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Costs and Benefits of Implementing the Disinfection Requirements Rule for Philadelphia Water

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In the Pennsylvania Bulletin, Vol. 46, No. 8, from February 20, 2016, on pages 871 and 872, the PADEP presents the benefits of the proposed regulation as avoidance of the costs associated with public health risks and waterborne disease outbreaks. The two examples cited are the cryptosporidiosis outbreak in Milwaukee, Wisconsin in 1993 and the Salmonellosis outbreak in Alamosa, Colorado in 2008.

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 groundwater 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 1-1.5 ft 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. (references for this paragraph are included at the end of these comments)

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 detectable total chlorine residual in a distribution system, would have no impact on a cryptosporidium contamination event. There is absolutely no connection between the Milwaukee event and a total chlorine 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. 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.

Philadelphia Water supports the PADEP in evaluating and finding the suitable minimum detectable total chlorine residual for water utilities in Pennsylvania. The current standard of 0.02 mg/L is not measurable. However, the implication that the costs incurred in Milwaukee and Alamosa are relevant to the discussion for this proposed regulation is not appropriate. Raising the minimum detectable total chlorine residual in Pennsylvania could have some benefit to the citizens of Pennsylvania. But, that analysis is not presented in this regulation and Philadelphia Water does not believe the water treatment community has the knowledge to reasonably predict such a benefit.

Under the section on Compliance Costs on Page 872 of the Proposed Rule, monthly average distribution system total chlorine residuals 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 total chlorine residuals for compliance determinations. The regulation uses individual sample location total chlorine residuals, places each result in a monthly database, and chooses the 95th percentile for that month. PADEP's monthly average distribution system total chlorine residuals database could only be used to estimate the 50th percentile total chlorine residual for PA utilities.

By using the monthly average distribution system total chlorine 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 distribution total chlorine residual portion of this proposed regulation. Please keep in mind that the focal point of this analysis is to eliminate total chlorine 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 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 to reduce water age which is one factor that leads to reduction of total chlorine 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 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). O&M costs for the booster stations, including chemicals, is estimated at \$ 1,434,614.

The total estimated capital costs are \$ 25,017,182 and the total estimated 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. 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.

In summary, the benefits of the Disinfection Requirements Regulation are not established in the proposed regulation. Philadelphia Water will incur significant capital and operating costs to ensure compliance with this proposed regulation.

That is Philadelphia Water's testimony regarding the costs and benefits associated with the new disinfection requirements regulations proposed by PADEP. I would be happy to answer any questions.

References

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