Where in Distribution Systems Should Monitoring Occur, and Why?

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Water Utility Management Plans

Like building systems, water utilities also have a form of a Water Management Plan

- Drinking Water Regulations
  - Surface Water Treatment Rules
  - Total Coliform Rules
  - Disinfectant, Disinfection By-Product Rules
  - Lead & Copper Rules
  - Ground Water Rule
  - Operator certification
  - Unregulated Contaminant Monitoring
  - Security and Resilience regulations

- Water Industry Best Practices
  - 10 State Standards
  - AWWA and other standards
  - State requirements
  - Fire protection requirements
  - Utility best practices

Activities to Protect Water Quality:
- Maintenance of a disinfectant residual
- Pipeline flushing
- Cleaning, maintenance of storage tanks
- Pipeline repair, replacement
- Corrosion, scale control
- Nitrification control
- Pressure management, cross connection control
- Avoidance of stagnation
  - Storage tank turnover
  - Avoid dead ends
  - System design-looping

National Research Council. 2006. Drinking Water Distribution Systems: Assessing and Reducing Risks.
National Academies Press. Washington, DC.

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Validation of Distribution System Water Quality

- Sanitary Surveys

- Required Monitoring
    - Disinfectant Residual, detectable in 95% of locations, 2 consecutive months for surface water systems
    - Disinfectant by-products – THMs, HAAs
    - Total coliform, *E. coli*, HPC bacteria
    - Corrosion control, optimal water quality parameters
    - Water Pressure, tank water levels

- Customer Complaints
    - Turbidity
    - Taste, odor
    - Discolored water
    - Water pressure, loss of service

Validation for *Legionella pneumophila* Management

- Management of *Legionella* is a shared responsibility

- Monitoring for fecal indicators (*E. coli*, Total Coliforms) does not indicate *L. pneumophila* management

- Current regulations permit up to 5% of the distribution system to not contain a disinfectant residual

- Availability of easy-to-use *L. pneumophila* methods enable utilities to collect, manage data themselves

- Biggest problem: Lack of guidance on responding to positive results

  - Development of *Developing a Legionella pneumophila Monitoring Program*, availabe at: www.drwaterconsulting.com

Developing a *L. pneumophila* monitoring program

The manual covers seven major steps:

1. Determine the *Legionella pneumophila* Monitoring Program Objectives

2. Identify the *Legionella pneumophila* Monitoring Team and begin to educate key stakeholders

3. Develop *Legionella pneumophila* monitoring protocols

4. Develop *Legionella pneumophila* Response and Communications Plan

5. Secure Support for Testing and Reporting Plan

6. Conduct pilot round of testing and review results

7. Document process for updating the *L. pneumophila* Monitoring Program

availabe at: www.drwaterconsulting.com

Develop *Legionella pneumophila* Monitoring Protocols

Determine sampling locations

- *Total Coliform Monitoring Locations*
- *Reservoirs, Storage Tanks*
- *Locations of Potentially Vulnerable Populations*
- *DBP Monitoring Locations*
- *Municipal and utility owned buildings*

Determine sampling frequency

- Depends on laboratory resources
- Monitoring program objectives
- Sampling can be more intense during periods of warm water (>15°C)

Select water quality data parameters

- *L. pneumophila*
- Total coliform / *E. coli*
- HPC bacteria
- Free, total chlorine (monochloramine)
- Temperature
- pH
- Total organic carbon

Chloraminated systems may wish to collect additional indicators of nitrification (nitrite, free and total ammonia).

In all cases, the utilities should follow their established procedures and quality control protocols for these analyses.

Develop *Legionella pneumophila* monitoring protocols (cont.)

[Sampling Program Implementation](#)

- Determine the responsibility for sample collection, delivery, and reporting
  - Scheduling
  - Training - https://www.idexx.com/en/water/education/water-academy/
  - Flushing (or not)
- Select Sampling Locations
  - Transported at ambient temperature
  - Analyses should be initiated as soon as possible, or
    refrigerate for samples processed within 24-48 hours from the time of collection
- Conduct and document training and quality control
  - Ideally, sampling locations should draw water directly from the distribution main or service connection
  - Dedicated sampling stations
  - Document training
- Sample Collection Follow-up
  - Protocols to follow-up on any unusual or low disinfectant results
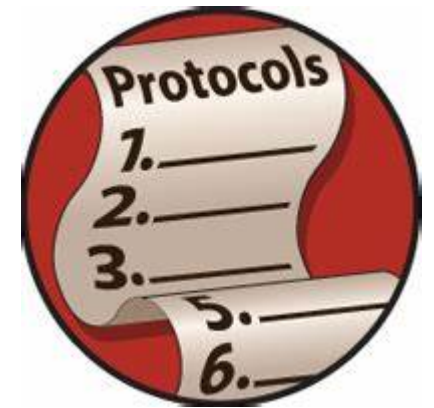
Develop a Communications Plan for reporting *L. pneumophila* results

The utility's stated goal should be to achieve zero *L. pneumophila* in the distribution system.

Suggested guidance on sharing *L. pneumophila* results:

<0.1 to MPN 1.0/mL. *L. pneumophila* at these levels may be transitory and repeat samples are often negative. Infrequent detection of *L. pneumophila* at these levels may not be of great concern if the other routine water quality data and system operations are normal.

>20% occurrence. Determination of the frequency of occurrence depends on the number of samples collected per monitoring event. Assuming that 10 samples are collected, then if more than two are positive during any particular sampling event, this would be an opportunity to conduct a system evaluation. If any deficiencies are detected, they should be corrected.

1.0 MPN to 10/mL. *L. pneumophila* levels in this range indicate that conditions may be favorable for growth of the organism in the system. Actions should be taken to correct any low disinfectant residuals, water stagnation, or other conditions can could lead to the proliferation of the bacteria. This would be an opportunity to notify the environmental/public health regulator and conduct a system evaluation. If any deficiencies are detected, they should be corrected.

>10 MPN /mL. *L. pneumophila* levels in this range indicate that conditions are favorable for growth of the organism and that immediate actions should be taken to reduce the bacterial levels. Disinfectant residuals should be increased, and positive areas of the system should be flushed. After consultation with the environmental/public health regulators, consider issuing public notification to boil tap water. As a precaution, advise the elderly and immunocompromised to avoid showers and situations where water is aerosolized.

LeChevallier, M.W. 2020. Managing *Legionella pneumophila* in Water Systems. *JAWWA*. 112(2): 11-23. https://doi.org/10.1002/awwa.1444

Develop a communications plan for reporting *L. pneumophila* results

- Consider posting updates on the *L. pneumophila* monitoring program on the utility's web page, even if all the results are negative.

- Posting the action levels discussed above will allow stakeholders to know when alerts will be issued.

- Consider including a statement on *Legionella* in the annual (or bi-annual) Consumer Confidence Report.

- The Water Research Foundation report (#4664 - Customer Messaging on Opportunistic Pathogens in Plumbing Systems) includes some samples that can be used.

- Interested stakeholders can be directed to the utility web page for more details. Example: https://amwater.com/corp/water-quality-wastewater-service-legionella

Concluding Thoughts

- *Legionella* is an increasing public health issue that utilities and their customers should be aware of

- Methods are available so that utilities can validate their treatment processes for *Legionella* control

- Guidelines and training are available for monitoring and responding to positive *Legionella* samples

- *Legionella* control is a shared responsibility and utilities should be proactively communicating with their customers on managing *Legionella* risks

- Stagnant buildings due to pandemic "stay at home" orders can heighten *Legionella* concerns

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