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PHILADELPHIA WATER
EST. 1801

Environmental Quality Board
P.O. Box 8477
Harrisburg, PA 17105-8477

Re: Philadelphia Water's Comments to the Proposed Disinfection Requirements Rule

Summary of Comments to the Environmental Quality Board (EQB)

Dear Board Members:

Philadelphia Water hereby submits its comments to the proposed rulemaking and proposed changes to Chapter 109 relating to the Disinfection Requirements Rule.

A brief summary of those comments are contained below. Please refer to the attached full formal comments for specific comment details and underlying support for Philadelphia Water's responses:

- **PaDEP has not identified any public health benefit from increasing the minimum chlorine disinfectant residual in the distribution system.** During stakeholder meetings, both before and after the proposed rulemaking was published, it was determined that increasing the required minimum distribution system disinfectant residual will not result in any known public health benefit. This specifically includes any reduction in *E. coli* and *Legionella*. Violations of such higher standards will result in public notifications where no true health risk exists, thereby undermining public confidence in its drinking water. Further, the cost savings that PaDEP cites that are associated with avoiding the waterborne disease outbreaks, *Cryptosporidium* and *Salmonella*, simply do not exist. These outbreaks would not be impacted by raising the required minimum distribution system disinfectant residual.

- **While there are no known health benefits of increasing the required minimum distribution system disinfectant residual, there are well known health risks.** Increasing the required minimum distribution system disinfectant residual will expose the public to higher levels of scientifically proven carcinogenic disinfection byproducts.

- **At this time, establish a required minimum distribution system disinfectant residual standard of 0.1 mg/L and adopt an information collection partnership in Pennsylvania to better understand the relationship between disinfectant residual and health effects.** Although the current required minimum distribution system disinfectant residual standard of 0.02 mg/L cannot assure a disinfectant is present, a standard of 0.1 mg/L can. Through gathering and evaluating comprehensive data from water systems in Pennsylvania, the information collection partnership will establish PaDEP as a leader in national efforts to make better data-driven decisions.

- **Collaborate with Pennsylvania water systems to define a required minimum distribution system disinfectant residual level that is practical, achievable, and balances the known risks and avoids unintended consequences.** Despite the lack of any identifiable public health benefit in the proposed rulemaking, there is the certainty of numerous risks and unintended consequences. Specifically, under the proposed rulemaking, there will be significant increases in capital and annual operational costs, public notification when there is no scientifically defensible public health risk, and higher population exposures to scientifically proven carcinogenic disinfection byproducts.

- **Retain heterotrophic plate count (HPC) analysis as a means to achieve compliance.** Water systems have proven HPC to be an effective parameter in demonstrating the control of bacteriological activity in water. Removing this provision, but still allowing bottled, bulk and retail water systems to utilize HPC for compliance, will weaken public health protection and discourage the use of HPC as a water quality parameter.

In addition to Philadelphia Water's full formal comments, we adopt and support the attached comments provided by the Disinfection Requirements Rule Stakeholder Workgroup (DRRSW) as our own.

Thank you very much for the opportunity to comment.

Sincerely,

David Katz
Deputy Commissioner
Compliance
Philadelphia Water

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- **Retain heterotrophic plate count (HPC) analysis as a means to achieve compliance.** Water systems have proven HPC to be an effective parameter in demonstrating the control of bacteriological activity in water. Removing this provision, but still allowing bottled, bulk and retail water systems to utilize HPC for compliance, will weaken public health protection and discourage the use of HPC as a water quality parameter.

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Sincerely,

David Katz
Deputy Commissioner
Compliance
Philadelphia Water

PHILADELPHIA WATER
EST. 1801

Debra A. McCarty, Water Commissioner

Philadelphia Water hereby submits its comments to the Pennsylvania Department of Environmental Protection's proposed regulatory changes to Chapter 109 to implement and address the Disinfection Requirements Rule.

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

Dated 02/20/2016

Philadelphia Water's

FINAL COMMENTS

04/19/2016

Issue #1: Information presented in PaDEP's Disinfection Requirements Rule Preamble alleges that increasing the required minimum distribution system disinfectant residual from 0.02 mg/L to 0.2 mg/L will reduce the likelihood of disease causing organisms such as *E. coli* and *Legionella*.

Philadelphia Water's Response: Information presented in PaDEP's Disinfectant Requirements Rule Preamble is false; increasing the required minimum distribution system disinfectant residual will not reduce the likelihood of *E. coil* and *Legionella*.

Pennsylvania does not have a problem with *E. coli* outbreaks that can be attributed to water systems.

Increasing the required minimum distribution system disinfectant residual will not control *Legionella*.

Explanation:
Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 859:
"*Lack of an adequate residual may increase the likelihood that disease-causing organisms such as E. coli and Legionella are present.*"

E. coli and *Legionella* are very different pathogens. *E. coli*, a pathogen that is fecal in origin, is very responsive to disinfection, whereas *Legionella*, natural environmental bacteria, are opportunistic pathogens that can result in Legionnaire's Disease (LD), and are not very readily controlled using distribution system disinfectant.

Control measures for *E. coli* and *Legionella* vary at different locations in the water system (i.e., at the treatment plant, in the distribution system or in premise plumbing). Throughout the regularly scheduled Technical Assistance Center (TAC) board meetings and additional stakeholder meetings, the PaDEP has never indicated that the state of Pennsylvania has reason to be concerned with *E. coli* outbreaks resulting from water systems. If there are public health concerns related to *E. coli* contamination, those may be addressed through the Revised Total Coliform Rule's (RTCR) find and fix approach (45 Pa.B. 5943).

At the TAC and additional stakeholder meetings, industry experts agreed that *Legionella* can be present in drinking water that meets all federal and state standards, and that the control of *Legionella* (and therefore LD) occurs within the building's premise plumbing, not within the distribution system. Therefore, increasing the required minimum distribution system disinfectant residual will not control *Legionella*.

Because there is no evidence to suggest that the state of Pennsylvania has a problem with *E. coli* outbreaks associated with water systems and because control of *Legionella* (and LD) occurs within a building's premise plumbing, the discussion that additional distribution system disinfectant will decrease the likelihood of disease resulting from either pathogen is incorrect.

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As a result of not providing a scientifically sound public health justification for the regulation, scientific experts and water systems are unclear as to which public health concern PaDEP will address by raising the required minimum distribution system disinfectant residual.

Conclusions and Recommendations: PaDEP's preamble is inaccurate, inadequate, and misleading. The current preamble does not incorporate testimony from industry experts given at the Technical Assistance Center (TAC) board meetings or additional stakeholder meetings held prior to the proposed rule's publication. The testimonies and documentation provided from various scientific experts at these meetings do not support the PaDEP's proposal to increase the required minimum distribution system disinfectant residual to 0.2 mg/L at this time.

Given the lack of any identifiable public health benefit, it was misleading for PaDEP to cite *E. coli* and *Legionella* to the Environmental Quality Board (EQB) on November 17, 2015 as impetus to adopt the proposed Disinfection Requirements Rule. Therefore, Philadelphia Water requests that discussion of *E. coli* and *Legionella* be removed from the preamble entirely.

Issue #2: In the proposed Disinfection Requirements Rule Preamble, to help support increasing the required minimum distribution system disinfectant residual, PaDEP references only specific, select data and corresponding figures from a 2013 Center for Disease Control and Prevention (CDC) Report regarding waterborne disease outbreaks.

Philadelphia Water's Response: The PaDEP omits to include additional data and corresponding figures from the same 2013 Center for Disease Control and Prevention (CDC) report that helps refute PaDEP's public health justification for increasing the required minimum distribution system disinfectant residual.

Explanation:
Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pgs. 859-861:
"According to the Centers for Disease Control and Prevention (CDC), despite advances in water treatment and management, waterborne disease outbreaks continue to occur in the United States (Figure 1). The outbreaks reported during 2009—2010 highlight several emerging and persisting public health challenges associated with drinking water systems. Legionella accounted for 58% of outbreaks and is the most frequently reported etiology among drinking water systems (Figure 2). In addition, the large proportion (78%) of illnesses observed in outbreaks involved distribution system deficiencies (Figure 3). This data emphasizes the importance of protecting, maintaining and improving the public drinking water distribution system infrastructure because these deficiencies can lead to widespread illness (CDC, 2013). Waterborne disease outbreaks in this Commonwealth have followed a similar trend in that nearly all outbreaks since 2010 have been associated with Legionella and distribution system deficiencies. Figures 1-4"

The PaDEP references specific data and corresponding figures from a 2013 CDC report; however, omits additional data from the same report that helps refute PaDEP's public health justification for the proposal rule.

Specifically, of the 33 total waterborne disease (WBD) outbreaks described in this report, only four (12.1%) were attributed to distribution system deficiencies. Three of these outbreaks involved systems using *only* ground water sources. Out of the three ground water systems, two applied chlorine disinfection while the other did not disinfect at all. The remaining outbreak attributed to distribution system deficiencies involved a system using both ground and surface water sources that also did not disinfect.

Additionally, of the 1,040 associated cases of illness, 811 (78%) involved distribution system deficiencies. Of these, 101 involved an "untreated groundwater and distribution system". These cases resulted from an outbreak at a non-transient, non-community water system (NTNCWS), using a groundwater source that was not treated with disinfectant.

Conclusions and Recommendations: PaDEP's Disinfection Requirements Rule Preamble is providing misinterpreted information from the Center for Disease Control and Prevention (CDC), and as a result, provides misleading information to the Environmental Quality Board (EQB) as a

means to justify an increase to the required minimum disinfectant residual within the distribution system.

Philadelphia Water requests that the PaDEP provide more accurate information within the preamble regarding waterborne disease outbreaks, specifically, that the majority of outbreaks, identified by CDC, occurred in groundwater systems, many of which provided no disinfection.

Issue #3: PaDEP's Disinfection Requirements Rule Preamble prematurely defines 0.2 mg/L as "an adequate residual for the control of microbial growth" in Pennsylvania on the basis of only one detailed residual study performed in Colorado.

Philadelphia Water's Response: Without examining sufficient data from Pennsylvania water systems, it is unreasonable for PaDEP to assume that conditions in Pennsylvania are comparable to those in Colorado. Unlike Colorado, Philadelphia Water saw no relationship between chlorine residual and total coliform or *E. coli* occurrence.

Explanation:
Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 862:
"*What is an adequate residual for the control of microbial growth?*
The CDPHE [Colorado Department of Public Health and Environment] *conducted a study to review total coliform and E. coli occurrence data. The study showed a relationship between chlorine residuals and occurrence. There was a higher rate of occurrence of both contaminants as the chlorine residual decreased. Specifically, the CDPHE found the following:*

Coliform Bacteria and Residual Chlorine Data
(July 1, 2011—November 15, 2013)

	Samples Received	*Number of TC+*	*% of Positives*
< 0.1 mg/L	3,357	102	3.0%
<0.2 mg/L	7,805	160	2.0%
≥ 0.2 mg/L	83,433	462	0.55%
Totals	91,238	622	0.7%

Regarding E. coli, the CDPHE found that ~48% of all E. coli positive results occurred when disinfectant residuals were < 0.2 mg/L (CDPHE, 2014)."

