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Bureau of Safe Drinking Water

Pre-Draft Proposed Rulemaking Revised Disinfectant Residual Requirements

TAC Board Meeting

May 18, 2015

History of Pre-Draft Rulemaking

- The disinfectant residual requirements were originally included in the Pre-Draft Proposed RTCR, which was presented to and discussed with the TAC Board on June 18 and September 23, 2014.
- On April 21, 2015, the EQB approved the proposed RTCR with modifications. The modifications included splitting out the "Non-RTCR" provisions for additional stakeholder input. The motion was made with the expectation that the "Non-RTCR" provisions will be revisited in short order.

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History of Pre-Draft Rulemaking

- On April 30, 2015, the TAC Board voted to recommend that the Department further split the "Non-RTCR" provisions to focus solely on the disinfectant residual requirements and the minor corrections needed to obtain primacy.
- Additional meetings were scheduled for May 18 (today) and May 26, 2015 to discuss the pre-draft rulemaking and obtain additional stakeholder input.
- Final comments will be solicited at the June 16, 2015 TAC meeting.

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Link to RTCR Rulemaking

How are disinfectant residual requirements linked to the RTCR?

- § 141.63(e) BAT (best technology, treatment techniques, or other means to achieve compliance) for RTCR includes "Maintenance of a disinfectant residual throughout the distribution system".
- § 142.16(q) includes special primacy requirements for states to define and provide examples of sanitary defects (e.g. lack of an adequate residual), and provide written guidance on the assessment and corrective action phase of the rule.

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Regulatory Schedule

Because disinfectant residuals are linked to the RTCR, the rule must be finalized in time to meet EPA deadlines for the RTCR:

- States with an approved extension must submit a Draft program revision package to EPA by August 2016.
- States with an approved extension must submit a Complete and Final program revision package to EPA by February 13, 2017.

Failure to meet the February 13, 2017 deadline may cause the EPA administrator to initiate proceedings to withdraw primacy approval.

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Existing Residual Requirements

§ 109.710. Disinfectant residual in the distribution system.

(a) A disinfectant residual acceptable to the Department shall be maintained throughout the distribution system of the CWS sufficient to assure compliance with the microbial MCLs and the TT requirements specified in § 109.202. The Department will determine the acceptable residual of the disinfectant considering factors such as type and form of disinfectant, temperature and pH of the water, and other characteristics of the water system.

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Existing Residual Requirements

§ 109.710. Disinfectant residual in the distribution system.

(b) A PWS that uses surface water or GUDI sources or obtains finished water from another permitted PWS using surface water or GUDI sources shall comply with the following requirements:

(1) As a minimum, a detectable residual disinfectant concentration of 0.02 mg/L measured as total chlorine, combined chlorine or chorine dioxide shall be maintained throughout the distribution system as demonstrated by monitoring conducted under § 109.301(1) and (2) or (8)(v).

(2) Sampling points with nondetectable disinfectant residuals which have HPC measurements < 500/mL are deemed to be in compliance with paragraph (1).

(3) When the requirements of paragraph (1) or (2) cannot be achieved, the supplier shall initiate an investigation under the Department's direction to determine the cause, potential health risks and appropriate remedial measures.

Existing Residual Requirements

§ 109.301. General monitoring requirements.

(1)(D) , (2)(E) & (8)(v) Shall measure and record the residual disinfectant concentration at representative points in the distribution system no less frequently than the frequency required for total coliform sampling for compliance with the MCL for microbiological contaminants.

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New Minimum Acceptable Residual

Why is DEP specifying a minimum acceptable residual?

- § 109.710(a) requires DEP to determine an acceptable disinfectant residual level.
- The PA SDWA and Chapter 109 regulations were intended to be protective of public health by ensuring continuous disinfection for all CWSs.
- The existing definition of a detectable residual (0.02 mg/L) does not represent a true detectable residual.
- A minimum acceptable residual is necessary to control microbial growth (biofilms) and down-stream amplification of pathogens such as *Legionella.*

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New Minimum Acceptable Residual

How did DEP determine the pre-draft proposed minimum residual of 0.30 mg/L (free) and 0.50 mg/L (total)?

