

Performance Measures of Pennsylvania's Area-Wide Optimization Program

The following report¹ contains information on the benefits, outcomes and outputs of the Filter Plant Performance Evaluation program (FPPE), Distribution System Optimization (DSO) program, Area Wide Optimization Program (AWOP), and the Partnership for Safe Water program (Partnership).

Benefits of the Programs

The Department of Environmental Protection (DEP) has invested in programs such as FPPE, DSO, AWOP, and the Partnership to protect Pennsylvanians from waterborne diseases and, more recently, disinfection byproducts. These programs focus on filtered drinking water suppliers that obtain source water from reservoirs, lakes, rivers, streams, and groundwater sources under the direct influence of surface water (GUDI). Since the mid-1990's, the Allegheny County Health Department has taken the lead on FPPEs within their county, but DEP continues to have the lead in all other counties in the state. These programs are important to Pennsylvanians and the state's surface water suppliers for the following reasons:

- ✓ **Population Impact:** Over 8.7 million people and numerous tourists receive some or all of their drinking water from the Commonwealth's filter plants.
- ✓ **Disease Prevention:** A treatment breakdown at a filter plant presents a widespread acute health threat from a waterborne disease outbreak. A disease outbreak can have a devastating impact on a community. Disease prevention saves lives and millions of dollars in expenses that businesses, homeowners, local government and state government would incur in response to an outbreak.
- ✓ **Economy and Essential Services:** The availability of safe public drinking water in sufficient quantity plays a critical role in the state's economic engine. Filter plants serve drinking water to large metropolitan areas and small rural communities and thus are a vital part of local infrastructure; they represent an essential service to factories, food processors, restaurants, and many other businesses; and they provide basic fire protection for homeowners and businesses.
- ✓ **Regulatory and Technical Complexities:** Filter plants are affected by some of the most complex regulations and involve complicated treatment processes. The FPPE and Partnership programs help suppliers in overcoming numerous on-going compliance challenges.
- ✓ **Infrastructure Improvements:** FPPE report rating and associated findings have been a long-standing consideration during the ranking process for Pennsylvania's low-interest loan program called Pennsylvania Infrastructure Investment Authority (PENNVEST).

¹ This report contains underlined website links in the areas titled, "For More Information." To access the information, you will need to view the report on a computer that is connected to the Internet.

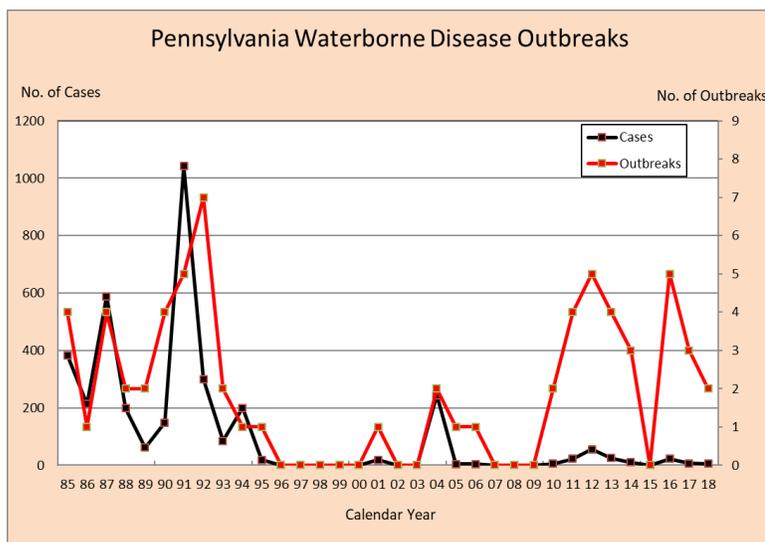
Outcomes of the Programs

The following outcomes measure the public health benefits of the programs.



Outcome #1. Waterborne disease outbreaks associated with public drinking water in Pennsylvania.

