Water Management Case Studies: Lessons Learned from two Chicago-area hospitals with Water Management Programs

HESNI Annual Conference
May 2, 2013
Presentation Outline

1. Water Management Drivers
2. ASHRAE Standard 188P
3. Case Study Examples
4. Open Discussion
Why Take Control of Your Water Systems?

• Extreme Cost Reduction Pressure in Healthcare

• Significant Water Processing Costs

• Importance of Water Safety

• Maximize Lifespan of Capital Assets
Water Processing Costs:

Water-Related Energy Consumption:
• Steam Production/HVAC Cooling
• 50% of total Energy Budget

Water Usage:
• Total Makeup Water
  • Utility
  • Potable
• Sewer

Utility Water Treatment:
• Bundled Chemicals & Service
• Equipment

Potable Water Treatment:
• Secondary Disinfection Systems
• Point-of-Use Filters

These Costs Impact Your Operating Budget
Current Water Management Drivers

- How will ASHRAE Standard 188P impact my facility?
- Potable Water Disinfection Options
  - Existing Systems at your hospital/LTC facilities?
  - “Technical truth” behind new technologies?
  - How do I know if municipal water treatment is “enough?”
  - What are my facility’s regulatory requirements?
- *Legionella* testing
  - Do I need to test for it?
  - How do I interpret results?
  - Should I test for other waterborne pathogens?
- **What Areas Impact You?**
Industry Drivers for Preventing Legionellosis

American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE)

U.S. Department of Labor
Occupational Safety & Health Administration
www.osha.gov

Legionnaires' Disease Standards

There are currently no specific OSHA standards for Legionnaires' disease. This page highlights OSHA Federal Registers (rules, proposed rules, and notices), directives (instructions for compliance officers), and national consensus standards related to Legionnaires' disease.

OSHA

Section 5(a)(1) of the OSH Act, often referred to as the General Duty Clause, requires employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees". The General Duty Clause covers failures to follow recognized good industry practices for instances in which Legionnaires' disease has been linked to poorly maintained water systems. Section 5(a)(2) requires employers to "comply with occupational safety and health standards promulgated under this Act".
Technical Consensus: ASHRAE Standard 188P

STANDARD REQUIREMENTS:

The Hazard Analysis Critical Control Point (HACCP) Process, which includes:

• Systematic, risk management plan to support the decision-making process
• Validation, independent, quantitative evidence, the water system is free of hazards or they have been prevented from harming people.

ASHRAE WEBSITE SPC 188 LINK: http://spc188.ashraepcs.org/index.html
ASHRAE Standard 188P: Current Status

• Third 45-day Public Comment period completed 3/11/13

• Section 5.2 – Identification of Risk Factors
  a) Multiple housing units with 1 or more centralized water heaters
  b) Building more than 10 stories high
  c) Inpatient healthcare facility
  d) Occupants are primarily over the age of 65 or those receiving chemotherapy for cancer or bone marrow transplantation

• Section 5.3
  a) Cooling Towers and/or evaporative condensers
  b) Whirlpools and/or spas
  c) Water based devices that, by design, release aerosols. (Examples: decorative water features, misters, atomizers, air washers, humidifiers)
HACCP: Required by ASHRAE Standard 188P

HACCP PROCESS - 7 PRINCIPLES

1. Hazard Analysis
2. Identify Critical Control Points
3. Establish critical limits
4. Establish control/monitoring plan
5. Establish corrective action procedures
6. Establish record-keeping & crisis response plan
7. Validation, verification, reassessment
Validation
Quantitative evidence (data) that control limits have prevented, eliminated or reduced the hazard under operating conditions, OR
*That the controls you apply ($, resources) are effective*

Verification
Independent confirmation that the risk management plan is being implemented correctly and is periodically reassessed, OR
*That the WMT and facility are following the HACCP Plan (control monitoring, corrective actions, etc.)*
Water Management Program Examples