- Based on scientific reports and studies
- Informed by other states' and industry standards
- Informed by comments from TAC
- Balances the need for simultaneous compliance with pathogen control and DBP formation
- Ensures an adequate residual for all customers "at the meter" to control amplification of pathogens such as *Legionella*

Scientific Reports and Studies

1. National Research Council (NRC). 2005. PWS Distribution Systems: Assessing and Reducing Risks, First Report. The National Academies Press.
2. NRC. 2006. Drinking Water Distribution Systems: Assessing and Reducing Risks. The National Academies Press.
3. EPA. 2002. Health Risks from Microbial Growth and Biofilms in Drinking Water Distribution Systems.
4. EPA. 2002. The Effectiveness of Disinfectant Residuals in the Distribution System.
5. VHA Directive 1061. August 2014.

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Scientific Reports and Studies

6. Kuchta, et al. 1983. Susceptibility of *Legionella pneumophila* to Chlorine in Tap Water. Applied and Environmental Microbiology, Vol. 46, No. 5.
7. Loret, et al. 2005. Comparison of Disinfectants for Biofilm, Protozoa and *Legionella* control. Journal of Water and Health, 03.4.
8. Water Research Foundation. 2010. Criteria for Optimized Distribution Systems.
9. Water Research Foundation. 2013. State of the Science and Research Needs for Opportunistic Pathogens in Premise Plumbing.

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Scientific Reports and Studies

10. Wang, et al. Effect of Disinfectant, Water Age, and Pipe Material on Occurrence and Persistence of *Legionella*, *mycobacteria*, *Pseudomonas aeruginosa* and Two Amoebas. Environ. Sci. Technol. 2012, 46, 11566-11574.
11. 2012 Edition of the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (Ten States Standards).
12. Craun, et al. Causes of Outbreaks Associated with Drinking Water in the US from 1971 to 2006, Clinical Microbiology Reviews, 23 (3), 507-528.

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Scientific Reports and Studies

13. CO Dept. of Public Health and Env. 2014. DRAFT-Minimum Distribution System Disinfectant Residuals: Chlorine Residuals Values Reported from Within Drinking Water Distribution Systems.
14. World Health Organization, *Legionella* and the Prevention of Legionellosis, 2007.
15. CDC. Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water-United States, 2009-2010. MMWR, Vol. 62, No. 35, 2013.
16. CDC. Legionellosis-United States, 2000-2009, MMWR, Vol. 60, No. 32, 2011.