The Pennsylvania DEP has the responsibility of assuring that the drinking water industry delivers a safe and reliable supply of water to consumers through efficiently and effectively operated facilities. Water systems that derive some or all of their drinking water from surface water sources (including GUDI) serve over 8.7 million Pennsylvanians as well as millions



of visitors to the state. Pennsylvania has a tremendous interest in the potential for waterborne diseases related to public water supplies. Between 1971 and 1980, Pennsylvania reported 20 percent of all waterborne outbreaks in the United States – more than any other state in the nation. These outbreaks had widespread health implications and cost families, businesses, and local/state governments millions of dollars. Decades ago the more significant outbreaks took place among communities that were served unfiltered surface or GUDI source water. Coinciding with the adoption of Pennsylvania’s mandatory surface water filtration regulation, the number of reported waterborne diseases outbreaks started to trend on a steep decline. See Figure 1. According to the Pennsylvania Department of Health, no waterborne disease outbreaks related to public drinking water supplies were reported in Pennsylvania during the period of 2007 through 2009. Since 2010 we have noticed a new trend in reported outbreaks. CDC’s outbreak reporting system known as NORS (National Outbreak Reporting System) was launched in 2009 as a web-based platform into which health departments enter outbreak information. Through NORS, CDC collects reports of enteric disease outbreaks caused by bacterial, viral, parasitic, chemical, toxin, and unknown agents, as well as waterborne outbreaks of non-enteric disease. This transition into electronic disease reporting of waterborne outbreaks took place 2009/2010. That is not to say that outbreaks of waterborne illness did not occur prior to this or were not documented, but this has certainly increased recognition and detailed reporting of waterborne outbreaks when they occur in the state. Since 2010, one (1) documented cryptosporidiosis outbreak, and twenty-five (27) documented legionella pneumophila outbreaks have occurred in the Commonwealth. Since the transition to NORS, reports of legionella pneumophila outbreaks have become a regular occurrence nearly every single year.

During 2018 there were 2 outbreaks reported that were related to public water supplies. The true number of actual outbreaks may be higher since not all outbreaks are recognized, investigated, and then reported to federal agencies. The Pennsylvania Department of Health provides DEP

with current information on waterborne disease outbreaks. The sensitivity of the disease surveillance system is affected by the following factors: the size of the outbreak; severity of disease caused by the outbreak; public awareness of the outbreak; routine laboratory testing for organisms; requirements for reporting cases of diseases; and resources available to the local health departments for surveillance and investigation of probable outbreaks. Thus, the surveillance system probably underreports the true number of outbreaks due to these factors. With the help of local public health agencies, DEP and the Pennsylvania Department of Health are continuing to improve the state's disease detection, investigation and reporting system.

Additional details regarding the 2018 public water supply outbreaks are shown below:

OUTBREAK: 1

The Pathogen/Organism: Legionella

Number of Cases: 2

Number of Hospitalizations: 2

Number of Deaths: 0

Mode of Transmission: waterborne (inhalation, ingestion)

Underlying Deficiency: Legionella species within water system; hyperchlorination conducted and re-testing conducted post-remediation.

Other Information: The facility was a public water supplier.

