAL QUALITY BOARD

Safe Drinking Water – General Update and Fees

25 Pa. Code, Chapter 109

PROPOSED RULEMAKING

ENVIRONMENTAL QUALITY BOARD

[25 PA. CODE CH. 109]
Safe Drinking Water (General Update and Fees)

The Environmental Quality Board (Board) proposes to amend Chapter 109 (relating to safe drinking water). The amendments include three parts:

1. Incorporate the remaining general update provisions that were separated from the proposed Revised Total Coliform Rule (RTCR) as directed by the Board on April 21, 2015, including revisions to treatment technique requirements for pathogens, clarifications to permitting requirements, and new requirements for alarms, shutdown capabilities, and auxiliary power.
2. Amend existing permit fees and add new annual fees to supplement Commonwealth costs and fill the funding gap ($7.5 million).
3. Add new amendments to establish the regulatory basis for issuing general permits, clarify that noncommunity water systems (NCWS) require a permit or approval from the Department prior to construction and operation, and address concerns related to gaps in the monitoring, reporting and tracking of back-up sources of supply.

Collectively, these amendments will provide for the increased protection of public health by every public water system (PWS) within the Commonwealth, and ensure that the Department of Environmental Protection (DEP or Department) has adequate funding to enforce the applicable drinking water laws, meet state and federal minimum program elements, and retain primacy (primary enforcement authority).

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.

One or more of these amendments will apply to all 8,521 PWSs in Pennsylvania.

This proposal was adopted by the Board at its meeting of May 17, 2017.

A. *Effective Date*

These amendments will go into effect upon publication in the *Pennsylvania Bulletin* as a final-form rulemaking. Several provisions are deferred for up to three years following promulgation to allow time for operational changes, budgeting or capital improvements.

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. Information regarding submitting comments on this proposal appears in Section I of this preamble. Persons with a disability may use the Pennsylvania AT&T Relay Service by calling (800) 654-5984 (TDD users) or (800) 654-5988 (voice users). This proposed rulemaking is available on the Department's web site at www.dep.pa.gov (select "Public Participation," then "Environmental Quality Board").

C. *Statutory Authority*

The proposed rulemaking is being made under the authority of section 4 of the Pennsylvania Safe Drinking Water Act (SDWA) (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*

The General Assembly found in section 2 of the Pennsylvania Safe Drinking Water Act that it is "in the public interest for the Commonwealth to assume primary enforcement responsibility under the Federal Safe Drinking Water Act." 35 P.S. § 721.2. When SDWA was passed, the purpose was to create a drinking water program to allow the Commonwealth to obtain legal primacy over the Federal program in Pennsylvania.

The Department is the agency that was delegated authority to implement the safe drinking water program, including the program elements necessary for Pennsylvania to assume and maintain primary (i.e., lead) administration and enforcement authority under the Federal Safe Drinking Water Act. 35 P.S. § 721.5(a). The Department, through its Bureau of Safe Drinking Water, provides services to over 8,500 public water systems serving over 10 million citizens to ensure compliance with both the Federal and State Safe Drinking Water Acts. The Board is proposing these amendments to regulations of the Department governing the provision of drinking water to the public in order to continue to implement critical program activities in accordance with applicable Federal and State law requirements.

Part I: General Update Provisions

This rulemaking incorporates the remaining general update provisions that the Board previously determined should be proposed in a separate rulemaking. These general updates are intended to:

- Clarify the source water assessment, source water protection area, and source water protection program elements and requirements.

- Revise the treatment technique requirements for pathogenic bacteria, viruses and protozoan cysts by adding specific turbidity performance requirements for membrane filtration.
- Revise the disinfection profiling and benchmarking requirements to clarify that all PWSs using filtered surface water or groundwater under the direct influence of surface water (GUDI) must consult with the Department prior to making significant changes to disinfection practices to ensure adequate Giardia inactivation is maintained.
- Revise and clarify the monitoring, calibration, recording and reporting requirements for the measurement of turbidity.
- Revise the permit requirements to clarify the components that must be included in a permit application for a new source, including a source water assessment, pre-drilling plan, evaluation of water quantity and quality, and hydrogeologic report.
- Revise the design and construction standards to require PWSs using surface water or GUDI sources to be equipped with alarm and shutdown capabilities. These provisions would be required for plants that are not staffed continuously while the plant is in operation.
- Clarify that treatment technologies must be certified for efficacy through an approved third party.
- Update the system management requirements for community water systems (CWSs) to strengthen system service and resiliency by requiring auxiliary power or an alternate provision such as finished water storage or interconnections.
- Clarify system management responsibilities relating to source water assessments and sanitary surveys.
- Revise the corrective action timeframes in response to a significant deficiency for PWSs using groundwater and surface water sources to be consistent.
- Delete the provision that allows a PWS to avoid the requirement for a corrective action by collecting five additional source water samples after an *E. coli*-positive triggered source water sample.

Amendments to Source Water Assessment and Protection Program:

The proposed source water assessment and protection amendments will not only protect public health, but should also help to maintain, reduce or avoid drinking water treatment costs. Source water protection represents the first barrier to drinking water contamination. A vulnerable drinking water source puts a water utility and the community it serves at risk and at a disadvantage in planning and building future capacity for economic growth. Contamination of a CWS source is costly for the water supplier and the public. For example, it is estimated that the total cost of the Walkerton, Ontario *E. coli* contamination incident was $64.5 million (*The Economic Costs of the Walkerton Water Crisis* by John Livernois, 2001). In addition to increased monitoring and treatment costs for the water system, a contaminated source may result in costs associated with containment or remediation, legal proceedings, adverse public health and environmental effects, reduced consumer confidence, diminished property values, and costs to replace the contaminated source.

A Texas A&M study (1997) showed that water suppliers in source water areas with chemical contaminants paid $25 more per million gallons to treat drinking water than suppliers in areas with no chemical contaminant detections. The study also showed that for every four percent increase in source water turbidity (an indicator of water quality degradation from sediment, algae and microbial pathogens), treatment costs increase by one percent (Trust for Public Land, 2002). A study by the Pennsylvania Legislative Budget and Finance Committee (2013) stated that "reducing pollution inputs from pipes and land-based sources can reduce locality costs to treat drinking water sources to safe standards." Similarly, a study by the Brookings Institute suggested that a one percent decrease in sediment loading will lead to a 0.05 percent reduction in water treatment costs. Source water assessments can support and enhance emergency response, improve land use planning and municipal decisions, complement sustainable infrastructure initiatives, and help prioritize and coordinate actions by Federal and Commonwealth agencies to better protect public health and safety.

The need to understand and update potential threats to public drinking water sources, as well as ways to minimize those threats, was underscored by the January 2014 chemical spill in West Virginia that impacted the drinking water for 300,000 people. Currently, of the 10.6 million people served by CWSs in Pennsylvania, 7.7 million people are covered by local source water protection programs that have been substantially implemented. Substantial implementation is a term referenced in the U.S. Environmental Protection Agency (EPA) work plans that indicates a measure of progress relative to source water protection efforts. These proposed amendments will help ensure that the remaining nearly three million people also benefit from local source water protection efforts.

Amendments to Surface Water Treatment Requirements:

The proposed amendments to surface water treatment requirements will benefit more than eight million Pennsylvanians who are supplied with water by PWSs utilizing filtration technologies. The amendments to the filtration requirements ensure identification and correction of problems at the plant before a turbidity exceedance occurs or escalates. The United States Environmental Protection Agency (EPA) describes turbidity as "a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (such as whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches." *National Primary Drinking Water Regulations,* EPA 816-F-09-004 (May 2009). These amendments will ensure that PWSs consistently produce water that meets turbidity standards to help ensure the delivery of safe and potable water to all users.

The proposed amendments are intended to reduce the public health risks related to waterborne pathogens and waterborne disease outbreaks. Costs related to waterborne disease outbreaks are extremely high. For example, as stated in the below-referenced article, the total medical costs and productivity losses associated with the 1993 waterborne outbreak of cryptosporidiosis in

Milwaukee, Wisconsin was $96.2 million: $31.7 million in medical costs and $64.6 million in productivity losses. The average total cost per person with mild, moderate, and severe illness was $116, $475, and $7,808. *Cost of Illness in the 1993 Waterborne Cryptosporidium Outbreak, Milwaukee, Wisconsin.* Corso, et al. Emerging Infectious Diseases, Volume 9, No. 4 (April 2003). Available at http://wwwnc.cdc.gov/eid/article/9/4/02-0417.

When problems such as rapid changes in source water quality, treatment upsets requiring a filter backwash, or other unforeseen circumstances occur at filter plants, an immediate response from water plant operators is needed. The proposed amendments will ensure that operators are promptly alerted to major treatment problems, or if an operator is unable to respond, that the plant will automatically shut down when producing inadequately treated water. Thus, these amendments will prevent violations that pose an imminent threat to consumers, reduce PWS costs related to issuing public notice, reduce costs to the community, and maintain consumer confidence.

Revisions to System Service and Auxiliary Power Requirements:

The proposed revisions to system service and auxiliary power requirements will strengthen system resiliency and ensure that safe and potable water is continuously supplied to consumers and businesses. A continuous and adequate supply of safe drinking water is vital to maintaining healthy and sustainable communities.

Pennsylvania's PWS sources and treatment facilities are susceptible to emergency situations resulting from both natural and man-made disasters. Examples of emergencies from recent years include tropical storms, flooding, high winds, ice, snow, industrial chemical plant runoff, pipeline ruptures, and transportation corridor spills. These emergencies have resulted in significant impacts to consumers and businesses due to inadequate water quantity or quality, and required water supply warnings and advisories. For example, in 2011, Hurricane Irene and Tropical Storm Lee caused flooding, water line ruptures, and power outages resulting in mandatory water restrictions and boil water advisories (BWA) at 32 PWSs in Pennsylvania. In 2012, Hurricane Sandy caused similar problems at 85 CWSs. Most of the impacted systems were small systems where redundancy and back-up systems were lacking. In comparison, systems with redundancy and adequate planning maintained operations until the power was restored, with little negative impact to their customers. Countless incidents at individual CWSs have occurred due to localized emergencies, with interruptions in potable drinking water service that could have been prevented if adequate preparation and equipment were available.

In addition, numerous wastewater treatment plants were forced to send untreated sewage to Pennsylvania waterways during these major weather events. PWSs that use these waterways as a source of supply were at an increased risk due to extremely elevated turbidity levels and pathogen loading. Effectively treating drinking water during and after emergencies requires increased vigilance and operational control.

Water outages caused by power failures or other emergencies can cause additional adverse effects including:

- Lack of water for basic sanitary purposes, such as hand-washing and flushing toilets.
- Increased risk to public health when water systems experience a sharp reduction in supply, which can result in low or no pressure situations within the distribution system. Low pressure can allow intrusion of contaminants into distribution system piping from leaks, and backflow from cross connections.
- Dewatering of the distribution system can result in physical damage to pipes when the system is re-pressurized. This situation is exacerbated due to the nationwide problem with aging infrastructure.

These proposed amendments improve the reliability of service provided to all consumers by requiring the development of a feasible plan to consistently supply an adequate quantity of safe and potable water during emergency situations. More specifically, water suppliers will need to provide on-site auxiliary power sources (*i.e.*, generators), or connection to at least two independent power feeds from separate substations; or develop a plan for alternate provisions, such as interconnections with neighboring water systems or finished water storage capacity. Ideally, water systems will implement a combination of options to improve their redundancy and resiliency.

Part II: New Annual Fees and Amended Permit Fees

Funding Necessary to Provide Services

The Department is required to adopt and implement a public water supply program under Section 5(a) of the SDWA that includes, but is not limited to, maximum contaminant levels or treatment technique requirements establishing drinking water quality standards, monitoring, reporting, recordkeeping and analytical requirements, requirements for public notification, standards for construction, operation and modification to public water systems, emergency procedures, standards for laboratory certification, and compliance and enforcement procedures. 35 P.S. § 721.5(a). All of these functions and services are required in order to have an approvable program and maintain primacy from EPA. Services provided by the Department to maintain compliance with Section 5(b) of the SDWA, as well as regulations in Chapter 109 and permits issued, include monitoring and inspection; maintaining an inventory of public water systems in the Commonwealth; conducting systematic sanitary surveys of public water supply systems; assuring the availability of laboratories certified to analyze drinking water for all contaminants specified in the drinking water standards; reviewing and approving plans and specifications for the design and construction of new or substantially modified public water systems to deliver water that complies with drinking water standards with sufficient volume and pressure to users of the systems; and issuing orders and taking other actions necessary and appropriate for enforcement of drinking water standards.

The proposed fees described in this rulemaking are necessary to ensure adequate funding for the Department to carry out its responsibilities under the Federal and State Safe Drinking Water Acts. Pennsylvania is ranked third in the nation in terms of the number of PWSs, with 8,521 PWSs across the Commonwealth. The Department is responsible for regulating all PWSs and ensuring that safe and potable drinking water is continuously supplied to the 10.7 million customers they serve.

The Department's appropriations from the General Fund have decreased in recent years while the cost of staff salaries and benefits, as well as other operation costs, have increased. The result has been an overall decrease in staffing for the Safe Drinking Water Program of 25% since 2009. As discussed in more detail below, these staff reductions have led to a steady decline in the Department's performance of services necessary to ensure compliance with SDWA requirements. Based on the current funding level of $19.7 million, approximately $7.5 million in additional funding is necessary to increase staffing to provide necessary services.

The minimum critical services that the Safe Drinking Water Program must provide to administer the SDWA and its regulations include:

- Conducting surveillance activities, such as sanitary surveys and other inspections;
- Collecting and analyzing drinking water samples;
- Determining compliance with the regulations, a permit or order;
- Taking appropriate enforcement actions to compel compliance;
- Reviewing applications, plans, reports, feasibility studies and special studies;
- Issuing permits;
- Conducting evaluations, such as filter plant performance evaluations and other site surveys;
- Tracking, updating and maintaining water supply inventory, sample file, and enforcement data in various data management systems;
- Meeting and assuring compliance with all Commonwealth and Federal recordkeeping and reporting requirements;
- Conducting training;
- Providing technical assistance; and
- Responding to water supply emergencies.

Failure to provide these fundamental services may result in an increased risk to public health as well as the loss of approval from EPA for the Department to serve as the primary enforcement agency for the administration of the Safe Drinking Water Program in Pennsylvania under Federal law.

The Board has the authority under section 4 of the SDWA (35 P.S. § 721.4(c)) to establish fees for services that bear a reasonable relationship to the actual cost of providing the services. The Board must also consider the impacts of the proposed fees on small businesses as part of the regulatory analysis required by section 5 of the Regulatory Review Act (71 P.S. § 745.5). Sixty-eight percent of the water systems in the Commonwealth are considered small businesses.

The fees proposed in this rulemaking will provide the Department with funding necessary to properly administer the SDWA consistent with the actual cost of services provided in a manner that minimizes the adverse impact on water systems with fewer customers to bear the cost.

Recent Decline in Department Staff and Services

The number of sanitary surveys (full inspections) conducted by the Department has steadily declined since 2009. The Federally mandated inspection frequency is every 3 years for CWSs and every 5 years for NCWSs.

SDW Measure	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
No. Sanitary Surveys	3,177	2,271	2,553	2,310	2,181	2,415	1,847

(Source: Governor's Office Performance Measures, data source is Environment Facility Application Compliance Tracking System (eFACTS))

The number of overdue inspections has ranged from 448 to 703 in the last 6 years. Failure to conduct routine and timely inspections may mean that serious violations are not being identified. In 2015, all six DEP regions had overdue inspections. The range of overdue inspections was 2.4 % to 11.5 %. The total number of systems with overdue inspections was 542. The Federal Public Water System Supervision (PWSS) Grant and primacy measure for inspection frequency has not been met.

SDW Measure	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
No. Overdue Inspections	703	551	458	448	492	542

(Source: eFACTS and Pennsylvania Drinking Water Information System (PADWIS))

The reduction in staffing levels and inability to conduct routine and timely inspections because of funding shortfalls may be contributing to the overall declining trend in PWS compliance rates. For the last four years, the percentage of CWSs that met health-based drinking water standards fell short of the goal of 95%.

SDW Measure:	FY 09-10	FY 10-11	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16
% of CWSs that Meet Health-based Drinking Water Standards	97%	97%	97%	91%	92%	92%	91%

(Source: Governor's Office Performance Measures, data source is PADWIS)

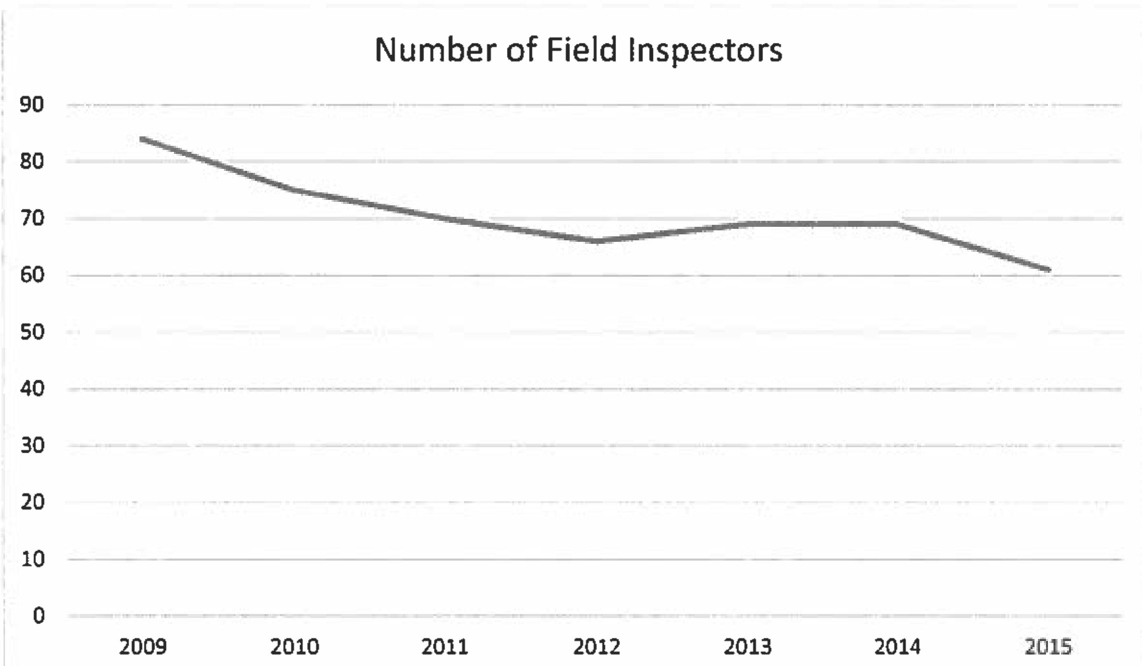
As per the Department's Annual Compliance Report for 2015, PWSs continue to exceed health-based maximum contaminant levels (MCL), maximum residual disinfectant levels (MRDL), and treatment technique (TT) requirements for arsenic, radionuclides, volatile organic chemicals, disinfection byproducts, nitrate/nitrite and pathogens; and for failure to adequately treat drinking water for contaminants such as lead.

The number of unaddressed violations has also continued to increase. In 2015, three of six DEP regions had more than 500 violations that had not been returned to compliance within 180 days or addressed through formal enforcement. (Note: Unaddressed violations are tracked over a five-year period because it generally takes several years to return MCL violations to compliance.)

SDW Measure:	FY 05-10	FY 06-11	FY 07-12	FY 08-13	FY 09-14	FY 10-15
No. Unaddressed Violations	4,298	4,746	5,536	6,849	6,353	7,922

(Source: PADWIS)

Performance is directly tied to the mandated workload and available resources for the Safe Drinking Water Program. Overall, staffing levels are down by 25% since 2009.



Thus, the Department's workload has steadily increased since 2009. As per a workload analysis, the recommended number of PWSs/sanitarian was determined to be 100-125 to ensure completion of mandated inspections, review of PWS self-monitoring data, compliance and enforcement determinations, maintenance of PADWIS and eFACTS, review of monitoring plans, emergency response plans, assessments, and waivers. In 2009, the Department's average workload was within the recommended range at 118 PWSs/sanitarian. In 2015, five of six DEP regions exceeded the recommended workload. The recommended workload has been exceeded in at least four of six DEP regions for the last three years. As per a 2012 Association of State Drinking Water Administrators (ASDWA) survey, the national range and average of PWSs/inspector is 45-140 and 67, respectively. All DEP regions far exceed the national average.

Region	No. PWSs			No. Sanitarians			Sanitarian Workload (No. PWSs/San)		
	2009	2014	2015	2009	2014	2015	2009	2014	2015
1 SERO	1,062	911	911	9	7	6	**118**	**130**	**152**
2 NERO	2,973	2,555	2,559	23	20	19	**129**	**128**	**135**

Region	No. PWSs			No. Sanitarians			Sanitarian Workload (No. PWSs/San)		
	2009	2014	2015	2009	2014	2015	2009	2014	2015
3 SCRO	2,596	2,400	2,408	21	14	13	124	**171**	**185**
4 NCRO	1,115	937	941	10	7	6	112	**134**	**157**
5 SWRO	879	680	694	10	8	6	88	78	105
6 NWRO	1,302	1,211	1,205	11	9	7	118	117	**158**
Totals	9,927	8,694	8,718	84	65	57	118 Avg.	**134 Avg.**	**153 Avg.**

Final numbers for FY 2016/2017 will be finalized by the end of August 2017. Currently, the number of sanitarian positions is 61. This workforce includes 43 sanitarians, 11 trainees and seven vacancies. Due to the ever-increasing complexity of the drinking water program, trainees are not considered adequately trained until they have at least two years of experience. In addition, due to a Department-wide complement reduction, it is unclear if or when the program will receive approval to fill the seven vacancies. As such, the actual available workforce is 54 sanitarians with a workload of 158 PWSs/sanitarian. Of those 54 sanitarians, 26 have four years or less of experience.

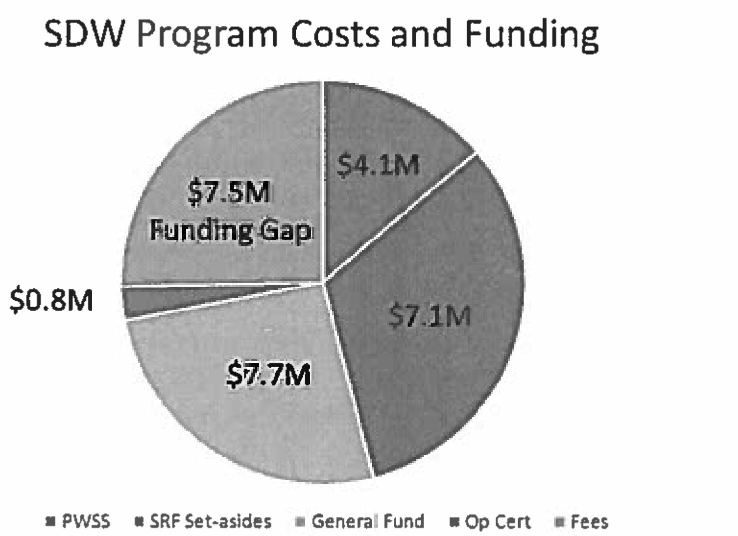
Performance issues and concerns have been well documented by EPA since 2009:

- EPA Region III PWSS Program Review for DEP Bureau of Water Standards and Facility Regulation (July 2009): identified the impacts of a 2008 hiring freeze that prevented the filling of vacancies to reach the full additional complement, and led to inadequate training of field staff. These problems continue today.
- EPA Region III Review of the Bureau of Safe Drinking Water (December 2012): identified that the Department was unsuccessful at retaining all allocated drinking water full time employees as of June 2009 due to budget cuts and increasing costs. Further, the report documented that the number of field inspectors was down by 20% since June of 2009. The report also found that because of staffing cuts, the Department had a backlog of required sanitary surveys (full inspections), and a backlog of Pennsylvania Drinking Water Information System (PADWIS) programming modifications and reports.
- Program performance is currently under review by EPA Region III. An EPA letter dated December 30, 2016 further documents the Department's poor performance. As per the letter, EPA's concerns include the following:
  - Programmatic requirements are not being met in a complete and timely manner. Minimum program requirements must be met for the Commonwealth to maintain primacy for the Safe Drinking Water Program.
  - DEP's average of 149 PWSs/sanitarian is more than double the ASDWA national average. EPA cautions DEP that this kind of excessive workload is not sustainable and program performance will continue to suffer.
  - DEP failed to meet the Federal requirement for sanitary surveys, which can have serious public health implications as major violations could be going unidentified.

- In November 2016, EPA conducted a file review of PA's Lead and Copper Rule. EPA is currently reviewing the information collected. EPA intends to highlight insufficient program personnel in its findings and recommendations.
- EPA is encouraged by DEP's proposed rulemaking to increase program funding and is hopeful that the Drinking Water Program will receive the necessary resources to improve program performance and reduce personnel shortfalls.
- A written action plan was due to EPA within 60 days of the letter (by February 28, 2017). The Department sent a response to EPA on February 24, 2017. Failure to meet minimum program elements may jeopardize EPA's approval of the Department's authority to enforce the Federal law.

Current Safe Drinking Water Program Funding

The current funding available to administer the Safe Drinking Water Program from State and federal sources is $ 19.7 million (see chart below). The proposed fees are expected to generate approximately $7.5 million, which would allow the Safe Drinking Water Program to restore staffing levels and reverse the decline in services that has occurred since 2009. The proposed fees would provide nearly 50% of the Commonwealth's share of funding for the Safe Drinking Water Program. The remaining portion of the Commonwealth's share ($7.7 million) would be provided through annual General Fund appropriations. If General Funds do not keep pace with program costs, a funding gap could remain even with this proposed regulation.



Federal sources currently provide approximately $11.2 million to fund the Pennsylvania Safe Drinking Water Program, including:

- PWSS ($4.1 million) – used for personnel costs; lab costs; staff training
- State Revolving Fund (SRF) Set-asides ($7.1 million) – used for personnel costs; capability enhancement programs (training, technical assistance, optimization

programs); source water assessment and protection; PADWIS; assistance grants/contracts

The Commonwealth currently provides approximately $8.5 million to fund the program through the following sources:

- General Fund appropriations (~$7.7 million) – used for personnel costs
- Operator Certification fees ($0.8 million) – used for Operator Certification Program implementation costs

With the addition of the $7.5 million expected to be generated from this proposed rulemaking, the funds available for the Safe Drinking Water Program would total $27.2 million.

Proposed New Annual Fee and Permit Fee Increases

The proposed fees apply to all 8,521 PWSs, which include 1,952 CWSs, 6,397 noncommunity water systems (NCWSs) and 172 bottled, vended, retail and bulk water hauling systems (BVRBs). The proposed new annual fees range from $250 - $40,000 for CWSs, $50 - $1,000 for NCWSs, and $1,000 - $2,500 for BVRBs. If passed on to their customers, these annual fees would result in an increase in cost ranging from $0.35 to $10 per year, depending on the water system size. Further explanation of the proposed annual fees is provided in the next section under § 109.1402. The proposed increased permit fees range from $100 to $10,000 depending on the population served and whether the permit is for major or minor construction. The prior permit fees ranged from $125 to $1,750. The proposed rulemaking provides for a review of the fee structure every three years to ensure that the fees continue to adequately supplement the cost of maintaining the program.

As provided in section 14 of the Safe Drinking Water Act (35 P.S. § 721.14), all fees would be paid into the State Treasury into a special restricted revenue account in the General Fund known as the Safe Drinking Water Account administered by the Department. The funds may only be used for such purposes as are authorized under the Act.

Comparison to Other States Annual Fees

At least 26 states charge annual fees to augment the cost of their Drinking Water Program. Some of these states charge a flat fee based on the PWS type and size. Other states charge a fee based on population served or the number of service connections. Annual fees for these 26 states range from $25 to $160,000 and are summarized below.