Advocate Lutheran General Hospital
Advocate Good Shepherd Hospital
Manager of Infection Prevention, Advocate Lutheran General Hospital

• Manager of Infection Prevention at Advocate Lutheran General Hospital/Advocate Children’s Hospital in Park Ridge.
• Bachelor’s of Nursing and Masters Degree in Public Health from Illinois Benedictine University.
• Certification in Infection Prevention in 2007.
• Participated in many process improvement teams, including the development & implementation of a Water Management Plan.
Infection Prevention Drivers for Strategic Water Management

• Evolution of Infection Control to Infection Prevention

• Numerous Competing Priorities

• The Pillars of Advocate Health System
  • Safety
  • Quality
  • Service

• How did the Safety of Water become a priority?
LGH Water Management Team

• Multi Disciplinary Team:
  ▪ Clinical  - Nursing Management
    - Infection Prevention
  ▪ Quality Management
  ▪ Facilities Management
  ▪ Ad Hoc Members
    ▪ Maintenance (i.e. Ice Machines)
    ▪ Equipment Vendors

• Benefits of the Water Management Team:
  ▪ Defined decision making process
  ▪ Coordinated communication
LGH Water Management Team

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Hazard Control

• Concerns about the safety and quality of the facility water system
  • *Legionella* bacteria
  • Other waterborne pathogens (e.g., coliforms, *P. aeruginosa*, *Mycobacterium*, *Acinetobacter*)
  • Water Quality Indicators – heterotrophic bacteria/chlorine residuals

• Application to the Hazard Analysis & Control Process
  • What are the hazards?
  • What is being done to control the hazards?
  • How do we know the hazards have been controlled?
Evaluation of Treatment and Control Options

• Utility Water Options:
  • Non-Chemical Devices
  • Chemical Strategies:
    o Oxidizing Biocides
    o Non-Oxidizing Biocides

• Potable Water Options
  • Non-Chemical Devices
    o Point of Use Filters
    o Disinfection Generation
  • EPA Approved Disinfection Strategies
    o Chlorine (on site generation or chemical feed)
    o Chlorine Dioxide (on site generation or chemical feed)
    o Chloramines
Water Management Plan to Prevent Disease Associated with Building Water Systems

Co-Authors:

Linda S. Stein - Manager Infection Control and Epidemiology; RN, MPH, CIC, Advocate Lutheran Hospital, Park Ridge, IL

William F. McCoy PhD - Chief Technology Officer, Phigenics LLC, Naperville, IL

Martin J. Detmer – Regional Manager. Phigenics LLC, Naperville, IL
**Issue:** To prevent disease associated with building water systems \(^{(1)}\), it is necessary to minimize pathogenic biological agents in hospital hot and cold water systems and other aerosolizing water systems.

**Project:** A multidisciplinary Water Management Team (WMT) representing infection control, plant engineering, clinical and senior leadership was assigned responsibilities and accountabilities. A Water Management Program (WMP) was established by using the Hazard Analysis and Critical Control Point (HACCP) process. The system was described with process flow diagrams that listed and named each processing step for potable water in the hospital. Systematic hazard analysis was performed. A critical need for hazard control was discovered in the cold water system supplying taps and devices including 80 ice machines. The Team reviewed many options for hazard control then decided to implement a comprehensive preventative maintenance (PM) process for ice machines and a continuous chlorine feed as a Hazard Control measure. The supplemental chlorine treatment was administered fully in accordance with the Safe Drinking Water Act (SDWA) \(^{(2)}\) under the regulatory authority of the Illinois Dept of Public Health. Validation of the program was by disease surveillance.

\(^{(1)}\) The Joint Commission, Environment of Care Standard EC 02.05.01 (2009)
\(^{(2)}\) Safe Drinking Water Act, Code of the Federal Regulations (40 CFR 141-143)
Establishing the Water Management Program

- **Form the Water Management Team (WMT)**
  - