Course Title**: Water Quality Improvement through Water Storage Tank Mixing**

60 minutes of instruction

Course Description: This 60-minute seminar will provide water system managers, operators and engineers a practical understanding of the science behind applying mixing energy to water in reservoirs or tanks as a means to improve water quality in distribution networks.

Course Outline:

1. The basics of water tank mixing
    a. Understanding and measuring water tank stratification (temperature and chemical)
    b. Methods that attempt to achieve the results of a well-mixed tank
    c. Modes of tank mixing in recent history
    d. Impact of applying the right amount of energy to a water storage asset
2. Equipment options and equipment form factors
    a. Mixer types – consider tank geometries, tank volumes, turnover, power availability and reliability
    b. Mixer hardware and components
    c. Properly specifying a tank mixer
3. Case Studies:
    a. Improving disinfectant residual levels
    b. Improving system residual stability
    c. As a building block toward THM removal and active residual control
4. Review and discussion of answers from the quiz

Presenter Bio:

Ethan Brooke
Senior Product Manager, THM Removal System, PSI Water Technologies, Inc.

Ethan Brooke is an internationally recognized expert on aeration technologies for trihalomethane (THM) removal. His master's thesis on THM aeration was published in the *Journal American Water Works Association* and resulted in three patents which are held by the University of New Hampshire. Ethan has a background in civil engineering and product management and has worked on a variety of water, wastewater and distribution system infrastructure improvement projects.

Learning Outcomes:

- Attendees will understand the role of tank mixing as a fundamental step to improving water network quality
- Attendees will understand the roles of various types of mixers in achieving a "well mixed" tank without excessive energy consumption
- Attendees will be able to understand the role of tank mixing as a first step to THM removal and active residual improvement or boosting

Course Title**: THM Mitigation in Water Distribution Systems through Water Storage Tank Mixing and Aeration**

60 minutes of instruction

Course Description: This 60-minute seminar will provide water system managers, operators and engineers a practical understanding of the conditions, chemistry and science behind trihalomethane (THMs) generation in water distribution systems. Importantly, the second half of the seminar will present a suite of proven technologies that can be employed to reduce THM levels in real world water distribution systems.

Course Outline:

1. Background on DBP and THM regulation in the United States
    a. EPA and Stage 2 DBP Rules
2. THM generation in water systems
    a. Conditions that allow for THM formation
    b. Nature of THMs (volatile compounds, Henry's Law)
3. Basics of THM removal
    a. THM volatilization – driving force
    b. Role of tank de-stratification and mixing
    c. Role of aeration
4. Equipment options and equipment form factors
5. Case Studies:
    a. Mixing and Ventilation
    b. Mixing, Ventilation and Aeration
    c. Process control and energy management
6. Review and discussion of answers from the quiz

Presenter Bio:

Ethan Brooke
Senior Product Manager, THM Removal System, PSI Water Technologies, Inc.

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Learning Outcomes:

- Attendees will understand the conditions that generate THMs in distribution systems and the physical/chemical nature of THMs
- Attendees will better understand the mechanisms for THM removal based on the physical/chemical nature of THMs

- Attendees will be able to understand the roles of various technology choices and form factors that can aid in the removal of THMs through in-tank aeration

Course Title**: Disinfectant Residual Control in Water Distribution Systems**

60 minutes of instruction

Course Description: This 60-minute seminar will provide water system managers, operators and engineers a practical understanding of the conditions, chemistry and science behind affecting positive control of both chloramine and free-chlorine levels in water distribution systems. Importantly, the second half of the seminar will present a suite of proven technologies that can be employed to automatically control disinfectant residual levels in real world water distribution systems.

Course Outline:

1. Background on the importance of controlling disinfectant residual levels in water systems
    a. Prevalence of low residual related MCL violations
    b. AWWA 2017 Disinfection Survey results
2. Nitrification
    a. Role of nitrifying bacteria in the destruction of water quality (chloramine systems)
    b. Operational procedures currently used to stave-off nitrification
3. The Breakpoint Curve – Understanding Fluctuating Residual Levels in Networks
    a. A simple explanation to a lot of chlorine based residual chemistry
    b. Requirements to controlling setpoint on a breakpoint curve
4. Equipment options and equipment form factors
    a. Roles of tank mixing, chemical feed, real-time water quality analysis and feedback algorithms
5. Case Studies:
    a. Automatic control of chloramine residuals in water networks
    b. Automatic control of chloramine residuals in water networks with multiple tanks
    c. Controlling free-chlorine residual versus chloramine residual
6. Review and discussion of answers from the quiz

Presenter Bio:

Ethan Brooke
Senior Product Manager, THM Removal System, PSI Water Technologies, Inc.

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Learning Outcomes:

- Attendees will understand the conditions and basic chemistry of chloramine and free-chlorine residual destruction in water distribution systems

- Attendees will understand how the breakpoint curve can be used to intelligently boost residual levels in an automated mode versus today's manual and time-consuming methods
- Attendees will be able to understand the roles of various technology choices and form factors that can be specified and employed in water systems to stabilize and improve residual levels

Course Title**: On-Site Sodium Hypochlorite Generation as a Safe and Efficient Alternative to Chlorine Gas or Commercial Strength Bulk Hypochlorite for Water Disinfection**

60 minutes of instruction

Course Description: This 60-minute seminar will provide water system managers, operators and engineers a practical understanding of the science and implementation behind on-site sodium hypochlorite generation (OSHG) as a source of chlorine disinfection capacity for water and wastewater plants as well as distributed well systems.

Course Outline:

1. The basics of electrolytic generation of sodium hypochlorite or bleach
    a. Understanding the relationships between table salt (NaCl), electricity, softened water, hydrogen and the bleach product
    b. Economic considerations versus bulk hypochlorite and OSHG
2. Equipment Components and Technical Design
    a. Previous generations of OSHG equipment versus current generation
    b. Role of equipment components
    c. Process flow diagram walk-through
    d. Engineering design considerations and lessons learned
3. Case Studies:
    a. San Diego, CA 30MGD conversion from bulk bleach to OSHG
    b. Nashville, TN 180MGD conversion from gas chlorine to OSHG
    c. Other cases studies include multiple well sites and distribution system residual control
4. Review and discussion of answers from the quiz

Presenter Bio:

Ethan Brooke
Senior Product Manager, THM Removal System, PSI Water Technologies, Inc.

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Learning Outcomes:

- Attendees will understand the basics of on-site generation of hypochlorite as an option for water or wastewater disinfection versus gas chlorine or commercial strength bleach
- Attendees will understand the roles of OSHG components as part of an overall OSHG system
- Attendees will be able relate to many applications of OSHG in both large and small plants as well as in applications distant from plants in the well fields or distribution systems

Tracking of Attendance

When the invitation is sent out, it includes a registration link. This registration link requires them to enter in their contact information. That is captured in an Excel format into a spreadsheet. These spreadsheets are stored on our internal website for future needs to be accessed.