Philadelphia Water reviewed over 25,000 total coliform compliance grab sample data collected from January 1, 2012, through March 31, 2016. There was no relationship between chlorine residual and total coliform occurrence. Furthermore, almost 96% of total coliform occurrence was observed in total coliform compliance samples with disinfectant residuals at or great than 1.0 mg/L, with the majority of those samples at or greater than 1.5 mg/L. During the same analysis period, no total coliform compliance samples tested positive for the presence of *E. coli*.

Philadelphia Water Total Coliform Occurrence: January 1, 2012 - March 31, 2016			
Chlorine Residual	**Number of Samples Received**	**Number of Samples with Total Coliform Present**	**Percent of Samples with Total Coliform Present**
< 0.1 mg/L	7	0	0%
≥ 0.1 mg/L and < 0.2 mg/L	60	0	0%
≥ 0.2 mg/L	25507	59	0.23%
Total	25574	59	0.23%

Philadelphia Water Total Coliform Occurrence: January 1, 2012 - March 31, 2016		
Chlorine Residual	**Number of Samples with Total Coliform Present**	**Percent of Samples with Total Coliform Present**
< 0.2 mg/L	0	0%
≥ 0.2 mg/L and < 0.5 mg/L	1	2%
≥ 0.5 mg/L and < 1.0 mg/L	2	3%
≥ 1.0 mg/L and < 1.5 mg/L	14	24%
≥ 1.5 mg/L and < 2.0 mg/L	24	41%
≥ 2.0 mg/L	18	31%
Total	59	100%

PaDEP references the Colorado study in the preamble to determine *"an adequate residual for the control of microbial growth"* (preamble pg. 862) in Pennsylvania. However, Colorado's established level was based on occurrence data from free chlorine systems specific to Colorado waters. The Colorado study did not evaluate chloraminated systems. Furthermore, from PW's analysis, it is apparent that total coliform (and *E. coli*) occurrence is not higher when the only associated factor is a decrease in chlorine residual.

During the Disinfection Requirements Rule stakeholder meetings, it was proposed that Pennsylvania participate in an information collection program to gather state-wide data to help better establish the required minimum distribution system disinfectant residual. The data collection effort, specific to Pennsylvania, would help PaDEP and Pennsylvania water systems better understand relationships between disinfectant residual and potential health effects. The effort will also establish Pennsylvania as a leader in data collection and enhance efforts in making data-driven, sound science decisions.

Conclusions and Recommendations: Philadelphia Water requests that PaDEP make better data-driven decisions, particularly through applicable data collection, and by engaging utilities throughout Pennsylvania to participate in studies similar to Colorado, but specific to free chlorine and chloraminated Pennsylvania water systems. Therefore, the PaDEP should not be instituting a required minimum distribution system disinfectant residual of 0.2 mg/L at this time.

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Issue #4: **PaDEP's Proposed Disinfection Requirements Rule regulation package submitted to the Independent Regulatory Review Commission (IRRC) states that Pennsylvania is at a competitive disadvantage compared to other states with more stringent disinfection residual requirements.**

Philadelphia Water's Response: **PaDEP's statement to IRRC is incorrect because most states do not define detectable or have numeric residual requirements. Therefore, Pennsylvania is not at a competitive disadvantage compared to other states.**

Explanation:

Regulatory Analysis Form (Proposed Rulemaking Disinfection Requirements Rule, pg. 5):

"The Department's existing disinfectant residual requirements, while consistent with the federal rule, have not kept pace with other states...This proposed amendment will make Pennsylvania more consistent with these other states regarding public health protection...The amendments will not put Pennsylvania at a competitive disadvantage with any other state. Rather the amendments will enhance Pennsylvania's ability to compete with other states by improving public health and promoting healthy and sustainable communities."

Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pgs. 862-863:

"In addition to reviewing numerous studies, the disinfectant residual requirements of other states were also reviewed. At least 23 states have promulgated more stringent requirements when compared to the Commonwealth's current standard of 0.02 mg/L. Nineteen of these states have disinfectant residual requirements that are ≥ 0.2 mg/L, which supports the Board's proposed standard of 0.2 mg/L. The following table includes a summary of other states' requirements."

State	Minimum Distribution System Residual (mg/L)	State	Minimum Distribution System Residual (mg/L)
Alabama*	0.2 (free), 0.5 (total)	Missouri	0.2 (total)
Colorado*	0.2 (free or total)	Nebraska	SW-0.2 (free), 0.25 or 0.5 (total); GW-0.1 (free)
Delaware	0.3 (free)	Nevada	0.05 (free or total)
Florida*	0.2 (free), 0.6 (total)	New Jersey*	0.05 (free or total)
Georgia	0.2 (free)	North Carolina*	0.2 (free), 1.0 (total)
Illinois*	0.2 (free), 0.5 (total)	Ohio*	0.2 (free), 1.0 (total)
Indiana	0.2 (free), 0.5 (total)	Oklahoma	0.2 (free), 1.0 (total)
Iowa	0.3 (free), 1.5 (total)	Tennessee*	0.2 (free)
Kansas*	0.2 (free), 1.0 (total)	Texas*	0.2 (free), 0.5 (total)
Kentucky*	0.2 (free), 0.5 (total)	Vermont	0.1 (free)
Louisiana*	0.5 (free or total)	West Virginia*	0.2 (total)
Minnesota	0.1 (free or total)	* States with mandatory disinfection	

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Although other states may have more stringent required minimum distribution system disinfectant residual requirements, during the disinfection requirements rule stakeholder meetings it was emphasized that the majority of states do not define detectable (40 states) or have numeric residual requirements (26 states). See the table below documenting how states regulate distribution system disinfectant residual.

How States Regulate Distribution System Disinfectant Residual		
Approach	**# States**	**States**
Must be detectable (detectable might not be defined)	26	AK, AZ, AR, CA, CT, HI, ID, ME, MD, MA, MI, MS, NH, NM, NY, ND, OR, RI, SC, SD, UT, VA, WA, WI, WY
Numeric minimum for total chlorine, < 0.2 mg/L	5	MN, NV, NJ, PA, VT
Numeric minimum for total chlorine, ≥ 0.2 mg/L	19	AL, CO, DE, FL, GA, IL, IN, IA, KS, KY, LA, MO, MT, NC, NE, OH, OK, TN, TX, WV

There are 19 states that regulate distribution system disinfectant residual at or above 0.2 mg/L, however 31 states regulate distribution system disinfectant residual below 0.2 mg/L or require a "detectable" disinfectant residual and detectable might not be defined. Therefore, Pennsylvania is not an outlier, in the minority, or at a competitive disadvantage compared to other states.

As previously mentioned in issue #3, during the Disinfection Requirements Rule stakeholder meetings, it was proposed that Pennsylvania participate in an information collection program to gather state-wide data as part of determining the required minimum distribution system disinfectant residual. The data collection effort, specific to Pennsylvania, would help PaDEP and Pennsylvania water systems better understand relationships between disinfectant residual and health effects. The effort will also establish and position Pennsylvania as a leader in data collection and enhance efforts in making data-driven, sound science decisions.

<u>Conclusions and Recommendations</u>: The proposed Disinfection Requirements Rule package to IRRC, without proof of any identifiable public health benefit, asserts that an increase in the required minimum distribution system disinfection residual will enhance Pennsylvania's ability to compete with other states by improving public health protection and promote healthy and sustainable communities.

Philadelphia Water requests that PaDEP make better data-driven decisions, particularly through applicable data collection, and by engaging utilities throughout Pennsylvania to participate in studies similar to Colorado, but specific to free chlorine and chloraminated Pennsylvania water systems. This approach will establish Pennsylvania as a leader in data collection and enhance efforts in making data-driven, sound science decisions.

Issue #5: PaDEP's Proposed Disinfection Requirements Rule Preamble, without supporting data, inappropriately assumes that increasing the required minimum distribution system disinfectant residual by ten-fold (0.02 mg/L to 0.2 mg/L) will have no negative impacts on water systems for meeting disinfection byproduct (DBP) compliance.

Philadelphia Water Response: Currently, many water systems in Pennsylvania struggle to meet compliance with disinfection byproducts (DBPs). An order of magnitude increase in the required minimum distribution system disinfectant residual will magnify issues with currently regulated carcinogenic DBPs and unregulated DBPs that may become regulated in the future.

Explanation:
Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 863):
"The proposed disinfectant residual requirements aim to strike a balance between improving microbial inactivation while limiting adverse impacts on DBP formation. Water systems can meet more stringent disinfectant residual requirements and still be in compliance with DBPs as evidenced by a review of TCR and DBP compliance data from other states (EPA, ECHO web site)."

Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 862):
"The goal of the Distribution System Optimization Program is to sustain the water quality leaving the plant throughout all points in the distribution system. To further define distribution system optimization, "optimization" refers to improving drinking water quality to enhance public health protection without significant capital improvements to the water treatment plant or distribution system infrastructure. The distribution system is the last "barrier" for protecting public health, meaning the physical and chemical barriers that have been established are necessary to protect the public from intentional or unintentional exposure to contaminants after the water has been treated. Distribution system optimization focuses on two primary health concerns related to water quality within the distribution system—microbial contamination and disinfection by-product (DBP) formation."

Under the current required minimum distribution system disinfectant residual of 0.02 mg/L, many Pennsylvania water systems struggle to meet DBP maximum contaminant levels (MCLs). During the Disinfection Requirements Rule stakeholder meetings, a conservative estimate of 12-16% of systems are near the total trihalomethanes (TTHM) or five haloacetic acids (HAA5) MCL. Additionally, systems across the nation are experiencing continuous challenges with source water changes, which may lead to increased levels of total organic carbon (TOC) and increased levels of bromide. Both of these will negatively impact DBP levels.

Pennsylvania water systems estimated to be non-compliant with DBPs under the current required minimum distribution system disinfectant residual of 0.02 mg/L	**#**	**%**
Systems with complete records	317	
Systems w/ complete records predicted to be in violation or near violation of DBP MCLs	51	16%
Systems w/ complete records confirmed to be in violation or near violation of DBP MCLs	37	12%

To meet the proposed distribution system disinfection residual level of 0.2 mg/L, systems will undoubtedly generate more DBPs because systems will need to increase disinfection chemical dosage at water treatment facilities and will also need to provide increased disinfection within the distribution system. Within the distribution system this will require the addition of expensive booster chlorination stations (see issue #8 for specific costs associated with these capital improvements). Increasing disinfection at the treatment plant and the addition of booster stations will expose the public to higher levels of scientifically proven carcinogenic DBPs.