Summary of Public Water System Fees Levied by Other States as of January 2017	
State	**Fee**
Alaska	18 AAC § 80.1910 Type: Fee for Service Examples: Sanitary survey - $398 to $585 for 1st source + $117 for each additional source, other inspections - $64/hour

Summary of Public Water System Fees Levied by Other States as of January 2017	
State	**Fee**
Arkansas *	AC § 20-28-104(a) Type: Annual Fee CWSs and Nontransient NCWSs: Based on # connections $0.30/connection/month, minimum fee = $250 Transient NCWSs: $125
California	Title 22 CCR, Division 4, Chapter 14.5, § 64305 Type: Annual Fee CWSs: minimum $250 or $6/connection (fee per connection on declining tiered scale from $6 to $1.35) Nontransient NCWSs: minimum $456 or $2/person Transient NCWSs: $800
Colorado	CRS § 25-1.5-209 Type: Annual Fee CWSs: Based on population Surface Water: ranges from $75 - $21,630 Ground Water: ranges from $75 - $4,450 Nontransient NCWSs: ranges from $75 - $4,450 Transient CWSs: ranges from $75 - $3,960
Delaware *	16 Del. Code § 135(b)(1) Type: Annual Fee CWSs: Based on # service connections, ranges from $50 - $3,000 Nontransient NCWSs: $50 Transient NCWSs: $25
Florida	FAC § 62-4.053 Type: Annual Fee CWSs: Based on permitted design capacity Ranges from $100 – $6,000 Nontransient NCWSs: $100 Transient NCWSs: $50
Idaho	IAC § 58.01.08-010 Type: Annual Fee CWSs and Nontransient NCWSs: Based on # connections 1-20 $100 21-184 $5/connection, max. $735 185-3,663 $4/connection, max. $10,988 >3,664 $3/connection Transient NCWSs: $25
Indiana	IC § 13-18-20.5-2 Type: Annual Fee CWSs: Based on # connections - < 400 connections $350 ≥ 400 connections $0.95/connection Nontransient NCWSs: Based on population – ranges from $150 - $300 Transient NCWSs: Based on source water type – ranges from $100 - $200

Summary of Public Water System Fees Levied by Other States as of January 2017	
State	**Fee**
Kansas	K.A.R. 28-15-12 Type: Annual Fee CWSs: Capped at $0.002 per 1,000 gallons of water sold
Louisiana *	Act 605 of 2016 Type: Annual Fee CWSs: Based on # connections, $12/connection
Maine	§ 10-144, CMR Chapter 231, § 1-A Type: Annual Fee Base Fee ($75) + ($0.45 (per capita rate) x (pop)) Cap = $30,000
Massachusetts	MGL, Chapter 21A, Section 18A Type: Annual Fee PWSs: Metered – minimum $20, $8.50/million gallons used Unmetered – $50 - $250 based on population
Michigan	MI SDWA, 1976, PA 399 Type: Annual Fee CWSs: Based on population, ranges from $400 - $134,000 Nontransient NCWSs: $575 Transient NCWSs: $135
Minnesota *	Minnesota Statutes 2009, § 144.3831 Type: Annual Fee CWSs: Based on # connections, $6.36/connection
Mississippi *	MS ST § 41-26-23 Type: Annual Fee CWSs: Based on # connections, $3.00/connection, cap = $40,000
Missouri *	RSMO § 640.100.8 Type: Annual Fee CWSs only: Based on # connections, whether connections are metered, and the size of the meters. $1.08 - $3.24/connection
Montana	ARM § 17.38.248 Type: Annual Fee CWSs: Based on # connections – $2.00/connection, Minimum fee = $100 Nontransient NCWSs: $100 Transient NCWSs: $50
New Jersey	NJAC § 7:10-15Type: Annual Fee CWSs only: Based on population, and whether system has treatment. w/o treatment w/t 25-999 $60 $120 1,000-9,999 $360 $720 10,000-49,999 $790 $1,580 >50,000 $1,640 $3,280

<table>
<tr><th colspan="2">Summary of Public Water System Fees Levied by Other States as of January 2017</th></tr>
<tr><th>State</th><th>Fee</th></tr>
<tr><td>North Carolina</td><td>NC ST § 130A-328
Type: Annual Fee
CWSs: Based on population, fee ranges from $255 - $5,950
Nontransient NCWSs: $150</td></tr>
<tr><td>Ohio</td><td>R.C. § 3745.11
Type: Annual Fee
CWSs: Based on sliding scale of # connections, min. $112
For 100 or more connections, fee ranges from $0.76 - $1.92/connection
Connections
278 (pop=750) $534
1,222 (pop=3,300) $2,346
3,704 (pop=10,000) $5,482
18,518 (pop=50,000) $20,370
92,592 (pop=250,000) $85,185
Nontransient NCWSs: ranges from $112 - $16,820
Transient NCWSs: ranges from $112 - $792</td></tr>
<tr><td>Oklahoma</td><td>OAC § 631-3-21
Type: Annual Fee
All PWSs:
Flat fee for inspections + Flat fee for SDWA activities + Lab costs
Ground water $100 + $1,600 +
Surface water $200 + $6,800 +</td></tr>
<tr><td>Rhode Island</td><td>R46-13-DWQ
Type: Annual License Fee
CWSs: Based on # connections –
$1.50 per connection, ranges from $330 - $32,500
Nontransient NCWSs: $330
Transient NCWSs: $200</td></tr>
<tr><td>South Carolina</td><td>S.C. Code of Regulations R. 61-30.G(2)
Type: Annual Fee
CWSs and Nontransient NCWSs:
3 Components: Administration + Distribution Monitoring + Source Monitoring
Costs for Admin only:
Connections — Base amount + rate/tap — Total Fee
278 (pop=750) — $769 + $3.85/tap — $1,839
1,222 (pop=3,300) — $3,749 + $1.96/tap — $6,144
18,518 (pop=50,000) — $23,389 + $0.46/tap — $31,907
92,592 (pop=250,000) — $35,239 + $0.17/tap — $50,979
Transient NCWSs: $275</td></tr>
</table>

Summary of Public Water System Fees Levied by Other States as of January 2017	
State	**Fee**
Texas	30 TAC § 290.51 Type: Annual Fee CWSs and NTNCWSs: Based on # connections – <25 $200 25-160 $300 ≥161 $4/connection Transient NCWSs: $100
Virginia	12VAC5-600-50 to 110 Type: Annual Fee CWSs: Based on # connections –$3/connection, cap = $160,000 # Connections 278 (pop=750) $834 1,222 (pop=3,300) $3,666 18,518 (pop=50,000) $55,554 92,592 (pop=250,000) $160,000 Nontransient NCWSs: $90
Washington	WAC 246-290-070 Type: Annual Fee Based on # connections – cap = $100,000 Base Fee + Per Connection Fee $100 + $1.05 to $1.30

* Indicates a State where a portion of the annual fee goes towards monitoring costs in addition to administrative costs to run the drinking water program.

Part III: New Amendments

Finally, this proposal will amend other parts of Chapter 109 to:

- Establish the regulatory basis for the issuance of general permits for high volume, low risk modifications or activities to streamline the permitting process.
- Clarify that NCWSs that are not required to obtain a permit must still obtain Department approval of the facilities prior to construction and operation.
- Address concerns related to gaps in the monitoring, reporting and tracking of back-up water sources and entry points. As per Commonwealth and Federal regulations, all sources and entry points must be included in routine compliance monitoring to ensure water quality meets safe drinking water standards. Sources and entry points that do not provide water continuously are required to be monitored when used. However, monitoring requirements for back-up sources are not currently tracked, which means verifiable controls are not in place to ensure that all sources and entry points meet safe drinking water standards. Some of these sources have not been used in at least five years, and, therefore, the Department does not know the water quality for these sources. In addition, the treatment facilities and other appurtenances associated with these sources may have gone unused as well, and may no longer be in good working

order. These amendments will ensure that all sources and entry points are monitored at least annually. PWSs will also be required to document in a comprehensive monitoring plan how routine compliance monitoring will include all sources and entry points.

The proposed rulemaking was presented to the Technical Assistance Center for Small Drinking Water Systems (TAC) on November 14, 2016. TAC met again on January 5, 2017 to continue its review and provide comments. Final comments were received on January 23, 2017. TAC made several recommendations, some of which were incorporated into this proposed rulemaking. Other recommendations were incorporated into this preamble as a means to solicit further public comment. Please refer to Section E for more information about TAC's comments and recommendations.

E. *Summary of Regulatory Requirements*

§ 109.1. Definitions.

New definitions are proposed for "Public Drinking Water Equipment Performance (PDWEP)", "source water assessment", "source water protection area", "source water protection program", "surface water intake protection area", and "surface water intake protection program", and amendments are proposed to the existing definitions for "wellhead protection area" and "wellhead protection program". Except for "PDWEP", these terms are necessary to clarify source water protection requirements in the Federal Safe Drinking Water Act.

Regarding the definition of surface water intake protection area, TAC recommended that the Department take measures to protect the confidentiality of source water and intake locations consistent with the Public Utility Confidential Security Information Disclosure Protection Act (35 P.S. §§ 2141.1—2141.6) and the Right-to-Know Law (65 P.S. §§ 67.101—67.3104). The Department avers that source locational information is protected consistent with these laws.

§109.5. Organization of chapter.

This section is proposed to be amended to add a new Subchapter N (relating to drinking water fees) to the regulations.

§ 109.202. State MCLs, MRDLs, and treatment technique requirements.

Section 109.202(c)(1)(i)(A)(V) is proposed to be added to require PWSs to achieve, within one year of the effective date of promulgation of the final-form regulation, filtered water turbidity of less than or equal to 0.30 Nephelometric Turbidity Unit (NTU) in at least 95% of the measurements taken each month under § 109.301(1), and less than or equal to 1.0 NTU at all times measured under § 109.301(1).

TAC commented that "the federal turbidity requirement is 0.3 NTU, not 0.30 NTU". TAC claimed that "adding a zero to the MCL is not based on science (see Standard Methods methodology regarding significant figures). The same issue applies to establishing the turbidity limit of 1.0 NTU"; TAC asserted "it should be 1 NTU per the EPA limit". TAC further referenced "the formal public comment regarding significant figures by Jeanne VanBriesen, Professor, Carnegie Mellon University", which was "provided to DEP on the proposed Disinfection Requirements Rule".

The Department avers that the revisions to the turbidity standard are warranted. Turbidity is a surrogate measurement for pathogen breakthrough, primarily for the acute pathogen Cryptosporidium. As turbidity increases, particle (and pathogen) breakthrough increases. This relationship is well established and accepted by the industry. In addition, industry expert research indicates that as filter effluent turbidity increases from baseline levels, the risk of Cryptosporidium breakthrough also increases. For example, several peer reviewed studies have specifically documented significant reduction in Cryptosporidium removal during breakthrough filtration as compared to stable operation. (Huck, P.M. et al, 2002. *Effects of Filter Operation on Cryptosporidium Removal*. Jour. AWWA, 94:6:97.) , Emelko, M.B. et al, 2003. *Cryptosporidium and Microsphere Removal During Late in Cycle Filtration*. Jour. AWWA, 95:5:173.)

Per Department records, the large majority of filter plants in Pennsylvania typically produce water that is less than 0.10 NTU. Water suppliers may be most challenged at meeting the lower turbidity standard when they are experiencing significant increases in turbidity. The intent of the proposed amendments is that water suppliers will be able to take the necessary corrective actions (*e.g.*, remove filter from service) earlier if they are experiencing significant treatment issues. When water suppliers take timely corrective actions, higher turbidity water is prevented from reaching consumers, and violations are avoided.

Additionally, the Department asserts that it is appropriate to "add zeros" for some drinking water standards where the level of sensitivity is warranted by the analytical method. In fact, several Federal drinking water standards end with a zero, including fluoride (4.0 mg/L), arsenic (0.010 mg/L), total trihalomethanes (TTHMs) (0.080 mg/L), haloacetic acids (HAA5) (0.060 mg/L), bromate (0.010 mg/L), chlorite (1.0 mg/L), chlorine (4.0 mg/L) and chloramine (4.0 mg/L). As per Water Supply Guidance (WSG) 20, EPA states that all MCLs are expressed in the number of significant digits permitted by the precision and accuracy of the specified analytical procedures. EPA considers all digits within the MCL to be significant for purposes of determining compliance. For example, EPA issued very clear guidance for the arsenic rule regarding how to determine compliance with the MCL of 0.010 mg/L. Results that are equal to or greater than 0.0105 mg/L are rounded to the nearest 0.001 mg/L and constitute a violation of the MCL. Regarding turbidity monitoring and recording devices, the instrumentation and method can produce precise and accurate results to the thousandths decimal (*e.g.*, 0.000) as evidenced by the manufacturer's specifications. Therefore, the improved sensitivity is warranted, and the amendments will improve public health protection. WSG 20 may be found at the following link: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NEI3.txt .

Section 109.202(c)(1)(i)(C) is proposed to be amended to include specific treatment technique requirements for membrane filtration. These standards are consistent with the results of pilot testing conducted throughout the State, recommendations by EPA in the Membrane Filtration Guidance Manual (EPA 815-R-06-009, November 2005), as well as recommendations made by equipment manufacturers. These standards were previously applied through special permit conditions. Certified operators have consistently maintained the proposed levels of performance at membrane filter plants throughout the Commonwealth; and when deviations from this performance have occurred, follow-up investigations revealed the need for repairs to this treatment barrier. The Membrane Filtration Guidance Manual may be found by typing the title of the document into the search box at https://nepis.pa.gov or at the following direct link: https://goo.gl/horVd4

§ 109.204. Disinfection profiling and benchmarking.

Section 109.204(b) is proposed to be amended and subsections (d) and (e) are proposed to be added to clarify the disinfection benchmark requirements for PWSs using surface water or GUDI sources. These amendments and additions reflect the Federal requirements found in 40 CFR 141.172 and 141.709. These proposed amendments also ensure that simultaneous compliance issues are assessed and addressed before making any changes to treatment.

TAC recommended that subsection (d) reflect the Federal regulations related to disinfection benchmarking and profiling and that subsection (e) include a requirement for the submittal of certain information to the Department. The Department agreed with these recommendations and made modifications accordingly.

§ 109.301. General monitoring requirements.

Section 109.301(1)(i) is proposed to be amended to remove a reference to § 109.301(1)(iii).

Section 109.301(1)(i)(A) and (B) are proposed to be amended to sunset to one year after the effective date of the regulation.

Existing § 109.301(1)(i)(C) is proposed to be renumbered as § 109.301(1)(i)(D).

Existing § 109.301(1)(i)(D) is proposed to be renumbered as § 109.301(1)(i)(E).

Section 109.301(1)(i)(C) is proposed to be added to require continuous monitoring and recording of the combined filter effluent (CFE) beginning one year after the effective date of the regulation. This amendment is consistent with existing individual filter effluent (IFE) turbidity monitoring and recording requirements. Health effects associated with microbial contaminants tend to be due to short-term, single dose exposure rather than long-term exposure. These amendments are part of a multi-barrier approach to ensure treatment is adequate to provide safe and potable water to all users.

TAC commented that many filter plants do not have the capability to sample combined filter effluent; therefore, an alternative methodology and locations should be available to meet the regulation. TAC stated that DEP should allow averaging of the individual filter effluent or, in some instances, allow the plant effluent to be utilized.

The Department has historically considered, and will continue to consider, on a case-by-case basis, alternative methodologies to comply. More specifically, if it is physically impossible for a system to obtain a representative sample (via sample line) from the actual CFE monitoring location, the Department will allow for instantaneous averaging of the IFE turbidity results to be reported for CFE compliance. In these instances, the water supplier would be required to make reasonable efforts to address the lack of CFE sampling during any future plant modifications. Sole reliance on an instantaneous average of IFE turbidity makes the water supplier more vulnerable to reporting violations, in the long term, should the system experience a breakdown in IFE monitoring equipment. Therefore, it is to the water supplier's advantage to develop a true CFE monitoring location if at all feasible.

Existing § 109.301(1)(ii) is proposed to be deleted.

Existing § 109.301(1)(iii) is proposed to be renumbered as § 109.301(1)(ii) and sunset one year after the effective date of the regulation.

Existing § 109.301(1)(iv) is proposed to be renumbered as § 109.301(1)(iii) and additional text was added to require continuous monitoring and recording of the IFE turbidity for filtration technologies other than conventional and direct beginning one year after the effective date of the regulation. This amendment ensures consistency among all filtration technologies.

Existing § 109.301(1)(iv)(A) is proposed to be moved to § 109.304(e).

Existing § 109.301(1)(iv)(B) – (D) are proposed to be deleted.

Section 109.301(1)(iv) is proposed to be added to clarify that all failures of continuous turbidity and residual disinfectant monitoring and recording equipment require grab sampling and manual recording not to exceed five working days and that it applies to all PWSs. This amendment is based on existing language in § 109.301(1) and ensures consistency among all PWSs.

TAC recommended that if continuous monitoring equipment cannot be repaired or replaced within the five working days, the PWS should not be in violation of § 109.301(1) if it notifies DEP.

The Department asserts that the monitoring equipment that water suppliers use to measure and record compliance every 15 minutes is necessary to protect public health. Water suppliers must take actions necessary to resume continuous monitoring and recording as soon as possible, but no later than within five working days, because for each day that four-hour grab sampling is used, water suppliers will have very limited data (six grab sample data points) to assess water quality and make operational changes (instead of 96 monitoring data points when continuous monitoring equipment is in use). Significant volumes of water are produced between each four-hour grab sampling event and no verifiable controls will be in place to ensure that the water continuously meets safe drinking water standards. However, in response to TAC's comment, language has been added to clarify that the Department will consider case-by-case extensions of the time frame if the water supplier provides sufficient written documentation that it is unable to repair or replace malfunctioning equipment within 5 working days due to circumstances beyond its control. If extensions are not pre-approved in writing by the Department, then a violation will occur.

Existing § 109.301(2)(i)(B) and (C) are proposed to be amended to sunset one year after the effective date of the regulation.

Section 109.301(2)(i)(D) is proposed to be added to require continuous monitoring and recording of the source water turbidity and to clarify grab sample monitoring requirements. This amendment was added to be consistent with filtration monitoring and recording requirements because health effects associated with microbial contaminants tend to be due to short-term, single dose exposure rather than long-term exposure.

Existing § 109.301(2)(i)(D) is proposed to be renumbered as § 109.301(2)(i)(E).

Existing § 109.301(2)(i)(E) is proposed to be renumbered as § 109.301(2)(i)(F).

Section 109.301(2)(ii) is proposed to be amended to sunset one year after the effective date of the regulation.

Section 109.301(2)(iii) is proposed to be amended to sunset one year after the effective date of the regulation.

Section 109.301(11) is proposed to be amended to clarify the monitoring requirements for entry points that do not provide water continuously. At a minimum, all entry points shall provide water to the public on at least an annual basis to ensure all sources and entry points are included in routine compliance monitoring.

This amendment is intended to address concerns related to gaps in the monitoring, reporting and tracking of back-up water sources and entry points. As per Commonwealth and Federal regulations, all sources and entry points must be included in routine compliance monitoring to ensure water quality meets safe drinking water standards. Currently, sources and entry points that do not provide water continuously are required to be monitored when used. However, monitoring requirements for back-up sources are not currently tracked, which means no verifiable controls are in place to ensure that all sources and entry points meet safe drinking water standards.

These concerns were most recently highlighted in a 2010 report from EPA's Office of Inspector General entitled *"EPA Lacks Internal Controls to Prevent Misuse of Emergency Drinking Water Facilities"* (Report No. 11-P-0001). Note: The term "emergency" is often used to describe sources other than permanent sources. In Pennsylvania, some of these back-up sources have not been used in at least five years, and, therefore, the Department does not know the water quality for these sources.

In order to better understand the scope of the problem in Pennsylvania, the following data was retrieved from PADWIS.

Entry Points (EP)				
PWS Type	Total No. EPs	No. Permanent EPs	No. Non-Permanent EPs	% Non-Permanent Eps
CWSs	3,330	3,003	327	10%
Others	7,880	7,760	120	2%
Total	11,210	10,763	447	4%

An entry point is the place at which finished water representative of each source enters the distribution system. Routine compliance monitoring is not tracked at non-permanent entry points. Non-permanent entry points include seasonal, interim, reserve, and emergency entry points.

Based on the data, CWSs provide finished water to consumers through a total of 3,330 entry points, 327 (or 10%) of which are non-permanent. Therefore, as many as 10% of all entry points may not be conducting all required monitoring prior to serving water to consumers.

The numbers are even higher at the individual source level.

Water Supply Sources (wells, springs, surface water intakes, etc.)				
PWS Type	Total No. Sources	No. Permanent Sources	No. Non-Permanent Sources	% Non-Permanent Sources
CWSs	5,252	4,634	618	12%
Others	8,604	8,297	307	4%
Total	13,856	12,931	925	7%

For CWSs, as many as 12% of all sources may not be included in routine compliance monitoring, yet these sources can be used at any time.

The Department also reviewed the monitoring history of the 447 non-permanent entry points mentioned above.

Non-Permanent Entry Points (EP)			
PWS Type	No. EPs	No. & % of EPs with No Monitoring Data (Since 1992)	No. of EPs with Some Monitoring Data
CWSs	327	143 (44%)	184 (of these EPs, 47 were sampled in 2016, 37 were sampled during the 2012-2015 monitoring period, and the remaining 101 were sampled prior to 2012.
Others	120	7 (6%)	113 (55 EPs have recent data (2016)).
Total	447	150 (34%)	

For CWSs, 143 (or 44%) of all non-permanent entry points have **no** monitoring data since 1992. Of the 184 entry points with some data, most of the data are 5 to 10 years old.

The use of unmonitored sources and entry points could adversely impact basic water quality, including pH, alkalinity, turbidity, corrosivity and lead solubility, dissolved inorganic carbon, and natural organic matter. Water suppliers may have limited information about how these sources or entry points will impact treatment efficacy and distribution system water quality. In addition, back-up or emergency sources may have poor water quality or MCL exceedances. The use of these sources without proper monitoring and verifiable controls could lead to an increased risk to public health.

Finally, treatment facilities and other appurtenances associated with these sources may no longer be in good working order. Back-up sources and entry points with unknown water quality or that are no longer in good working order provide a false sense of security in terms of system resiliency and emergency response. While the Department understands that many facilities are not used on a 24/7 basis, these proposed amendments will ensure that all permitted sources and entry points are monitored at least annually.

TAC requested the Department to provide more details about how this provision would be applied to interconnections, or instances where the use of a source is limited by some other entity or permit/approval. TAC also recommended that this proposed amendment have an effective date of one year after the effective date of the regulation.

The Department anticipates that select purchased interconnections will be able to retain the "emergency" designation if the following criteria are met. As noted previously, the term "emergency" is often used to describe sources other than permanent sources.

- Using the last three years of historical water use data, the water supplier can demonstrate that the purchased interconnection has only been used for emergency purposes.
- Emergency use has not occurred more than 14 days per year, excluding use under Commonwealth or Federal emergency declarations.
- The Department has conducted an annual compliance check using reported water use data.

On a case-by-case basis, the Department also anticipates that select sources may be able to be retained in the permit, without conducting routine annual compliance monitoring, if documentation is provided to the Department that the use of the source is limited by some other entity or permit or approval. Select sources that meet these criteria will be covered by a special condition in the permit that requires Department notification and completion of compliance monitoring prior to use.

The Board is seeking comment on this amendment, the inclusion of the additional information provided above related to retention of the emergency designation of interconnections, and whether deferred implementation is needed. The Board will consider other options that address these concerns while providing the same level of public health protection.

§ 109.302. Special monitoring requirements.

Section 109.302(a) is proposed to be amended to allow the Department to require special monitoring if the Department has reason to believe that a system is not in compliance with an action level for lead or copper.

§ 109.303. Sampling requirements.

Section 109.303(a) is proposed to be amended to ensure that all samples taken for compliance purposes are collected at the required locations.

Section 109.303(a)(4) is proposed to be amended to be consistent with Federal requirements at 40 CFR 141.61, 141.62 and 141.66. Water suppliers are required to monitor at each entry point representative of each source after all treatment. This section was also amended to clarify the monitoring requirements when sources are blended or alternated prior to the entry point. In some cases, additional samples may need to be collected to ensure that the samples are representative of all sources.

TAC recommended that the Department provide additional discussion and examples to clarify this amendment. TAC expressed concern that too many real-world scenarios may exist to be covered by a blanket requirement. TAC also recommended that the provision be addressed in the facility permit.

The Department avers that the system-specific scenarios will be able to be addressed in the system's comprehensive monitoring plan required under § 109.717. However, the Board is seeking comment on whether additional regulatory language is needed for clarity.

Section 109.303(i) is proposed to be added to clarify that samples taken to determine compliance shall be taken in accordance with a written comprehensive monitoring plan as specified in new § 109.717. These plans are subject to Department review and revision.

§ 109.304. Analytical requirements.

Section 109.304(c)(2) is proposed to be amended to clarify that an individual conducting analysis using a standard operating procedure must do so following not only the Water and Wastewater Systems Operators' Certification Act (63 P.S. § 1001—1015.1) but also the regulations promulgated under that act.

Section 109.304(e) is proposed to be added to clarify turbidimeter calibration requirements. Existing language moved from § 109.301(1)(iv)(A) and was amended as described previously under § 109.301 (relating to general monitoring requirements) of this section.

TAC recommended that "the calibration schedule should remain at the current quarterly frequency for consistency and ease of enforcement [see § 109.301(1)(i)(B)]". The reasoning for this recommendation is a concern that "every 90 days is more difficult to track and is not the same as quarterly".

The Department avers that this revision relates to critical monitoring equipment that is needed to ensure acute pathogens such as Cryptosporidium and Giardia are not present in the drinking water supplied to customers. Therefore, a routine calibration frequency is critical to ensure ongoing data integrity. The Department's experiences during inspections and filter plant performance evaluations (FPPE) indicate the opposite of TAC's comment – that "quarterly" is more difficult to track than "every 90 days". Based on Department review of calibration records during FPPEs, filter plants with standard operating procedures (SOPs) for calibration every 90 days had much better overall routine calibration of critical equipment than systems with SOPs for calibration on a quarterly basis. In one case, a water supplier met the quarterly calibration frequency by calibrating the instrument during the first quarter on January 2, 2016, and then again on June 30, 2016 to meet the second quarterly requirement. This system was technically in compliance. However, 178 days lapsed between calibrations, making the validity of the data questionable. The quarterly calibration frequency is far less consistent and protective of data integrity than calibration every 90 days. In addition, references from the largest manufacturer of turbidimeters (HACH Company) include the following language "calibrate once every 90 days, when used for compliance". This proposed revision is a necessary clarification consistent with leading industry manufacturer expectations, and serves as a basis for protecting public health by insuring accuracy of turbidity data (the surrogate measurement for pathogens). In response to concerns raised by TAC about violations for missing the 90-day maximum frequency by just a few days, the Department modified the language to allow it to "*extend this 90-day calibration frequency if the calibration due date coincides with a holiday or weekend, or during a water system emergency which prevents timely calibration.*" This revision will help reduce the likelihood of inadvertent violations while still maintaining a routine frequency to insure instrument accuracy.

§ 109.305. Fees.

This section is proposed to be reserved. Data management fees were a one-time fee and are being deleted. Monitoring waiver fees are being relocated to the new Subchapter N (relating to drinking water fees).

§ 109.416. CCR Requirements.

Section 109.416(4)(i) is proposed to be amended and § 109.416(4)(ii) is proposed to be added to require a public water system to mail a paper copy of the annual Consumer Confidence Report (CCR) to the Department rather than the other direct delivery options (including electronic delivery) currently provided in subparagraph (i). The Department requires a paper copy for its files. Existing subparagraphs (ii) through (vii) of this paragraph were renumbered to reflect this addition.

TAC recommended that electronic submission of CCRs to DEP be allowed as an environmentally prudent option.

The Department continues to investigate options for water suppliers to submit reports electronically, but resource considerations (including creating a secure computer application accessible to water suppliers, creating and maintaining a CCR format, legal verification of electronic data submittal, server space and retrieval of records) will affect when and how electronic reporting to DEP occurs. CCRs are documents that must be easily available to the public upon request. Electronic submission of the CCR may still require the Department to print a paper copy for the public records file, which adds additional Department costs to print CCRs for the nearly 2,000 regulated CWSs. Additionally, water suppliers are required to maintain a sufficient number of paper copies to fulfill the good-faith delivery provisions to consumers that do not receive water bills, such as customers that rent, and to provide to the public upon request. Thus, one additional paper copy for the Department is not burdensome to a CWS.

§ 109.503. Public water system construction permits.

Section 109.503(a) is proposed to be amended to correct the Department's Drinking Water Bureau name and mailing address.

Section 109.503(a)(1)(iii) is proposed to be amended to add the requirement to submit a source water assessment and pre-drilling plan as part of a new source permit application. In addition, the clauses under this subparagraph were reorganized to clarify the order in which key actions are taken during the process of permitting a new source. These proposed amendments will help ensure that public water systems obtain the highest source water quality available, and that the proper level of treatment for the source is identified and installed in a timely manner. Overall, these amendments will not only protect public health but also help to maintain, reduce or avoid drinking water treatment costs. These amendments are consistent with existing Department guidance, and are based on a significant amount of experience permitting new drinking water sources throughout the Commonwealth.

TAC recommended that DEP provide confidentiality of the source and intake identification and location per the Public Utility Confidential Security Information Disclosure Protection Act and the Right-to-Know Law. As per long-standing policy, the Department protects source locational information consistent with these laws.

Section 109.503(c) is proposed to be amended to require an application fee in the amount required under the new Subchapter N.

§ 109.505. Requirements for noncommunity water systems.

Sections 109.505(a)(2)(i) and (ii) are proposed to be amended to clarify the specifications and conditions that noncommunity water systems must meet to avoid obtaining a permit from the Department. These amendments also clarify that Department approval is needed prior to construction or operation.

Section 109.505(a)(3)(ii) is proposed to be amended to correct a Chapter 109 cross reference to reflect amendments to § 109.503(a)(1)(iii).

§ 109.511. General permits.

This section is proposed to be added to establish the regulatory basis for the issuance of general permits. General permits are intended for high volume, low risk modifications or activities, and can streamline the permitting process.

TAC recommended that the entity submitting the first general permit application should not incur all the cost for submitting the General Permit Application because the general permit would benefit all future users and DEP. The cost to the first entity seeking coverage under a general permit issued by the Department would be the same for all entities seeking coverage. To provide certainty to the regulated community, the Department is proposing in this section that reasonable fees (not to exceed $500) will be established in each general permit for anyone seeking coverage from the Department under a general permit. Draft general permits are noticed in the *Pennsylvania Bulletin* for public comment. The public will be able to provide comments on the fees in addition to the technical aspects of the general permit.

The Board is seeking comment on the types of modifications or activities that may be appropriate for a general permit.

§ 109.602. Acceptable design.

Section 109.602(a) is proposed to be amended to include Subchapter K (relating to lead and copper) to clarify that a public water system must be designed to be able to comply with standards established in that chapter.

Section 109.602(e) is proposed to be amended to clarify that point-of-use devices are not acceptable treatment to comply with a maximum residual disinfectant level (MRDL). The addition of "MRDL" was to remain consistent with regulatory language in Subchapter F.

Sections 109.602(f), (g), (h), and (i) are proposed to be added to define new requirements for alarm and shutdown capabilities. Alarm and shutdown capabilities are intended to prevent unsafe water from reaching customers.

TAC recommended that DEP should provide accurate cost estimates for compliance with these provisions and evaluate whether 12 months is adequate time for systems to comply given the costs associated overall with the regulatory package and the addition of fees. TAC expressed concerns that the proposed provision in § 109.602(i)(2)(iv), concerning other operational parameters that the Department may determine necessary for compliance, may be too far reaching and cost prohibitive.

To address TAC's concerns about costs, the Department conducted additional cost estimate research. The Department estimates that 10% of the 353 filter plants in Pennsylvania will need to install an auto-dialer. The Department estimates that the cost to achieve the proposed automatic alarm and shutdown capabilities ranges from $8,860 to $11,980 per treatment plant, depending on the options chosen, with annual maintenance costs of $600. A detailed discussion of these estimated costs are included in Section F of this preamble.

The Department notes that the proposed alarm and shutdown amendments will be cost-effective in comparison to staffing costs incurred by systems that maintain physical staffing of the facility. Several states have regulations that do not allow unattended operation of surface water filtration plants. These proposed revisions provide a reasonable alternative to mandating the presence of a certified operator at all times in all water systems in Pennsylvania.

§ 109.606. Chemicals, materials and equipment.

Section 109.606(a) is proposed to be amended to clarify that equipment which may come into contact with water or affect the quality of the water may not be used unless the equipment is acceptable to the Department.

Section 109.606(c) is proposed to be amended to clarify that equipment, including mechanical devices and drinking water treatment equipment, which are certified for conformance with American National Standards Institute (ANSI)/NSF International (NSF) Standard 61 are deemed acceptable to the Department.

New § 109.606(d) is proposed to be added to clarify that drinking water treatment equipment shall be certified for inactivation, reduction or removal performance, and to allow equipment which is certified for conformance with the NSF Guidelines for Public Drinking Water Equipment Performance (PDWEP) to be acceptable for use in PWS construction or modification.

Existing § 109.606(d) is proposed to be renumbered as § 109.606(e) and amended to add reference to new subsection (d) and PDWEP.

New § 109.606(e)(2) and § 109.606(e)(3)(iv) are proposed to be amended to add references to new PDWEP.

TAC commented that water suppliers have encountered product suppliers that have certified products to conform to either Standard 60 or 61 or PDWEP and do not mark individual product containers. For example, bulk deliveries typically are provided with a certification document and not product markings. In these cases, it has been the Department's practice to require the water supplier to provide documentation that the bulk delivery was NSF certified. In this case, the chemical supplier must also be NSF certified for repackaging.

Section 109.606(e)(3)(v) is proposed to be added to require ANSI equivalent accreditation for the quality assurance/quality control (QA/QC) of equipment claimed to remove or reduce a contaminant.

Section 109.606(e) is proposed to be renumbered as § 109.606(f).

§ 109.612. POE devices.

Section 109.612(b) is proposed to be amended to update the reference to a subsection that was amended in § 109.606. This section was also amended in response to TAC's recommendation that the Department should add "components" to point-of-entry (POE) devices used by public water suppliers.

§ 109.701. Reporting and recordkeeping.

Section 109.701(a)(2)(i)(A) is proposed to be amended to clarify that this clause pertains to CFE turbidity.

