Pre-Draft Proposed Rulemaking Revised Disinfectant Residual Requirements

TAC Board Meeting

May 18, 2015
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.
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.
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.
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.
§ 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.
§ 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.
§ 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.
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*. 
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*


National Waterborne Disease Outbreaks

Source: CDC, MMWR, Vol. 62, No. 35, September 6, 2013
National Waterborne Disease Outbreaks

Outbreaks (N=33)

- Legionella (19)
- Bacteria, other (6)
- Parasites (3)
- Multiple (2)
- Viruses (2)
- Chemical (1)

Outbreaks (N=33)

- Legionella in premise plumbing (19)
- Untreated ground water (8)
- Distribution system (4)
- Untreated GW & DS (1)
- POU - bottled water (1)
Pennsylvania Waterborne Disease Outbreaks

[Graph showing the number of cases and outbreaks from 1985 to 2013, with peaks in the late 1980s and early 1990s.]
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
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
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
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.  

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6. Report and Study Findings
Opportunistic pathogens include:

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

Primary modes of transmission: inhalation, aspiration or wound infection
Legionella

- Causes Legionnaires’ Disease (pneumonia) and Pontiac Fever
- Mode of exposure – inhalation or aspiration
- No safe level of Legionella
- Mortality rate is 5 - 20%
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
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
### Disinfection Standards - Other States

<table>
<thead>
<tr>
<th>State</th>
<th>Minimum Distribution System Residual (mg/L)</th>
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<tbody>
<tr>
<td>Alabama</td>
<td>0.2 (free)</td>
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<tr>
<td>California</td>
<td>0.2 (free)</td>
</tr>
<tr>
<td>Colorado</td>
<td>0.2 (free)</td>
</tr>
<tr>
<td>Delaware</td>
<td>0.3 (free)</td>
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<tr>
<td>Florida</td>
<td>0.2 (free), 0.6 (total)</td>
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<tr>
<td>Georgia</td>
<td>0.2 (free)</td>
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<tr>
<td>Illinois</td>
<td>0.2 (free), 0.5 (total)</td>
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<tr>
<td>Indiana</td>
<td>0.2 (free), 0.5 (total)</td>
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<tr>
<td>Iowa</td>
<td>0.3 (free), 1.5 (total)</td>
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<tr>
<td>Kansas</td>
<td>0.2 (free), 1.0 (total)</td>
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<tr>
<td>Kentucky</td>
<td>0.2 (free), 0.5 (total)</td>
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<tr>
<th>State</th>
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<tbody>
<tr>
<td>Louisiana</td>
<td>0.5 (free or total)</td>
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<tr>
<td>Missouri</td>
<td>0.2 (total)</td>
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<tr>
<td>Nebraska</td>
<td>0.2 (free), 0.5 (total)</td>
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<tr>
<td>NC</td>
<td>0.2 (free), 1.0 (total)</td>
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<tr>
<td>Ohio</td>
<td>0.2 (free), 1.0 (total)</td>
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<td>Oklahoma</td>
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<tr>
<td>Tennessee</td>
<td>0.2 (free)</td>
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<tr>
<td>Texas</td>
<td>0.2 (free), 0.5 (total)</td>
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<tr>
<td>Vermont</td>
<td>0.1 (free)</td>
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<tr>
<td>WV</td>
<td>0.2 (total)</td>
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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?
Questions or Comments?