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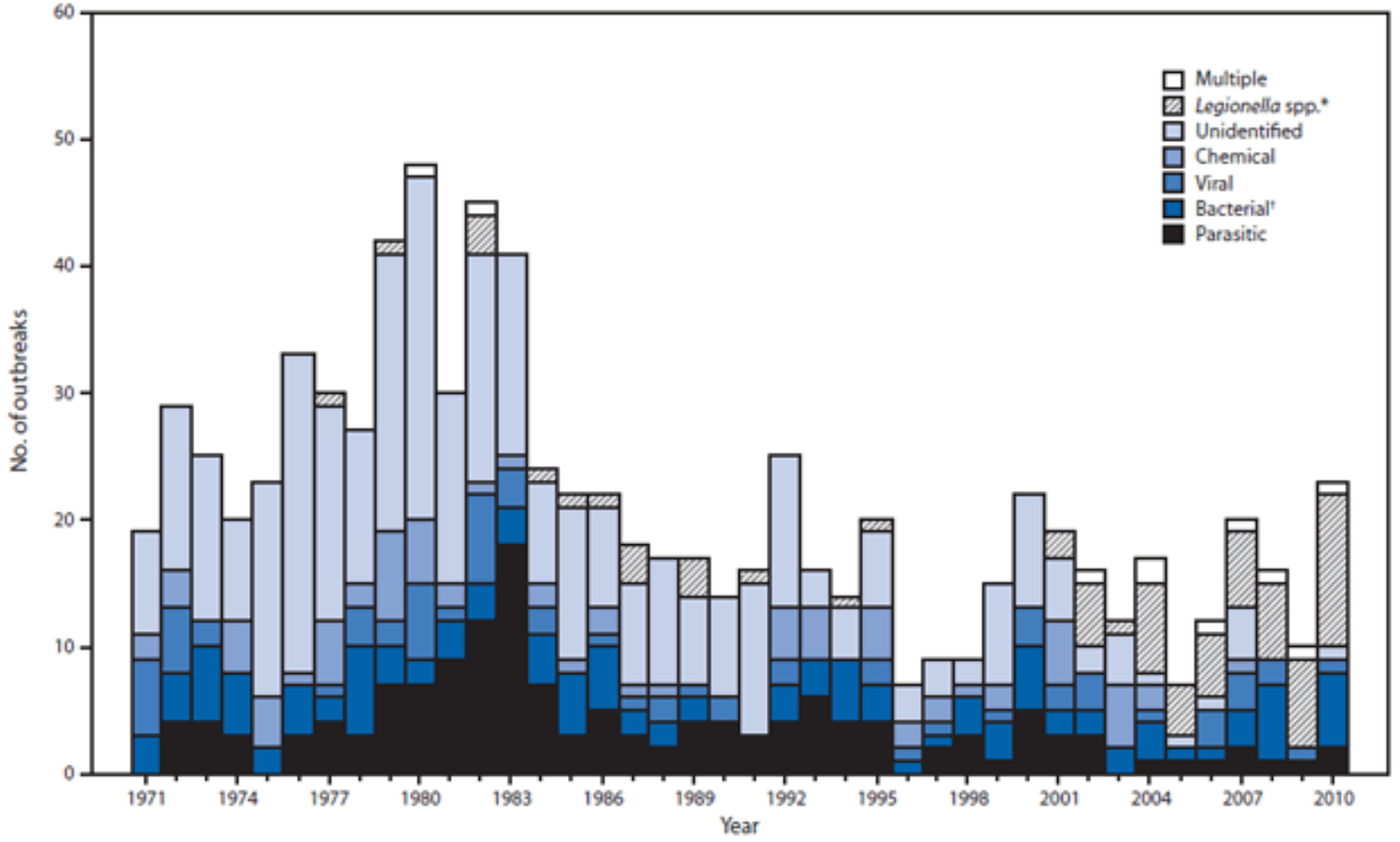
National Waterborne Disease Outbreaks



Source: CDC, MMWR, Vol. 62, No. 35, September 6, 2013

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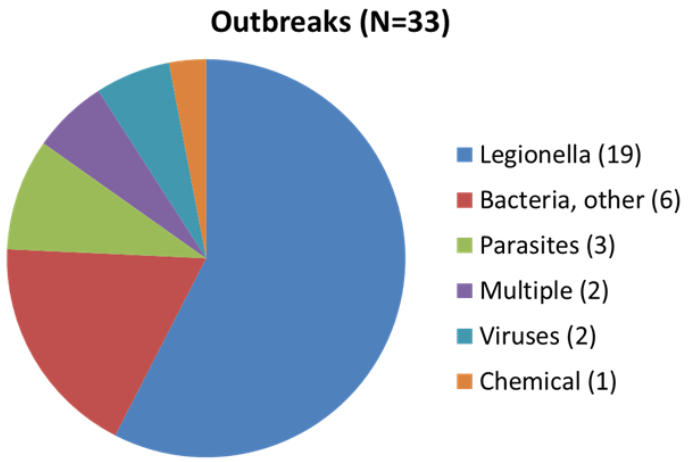
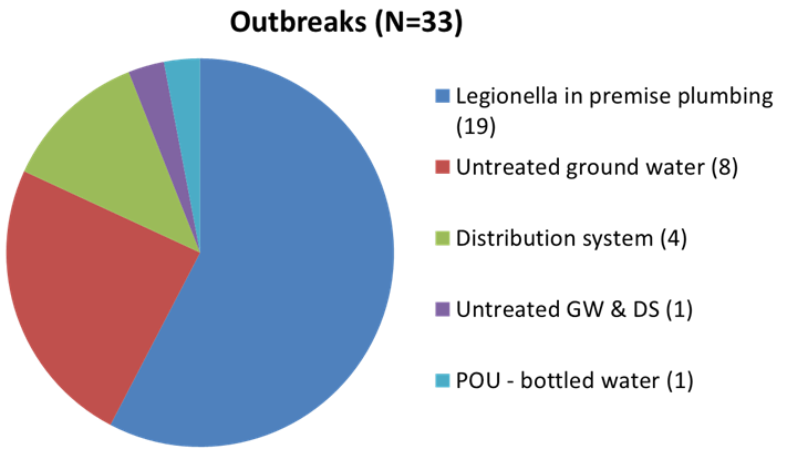
National Waterborne Disease Outbreaks