Section 109.701(a)(2)(i)(A)(VIII) and (IX) are proposed to be added to reflect proposed amendments in § 109.202(c)(1)(i).

Section 109.701(a)(2)(ii)(A) is proposed to be amended to clarify the turbidity reporting requirements for systems using unfiltered surface water sources and to reflect proposed amendments in § 109.301(2)(i).

Section 109.701(a)(3)(iii)(B) and (C) are proposed to be amended to clarify what situations would require one-hour reporting to the Department.

In addition to the reporting requirements found under § 109.701(a)(1), a new § 109.701(a)(10) is proposed to be added to require water systems to report individual constituents for TTHMs and HAA5. These data are already measured and determined by laboratories and have been voluntarily reported since 2011. These data are necessary for public water systems to identify trends in disinfection byproduct formation and better manage their disinfection practices. Reporting of individual constituent data are consistent with Federal reporting requirements.

Existing § 109.701(a)(10) is proposed to be renumbered as § 109.701(a)(11).

Section 109.701(e)(2) is proposed to be amended to add a citation to clarify which systems are required to report individual filter turbidity monitoring.

The trigger levels specified in § 109.701(e)(2)(i) – (iv) are proposed to be replaced by lower trigger levels for IFE reporting requirements for all filtration technologies as specified in proposed new subparagraphs (v) – (viii). These turbidity reporting requirements are being strengthened because health effects associated with microbial contaminants tend to be due to short-term, single dose exposure rather than long-term exposure. These amendments are part of a multi-barrier approach to ensure treatment is adequate to provide safe and potable water to all users.

TAC commented that this provision is "more stringent than Federal IFE turbidity standards" and that the "provision also reduces IFE turbidity standards significantly as well". TAC referred to "the requirements of the Interim Enhanced Surface Water Treatment Rule and Long Term 1 Enhanced Surface Water Treatment Rule per EPA Fact Sheets and EPA Compilation of Quick Reference Guides from 2011". TAC noted that the proposed amendments would require reporting in the following circumstances:

- IFE turbidity in two consecutive 15 minute readings at end of 4 hours of operation or after filter is off line exceeds 0.30 NTU rather than 0.5 NTU;

- IFE turbidity maximum in two consecutive 15 minute readings exceeds 0.30 NTU rather than 1.0 NTU;
- IFE turbidity in two consecutive 15 minute readings for three consecutive months exceeds 0.30 NTU rather than 1.0 NTU; and
- IFE turbidity in two consecutive 15 minute readings for two consecutive months exceeds 1.0 NTU rather than 2.0 NTU.

TAC asserted that the "ramifications of these turbidity reductions include additional reporting, self-assessments and comprehensive performance evaluations, as well as possible public notifications". TAC recommended that "DEP should provide rationale, science and methodology, cost vs. benefits, public health benefit, etc. and data to support the proposed changes".

These comments mirror previous comments regarding significant figures and reducing IFE turbidity standards significantly.

In response to TAC's comments, the Department offers the following. Individual Filter Effluent is a primary compliance monitoring location. As with CFE, IFE turbidity is the surrogate measurement for pathogen breakthrough, primarily the acute pathogen Cryptosporidium. Turbidity breakthrough on individual filters often provides an indication of water quality problems before CFE turbidity is significantly impacted. As IFE turbidity increases, risk of particle breakthrough on that particular filter increases; this is very simple science supported by existing regulations and industry experts. The vast majority of filter plants in Pennsylvania typically produce IFE water quality <0.10 NTU. Therefore, exceedances of the proposed lower turbidity levels will occur only when water systems are experiencing significant increases in turbidity from an individual filter. Multiple peer reviewed research papers indicate that as turbidity significantly increases from the baseline levels, the risk of pathogen breakthrough increases. The real-world impact to operational practices at Pennsylvania filter plants under the proposed revisions would be that water suppliers take important corrective actions (*e.g.*, remove the filter from service, consult with Department, notify customers) sooner. This will enable suppliers to identify physical integrity issues within an individual filter before CFE water quality is impacted, or before problems within one filter occur in other filters. The Department has documented breakdowns in treatment and the presence of pathogens (*e.g.*, Giardia or Cryptosporidium) in the individual filter effluent of water treatment plants in Pennsylvania that complied with the current IFE turbidity standards. This has been documented both with continuous turbidity monitoring and Microscopic Particulate Analysis (MPA) cartridges. Therefore, the current IFE turbidity standards do not provide an adequate level of protection. Additionally, several peer reviewed studies have specifically documented significant reduction in Cryptosporidium removal during breakthrough filtration as compared to stable operation. (Huck, P.M. et al, 2002; Emelko, M.B. et al, 2003). Therefore, failure to adopt the proposed revisions will increase the risk of exposure to pathogens whenever significant operational problems occur with individual filters. This interim step is necessary to protect public health now. This small step will also better position water systems for future, more significant, reductions in turbidity requirements via Federal regulations.

In addition, for the reasons discussed previously under § 109.202, the Department believes that it is appropriate to add zeros for some drinking water standards where the level of sensitivity is warranted by the analytical method.

§ 109.702. Operation and maintenance plan.

Section 109.702(a) is proposed to be amended to clarify that a water system must have an operation and maintenance plan that follows guidelines in the Public Water Supply Manual, and includes the information contained in § 109.702(a)(1)-(14).

Section 109.702(a)(13) is proposed to be amended to require that the operation and maintenance plan also include an exercise and testing program for alarm and shutdown and auxiliary power equipment. This requirement was added because testing of all critical water system components is consistent with § 109.4(3) and (4).

§ 109.703. Facilities operation.

Section 109.703(b)(1)-(3) is proposed to be amended to remove implementation dates that have already passed.

Section 109.703(b)(1) is proposed to be also amended to strengthen filter-to-waste requirements. Filters are most likely to shed turbidity, particles, and microbial organisms at the beginning of a filter run when the filter is first placed into service following filter backwashing and/or maintenance. For systems with filter-to-waste capabilities, an adequate filter-to-waste protocol following filter backwashing and/or maintenance and prior to placing a filter into service will reduce the likelihood of pathogens passing through filters and into the finished drinking water.

TAC commented that one full filter volume may be excessive and unnecessarily wasting water. TAC also commented that facilities may not be able to hold that volume of filter waste. Further, TAC asserted that many facilities do not have filter-to-waste capability because it is prohibitively expensive to provide. TAC reiterated its concern that achieving turbidity of less than 0.30 NTU is more stringent than EPA regulation and again raised the concern with the additional significant figure. TAC stated that DEP needs to allow new filter backwash technologies such as sub-fluidization; or resting a filter after backwash before putting a filter back in service. TAC suggested requiring filter-to-waste for one full filter volume or until the filter bed effluent turbidity is less than 0.3 NTU at the normal production flow rate or unless a filter plant can demonstrate that an alternate methodology provides turbidity compliance.

The Department notes that these proposed revisions only apply to operation of existing filter-to-waste capabilities and do not require installation of filter-to-waste. The proposed amendment makes this clarification. The Department believes that filtering to waste for one full filter bed volume is critical for public health protection. For effective operation, one full filter bed volume of water is necessary for a water supplier to determine how the filter will perform relative to the first slug of applied (settled) water. A shorter duration of filter-to-waste can lead to a secondary turbidity spike after the filter has been placed into service. Regarding TAC's comment about storage capacity, the Department is unaware of facilities that lack the waste holding capacity necessary to filter-to-waste one full filter bed volume. The Department agrees with TAC regarding its comment to include an alternate methodology.

In addition, for the reasons discussed previously under § 109.202, the Department believes that it is appropriate to add zeros for some drinking water standards where the level of sensitivity is warranted by the analytical method.

Section 109.703(b)(5) is proposed to be amended to clarify the requirements of the filter bed evaluation program and to ensure that all plants are evaluating their filters. A filter bed evaluation program assesses the overall health of each filter to identify and correct problems before a turbidity exceedance occurs. TAC recommended that the language regarding a filter bed evaluation program be revised to further clarify this requirement, which the Department has done.

TAC recommended that DEP should not be requiring best management practices unless a facility is not meeting turbidity requirements or not meeting filter plant performance objectives. The Department notes that this proposed requirement is not a best management practice. Rather, it is a minimum requirement to verify the critical filtration barrier is physically intact. Filter components are in constant use and as such are constantly aging. Operators routinely (*e.g.*, on average once per shift) walk through the filter plant to visually verify operational integrity of critical filter plant components. However, assessment of the physical integrity of one of the most critical components -- the filter itself -- is difficult, or often impossible, for operators to evaluate during walk-throughs. Most of the filter's components are below the water line or buried within the filter media. Physical inspection of filter components once per year constitutes a minimum preventative measure, and not a best management practice. If a water system waits until a filter plant is no longer meeting performance objectives before investigating the integrity of the filter components, significant deterioration may have occurred and public health may have been compromised. In addition, the amount of time necessary to repair compromised filter components can be excessive. During times of filter repair, loading ratings are increased on adjacent filters or production is limited. Proactive annual investigations should be more cost effective in the long run because it increases the chances of identifying and fixing small problems before they become larger and more widespread.

Section 109.703(c) is proposed to be added to require a water supplier to test alarm and shutdown capabilities at the filter plant and to outline the procedures to be followed in the event of a failure of alarm or shutdown equipment. This paragraph is proposed to be added because testing of all critical water system components is consistent with § 109.4(3) and (4). TAC recommended that during quarterly tests of plant shutdown capabilities, the Department should allow for simulation of a shutdown. The Department agrees and has proposed that simulated testing of shutdown capabilities would be acceptable.

§ 109.704. Operator certification.

Section 109.704(a) is proposed to be amended to clarify that CWSs and NTNCWSs must have personnel certified to operate and maintain a public water system under the Water and Wastewater Systems Operators' Certification Act <u>and</u> the regulations promulgated under that act.

§ 109.705. System evaluations and assessments.

Section 109.705(a)(1) is proposed to be amended by separating all existing language following the first sentence of the paragraph into three subparagraphs (i)-(iii). The first sentence of existing § 109.705(a)(1) was amended to replace "drainage area or wellhead" to incorporate the new term "source water protection area" as defined in § 109.1.

Section 109.705(a)(1)(i) is proposed to be added using language from existing § 109.705(a)(1). This language is proposed to be amended to replace "wellhead protection area" with the new term "source water protection area" as defined in § 109.1.

Section 109.705(a)(1)(iii) is proposed to be added to require revisions to the source water assessment if a system evaluation identified any changes to actual or potential sources of contamination. This addition was made to fulfill the EPA's expectation that source water assessments are routinely updated.

Section 109.705(a)(2) is proposed to be amended to remove the requirement for an evaluation of "source protection" since a CWS will be required to inspect portions of a source water protection area as part of an evaluation conducted under § 109.705(a)(1).

Section 109.705(a)(6) is proposed to be added to require the system evaluation be documented and made available to the Department upon request instead of requiring the water system to submit the evaluation.
Sections 109.705(c)-(d) are proposed to be amended to remove significant deficiency language that would be incorporated in proposed § 109.716.

§ 109.706. System distribution map.

The title of § 109.706 is proposed to be revised to "System map" to be consistent with changes to the map requirements listed in the section.

Section 109.706(a) is proposed to be amended to require all PWSs to prepare and maintain a system map. This amendment was made to ensure that public water suppliers "[p]rovide and effectively operate and maintain public water system facilities" to be consistent with § 109.4(3).

Section 109.706(b) and (c) are proposed to be amended to clarify system map requirements.

TAC commented that medium to large facilities will not be able to capture all of the minimum requirements on one system map. Systems should be able to develop maps and or schematics of their systems as appropriate for that system. Direction of flow is not predictable or known under all circumstances depending on system conditions. Flow may go in different directions dependent on system demands. TAC claimed that DEP's request for one system map is overly simplified and not realistic for how systems operate; distribution systems are dynamic and not static; therefore, larger systems will not be able to meet this requirement. Further, TAC stated that this information should be protected under the Public Utility Confidential Security Information Disclosure Protection Act and the Right-to-Know Law.

Multiple maps are acceptable. Map scale would be the determining factor regarding the overall number of maps. Maps should be of sufficient scale and detail to be interpreted during on-site review by Department staff. The Department is not requesting submittal of these maps. Rather, they should be kept on file at the facility for on-site review during inspection, and submittal upon request. Regarding direction of flow, the Department recognizes TAC's comment that direction of flow can change with time. The Department's expectation is that the maps will contain adequate detail so water system staff can explain to Department staff the expected direction of flow under a specific circumstance (*e.g.*, tanks filling, tanks drawing). The "direction of flow" requirement was removed from the provision. If a system's distribution system is so complex that staff are unable to use a map to determine expected direction of flow under specific circumstances, then a calibrated hydraulic model should be developed and maintained. The Department revised subsection (c) to provide that "*systems may meet this requirement by maintaining a calibrated hydraulic model instead of paper maps*".

§ 109.708. Planned service interruptions.

Section 109.708 is proposed to be amended to describe new requirements for system resiliency.

The heading is proposed to be amended to read "System service and auxiliary power."

Pennsylvania is susceptible to natural disasters, such as ice storms, tropical storms and hurricanes, which can lead to massive and extended flooding and/or power outages. As noted previously, all of Pennsylvania's drinking water sources and treatment facilities are susceptible to emergency situations resulting from both natural and man-made disasters. Therefore, all CWSs must have effective options to provide consistent system service during such emergencies. Despite long-standing efforts to encourage water systems to develop feasible plans for the continuous provision of adequate and safe water quantity and quality during emergency circumstances, many water suppliers are still inadequately prepared. In fact, the Department estimates that more than 400 CWSs do not have an up-to-date emergency response plan. This has resulted in significant impacts to consumers in the form of inadequate water quantity and/or quality and the resulting consumption advisories.

Flooding events caused by localized heavy rains, hurricanes, and tropical storms result in elevated public health risks. Source water turbidity and pathogen loading can increase dramatically during these events. Additionally, when power outages cause interruptions in water system operations, water systems can experience a sharp reduction in supply, which results in low or no pressure within the distribution system. This results in increased risk to public health, because low pressure can allow intrusion of contaminants into distribution system piping from backflow and cross connections. Some customers may also experience inadequate supply of water for basic sanitary purposes, flushing toilets, and potable uses.

Several other mid-Atlantic and Northeastern states are considering or have already promulgated regulations for auxiliary power. Both New Jersey and New York have existing design standards for auxiliary power. New York requires standby power through incorporation of standards recommended by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (known as the 10 States Standards). New Jersey's requirements can be found at N.J.S.A. 58:12A-4(c) and N.J.A.C. 7:10-11.6(i). New Jersey recently evaluated its regulations and issued additional guidance and best management practices regarding auxiliary power, which is available on its website at http://www.nj.gov/dep/watersupply/pdf/guidance-ap.pdf . Finally, Connecticut is in the process of updating its regulations to incorporate generator and emergency contingency and response plan requirements. Connecticut's proposed regulations can be found on its website at http://www.ct.gov/dph/lib/dph/public_health_code/pending_regulations/proposed_regulation--generators.pdf .

The Board is seeking comment on the following:

- What actual costs have been incurred by water systems that have already installed an auxiliary power supply or other resiliency measures?
- Which facilities should be considered a primary component of a water system, meaning the facilities are indispensable to the effective operation of the water system?
- Costs vary considerably for portable versus fixed generators. The type of fuel supply also impacts costs. What are the pros and cons of these various options?
- Do additional alternatives exist to meet the system service requirements of subsection (a)?

TAC commented that DEP should not be prescribing the methods by which a public water supplier obtains auxiliary power. TAC further claimed that DEP has not sufficiently evaluated the cost of providing auxiliary power; that secondary power feeds may not be attainable in rural areas or may be extremely cost prohibitive; and that DEP has not properly evaluated the total cost for implementing generator power. Also, TAC stated that systems may avail themselves of the resources from PaWARN to meet auxiliary power demands. TAC recommended that this provision be addressed in the Emergency Response Plans and not in regulation.

The proposed regulation does not prescribe the specific method by which a system must comply. Rather, it would require that a feasible plan be in place to ensure safe and potable water is continuously supplied to users. The water supplier will determine which option or combination of options it will use to comply. Ideally, suppliers will implement a combination of options to improve their redundancy and resiliency.

This information should be incorporated into Emergency Response Plans, as TAC suggests. However, despite long-standing efforts to encourage water systems to develop feasible plans for the continuous provision of adequate and safe water quantity and quality during emergency circumstances, many water suppliers are still inadequately prepared. In fact, the Department estimates that more than 400 CWSs do not have an up-to-date emergency response plan.

Regarding TAC's comment that systems can use the services of PaWARN to comply, PaWARN has limited resources. Those resources will be quickly overwhelmed during any large scale event. Additionally, as of December 2016, PaWARN had approximately 100 members, and approximately 89 of those members manage CWSs throughout the Commonwealth. This is a small subset of the 1,952 CWSs in Pennsylvania.

Therefore, the Department believes that these revisions are necessary. Wastewater treatment plants have been required to have back-up power supplies for many years now. These amendments would provide consistency within the drinking water and wastewater industry. It is not feasible to develop these plans under an emergency. Rather, plans must be in place before emergencies occur. It is only a matter of time before another natural or man-made disaster significantly impacts water systems in Pennsylvania. If proposed revisions are not adopted, it is anticipated that a large number of CWSs will not be able to provide a consistent supply of safe and potable water.

§ 109.713. *Wellhead protection program.*

The title of § 109.713 is proposed to be revised to "Source water protection program" to be consistent with the new definition of "source water protection program" specified in § 109.1.

Section 109.713(a)(1) – (2) are proposed to be amended to change "wellhead" to "source water" to remain consistent with the new definition of "source water protection program" specified in § 109.1, which encompasses both a surface water intake protection program and a wellhead protection program.

Section 109.713(a)(3) and (4) are proposed to be rewritten to remain consistent with the new definitions of "source water protection area" and "source water assessment" specified in § 109.1.

Section 109.713(a)(5) is proposed to be amended to change all references to "wellhead" to "source water" to remain consistent with the new proposed definition of "source water protection program" specified in § 109.1, which encompasses both a surface water intake protection program and a wellhead protection program.

Section 109.713(a)(6) is proposed to be amended to make the contingency planning for the provision of alternate water supplies relate to all sources, not just groundwater. This proposed amendment is consistent with the proposed definition of a "source water protection program", which encompasses both surface and groundwater sources.

Section 109.713(a)(7) is proposed to be amended to make the provisions for protection of new source sites applicable to all source types. This amendment is consistent with the proposed definition of a "source water protection program", which encompasses both surface and ground water sources.

Section 109.713(b) is proposed to be added to require water suppliers with an approved source water protection program to conduct an annual review of the program. This proposed addition is made to clarify an existing program requirement that fulfills the EPA's expectation that source water assessments are routinely updated.

TAC commented that this provision mandates that a public water supplier is responsible for ensuring protection of their sources, when the Source Water Protection Program does not provide legal access or the authority for the water supplier to inspect or enforce up-gradient facilities that pose a potential source water contamination. The Department notes that this proposed revision was not intended to mandate water supplier inspection or enforcement of up-gradient facilities. However, the provision has been revised to address TAC's concerns.

§ 109.716. Significant deficiencies.

Language contained in this proposed new section was compiled from existing §§ 109.705 and 109.1302 to provide implementation consistency in identifying and responding to significant deficiencies by systems using surface and ground water sources. This section will ensure that all Federal requirements are met.

§ 109.717. Comprehensive monitoring plan.

This section is proposed to be added to ensure that all sources and entry points are included in routine compliance monitoring at the entry point and within the distribution system. The plan must be specific to the system and include details about the various sources and entry points, and how the facilities are operated. The operation of each source and entry point will dictate how compliance monitoring is conducted to ensure that all sources and entry points are included in routine compliance monitoring.

Section 109.717(a) contains the basic components of the plan.

Section 109.717(b) clarifies that the monitoring plans required under other sections must be added to the system's comprehensive monitoring plan. In other words, all monitoring plans must be stored in the same comprehensive plan.

Section 109.717(c) contains the requirements for an annual PWS review and update of the plan. The date of each update must be recorded on the plan.

Section 109.717(d) contains the requirements for submission of the plan to the Department. The plans are subject to Department review and revision.

§ 109.810. Reporting and notification requirements.

Section 109.810(b) is proposed to be amended to clarify laboratory reporting and notification requirements.

§ 109.1003. Monitoring requirements.

Section 109.1003(b)(3) is proposed to be amended to clarify sampling and analysis requirements in order to be consistent with § 109.304(a) and is necessary to maintain primacy in response to EPA comments.

§ 109.1005. Permit Requirements.

Section 109.1005(c)(5)(ii) is proposed to be amended to correct a Chapter 109 citation.

Section 109.1005(e) is proposed to be amended to correct the Department's Drinking Water Bureau name.

Section 109.1005(i) is proposed to be amended to clarify that the permit fees that have been moved to the new proposed Subchapter N.

§ 109.1105. Permit requirements.

Section 109.1105(b)(1) and (2) are proposed to be amended to clarify that CWSs and NTNCWSs should follow the requirements specified in those paragraphs only until the effective date of the regulation. After that time, they should follow the requirements specified in new proposed paragraph (3).

Section 109.1105(b)(3) is proposed to be added to require all CWSs and NTNCWSs to obtain a construction and operations permit for new corrosion control treatment beginning the effective date of the regulation. This paragraph was added to be consistent with existing permitting requirements in subchapter E.

§ 109.1107. System management responsibilities.

Section 109.1107(a)(2)(i) is proposed to be amended to delete the reporting requirements under the Lead and Copper Rule that required accredited labs to calculate and submit the 90^{th} percentile values. DEP now calculates the 90^{th} percentile compliance values so labs are only required to report the individual lead and copper results. In addition, the requirements that information regarding the number of lead and copper samples required and the number of samples taken and whether a lead and copper action level has been exceeded are proposed to be deleted.

§ 109.1108. Fees.

Fees for activities under the Lead and Copper Rule are proposed to be relocated to the new proposed Subchapter N.

§ 109.1202. Monitoring requirements.

Section 109.1202((l) is proposed to be amended to clarify the section title.

The title of § 109.1202(n) is proposed to be amended to clarify that the paragraph applies to source water sample locations for plants with bank filtration. This proposed amendment is consistent with the existing title of § 109.1202(k) and (m).

The title of § 109.1202(o) is proposed to be amended to clarify that the paragraph applies to source water sample locations for plants with multiple sources. This amendment is consistent with the existing title of § 109.1202(k) and (m).

§ 109.1203. Bin classification and treatment technique requirements.

Section 109.1203(f)(2) is proposed to be amended to clarify a citation relating to requirements for microbial toolbox components.

Section 109.1203(g) is proposed to be amended to clarify a citation relating to requirements for microbial toolbox components.

§ 109.1204. Requirements for microbial toolbox components.

Section 109.1204(h) is proposed to be amended to clarify a citation relating to general monitoring requirements.

§ 109.1206. Reporting and recordkeeping requirements.

Section 109.1206(e)(1) is proposed to be amended to clarify a citation to account for the addition of a subparagraph.

A new § 109.1206(e)(1)(viii) is proposed to be added to require a system to report the concentration of oocysts per liter when reporting the results of each Cryptosporidium analysis. Existing § 109.1206(e)(1)(viii)-(x) are proposed to be renumbered to account for the addition of new § 109.1206(e)(1)(viii).

§ 109.1302. Treatment technique requirements.

The title of § 109.1302(c) was amended to improve readability.

Section 109.1302(c)(1) is proposed to be amended to remove significant deficiency language that is proposed to be incorporated in § 109.716.

Section 109.1302(c)(2)(iii) is proposed to be deleted to remove a provision providing that a groundwater system with an *E. coli*-positive groundwater source sample will receive direction from the Department that it needs correction. This clarifies that all *E. coli*-positive source water samples require corrective action under § 109.716.

Section 109.1302(c) is proposed to be amended to remove significant deficiency language from the text of paragraph (1). Paragraph (3) is proposed to be moved to § 109.716 with minor amendments and to include a citation in amended paragraph (3) directing the PWS to that section. Paragraph (4) is proposed to be deleted.

§ 109.1303. Triggered monitoring requirements for groundwater sources.

Section 109.1303(h) is proposed to be amended to remove. the corrective action provisions of subparagraphs (1) and (2) and move the Tier 1 notification provision of subparagraph (3) to be incorporated into the text of the subsection.

§ 109.1305. Compliance monitoring.

Section 109.1305(a)(1)(iii) is proposed to be amended to clarify grab sample and manual recording and reporting requirements in the case of a failure of continuous monitoring equipment. These proposed amendments are consistent with revised language contained in § 109.301.

Section 109.1305(a)(2)(i) is proposed to be amended to clarify that a groundwater system must record the results of the follow up samples which are required under this paragraph.

§ 109.1306. Information describing 4-log treatment and compliance monitoring.

Section 109.1306(b)(3) is proposed to be amended to correct the Department's Drinking Water Bureau name.

§ 109.1307. System management responsibilities.

Section 109.1307(a)(1)(ii) is proposed to be amended to further clarify the time period which constitutes a breakdown in treatment.

§ 109.1401. General.

This proposed section contains the general requirements for fees being collected under the Safe Drinking Water Act.

§ 109.1402. Annual fees.

Subsection (a) proposes to add a new requirement for PWSs to pay an annual fee to support the cost of Department services provided under the Safe Drinking Water Act. As described in Part II of this preamble, the Department has had a reduction in Safe Drinking Water Program staff of 25% since 2009. These new annual fees, as well as the proposed increases in permit fees in § 109.1404, are expected to generate the $7.5 million necessary to restore staffing levels and to provide services required under the SDWA to the 8,521 public water systems in the Commonwealth and the 10.7 million customers they serve.

The following table summarizes the proposed annual fees for CWSs, which are based on population and range from $250 to $40,000. The per-person costs range from $0.35 to $10/person/year.

Proposed Community Water System Annual Fees (Based on Population)		
Population Served	**Annual Fee**	**Cost/Person/Year**
25 - 100	$250	$2.50 - $10.00
101 – 500	$500	$1.00 - $4.95
501 – 1,000	$1,000	$1.00 - $2.00
1,001 – 2,000	$2,000	$1.00 - $2.00
2,001 – 3,300	$4,000	$1.21 - $2.00
3,301 – 5,000	$6,500	$1.30 - $1.97
5,001 – 10,000	$10,000	$1.00 - $2.00
10,001 – 25,000	$20,000	$0.80 - $2.00
25,001 – 50,000	$25,000	$0.50 - $1.00
50,001 – 75,000	$30,000	$0.40 - $0.60
75,001 – 100,000	$35,000	$0.35 - $0.47
100,001 or more	$40,000	≤ $0.40

The Department analyzed the cost of providing services to administer the SDWA and its regulations. The cost of some services can be reasonably estimated, while the cost of other services depends on the specific circumstances and will vary widely. The table below summarizes the Department's costs of providing those services that can be reasonably estimated for CWSs serving various populations. The hourly rate was provided by the Department's fiscal office and includes salary, benefits, and in-direct costs (supplies, etc.).

Cost of Services That Can Be Estimated				
Activity	**Hours/Activity/Year for CWSs Serving the Following Population**			
	<750	**750-5,000**	**5,000-50,000**	**>50,000**
Conduct sanitary surveys	7.5	10	25	37.5
Conduct other inspections	2.5	3.3	5	10
Determine compliance	12	12	15	15
Maintain PADWIS/eFACTS	7.5	7.5	10	10
Review plans/reports	7.5	10	15	15
Provide technical assistance/ training	7.5	7.5	10	10
Total Hours	**44.5**	**50.3**	**80**	**97.5**
@ $49/hr =	**$2,180**	**$2,465**	**$3,920**	**$4,778**

Examples of other services and costs that involve variable circumstances and preclude a single estimate for the services include the following:

1. Sanitary surveys that take longer to conduct due to the complexity or size of the water system. Examples of actual hours expended and costs to complete more complicated sanitary surveys at large water systems (i.e., those serving populations > 50,000) are as follows:
   a. System A (population = 57,000): 40.5 hours at a cost of $1,984
   b. System B (population = 66,500): 40 hours at a cost of $1,960
   c. System C (population = 87,000): 49 hours at a cost of $2,401
   d. System D (population = 105,000): 60 hours at a cost of $2,940

e. System E (population = 120,000): 60 hours at a cost of $2,940

f. System F (population = 747,500): 103 hours at a cost of $5,047

g. System G (population = 1.6 million): 124 hours at a cost of $6,076

2. Additional follow-up actions taken by the Department in response to a violation. When a drinking water standard is exceeded, Department staff are responsible for consulting with and providing direction to the water system; ensuring that public notice is complete, timely and repeated as needed; tracking, reviewing and approving follow-up and corrective actions (such as collecting confirmation or additional samples, repairing/replacing/installing water treatment, or taking contaminated sources off line); and determining when the system has returned to compliance.

   For example, in 2016, monitoring results for a large Pennsylvania water system indicated the 90th percentile lead value exceeded the action level established in the Lead and Copper Rule. This triggered lead service line replacement actions. Department staff spent at least 116.5 hours working to address this important issue. Services provided by the Department to achieve compliance included meetings, file reviews, drafting compliance documents, follow up action reviews and letters. The approximate cost for these services is $5,708.

3. Additional follow-up, corrective and emergency actions taken by the Department in response to a water supply emergency. Water supply emergencies occur each year and require substantial resources from the Department. The following are examples of emergencies and associated costs for services provided by the Department:

   a. In the Spring of 2011, unexpected damage to a very large water main resulted in a major leak, loss of significant water quantity and pressure. The result was closure of multiple businesses and government agencies in a large city within the Commonwealth for three days due to lack of potable water supply. This emergency spanned approximately five consecutive days with approximately 66,500 customers impacted. The Department provided a variety of onsite support services at the site of the break, and at the drinking water filtration plant. Department cost for services provided during this event equates to approximately160 hours of staff time and a cost of $7,840.

   b. During the Summer of 2012, significant construction delays in completing critical renovations and upgrades to a water filter plant threatened the ability to provide an adequate quantity of drinking water to approximately 210,000 customers. Department staff provided a variety of specialized engineering and operational support services over the course of several weeks. Total cost estimate of Department services provided during this event includes 600 hours of staff time costing approximately $29,400.

   c. In the Summer of 2015, runoff from a large fire at an industrial facility severely contaminated the intakes for two public water systems thereby rendering their normal source of surface water untreatable for almost three months. Together, the two public water suppliers impacted provided drinking water to approximately 43,000 customers. Several Department staff were involved in providing a wide variety of emergency support services, over the course of several months, to the water suppliers affected. Department cost estimates for this event include 515 staff hours ($25,235) and emergency sampling costs ($17,818). The total cost of Department services provided was approximately $43,053.

d. In the winter of 2016, an equipment failure resulted in flooding at a surface water filtration plant which provides water to approximately 20,000 customers. This immobilized treatment and pumping capabilities for six consecutive days. The filter plant did not resume normal operations for approximately two weeks. Without combined efforts by the water system, the Department and neighboring water systems, 20,000 customers could have endured consecutive days without an adequate supply of water. Department services included coordination with neighboring water systems to identify alternate sources of water, emergency permit considerations, site assessments, engineering and operational support. Additionally, the Department loaned the public water system critical water quality monitoring equipment (valued at approximately $24,000) for approximately 10 weeks to help verify that safe water was consistently provided. The total cost estimate of Department services provided during this event also includes 300 hours of staff time, which cost approximately $14,700.

4. The cost of samples collected by the Department during inspections and filter plant performance evaluations, in response to complaint investigations, and to assess water quality and protect public health during water supply emergencies. These sampling costs range from $30 for inorganic analyses to $400 for pesticides to $1,200 for analysis of Cryptosporidium and Giardia to $2,968 for a complete emergency sampling suite. Total Department lab costs average approximately $680,000 per year.
5. The costs associated with additional training when new regulations are promulgated. One example is the numerous training sessions that were developed and delivered in 2015 - 2016 to roll-out implementation of the Revised Total Coliform Rule (RTCR) adopted to conform to Federal requirements. This training included eight different training courses, workshops and webinars; that were presented 160 times across the Commonwealth; for a total of 482 hours of training. The cost to deliver 482 hours of training was $23,618.

6. The costs associated with specific follow-up actions established in new regulations. The federal RTCR became effective on April 1, 2016, and the Department and EPA shared enforcement of the federal rule until Pennsylvania's regulations were published as final (which occurred on Sept. 24, 2016). As part of the Department's enforcement responsibilities during this interim period, staff conducted Level 2 assessments at public water systems. A Level 2 assessment is triggered when a public water supply has an *E. coli* MCL violation or when two total coliform triggers occur during a 12-month period. During this interim period, Department staff completed 94 Level 2 Assessments at more than 85 regulated public water systems. These assessments identified over 400 defects that have already been, or are being, corrected thereby improving public health protection. Estimated costs for services provided by the Department were approximately $3,000 per assessment for a total cost of $282,000.

The additional costs described in items 1 – 4 above are more evident in medium and large water systems due to their size, age, complexity, and number of customers at risk. Because these additional costs are variable (*i.e.*, the costs are not incurred every year for every water system), it is not possible to establish an average cost for these services. However, these additional costs were considered when determining the annual fees for the medium and large water systems.

The proposed annual fees could have been based solely on the costs for the services that could be estimated above. However, that approach would have resulted in a disproportionate impact on the smallest CWSs and would have failed to account for the additional costs incurred by the Department to provide services that cannot be readily estimated, such as those described above, which result in substantially higher costs for medium and large water systems. Thus, the proposed annual fees were developed, to the extent possible, to bear a reasonable relationship to the actual costs of the services provided while achieving a reasonable cost to the 10.7 million customers served. The following table shows the per person costs associated with the proposed annual fees as compared to the per person costs associated with annual fees based solely on the cost of services that can be estimated.

Annual Fees vs. Cost Per Person Per Year				
Population Served	**Proposed Annual Fee**	**Cost Per Person Per Year**	**Estimated Cost of Services**	**Cost Per Person Per Year**
25 - 100	$250	$2.50 - $10.00	$2,180	$21.80 - $87.20
101 – 500	$500	$1.00 - $4.95	$2,180	$4.36 - $21.58
501 – 1,000	$1,000	$1.00 - $2.00	$2,180	$2.18 - $4.35
1,001 – 2,000	$2,000	$1.00 - $2.00	$2,465	$1.23 - $2.46
2,001 – 3,300	$4,000	$1.21 - $2.00	$2,465	$0.74 - $1.23
3,301 – 5,000	$6,500	$1.30 - $1.97	$2,465	$0.49 - $0.75
5,001 – 10,000	$10,000	$1.00 - $2.00	$3,930	$0.39 - $0.78
10,001 – 25,000	$20,000	$0.80 - $2.00	$3,920	$0.16 - $0.39
25,001 – 50,000	$25,000	$0.50 - $1.00	$3,920	$0.08 - $0.16
50,001 – 75,000	$30,000	$0.40 - $0.60	$3,920	$0.05 - $0.08
75,001 – 100,000	$35,000	$0.35 - $0.47	$4,778	$0.05 - $0.06
100,001 or more	$40,000	$0.40 or less	$4,778	$0.05 or less

The Board is seeking comment on the proposed annual fees and the approach discussed above used to develop them.

Other Alternatives Considered

Another approach that was considered, based on how some other states have established annual fees, is establishing the fee based on the number of service connections associated with the CWS. The two options considered were:

1. Option #1: Annual fee based on the number of service connections (estimating the number of service connections, using a flat rate per connection, and no minimum or maximum fees).

2. Option #2: Annual fee based on the number of service connections (estimating the number of service connections, using a sliding scale rate per connection, and a minimum fee).

Alternate Option #1: Annual Fees Based on Flat Rate Per Number of Connections

The Department does not currently have accurate data on the number of service connections in PWSs in Pennsylvania. This is not a required field in the Federal or Commonwealth databases. To estimate the number of service connections, the population served by the CWS was divided by 2.7 persons per household. The estimated number of connections associated with CWSs within the Commonwealth range from 9 to almost 600,000, with total connections estimated to exceed 4.4 million. To base an annual fee on the number of connections, the $7.5 million needed was divided by the estimated number of total connections to derive a per connection fee of $1.70. This per connection fee would equate to an estimated per person cost of $0.63. When the per connection fee is multiplied by the estimated number of CWS connections, the total annual fee paid by CWSs would range from $15.30 to over $1 million (see table below). While this approach may achieve approximately the same cost per person, the annual fees would not bear a reasonable relationship to the actual cost of providing services to the CWSs. Therefore, this alternative approach to developing the proposed annual fee was not recommended.

Option #1: Annual Fees Based on Flat Rate/Connection vs. Cost of Providing Services				
Population Served	**# Service Connections**	**Annual Fee**	**Minimum Cost of Services**	**% of Cost of Minimum Services**
25	9	$15.30	$2,180	<1 %
125	46	$78.20	$2,180	4 %
750	278	$472.60	$2,180	22 %
3,300	1,222	$2,077.40	$2,465	84 %
10,000	3,704	$6,296.80	$3,920	160 %
50,000	18,518	$31,480.60	$3,920	803 %
100,000	37,037	$62,962.90	$4,778	1,318 %
120,000	45,052	$76,588.40	$4,778	1,603 %
160,000	59,259	$100,740.30	$4,778	2,108 %
250,000	92,592	$157,406.40	$4,778	3,294 %
660,000	244,444	$415,554.80	$4,778	8,697 %
820,000	303,704	$516,296.80	$4,778	10,806 %
1,600,000	592,593	$1,007,408.10	$4,778	21,084 %

Alternate Option #2: Annual Fees Based on Sliding Rate with Minimum Fee

A second per connection option considered was to use a sliding scale fee per connection. As illustrated in the table below, the annual fees generated using a sliding scale would not bear a reasonable relationship to the actual costs of the services provided. Therefore, this alternative approach to developing the proposed annual fees was not recommended.

	Option #2: Annual Fees Based on Sliding Scale/Connection vs. Cost of Providing Services				
Population Served	**# Service Connections**	**Sliding Scale Fee Per Connection**	**Annual Fee**	**Minimum Cost of Services**	**% of Cost of Minimum Services**
25	9	Flat fee	$250.00	$2,180	11 %
125	46	Flat fee	$250.00	$2,180	11 %
750	278	$3.20	$889.60	$2,465	36 %
3,300	1,222	$3.20	$3,910.40	$2,465	150%
10,000	3,704	$3.00	$11,112.00	$2,465	450 %
50,000	18,518	$1.70	$31,480.60	$3,920	803%
100,000	37,037	$1.50	$55,555.50	$4,778	1,163 %
120,000	45,052	$1.50	$67,578.00	$4,778	1,414 %
160,000	59,259	$1.50	$88,888.50	$4,778	1,860 %
250,000	92,592	$1.50	$138,888.00	$4,778	2,907 %
660,000	244,444	$1.00	$244,444.00	$4,778	5,116 %
820,000	303,704	$1.00	$303,704.00	$4,778	6,356 %
1,600,000	592,593	$1.00	$592,593.00	$4,778	12,402 %

Advisory Committee Comments

TAC asserted that the public water supply community needs adequate time to review and evaluate the proposed fees. TAC recommended that, prior to seeking fees from the regulated water suppliers, the Department should first request adequate funding from the Legislature to maintain the Safe Drinking Water Program and its core functions, including upgraded information technology (IT) systems. Further, TAC recommended that the Department should streamline operating costs and improve efficiencies before seeking fees. TAC asserted that improving IT systems would greatly improve the efficiency of the Department. Further, TAC stated that the General Fund should subsidize the small systems, not the ratepayers of the medium and large systems.

The Department has requested and will continue to request additional funding from the General Fund during the annual budget process to support the Safe Drinking Water Program. The decrease in such funding has caused the need for the proposed annual fees. If such funding becomes available, the Department will evaluate the continuing need for the proposed annual fees. As for the cost to customers of small versus medium and large CWSs, the proposed annual fees provide a reasonable relationship to the actual costs of the services provided by the Department when considering both the minimum costs that can be estimated in advance and the cost of services that arise on a case-by-case basis discussed above.

The Department has streamlined its operations in nearly all areas, except for e-Inspections. In response to many years of staffing and resource shortfalls, the program has been reduced to only those activities that are mandated by Commonwealth and Federal laws, regulations and primacy requirements. Implementation of e-Inspections would streamline data management by eliminating the manual entry of inventory updates, inspection results, etc. into PADWIS and eFACTS. However, the Department would need additional funding in order to purchase mobile devices, and develop and maintain e-Inspection computer programs. If e-Inspections or other efficiencies are developed in the future, the ongoing three-year review of fees will be updated accordingly. However, future efficiencies may also be offset by new regulations and mandates. All of these circumstances will be considered every three years. If overall Department costs go down due to improved efficiencies, the fees will be adjusted accordingly.

TAC recommended that the Department also evaluate a surcharge rate factor based on gallons produced for each permitted facility to determine the annual fee for community, bottled, vended, retail and bulk hauling water systems. TAC also claimed that bottled and vended water fees do not seem equitable in relationship to the cost of the product and asked why the fee is not based on the gallons produced. The Department does not currently have sufficient data to determine the gallons produced as this is not a required data field.

Other Annual Fees

Regarding the other annual fees in subsection (a), proposed fees for nontransient noncommunity water systems (NTNCWS) range from $100 to $1,000; annual fees for transient noncommunity water systems (TNCWS) range from $50 to $500; annual fees for bottled water systems are $2,500; and annual fees for vended, retail and bulk water systems are $1,000 (BVRB).

These proposed fees were determined using the same criteria as discussed above and are illustrated in the table below. The total hours for services that can be estimated were as follows:

- For NTNCWSs, the total hours ranged from 16 to 22 hours.
- For TNCWSs, the total hours ranged from 8 to 13 hours.
- For BVRBs, the total hours ranged from 21 to 26 hours.

Annual Fees vs. Cost Per Person Per Year				
Population Served	**Proposed Annual Fee**	**Cost Per Person Per Year**	**Estimated Cost of Services**	**Cost Per Person Per Year**
NTNCWSs:				
25 - 100	$100	$1.00 - $4.00	$784	$7.84 - $31.36
101 – 500	$250	$0.50 - $2.48	$784	$1.57 - $7.76
501 – 1,000	$500	$0.50 - $1.00	$784	$0.78 - $1.56
1,001 – 3,300	$750	$0.23 - $0.75	$1,078	$0.33 - $1.08
3,301 or more	$1,000	$0.30 or less	$1,078	$0.33 or less
TNCWSs:				
25 – 100	$50	$0.50 - $2.00	$392	$3.92 - $15.68
101 – 500	$100	$0.20 - $0.99	$392	$0.78 - $3.88
501 – 1,000	$200	$0.20 - $0.40	$392	$0.39 - $0.78
1,001 or more	$500	$0.50 or less	$392	$0.39 or less
BVRBs:				
Bottled	$2,500	N/A	$1,274	N/A
Vended	$1,000	N/A	$1,029	N/A
Retail	$1,000	N/A	$1,029	N/A
Bulk	$1,000	N/A	$1,029	N/A

Subsection (b) specifies that the number of customers served shall be based on the Department's public water system inventory, PADWIS, at the time of billing for annual fees.

Subsection (c) contains a schedule of payments for the annual fees. The Department will allow quarterly payments for fees of $10,000 or more.

§ 109.1403. Monitoring waiver fees.

Subsection (a) is proposed to add the fees for waiving the monitoring requirements for volatile organic chemicals (VOC), synthetic organic chemicals (SOC), and inorganic chemicals (IOC) for systems with a single source of drinking water.

Subsection (b) is proposed to add the fees for renewing a waiver from monitoring requirements for systems with a single source of drinking water.

Subsection (c) is proposed to add the fees for waiving the monitoring requirements for systems with more than one source of drinking water.

§ 109.1404. Community and noncommunity water system permitting fees.

The proposed permitting fees were determined using a workload analysis. Costs were assigned based on the relative complexity of the permit review. Permit fees have not been increased since they were originally adopted in 1984.

The Department used the following milestones or steps in the permit review process (with time ranges in hours) to calculate the proposed fees:

- Administrative completeness review (1 hour)
- Technical review (range of 1 – 153 hours, average of 32 hours)
- Preparation of the construction permit (2 hours)
- Pre-operational inspection (1 – 3 hours)
- Preparation of the operation permit (1 hour)

A figure of $64 per hour was used for technical staff time.

Proposed Permit Fees		
Title	**Current Fee**	**Proposed Fee**
Permitting Fees (CWSs and NCWSs):		
Permit/Major Amendment	$750	$300 - $10,000
Minor Amendment	$0	$100 - $5,000
Operations Permit	$0	$50
Emergency Permit	$0	$100
Change in Legal Status	$0	$100
Additional NCWS Fees:		

Proposed Permit Fees		
Title	**Current Fee**	**Proposed Fee**
Application for Approval	$0	$50
4-log Permit	$0	$50
Feasibility Study Fees:		
Feasibility Study	$0	$300 - $10,000

Subsection (a) is proposed to add the fee schedule for applications for construction permits or major construction permit amendments under § 109.503 (relating to public water system construction permits), except for an application for BVRB facilities under § 109.1005.

Subsection (b) is proposed to add the fee schedule for requests for minor construction permit amendments under § 109.503, except for a change in legal status.

Subsection (c) is proposed to add the fee for changes in legal status of the permit.

Subsection (d) is proposed to add the fee for new or amended operations permits under § 109.504 (relating to public water system operating permits).

Subsection (e) is proposed to add the fee for a request for an emergency permit.

TAC recommended that permit fees should not be based on population. Rather, TAC asserted that the fees should be based on the type, scope, size and complexity of the project. TAC also commented that minor amendments should not require extensive review and should be substantially less than major amendments or new permits.

Based on a workload analysis and a review of historical permits, the Department determined that the assessment of permit fees by population generally takes into consideration the size and complexity of the project. Projects for larger systems are generally larger and more complex than projects for smaller systems. Larger systems generally have more complicated simultaneous compliance concerns, which add to the complexity of the project. Finally, the fees for minor amendments are lower than the fees for major amendments or new permits.

§ 109.1405. Permitting fees for general permits.

The proposed section explains that fees for general permits will be established in the general permit and will not exceed $500. The fee for each general permit will be based on a workload analysis prepared prior to issuance of a draft of the general permit for public comment and will reflect the Department's estimated cost for providing services associated with the general permit, including reviewing and approving coverage or renewed coverage under the general permit and conducting inspections and providing other services to ensure compliance.

§ 109.1406. Permitting fees for bottled water and vended water systems, retail water facilities, and bulk water hauling systems.

The Department used the following milestones or steps in the permit review process (with time ranges in hours) to calculate the proposed fees:

- Administrative completeness review (1 hour)
- Technical review (range of 1 – 153 hours, average of 32 hours)
- Preparation of the construction permit (2 hours)
- Pre-operational inspection (1 – 3 hours)
- Preparation of the operation permit (1 hour)

A figure of $64 per hour was used for technical staff time.

Proposed Permit Fees		
Title	**Current Fee**	**Proposed Fee**
Permitting Fees (BVRBs):		
Permit/Major Amendment	$750	$100 – 10,000
Minor Amendment	$0	$100 - $1,000
Operations Permit	$0	$50
Change in Legal Status	$0	$100
Out-of-State Bottled Water	$100	$1,000
Emergency Permit	$0	$100

Subsection (a) is proposed to add the fees for construction permits or major construction permit amendments under § 109.1005 (relating to permit requirements), except an out-of-state facility or system using finished water as its sole source of water.

Subsection (b) is proposed to add fees for a bottled water system, retail water facility or bulk water hauling system purchasing finished water, as its sole source of water.

Subsection (c) is proposed to add the fees for an out-of-State bottled water system submitting proof of out-of-State approval under § 109.1005.

Subsection (d) is proposed to add the fees for minor construction permit amendments under § 109.1005, except for a change in legal status.

Subsection (e) is proposed to add the fees for a change in legal status, such as a transfer of ownership, incorporation or merger.

Subsection (f) is proposed to add the fees for a new or amended operations permit.

Subsection (g) is proposed to add the fees for an emergency permit.

§ 109.1407. Feasibility Study.

This section is proposed to add the fees for feasibility study and pilot study review services from the Department. The average hours to review and approve a feasibility study or pilot study are 37.5 hours.

TAC recommended that the fees should be based on the type, scope and complexity of the project, rather than the system population. The Department notes that system population takes into account the increasing complexity of water systems as population increases.

§ 109.1408. Noncommunity Water System Application for Approval.

This section is proposed to add the fees for an Application for Approval for a NCWS that is released from the obligation to obtain a construction and an operation permit under section 109.505 (relating to requirements for noncommunity water systems).

§ 109.1409. Noncommunity Water System 4-Log Permit.

This section is proposed to add the fees for NCWSs demonstrating 4-log treatment of viruses under subchapter M (relating to additional requirements for groundwater sources).

§ 109.1410. Payment of fees.

This section is proposed to add requirements for paying the fees required by subchapter N.

§ 109.1411. Disposition of funds.

As per the Safe Drinking Water Act, this section is proposed to require that all fees be paid into the State Treasury into a special restricted revenue account in the General Fund known as the Safe Drinking Water Account, which is to be administered by the Department for use in protecting the public from the hazards of unsafe drinking water.

§ 109.1412. Failure to remit fees.

As requested by TAC, this section is proposed to add provisions for the addition of 6% interest for systems which do not pay their annual fees in a timely manner.

The interest charges are extra costs associated with the collection of overdue fees. Section 4(c) of the SDWA provides that Department fees are to ". . . bear a reasonable relationship to the actual cost of providing a service." The proposed interest charges relate to extra services necessary to collect overdue fees such as reminder notice mailings, NOV mailings, phone calls and emails to delinquent payers. The amount of interest actually charged will depend on how long it takes for the PWS to pay the overdue amount. The longer it takes to collect the fee, more services will be required of the Department to collect the overdue fee and the interest charges associated with that service.

This section would also allow the Department to suspend technical services, such as issuing monitoring waivers, plan approvals or permits, for water systems with delinquent fees in excess of 180 days.

§ 109.1413. Evaluation of fees.

This section is proposed to require the Department to provide the Board with an evaluation of the fees set forth in this Chapter and recommend regulatory changes to the Board to address any disparity between the program income generated by the fees and the Department's cost of administering the program with the objective of ensuring fees meet program costs and programs are self-sustaining.

TAC concurred with the three-year cycle for evaluating fees.

F. *Benefits, Costs and Compliance*

Benefits

One or more of the proposed amendments will affect all 8,521 PWSs serving approximately 12.7 million Pennsylvanians. The residents of the 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 protection of public drinking water sources, which will result in maintaining the highest source water quality available, thereby minimizing drinking water treatment costs.

This rulemaking will protect public health by providing increased protection from microbial pathogens and chemical contaminants in PWSs, and strengthen system resiliency. 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 PWS 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 for years to come.

Source Water Assessment, Protection and Permitting Requirements: The benefits of the source water assessment and protection program amendments are discussed in Section D (Background and Purpose) of this preamble under "Amendments to Source Water Assessment and Protection Programs".

In addition to those benefits, the proposed changes relating to new sources of supply in § 109.503 will more clearly define the existing requirements regarding the proper order of the permitting process for developing a new PWS source. These clarifications are needed to help insure that the proper level of treatment is designed and installed in a timely manner; thereby resulting in less delay for permitting a new source that may be needed to meet public health protection requirements, or provide redundancy in the event of contamination of existing sources. These amendments should result in cost savings due to the avoidance of expensive permitting mistakes.

Two other states in EPA Region III, West Virginia and Virginia, also require source water assessments for new sources. In Virginia, the goal is to have a source water assessment completed by Virginia drinking water program staff before the operations permit is issued. Under West Virginia's new statute on source water protection, an assessment is included as part of a local source water protection plan and must be completed by the water supplier prior to operation for a surface water source.

Regarding the development of local source water protection programs, Delaware and more recently, West Virginia, have requirements for source water protection by statute. Under these proposed amendments, the development of a local source water protection program will remain voluntary in Pennsylvania.

Turbidity and Filtration Requirements: Proposed amendments to the monitoring, calibration, recording and reporting requirements for the measurement of turbidity are more stringent than Federal requirements. These proposed amendments will benefit more than 8 million Pennsylvanians that are supplied water by PWSs using filtration technologies. These amendments are based on Department inspections and the evaluation of more than 1,250 filters through the Department's FPPE program. These evaluations have documented that existing requirements are not sufficient to prevent turbidity spikes or the shedding of particles and microbial pathogens into the finished water, which puts consumers at risk of exposure to microbial pathogens. Costs related to waterborne disease outbreaks are discussed in Section D of this preamble under "Amendments to Surface Water Treatment Requirements".

Existing regulations at § 109.301(i) require turbidity monitoring of the CFE once every 4 hours. This period of intermittent sample review allows the production of significant volumes of water that are not monitored for compliance with the maximum allowable turbidity limit. The proposed amendments for CFE turbidity monitoring will require continuous monitoring and recording of the results every 15 minutes. This will also enable operators to identify problematic water quality trends and respond more quickly with necessary process control adjustments.

IFE monitoring ensures that filter deficiencies are identified and corrected before a CFE turbidity exceedance occurs. Existing regulations require continuous IFE turbidity monitoring at conventional and direct filtration plants. The proposed amendments for IFE monitoring include all filtration types. In recent years, the Department has documented breakdowns in treatment of individual filters at filter plants not classified as conventional or direct. The likelihood of a breakdown in treatment or physical integrity of an individual filter is a concern regardless of the specific type of filter technology utilized. Thus, an expansion of existing requirements is needed.

Health effects associated with microbial contaminants tend to be due to short-term, single dose exposure rather than long-term exposure. Therefore, if a short duration single turbidity exceedance of the existing maximum allowable turbidity limit occurs and goes unnoticed, consumers are at risk of exposure to microbial pathogens. By requiring continuous monitoring and recording of the results at least every 15 minutes at both CFE and IFE locations for all filter plants, water suppliers will be better able to identify problems before an exceedance occurs and determine compliance with the maximum allowable turbidity limit at all times.

The proposed amendments lower IFE trigger levels to be consistent with CFE turbidity requirements. Exceeding an IFE trigger is not a violation; instead, it prompts the water supplier to investigate the cause of the problem and correct any deficiencies. If water suppliers are diligent, no violations should occur.

An additional revision will require all surface water filtration plants to implement a filter bed evaluation program that assesses the overall integrity of each filter to identify and correct problems before a turbidity exceedance or catastrophic filter failure occurs. Filters are the final barrier for removal of acute pathogens, and are therefore critical to public health protection. For many systems in Pennsylvania and across the country, this infrastructure is aging, and the revision to require a physical inspection once per year is a necessary minimum preventative action item.

All of these proposed filter plant performance provisions are part of a multi-barrier approach to ensure treatment is adequate to provide safe and potable water to all users.

Thirty states responded to a survey conducted by ASDWA on behalf of Pennsylvania. Twenty states require continuous turbidity monitoring and recording of CFE and fourteen states require continuous IFE monitoring and recording for all filtration types.

Automatic Alarms and Shutdown Capabilities: Filter plants are complex and dynamic. In response to many circumstances, the water plant operator must take an immediate action to protect public health, such as when source water quality changes, chemical feed pumps malfunction, filters require backwashing, or other unforeseen circumstances occur. Water plant operators are often required to perform other duties, which leave water plants unattended, and which limit operators' ability to respond immediately to treatment needs.

Automated alarms and shutdown capabilities play an important role in modern water treatment and public health protection. Many water suppliers have already taken advantage of readily available technology to reduce personnel costs while still providing safe water to their customers. The proposed amendments will ensure that all surface water filtration plants have the minimum controls in place to ensure that operators are immediately alerted to major treatment problems. The proposed amendments will also ensure that unmanned filter plants are automatically shut down when the plant is producing water that is not safe to drink, which prevents contaminated water from being provided to customers for extended periods of time. These alarms and shutdown capabilities will allow operators at both attended and unattended filtration plants to promptly respond to the water quality problems and treatment needs of the plant. The automated plant shut down is intended to prevent poor quality water from reaching customers, which will protect public health, reduce PWS costs related to corrective actions and issuing public notice, reduce costs to the community, and maintain consumer confidence.

Based on an ASDWA survey, twelve states responded that they require filter plants to be attended at all times while in operation. Of the twelve states that require attended operation, seven have regulations that establish standards for plant automation, alarms and shutdowns. Pennsylvania's proposed amendments are less stringent than twelve other states since attended operation is not being required. In addition, the proposed amendments related to plant automation, alarms, and shutdown capabilities are less stringent than the 10 States Standards.

Filter-To-Waste Requirements: The Department's FPPE program has evaluated approximately 1,250 filters since 1999. The results of these evaluations show that filters are most likely to shed turbidity, particles, and microbial organisms at the beginning of a filter run when the filter is first placed into service following filter backwash and/or maintenance. The proposed amendments will require all filter plants that have the ability to filter-to-waste to do so following filter backwash and/or maintenance and before placing the filter into service. Filtering to waste will reduce the likelihood of pathogens passing through filters and into the finished drinking water. The proposed amendments will not require water suppliers without filter-to-waste capabilities or with undersized filter-to-waste capabilities to make a capital improvement.

All thirty states responding to an ASDWA survey require some of their filter plants to filter-to-waste. This proposed regulation is not expected to negatively affect Pennsylvania because implementation is not expected to require any capital improvements.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions: The proposed revisions to system service and auxiliary power requirements will strengthen system resiliency and ensure that safe and potable water is continuously supplied to consumers and businesses. A continuous and adequate supply of safe drinking water is vital to maintaining healthy and sustainable communities.

Pennsylvania's PWS sources and treatment facilities are susceptible to emergency situations resulting from both natural and man-made disasters. Examples of emergencies from recent years include tropical storms, flooding, high winds, ice, snow, industrial chemical plant runoff, pipeline ruptures, and transportation corridor spills. These emergencies have resulted in significant impacts to consumers and businesses due to inadequate water quantity or quality, and in water supply warnings and advisories. Examples of emergencies that have occurred in Pennsylvania and demonstrate the benefit of these amendments are provided in Section D of this preamble under "Revisions to System Services and Auxiliary Power Requirements".

New Annual Fees and Amended Permit Fees: To improve program performance, the proposed rulemaking is intended to supplement Commonwealth costs for administering the Safe Drinking Water Program by filling the funding gap. The proposed fees will total approximately $7.5 million annually and will account for nearly 50% of the Program's Commonwealth funding. The fees will augment the Program funding currently coming from the General Fund ($7.7 million).

The proposed annual fees range from $250 - $40,000 for CWSs, $50 - $1,000 for NCWSs, and $1,000 - $2,500 for bottled, vended, retail, and bulk water haulers (BVRB). The fees will most likely be passed on to the 10.7 million customers of these PWSs as a user fee. Per person costs are expected to range from $0.35 to $10 per year, depending on the water system size.

Please refer to Sections D and E for more information about the benefits and costs associated with the proposed fees.

General Permits: These proposed amendments will establish the regulatory basis for the issuance of general permits for high volume, low risk modifications or activities to streamline the permitting process. General permits provide a cost-effective method to regulate such activities.

Requirements for NCWSs: These proposed amendments will clarify that NCWSs that are not required to obtain a permit must still obtain Department approval of the facilities prior to construction and operation.

Address Gaps in Monitoring, Reporting and Tracking Back-up Sources: These proposed amendments will address concerns related to gaps in the monitoring, reporting and tracking of back-up water sources and entry points. As per Commonwealth and Federal regulations, all sources and entry points must be included in routine compliance monitoring to ensure water quality meets safe drinking water standards. Sources and entry points that do not provide water continuously are required to be monitored when used. However, monitoring requirements for back-up sources are not currently tracked, which means that verifiable controls are not in place to ensure that all sources and entry points meet safe drinking water standards. Some of these sources have not been used in 5 to 10 years, and, therefore, the Department does not know the water quality for these sources. These concerns were most recently highlighted in a 2010 report from EPA's Office of Inspector General entitled *"EPA Lacks Internal Controls to Prevent Misuse of Emergency Drinking Water Facilities"* (Report No. 11-P-0001). These proposed amendments will ensure that all sources and entry points are monitored at least annually. PWSs will also be required to document in a comprehensive monitoring plan how routine compliance monitoring will include all sources and entry points.

The use of unmonitored sources and entry points could adversely impact basic water quality, including pH, alkalinity, turbidity, corrosivity and lead solubility, dissolved inorganic carbon, and natural organic matter. Water suppliers may have limited information about how these sources or entry points will impact treatment efficacy and distribution system water quality. In addition, many sources may be off-line due to poor water quality or MCL exceedances. The use of these back-up or emergency sources, without proper monitoring and verifiable controls, could lead to an increased risk to public health.

Finally, treatment facilities and other appurtenances associated with these sources may also have gone unused, and may no longer be in good working order. Back-up sources and entry points with unknown water quality or that are no longer in good working order provide a false sense of security in terms of system resiliency and emergency response. While the Department understands that many facilities are not used on a 24/7 basis, these amendments will ensure that all permitted sources and entry points are monitored at least annually.

Compliance Costs

The proposed general update provisions will increase public health protection and system resiliency. 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. For example, it is estimated that the total cost of an *E. coli* contamination incident in Walkerton, Ontario was $64.5 million. Costs related to the waterborne outbreak of cryptosporidiosis in Milwaukee, Wisconsin were $96.2 million. Waterborne disease outbreaks result in significant economic and health impacts and can have long-term impacts due to the loss of trust in public water systems.

Proper investment in PWS 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 for years to come.

The proposed fees are necessary to improve program performance and fulfill the Department's fiscal responsibility to cover most, if not all, of its Commonwealth program costs. Program costs are directly tied to the resources needed to meet Federal and Commonwealth mandates for minimum program elements and for the administration of an effective State Drinking Water Program. Failure to meet minimum program elements may result in an increased risk to public health and the loss of primacy for the Safe Drinking Water Program and associated Federal funding.

Source water protection and permitting requirements: Per the Department's records, approximately 30 new CWS sources are permitted each year. DEP estimates that an additional 8 hours of work completed by a professional geologist will be needed to comply with the new source permitting amendments. This extra time will amount to approximately $1,176 per source permitted, based on current hourly rates charged by consulting firms.