OUTBREAK: 2

The Pathogen/Organism: Legionella

Number of Cases: 3

Number of Hospitalizations: 3

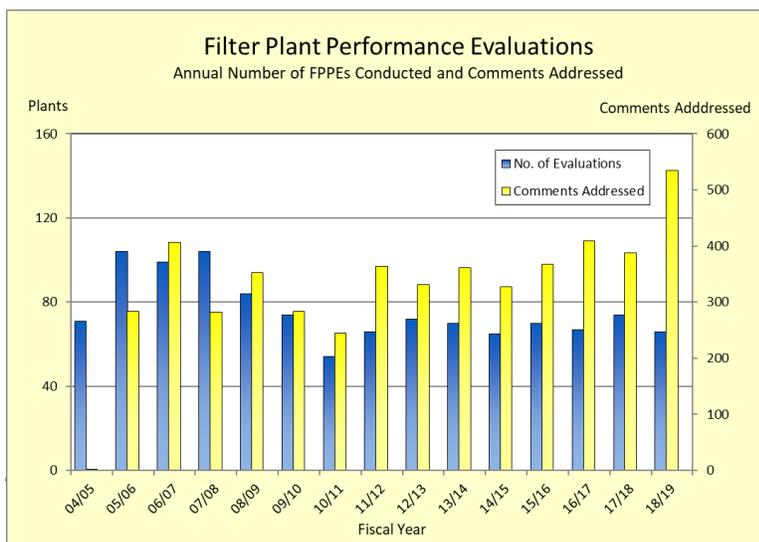
Number of Deaths: 0

Mode of Transmission: waterborne (inhalation, ingestion)

Underlying Deficiency: Legionella species within water system; hyperchlorination conducted and re-testing conducted post-remediation.

Other Information: The facility was a public water supplier.

For more information: [Waterborne Diseases in Pennsylvania](#).



Outcome #2. Follow-up efforts from 1142 FPPEs conducted between July 1, 2004, and June 30, 2019 resulted in public water suppliers in Pennsylvania correcting 4,936 deficiencies.

The FPPE process is a method of determining the effectiveness of a filter plant in removing disease-causing organisms from the incoming raw water. Following

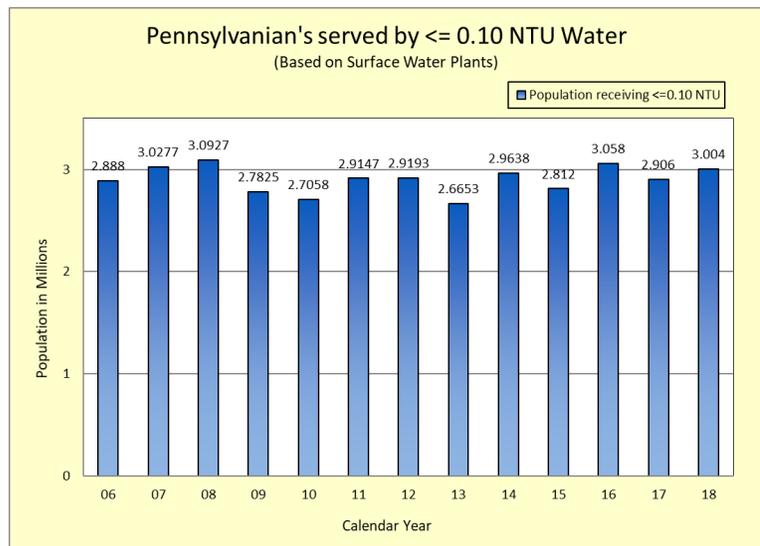
August 27, 2019

the on-site evaluation, the water supplier receives DEP’s detailed report that summarizes an assessment of plant operations, equipment and water quality conditions. The report also concludes whether the water supplier corrected problems that DEP identified during a previous FPPE. Fiscal year 2004-2005 (July 1 through June 30) is the first year when total corrections were tallied across the state. Overall, FPPEs have enhanced the skills of water supply operators and have improved drinking water quality. In fiscal year 2018-2019, statewide a total of 535 deficiency comments were addressed and 68 filter plant evaluations were conducted. Over the last fifteen fiscal years, 4,936 deficiency comments were addressed at 1142 filter plant evaluations. Since FPPE comments outline factors that are limiting optimal plant performance, adequately addressing previous comments can be considered a measure of the effectiveness of the FPPE process and a real world outcome.