In regards to DBPs, Philadelphia Water's internal operational goal is to maintain individual DBP results below 75% of the respective MCL. For HAA5 this is below 0.045 mg/L; for TTHMs this is below 0.060 mg/L. When individual DBP values meet or exceed 75% of the DBP MCL, Philadelphia Water investigates and implements corrective actions to minimize further DBP formation.

Utilizing both the Environmental Protection Agency's (EPA) Safe Drinking Water Information System (SDWIS) Database and PaDEP's Drinking Water Reporting System (DWRS) Database, DBP data from three very large community water systems (as defined by SDWIS as serving population greater than 100, 000) were obtained for the period from January 1, 2015, through January 1, 2016. The number and percent of individual DBP samples that met or exceeded the 75% MCL was recorded. For all three very large Pennsylvania water systems, a significant number of elevated DBP results were observed, especially for TTHMs.

It's likely that other systems in Pennsylvania experience similar, or worse, DBP trends compared to the three very large systems summarized below. And given the proposed required minimum distribution system disinfectant residual of 0.2 mg/L, both with and without significant capital improvements, water systems will likely exceed individual DBP MCLs and be at risk for not achieving DBP compliance based on the individual site's locational running annual averages (LRAAs), calculated to determine compliance.

3 Very Large PA Water Systems - Individual DBP Results ≥ 75% MCL (January 1, 2015 - January 1, 2016)					
System	# of HAA5/THM Samples	# HAA5 ≥ 0.045 mg/L	% HAA5 ≥ 0.045 mg/L	# THM ≥ 0.060 mg/L	% THM ≥ 0.060 mg/L
A	192	22	11%	35	18%
B	48	0	0%	26	54%
C	48	10	21%	11	23%

<u>Conclusions and Recommendations</u>: Given the lack of any identifiable public health benefit and the certainty of risks associated with increased DBP exposure, PaDEP is urged to collaborate with water systems to better define a minimum required distribution system disinfectant residual that is practical, achievable, and balances known risks and avoids unintended consequences. Water systems will need to provide significantly higher distribution system disinfectant residuals to meet the proposed required minimum distribution system disinfectant residual and will incur significant capital improvements and annual operating costs.

Issue #6: PaDEP's Proposed Disinfection Requirements Rule Preamble presents the benefits of the proposed regulation as avoidance of the costs associated with avoiding waterborne disease outbreaks, like the cryptosporidiosis outbreak in Milwaukee, Wisconsin in 1993 and the salmonellosis outbreak in Alamosa, Colorado in 2008.

Philadelphia Water's Response: The events (and their associated costs) like the cryptosporidiosis outbreak in Milwaukee, Wisconsin in 1993 and the salmonellosis outbreak in Alamosa, Colorado in 2008 cannot be avoided by simply raising the required minimum distribution system disinfectant residual, as PaDEP is proposing.

***Cryptosporidium* is not responsive to disinfection treatment.**

The *Salmonella* outbreak occurred in a ground water system (without disinfection) that was poorly maintained. Simply increasing the required minimum distribution system disinfectant residual will not entice all water systems to find and fix sanitary defects and deficiencies or perform sanitary surveys.

Explanation:
Within 46 Pa. B. 857, Benefits, Costs, and Compliance - Benefits Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pgs. 871-872:
"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, the total medical costs and productivity losses associated with the 1993 waterborne outbreak of cryptosporidiosis in Milwaukee, WI, 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. See Corso, P. S., Kramer, M. H., Blair, K. A., Addiss, D. G., Davis, J. P., Haddix, A. C. (April 2003). "Cost of illness in the 1993 Waterborne Cryptosporidium outbreak, Milwaukee, Wisconsin." Emerging Infectious Diseases, http://wwwnc.cdc.gov/eid/article/9/4/02-0417.

In 2008, a large Salmonella outbreak caused by contamination of a storage tank and distribution system of the municipal drinking water supply occurred in Alamosa, CO. The outbreak's estimated total cost to residents and businesses of Alamosa using a Monte Carlo simulation model (10,000 iterations) was approximately $1.5 million (range: $196,677—$6,002,879) and rose to $2.6 million (range: $1,123,471—$7,792,973) with the inclusion of outbreak response costs to local, state and nongovernmental agencies and City of Alamosa healthcare facilities and schools. This investigation documents the significant economic and health impacts associated with waterborne disease outbreaks and highlights the potential for loss of trust in public water systems following these outbreaks. See "Economic and Health Impacts Associated with a Salmonella Typhimurium Drinking Water Outbreak—Alamosa, CO, 2008," http://www.ncbi.nlm.nih.gov/pubmed/23526942.

Communities in this Commonwealth will benefit from: (1) the avoidance of a full range of health effects from the consumption of contaminated drinking water such as acute and chronic illness, endemic and epidemic disease, waterborne disease outbreaks, and death; (2) the continuity of a safe and adequate

supply of potable water; and (3) the ability to plan and build future capacity for economic growth and ensure long-term sustainability for years to come."

The Milwaukee cryptosporidiosis outbreak was caused by poor coagulation and filtration of lake water that was contaminated by *Cryptosporidium* oocysts. The poor plant performance, which occurred over consecutive days, was not due to a low chlorine residual in the distribution system. *Cryptosporidium* oocysts are not effectively killed by chlorine disinfection. Not even high doses of free chlorine during a disinfection process are effective at killing these organisms. *Cryptosporidium* oocysts must be killed by more advanced disinfection methods like ultraviolet radiation or must be physically removed using coagulation and filtration.

The US Environmental Protection Agency worked with stakeholders from around the country to determine regulatory initiatives that would prevent possible future outbreaks of cryptosporidiosis in the US and, as a result, promulgated the Enhanced Surface Water Treatment Rule, which went into effect in 2000. This rule lowered the combined filter effluent turbidity standard to less than 0.30 NTU 95% of the time. Since this regulation went into effect, there have not been additional waterborne disease outbreaks of cryptosporidiosis in the US for a water treatment facility that operates within federal guidelines.

In Alamosa, Colorado, a salmonellosis outbreak was traced back to a drinking water reservoir. The water source was a ground water well. *Salmonella* bacteria in the water supply may originate from infected human/animal feces and enter the water supply through potential pathways including sewage overflows, polluted stormwater runoff, and agricultural runoff. Alamosa's Weber Reservoir was in poor condition. Holes were observed by crews, cracks were visible on the roof and sides of the tank, and approximately 1.5 feet of sediment had accumulated on the tank's bottom. The tank was last drained and cleaned in 1984, 24 years prior to the outbreak despite receiving recommendations from a 1997 inspection report that the reservoir should be inspected and cleaned every three to five years. Prior to the March 2008 contamination event the City operated under a State-issued disinfection waiver that was granted in 1974 (Falco, R. and Williams, S. (2009), "Waterborne *Salmonella* Outbreak in Alamosa, Colorado in March and April 2008", Colorado Dept. of Public Health and Environment. Hrudey, S. and Hrudey, E. (2014), *Ensuring Safe Drinking Water: Learning from Frontline Experience with Contamination*, AWWA).

The costs for the cryptosporidiosis outbreak in Milwaukee were estimated at $ 96.2 million dollars. The PaDEP's proposed Disinfection Requirements Regulation, which is targeted to increase the minimum distribution system disinfectant residual, would have no impact on a *Cryptosporidium* contamination event. There is absolutely no connection between the Milwaukee event and a distribution system disinfectant residual of any level. Using the $ 96.2 M cost of this 1993 event to claim similar benefit to the citizens of Pennsylvania is inappropriate. No such benefit will be realized by this proposed regulation.

The estimated costs for the Alamosa, Colorado outbreak were $ 2.6 M. While *Salmonella* can be effectively treated using lower free chlorine residuals and adequate detention time, the reason the salmonellosis outbreak occurred was that Colorado issued a disinfection waiver to the water utility and the water utility did not maintain the reservoir to any reasonable standard. <u>This condition is a sanitary defect. Contamination was not in the water prior to entering the reservoir but was introduced to the reservoir from an outside source.</u> If the chlorine residual is raised to a higher detectable level in

Pennsylvania, a water utility that treats its water and maintains its reservoirs like Alamosa, Colorado did in 2008 will still have water quality problems and could experience a similar outbreak. Once again, the residents of Pennsylvania would not experience the benefits implied by these costs.

Conclusions and Recommendations: Philadelphia Water requests that avoidance of event and costs associated with the *Cryptosporidium* outbreak in Milwaukee, Wisconsin, and the *Salmonella* outbreak in Alamosa, Colorado be removed from the preamble entirely. Given the lack of any identifiable public health benefit, it was misleading for PaDEP to provide these examples to the Environmental Quality Board (EQB) on November 17, 2015, as impetus to adopt the proposed Disinfection Requirements Rule. This proposed regulation should consider the required minimum distribution system disinfectant residual for the distribution system and not a residual designed to treat sanitary defects, such as a poorly maintained reservoir.

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Issue #7: PaDEP's Proposed Disinfection Requirements Rule Preamble uses monthly average distribution system disinfectant residual data to determine the potential for utilities to comply with the proposed required minimum distribution system disinfectant residual of 0.2 mg/L.

Philadelphia Water's Response: By using monthly average distribution system disinfectant residual data, PaDEP has dramatically overestimated the potential for water systems to comply with the proposed required minimum distribution system disinfectant residual of 0.2 mg/L.

Explanation:
Within 46 Pa. B. 857, Benefits, Costs, and Compliance – Compliance Costs, Disinfectant Residual in the Distribution Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 872:
"It is anticipated that the large majority of water systems will be able to comply with this requirement with little to no capital costs. According to Department records for the last 3 years (2012—2014):

- *Based on more than 82,000 monthly average distribution system disinfectant residual values reported by 2,583 different water systems: 95.6% of the average values already meet or exceed the increased minimum residual of 0.2 mg/L (free chlorine); and only 4.4% of the average values are below the minimum residual.*

- *For the 37 systems that chloraminate, based on more than 1,200 monthly average values reported: 99.67% of the average values already meet or exceed the increased minimum residual of 0.2 mg/L (total chlorine); and only 0.33% of the average values are below the minimum residual.*

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

Monthly average distribution system disinfectant residual data from a PaDEP database are used to estimate the compliance potential of distribution systems. The proposed regulation, however, does not use monthly average distribution system disinfectant residual data for compliance determinations. The proposed regulation uses individual sample location disinfectant residuals, places each result in a monthly database, and chooses the 95th percentile for that month. PaDEP's monthly average distribution system disinfectant residual data cannot be used to accurately predict 95% compliance.

Conclusions and Recommendations: By using the monthly average distribution system disinfectant residual data, PaDEP has dramatically overestimated the potential for utilities to comply with the proposed required minimum distribution system disinfectant residual. PaDEP must request water systems to submit comprehensive distribution system disinfectant residual data to evaluate and accurately estimate the potential for utilities to comply with the proposed minimum distribution system disinfectant residual of 0.2 mg/L.