Revisions to turbidity monitoring, recording and reporting requirements: Filter plants that need to install continuous monitoring and recording devices will need to spend about $3,000 - $4,000 per monitoring site (includes turbidimeter, controller and installation), with estimated annual costs for maintenance and calibration of $500 per plant. It is estimated that 21 filter plants will need to install this equipment on individual filters and 52 filter plants will need to install this equipment at their combined filter effluent monitoring site.

- *IFE and CFE Monitoring Costs*: Costs have been derived from vendors of HACH brand turbidimeters; the most commonly used turbidimeter in Pennsylvania. If the water supplier prefers a different brand of equipment, the cost may change. Some per instrument cost savings may occur when multiple instruments are purchased. The following table, provided for illustrative purposes, shows costs related to installing and maintaining one HACH continuous monitoring and recording device:

White Light Turbidimeter (analog) and Chart Recorder (analog)

Items	Initial Cost for First Turbidimeter and Recorder	Estimated Annual Calibration and Maintenance Cost	Additional Turbidimeter and Recorder
HACH 1720E and SC200 (analog signal)	$2,881.00		$2,881.00
Calibration Cylinder	$ 89.00		
20 NTU StablCal x (4) Calibrations		$ 556.00	

Items	Initial Cost for First Turbidimeter and Recorder	Estimated Annual Calibration and Maintenance Cost	Additional Turbidimeter and Recorder
Lamp Assembly Replacement		$ 62.00	
Chart Recorder- Duel Pen	$1,657.00		$1,657.00
Chart Recorder Paper		$ 60.00	
Chart Recorder Replacement Pens		$ 79.00	
Installation	$1,000.00		
Total (not including tax and shipping)	$5,627.00	$ 757.00	$4,538.00

Laser Turbidimeter (digital) and Chart Recorder (analog)

Items	Initial Cost for First Laser Turbidimeter and Recorder	Estimated Annual Calibration and Maintenance Cost	Additional Turbidimeter and Recorder
HACH TU5400 Laser Turbidimeter (includes flow sensor RFID, and System Check)	$6,142.00		$6,142.00
HACH SC200 (includes flow sensor input, RFID, and Modbus))	$2,596.00		$2,596.00
Maintenance/Calibration Kit (includes primary standards)		$1,100.00 ($349 to replace the primary standards that are included in the kit)	
Replacement Desiccant Cartridge		$ 17.00	
Chart Recorder- Duel Pen	$1,657.00		$1,657.00
Chart Recorder Paper		$ 60.00	
Chart Recorder Replacement Pens		$ 79.00	
Installation	$1,000.00		
Total (not including tax and shipping)	$11,395.00	$ 1,256.00 (1st year) $ 505.00 (subsequent year)	$10,395.00

- *IFE Monitoring:* Pennsylvania has 353 filter plants, of which 263 are currently required to continuously monitor and record their IFE and already have instrumentation installed. The proposed amendments will require the remaining 90 filter plants to comply with the IFE monitoring requirements of which 69 already have the needed instrumentation.

Therefore, 21 filter plants will need to install one or more monitoring and recording devices. The majority of these 21 filter plants only have two filters. The estimated cost for a water supplier having two filters to install IFE monitoring and recording equipment is expected to be $10,165.00 for white light turbidimeters or $21,790 for laser turbidimeters. The annual maintenance cost for the monitoring and recording equipment on two filters is estimated to be $757.00 for the white light turbidimeters or $505.00 for laser turbidimeters. The cumulative cost for the installation of the IFE monitoring and recording equipment at all 21 filter plants is estimated to be $213,465.00 for white light turbidimeters or $457,590.00 for laser turbidimeters. The cumulative cost for maintaining the monitoring and recording equipment at all 21 filter plants is estimated to be $15,897.00 per year for white light turbidimeters and $10,605 per year for laser turbidimeters.

- <u>*CFE Monitoring:*</u> The majority of filter plants in Pennsylvania already continuously monitor and record their CFE. The exact number of filtration plants without this capability is not known, but based on a review of 90 filtration plants, it is estimated to be 15% of the 353 filter plants in the Commonwealth. The estimated cost to install CFE monitoring and recording equipment is $5,627.00 per plant for white light turbidimeters and recorders or $11,395.00 per plant for laser turbidimeters and recorders. The annual maintenance cost for the monitoring and recording equipment is estimated to be $757.00 for the white light turbidimeters or $505.00 for laser turbidimeters. The cumulative cost for an estimated 52 filter plants to install continuous monitoring and recording equipment is estimated to be $292,604.00 for white light or $592,540.00 for laser turbidimeters. The cumulative cost for maintaining the monitoring and recording equipment at all 52 filter plants is estimated to be $39,364.00 per year for white light turbidimeters or $26,260.00 per year for laser turbidimeters.

<u>*Annual Filter Inspection Program:*</u> No significant additional costs are expected to be associated with implementation of a filter inspection program.

<u>*Filter-To-Waste Requirements:*</u> No expected costs are associated with the proposed filtering to waste amendments.

<u>*Automatic Alarms/Shutdown Capabilities:*</u> Depending on options chosen, systems may incur $8,860 to $11,980 per treatment plant with annual maintenance costs of $600. Note: it is estimated that 317 of the 353 filter plants already meet these provisions and therefore will not incur any additional costs.

The following information is provided as example cost estimates related to adding automated alarm and shutdown capabilities at a small surface/GUDI water filtration plant. The costs include the monitor, controller and alarm dial-out system. It is assumed that the existing filtration plant will already have the chlorine residual analyzer, turbidity analyzer and clear-well level transmitter. These instruments are required to maintain compliance with existing regulations. An estimated cost for the equipment installation is provided. However, systems could save costs if they install the equipment using in-house staff or a local contract electrician.

The controller and monitor will include adjustable alarm set-points with time delay for a relay output which can be wired to the plant for shut down of the filter system upon the following conditions:

- High or Low Clear Well Level
- High or Low Entry Point Chlorine Residual
- High CFE Turbidity

The monitor and controller can be configured to send a pre-shut down warning to allow operators the opportunity to go to the plant to try to resolve the problem before reaching the shut-down set-point. If the process value reaches the shut-down set-point, the filter plant shut-down command will occur and a shut-down alarm message will be sent to the plant operator by text message, email or voice message.

If the facility already has an alarm dialer with capacity for three additional alarm inputs, the alarm dialer can be eliminated from the package. A deduction is shown for this on each equipment option. If the system is staffed continuously, then only alarm capabilities are necessary. This can be accomplished for a lower cost, or possibly no additional cost, depending on the capability of existing filter plant supervisory control and data acquisition (SCADA) equipment.

<u>Option A – Monitor/Alarm System with Standard Dial-up Phone Line and Phonetics Alarm Dialer</u>

1) One alarm control device with analog inputs for the following:
   - CFE Chlorine Residual
   - CFE Turbidity
   - Clear Well Level

2) One Phonetics eight-channel alarm auto-dialer with power supply and battery backup. Requires standard dial-up telephone line connected to alarm dialer. Provides voice message alarm only.

3) One System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.

4) Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.

5) Provide onsite operator training on maintenance and standardization of above equipment.

6) Four Operation and Maintenance Manuals with complete Instruction Manuals for the above system.

Total System Price: $8,860.00
Delivery: 2-3 Weeks (standard delivery)
Estimated Installation Cost: $2,000.00
Deduct for use of Owner Furnished Alarm Dialer: ($1,400.00)

Option B – Monitor/Alarm System with Standard Dial-up Phone Line and Alarm Dialer

1) One alarm control device with analog inputs for the following:

- CFE Chlorine Residual
- CFE Turbidity
- Clear Well Level

2) One eight-channel alarm auto-dialer with power supply and battery backup. Requires standard dial-up telephone line connected to alarm dialer. Provides voice message alarm only.

3) One System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.

4) Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.

5) Provide onsite operator training on maintenance and standardization of above equipment.

6) Four Operation and Maintenance Manuals with complete Instruction Manuals for the above system.

Total System Price: $9,980.00
Delivery: 2-3 Weeks (standard delivery)
Estimated Installation Cost: $2,000.00
Deduct for use of Owner Furnished Alarm Dialer: ($2,500.00)

Option C – Monitor/Alarm System with Cellular Alarm Dialer

1) One alarm control device with analog inputs for the following:

- CFE Chlorine Residual
- CFE Turbidity
- Clear Well Level

2) One cellular alarm notification system with 8-channel alarm input with power supply and battery backup. No dial-up telephone line is required. Provides text and email alarm notification.

3) One System Wiring Diagram – custom wiring diagram for specific analyzer types in use at Owners site. Exact terminal numbers will be provided based on Owners equipment to allow installation by local electrical contractor.

4) Furnish onsite calibration, programming and alarm configuration for all equipment and provide full onsite testing for all equipment including alarm testing and dial-out for plant designated phone numbers and/or pager numbers.

5) Provide onsite operator training on maintenance and standardization of above equipment.

6) Four Operation and Maintenance Manuals with complete Instruction Manuals for the above system.

Total System Price: $9,700.00
Delivery: 2-3 Weeks (standard delivery)
Estimated Installation Cost: $2,000.00

The Department estimates that 10% of the 353 filter plants in Pennsylvania will need to install a controller.

Strengthened System Resiliency Through Auxiliary Power or Alternate Provisions: All CWSs will be expected to review their existing emergency response plan and equipment to specifically develop a plan to provide a consistent supply of adequate quantity and quality of water during emergency situations. The Department estimates that 400 CWSs do not even have an updated emergency response plan. CWSs that do not have a functional generator or do not have existing capability to meet this requirement via the alternate provision options may need to purchase a generator. The generator should be adequately sized such that it can supply power to critical treatment components necessary to supply safe and potable water. Therefore, the cost of the generator will be proportional to the size of the system (*e.g.*, less expensive for small systems). It is difficult to predict system specific costs because of the various options to comply with the proposed revisions. Estimates for small systems are $3,000 - $4,000 for the installation of a transfer switch, generator and concrete pad. Costs for medium and large systems could range from $50,000 - $200,000 per treatment plant. Not all systems will require auxiliary power. Some systems may already meet reliability criteria through storage or interconnections. Several mid-Atlantic states have already moved forward with mandatory requirements for auxiliary power supply including New Jersey, New York and Connecticut.

An estimated 30% of small systems (<3,300) or 485 systems may need to install a back-up power supply. The cumulative cost is estimated to be $1,940,000. The estimate for medium and large systems is that 20% or 65 systems may need to install a back-up power supply at a cumulative cost of $8,125,000.

Cost savings of avoiding interruption of continuous supply of safe and potable water were evaluated using the Water Health and Economic Analysis Tool (WHEAT) software developed by EPA. The Department ran the model for a scenario of a water system serving 2,500 customers and experiencing a water outage for two days. The model outcomes regarding economic consequences are summarized as follows:

- The value of water sales that would have occurred if there wasn't a disruption in water service is estimated to be $2,891.00.
- The value of additional operating costs incurred during the event, which may include bottled/replacement water, equipment, other remediation, or miscellaneous costs is estimated at $24,775.00.
- Total economic impact on the water utility due to the two-day outage (sum of the above losses) is estimated at $27,666.00.
- Regional economic consequences for this same event are estimated at $926,486. This is the total value of economic activity lost among businesses directly affected by the water service disruption, due to the contraction in business activity during the two-day event.

If the water utility complies with the proposed revisions, the potential cost savings for this two-day outage, offsetting the costs to install additional auxiliary power, emergency interconnections with neighboring water systems, and/or finished water storage, are summarized above. These costs would increase with each additional day that the water outage continues.

Additional costs savings to water systems and customers will be the prevention of dewatering of the distribution system piping and protection from damage to collapsed water lines (due to lack of ability to provide adequate quantity water to maintain positive pressure).

An estimated 250 boil water advisories (BWA) occur each year and 25% or 63 BWAs are caused by water supply disruptions. The total annual cost savings to the regulated water systems is estimated at $1,742,958. However, the regional economic cost savings to businesses is estimated at more than $58 million. These cost savings will off-set the costs of improving system resiliency.

Compliance Assistance Plan

The Safe Drinking Water Program uses the Commonwealth's PENNVEST Program to offer financial assistance to eligible PWS. 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 PWS operators. The DEP website also provides timely and useful information for treatment plant operators.

Paperwork Requirements

Paperwork requirements may include:

- Updating of a source water assessment report when a community water system's annual evaluation identifies changes to actual or probable sources of contamination.
- Additional reporting requirements for PWSs that exceed the lower IFE triggers.
- Reporting a failure of alarm or shutdown equipment.
- Development and maintenance of a distribution map for noncommunity water systems.
- Development and maintenance of a comprehensive monitoring plan.
- CWSs will be required to update their existing emergency response plans to include specific information on how they will meet the requirements of this proposal. To minimize the reporting burden and for maintaining security of sensitive documents, the system specific plans for providing a continuous supply of safe and potable water (Uninterrupted System Service Plan – USSP) will not be required to be reported to the Department; rather, this information will be kept onsite for Department review during inspections and/or emergencies. A USSP template will be provided to water suppliers to help facilitate development of the plans.

G. *References*

The following is a comprehensive list of references listed in the order in which they appear throughout this preamble.

1. The Economic Costs of the Walkerton Water Crisis, John Livernois, 2001.
2. Costs of Water Treatment Due to Diminished Water Quality: A Case Study in Texas McCarl B.A. et al, 1997.
3. The Cost of Not Protecting Source Waters, Trust for Public Land, 2002
4. A Cost Effective Alternative Approach to Meeting Pennsylvania's Chesapeake Bay Nutrient Reduction Targets, Pennsylvania Legislative Budget and Finance Committee, January 2013.
5. National Primary Drinking Water Regulations, EPA 816-F-09-004, May 2009.
6. Cost of Illness in the 1993 Waterborne Cryptosporidium Outbreak, Milwaukee, Wisconsin, Corso, et al., Emerging Infectious Diseases, Volume 9, No. 4, April 2003.
7. Effects of Filter Optimization on Cryptosporidium Removal, Huck, P.M. et al, 2002.
8. Cryptosporidium and Microsphere Removal During Late In-Cycle Filtration, Jour. AWWA, 95:5:173, Emelko, M.B. et al, 2003.
9. EPA Water Supply Guidance 20.
10. EPA Membrane Filtration Guidance (EPA 815-R-06-009), November 2005.
11. EPA Lacks Internal Controls to Prevent Misuse of Emergency Drinking Water Facilities (Report No. 11-P-0001), EPA's Office of Inspector General, 2010.

H. *Sunset Review*

Certain provisions in § 109.301(1) and (2) are proposed to sunset in one year. Otherwise, the Board is not establishing a sunset date for this regulation, since it is needed for the Department to carry out its statutory authority. The Department will continue to closely monitor this regulation for its effectiveness and recommend updates to the Board as necessary.

I. *Regulatory Review*

Under section 5(a) of the Regulatory Review Act (71 P.S. § 745.5(a)), on August 9, 2017, the Department submitted a copy of this proposed rulemaking and a copy of a Regulatory Analysis Form to the Independent Regulatory Review Commission (IRRC) and to the Chairpersons of the House and Senate Environmental Resources and Energy Committees. A copy of this material is available to the public upon request.

Under section 5(g) of the Regulatory Review Act, IRRC may convey any comments, recommendations or objections to the proposed rulemaking within 30 days of the close of the public comment period. The comments, recommendations or objections must specify the regulatory review criteria which have not been met. The Regulatory Review Act specifies detailed procedures for review, prior to final publication of the rulemaking, by the Department, the General Assembly and the Governor of comments, recommendations or objections raised.

J. *Public Comments*

The Board is seeking comment on several proposed amendments included in this rulemaking. Comment is requested on specific proposed amendments that are included in this preamble in Section E – Summary of Regulatory Requirements. Please refer to Sections 109.301(11), 109.303, 109.511, 109.708, and 109.1402.

Interested persons are invited to submit written comments, suggestions, support, or objections regarding the proposed rulemaking to the Board. Comments, suggestions, support, or objections must be received by the Board by September 25, 2017.

Comments may be submitted to the Board online, by e-mail, by mail or express mail as follows.

Comments may be submitted to the Board by accessing eComment at http://www.ahs.dep.pa.gov/eComment.

Comments may be submitted to the Board by e-mail at RegComments@pa.gov. A subject heading of the proposed rulemaking and a return name and address must be included in each transmission.

If an acknowledgement of comments submitted online or by e-mail is not received by the sender within 2 working days, the comments should be retransmitted to the Board to ensure receipt. Comments submitted by facsimile will not be accepted.

Written comments should be mailed to the Environmental Quality Board, P.O. Box 8477, Harrisburg, PA 17105-8477. Express mail should be sent to the Environmental Quality Board, Rachel Carson State Office Building, 16th Floor, 400 Market Street, Harrisburg, PA 17101-2301.

Patrick McDonnell,
Chairperson

Annex A

TITLE 25. ENVIRONMENTAL PROTECTION

PART I. DEPARTMENT OF ENVIRONMENTAL PROTECTION

Subpart C. PROTECTION OF NATURAL RESOURCES

ARTICLE II. WATER RESOURCES

CHAPTER 109. SAFE DRINKING WATER

Subchapter A. GENERAL PROVISIONS

§ 109.1. Definitions.

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

* * * * *

Noncommunity water system – A public water system which is not a community water system.

PDWEP **– Guidelines for Public Drinking Water Equipment Performance issued by NSF**

Person – An individual, partnership, association, company, corporation, municipality, municipal authority, political subdivision or an agency of Federal or State government. The term includes the officers, employees and agents of a partnership, association, company, corporation, municipality, political subdivision, or an agency of Federal or State government.

* * * * *

Source—The place from which water for a public water system originates or is derived, including, but not limited to, a well, spring, stream, reservoir, pond, lake or interconnection.

Source water assessment **– An evaluation documented in writing of the contamination potential of a drinking water source used by a public water system which includes identifying the contributing area to the water source, an inventory of potential contaminant sources and a determination of the susceptibility of the water source to contamination.**

Source water protection area **– A surface water intake protection area, a wellhead protection area or both.**

Source water protection program **– A surface water intake protection program, a wellhead protection program or both.**

Spent filter backwash water—A stream containing particles dislodged from filter media when the filter is backwashed to clean the filter.

Substantial modification—A change in a public water system that may affect the quantity or quality of water served to the public or which may be prejudicial to the public health or safety and includes the addition of new sources; the expansion of existing facilities; changes in treatment processes; addition, removal, renovation or substitution of equipment or facilities; and interconnections.

Surface water – Water open to the atmosphere or subject to surface runoff. The term does not include finished water,

***Surface water intake protection area* – The surface and subsurface area surrounding a surface-water intake supplying a public water system through which contaminants are reasonably likely to move toward and reach the water source. A surface water intake protection area shall consist of up to three zones:**

(i) *Zone A.* A quarter-mile wide area inland from the edge of a waterway or surface water body and from an area one quarter-mile downstream of the intake to a five hour time-of-travel upstream.

(ii) *Zone B.* A two-mile wide area inland from the edge of a waterway or surface water body and extending upstream to the 25-hour time-of-travel.

(iii) *Zone C.* For drainage basins greater than or equal to 100 square miles, the remainder of the upstream basin. Zone B and Zone C, if present, comprise the contributing area for the water source.

***Surface water intake protection program* – A comprehensive program designed to protect each surface water source used by a public water system from contamination.**

* * * * *

Wellhead protection area—The surface and subsurface area surrounding a water well, well field, spring or infiltration gallery supplying a public water system, through which contaminants are reasonably likely to move toward and reach the water source. A wellhead protection area shall consist of **[the following]** **up to three** zones:

(i) *Zone I.* The protective zone immediately surrounding a well, spring or infiltration gallery which shall be a 100-to-400-foot radius depending on site-specific source and aquifer characteristics.

(ii) *Zone II.* The zone encompassing the portion of the aquifer through which water is diverted to a well or flows to a spring or infiltration gallery. Zone II shall be a 1/2 mile radius around the source unless a more detailed delineation is approved.

(iii) *Zone III.* **[The]** **As hydrogeologic conditions warrant, the** zone beyond Zone II that **[contributes surface water and groundwater]** **provides groundwater recharge** to Zones I and II. **Zone II and Zone III, if present, comprise the contributing area for the water source.**

Wellhead protection program—A comprehensive program designed to protect **[a]** **each** well, spring or infiltration gallery used by a public water system from contamination.

* * * * *

§ 109.5. Organization of chapter.

(a) This subchapter and **[Subchapter]** **<u>Subchapters</u>** H **<u>and N</u>** (relating to laboratory certification **<u>and drinking water fees</u>**) apply to all public water systems.

* * * * *

Subchapter B. MCLs, MRDLs OR TREATMENT TECHNIQUE REQUIREMENTS

§ 109.202. State MCLs, MRDLs and treatment technique requirements.

* * * * *

(c) *Treatment technique requirements for pathogenic bacteria, viruses and protozoan cysts*. A public water system shall provide adequate treatment to reliably protect users from the adverse health effects of microbiological contaminants, including pathogenic bacteria, viruses and protozoan cysts. The number and type of treatment barriers and the efficacy of treatment provided shall be commensurate with the type, degree and likelihood of contamination in the source water.

(1) A public water supplier shall provide, as a minimum, continuous filtration and disinfection for surface water and GUDI sources. The treatment technique must provide at least 99.9% removal and inactivation of *Giardia lamblia* cysts, and at least 99.99% removal and inactivation of enteric viruses. Beginning January 1, 2002, public water suppliers serving 10,000 or more people shall provide at least 99% removal of *Cryptosporidium* oocysts. Beginning January 1, 2005, public water suppliers serving fewer than 10,000 people shall provide at least 99% removal of *Cryptosporidium* oocysts. The Department, depending on source water quality conditions, may require additional treatment as necessary to meet the requirements of this chapter and to protect the public health.

(i) The filtration process shall meet the following performance requirements:

(A) *Conventional or direct filtration.*

(I) The filtered water turbidity shall be less than or equal to .5 NTU in 95% of the measurements taken each month under § 109.301(1) (relating to general monitoring requirements).

(II) The filtered water turbidity shall be less than or equal to 2.0 NTU at all times, measured under § 109.301(1).

(III) Beginning January 1, 2002, for public water systems serving 10,000 or more persons, the filtered water turbidity shall meet the following criteria:

(-a-) Be less than or equal to 0.3 NTU in at least 95% of the measurements taken each month under § 109.301(1).

(-b-) Be less than or equal to 1 NTU at all times, measured under § 109.301(1).

(IV) Beginning January 1, 2005, for public water systems serving fewer than 10,000 persons, the filtered water turbidity shall meet the following criteria:

(-a-) Be less than or equal to 0.3 NTU in at least 95% of the measurements taken each month under § 109.301(1).

(-b-) Be less than or equal to 1 NTU at all times, measured under § 109.301(1).

(V) Beginning ______ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), for all public water systems, the filtered water turbidity shall meet the following criteria:

(-a-) Be less than or equal to 0.30 NTU in at least 95% of the measurements taken each month under § 109.301(1).

(-b-) Be less than or equal to 1.0 NTU at all times measured under § 109.301(1).

(B) *Slow sand or diatomaceous earth filtration.*

(I) The filtered water turbidity shall be less than or equal to 1.0 NTU in 95% of the measurements taken each month under § 109.301(1).

(II) The filtered water turbidity shall be less than or equal to 2.0 NTU at all times, measured under § 109.301(1).

(C) ***Membrane filtration.***

(I) Beginning ______ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), for all public water systems, the filtered water turbidity shall be less than or equal to 0.15 NTU in at least 95% of the measurements taken each month under § 109.301(1).

(II) Beginning ______ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), for all public water systems, the filtered water turbidity shall be less than or equal to 1.0 NTU at all times, measured under § 109.301(1).

(D) *Other filtration technologies.* The same performance criteria as those given for conventional filtration and direct filtration in clause (A) shall be achieved unless the Department specifies more stringent performance criteria based upon onsite studies, including pilot plant studies, where appropriate.

* * * * *

(iii) For an unfiltered surface water source permitted for use prior to March 25, 1989, the public water supplier shall:

* * * * *

(B) Provide continuous filtration and disinfection in accordance with this paragraph according to the following schedule:

(I) By December 31, 1991, for a public water system that, prior to March 25, 1989, had a waterborne disease outbreak or Giardia contamination in its surface water source.

(II) Within 48 months after the discovery of one of the following conditions, or by December 31, 1995, whichever is earlier, for a public water system that experiences the condition after March 25, 1989:

* * * * *

(-d-) A violation of the source microbiological or turbidity monitoring requirements under § 109.301(2)(i)**[(A) and (B)]** or the related reporting requirements.

* * * * *

§ 109.204. Disinfection profiling and benchmarking.

* * * * *

(b) Public water suppliers that did not conduct TTHM and HAA5 monitoring under this section because they served fewer than 10,000 persons when the monitoring was required, but serve 10,000 or more persons before January 1, 2005, shall comply with this section. These suppliers shall also establish a disinfection benchmark **[and consult with the Department for approval. A supplier that decides to make a significant change to its disinfection practice, as described in this section, shall consult with the Department before making such a change]**.

* * * * *

<u>(d) A public water supplier that obtains a permit or permit modification for filtration treatment for a surface water or GUDI source after _____ (Editor's Note: The blank refers to the effective date of adoption of this rulemaking.) shall submit documentation with the permit application relative to operational parameters which will be used to maintain Giardia lamblia inactivation throughout the expected range of operating conditions.</u>

<u>(e) A public water supplier using surface water or GUDI sources shall consult with the Department before making a significant change to its disinfection practice or operating treatment processes in such a manner that may result in an inactivation level that is lower than the level needed to meet the Giardia lamblia inactivation requirements specified in § 109.202(c)(1)(ii). As part of the consultation, the water supplier shall submit the following information to the Department:</u>
<u>(1) A completed disinfection profile and disinfection benchmark for Giardia lamblia and viruses.</u>
<u>(2) A description of the proposed change.</u>
<u>(3) An analysis of how the proposed change will affect the current level of disinfection.</u>

Subchapter C. MONITORING REQUIREMENTS

§ 109.301. General monitoring requirements.

Public water suppliers shall monitor for compliance with MCLs, MRDLs and treatment technique requirements in accordance with the requirements established by the EPA under the National Primary Drinking Water Regulations, 40 CFR Part 141 (relating to national primary drinking water regulations), except as otherwise established by this chapter unless increased monitoring is required by the Department under § 109.302 (relating to special monitoring requirements). Alternative monitoring requirements may be established by the Department and may be implemented in lieu of monitoring requirements for a particular National Primary Drinking Water Regulation if the alternative monitoring requirements are in conformance with the Federal act and regulations. The monitoring requirements shall be applied as follows:

(1) *Performance monitoring for filtration and disinfection.* A public water supplier providing filtration and disinfection of surface water or GUDI sources shall conduct the performance monitoring requirements established by the EPA under the National Primary Drinking Water Regulations, unless increased monitoring is required by the Department under § 109.302.

(i) Except as provided under subparagraph**[s]** (ii) **[and (iii)]** a public water supplier:

(A) Shall determine and record the turbidity level of representative samples of the system's filtered water as follows **until _____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.)**:

(I) For systems that operate continuously, at least once every 4 hours that the system is in operation, except as provided in clause (B).

(II) For systems that do not operate continuously, at start-up, at least once every 4 hours that the system is in operation, and also prior to shutting down the plant, except as provided in clause (B).

(B) May substitute continuous turbidity monitoring and recording for grab sample monitoring and manual recording **until _____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.)** if it validates the continuous measurement for accuracy on a regular basis using a procedure specified by the manufacturer. At a minimum, calibration with an EPA-approved primary standard shall be conducted at least quarterly. For systems using slow sand filtration or filtration treatment other than conventional filtration, direct filtration or diatomaceous earth filtration, the Department may reduce the sampling frequency to once per day.

(C) **Shall continuously monitor the turbidity level of the combined filter effluent beginning _____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), using an analytical method specified in 40 CFR 141.74(a) and record the results at least every 15 minutes while the plant is operating. For systems that do not operate continuously, the turbidity level shall also be measured and recorded at start-up and immediately prior to shutting down the plant.**

[C] **(D)** Shall continuously monitor and record the residual disinfectant concentration of the water being supplied to the distribution system and record both the lowest value for each day and the number of periods each day when the value is less than .2 mg/L for more than 4 hours. If a public water system's continuous monitoring or recording equipment fails, the public water supplier may, upon notification of the Department under § 109.701(a)(3) (relating to reporting and recordkeeping), substitute grab sampling or manual recording every 4 hours in lieu of continuous monitoring. Grab sampling or manual recording may not be substituted for continuous monitoring or recording for longer than 5 days after the equipment fails.

[(D)] **(E)** Shall measure and record the residual disinfectant concentration at representative points in the distribution system no less frequently than the frequency required for total coliform sampling for compliance with the MCL for microbiological contaminants.

(ii) **[For a public water supplier serving 3,300 or fewer people, the Department may reduce the residual disinfectant concentration monitoring for the water being supplied to the distribution system to a minimum of 2 hours between samples at the grab sampling**

frequencies prescribed as follows if the historical performance and operation of the system indicate the system can meet the residual disinfectant concentration at all times:

System Size (People)	***Samples/Day***
‹500	**1**
500—1,000	**2**
1,001—2,500	**3**
2,501—3,300	**4**

If the Department reduces the monitoring, the supplier shall nevertheless collect and analyze another residual disinfectant measurement as soon as possible, but no longer than 4 hours from any measurement which is less than .2 mg/L.]

[(iii)] <u>Until</u> <u>***(Editor's Note:*** **The blank refers to 1 year after the effective date of adoption of this rulemaking.),**</u> [F]<u>f</u>or a public water supplier serving fewer than 500 people, the Department may reduce the filtered water turbidity monitoring to one grab sample per day, if the historical performance and operation of the system indicate effective turbidity removal is maintained under the range of conditions expected to occur in the system's source water.

[(iv)]<u>(iii)</u> A public water supplier providing conventional filtration treatment or direct filtration and serving 10,000 or more people and using surface water or GUDI sources shall, beginning January 1, 2002, conduct continuous monitoring of turbidity for each individual filter using an approved method under the EPA regulation in 40 CFR 141.74(a) (relating to analytical and monitoring requirements) and record the results at least every 15 minutes. Beginning January 1, 2005, public water suppliers providing conventional or direct filtration and serving fewer than 10,000 people and using surface water or GUDI sources shall conduct continuous monitoring of turbidity for each individual filter using an approved method under the EPA regulation in 40 CFR 141.74(a) and record the results at least every 15 minutes. <u>**Beginning** ***(Editor's Note:*** **The blank refers to 1 year after the effective date of adoption of this rulemaking.), a public water supplier using surface water or GUDI sources and providing filtration treatment other than conventional or direct filtration shall conduct continuous monitoring of turbidity for each individual filter using an approved method under the EPA regulation in 40 CFR 141.74(a) and record the results at least every 15 minutes.**</u>

[(A) The water supplier shall calibrate turbidimeters using the procedure specified by the manufacturer. At a minimum, calibration with an EPA-approved primary standard shall be conducted at least quarterly.

(B) If there is failure in the continuous turbidity monitoring or recording equipment, or both, the system shall conduct grab sampling or manual recording, or both, every 4 hours in lieu of continuous monitoring or recording.

(C) A public water supplier serving 10,000 or more persons has a maximum of 5 working days following the failure of the equipment to repair or replace the equipment before a violation is incurred.

(D) A public water supplier serving fewer than 10,000 persons has a maximum of 14 days following the failure of the equipment to repair or replace the equipment before a violation is incurred.]

(iv) **In addition to the requirements of subparagraphs (i) – (iii), a public water supplier shall conduct grab sampling or manual recording, or both, every 4 hours in lieu of continuous monitoring or recording if there is a failure in the continuous monitoring or recording equipment, or both. The public water supplier shall notify the Department within 24 hours of the equipment failure. Grab sampling or manual recording may not be substituted for continuous monitoring for longer than 5 working days after the equipment fails. The Department will consider case-by-case extensions of the time frame to comply if the water supplier provides written documentation that it was unable to repair or replace the malfunctioning equipment within 5 working days due to circumstances beyond its control.**

(2) *Performance monitoring for unfiltered surface water and GUDI.* A public water supplier using unfiltered surface water or GUDI sources shall conduct the following source water and performance monitoring requirements on an interim basis until filtration is provided, unless increased monitoring is required by the Department under § 109.302:

(i) Except as provided under subparagraphs (ii) and (iii), a public water supplier:

* * * * *

(B) Shall measure the turbidity of a representative grab sample of the source water immediately prior to disinfection as follows **until _____ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.)**:

(I) For systems that operate continuously, at least once every 4 hours that the system is in operation, except as provided in clause (C).

(II) For systems that do not operate continuously, at start-up, at least once every 4 hours that the system is in operation, and also prior to shutting down the plant, except as provided in clause (C).

(C) May substitute continuous turbidity monitoring for grab sample monitoring **until _____ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.)** if it validates the continuous measurement for accuracy on a regular basis using a procedure specified by the manufacturer. At a minimum, calibration with an EPA-approved primary standard shall be conducted at least quarterly.

(D) **Shall continuously monitor and record the turbidity of the source water immediately prior to disinfection beginning _____ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.) using an analytical method specified in 40 CFR 141.74(a) and record the results at least every 15 minutes while the source is operating. If there is a failure in the continuous turbidity monitoring or recording equipment, or both, the supplier shall conduct grab sampling or manual recording, or both, every 4 hours in lieu of continuous monitoring or recording. The public water supplier shall notify the Department within 24 hours of the equipment failure. Grab sampling or manual recording may not be substituted for continuous monitoring for longer than 5 working days after the equipment fails. The Department will consider case-by-case extensions of the time frame to comply if the water supplier provides written documentation that it was unable to repair or replace the malfunctioning equipment within 5 working days due to circumstances beyond its control.**

[(D)] (E) Shall continuously monitor and record the residual disinfectant concentration required under § 109.202(c)(1)(iii) (relating to State MCLs, MRDLs and treatment technique requirements) of the water being supplied to the distribution system and record the lowest value for each day. If a public water system's continuous monitoring or recording equipment fails, the public water supplier may, upon notification of the Department under § 109.701(a)(3), substitute grab sampling or manual recording, or both, every 4 hours in lieu of continuous monitoring. Grab sampling or manual recording may not be substituted for continuous monitoring for longer than 5 days after the equipment fails.

[(E)] (F) Shall measure the residual disinfectant concentration at representative points in the distribution system no less frequently than the frequency required for total coliform sampling for compliance with the MCL for microbiological contaminants.

(ii) **Until** ______ ***(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), [For] for** a public water supplier serving 3,300 or fewer people, the Department may reduce the residual disinfectant concentration monitoring for the water being supplied to the distribution system to a minimum of 2 hours between samples at the grab sampling frequencies prescribed as follows if the historical performance and operation of the system indicate the system can meet the residual disinfectant concentration at all times:

System Size (People)	Samples/Day
‹500	1
500—1,000	2
1,001—2,500	3
2,501—3,300	4

If the Department reduces the monitoring, the supplier shall nevertheless collect and analyze another residual disinfectant measurement as soon as possible, but no longer than 4 hours from any measurement which is less than the residual disinfectant concentration approved under § 109.202(c)(1)(iii).

(iii) **Until** ______ ***(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), [For] for** a public water supplier serving fewer than 500 people, the Department may reduce the source water turbidity monitoring to one grab sample per day, if the historical performance and operation of the system indicate effective disinfection is maintained under the range of conditions expected to occur in the system's source water.

* * * * *

(11) *Monitoring requirements for entry points that do not provide water continuously.*

(i) Entry points from which water is not provided during every quarter of the year shall monitor in accordance with paragraphs (5)—(7) **and (14)**, except that monitoring is not required during a quarter when water is not provided to the public, unless special monitoring is required by the Department under § 109.302.

(ii) At a minimum, all entry points shall provide water to the public on an annual basis to ensure all sources and entry points are included in routine compliance monitoring.

* * * * *

§ 109.302. Special monitoring requirements.

(a) The Department may require a public water supplier to conduct monitoring in addition to that required by § 109.301 (relating to general monitoring requirements) if the Department has reason to believe the public water system is not in compliance with the **action level,** MCL, MRDL or treatment technique requirement for the contaminant.

* * * * *

§ 109.303. Sampling requirements.

(a) The samples taken to determine a public water system's compliance with MCLs**,** **[or]** MRDLs or **treatment technique requirements or** to determine compliance with monitoring requirements shall be taken at the locations identified in § § 109.301**,** **[and]** 109.302**, 109.1003, 109.1103, 109.1202 and 109.1303** (relating to general monitoring requirements; **[and]** special monitoring requirements**; monitoring requirements for bottled water and vended water systems, retail water facilities and bulk water hauling systems; monitoring requirements for lead and copper; monitoring requirements for the long-term 2 enhanced surface water treatment rule; and triggered monitoring requirements for groundwater sources**), **[or]** **and** as follows:

(1) Samples for determining compliance with the turbidity MCL shall be taken at each entry point associated with a surface water source that the Department has determined shall be filtered.

(2) Samples for determining compliance with the *E. coli* MCL under § 109.202(a)(2) (relating to State MCLs, MRDLs and treatment technique requirements) and for determining whether an assessment is triggered under § 109.202(c)(4) shall be taken at regular intervals throughout the monitoring period at sites which are representative of water throughout the distribution system according to a written sample siting plan as specified under § 109.701(a)(5) (relating to reporting and recordkeeping). Representative locations include, but are not limited to, the following:

(i) Dead ends.

(ii) First service connection.

(iii) Finished water storage facilities.

(iv) Interconnections with other public water systems.

(v) Areas of high water age.

(vi) Areas with previous coliform detections

(3) Samples for determining compliance with the fluoride MCL shall be taken at each entry point.

(4) Samples for determining compliance with MCLs for organic contaminants listed by the EPA under 40 CFR 141.61 (relating to maximum contaminant levels for organic contaminants) **[and]** **,** inorganic contaminants listed by the EPA under 40 CFR 141.62 (relating to maximum contaminant levels (MCLs) for inorganic contaminants)**, radionuclide contaminants listed by the EPA under 40 CFR 141.66 (relating to maximum contaminant levels for radionuclides)** and with the special monitoring requirements for unregulated contaminants under § 109.302(f) shall be taken at each entry point to the distribution system **which is representative of each source** after an application of treatment during periods of normal operating conditions. If a system draws water from more than one source and the sources are combined prior to distribution, the system **[shall]** **must** sample at the entry point **during periods of normal operating conditions** [where the] **when** water is representative of **[combined]** **all**

sources being used **[during normal operating conditions]**. **<u>If sources are blended at a consistent ratio prior to the entry point, a blended sample may be taken to determine compliance. If sources are not blended at a consistent ratio or if sources are alternated prior to the entry point, more than one sample must be taken to ensure that the samples are representative of all sources.</u>**

(5) Asbestos sampling points shall be at the distribution tap where asbestos contamination is expected to be the greatest based on the presence of asbestos cement pipe and lack of optimum corrosion control treatment, and at the entry point for each source which the Department has reason to believe may contain asbestos, except that a collected distribution sample which is representative of a source may be substituted for a required entry point sample.

(b) The samples taken to determine a public water system's compliance with treatment technique and performance monitoring requirements shall be taken at a point that is as close as practicable to each treatment technique process and that is not influenced by subsequent treatment processes or appurtenances.

* * * * *

(h) Samples taken to determine compliance with beta particle and photon radioactivity under 40 CFR 141.66(d) may be composited as follows:

(1) Monitoring for gross beta-particle activity may be based on the analysis of a composite of 3 monthly samples.

(2) Monitoring for strontium-90 and tritium may be based on the analysis of a composite of 4 consecutive quarterly samples.

<u>(i) Samples taken to determine compliance with this chapter shall be taken in accordance with a written comprehensive monitoring plan as specified in § 109.717 (relating to comprehensive monitoring plan). These plans are subject to Department review and revision.</u>

§ 109.304. Analytical requirements.

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(c) For the purpose of determining compliance with the monitoring and analytical requirements established under this subchapter and Subchapters K, L and M (relating to lead and copper; long-term 2 enhanced surface water treatment rule; and additional requirements for groundwater sources), the Department will consider only samples analyzed by a laboratory accredited by the Department, except that measurements for turbidity, fluoridation operation, residual disinfectant concentration, temperature, pH, alkalinity, orthophosphates, silica, calcium, conductivity, daily chlorite, and magnesium hardness may be performed by a person meeting one of the following requirements:

* * * * *

(2) A person using a standard operating procedure as provided under authority of the Water and Wastewater Systems Operators' Certification Act (63 P.S. §§ 1001—1015.1) **<u>and the regulations promulgated thereunder.</u>**

* * * * *

(e) A water supplier shall calibrate all turbidimeters used for compliance monitoring using the procedure specified by the manufacturer. At a minimum, calibration with an EPA-approved primary standard shall be conducted at least every 90 days. The Department may extend this 90-day calibration frequency if the calibration due date coincides with a holiday or weekend, or during a water system emergency which prevents timely calibration.

*** * * * ***

§ 109.305. [Fees] Reserved.

[(a) *Data management fees.* Community water systems shall submit the following data management fees to the Department by December 31, 1995:

System Size (population served)	***Fee***
<100	**$ 120**
100-1,000	**$ 120**
1,001-3,300	**$ 240**
3,301-10,000	**$ 360**
10,001-50,000	**$ 600**
>50,000	**$1,200**

(b) *Waivers.* A request for a waiver from the monitoring requirements in § § 109.301 and 109.302 (relating to general monitoring requirements; and special monitoring requirements) shall be accompanied by the appropriate fee as follows:

System Size (population served)	***Fee***
<100	**$ 100**
100-1,000	**$ 200**
1,001-3,300	**$ 400**
3,301-10,000	**$ 500**
10,001-50,000	**$1,000**
>50,000	**$2,000**

Fees will be based on system size, taking into consideration the following conditions:

(1) For systems with one or more sources all in the same contribution area—for groundwater systems, the contribution area is the surface area overlying the portion of the aquifer through which water is diverted to a well or flows to a spring or infiltration gallery—the fee will be as indicated in this subsection.

(2) For systems with a single wellfield—one contribution area—the fee will be as indicated in this subsection.

(3) For systems with sources in two or more contribution areas, the fee will be as indicated in this subsection plus 1/2 of the system size fee as indicated in this subsection for each additional contribution area in which a source is located.]

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Subchapter D. PUBLIC NOTIFICATION

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§ 109.416. CCR requirements.

This section applies only to community water systems and establishes the minimum requirements for the content of the annual CCR that each system must deliver to its customers. This report shall contain information on the quality of the water delivered by the system and characterize the risks, if any, from exposure to contaminants detected in the drinking water in an accurate and understandable manner.

* * * * *

(4) *Report delivery and recordkeeping.* Each community water system shall do the following:

(i) Mail or otherwise directly deliver to each customer **[and to the Department]** one copy of the annual CCR no later than the date **[the water system is required to distribute the CCR to its customers]** <u>**specified in paragraph (2)**</u>.

(ii) <u>**Mail a paper copy of the annual CCR to the Department no later than the date the water system is required to distribute the CCR to its customers.**</u>

[ii] <u>**(iii)**</u> Make a good faith effort to reach consumers who do not get water bills. The Department will determine "good faith" based on those methods identified in 40 CFR 141.155(b) (relating to delivery requirements), which are incorporated by reference.

[(iii)] <u>**(iv)**</u> Submit in writing to the Department no later than 3 months after the delivery of the annual CCR:

* * * * *

(B) A description of what was done to meet the good faith effort requirement described in subparagraph **[(ii)]** <u>**(iii)**</u>.

[(iv)] <u>**(v)**</u> If another State agency or commission also regulates the community water system, submit a copy of the system's annual CCR to the other agency or commission upon the specific request of that agency or commission no later than the date the water system is required to distribute the CCR to its customers. Each state agency or commission shall determine the way it requests a copy of the system's CCR. Those agencies or commissions may include, but are not limited to the following:

* * * * *

[(v)] <u>**(vi)**</u> Make copies of its annual CCR available to the public on request.

[(vi)] <u>**(vii)**</u> If a community water system serves 100,000 or more people, post its current year's report to a publicly accessible site on the Internet.

[(vii)] <u>(viii)</u> Retain copies of each annual CCR and the related information required in paragraph (3) on the premises of the system or at a convenient location near the premises for no less than 3 years after the date of its delivery to customers.

Subchapter E. PERMIT REQUIREMENTS

§ 109.503. Public water system construction permits.

(a) *Permit application requirements.* An application for a public water system construction permit shall be submitted in writing on forms provided by the Department and shall be accompanied by plans, specifications, engineer's report, water quality analyses and other data, information or documentation reasonably necessary to enable the Department to determine compliance with the act and this chapter. The Department will make available to the applicant the Public Water Supply Manual, available from the Bureau of **[Water Standards and Facility Regulation]** **<u>Safe Drinking Water</u>**, Post Office Box **[8774]** <u>8467</u>, Harrisburg, Pennsylvania 17105 which contains acceptable design standards and technical guidance. Water quality analyses shall be conducted by a laboratory accredited under this chapter.

(1) *General requirements.* An application must include:

* * * * *

(iii) *Information describing new sources.* **<u>Information describing new sources must include the items specified in clauses (A) through (F). The information specified in clauses (C) and (D) may not be more than 2 years old from the date the permit application is submitted unless the Department approves the use of data more than 2 years old.</u>** The Department may accept approval of an out-of-State source by the agency having jurisdiction over drinking water in that state if the supplier submits adequate proof of the approval and the agency's standards are at least as stringent as this chapter. **[Information describing sources must include:]**

(A) A **[comprehensive sanitary survey of the physical surroundings of each new source of raw water and its proximity to potential sources of contamination. For surface water, this information shall include a description of the watershed topography and land uses within the watershed. For systems using wells, springs or infiltration galleries, this information shall include a hydrogeological report prepared and signed by a professional geologist who has complied with the requirements of the Engineer, Land Surveyor and Geologist Registration Law (63 P. S. § § 148—158.2) describing the geology of the area including the source aquifers, overlying formations, hydrogeologic boundaries, aquifer porosity estimates, water table contour or potentiometric surface maps depicting prepumping conditions and other information deemed necessary to evaluate the hydraulic characteristics of the aquifer and demonstrate the suitability of the proposed source. At the discretion of the Department, these requirements may be altered for a proposed well, wellfield, spring or infiltration gallery that will be pumping less than or yielding less than 100,000 gallons per day]** **<u>source water assessment of each new raw water source</u>**.

(B) **[An evaluation of the quality of the raw water from each new source. This clause does not apply when the new source is finished water obtained from an existing permitted community water system unless the Department provides written notice that an evaluation is required. The evaluation must include analysis of the following:**

(I) VOCs for which MCLs have been established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.61(a) (relating to maximum contaminant levels for organic contaminants). Vinyl chloride monitoring is required only if one or more of the two-carbon organic compounds specified under § 109.301(5)(i) (relating to general monitoring requirements) are detected. Samples for VOCs shall be collected in accordance with § 109.303(d) (relating to sampling requirements).

(II) Except for asbestos, IOCs for which MCLs have been established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.62 (relating to maximum contaminant levels for inorganic contaminants). The new source shall be monitored for asbestos if the Department has reason to believe the source water is vulnerable to asbestos contamination.

(III) Lead.

(IV) Copper.

(V) Total coliform concentration and, if total coliform-positive, analyze for the presence of *E. coli*.

(VI) SOCs.

(-a-) Except for SOCs that have been granted a Statewide waiver, SOCs for which MCLs have been established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.61(c).

(-b-) Dioxin where there is a source of dioxin contamination within 1,000 feet of a groundwater source or within 1 mile upstream of a surface water source.

(-c-) Polychlorinated biphenyls (PCBs) where there is a source of PCB contamination within 1,000 feet of a groundwater source or within 1 mile upstream of a surface water source.

(VII) Gross Alpha (α), radium-226, radium-228, uranium and Gross Beta (ß).

(VIII) Aluminum, chloride, color, foaming agents, iron, manganese, pH, silver, sulfate, total dissolved solids and zinc for which MCLs have been established by the EPA under the National Secondary Drinking Water Regulations in 40 CFR 143.3 (relating to secondary MCLs).

(IX) Alkalinity.

(X) Hardness.

(XI) Temperature.

(XII) For surface water or GUDI sources, *E. coli* or *Cryptosporidium*, or both, as specified in § 109.1202 (relating to monitoring requirements).

(XIII) Other contaminants that the Department determines necessary to evaluate the potability of the source.] A pre-drilling plan for a new groundwater source prepared and signed by a professional geologist licensed to practice in the Commonwealth. The pre-drilling plan must be submitted and approved by the Department prior to well construction and conducting an aquifer test. At a minimum, the pre-drilling plan must include preliminary results of the source water assessment, a hydrogeologic description, an aquifer test monitoring plan and the proposed well construction design.

(C) An evaluation of the quantity of the raw water from each new source. Flow data shall be submitted for springs, infiltration galleries or surface water sources. Aquifer test data, including drawdown and recovery data and the derivation of hydraulic conductivity, transmissivity and storage coefficient of the aquifer, shall be submitted for wells. At the discretion of the Department, these requirements may be altered for wells or wellfields pumping less than 100,000 gallons per day. The Department may require **[that other]** **additional** information **[be submitted]** to evaluate the safe **or sustainable** yield of the source. The safe **or sustainable** yield is the amount of water that can be withdrawn from an aquifer without causing an undesired result, such as adverse dewatering of an aquifer, induced potential health threats or impacts upon stream uses.

(D) **[A Department approved delineation of the Zone I wellhead protection area for community water system wells, springs or infiltration galleries.] An evaluation of the quality of the raw water from each new source. For groundwater sources, the evaluation shall be conducted at the conclusion of the constant rate aquifer test. This clause does not apply when the new source is finished water obtained from an existing permitted community water system unless the Department provides written notice that an evaluation is required. The evaluation must include analysis of the following:**

(I) VOCs for which MCLs have been established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.61(a) (relating to maximum contaminant levels for organic contaminants). Vinyl chloride monitoring is required only if one or more of the two-carbon organic compounds specified in § 109.301(5)(i) (relating to general monitoring requirements) are detected. Samples for VOCs shall be collected in accordance with § 109.303(d) (relating to sampling requirements).

(II) IOCs, including asbestos, for which MCLs have been established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.62 (relating to maximum contaminant levels for inorganic contaminants).

(III) Lead.

(IV) Copper.

(V) Total coliform and *E. coli* concentration.

(VI) SOCs, including dioxin and PCBs, for which MCLs have been established by the EPA under the National Primary Drinking Water Regulations in 40 CFR 141.61(c).

(VII) Gross Alpha (α), radium-226, radium-228, uranium and Gross Beta (ß).

(VIII) Aluminum, chloride, color, foaming agents, iron, manganese, pH, silver, sulfate, total dissolved solids and zinc for which MCLs have been established by the EPA under the National Secondary Drinking Water Regulations in 40 CFR 143.3 (relating to secondary MCLs).

(IX) Alkalinity.

(X) Hardness.

(XI) Temperature.

(XII) For surface water or GUDI sources, *E. coli* or *Cryptosporidium*, or both, as specified in § 109.1202 (relating to monitoring requirements).

(XIII) Turbidity.

(XIV) For groundwater sources, the monitoring specified in § 109.302(f) if the Department determines that the source is susceptible to surface water influence.

(XV) Other contaminants that the Department determines necessary to evaluate the potability of the source.

(E) A hydrogeologic report for a new groundwater source. For wells, springs or infiltration galleries, this information shall include a description of the geology of the area including the source aquifers, overlying formations, hydrogeologic boundaries, aquifer porosity estimates, water table contour or potentiometric surface maps depicting prepumping conditions and other information deemed necessary to evaluate the hydraulic characteristics of the aquifer and demonstrate the suitability of the proposed source and a Department approved delineation of the Zone 1 and Zone II wellhead protection areas. All information included in the source water assessment, in addition to the results of the water quantity and quality evaluations as specified in clauses (C) and (D) must be included in a hydrogeological report prepared and signed by a professional geologist licensed to practice in the Commonwealth.

(F) A description of the watershed topography and land uses within the watershed for a new surface water source.

* * * * *

(c) *Permit fees.* **An application for a permit from the Department under this subchapter shall be accompanied by a fee in the amount specified in Subchapter N (relating to drinking water fees).**

[(1) An application for a permit or a major permit amendment under subsection (a)(1), except for an application for construction or modification of corrosion control treatment facilities under § 109.1105 (relating to permit requirements), shall be accompanied by a check in the amount of $750, payable to the "Commonwealth of Pennsylvania," except a fee is not required for an application submitted by a State regulatory agency, or an application submitted for a public water system serving 100 or fewer individuals. The fees for permitting and related services under § 109.1105 for corrosion control treatment facilities are established under § 109.1108 (relating to fees).

(2) A fee is not required for an application for an emergency permit under § 109.506 (relating to emergency permits).]

* * * * *

§ 109.505. Requirements for noncommunity water systems.

(a) A noncommunity water system shall obtain a construction permit under § 109.503 (relating to public water system construction permits) and an operation permit under § 109.504 (relating to public water system operation permits), unless the noncommunity water system satisfies paragraph (1) or (2). The Department retains the right to require a noncommunity water system that meets the requirements of paragraph (1) or (2) to obtain a construction and an operation permit, if, in the judgment of the Department, the noncommunity water system cannot be adequately regulated through standardized specifications and conditions. A noncommunity water system which is released from the obligation to obtain a construction and an operation permit shall comply with the other requirements of this chapter, including design, construction and operation requirements described in Subchapters F and G (relating to design and construction standards; and system management responsibilities).

(1) A noncommunity water system which holds a valid permit or license issued after December 8, 1984, under one or more of the following acts satisfies the permit requirement under the act. The licensing authority will review the drinking water facilities under this chapter when issuing permits under the following acts:

(i) The act of May 23, 1945 (P. L. 926, No. 369) (35 P. S. § § 655.1—655.13).

(ii) The Seasonal Farm Labor Act (43 P. S. § § 1301.101—1301.606).

(iii) The Public Bathing Law (35 P. S. § § 672—680d).

(2) A noncommunity water system not covered under paragraph (1) is not required to obtain a construction and an operation permit if it satisfies the following specifications and conditions:

(i) The sources of supply for the system are groundwater sources requiring treatment no greater than **hypochlorite or ultraviolet light** disinfection to **reduce total coliform bacteria concentrations to undetectable levels in the finished water, and otherwise** provide water of a quality that meets the primary MCLs established under Subchapter B (relating to MCLs, MRDLs or treatment technique requirements).

(ii) The water supplier **[files a brief description of the system]** **submits a noncommunity water system application**, including raw source **water** quality data, on forms acceptable to the Department**, and receives Department approval of the facilities prior to construction or operation**. **[Amendments to the system description]** **The water supplier** shall **[be filed when a substantial modification is made]** **also submit a noncommunity water system application to the Department for proposed modifications** to the system **or a change of ownership, and receive Department approval prior to construction or operation**. **[Descriptions of new systems or modifications shall be submitted and approved by the Department prior to construction.]**

(3) A noncommunity water system which satisfies the requirements of paragraphs (1) and (2) shall provide the Department with the following information describing new sources, including an evaluation of the quality of the raw water from each new source. Water quality analyses shall be conducted by a laboratory certified under this chapter. This paragraph does not apply when the new source is finished water obtained from an existing permitted community water system or an existing permitted or approved noncommunity water system unless the Department provides written notice that one or more of the provisions of this paragraph apply.

(i) For transient noncommunity water systems, the evaluation must include analysis of the following:

(A) Nitrate (as nitrogen) and nitrite (as nitrogen).

(B) Total coliform concentration and, if total coliform-positive, analyze for the presence of *E. coli*.

(C) Any other contaminant which the Department determines is necessary to evaluate the potability of the source or which the Department has reason to believe is present in the source water and presents a health risk to the users of the system.

(ii) For nontransient noncommunity water systems, the evaluation must include the information required under **[§ 109.503(a)(1)(iii)(B)]** **§ 109.503(a)(1)(iii)(D)**.

(b) A noncommunity water system providing 4-log treatment of a groundwater source under § 109.1302(b) (relating to treatment technique requirements) that has not obtained a construction permit under § 109.503 (relating to public water system construction permits) and an operations permit under § 109.504 (relating to public water system operation permits) shall obtain a noncommunity water system 4-log treatment of groundwater permit under § 109.1306 (relating to information describing 4-log treatment and compliance monitoring) and comply with subsection (a)(2)(ii).

* * * * *

§ 109.511. General permits.

(a) The Department may issue a general permit, in lieu of issuing a construction and operation permit under this subchapter, for a specific category of modifications if the following conditions are met:

(1) The modifications in the category are the same or substantially similar in nature.

(2) The modifications in the category are not prejudicial to the public health and can be adequately regulated utilizing standardized specifications and conditions.

(3) The modifications in the category will comply with the design and construction standards under Subchapter F (relating to design and construction standards).

(b) The Department may suspend, revoke, modify, reissue or terminate coverage under a general permit issued under this chapter for noncompliance with a condition of the permit, or upon a finding of a condition prejudicial to the public health.

(c) Issuance of a general permit does not exempt a person from compliance with this chapter.

* * * * *

Subchapter F. DESIGN AND CONSTRUCTION STANDARDS

§ 109.602. Acceptable design.

(a) A public water system shall be designed to provide an adequate and reliable quantity and quality of water to the public. The design must ensure that the system will, upon completion, be capable of providing water that complies with the primary and secondary MCLs, MRDLs and treatment techniques established in Subchapters B, **K,** L and M (relating to MCLs, MRDLs or treatment technique requirements; **lead and copper;** long-term 2 enhanced surface water treatment rule; and additional requirements for groundwater sources) except as further provided in this section.

* * * * *

(e) Point-of-use devices which are treatment devices applied to a single tap are not an acceptable treatment method for complying with an MCL**, MRDL** or treatment technique requirement.

(f) A public water system that provides filtration of surface water or GUDI sources must be equipped with alarm capabilities that meet the requirements of subsection (i) within 12 months of _____ *(Editor's Note:* The blank refers to the effective date of adoption of this rulemaking.*)*.

(g) A public water system that provides filtration of surface water or GUDI sources and that is not staffed continuously while the plant is operating must be equipped with alarm and shutdown capabilities that meet the requirements of subsection (i) within 12 months of _____ *(Editor's Note:* The blank refers to the effective date of adoption of this rulemaking.*)*.

(h) In addition to public water systems covered under subsections (f) or (g), the Department may require a public water system to meet the requirements of subsection (i), according to a schedule set forth in a permit or order issued by the Department.

(i) Alarm and shutdown capabilities must conform to the following:

(1) Be set forth in the water system's operation and maintenance plan and set at a level no less stringent than the level needed for the facility to continuously maintain compliance with applicable MCLs, MRDLs and treatment technique requirements.

(2) Be established for the following parameters, at a minimum:

(i) Individual filter effluent turbidity and combined filter effluent turbidity for filter plants treating surface water or GUDI sources.

(ii) Entry point disinfectant residual.

(iii) Clearwell water levels.

(iv) Any other operational parameter determined by the Department as necessary for the system to maintain compliance.

(3) Be capable of notifying the available operator on duty of events triggering an alarm or plant shutdown.

* * * * *

§ 109.606. Chemicals, materials and equipment.

(a) Chemicals **[or]**, materials **or equipment** which may come in contact with the water or affect the quality of the water may not be used unless the chemicals **[or]**, materials **or equipment** are acceptable to the Department.

* * * * *

(c) Materials **or equipment** used in the construction or modification of a public water system, including waterline extensions**, mechanical devices and drinking water treatment equipment,** which may come into contact with or affect the quality of the water and which are certified for conformance with ANSI/NSF Standard 61 (Drinking Water System Components-Health Effects-National Sanitation Foundation) are deemed acceptable to the Department.

(d) **Drinking water treatment equipment used in the construction or modification of a public water system that may come into contact with or affects the quality of the water and that is certified for inactivation, reduction or removal performance in conformance with PDWEP is deemed acceptable to the Department.**

[(d)] **(e)** Acceptable certification under subsection (b), **[or]** (c) **or (d)** related to ANSI/NSF Standards 60 and 61 **or PDWEP** includes that performed by NSF International or other certification organization acceptable to the Department. To be acceptable to the Department, a certification organization shall be accredited by ANSI as a third party certification organization and meet the following requirements. The organization shall:

* * * * *

(2) Require that a registered mark or seal be placed upon each product certified under ANSI/NSF Standard 60 or 61 **or PDWEP**, as applicable.

(3) Maintain an ongoing quality assurance and quality control program that includes, at a minimum, the following:

* * * * *

(iv) Maintenance of procedures for notification and recall of the use of the registered mark or seal for previously certified products which do not meet the certification requirements of ANSI/NSF Standards 60 and 61 **or PDWEP**.

(v) For equipment that is claimed to remove or reduce a specific contaminant, the name of the organization that meets the accreditation standards of the American National Standards Institute and that has certified the device to verify its inactivation, reduction or removal performance for that contaminant, the name of the testing protocol or standard used to test the device, a statement from the testing laboratory giving the date of the test, a summary of the results, and the date, if any, by which the device must be retested for verification of the removal or reduction performance to remain effective.

* * * * *

[(e)] **(f)** Facilities or equipment, including, but not limited to, pipes, pumping facilities and storage tanks, previously or currently used for the treatment, storage or transportation of wastewater, petroleum products or other nonfood products, except for facilities or equipment used to store or transport chemicals used in treating drinking water, may not be used for the treatment, transportation or storage of drinking water.

* * * * *

§ 109.612. POE devices.

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(b) POE devices **and components** used by a public water supplier shall be tested and certified by the NSF or other certification organization acceptable to the Department against ANSI/NSF standards established for drinking water treatment devices. To be acceptable to the Department a certification organization other than NSF shall have a program at least as stringent as the NSF program and meet the requirements under **[§ 109.606(d)]** **§ 109.606(e)** (relating to chemicals, materials and equipment) as applicable to ANSI/NSF standards for drinking water treatment devices.

Subchapter G. SYSTEM MANAGEMENT RESPONSIBILITIES

§ 109.701. Reporting and recordkeeping.

(a) *Reporting requirements for public water systems.* Public water systems shall comply with the following requirements:

* * * * *

(2) *Monthly reporting requirements for performance monitoring.*

(i) The test results of performance monitoring required under § 109.301(1) (relating to general monitoring requirements) for public water suppliers providing filtration and disinfection of surface water or GUDI sources must include the following at a minimum:

(A) For **the combined filter effluent** turbidity performance monitoring:

(I) The number of days of filtration operation.