For more information: [Filter Plant Performance Evaluation: Program Information.](#)

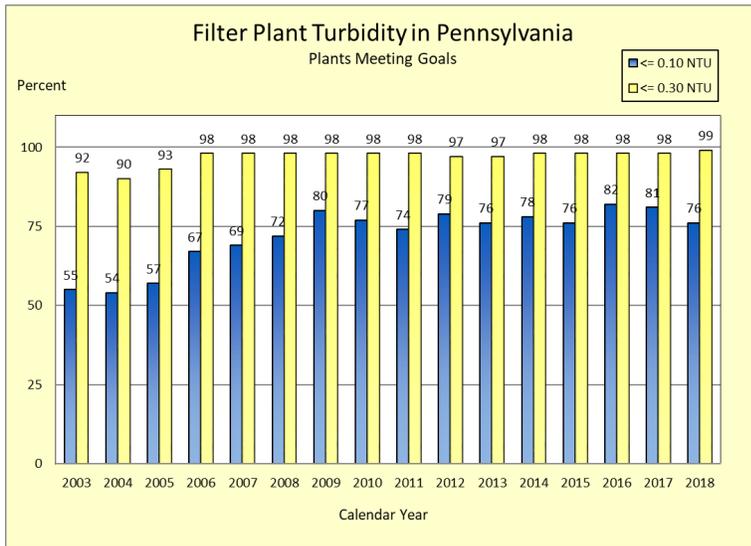


Outcome #3. Over 3.0 million Pennsylvanians are benefiting from drinking water meeting optimized turbidity performance goals. These consumers receive water from filter plants that meet the ≤0.10 NTU 95th percentile Optimized Performance Goal based on daily maximum combined filter effluent turbidity results. As mentioned earlier, filter plants producing water that meets the ≤0.10 NTU optimization goal are providing a greater level of public health protection.



The data used for this outcome came from DEP’s WebOAS (Web Optimization Assessment Software), which determines whether plants across the state are meeting the goals that maximize public health protection. Approximately 185 filter plants participate in AWOP by submitting their turbidity data through WebOAS. Therefore, the above data/graph unfortunately does not account for the 156 plants that do not participate in AWOP.

For more information: [Area Wide Optimization Program.](#)



Outcome #4. In calendar years 2017 and 2018, the percentage of filter plants meeting the optimization goal of ≤ 0.10 NTU for the maximum daily combined filter effluent turbidity was 81 percent and 76 percent, respectively.

Operators at filter plants use “turbidity” to measure the effectiveness of the treatment processes. Basically, turbidity is an indicator of the presence of protozoa, bacteria, viruses and other disease-causing organisms. It is measured as “NTU” or

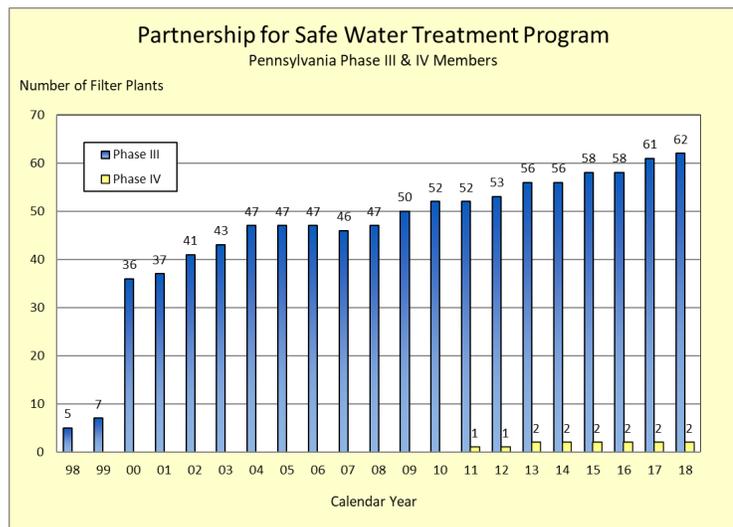
nephelometric turbidity units. Turbidity levels over 0.10 NTU represent an increased risk of a waterborne disease outbreak. DEP uses a Web-based software program called WebOAS (Web Optimization Assessment Software), which determines whether plants across the state are meeting the goals and maximizing public health protection by optimizing performance. Unlike compliance data, the optimization goal is a measure of whether water suppliers are *maximizing* public health protection by *minimizing* risks of a waterborne disease outbreak. Currently in 2018, WebOAS data is available for 54 percent (185) of the plants in the state.