Issue #8: PaDEP's Proposed Disinfection Requirements Rule Preamble estimates that the total capital costs for the entire regulated community to comply with the regulation, in particular those water systems implementing automatic flushing stations and booster chlorination stations, to be approximately $780,000.

Philadelphia Water's Response: PaDEP's total capital costs estimates for the regulated community and timeline to make any necessary operational changes are dramatically underestimated.

Explanation:
Within 46 Pa. B. 857, Benefits, Costs, and Compliance – Compliance Costs, Disinfectant Residual in the Distribution Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pgs. 867, 872:
"Some systems with very large and extensive distribution systems may need to install automatic flushing systems or booster chlorination stations to achieve a 0.2 mg/L at all points in the distribution system. The Department's estimates for these facilities are as follows: costs for automatic flushers: ~ $2,000; and costs for booster chlorination stations: $200,000—$250,000.

It is estimated that 20% of large systems (serving > 50,000), or six systems, may need to install automatic flushing devices or booster chlorination stations, or both. Three systems may need to install up to five automatic flushers for a cost of $10,000 for each system, a total of $30,000. Three systems may need to install a booster chlorination station at $250,000 for each system, a total of $750,000. The total capital costs to the regulated community may be $780,000.

Costs for small systems are not expected to increase because most small systems are already maintaining adequate disinfectant residuals (0.40 mg/L) as required by the Groundwater Rule.

Total costs for the regulated community are estimated at $43,500 + $780,000 = $823,500.

The Board requests comments on anticipated costs to comply with the proposed disinfectant residual requirements.

The Board is also seeking comments on whether a deferred effective date of 6 months after final promulgation is warranted to provide water systems with additional time to make any necessary operational changes. If capital improvements are needed, a system-specific compliance schedule may be needed. Comments on the anticipated length of time needed to increase disinfectant residuals and whether capital improvements are anticipated to meet the proposed requirements are requested."

Monthly average distribution system disinfectant residual data from a PaDEP database are used to estimate the compliance potential of distribution systems. The proposed regulation, however, does not use monthly average distribution system disinfectant residual data for compliance determinations. The proposed regulation uses individual sample location disinfectant residuals, places each result in a monthly database, and chooses the 95th percentile for that month. PaDEP's monthly average distribution system disinfectant residual data cannot be used to accurately predict 95% compliance.

By using the monthly average distribution system disinfectant residuals, PaDEP has dramatically overestimated the potential for utilities to comply with this regulation. As a result of overestimating ease

of compliance, the total capital costs for the regulated community to comply with this regulation, determined to be $780,000, are dramatically underestimated.

Philadelphia Water has attempted to estimate capital and operating costs to comply with the required minimum distribution system disinfectant residual portion of this proposed regulation. Please keep in mind that the focal point of this analysis is to eliminate distribution system disinfectant residuals below 0.2 mg/L. When Philadelphia Water sets out to comply with a regulation, we do not simply comply. Our outlook is to ensure complete compliance. So, when we focus on 0.2 mg/L, we are actually considering design for 0.5 mg/L to conservatively meet the proposed regulation.

After consultation with distribution water quality and operations managers, an estimate of 25 permanent automated flushers were chosen for select locations around the City of Philadelphia to reduce water age, which is one factor that leads to reduction of distribution system disinfectant residual. The characteristics of these flushers would be:

- they could be located near a sewer or in a more remote location
- the best option is to flush to a sewer, if sewer capacity allows
- the 2nd option is to dechlorinate and flush to a storm sewer
- underground piping and valving will be required
- non-privately owned land will be required
- flowmeters would be required
- backflow preventers would be required for sewer connections
- above ground enclosures with power and heat may be required
- an underground chamber is an alternative to an above ground enclosures

Design engineers were consulted to provide an estimated cost. The estimated capital cost to installing these systems would be $45,000 each.

An additional six (6) online water quality monitoring stations would be required to assist the water quality managers in tracking system water quality. The estimated cost of each station is $35,000.

Philadelphia Water carries a chloramine residual in its distribution system. Chloramine booster station cost estimates include:

- both ammonia and chlorine storage and feed systems
- dosage requirements
- estimates assume a 15 day chemical storage quantity, which would require a PaDEP waiver. (Current regulations call for a 30 day storage requirement for average monthly chemical dose. If we were required to use 30 day storage, the estimated capital costs would be higher.)
- storage tanks, chemical feed pumps, double walled dosing lines, chemical delivery stations, security cameras, power requirements, instrumentation, leak sensors and auto shutdown equipment, online residual analyzers, safety eyewashes and showers, underground heated concrete vaults, remote operational monitoring and control equipment, and flow paced control equipment.

The estimates do not include community support, land acquisition, zoning accommodations, public outreach costs, administrative costs, water flow measurement equipment, and chemical mixing equipment costs.

The total capital installation cost of the automatic flushers and online analyzers is estimated at $2,585,000. The annual O&M costs are estimated at $1,066,600 and includes new personnel, vehicles, and equipment.

The estimated capital costs for the chlorine booster stations is $22,432,182, including new systems at the end of finished water storage basins at the Baxter (160 MGD) and Queen Lane (65 MGD) Water Treatment Plants and new systems at Oak Lane Reservoir (17 MGD), East Park Reservoir (50 MGD), and the Navy Yard (1.5 MGD). The engineering estimate is Class 4 according to the Association for the Advancement of Cost Engineering (AACE). Annual O&M costs for the booster stations, including chemicals, are estimated at $1,434,614.

The total estimated capital costs are ***$25,017,182*** and the total estimated annual O&M costs are ***$2,501,182***.

To improve the plan for implementing any capital work, Philadelphia Water would first perform a more thorough analysis of the system using water quality data and hydraulic modeling, as well as choose design priorities, and initiate the design of projects. Philadelphia Water cannot perform this level of analysis for multiple distribution system disinfectant residual levels, so this research would need to be initiated after the final distribution system disinfectant residual level is chosen. The study would take up to a year to complete; design would take 1 to 2 years, and construction would take 1 to 2 years. The automatic flushers and online water quality analyzers would take less effort, design, and construction time than the chloramine booster stations. These timeframe estimates do not include the time required to gain neighborhood acceptance, if required.

Conclusions and Recommendations: Philadelphia Water requests that PaDEP revise the compliance cost estimates in the proposed regulation to accurately reflect costs and provide a cost/benefit analysis.

Additionally, Philadelphia Water requests that PaDEP revise the proposed regulation to allow water systems the ability to submit an implementation plan allowing systems adequate time to make necessary operational changes. Possible elements of the implementation plan would be:

- **Water utility requests implementation plan within 30 days of the final regulation date.**
- **Water utilities will be given 1 year from the final regulation date to submit an implementation plan for compliance. The plan must determine which utility districts are affected by the plan and must include capital work required.**
- **For automatic flushers, a water utility will be given a maximum of 2 years to install flushers. Compliance begins 2 years after the final regulation date.**
- **For chlorine or chloramine booster stations, a water utility will be given a maximum of 3 years to install the booster stations. Compliance begins 3 years after the final regulation date.**
- **In the interim, water utilities in the implementation plan will submit all regulatory data required under this regulation but will not be subject to public notification requirements until the implementation plan is completed.**

Issue #9: PaDEP's Proposed Disinfection Requirement Rule proposes the required minimum distribution system disinfectant residual to be 0.2 mg/L.

Philadelphia Water's Response: At this time, Philadelphia Water requests that PaDEP change the proposed required minimum distribution system disinfectant residual to 0.1 mg/L.

Explanation:
During the second Disinfection Requirements Rule Stakeholder Meeting on March 30, 2016, a member representing water systems provided PaDEP with the suggestion to adopt an interim goal for distribution system disinfection requirements. The goal proposed the following:

a. Define the minimum detectable level as a goal of 0.1 mg/L.
b. Achieve 95% compliance; when the goal is not achieved in two consecutive months, the water system will be required to submit a mitigation plan to find and fix the problem, an approach similar to the Revised Total Coliform Rule (RTCR).
c. Design an information collection program to gather state-wide data and better understand the relationship between disinfectant residual and health effects. By doing so, Pennsylvania will become a leader in information collection, analysis, and actions taken based on sound science while balancing real costs and benefits.

Conclusions and Recommendations: Because PaDEP cannot set a required minimum distribution system disinfectant residual goal and must set a standard, a standard set at 0.1 mg/L is practical, achievable, and provides less known risks for unknown benefits compared to the proposed required distribution system disinfectant residual of 0.2 mg/L.

Philadelphia Water requests that PaDEP make better data-driven decisions, particularly through adopting a required minimum distribution system disinfectant residual standard of 0.1 mg/L.

Philadelphia Water also requests that PaDEP engage utilities throughout Pennsylvania to participate in studies to gather state-wide date to better determine relationships between distribution system disinfectant residual and health effects. In doing so, Pennsylvania will emerge as a national leader in data collection and enhance efforts in making data-driven, sound science decisions.

Issue #10: PaDEP's proposed Disinfection Requirement Rule amends to clarify requirements for Tier 1 Public Notice for Minimum Entry Point Disinfectant Residuals and Treatment Technique Requirements for pathogenic bacteria, viruses and protozoan cysts.

Philadelphia Water's Response: Philadelphia Water requests that PaDEP refine the proposed language in the preamble and Annex A to more effectively clarify requirements for Tier 1 Public Notice for Minimum Entry Point Disinfectant Residuals and Treatment Technique Requirements for pathogenic bacteria, viruses and protozoan cysts.

Explanation:
Within 46 Pa. B. 857, Summary of Regulatory Requirements, Section E, § 109.408(a)(6). Tier 1 public notice – categories, timing and delivery of notice, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 869:
"Section 109.408(a)(6) is proposed to be amended to clarify that Tier 1 public notice is required for a failure to meet log inactivation requirements for more than 4 hours or a failure to maintain minimum entry point disinfectant residuals for more than 4 hours when the log inactivation value was not calculated."

Within 46 Pa. B. 857, Subchapter B. MCLs, MRDLs, or Treatment Technique Requirements, § 109.202(c)(1)(ii)(B). Treatment Technique Requirements for pathogenic bacteria, viruses, and protozoan cysts pg. 874):
"(B) Provide a minimum residual disinfectant concentration of 0.20 mg/L at the entry point as demonstrated by measurements taken under § 109.301(1). Failure to maintain the minimum entry point disinfectant residual for more than 4 hours of operation is a treatment technique violation."

Within 46 Pa. B. 857, Subchapter D. Public Notification, § 109.408(a)(6)(iii). Tier 1 public notice – categories, timing and delivery of notice pg. 879:
"(6) Violation of a treatment technique requirement for pathogenic bacteria, viruses and protozoan cysts as defined in § 109.202(c), resulting from:

(ii) A failure to meet the minimum log inactivation for more than 4 hours.

