Synopses of Other Potential Risks Related to Distribution Systems

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This Meeting's Presentations

Objectives

Provisions

System compliance

Improvement

Research

Other Potential Risks Related to Distribution Systems

Presentation Objectives

- Define the issues
- Explain potential concerns
- Describe existing mitigation strategies
- Present cross-cutting issues

Other Potential Risks

- Issues related to contaminants that are currently regulated at the point of entry but can also be found in the distribution system
  - Permeation
  - Leaching
  - Internal Corrosion
  - Contaminant Accumulation
- Issues that are contributing factors to a variety of distribution system concerns
  - Water Age
  - Loss of Disinfectant Residual
- Premise Plumbing

Permeation

Why is Permeation a Concern?

- Permeation is the movement of chemicals from outside the pipe through the pipe or appurtenance material and into the water
  - Hydrocarbons permeating through plastic pipes is most common
- Required sampling for many of these contaminants occurs only at the entry to the distribution system so these events can go undetected
- Permeation of contaminants may result in customer complaints, but not always
  - May exceed MCL before taste & odor threshold is reached
- Over 100 incidents of contamination due to permeation have been reported in the U.S.

Mitigation Strategies for Permeation

- Engineering standards require use of non-permeable pipe materials in areas suspected to be contaminated
- Replace pipe that has had permeation

Leaching

Why is Leaching a Concern?

- Leaching is the dissolution of contaminants from the pipe, pipe lining, or appurtenances into the water
- Required sampling for many of these contaminants occurs only at the entry to the distribution system so these events can go undetected
- Arsenic, barium, cadmium, chromium can leach from cement mortar
- Solvents added to coatings can diffuse through the coatings into the water
- Epoxy resins and related agents from lining materials can leach into water

Mitigation Strategies for Leaching

- Industry standards on acceptable materials, coatings, and linings and their installation
- Replace pipe that has evidence of leaching

Internal Corrosion

Why is Internal Corrosion a Concern?

- Deterioration of metallic infrastructure or appurtenances due to contact with water
- Corrosion and corrosion byproducts can:
  - Be chemically or microbially mediated
  - Result in metals release
  - Exert a demand on disinfectant residual
  - Increase taste, odor, and color
  - Provide a surface for microorganisms to grow, shielded from disinfection
  - Serve as a nutrient and substrate for microbial growth
  - Reduce pipeline capacity
  - Contribute to failure of physical integrity and intrusion

Mitigation Strategies for Internal Corrosion

- Internal corrosion can be controlled by the adjustment of water quality parameters (pH, alkalinity) or use of chemical corrosion inhibitors
  - Corrosion control strategies required under LCR
  - Other regulations impose some constraints on corrosion control options
  - Need to carefully select and test the proper approach, chemicals and dose for each system
- Materials, coatings, linings, and pipe rehabilitation / replacement can be used to minimize corrosion

Contaminant Accumulation

Why is Contaminant Accumulation a Concern?

- Contaminants in water can accumulate on solids (e.g., sediment) in drinking water distribution systems
- Regulated and unregulated contaminants with known health effects have been found to accumulate in the distribution system including:
  - Arsenic (measured at many times the MCL in one case)
  - Radium
  - Uranium
  - Vanadium
- Significant accumulation of contaminant can occur even when the respective contaminant is below it's MCL in the water.

Mitigation Strategies for Contaminant Accumulation

- Release mechanisms to be avoided include:
  - Changes in water chemistry and/or treatment practices
  - Hydraulic disturbances
  - Corrosion
  - Microbiological activity
- Develop mitigation plan on a case-by-case basis, which may include:
  - Corrosion control
  - Regular flushing
  - Control of inorganic constituents entering the distribution system that might become deposits that facilitate accumulation of other contaminants

Water Age

Why is Water Age a Concern?

- Water age is the length of time from when the water enters the distribution system to when it reaches the customer
- Although there is no specific age at which water becomes unsafe, increased water age provides increased opportunity for undesirable water quality changes to occur.
- Water quality changes of concern include:
  - Loss of a disinfectant residual
  - Disinfection byproduct formation
  - Nitrification in chloraminated systems
  - Microbial survival and growth
  - Corrosion and corrosion byproduct formation
  - Sediment deposition
  - Increase in temperature

Mitigation Strategies for Water Age

- Mitigation should address the largest contributors to increased water age, which include:
  - Quantity of storage
  - Hydraulic operations, particularly related to storage
  - Pressure zone boundaries

Loss of Disinfectant Residual

Why is Loss of Disinfectant Residual a Concern?

Disinfectant Residual Concentration = Initial Dose – Decay over Time

- Degree of disinfectant loss indicates degree of residual disinfectant decay that has happened in the system
- No direct link to public health due to lack of disinfectant residual, indirect links only
- Maintenance of a disinfectant residual may help to:
  - Control biofilm growth
  - Inactivate microorganisms
- Fluctuations in residual may have adverse implications

Mitigation Strategies for Loss of Disinfectant Residual

- Many best management practices for distribution systems will be effective in minimizing loss of residual, including:
  - Hydraulic operations, particularly related to storage
  - Removal of chlorine-demanding constituents in treatment
  - Corrosion control
  - Regular flushing

Premise Plumbing

Why is Premise Plumbing a Concern?

- Premise plumbing is the potable water system of the customer
  - Similar to the public system in many ways, just on a smaller scale
- Location of connection to potentially hazardous equipment (e.g. chemical equipment, boilers, irrigation systems)
- Issues of greatest concern related to premise plumbing include:
  - Cross-connections
  - Lead and copper
  - Pinhole leaks
  - *Legionella*
- Mitigation strategies similar to those for distribution system

Cross-Cutting Issues

- Health effects for many of the contaminants discussed here are known
  - Current regulatory sampling and compliance does not take distribution system sources into account
- Water age and loss of disinfectant residual generally have indirect impacts on overall water quality delivered to the customer
- Many of the mitigation strategies (e.g. corrosion control) could provide benefits for a variety of issues