For more information: [Area Wide Optimization Program](#).



Outcome #5. Approximately 5.3 million Pennsylvanians are benefiting from improved drinking water provided from 62 filter plants that have achieved Phase III and 2 filter plants that achieved Phase IV of the Partnership program.

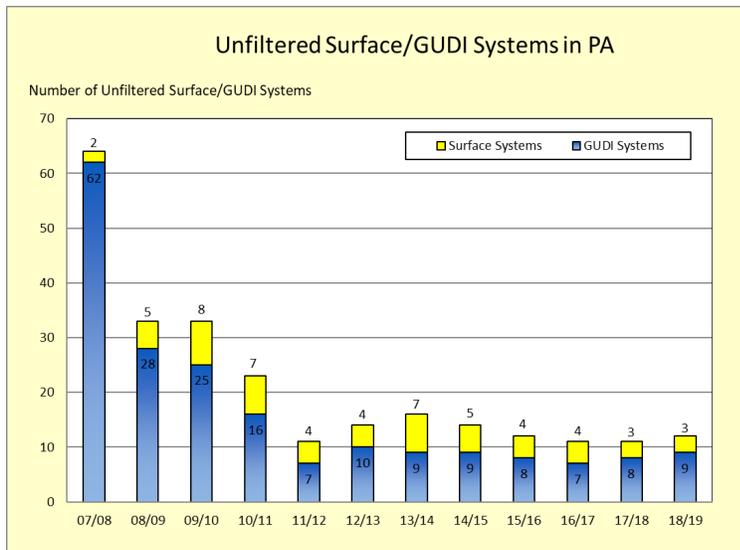
Phase III of the Partnership program is a detailed, peer-reviewed report that summarizes a rigorous self-assessment. This phase is specifically geared toward identifying weakness in plant operation, design and administration that could lead to a breakthrough of waterborne disease-causing organisms into finished water that is distributed to



consumers. Based on 95th percentile turbidity values, a national Partnership report revealed that plant performance improved more than 60 percent following the Partnership Phase III self-assessment.

Phase IV is optional and includes a rigorous assessment to determine conformance with Partnership performance goals. A team of utility peers reviews the plant data and determines if optimized performance has been achieved. Successful reports will result in the plant receiving the Excellence in Water Treatment Award from the Partnership. Currently only 16 filter plants in the nation have achieved this phase.

For more information: [Partnership for Safe Water](#).



Outcome #6. The number of Surface/GUDI water systems that are using unfiltered source water has been reduced to twelve.

DEP is continuously working with water systems that are using unfiltered surface and GUDI sources by having these systems either abandon their unfiltered sources or install filtration. In most cases, these water systems use disinfection as their only form of treatment. *Cryptosporidium* is resistant to levels of chlorination that are acceptable for drinking water

systems, hence the need for filtration. Therefore, DEP is concerned about the public health risk that is created when pathogenic organisms, such as *Cryptosporidium*, are not being removed by filtration. During the last few years, the total number of unfiltered systems has remained low. In addition, the actual systems within this category may be slightly different from year to year. This chart does not fully capture all the progress that is being made since systems with newly identified surface/GUDI sources are being added to this category; while, systems that have abandoned their source(s) or installed filtration are being removed. A few of these systems are on a compliance schedule for corrective action through Consent Order Agreements (COA).



Outcome #7. Since the FPPE program's inception in 1988, the percentage of plants that were rated and have a "Commendable" or "Satisfactory" performance rating has been tracked and is currently at 75 percent.

Since 1988, over 2,250 FPPEs have occurred in the state. The drinking water industry and the FPPE protocol, have substantially evolved over this time period. Peer reviewed research indicates that a higher level of plant performance is necessary to remove pathogens.