(iii) A failure to maintain the minimum entry point disinfectant residual for more than 4 hours and a failure to calculate the log inactivation in accordance with § 109.301(1)(v) and (vi)."

As discussed at some of the TAC and stakeholder meetings, it is very possible for water systems to achieve extensive CT compliance (sometimes as high as 10 to 20 log *Giardia* CT within a water treatment plant) while simultaneously having low disinfectant residual at the entry point to the distribution system. A treatment technique violation occurs when the minimum entry point disinfectant level is not achieved for more than 4 hours and the water system did not meet the required CT inactivation requirements during that period of more than 4 hours.

The premise for this revision is to make sure that adequate disinfection has been achieved. Water entering the distribution system with a low chlorine residual for a short period of time does not constitute a public health or water quality concern. Water entering the distribution system that has not been

adequately disinfected according to treatment technique requirement for pathogenic bacteria, viruses, and protozoan cysts is the primary concern.

Conclusions and Recommendations: Philadelphia Water requests that PaDEP refine the language in the preamble (pg. 869) to:
Section 109.408(a)(6) is proposed to be amended to clarify that Tier I public notice is required for a failure to meet log inactivation requirements for more than 4 hours or a failure to maintain minimum entry point disinfectant residuals for more than 4 hours *when the log inactivation calculated during this greater than 4 hour period does not meet the log inactivation requirements.*

Philadelphia Water requests that PaDEP refine the language in Chapter 109's Annex A (pg. 874) to:

(B) Provide a minimum chlorine residual disinfectant concentration of 0.20 mg/l at the entry point as demonstrated by measurements taken under 109.301(1). *Failure to maintain minimum entry point disinfectant residual for more than 4 hours when the log inactivation calculated during this greater than 4 hour period does not meet the log inactivation requirements constitutes a treatment technique violation.*

Philadelphia Water requests that PaDEP refine the language in Chapter 109's Annex A (pg. 879):

(6) Violation of a treatment technique requirement for pathogenic bacteria, viruses, and protozoan cysts, the same comment from the previous two comments applies.

(iii) *Failure to maintain minimum entry point disinfectant residual for more than 4 hours when the log inactivation calculated during this greater than 4 hour period does not meet the log inactivation requirements constitutes a treatment technique violation.*

Issue #11: PaDEP's proposed Disinfection Requirement Rule requires new monitoring requirements to ensure compliance with existing treatment technique requirements.

Philadelphia Water's Response: Philadelphia Water requests that PaDEP refine the proposed language in Annex A to accurately reflect how water systems determine peak hourly flow to ensure compliance with treatment technique requirements.

Explanation:
Within 46 Pa. B. 857, Subchapter C. Monitoring Requirements, § 109.301(1)(i)(v) and (vi). General Monitoring Requirements, Performance Monitoring for Filtration and Disinfection pg. 875):
"(v) A public water supplier shall calculate the log inactivation of Giardia, using measurement methods established by the EPA, at least once per day ***during*** *peak hourly flow. The log inactivation for Giardia must also be calculated whenever the residual disinfectant concentration at the entry point falls below the minimum value specified in§ 109.202(c) (relating to State MCLs, MRDLs and treatment technique requirements) and continue to be calculated every 4 hours until the residual disinfectant concentration at the entry point is at or above the minimum value specified in § 109.202(c). Records of log inactivation calculations must be reported to the Department in accordance with § 109.701(a)(2).*

(vi) In addition to the requirements specified in subparagraph (v), a public water supplier that uses a disinfectant other than chlorine to achieve log inactivation shall calculate the log inactivation of viruses at least once per day ***during*** *peak hourly flow. The log inactivation for viruses must also be calculated whenever the residual disinfectant concentration at the entry point falls below the minimum value specified in § 109.202(c) and continue to be calculated every 4 hours until the residual disinfectant concentration at the entry point is at or above the minimum value specified in § 109.202(c). Records of log inactivation calculations must be reported to the Department in accordance with § 109.701(a)."*

Philadelphia Water would like to see the language changed in (v) and (vi) to substitute the word ***using*** for the word ***"during"***. *The phrases would then read;* "...at least once per day ***using*** peak hourly flow."

The peak hourly flow at Philadelphia Water facilities is not known until the end of the day. The word "during" implies that an operator knows when the peak hourly flow will occur. Flow can change due to demands in the system caused by hot weather, customer time of day demand, off peak pumping operations, water main breaks, or system shifts caused by planned maintenance. The peak hourly flow must be determined at the end of the day and then used to calculate the peak hourly flow CTs to be recorded for submission to PaDEP.

We agree that the requirement for daily *Giardia* and virus CT calculation at a water treatment plant is necessary for operators understand and document the actual level of disinfection treatment. If flow changes dramatically or if the disinfectant chemical dosing is disrupted, CTs should be recalculated to insure compliance. However the impact of this requirement on small system operators will likely be significant. To accurately calculate daily peak flow CT, water quality parameters (pH, water temperature and the disinfectant residuals) must be measured at the time of the peak daily flow. For many small systems this may require costly investments in on-line analyzers and data collectors to capture the water quality data coincident with plant peak hourly flow.

Conclusions and Recommendations: Philadelphia Water requests that PADEP refine the language in Chapter 109's Annex A (pg. 875) to:

"(v) A public water supplier shall calculate the log inactivation of Giardia, using measurement methods established by the EPA, at least once per day *using* peak hourly flow. The log inactivation for Giardia must also be calculated whenever the residual disinfectant concentration at the entry point falls below the minimum value specified in§ 109.202(c) (relating to State MCLs, MRDLs and treatment technique requirements) and continue to be calculated every 4 hours until the residual disinfectant concentration at the entry point is at or above the minimum value specified in § 109.202(c). Records of log inactivation calculations must be reported to the Department in accordance with § 109.701(a)(2).

(vi) In addition to the requirements specified in subparagraph (v), a public water supplier that uses a disinfectant other than chlorine to achieve log inactivation shall calculate the log inactivation of viruses at least once per day *using* peak hourly flow. The log inactivation for viruses must also be calculated whenever the residual disinfectant concentration at the entry point falls below the minimum value specified in § 109.202(c) and continue to be calculated every 4 hours until the residual disinfectant concentration at the entry point is at or above the minimum value specified in § 109.202(c). Records of log inactivation calculations must be reported to the Department in accordance with § 109.701(a)."

Issue #12: PaDEP is removing the provision that allows water systems to utilize heterotrophic plate count (HPC) bacteriological analysis to achieve the required minimum distribution system disinfectant residual.

Philadelphia Water's Response: HPC determination for compliance is in the federal regulation. Removing it from the proposed Disinfection Requirements Rule is not only inconsistent with the federal rule, but removes a useful water quality parameter for determining bacteriological activity within the distribution system.

Explanation:
Within 46 Pa. B. 857, Background and Purpose Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 866:
"The TAC also recommended (by a vote of 12 to 0 with 1 abstention) that the Board retain the requirement for Heterotrophic Plate Count (HPC) monitoring. It was recommended that HPC should be kept as another tool to demonstrate compliance with the distribution system disinfectant residual requirements. No supporting studies or reports were provided to support that an HPC < 500 provides an equivalent level of public health protection when compared to a disinfectant residual of 0.2 mg/L. The Board requests comments including references to studies, reports or data that provide supporting evidence that an HPC < 500 provides an equivalent level of public health protection when compared to a disinfectant residual of 0.2 mg/L."

Within 46 Pa. B. 857, Summary of Regulatory Requirements Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pgs. 869, 870:
"Section 109.701(a)(2)(iv) is proposed to be deleted because the requirement to collect HPC measurements is proposed to be deleted from § 109.710(b). This provision is no longer necessary due to the changes to residual disinfectant requirements specified in § 109.710."

Within 46 Pa. B. 857, Chapter 109 Annex A, Subchapter G. System Management Responsibilities, §109.701(a)(2)(iv). Reporting and Recordkeeping, Monthly Reporting Requirements for Performance Monitoring pg. 880:
To be deleted under proposed rule:
"(iv) The test results of heterotrophic plate count measurements taken under in § 109.710(b) (relating to disinfectant residual in the distribution system) shall include the date, time and value of each sample."

Within 46 Pa. B. 857, Chapter 109 Annex A, Subchapter G. System Management Responsibilities, § 109.710(a)(b)(2). Disinfectant Residual in the Distribution System Section pg. 881:
To be deleted under proposed rule:
"(2) Sampling point with nondetectable disinfectant residuals which have heterotrophic plate count (HPC) measurements of less than 500/ml are deemed to be in compliance with paragraph (1)."

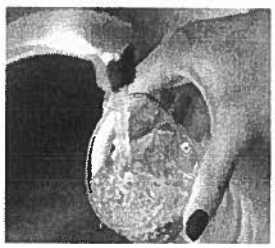
Philadelphia Water will never approve a new water main for public service unless it has achieved satisfactory water quality and bacteriological testing; this includes, but is not limited to, testing the level of disinfectant, the presence or absence of coliform bacteria and the level of HPC. The water tested should be similar to water within the distribution system that is tested daily. When

coliforms are present, new mains must be re-chlorinated and re-sampled. When HPC is present or elevated, remedial action is always required. The remedial action may include flushing or re-chlorination of the new main or a combination of both actions before the new water main can be re-sampled and thus approved for public service.

When reviewing new water main data from January 1, 2012, through March 31, 2016, in which disinfectant residual was at or below 0.2 mg/L and coliform bacteria were present, HPC was always elevated. And in most total coliform positive new water main samples with disinfectant residual at or below 0.2 mg/L, HPCs almost always exceeded 500 counts. Therefore, contamination was most likely a result of unsanitary practices, thus showing there is a correlation between contamination and HPC level.

Because there is no active contamination or intrusion source during day to day operations within the distribution system, Philadelphia Water does not experience high levels of HPC with low disinfectant residual values. Therefore, regulatory distribution samples yielding low disinfectant residual levels and low HPC helps ensure efficacy of drinking water treatment processes and monitoring for undesirable changes in bacterial water quality during storage and distribution when compared to a disinfectant residual of 0.2 mg/L or lower without the HPC measurement.

Additionally, in § 109.1003(a)(1)(xiv), PaDEP is still allowing bottled, bulk, and retail water systems the provision to allow HPC less than 500 instead of a disinfectant residual to be in compliance and meet the minimum distribution system disinfection residual requirements.

Under the proposed rulemaking, this water system ***would not achieve compliance.***	*Under the proposed rulemaking, this water system* ***would achieve compliance.***
Drinking Water Testing Results (collected from a PWS tap): Cl_2 = 0.1 mg/L HPC = 50 CFU/mL 	**Bottled Water Testing Results:** Cl_2 = 0 mg/L HPC = 50 CFU/mL 

Considering the above figure, water systems are confused in regards to how drinking water with low disinfectant residual and low HPC is less safe for consumption compared to bottled water with no disinfectant residual and similar or even higher levels of HPC present.