(II) The number of filtered water turbidity measurements taken each month.

(III) The number of filtered water turbidity measurements that are less than or equal to 0.5 NTU for conventional, direct or other filtration technologies, or 1.0 NTU for slow sand or diatomaceous earth filtration technologies.

(IV) The date, time and values of any filtered water turbidity measurements exceeding 2.0 NTU.

(V) Instead of subclauses (III) and (IV), beginning January 1, 2002, for public water systems that serve 10,000 or more people and use conventional or direct filtration:

(-a-) The number of filtered water turbidity measurements that are less than or equal to 0.3 NTU.

(-b-) The date, time and values of any filtered water turbidity measurements exceeding 1 NTU.

(VI) Instead of subclauses (A)(III) and (IV), beginning January 1, 2005, for public water systems that serve fewer than 10,000 persons and use conventional or direct filtration:

(-a-) The number of filtered water turbidity measurements that are less than or equal to 0.3 NTU.

(-b-) The date, time and values of any filtered water turbidity measurements exceeding 1 NTU.

(VII) Instead of subclauses (III) and (IV), beginning January 1, 2002, for public water systems that serve 10,000 or more people and use other filtration technologies:

(-a-) The number of filtered water turbidity measurements that are less than or equal to 0.3 NTU or a more stringent turbidity performance level requirement that is based upon onsite studies and is specified by the Department.

(-b-) The date, time and values of any filtered water turbidity measurements exceeding 1 NTU or a more stringent turbidity performance level requirement that is based upon onsite studies and is specified by the Department.

(VIII) Instead of subclauses (III)-(VII), beginning _____ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), the number of filtered water turbidity measurements that are less than or equal to the following:

(-a-) 0.30 NTU for conventional or direct filtration technologies.

(-b-) 1.0 NTU for slow sand or diatomaceous earth filtration technologies.

(-c-) 0.15 NTU for membrane filtration technologies.

(-d-) 0.30 NTU for other filtration technologies unless a more stringent turbidity performance level requirement is specified by the Department.

(IX) Instead of subclauses (III)-(VII), beginning ____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), the date, time and values of any filtered water turbidity measurements exceeding the following:

(-a-) 1.0 NTU for conventional, direct or membrane filtration technologies.

(-b-) 2.0 NTU for slow sand or diatomaceous earth filtration technologies.

(-c-) 1.0 NTU for other filtration technologies unless a more stringent turbidity performance level requirement is specified by the Department.

* * * * *

(ii) The test results of performance monitoring required under § 109.301(2) for public water suppliers using unfiltered surface water or GUDI sources shall include the following, at a minimum:

(A) For turbidity performance monitoring:

(I) The date, time and value of each sample that exceeds 1.0 NTU.

(II) The date, time and highest turbidity value if the turbidity does not exceed 1.0 NTU in a sample.

(III) Instead of subclauses (I)-(II), beginning ____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.):

(-a-) The number of source water turbidity measurements taken each month.

(-b-) For measurements in which the source water turbidity is greater than 1.0 NTU, the date, time and value for each occurrence that the turbidity exceeds 1.0 NTU and the subsequent date, time and value that the turbidity is less than or equal to 1.0 NTU.

(-c-) The date, time and highest turbidity value for each day the source water turbidity remains less than or equal to 1.0 NTU.

* * * * *

(3) *One-hour reporting requirements.* A public water supplier shall report the circumstances to the Department within 1 hour of discovery for the following violations or situations:

* * * * *

(iii) Circumstances exist which may adversely affect the quality or quantity of drinking water including, but not limited to:

* * * * *

(B) A failure**,** **[or]** significant interruption **or breakdown** in key water treatment processes.

(C) A **[natural]** disaster that disrupts the water supply or distribution system.

* * * * *

(10) ***Reporting requirements for disinfection byproducts.* In addition to the reporting requirements specified in paragraph (1), public water systems monitoring for disinfection byproducts under § 109.301(12) shall report the individual constituents for total trihalomethanes and haloacetic acids.**

[(10)] **(11)** *Noncompliance report.* Except where a different reporting period is specified in this chapter, the water supplier shall report to the Department within 48 hours the failure to comply with any National Primary Drinking Water Regulation, including the failure to comply with any monitoring requirement set forth in this chapter.

* * * * *

(e) *Reporting requirements for public water systems required to perform individual filter monitoring under § 109.301(1)(iv).*

* * * * *

(2) Public water systems required to perform individual monitoring **under § 109.301(1)(iii)** shall report individual filter turbidity results if individual filter turbidity measurements demonstrate that one or more of the following conditions exist:

(i) An individual filter has a measured turbidity level greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart.

(ii) An individual filter has a measured turbidity level of greater than 0.5 NTU in two consecutive measurements taken 15 minutes apart at the end of the first 4 hours of continuous filter operation after the filter has been backwashed or otherwise taken offline.

(iii) An individual filter has a measured turbidity level greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of 3-consecutive months.

(iv) An individual filter has a measured turbidity level greater than 2.0 NTU in two consecutive measurements taken 15 minutes apart at any time in each of 2-consecutive months.

(v) Instead of (i), beginning ____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), an individual filter has a measured turbidity level greater than 0.30 NTU for conventional, direct or other filtration technologies, 0.15 NTU for membrane filtration technologies or 1.0 NTU for slow sand or diatomaceous earth filtration technologies in two consecutive measurements taken 15 minutes apart.

(vi) Instead of (ii), beginning ____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), an individual filter has a measured turbidity level of greater than 0.30 NTU for conventional, direct or other filtration technologies, 0.15 NTU for membrane filtration technologies or 1.0 NTU for slow sand or diatomaceous earth filtration technologies in two consecutive measurements taken 15 minutes apart at the end of the first 4 hours of continuous filter operation after the filter has been backwashed or otherwise taken offline.

(vii) Instead of (iii), beginning ____ *(Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), an individual filter has a measured turbidity level greater than 0.30 NTU for conventional, direct or other filtration technologies, 0.15 NTU for membrane filtration technologies or 1.0 NTU for slow sand or diatomaceous earth

filtration technologies in two consecutive measurements taken 15 minutes apart at any time in each of 3-consecutive months.

(viii) Instead of (iv), beginning ___ (*Editor's Note:* The blank refers to 1 year after the effective date of adoption of this rulemaking.), an individual filter has a measured turbidity level greater than 1.0 NTU for conventional, direct, membrane or other filtration technologies, or 2.0 NTU for slow sand or diatomaceous earth filtration technologies in two consecutive measurements taken 15 minutes apart at any time in each of 2-consecutive months.

* * * * *

§ 109.702. Operation and maintenance plan.

(a) A community water supplier shall develop an operation and maintenance plan for the community water system. The operation and maintenance plan must generally conform to the guidelines contained in the Department's *Public Water Supply Manual* and **must** contain at least the following information:

* * * * *

(13) An interconnect, valve, **[and]** blowoff, **alarm and shutdown, and auxiliary power equipment** exercise and testing program.

* * * * *

§ 109.703. Facilities operation.

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(b) For surface water or GUDI sources, a public water supplier using filtration shall comply with the following requirements:

(1) **[By July 1, 1990,] Water** suppliers using conventional or direct filtration shall, **[after filter backwash, and before putting the backwashed filter back on line] prior to returning a filter to service**, filter-to-waste **for one full filter volume and** until the filter bed effluent turbidity is less than **[0.5] 0.30** NTU at the normal production flow rate. **Water suppliers may implement filter-to-waste for a period of time less than one full filter bed volume if an alternate operating technique is properly utilized to minimize the post backwash turbidity spike to less than 0.15 NTU. Alternate techniques may include extended terminal sub-fluidization backwash, permitted addition of coagulant during the backwash, or a post backwash offline filter resting period. Water suppliers implementing alternate techniques must keep records to document consistent and proper utilization of said technique.**

(2) **[Beginning May 16, 1992, a] A water** supplier using slow sand filtration shall, following sanding, scraping or resanding of slow sand filters, filter-to-waste until one of the following occurs:

* * * * *

(3) **[Beginning May 16, 1992, a] A water** supplier using diatomaceous earth filtration shall, following backwashing and recoating of diatomaceous earth filters, filter-to-waste until one of the following occurs:

* * * * *

(5) **[Except for public water systems covered under § 109.301(1)(iv) (relating to general monitoring requirements), a]** A system with **[conventional or direct]** filtration facilities **[permitted prior to March 25, 1989, without individual filter bed turbidity monitoring capabilities]** shall **[conduct an annual]** **implement a** filter bed evaluation program, acceptable to the Department, which includes**, but is not limited to,** an evaluation of filter media, **filter bed expansion,** valves, surface sweep and sampling of filter turbidities over one entire filter run**[; and shall submit to the Department, with the Annual Water Supply Report, a study that demonstrates that the water supplier's filter-to-waste or alternate approved operating procedures are meeting the operating conditions under paragraph (1) or (4)]**. **The results of the evaluation shall be maintained on file and submitted to the Department upon request.**

(c) A public water supplier required to install alarm or shutdown capabilities or both under § 109.602 shall comply with the following:

(1) Test the alarm and shutdown capabilities at least quarterly and document the results in the plant's operational log. In order to avoid unnecessary disruptions in treatment, simulated testing of shutdown capabilities is acceptable.

(2) For any failures of alarm or shutdown equipment:

(i) Ensure the plant is adequately staffed until the equipment is operational.

(ii) Notify the Department as soon as possible of any failure that cannot be corrected within 24 hours.

(iii) Restore the equipment to operation within 5 working days of the failure unless a longer period of time is approved by the Department.

§ 109.704. Operator certification.

(a) Community and nontransient noncommunity water systems shall have personnel certified under the Water and Wastewater Systems Operators' Certification Act (63 P. S. § § 1001—1015.1) **and the regulations promulgated thereunder** to operate and maintain a public water system.

* * * * *

§ 109.705. System evaluations and assessments.

(a) A community water supplier shall conduct an evaluation of the water system at least annually. The evaluation shall include the following activities:

(1) **[Watershed surveillance consisting of an]** **An** inspection of portions of the **[drainage area or wellhead]** **source water** protection area necessary to identify and evaluate actual and **[probable]** **potential** sources of contamination.

(i) An inspection of a **[wellhead]** **source water** protection area shall include a review of available information pertaining to possible sources of contamination such as underground storage tanks, onlot disposal systems and other activities that may have an adverse impact on water quality or quantity.

(ii) Specific hydrogeological studies of sources of contamination are not necessary unless required under § 109.4, § 109.602 or § 109.603 (relating to general requirements; acceptable design; and source quality and quantity) or other rules of the Department.

(iii) Revisions to the source water assessment if the inspection identified changes to actual or potential sources of contamination.

(2) Evaluation of **[source protection,]** intake structures and transmission facilities.

* * * * *

(6) The results of the annual system evaluation must be documented and made available to the Department upon request.

* * * * *

[(c) The following apply to significant deficiencies identified at public water systems supplied by a surface water source and public water systems supplied by a groundwater source under the direct influence of surface water:

(1) For sanitary surveys performed by the Department, a public water system shall respond in writing to significant deficiencies in sanitary survey reports no later than 45 days after receipt the report, indicating how and on what schedule the system will address significant deficiencies noted in the survey.

(2) A system shall correct significant deficiencies identified in sanitary survey reports, or according to the schedule approved by the Department, or if there is no approved schedule, according to the schedule reported under paragraph (1) if the deficiencies are within the control of the system.

(d) Significant deficiencies identified by the Department at public water systems using groundwater shall comply with § 109.1302(c) (relating to treatment technique requirements).]

§ 109.706 System [distribution] map.

(a) **[The community]** **A public** water supplier shall prepare and maintain on file a detailed map of the water **[system's transmission and distribution facilities]** **system. A copy of the map shall be submitted to the Department upon request.**

(b) **[A noncommunity water supplier shall submit a detailed map of the water system's transmission and distribution facilities at the request of the Department.]** **At a minimum the map must include:**

(1) Source and treatment plant locations.

(2) Size and location of storage facilities.

(3) Pump station locations.

(4) Size, location and construction material of pipes.

(5) Pressure zones.

(6) Interconnections with other public water systems.

(7) Monitoring locations.

(c) **[The map shall include information sufficient to allow the Department to analyze the distribution system and determine quantity, pressure and direction of flow from the sources to the customers, and shall include the type and size of pipes within the distribution system.]** The map shall be **[updated]** **reviewed by the water supplier** at least annually **and updated as necessary**.

Water suppliers may meet this requirement by maintaining a calibrated hydraulic model instead of paper maps.

* * * * *

§ 109.708. [Planned] System service [interruptions] and auxiliary power.

(a) *System service.* No later than the dates specified in paragraphs (1) – (3), a community water supplier shall ensure operation of the sources, treatment and pumping facilities necessary to ensure that safe and potable water is continuously supplied to users in accordance with the requirements of subsection (b) or (c) or both. A continuous supply of safe and potable water is one that meets all applicable MCLs, MRDLs and treatment techniques specified in § 109.202 (relating to state MCLs, MRDLs and treatment technique requirements) and is sufficent to maintain system pressure as specified in § 109.607 (relating to pressures) throughout the distribution system.

(1) By ______________ *(Editor's note: The blank refers to a date 12 months after the effective date of this rulemnaking.)*, for systems serving 3,300 or fewer persons.

(2) By ______________ *(Editor's note: The blank refers to a date 24 months after the effective date of this rulemaking.)*, for systems serving 3,301- 10,000 persons.

(3) By ______________ *(Editor's note: The blank refers to a date 36 months after the effective date of this rulemaking.)*, for systems serving greater than 10,000 persons.

(b) *Auxiliary power.* System service must be provided through one or more of the following methods:

(1) Connection to at least two independent power feeds from separate substations.

(i) The power feeds shall not be located in the same conduit or supported from the same utility pole.

(ii) If overhead power feeds are used, the power feeds may not cross or be located in an area where a single plausible occurrence (e.g., a fallen tree) could disrupt both power feeds.

(2) On-site auxiliary power sources (i.e. generators or engines).

(c) *Alternate provisions.* The Department may approve alternate provisions, such as finished water storage capacity or interconnections with another public water system, to meet the requirements of subsection (a).

(d) *Planned service interruptions.* The public water supplier shall give reasonable notice to the affected customers prior to a planned service interruption affecting quantity or quality of the water delivered to the customer. If the interruption is scheduled to exceed 8 hours and affect 15 or more service connections the water supplier shall also notify the Department.

* * * * *

§ 109.713. [Wellhead] Source water protection program.

(a) For water suppliers seeking to obtain Department approval for a **[wellhead] source water** protection program, the **[wellhead] source water** protection program shall**, at a minimum,** consist of the following **elements**:

(1) A steering committee composed of the necessary representatives, including, but not limited to, the water supplier, local government officials from the affected jurisdictions and potentially affected industry, to designate responsibilities for the planning and implementation of **[wellhead]** **<u>source water</u>** protection activities.

(2) Public participation and education activities to promote awareness and encourage local support of **[wellhead]** **<u>source water</u>** protection activities.

(3) **[Zone II and Zone III wellhead protection area delineation performed in accordance with methodology provided by the Department. Methods applicable to that hydrogeologic setting shall be utilized and site-specific hydraulic and hydrogeologic information shall include, but is not limited to, pumping rate or yield, aquifer properties, water table or potentiometric surface configuration and hydrogeologic mapping.]** **<u>A map depicting the source water protection areas that were delineated in accordance with the methodology provided by the Department.</u>**

(4) **[Identification of existing and potential sources of contamination within each wellhead protection area.]** **<u>A source water assessment for each source. If a source water assessment has not been previously conducted, identification of the source's susceptibility to potential and existing sources of contamination within each source's contributing area conducted in accordance with the methodology provided by the Department.</u>**

(5) Development and implementation of **[wellhead]** **<u>source water</u>** protection area management approaches to protect the water supply source from activities that may contaminate the source. These approaches may include, but are not limited to, one or more of the following actions:

(i) Purchase of the **[wellhead]** **<u>source water</u>** protection area by the water system.

(ii) Adoption of municipal ordinances or regulations controlling, limiting or prohibiting future potential sources of contamination within the **[wellhead]** **<u>source water</u>** protection area.

(iii) Adoption of municipal ordinances or regulations establishing design and performance standards for potential sources of contamination within the **[wellhead]** **<u>source water</u>** protection area.

(iv) Transfer of development rights within the **[wellhead]** **<u>source water</u>** protection area to land outside of the **[wellhead]** **<u>source water</u>** protection area.

(v) **[A]** **<u>For groundwater sources, a</u>** groundwater monitoring network that serves as an early warning system.

(vi) Public education programs.

(vii) Other methods approved by the Department which will ensure an adequate degree of protection for the source.

(6) Contingency planning for the provision of alternate water supplies in the event of contamination of a **[well, spring or infiltration gallery]** **<u>source</u>** and emergency responses to incidents that may impact water supply source quality.

(7) **[New water supply source siting provisions]** **<u>Provisions</u>** to ensure the protection of **<u>sites identified for development as</u>** new **[wells, springs or infiltration galleries]** **<u>water sources</u>**.

<u>(b) Water suppliers with an approved source water protection program shall review and update the program on an annual basis to ensure it is accurate and reflects current activities, and shall complete and submit the current version of the Department-provided annual update form.</u>

* * * * *

§ 109.716. Significant deficiencies.

The following apply to significant deficiencies identified by the Department:

(1) Within 30 days of receiving written notification, the public water supplier shall consult with the Department regarding appropriate corrective actions unless the Department directs the system to implement a specific corrective action.

(2) The public water supplier shall respond in writing to significant deficiencies no later than 45 days after receipt of written notification from the Department, indicating how and on what schedule the system will address significant deficiencies.

(3) Corrective actions must be completed in accordance with applicable Department plan review processes or other Department guidance or direction, if any, including Department-specified interim measures.

(4) The public water supplier shall correct significant deficiencies identified within 120 days of receiving written notification from the Department, or earlier if directed by the Department, or according to the schedule approved by the Department.

(5) If the Department specifies interim measures for protection of the public health pending Department approval of the corrective action plan and schedule or pending completion of the corrective action plan, the public water supplier shall comply with these interim measures as well as with any schedule specified by the Department.

(6) The public water supplier shall request and obtain approval, in writing, from the Department for any subsequent modifications to a Department-approved corrective action plan and schedule.

§109.717. Comprehensive monitoring plan.

(a) A community or nontransient noncommunity water supplier shall develop a comprehensive monitoring plan to assure that all sources and entry points are included in routine compliance monitoring at the entry points and within the distribution system. The plan must contain at least the following:

(1) A list of all sources and associated treatment plants and entry points. This list shall also include purchased interconnections.

(2) A schematic of all sources and associated treatment plants and entry points, purchased interconnections, and the relative locations of the points of entry into the distribution system.

(3) For each entry point, a description of system operations, including whether the entry point provides water continuously, whether each source provides water continuously, whether sources are alternated or blended and on what cycle or blending ratio, and whether the blending ratio is consistent.

(4) A description of how all sources and entry points are included in routine compliance monitoring.

(b) The plan must include the sample siting plans and monitoring plans required under other sections of this chapter, including the total coliform sample siting plan required under § 109.701(a)(5); the monitoring plan for disinfectants, DBPs and DBP precursors required under §

109.701(g); the lead and copper sample site location plan required under § 109.1107(a)(1); and the source water sampling plan required under §109.1202(h).

(c) The water supplier shall review and update the plan at least annually and as necessary to reflect changes to facilities or operations. The date of each update shall be recorded on the plan.

(d) The water supplier shall submit the initial plan. The water supplier shall review the plan annually and submit an updated plan to the Department, if revisions are made. These plans are subject to Department review and revision.

Subchapter H. LABORATORY CERTIFICATION

§ 109.810. Reporting and notification requirements.

* * * * *

(b) A laboratory accredited under Chapter 252 shall whenever the results of test measurements or analyses performed by the laboratory under this chapter indicate an MCL, MRDL or a treatment technique performance requirement under § 109.202 (relating to State MCLs, MRDLs and treatment technique requirements) is exceeded, or **[an action level under]** **any individual tap sample result exceeds the action level value specified in** § 109.1102(a) (relating to action levels and treatment technique requirements) **[is exceeded]**, or a sample result requires the collection of check or confirmation samples under § 109.301 (relating to general monitoring requirements), or any check sample collected under § 109.301(3) is total coliform-positive, or a sample collected by a seasonal system as part of a Department-approved start-up procedure under § 109.301(3)(i)(c) is total coliform-positive or a sample collected under Subchapter M (relating to additional requirements for groundwater sources) is *E. coli*-positive:

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Subchapter J. BOTTLED WATER AND VENDED WATER SYSTEMS, RETAIL WATER FACILITIES AND BULK WATER HAULING SYSTEMS

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§ 109.1003. Monitoring requirements.

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(b) *Sampling requirements.*

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(3) **[Public water suppliers shall assure that samples for laboratory analysis are properly collected and preserved, are collected in proper containers, do not exceed maximum holding times between collection and analysis and are handled in accordance with guidelines governing quality control which may be established by the Department. A public water supplier who utilizes a certified laboratory for sample collection as well as analysis satisfies the requirements of this subsection.]** **Sampling and analysis shall be performed in accordance with analytical techniques adopted by the EPA under the Federal act or methods approved by the Department.**

* * * * *

§ 109.1005. Permit requirements.

(a) *General permit requirement.* A person may not construct or operate a bottled water or vended water system, retail water facility or bulk water hauling system without first having obtained a public water system permit under subsection (b) or (e).

* * * * *

(c) *Special permit by rule requirement for bottled water systems.* A person owning or operating a bottled water system in this Commonwealth permitted under this chapter shall obtain an amended permit before making substantial modifications to the processing and bottling facilities unless the bottled water system satisfies the conditions in paragraphs (1)—(5). The permit-by-rule does not apply to the collection facilities. The Department retains the right to require a bottled water system that meets the requirements of paragraphs (1)—(5) to obtain a permit, if, in the judgment of the Department, the bottled water system cannot be adequately regulated through the standardized specifications and conditions. A bottled water system which is released from the obligation to obtain a permit shall comply with the other requirements of this subchapter, including design, construction and operation requirements. The following are the conditions for a permit-by-rule:

* * * * *

(5) A bottled water system operating under this subsection shall file descriptions of substantial modifications made to the system to the Department within 30 days of operation of the modification. The description shall include documentation that the modification meets the following requirements as applicable:

* * * * *

(ii) Validated treatment technologies for the reduction of contaminants. Validated treatment technologies are those that have been permitted by the Department under this chapter at the bottled water system operating under the permit by rule or certified to an applicable ANSI/NSF standard by NSF or other certification organization acceptable to the Department or verified under the EPA Environmental Technology Verification Program. To be acceptable to the Department, a certification organization other than NSF shall be accredited by ANSI as a third-party certification organization and meet the requirements under **[§ 109.606(d)]** **<u>§ 109.606(e)</u>** as applicable to the appropriate ANSI/NSF standard for the treatment technology.

* * * * *

(e) *Permit applications.* An application for a public water system permit for a bottled water or vended water system, retail water facility or bulk water hauling system shall be submitted in writing on forms provided by the Department and shall be accompanied by plans, specifications, engineer's report, water quality analyses and other data, information or documentation reasonably necessary to enable the Department to determine compliance with the act and this chapter. The Department will make available to the applicant the *Public Water Supply Manual*, available from the Bureau of **[Water Standards and Facility Regulation]** **<u>Safe Drinking Water</u>**, Post Office Box 8467, Harrisburg, Pennsylvania 17105-

8467 which contains acceptable design standards and technical guidance. Water quality analyses shall be conducted by a laboratory certified under this chapter. An application for a public water system permit for a bottled water or vended water system, retail water facility or bulk water hauling system shall include:

* * * * *

(i) *Permit fees.* **An application for a permit from the Department under this subchapter shall be accompanied by a fee in the amount specified in Subchapter N (relating to drinking water fees).**

[(1) An application for a new permit or major permit amendment under subsection (f)(1) for a bottled water or vended water system, retail water facility or bulk water hauling system shall be accompanied by a check in the amount of $750 payable to the "Commonwealth of Pennsylvania," except that:

(i) An application from an out-of-State bottled water system submitting proof of out-of-State approval under subsection (e)(6) shall be accompanied by a fee of $100.

(ii) An application from a bottled water system, retail water facility or bulk water hauling system purchasing finished water, as its sole source of water, from a public water system operating under a permit issued under this chapter, and a vended water system permitted by rule, shall submit a fee of $300.

(2) A fee is not required for an emergency permit under subsection (g) or a minor permit amendment under subsection (f)(2).]

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Subchapter K. LEAD AND COPPER

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§ 109.1105. Permit requirements.

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(b) *Construction permits and permit amendments.* The water supplier shall submit an application for a public water system construction permit for a newly-created system or an amended construction permit for a currently-permitted system for corrosion control treatment facilities by the applicable deadline established in § 109.1102(b)(2) (relating to action levels and treatment technique requirements), unless the system complies with paragraph (1) or (2) or otherwise qualifies for a minor permit amendment under § 109.503(b) (relating to public water system construction permits). The permit application must comply with § 109.503 and contain the applicable information specified therein. The application must include recommended water quality parameter performance requirements for optimal corrosion control treatment as specified in § 109.1102(b)(5) and other data, information or documentation necessary to enable the Department to consider the application for a permit for construction of the facilities.

(1) *Community water system minor permit amendments.* **[The] Until ______ *(Editor's Note:* The blank refers to the effective date of adoption of this rulemaking.*)* , a** community water supplier may submit a written request for an amended construction permit to the Department if the system satisfies the conditions under subparagraphs (i)—(iv). A request for an amended construction permit under this paragraph shall describe the proposed change in sufficient detail to allow the Department to adequately evaluate the proposal.

* * * * *

(2) *Nontransient noncommunity water system permits.* **[The]** **Until ______ (*Editor's Note:* The blank refers to the effective date of adoption of this rulemaking.), a** nontransient noncommunity water supplier is not required to obtain a construction permit or permit amendment under subsection (b) if the system satisfies the following specifications and conditions:

* * * * *

(3) Beginning ______ (*Editor's Note:* The blank refers to the effective date of adoption of this rulemaking.), community water systems and nontransient noncommunity water systems required to install optimal corrosion control treatment in accordance with § 109.1102(b) shall obtain a construction and operations permit.

* * * * *

§ 109.1107. System management responsibilities.

(a) *Reporting and recordkeeping.* Systems shall comply with the following requirements and otherwise comply with § 109.701 (relating to reporting and recordkeeping):

* * * * *

(2) *Reporting of monitoring results.* The water supplier shall assure that the results of analyses conducted in accordance with § 109.1103 are reported to the Department within the first 10 days following the end of each applicable monitoring period as stipulated by § 109.1103. Additional monitoring results beyond that required under § 109.1103 shall be kept on record by the water supplier and presented or submitted to the Department upon request.

(i) *Lead and copper tap monitoring results.* The following minimum information is required when reporting lead and copper tap monitoring results to the Department.

(A) The name, address and public water system identification number (PWSID) of the public water system from which the samples are taken.

(B) The contaminant ID.

(C) The parameter name.

(D) The sample period.

(E) The sample type.

(F) **[The number of samples required and the number of samples taken.]**

[(G)] The analytical methods used.

[(H)] **(G)** The results of analyses conducted in accordance with this subchapter for lead and copper tap monitoring.

[(I)] **(H)** The sample location.

[(J) The 90th percentile result.]

[(K) Whether an action level has been exceeded.]

[(L)] **(I)** The name, address and identification number of the certified laboratory performing the analysis.

* * * * *

§ 109.1108. Fees.

[A system receiving permitting and related services from the Department under § 109.1105 (relating to permit requirements) for corrosion control treatment facilities shall pay the applicable fees in this section by a check in the amount specified in this section to the "Commonwealth of Pennsylvania."

(1) An application for a construction permit or major permit amendment under § 109.1105(b) shall be accompanied by payment for the applicable fee as follows:

System size	***Fee***
Small...	**$ 250**
Medium...	**$ 500**
Large...	**$1,750**

(2) A system not required to submit an application for a construction permit or major permit amendment under § 109.1105(b) shall submit payment for the applicable fee with its request for Department designation of optimal corrosion control treatment performance requirements in accordance with § 109.1102(b)(2) (relating to action levels and treatment technique requirements):

System size	***Fee***
Small...	**$ 125**
Medium...	**$ 375**
Large...	**$1,250]**

An application for the review of a corrosion control treatment feasibility study under § 109.1102(b)(3) (relating to action levels and treatment technique requirements), a permit from the Department under this subchapter, or a Department designation of optimal corrosion control treatment performance requirements in accordance with § 109.1102(b)(2)(ii) shall be accompanied by a fee in the amount specified in Subchapter N (relating to drinking water fees).

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Subchapter L. LONG-TERM 2 ENHANCED SURFACE WATER TREATMENT RULE

* * * * *

§ 109.1202. Monitoring requirements.

(a) *Initial round of source water monitoring.* A system shall conduct the following monitoring on the schedule in subsection (c) unless it meets the monitoring exemption criteria in subsection (d):

* * * * *

(k) *Source water sampling locations.* Systems required to conduct source water monitoring under subsections (a)—(g) shall collect samples for each plant that treats a surface water or GUDI source. When multiple plants draw water from the same influent, such as the same pipe or intake, the Department may approve one set of monitoring results to be used to satisfy the requirements of subsections (a)—(g) for all plants.

(l) **[*Chemical treatment prior to sampling location*]** ***Source water sample locations for plants with chemical treatment***. Systems shall collect source water samples prior to chemical treatment, such as coagulants, oxidants and disinfectants.

* * * * *

(n) **[*Bank filtration*]** ***<u>Source water sample locations for systems with bank filtration</u>***.

(1) Systems that receive *Cryptosporidium* treatment credit for bank filtration to meet existing treatment requirements of § 109.202(c) (relating to State MCLs, MRDLs and treatment technique requirements), as applicable, shall collect source water samples in the surface water prior to bank filtration.

* * * * *

(o) **[*Multiple sources*]** ***<u>Source water sample locations for systems with multiple sources</u>***. Systems with plants that use multiple sources, including multiple surface water sources and blended surface water and groundwater sources, shall collect samples as specified in paragraph (1) or (2). The use of multiple sources during monitoring must be consistent with routine operational practice. Sources not adequately evaluated during the monitoring period will be considered new sources and the requirements under subsection (f) will apply. Systems must begin monitoring a new source as soon as a sampling schedule and plan have been approved by the Department.

* * * * *

§ 109.1203. Bin classification and treatment technique requirements.

* * * * *

(f) *Treatment and management options for filtered systems, microbial toolbox.*

* * * * *

(2) Systems using sources classified in Bin 3 and Bin 4 shall achieve at least 1-log of the additional *Cryptosporidium* treatment required under § 109.1204(a) using either one or a combination of the following: bag filters, bank filtration, cartridge filters, chlorine dioxide, membranes, ozone or UV, as described in **[§ 109.1204 (b), (c) and (n)—(q)]** **<u>§ 109.1204</u>** (relating to requirements for microbial toolbox components).