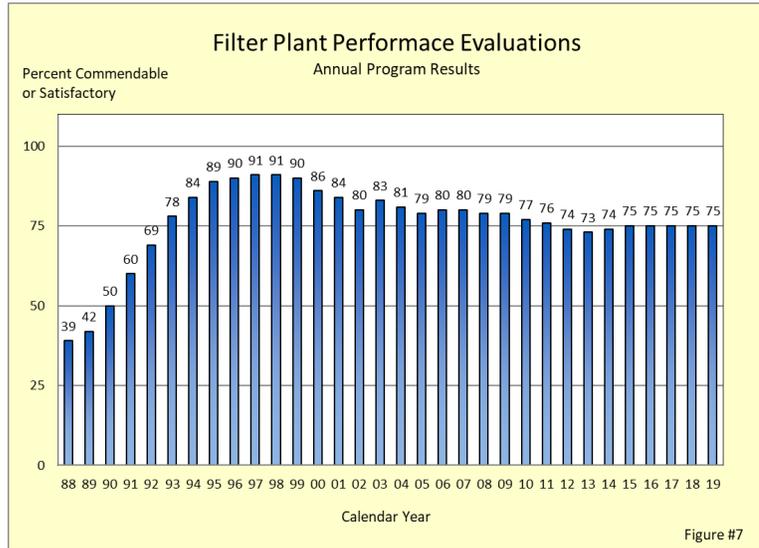


Figure #7

Also, the U.S. Environmental Protection Agency has promulgated more stringent regulations at the national level. As a result, DEP's on-site FPPEs continue to become more rigorous in order to encourage water suppliers to produce finished water quality that is better than current regulatory standards. Since the FPPE program's inception in 1988, a philosophy of maintaining a rigorous program positions Pennsylvania's filter plants for compliance with future regulations and the prevention of waterborne diseases. Therefore, when taking this into account, the accompanying graph shows that 25 percent of the plants in the state have a "Needs Improvement" performance rating.

For more information: [Filter Plant Performance Evaluation: Program Information.](#)



Outputs and Status of the Programs

The following outputs measure the productivity and current status of the programs.



Output/Status #1. *The current cycle to evaluate every plant in the state is once every 5.0 years. Our statewide goal and our federal grant commitment is to evaluate every plant every 3 years.*

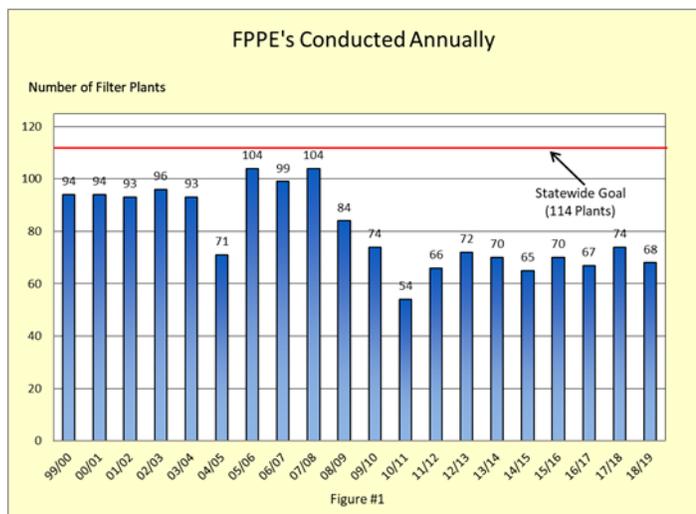
FPPEs were historically conducted by 2 staff located in central office. In July 1999, the FPPE program used EPA Setaside Funds to hire additional field operations staff, vehicles, and equipment to begin conducting evaluations at all of the state's surface water treatment plants on a more frequent basis. Sixty-eight FPPEs occurred between July 1, 2018, and June 30, 2019 equating to an FPPE return rate of every 5.0 years.