<u>Conclusions and Recommendations</u>: Loss of disinfectant residual and elevated levels of HPC would indicate potential intrusion or biological regrowth. Loss of disinfectant residual and low levels of HPC would indicate the potential for conditions to develop that would promote biological regrowth. In either case, ongoing monitoring of both parameters should continue until either the disinfectant residual is restored or HPC becomes elevated. If a water system elects not to do HPC analysis, then it cannot offset a low disinfectant residual result.

Philadelphia Water requests that PaDEP allow water systems to continue utilizing HPC to achieve compliance for those instances when the measured disinfectant residual does not meet the required minimum distribution system disinfectant residual. HPC analysis, in lieu of a detectable residual, yielding results < 500 counts/mL are in compliance with the disinfection requirements under the federal rule. The current proposal removes this provision and is therefore inconsistent with the federal rule.

HPC analysis, for Philadelphia Water, has proven to be an effective parameter in demonstrating the control of bacteriological activity within water. HPC has also proven to be a conservative parameter in estimating water quality. Water testing results with low disinfectant residual and low bacteriological activity are not unsafe for consumption. Removing this provision will weaken public health protection by discouraging the use of HPC as a water quality parameter.

Issue #13: PaDEP is requiring water systems that chloraminate to develop a Nitrification Control Plan.

Philadelphia Water's Response: PaDEP must not dictate a regulation through guidance, specifically in regards to a Nitrification Control Plan.

Explanation:
Within 46 Pa. B. 857, Summary of Regulatory Requirements Section, Proposed Rulemaking Disinfection Requirements Rule Preamble, pg. 870:
"§ 109.715. Nitrification control plan
Proposed § 109.715 (relating to nitrification control plan) requires a water system that uses chloramines as a disinfection process to develop and implement a nitrification control plan. This plan is instead of requiring a higher residual for systems that chloraminate to provide simultaneous control of microbes and nitrification. The TAC recommended (by a vote of eight to five) that nitrification control plans should be system-specific. This recommendation was incorporated into this proposed rulemaking."

Within 46 Pa. B. 857, Chapter 109 Annex A, Subchapter G. System Management Responsibilities, § 109.715, Nitrification Control Plan, pg. 880:
"§ 109.715. Nitrification control plan.
(a) A public water system that uses chloramines or purchases water that contains chloramines shall develop a nitrification control plan. The plan must conform to the guidelines in industry standards such as the American Water Works Association's M56 Manual on Nitrification and contain at least the following information:
(1) A system-specific monitoring plan that includes, at a minimum:

(i) The list of parameters that will be monitored such as pH, free ammonia, total chlorine, monochloramine, HPC, nitrite and nitrate.

(ii) The monitoring locations.

(iii) The monitoring schedule.

(2) A response plan with expected water quality ranges and action levels.

(b) The public water system shall implement the nitrification control plan in accordance with accepted practices of the water supply industry.

(c) The public water system shall review and update the plan as necessary.

(d) The plan shall be retained onsite and shall be made available to the Department upon request."

Nitrification is not an immediate public health issue. Rather, according to the American Water Works Association (AWWA) (Opflow Article titled *Preventing the Perfect Storm – Public Health Relies on Risk Management*), the top four concerns for distribution systems, as indicated by actual records of contamination and waterborne disease outbreaks, are as follows:

1. Cross-connection and backflow of contaminated water
2. Contamination resulting from storage facility design, operation, or maintenance

3. Contamination caused by main installation, repair, or rehabilitation practices
4. Contaminant intrusion caused by pressure conditions and physical gaps in distribution system infrastructure.

The health concerns with nitrification have come from water systems the feed free chlorine to ammonia-contaminated water, unaware they are forming chloramine and putting ammonia into their distribution system.

Nitrification can be one reason for a chloramine demand. It may not be the controlling reason.

The Nitrification Control Plan should not be based on PaDEP telling water systems how to meet a standard and listing minimum requirements, but by telling systems what the standard is and allowing systems to figure out the best means to meet the standard.

The inability to maintain required distribution system disinfectant residual can be met by operational practices other than nitrification control, like water turnover, valve operations, and adapting pressure zone boundaries.

Conclusions and Recommendations: Nitrification is not an immediate public health issue. Nitrification can be one reason for a chloramine demand, but may not be the controlling reason. Therefore, Philadelphia Water requests that PaDEP allow water systems to determine the best means to maintain the required minimum distribution system disinfectant residual rather than requiring a Nitrification Control Plan for systems that chloraminate.

END OF COMMENTS

ATTACHMENTS

Disinfection Requirements Rule Stakeholder Workgroup Final Comment Letter (DRRSW) **(April 2016)**

Preventing the Perfect Storm – Public Health Relies on Risk Management, **American Water Works Association (AWWA) Opflow (April 2011)**

April 19, 2016

Environmental Quality Board
P. O. Box 8477
Harrisburg, PA 17105-8477

Re: Comments on the proposed Disinfection Requirements Rule updates to Chapter 109

The Disinfection Requirements Rule Stakeholder Workgroup (DRRSW) met on March 9, 2016, March 30, 2016 and April 15, 2016 to review and discuss the Department's proposed changes to the safe drinking water regulations, specific to the Disinfection Requirements Rule. The following comments were approved by this workgroup:

1. There is no direct public health issue being addressed by the proposed rule. References are noted below.
   - *Comments on Legionella & Legionnaires Disease* and Microbiological Water Quality in the Distribution System and Premise Plumbing: Legionnaires' Disease – Dr. Jennifer Clancy, Corona Environmental Consulting
   - *Estimated Costs of Compliance with the Proposed Disinfection Requirements Rule* - Jeff Hines, The York Water Co.
2. Although the DRRSW agrees with the stated goal of the Department to address the minimum detectable residual and low chlorine distribution disinfectant residuals, the group does not agree that the minimum residual should be set at 0.2 mg/L.
3. The DRRSW agrees that the current minimum distribution system detectable residual of 0.02 mg/L is not valid. The DRRSW believes the minimum residual should be set at 0.1 mg/L. The current regulatory language should only change the 0.02 mg/L to 0.1 mg/L Aand keep all other existing language. References are noted below.
   - *Draft—Minimum Distribution System Disinfectant Residuals: Chlorine Residual Values Reported from Co Drinking Water Distribution Systems* – Colorado Dept. Public Health & the Environment
   - *Aqua PA Disinfection Residual Measurements Presentation* - Dr. Charles Hertz, Aqua PA;
   - *The Meaning and Quantification of a Detectable Residual* - Tim Bartrand, Corona Environmental Consulting
   - *An Alternative Approach for Setting an Interim Chlorine Residual Requirement* - Jeff Rosen, Corona Environmental Consulting
4. Increasing the minimum disinfectant level in the distribution system from the existing 0.02 mg/L to 0.1 mg/L (for both free & total chlorine) is a 5-fold increase from the current level. A minimum value of 0.1 mg/L is a responsible level given the Department of Environmental Protection's concerns. The 0.2 mg/L does not provide any additional health benefits to our customers, but it does require additional capital improvements & operating costs.

5. The DRRSW agrees with the proposed rule that the compliance calculation for systems serving greater than 33,000 people is 95% in 2 consecutive months and the compliance calculation for systems serving 33,000 or fewer people is 75% in 2 consecutive months. However, the DRRSW is concerned that the increased residual monitoring (from once/ month to once/week) will increase small system operating costs.

6. The stated compliance benefits in the proposed rule are unfounded and the associated compliance costs are dramatically underestimated. References are noted below.
   - *Costs & Benefits for the Disinfection Requirements Rule* - Philadelphia Water Dept;
   - Cost *Analysis of Increased Disinfection Residual* – The York Water Co
   - *The RTCR and Chlorine Residual Standard and Its Operational Impacts on Lehigh County Authority Water Systems* - Aurel Arndt, Lehigh County Authority
   - *Impact of the Proposed Chapter 109 Update to Disinfectant Residual Requirements* – Mary Neutz, Suez (United) Water
   - *The RTCR and Chlorine Residual Standard and its Operational Impacts on the Utility* - Gary Burlingame, Philadelphia Water Department
   - *Impact of Pre-Draft Chapter 109 Revisions: The Impacts are Complex and Require Proper Vetting* - David Lewis, Columbia Water Company
   - *Chlorine Residual and Compliance Samples in Distribution Systems* – Charles Hertz, Aqua PA
   - *Western Berks Water Authority Presentation* - Matthew Walborn, Western Berks Water Authority
   - *Pre-Draft Chapter 109 Revisions: One Water Utility's Perspective* – Dan Preston/Heidi Palmer, North Penn Water Authority
   - *Chapter 109 Update, Water Supplier Challenges and Unintended Consequences* – Jeff Hines, The York Water Company
   - *RTCR and Chlorine Residuals – Overall Look From A Utility Perspective* – Sharon Fillmann, Chester Water Authority

7. Disinfection byproducts (DBPs) are likely to increase at some utilities as a result of increasing the distribution disinfection residual to 0.2 mg/L. Setting the minimum residual at 0.1 mg/L will allow time for utilities to assess impacts to DBPs.
   - Reference: *DBPs, HPCs and a shared goal of Optimized Distribution Systems* - Tim Bartrand/Jeff Rosen, Corona Environmental Consulting

8. Taste & odor complaints will likely increase if the minimum distribution disinfection residual is set at 0.2 mg/L.

9. The option for Heterotrophic Plate Count (HPC) should be retained as an alternative compliance criteria for surface water systems when the distribution disinfectant residual is below the minimum required level. This is still allowed under the federal regulation and will reduce the number of instances where Public Notice (PN) is required.

- Reference: *DBPs, HPCs and a shared goal of Optimized Distribution Systems* - Tim Bartrand/Jeff Rosen, Corona Environmental Consulting

10. Because no known health risks have been identified in this proposed rulemaking, requiring water utilities to issue Tier 2 PN for failing to meet 0.2 mg/L will unnecessarily erode public confidence in water quality. This is another justification for setting the minimum distribution disinfection residual at 0.1 mg/L and continuing to allow HPC as an alternative compliance method.

11. The DRRSW requests that these comments be shared with the Small Water Systems Technical Assistance Center Advisory (TAC) board at their next meeting.

12. The DRRSW requests that the Comment and Response document be provided to the advisory committees when a draft-final regulation is presented for their input.

Thank you for the opportunity to comment.