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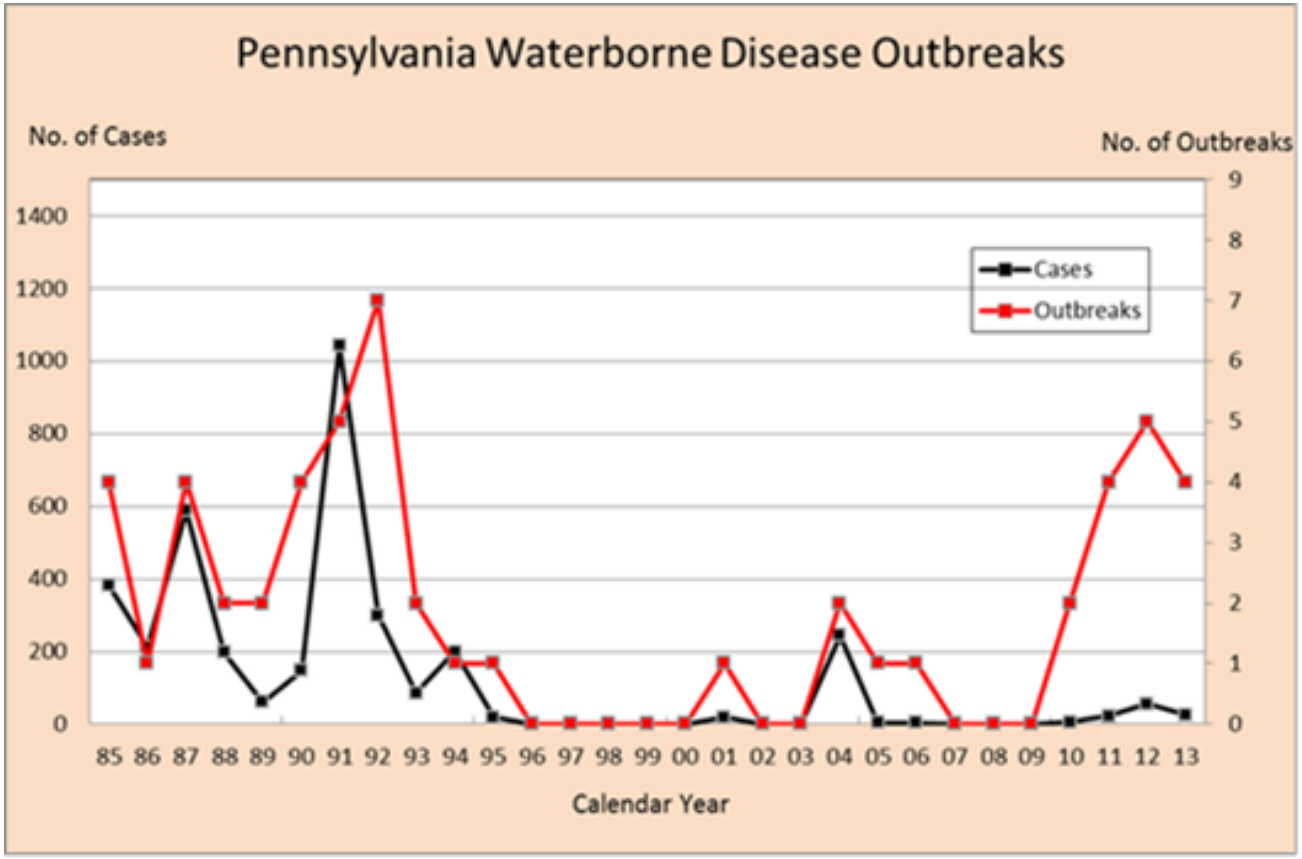
Pennsylvania Waterborne Disease Outbreaks