For more information: [Filter Plant Performance Evaluation: Program Information.](#)



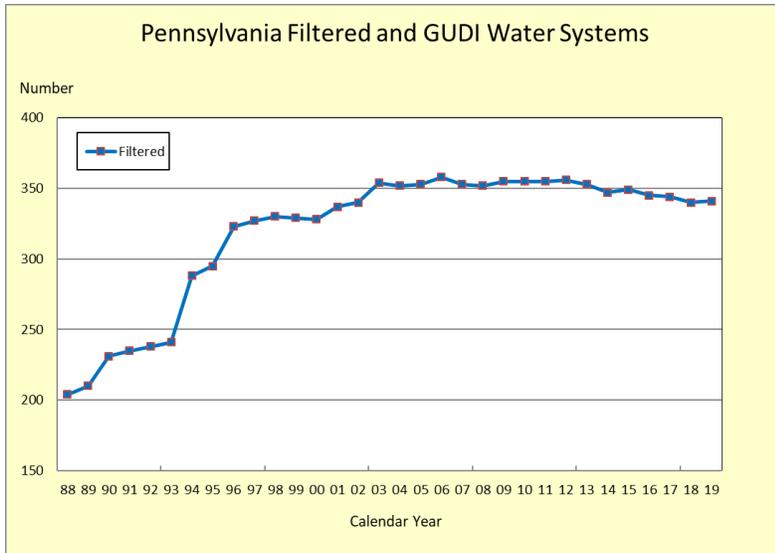
Output/Status #2. *Statewide, staff have performed 68 FPPEs between July 1, 2018, and June 30, 2019.*

DEP performed 1,612 evaluations from July 1999 through June 2019. Sixty-Eight FPPEs occurred between July 1, 2018, and June 30, 2019. DEP's goal and federal grant commitment is to conduct an FPPE at each plant every 3 years. To meet this 3 year goal, 114 FPPEs would need to be conducted each year. In many instances, FPPE staff take on additional responsibilities within the drinking water program, such as responding to filter plant emergencies and working with filter plants with significant violations. This is often necessary in order to offset overall reduction in Safe Drinking Water staffing levels; and, these additional tasks are a primary factor contributing to reduced number of FPPEs completed. In the accompanying graph, each bar represents the number of FPPEs conducted during each fiscal year (FY) since FY 99/00.



For more information: [Filter Plant Performance Evaluation: Program Information.](#)





Output/Status #3. *The state's surface and GUDI water treatment plants increased from 204 (1988) to the current level of 341 plants, which together serve approximately 8.7 million Pennsylvanians and numerous out-of-state visitors.*

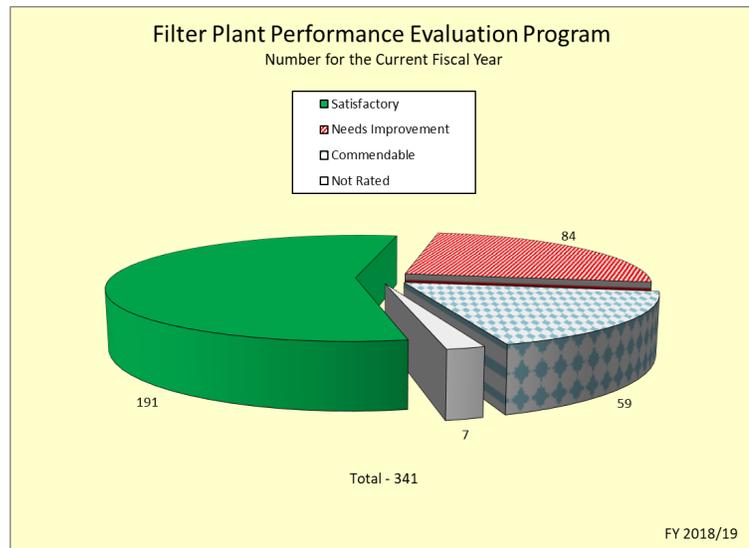
In 1989, the adoption of Pennsylvania's mandatory surface water filtration regulation resulted in a dramatic decline in risks from waterborne giardiasis and cryptosporidiosis. The number of filter plants has increased

dramatically. With filtration, our exposure to organisms resistant to disinfection, like *Cryptosporidium*, is much more limited. Today, Pennsylvania's community of surface water treatment plants provides water to over 8.7 million people. That's nearly 68 percent of the state's residents.