Respectfully,

The members of the Disinfection Requirements Rule Stakeholder Workgroup:

Steve Tagert, Dr. Charles Hertz, Frank Medora - Aqua Pennsylvania
Dave Runkle - Carlisle Municipal Water Authority
Sharon Fillmann - Chester Water Authority
Tony Bellitto - North Penn Water Authority/PA Municipal Authorities Association
Chris Abruzzo – PA American Water Co.
John Muldowney – Philadelphia Water Department/PA Section, American Water Works Association
David Katz, Rita Kopansky, Dennis O'Connor - Philadelphia Water Department
Penny McCoy, Erik Ross – PA Rural Water Association
Mary Neutz, Christine Swailes – Suez Water
Serena DiMagno – Water Works Operators Association of Pennsylvania
Jeff Hines – The York Water Co./National Association of Water Companies, PA Chapter

Gary A. Burlingame is an administrative scientist with the Philadelphia Water Department (www.phila.gov), Philadelphia. Chris Rayburn, director of subscriber and research services, and Frank J. Blaha, senior research manager, are with the Water Research Foundation (www.waterrf.org), Denver.

The simultaneous occurrence of certain events in your distribution system can spell disaster. A thorough understanding of those events is necessary to plan for the worst and more fully evaluate the public health risks associated with water quality degradation in the distribution system.

BY GARY A. BURLINGAME, CHRIS RAYBURN, AND FRANK J. BLAHA

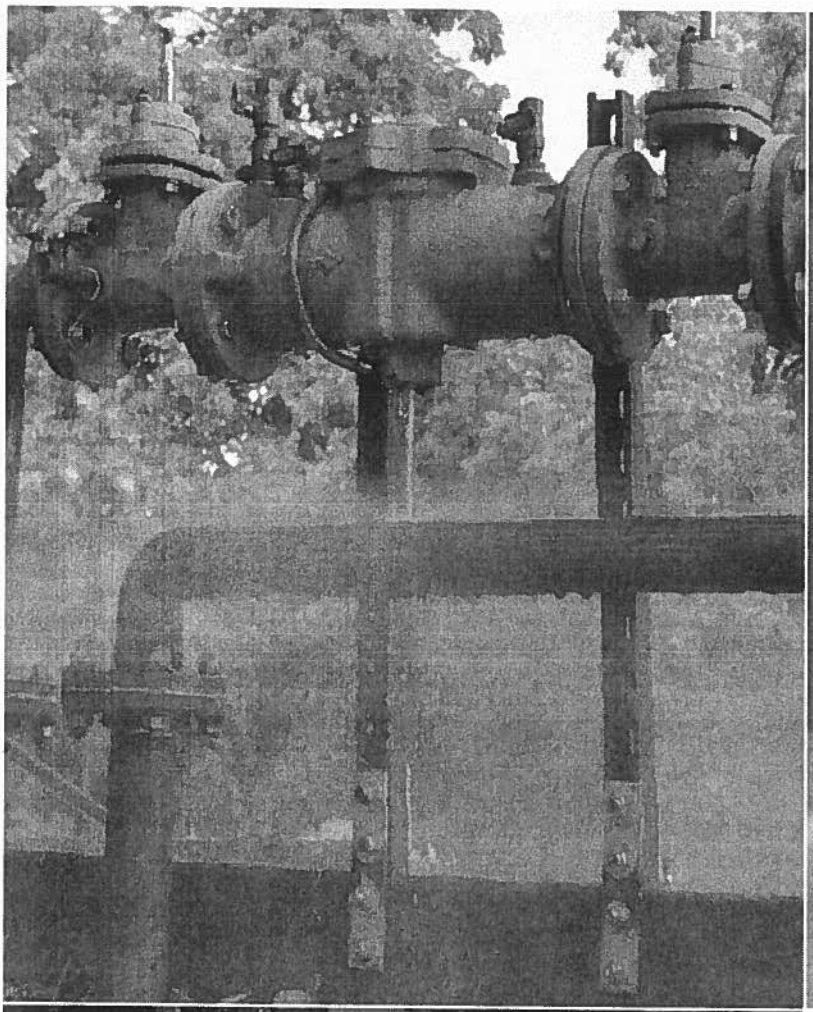
PREVENTING THE PERFECT STORM
PUBLIC HEALTH RELIES ON RISK MANAGEMENT

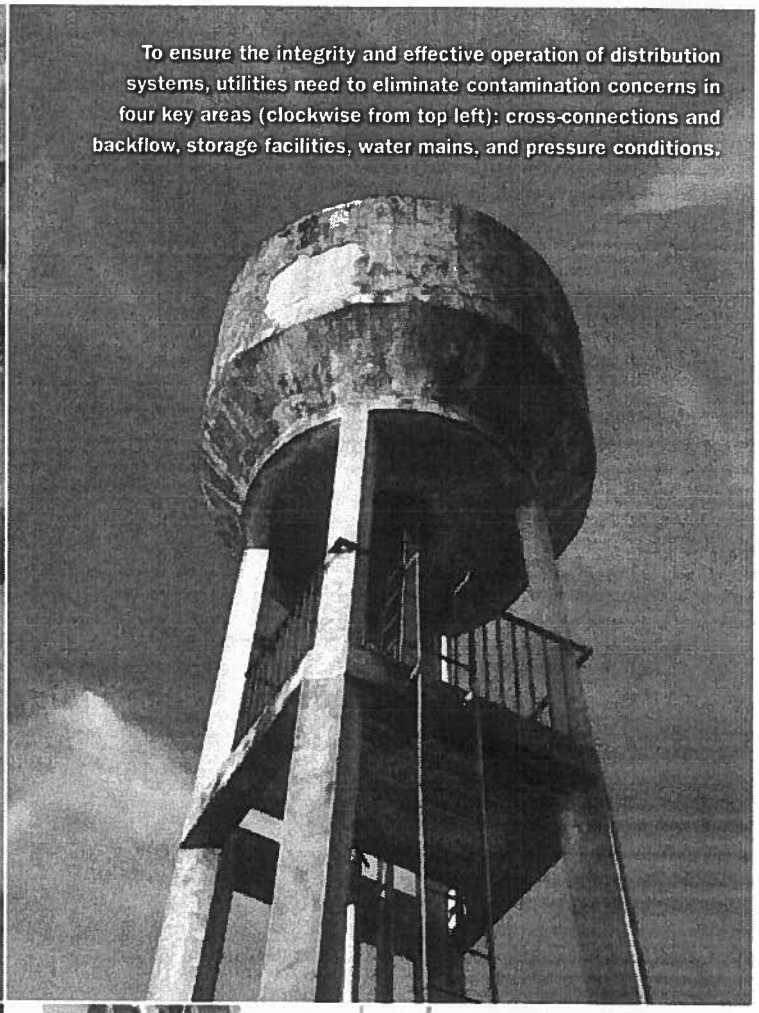
SPANNING ALMOST 1 MILLION miles, US drinking water distribution systems represent most of the physical infrastructure for the country's drinking water supplies. Ensuring the integrity and effective operation of distribution systems is critical for protecting public health. Therefore, a good understanding of the factors that can converge to threaten public health is essential. Such understanding will help us better train and educate, design and construct, treat and operate, and regulate to prevent and mitigate public health risks.

In 2006, the National Academies Press released a National Research Council report, *Drinking Water Distribution Systems: Assessing and Reducing Risks*, which cites three integrity factors involved in failures and public health risk—hydraulic (loss of pressure), physical (water main blowout), and water quality (loss of chlorine residual). Understanding these failures provides a way to predict, diagnose, and prevent or manage potential risks.

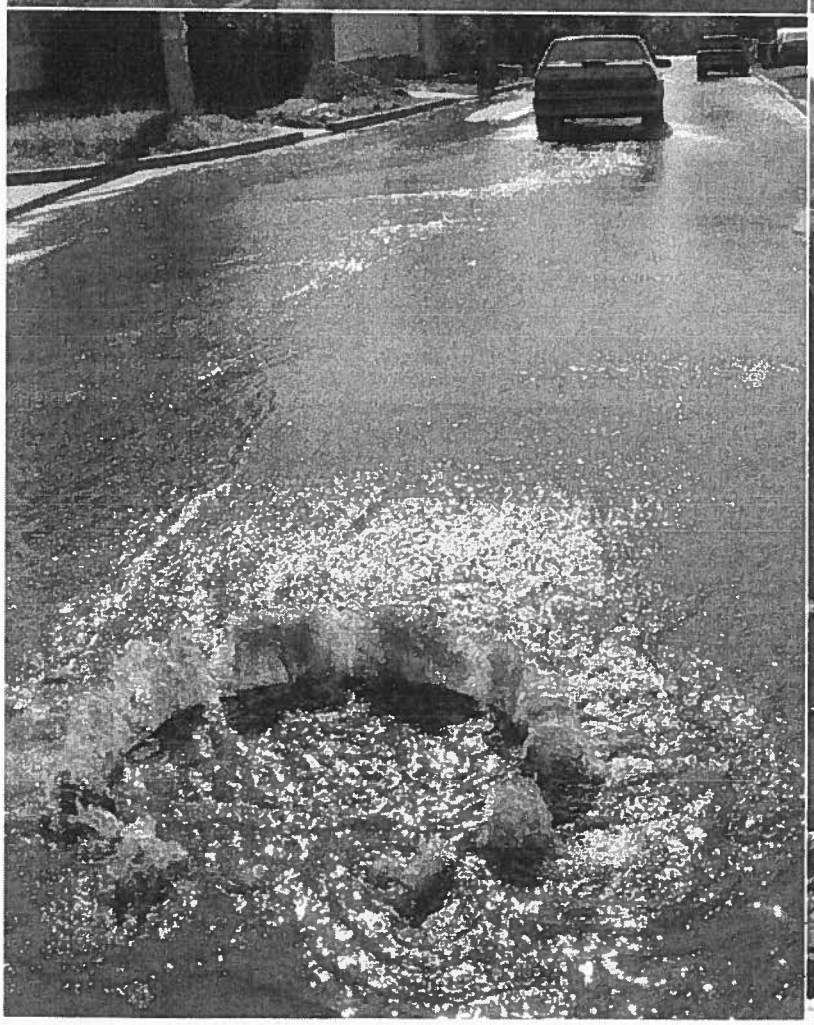
In general, three failures must converge to create a perfect storm of drinking water contamination that can lead to public health risks. First, a pathway must convey one or more contaminants (contaminated water) to customers. Next, the contaminant, whether microbiological or chemical, must be present and travel the pathway to customers. Last, a failure to detect and quickly mitigate the contamination must occur. In other words, customers aren't warned, and the water isn't flushed or disinfected to eliminate the contamination and health risk.