(g) *Failure to meet treatment credit.* Failure by a system in any month to achieve treatment credit by meeting criteria in **[§ 109.1204 (b), (c) and (n)—(q)]** **<u>§ 109.1204</u>** for microbial toolbox options that is at least equal to the level of treatment required in subsection (e) is a violation of the treatment technique requirement.

* * * * *

§ 109.1204. Requirements for microbial toolbox components.

* * * * *

(h) *Individual filter performance.* Systems using conventional filtration treatment or direct filtration treatment will receive 0.5-log *Cryptosporidium* treatment credit, which can be in addition to the 0.5-log credit under subsection (g), during any month the system meets the criteria in this subsection. Compliance with these criteria must be based on individual filter turbidity monitoring as described in **[§ 109.301(1)(iv)]** **<u>§ 109.301(1)(ii)</u>** (relating to general monitoring requirements), as applicable.

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§ 109.1206. Reporting and recordkeeping requirements.

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(e) *Source water reporting data elements*. Systems shall report the applicable information in paragraphs (1) and (2) for the source water monitoring required under § 109.1202.

(1) Cryptosporidium *data elements*. Systems shall report data elements in subparagraphs (i)—**[(vii)]**<u>(viii)</u> for each *Cryptosporidium* analysis. Systems shall report, in a form acceptable to the Department, data elements in subparagraphs **[(viii)—(x)]** <u>(ix)—(xi)</u> as applicable.

* * * * *

(viii) <u>**The concentration of oocysts per liter.**</u>

[(viii)] <u>(ix)</u> For matrix spike samples, systems shall also report the sample volume spikes and estimated number of oocysts spiked. These data are not required for field samples.

[(ix)] <u>(x)</u> For samples in which less than 10 L is filtered or less than 100% of the sample volume is examined, systems shall also report the number of filters used and the packed pellet volume.

[(x)] <u>(xi)</u> For samples in which less than 100% of sample volume is examined, systems shall also report the volume of resuspended concentrate and volume of this resuspension processed through immunomagnetic separation.

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Subchapter M. ADDITIONAL REQUIREMENTS FOR GROUNDWATER SOURCES

§ 109.1302. Treatment technique requirements.

(a) *Community groundwater systems*. Community groundwater systems are required to provide continuous disinfection under § 109.202(c)(2) (relating to state MCLs, MRDLs and treatment technique requirements) and in addition shall:

* * * * *

(c) *Groundwater systems with* ***[significant deficiencies or]*** *source water* E. coli *contamination* <u>***or significant deficiencies***</u>.

(1) A groundwater system with **[a significant deficiency or]** an *E. coli*-positive groundwater source sample collected under § 109.505(a)(3), § 109.1303(a) or § 109.1304(a) (relating to requirements for noncommunity water systems; triggered monitoring requirements for groundwater sources; and assessment source water monitoring) **[shall correct all significant deficiencies and, if directed by the Department,]** shall implement one or more of the following corrective actions:

(i) Provide an alternative source of water.

(ii) Eliminate the source of contamination.

(iii) Submit information required under § 109.1306 and provide treatment that reliably achieves at least 4-log treatment of viruses before the first customer for the groundwater source or sources and comply with compliance monitoring requirements under § 109.1305.

(2) A groundwater system with a significant deficiency or an *E. coli*-positive groundwater source sample collected under § 109.1303(a) or § 109.1304(a) will receive one of the following forms of notification:

(i) Written notice from the Department of a significant deficiency.

(ii) Notification from a laboratory under § 109.810(b) (relating to reporting and notification requirements) that a groundwater source sample collected under § 109.1303(a) or § 109.1304(a) was found to be *E. coli*-positive.

[(iii) Direction from the Department that an *E. coli* positive sample collected under § 109.1303(a) requires corrective action.]

(3) **[Within 30 days of receiving initial notification under paragraph (2), the groundwater system shall consult with the Department regarding the appropriate corrective action unless the Department directs the groundwater system to implement a specific corrective action.] <u>A groundwater system with a significant deficiency or an *E. coli*-positive source water sample collected under §§ 109.1303(a) or 109.1304(a) shall comply with the requirements of § 109.716 (relating to significant deficiencies).</u>**

[(4) Within 120 days of receiving initial notification under paragraph (2), or earlier if directed by the Department, the groundwater system shall correct all significant deficiencies if applicable and shall either:

(i) Have completed corrective action in accordance with applicable Department plan review processes or other Department guidance or direction, if any, including Department-specified interim measures.

(ii) Be in compliance with a Department-approved corrective action plan and schedule subject to the following conditions:

(A) The groundwater system shall request and obtain approval from the Department for any subsequent modifications to a Department-approved corrective action plan and schedule.

(B) If the Department specifies interim measures for protection of the public health pending Department approval of the corrective action plan and schedule or pending completion of the corrective action plan, the system shall comply with these interim measures as well as with any schedule specified by the Department.]

§ 109.1303. Triggered monitoring requirements for groundwater sources.

* * * * *

(h) For an *E. coli*-positive source water sample collected under subsection (a) that is not invalidated under subsection (g)**[:]<u>, the system shall comply with Tier 1 public notification requirements under § 109.408 (relating to Tier 1 public notice—category, timing and delivery of notice).</u>**

[(1) The Department may require a groundwater system to perform a corrective action as described under § 109.1302(c) (relating to treatment technique requirements).

(2) If the Department does not require corrective action under § 109.1302(c), the system shall collect five additional source water samples from the same source within 24 hours of being notified of the *E. coli*-positive sample. If one of the additional samples collected under this paragraph is *E. coli*-positive, the groundwater system shall perform a corrective action as described under § 109.1302(c).

(3) The system shall comply with Tier 1 public notification requirements under § 109.408 (relating to Tier 1 category, timing and delivery of notice).]

* * * * *

§ 109.1305. Compliance monitoring.

(a) *Chemical disinfection*. Groundwater systems demonstrating at least 4-log treatment of viruses using chemical disinfection shall monitor for and maintain the Department-approved residual disinfection concentration every day the system serves the public from the groundwater source.

(1) A groundwater system serving greater than 3,300 people shall:

(i) Continuously monitor the residual disinfectant concentration at the entry point or other location approved by the Department and record the results at least every 15 minutes each day that water from the groundwater source is served to the public.

* * * * *

(iii) Conduct grab sampling every 4 hours until the continuous monitoring equipment is returned to service if there is a failure in the continuous monitoring equipment **<u>and notify the Department within 24 hours of the equipment failure that grab sampling is being conducted</u>**. **[The system shall resume continuous residual disinfectant monitoring within 14 days]**. **<u>Grab sampling or manual recording may not be substituted for continuous monitoring for longer than 5 working days after the equipment fails unless a longer period of time is approved by the Department.</u>**

(2) A groundwater system serving 3,300 or fewer people shall comply with one of the following subparagraphs:

(i) The groundwater system shall maintain the Department-approved minimum residual disinfectant concentration every day the public water system serves water from the groundwater source to the public. The groundwater system shall take a daily grab sample at the entry point or other location approved by the Department during the hour of peak flow or at any other time specified by the Department. If any daily grab sample measurement falls below the Department-approved minimum residual disinfectant concentration, the groundwater system shall take follow up samples every 4 hours **<u>and record the results</u>** until the residual disinfectant concentration is restored to the Department-approved minimum level.

* * * * *

§ 109.1306. Information describing 4-log treatment and compliance monitoring.

* * * * *

(b) A noncommunity water system not covered under subsection (a) demonstrating at least 4-log treatment of viruses under § 109.1302 (relating to treatment technique requirements) shall:

* * * * *

(3) Submit plans, specifications, engineer's report, water quality analyses and other data, information or documentation reasonably necessary to enable the Department to determine compliance with the act and this chapter. The Department will make available to the applicant

the *Public Water Supply Manual*, available from the Bureau of **[Water Standards and Facility Regulation]** <u>**Safe Drinking Water**</u>, Post Office Box **[8774]** <u>**8467**</u>, Harrisburg, Pennsylvania 17105 which contains acceptable design standards and technical guidance. Water quality analyses shall be conducted by a laboratory accredited under this chapter.

§ 109.1307. System management responsibilities.

(a) *Reporting*. Groundwater systems shall comply with the following requirements and otherwise comply with § 109.701 (relating to reporting and recordkeeping):

(1) A groundwater system conducting compliance monitoring under § 109.1305 (relating to compliance monitoring):

* * * * *

(ii) That experiences a breakdown in treatment shall notify the Department within 1 hour after the water system learns of the violation or the situation and provide public notice in accordance with § 109.408 (relating to Tier 1 public notice—categories, timing and delivery). A breakdown in treatment occurs whenever the system fails to meet, for greater than 4 **[continuous]** hours <u>**of operation**</u>, any Department-specified requirements relating to:

* * * * *

<u>**Subchapter N. DRINKING WATER FEES**</u>

<u>**§109.1401. General.**</u>

<u>**(a) This subchapter establishes fees for each public water system for services provided by the Department to implement the Safe Drinking Water Act, retain primacy and protect the public health and safety.**</u>

<u>**(b) This subchapter applies to each public water system.**</u>

<u>**§109.1402. Annual fees.**</u>

<u>**(a) Each public water system shall pay an annual fee as set forth in this section.**</u>

<u>**(1) For community water systems, the annual fees are as follows:**</u>

<u>***Population Served***</u>	<u>***Fee***</u>
<u>**25 – 100**</u>	<u>**$250**</u>
<u>**101 – 500**</u>	<u>**$500**</u>
<u>**501 – 1,000**</u>	<u>**$1,000**</u>
<u>**1,001 – 2,000**</u>	<u>**$2,000**</u>
<u>**2,001 – 3,300**</u>	<u>**$4,000**</u>
<u>**3,301 – 5,000**</u>	<u>**$6,500**</u>
<u>**5,001 – 10,000**</u>	<u>**$10,000**</u>

<u>**10,001 – 25,000**</u>	<u>**$20,000**</u>
<u>**25,001 – 50,000**</u>	<u>**$25,000**</u>
<u>**50,001 – 75,000**</u>	<u>**$30,000**</u>
<u>**75,001 – 100,000**</u>	<u>**$35,000**</u>
<u>**100,001 or more**</u>	<u>**$40,000**</u>

<u>**(2) For nontransient noncommunity water systems, the annual fees are as follows:**</u>

<u>***Population Served***</u>	<u>***Fee***</u>
<u>**25 – 100**</u>	<u>**$100**</u>
<u>**101 – 500**</u>	<u>**$250**</u>
<u>**501 – 1,000**</u>	<u>**$500**</u>
<u>**1,001 – 3,300**</u>	<u>**$750**</u>
<u>**3,301 or more**</u>	<u>**$1,000**</u>

<u>**(3) For transient noncommunity water systems, the annual fees are as follows:**</u>

<u>***Population Served***</u>	<u>***Fee***</u>
<u>**25 – 100**</u>	<u>**$50**</u>
<u>**101 – 500**</u>	<u>**$100**</u>
<u>**501 – 1,000**</u>	<u>**$200**</u>
<u>**1,001 or more**</u>	<u>**$500**</u>

<u>**(4) For bottled water or vended water systems, retail water facilities, or bulk water hauling systems, the annual fees are as follows:**</u>

<u>***Type***</u>	<u>***Fee***</u>
<u>**Bottled – In-state**</u>	<u>**$2,500**</u>
<u>**Bottled – Out of state**</u>	<u>**$2,500**</u>
<u>**Vended**</u>	<u>**$1,000**</u>
<u>**Retail**</u>	<u>**$1,000**</u>
<u>**Bulk**</u>	<u>**$1,000**</u>

<u>**(b) The "population served" shall be based on the Department's public water system inventory at the time of billing.**</u>

<u>**(c) Payment of fees.**</u>

<u>**(1) All fees payable under this section shall be due according to the following schedule:**</u>

<u>***Population Served***</u>	<u>***Submit annual fee by:***</u>

25 – 100	September 30
101 – 500	December 31
501 – 3,300	March 31
3,301 or more	June 30

(2) New systems that begin operation after January 1 shall not be assessed an annual fee for partial calendar-year periods. Annual fees shall be payable on or before the date indicated in paragraph (1) of the next calendar year, and each year thereafter.

(3) For annual fees of $10,000 or more, a public water system may request to divide its annual fee payment into equal quarterly installments by submitting a written request to the Department. Quarterly installments shall be due on March 31, June 30, September 30 and December 31.

§109.1403. Monitoring waiver fees.

(a) *New waivers.* An application for a new waiver from the monitoring requirements in §§ 109.301 and 109.302 (relating to general monitoring requirements; and special monitoring requirements) for a single source shall be accompanied by a fee as set forth below:

Waiver Type	*New Waiver Fee*
VOC Use Waiver	$100
SOC Use Waiver	$100
SOC Susceptibility Waiver	$300
IOC Waiver	$100

(b) *Waiver renewals.* An application for a waiver renewal from the monitoring requirements in §§ 109.301 and 109.302 for a single source shall be accompanied by the appropriate fee as follows:

(1) For renewal applications with no changes in land uses or potential sources of contamination, the fee will be $50.

(2) For renewal applications with changes in land uses or potential sources of contamination, the fee will be based on the type of waiver and the fee for that waiver set forth in subsection (a).

(c) *Waiver fees for systems with more than one source.*

(1) For systems with multiple sources all in the same contributing area, the fee will be as indicated in subsection (a) or (b), as applicable. For groundwater systems, the contributing area is the surface area overlying the portion of the aquifer through which water is diverted to a well or flows to a spring or infiltration gallery.

(2) For systems with sources in two or more contributing areas, the fee will be as indicated in subsection (a) or (b), as applicable, for the first source, plus one-half of the applicable fee for each additional contributing area in which a source is located.

§109.1404. Community and noncommunity water system permitting fees.

(a) An application for a construction permit or a major construction permit amendment under subsection 109.503 (relating to public water system construction permits), except for an application for BVRB facilities under § 109.1005, shall be accompanied by a fee as set forth below:

Population Served	*Fee*
25 – 100	$300
101 – 500	$600
501 – 3,300	$1,000
3,301 – 10,000	$2,500
10,001 – 50,000	$5,000
50,001 – 100,000	$7,500
100,001 or more	$10,000

(b) A written request for a minor construction permit amendment under subsection 109.503, except for a change in legal status (relating to paragraph 3), shall be accompanied by a fee as set forth below:

Population Served	*Fee*
25 – 100	$100
101 – 500	$250
501 – 3,300	$500
3,301 – 10,000	$750
10,001 – 50,000	$1,000
50,001 – 100,000	$2,500
100,001 or more	$5,000

(c) A written request for a change in legal status, such as a transfer of ownership, incorporation or merger, shall be accompanied by a fee of $100.

(d) A written request for a new or amended operations permit under section 109.504 (relating to public water system operating permits) shall be accompanied by a fee of $50.

(e) A written request for an emergency permit shall be accompanied by a fee of $100.

§109.1405. Permitting fees for general permits.

Fees for coverage under a general permit under § 109.511 (relating to general permits) will be established in the general permit. Fees may not exceed $500. An eligible person shall submit to the Department the applicable fee before the Department approves coverage under the general permit for that person.

§109.1406. Permitting fees for bottled water and vended water systems, retail water facilities, and bulk water hauling systems.

(a) An application for a construction permit or a major construction permit amendment under § 109.1005 (relating to permit requirements), except an out-of-state facility or system using finished water as its sole source of water, shall be accompanied by a fee as set forth below:

System Type	*Fee*
Bottled Water System (population served)	
25 – 100	$500
101 – 500	$750
501 – 3,300	$1,000
3,301 – 10,000	$2,500
10,001 – 50,000	$5,000
50,001 – 100,000	$7,500
100,001 or more	$10,000
Vended Water System	$100
Retail Water Facilities	$250
Bulk Water Hauling System	$500

(b) An application from a bottled water system, retail water facility or bulk water hauling system whose sole source of water is finished water purchased from another public water system shall be accompanied by a fee as set forth below:

System Type	*Fee*
Bottled Water System (population served)	
25 – 100	$100
101 – 500	$250
501 – 3,300	$500
3,301 – 10,000	$750
10,001 – 50,000	$1,000
50,001 – 100,000	$2,500
100,001 or more	$5,000
Retail Water Facilities	$100
Bulk Water Hauling System	$100

(c) An application from an out-of-state bottled water system submitting proof of out-of-state approval under § 109.1005 shall be accompanied by a fee of $1,000.

(d) A written request for a minor construction permit amendment under § 109.1005, except for a change in legal status, shall be accompanied by a fee as set forth below:

System Type	*Fee*

Bottled Water System	**$1,000**
Vended Water System	**$100**
Retail Water Facilities	**$100**
Bulk Water Hauling System	**$100**

(e) A request for a change in legal status, such as a transfer of ownership, incorporation or merger, shall be accompanied by a fee of $100.

(f) A written request for a new or amended operations permit shall be accompanied by a fee of $50.

(g) A written request for an emergency permit shall be accompanied by a fee of $100.

§109.1407. Feasibility Study.

An application for a review of a feasibility study or pilot study shall be accompanied by a fee as set forth below:

Population Served	***Fee***
25 – 100	**$300**
101 – 500	**$600**
501 – 3,300	**$1,000**
3,301 – 10,000	**$2,500**
10,001 – 50,000	**$5,000**
50,001 – 100,000	**$7,500**
100,001 or more	**$10,000**

§109.1408. Noncommunity Water System Application for Approval.

For a noncommunity water system that is released from the obligation to obtain a construction and an operation permit under § 109.505 (relating to requirements for noncommunity water systems), the application for approval required under § 109.505(a)(2)(ii) shall be accompanied by a fee of $50.

§109.1409. Noncommunity Water System 4-Log Permit.

For noncommunity water systems demonstrating 4-log treatment of viruses under subchapter M (relating to Additional requirements for groundwater sources), the permit application shall be accompanied by a fee of $50.

§109.1410. Payment of fees.

All fees under this subchapter shall be payable by a check to the "Commonwealth of Pennsylvania" or through a secure computer application provided by the Department.

§109.1411. Disposition of funds.

All fees shall be paid into the state Treasury into a special restricted revenue account in the General Fund known as the Safe Drinking Water Account administered by the Department for use in protecting the public from the hazards of unsafe drinking water and which funds are hereby appropriated to the department for such purposes as are authorized in the act.

§109.1412. Failure to remit fees.

(a) If fees are not remitted as required under section 109.1402, interest shall accrue on the entire amount from the original date payment was due, at a rate of six percent (6%) per annum until payment is remitted.

(b) For any system delinquent in payment of fees in excess of one hundred and eighty (180) days, the Department may suspend technical services provided by the Department until payment is remitted.

§109.1413. Evaluation of fees.

At least every three years, the Department will provide the Environmental Quality Board with an evaluation of the fees in the Chapter and recommend regulatory changes to the Environmental Quality Board to address any disparity between the program income generated by the fees and the Department's cost of administering the program with the objective of ensuring fees meet all program costs and programs are self-sustaining. The evaluation will include an assessment of program complement and workload.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

August 9, 2017

David Sumner
Executive Director
Independent Regulatory Review Commission
333 Market Street, 14th Floor
Harrisburg, PA 17120

Re: Proposed Rulemaking: Safe Drinking Water: General Update and Fees (#7-521)

Dear Mr. Sumner:

Pursuant to Section 5(a) of the Regulatory Review Act, please find enclosed a copy of a proposed regulation for review and comment by the Independent Regulatory Review Commission (Commission). This proposal is scheduled for publication in the *Pennsylvania Bulletin* on August 26, 2017, with a 30-day public comment period. The Environmental Quality Board (EQB) adopted this proposal on May 17, 2017.

The enclosed proposed rulemaking amends 25 Pa. Code, Chapter 109 to: (1) incorporate the remaining general update provisions that were separated from the Revised Total Coliform Rule (RTCR) as directed by the EQB on April 21, 2015, including revisions to treatment technique requirements for pathogens, clarifications to permitting requirements, and new requirements for alarms, shutdown capabilities, and auxiliary power; (2) amend existing permit fees and add new annual fees to supplement state costs and fill the funding gap ($7.5 million); and (3) establish the regulatory basis for issuing general permits, clarify that noncommunity water systems (NCWS) require a permit or approval from the Department of Environmental Protection (DEP or Department) prior to construction and operation, and address concerns related to gaps in the monitoring, reporting and tracking of back-up sources of supply.

The various general updates are being proposed based on DEP's experience through inspections and filter plant performance evaluations, and feedback from field staff. The fees are being proposed to fill the funding gap, improve program performance, retain primacy, and protect public health.

Collectively, these amendments will provide for the increased protection of public health at public water systems (PWS), and ensure that state and federal minimum program elements are met and primacy is retained. PWSs serve approximately 12.7 million Pennsylvanians. 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 incidence 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 for years to come.

One or more of these proposed amendments will apply to all 8,521 PWSs. More specifically:

- The amended source water protection and new source permitting requirements will apply to all 1,952 community water systems (CWS). Based on historical permit submissions, approximately 50 CWSs per year will be required to comply.
- The revised turbidity treatment technique requirements, filter assessment requirements, and alarm/shutdown capabilities will apply to all 353 filter plants in Pennsylvania which are operated by 319 water systems.
- The resiliency requirements for back-up power or alternate provisions will apply to all 1,952 CWSs.
- The new annual fees and amended permit fees will apply to all 8,521 PWSs.
- Clarifications to the monitoring requirements for back-up sources of supply and the comprehensive monitoring plan requirements will apply to all 8,521 PWSs. However, only those PWSs with sources designated as emergency, interim and reserve will see any changes to their monitoring and reporting requirements. The majority of PWSs only have one permanent source and entry point.

The benefits of the proposal include the following:

Source Water Protection and Permitting Requirements: The source water assessment and protection program amendments support the protection of public drinking water sources, which will result in maintaining the highest source water quality available. These revisions will not only protect public health but should also help to maintain, reduce or avoid drinking water treatment costs which occur when the best available source is not selected and protected. Source water protection represents the first barrier to drinking water contamination. A vulnerable drinking water source puts a water utility and the community it serves at risk and at a disadvantage in planning and building future capacity for economic growth.

The proposed changes more clearly define the existing requirements regarding the proper order of the permitting process for developing a new PWS source. These clarifications are needed to help ensure that the proper level of treatment is designed and installed in a timely manner; thereby resulting in less delay for permitting a new source that may be needed to meet public health protection requirements, or provide redundancy in the event of contamination of existing sources. These amendments should result in cost savings due to the avoidance of expensive permitting mistakes.

Turbidity and Filtration Requirements: Proposed amendments to the monitoring, calibration, recording and reporting requirements for the measurement of turbidity will benefit more than eight million Pennsylvanians that are supplied water by PWSs using filtration technologies. These amendments are based on DEP inspections and the evaluation of more than 1,250 filters through DEP's Filter Plant Performance Evaluation (FPPE) program since 1999. These evaluations have documented that existing requirements are not sufficient to prevent turbidity spikes or the shedding of particles and microbial pathogens into the finished water. The existing monitoring and recording requirements also allow these serious events to go unnoticed, which puts consumers at risk of exposure to microbial pathogens.

Automatic Alarms and Shutdown Capabilities: Filter plants are complex and dynamic. In response to many circumstances, the water plant operator must take an immediate action to protect public health, such as when source water quality changes, chemical feed pumps malfunction, filters require backwashing, or other unforeseen circumstances occur. Water plant operators are often required to perform other duties, which leaves the operation of the water plant unattended, and which limits the operator's ability to respond immediately to treatment needs. The proposed amendments will ensure that all surface water filtration plants have the minimum controls in place to ensure that operators are immediately alerted to major treatment problems. The proposed amendments will also ensure that unmanned filter plants are automatically shut down when the plant is producing water that is not safe to drink, which prevents contaminated water from being provided to customers for extended periods of time.

Filter-To-Waste Requirements: DEP has evaluated approximately 1,250 filters. The results of these evaluations show that filters are most likely to shed turbidity, particles, and microbial organisms at the beginning of a filter run when the filter is first placed into service following filter backwash and/or maintenance. The proposed amendments will require all filter plants that can filter-to-waste to do so following filter backwash and/or maintenance and before placing the filter into service. Filtering to waste will reduce the likelihood of pathogens passing through filters and into the finished drinking water. The proposed amendments will not require water suppliers without filter-to-waste capabilities or with undersized filter-to-waste capabilities to make a capital improvement.

Strengthen Resiliency Through Auxiliary Power or Alternate Provisions: The proposed revisions to system service and auxiliary power requirements will strengthen system resiliency and ensure that safe and potable water is continuously supplied to consumers and businesses. A continuous and adequate supply of safe drinking water is vital to maintaining healthy and sustainable communities.

These amendments are focused on improving the reliability of service provided to all consumers by requiring the development of a feasible plan to consistently supply an adequate quantity of safe and potable water during emergency situations. More specifically, water suppliers will need to provide on-site auxiliary power sources (i.e. generators), or connection to at least two independent power feeds from separate substations; or develop a plan for alternate provisions, such as interconnections with neighboring water systems or finished water storage capacity. Ideally, water systems will implement a combination of options to improve their redundancy and resiliency.

New Annual Fees and Amended Permit Fees: To improve program performance, the proposed rulemaking is intended to supplement state costs for administering the Safe Drinking Water Program by filling the funding gap. The proposed fees will total approximately $7.5 million annually and will account for nearly 50% of state funding. The proposed fees will augment General Fund appropriations the Program currently receives ($7.7 million).

The proposed annual fees range from $250 - $40,000 for CWSs, $50 - $1,000 for NCWSs, and $1,000 - $2,500 for bottled, vended, retail, and bulk water haulers (BVRB). The fees will most likely be passed on to the 10.7 million customers of these PWSs as a user fee. Per person costs are expected to range from $0.35 to $10 per year, depending on the water system size.

General Permits: Proposed amendments establish the regulatory basis to allow for the issuance of general permits for high-volume, low-risk modifications or activities to streamline the permitting process.

Requirements for NCWSs: Proposed amendments clarify that NCWSs that are not required to obtain a permit must still obtain DEP approval of the facilities prior to construction and operation.

Address Gaps in Monitoring, Reporting and Tracking Back-up Sources: Proposed amendments address concerns related to gaps in the monitoring, reporting and tracking of back-up water sources and entry points. Per state and federal regulations, all sources and entry points must be included in routine compliance monitoring to ensure water quality meets safe drinking water standards. Sources and entry points that do not provide water continuously are required to be monitored when used. However, monitoring requirements for back-up sources are not currently tracked, which means there are no verifiable controls in place to ensure that all sources and entry points meet safe drinking water standards. Some of these sources have not been used in more than five years, and, therefore, DEP does not know the water quality for these sources. In addition, the treatment facilities and other appurtenances associated with these sources may have gone unused as well, and may no longer be in good working order. These proposed amendments will ensure that all sources and entry points are monitored at least annually. PWSs will also be required to document in a comprehensive monitoring plan how routine compliance monitoring will include all sources and entry points.

The costs of the proposal include the following:

Source water protection and new source permitting requirements: Per DEP records, approximately 50 new CWS sources are permitted each year. DEP estimates that an additional eight hours of work completed by a Professional Geologist will be needed to comply with the new source requirements at a cost of $1,176 per source.

Amended turbidity and filtration requirements: Most filter plants already continuously monitor and record their individual filter effluent (IFE) and combined filter effluent (CFE). DEP estimates that 21 filter plants will need to install continuous monitoring and recording devices for IFE, and 52 plants for CFE. The costs for installation will be $5,000 - $10,000, and the annual maintenance costs will be $500 - $800. Regarding the automated alarms/shutdown capability, it is estimated that 35 filter plants will need to comply at a cost of $10,000 - $12,000.

System resiliency requirements for back-up power or alternate provisions: It is estimated that 30% of small systems may need to install a back-up power supply at an estimated cost of $3,000 - $4,000. It is estimated that 20% of medium and large systems may need to comply at a cost of $50,000 - $200,000.

However, cost savings will be realized through the avoidance of water supply disruptions and boil water advisories. Using an EPA model, it is estimated that a two-day outage at a PWS serving 2,500 customers has the following economic impacts:

- Costs to the water supplier of $28,000 for loss of revenue, additional operating costs, and the costs for providing bottled/bulk water.
- Costs to the business community of $900,000 due to the contraction of business during the outage.

DEP estimates that 25% of all water supply disruptions/boil water advisories (or 63 incidences per year) are caused by power outages.

Clarifications to monitoring requirements for back-up sources of supply and comprehensive monitoring plan requirements: These amendments clarify current requirements, which is that all permitted sources of supply should be included in routine compliance monitoring.

The draft proposed rulemaking was submitted to the Small Water Systems Technical Assistance Center (TAC) Board for review and discussion on November 14, 2016 and January 5, 2017. Comments and recommendations were received from TAC on January 23, 2017. TAC made several recommendations, some of which were incorporated into this proposed rulemaking. Other recommendations were incorporated into the preamble to solicit further public comment.

The proposed rulemaking was also presented to stakeholders through a webinar on December 8, 2016. Email invitations to this webinar were sent to 6,248 water system owners and operators (all PWSs with an email address in PADWIS), and it was advertised on various DEP and water industry websites. 325 registered attendees participated in the webinar, with some viewing the webinar with a group of other individuals. Therefore, total attendee participation was greater than 325 individuals.

The Department will provide the Commission with the assistance required to facilitate a thorough review of this proposal. Section 5(g) of the Regulatory Review Act provides that the Commission may, within 30 days of the close of the comment period, convey to the agency its comments, recommendations and objections to the proposed regulation. The Department will consider any comments, recommendations or suggestions made by the Commission, as well as the Committees and public commentators, prior to final adoption of this rulemaking.

Please contact me by e-mail at ledinger@pa.gov or by telephone at 717.783.8727 if you have any questions or need additional information.

Sincerely,

Laura F. Edinger

Laura Edinger
Regulatory Coordinator

Enclosures

0120-FM-PO0011 6/2015

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
POLICY OFFICE

TRANSMITTAL SHEET FOR REGULATIONS SUBJECT TO THE REGULATORY REVIEW ACT

I.D. NUMBER: 7-521

SUBJECT: Safe Drinking Water: General Update and Fees

AGENCY: DEPARTMENT OF ENVIRONMENTAL PROTECTION

TYPE OF REGULATION

☒ Proposed Regulation

☐ Final Regulation

☐ Final Regulation with Notice of Proposed Rulemaking Omitted

☐ 120-day Emergency Certification of the Attorney General

☐ 120-day Emergency Certification of the Governor

☐ Delivery of Tolled Regulation

a. ☐ With Revisions b. ☐ Without Revisions

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FILING OF REGULATION

DATE	SIGNATURE	DESIGNATION
8/9/17	Shelly K. Weaver	Majority Chair, HOUSE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Representative John Maher
8/9/17	Sandy Nitzgabler	Minority Chair, HOUSE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Representative Mike Carroll
8/9/17	Carey Simpson	Majority Chair, SENATE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Senator Gene Yaw
8/9	Patti C[illegible]	Minority Chair, SENATE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Senator John Yudichak
8/9/17	K. Cooper	INDEPENDENT REGULATORY REVIEW COMMISSION David Sumner
		ATTORNEY GENERAL (for Final Omitted only)
8/9/17	Connie Grant	LEGISLATIVE REFERENCE BUREAU (for Proposed only)