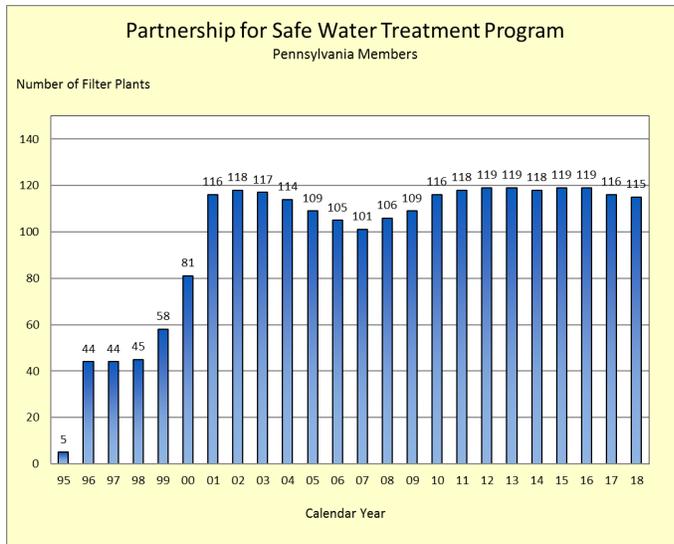
Output/Status #4. *7 filter plants have not been rated and 84 plants hold a “Needs Improvement” performance rating in Pennsylvania.*

DEP will continue to work with the state's water systems that remain in the “Needs Improvement” status. The plants in this status serve over 2,016,988 Pennsylvanians. In addition, newly constructed filter plants in Pennsylvania still need a performance rating under the FPPE program.



For more information: [Filter Plant Performance Evaluation: Program Information.](#)





Output/Status #5. With 115 Partnership members serving over 6.6 million customers, Pennsylvania is the leader in the nation.

The Partnership is made up of DEP, the U.S. Environmental Protection Agency, the Pennsylvania Section American Water Works Association and other drinking water organizations. Its goal is to implement preventative measures that are based on optimizing treatment plant performance. Participation shows a continuing commitment toward the goal of providing safe water 100% of the time and achieving operational excellence in

water treatment. Currently, Pennsylvania accounts for over 24 percent of the nation’s total membership.

For more information: [Partnership for Safe Water: General Questions and Information.](#)



Output/Status #6. Pennsylvania continues to develop a Distribution System Optimization (DSO) Program, with one staff dedicated to this objective.

In support of the continued development of the DSO program, from July 1, 2018 to June 30, 2019, continuous on-line monitoring equipment was deployed at three water systems in Pennsylvania with associated analysis and system follow-up. In-plant sampling was performed at six systems to determine the impact of water treatment processes on the quality of water entering the distribution system. Investigative distribution system monitoring was performed at eleven systems to evaluate the quality of water being delivered to customers. In addition, in-tank sampling studies were conducted at six system to determine the impacts of tank turnover and mixing on water quality within and leaving the tank. In conjunction with other activities, hold studies were conducted at three systems to determine the overall chlorine degradation and DBP formation potentials of the water entering the distribution system. This data was also used to help support the data collected at the tank sites and throughout the distribution system. These numbers include a multi-state Comprehensive Performance Evaluation conducted as a joint effort between staff from DEP, EPA, and six AWOP-participating states at a parent system and two of its consecutive systems. Pennsylvania staff also participated on the Distribution Program Effectiveness Assessment Committee (PEAC-D) of the Partnership for Safe Water (PFSW). As a result of ongoing program development and cooperation with EPA, DSO goals and tools have been established and are available on DEP’s website.

For more information: [PA DEP DSO Webpage](#)