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Report and Study Findings

- According to the NRC, the distribution system is the remaining component of public water supplies yet to be adequately addressed in national efforts to eradicate waterborne disease. [2]
- According to the EPA, many different microbes have demonstrated the ability to survive in the distribution system including bacteria, viruses and protozoa. Microbes introduced into the distribution system can become entrained in biofilm. Biofilms can act as a slow-release mechanism for persistent contamination of the water. [3]

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Report and Study Findings

Colorado found that after analyzing data from > 450 data points taken from distribution systems across the State:

- The true detectable residual for free chlorine was **0.09 mg/L** (99% confidence)
- The occurrence data showed there was a higher rate of occurrence of both total coliform bacteria and *E. coli* as the chlorine residual decreased. **48%** and **64%** of all *E. coli* positive results occurred when chlorine residuals were **< 0.2 mg/L** and **< 0.4 mg/L** respectively. [13]

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Report and Study Findings

Wang et al examined the influence of pipe materials, disinfectant type and water age on occurrence and persistence of opportunistic pathogens and found:

- Disinfectant type and dose was observed to have the strongest influence on the microbiota. The importance of secondary disinfectant residual in controlling opportunistic pathogens was apparent.
- Disinfectant decay was noted with water age, particularly in chloraminated simulated distribution systems (due to nitrification), generally resulting in increased microbial detection frequencies and densities with water age. [10]

Report and Study Findings

Kuchta et al examined the susceptibility of *Legionella* and coliforms to chlorine disinfection and found:

- At a free chlorine residual of 0.1 mg/L, a contact time of 30-60 minutes was required to achieve 99% inactivation of *Legionella*.
- Increasing the chlorine residual predictably enhanced the bactericidal effect. Increasing the residual to 0.2 mg/L still required a fairly high contact time of 30 minutes.
- Inactivation rates improved above 0.2 mg/L, with a 99% inactivation of *Legionella* within five minutes at a concentration of 0.5 mg/L. [6]

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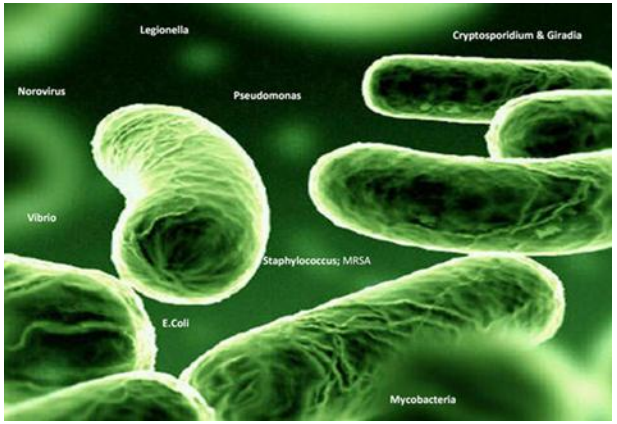
Emerging Pathogens of Concern

Opportunistic pathogens include:

- *Legionella pneumophila*
- *Mycobacterium avium* Complex (MAC)
- *Pseudomonas aeruginosa*
- *Acanthamoeba* spp.
- *Naegleria fowleri*