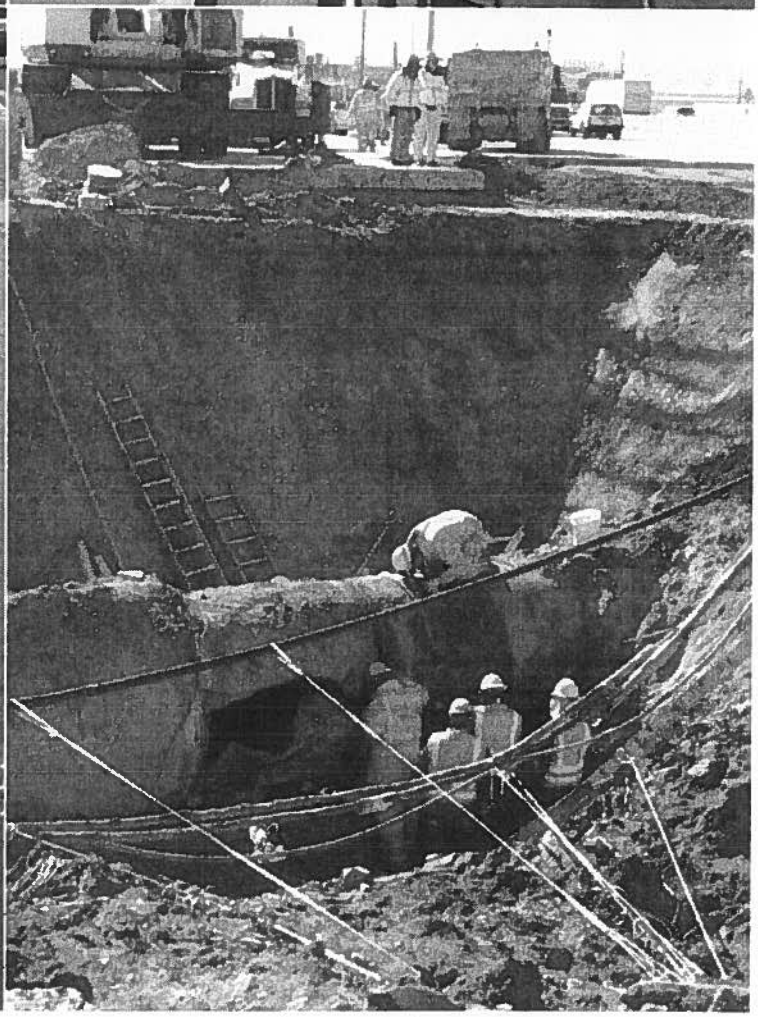
PHOTOGRAPH (BOTTOM RIGHT): DENNIS SCHROEDER, *ROCKY MOUNTAIN NEWS*





To ensure the integrity and effective operation of distribution systems, utilities need to eliminate contamination concerns in four key areas (clockwise from top left): cross-connections and backflow, storage facilities, water mains, and pressure conditions.





Distribution

The top four concerns for distribution systems, as indicated by actual records of contamination and waterborne disease outbreaks, are

- Cross-connections and backflow of contaminated water
- Contamination resulting from storage facility design, operation, or maintenance
- Contamination caused by main installation, repair, or rehabilitation practices
- Contaminant intrusion caused by pressure conditions and physical gaps in distribution system infrastructure

CROSS-CONNECTIONS AND BACKFLOW

Exposure Pathway. Cross-connection occurs when there's an interconnection between a potable water supply and a nonpotable source where it's possible for a contaminant to enter the drinking water supply. The presence of an unprotected cross-connection represents a loss of physical integrity in a distribution system through which backflow of contaminants can occur. Backflow can result from backsiphonage or backpressure. Backsiphonage occurs when contaminants from the nonpotable source enter the drinking water supply because of low or negative distribution system pressure. Backpressure occurs when the nonpotable source of a contaminant exceeds the positive pressure in the potable water distribution system.

Contaminants in a Pathway. A physical connection or cross-connection can exist with hot water systems, heating/ventilation/air conditioning systems, industrial processes, swimming pools, and irrigation systems. Contaminants can be microbial (e.g., *Giardia* or *E. coli*), chemical (e.g., copper or ethylene glycol), or a combination of the two.

Failure to Detect and Mitigate. Approved protection devices should be in place to prevent backflow, but not all communities require them or have the ability to enforce requirements. A change in pressure or loss of pressure for even a minute is enough to allow contamination to occur. The ability to detect backflow or backpressure is limited. The ability to detect the presence of contaminants exists, but sampling must occur at the exact time of the transient event, which is highly unlikely.

STORAGE FACILITIES

Exposure Pathway. Finished water storage facilities play a vital role in providing safe, adequate, and reliable water supplies. Such facilities vary in design and operation and include belowground storage, covered reservoirs, tanks, and standpipes. Contaminants can be introduced into storage facilities through openings (hatches, vents, and holes) and by inadequate inactivation of pathogens, disinfectant residual loss, and microbial and chemical reactions that affect water quality.

Contaminants in a Pathway. Contaminants that enter storage facilities are usually microbial, such as those carried by birds and animals. Chemical spills may also enter a storage facility.

Failure to Detect and Mitigate. Failure to maintain a storage facility's structural and sanitary integrity can allow contaminants to enter. Storage facility inspection programs vary widely. Although online water quality monitoring capabilities exist, they won't detect actual microbiological contaminants. Sampling must occur such that water flowing out, as well as stagnant water, is checked. Storage facilities that are taken out of service must be inspected, cleaned, and disinfected before they're returned to use.

WATER MAINS

Exposure Pathway. Construction, rehabilitation, and repair of water mains and service lines commonly occur in all water systems. When the interior of a water main is exposed to the environment,

DISTRIBUTION SYSTEM WATER QUALITY

FILLING THE INFORMATION GAPS

During 2007 and 2008, the US Environmental Protection Agency (USEPA) convened its Total Coliform Rule (TCR) Distribution System Advisory Committee to recommend TCR revisions. The committee was tasked with determining what distribution system information is needed to understand the effects of degraded drinking water quality in distribution systems. In September 2008, the committee developed the Total Coliform Rule/Distribution Federal Advisory Committee Agreement in Principle (www.epa.gov/safewater/disinfection/tcr/pdfs/tcrdsac/agreementinprinciple_tcrdsac_2008-09-18.pdf). Although most of the language in the agreement focuses on recommendations for TCR changes, the document also makes recommendations about distribution system water quality. Collaboration between the Water Research Foundation and USEPA, known as the Research and Information Collection Partnership (RICP), began in January 2009.

On May 13, 2010, the Water Research Foundation and USEPA released the results of a year-long collaboration to identify high-priority drinking water distribution system research and information collection topics. RICP activities were overseen and approved by a volunteer steering committee of water community experts. In addition, since 2007, the Water Research Foundation has been funding separate research on distribution system water quality.

The RICP released a road map for filling information gaps; an RICP fact sheet is available at www.epa.gov/safewater/disinfection/tcr/pdfs/tcrdsac/fsdsricp510.pdf. Research and data collection are needed to better understand the pathways, contaminants, early detection, and mitigation aspects of drinking water distribution systems. Such information will aid development of education and training, best practices and standards, and regulations.

We may find that we need enhanced regulations, better training, new standards, and broader education.

there's an opportunity for contamination. Also, depressurization during a water main break can trigger backflow or backsiphonage through cross-connections.

Contaminants in a Pathway. During main repair and installation, distribution systems may be vulnerable to microbial or chemical contaminant entry from the surrounding environment. Microbial pathogens include bacteria, protozoa, and viruses. Chemicals include hydrocarbons, gasoline compounds, and herbicides and pesticides from runoff.

Failure to Detect and Mitigate. Sanitary construction practices must be followed during repair and installation of mains and other infrastructure activities to prevent the introduction of contaminants. Putting a new or repaired main into service requires inspection. For example, AWWA Standard C651-05, Disinfecting Water Mains, specifies procedures for protecting pipe, testing water before it's released, and disinfection and flushing procedures. Main breaks are difficult, perhaps impossible, to sample to determine if contamination has occurred.

PRESSURE CONDITIONS

Exposure Pathway. Intrusion is defined as the flow of nonpotable water into drinking water through leaks, cracks, submerged air valves, faulty seals, and other openings during low or negative pressures. Transient pressure regimes are inevitable. All systems will, at some time, be started, switched off, or undergo rapid flow changes, and they'll likely experience the effects of human errors, equipment breakdowns, and disturbances of high risk, such as earthquakes. Buried infrastructure or infrastructure in underground pits usually has some degree of cracks or holes through which an exchange of water with the external environment can occur under the right conditions.

Contaminants in a Pathway. Microbiological contaminants, such as bacteria and viruses, can enter a distribution system from the external environment through intrusion. It's also possible for soil contaminants, such as hydrocarbons and gasoline, to enter through cracks, holes, and seals.

Failure to Detect and Mitigate. Positive pressure in water distribution systems mitigates infiltration of external contaminants that might be present in soil or water surrounding buried pipes. Maintaining pressure is usually accomplished through a combination of pumping and elevated storage tanks. Sudden changes in water use, main breaks, valves opening and closing, and other service changes can cause pressure changes. Low or negative pressure can occur during events such as main breaks, major fires, and power outages. Detecting contaminants by using water quality sampling is difficult because intrusion could involve minute volumes and could be transient in nature.

IT ALL COMES DOWN TO COMMITMENT

The US Environmental Protection Agency and Water Research Foundation have agreed that critical information gaps exist and that filling these gaps will help water utilities better protect public health by improving the operation and maintenance of water distribution systems (see "Filling the Information Gaps," page 14). Some of the needed information will be obtained by collecting data on the existing conditions of the nation's systems (see "Is Your System Doing Its Best to Deliver Safe Water" at right). Other information requires the funding of strategic research. Once this information is collected and compiled, we may find that we need enhanced regulations, better training, new standards, and broader education. However, when all is said and done, the protection of public health will always rely on the nation's distribution system samplers, inspectors, designers, managers, and operators to provide a safe and reliable drinking water supply. It's their commitment and dedication to the drinking water community that ensures public health protection 24/7.

PARTNERSHIP FOR SAFE WATER

IS YOUR SYSTEM DOING ITS BEST TO DELIVER SAFE WATER?

Optimizing distribution system performance ensures the reliable delivery of high-quality water. But how do you convince customers, regulators, owners, and managers you're doing the right things?

The Partnership for Safe Water (PSW) is an independent, voluntary, continuous improvement program that provides objective, credible distribution system evaluation. The fundamental approach is to improve performance through optimizing system operations rather than significant capital improvements. PSW recognition provides powerful evidence your system does its best to manage health risks.

A new PSW Distribution System Optimization program is the result of more than 10 years of discussions, planning, and research. Based on the Water Research Foundation report *Criteria for Optimized Distribution Systems*, the program consists of four phases: commitment, baseline and annual data collection, self-assessment, and optimized performance (optional).

Many factors can affect water quality and system reliability. However, there is a *primary* performance indicator for each major system integrity component. The primary indicators used in the self-assessment include disinfectant residual for water quality, pressure for hydraulic performance, and main break frequency for physical performance.

PSW's program payoffs include

- Water quality improvements
- Enhanced system reliability
- Ensured compliance with future regulations
- A utility culture of excellence
- Demonstrated superior performance to stakeholders

Additional information can be found at www.partnershipforsafewater.org.