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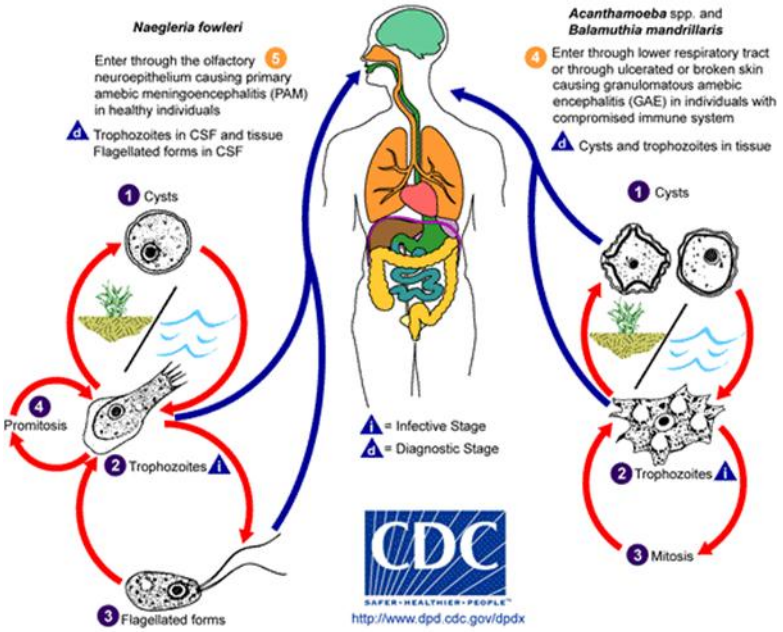
Emerging Pathogens of Concern

Primary modes of transmission: inhalation, aspiration or wound infection



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Legionella

- Causes Legionnaires' Disease (pneumonia) and Pontiac Fever
- Mode of exposure – inhalation or aspiration
- No safe level of Legionella
- Mortality rate is 5 - 20%

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Current Knowledge of Control Measures

Pathogen control may involve multiple approaches, such as:

- Finding and fixing sanitary defects to limit entry of pathogens (as required under the RTCR)
- Maintaining adequate disinfectant residuals
- Improving hydraulics and water quality to control biofilms
- Implementing effective O&M and BMPs

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Simultaneous Compliance

Simultaneous compliance issues are a concern with distribution disinfection provisions:

- Increased residual requirements could lead to increased disinfection byproducts
- Systems should be able to meet the new standards through better operations and BMPs, which will reduce chlorine demand and improve overall water quality

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Disinfection Standards - Other States

State	Minimum Distribution System Residual (mg/L)
Alabama	0.2 (free)
California	0.2 (free)
Colorado	0.2 (free)
Delaware	0.3 (free)
Florida	0.2 (free), 0.6 (total)
Georgia	0.2 (free)
Illinois	0.2 (free), 0.5 (total)
Indiana	0.2 (free), 0.5 (total)
Iowa	0.3 (free), 1.5 (total)
Kansas	0.2 (free), 1.0 (total)
Kentucky	0.2 (free), 0.5 (total)

State	Minimum Distribution System Residual (mg/L)
Louisiana	0.5 (free or total)
Missouri	0.2 (total)
Nebraska	0.2 (free), 0.5 (total)
NC	0.2 (free), 1.0 (total)
Ohio	0.2 (free), 1.0 (total)
Oklahoma	0.2 (free), 1.0 (total)
Tennessee	0.2 (free)
Texas	0.2 (free), 0.5 (total)
Vermont	0.1 (free)
WV	0.2 (total)

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DEP is Seeking Stakeholder Input

- Will the pre-draft minimum disinfectant residual levels meet public health goals? Why or why not?
- What data exists that suggests a different level is equally protective?
- Are there additional options for disinfectant residual monitoring locations and frequencies that are protective of public health?
- Are there additional options for determining compliance that are equally protective of public health?
- Are DEP's assumptions correct regarding compliance costs?

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Questions or Comments?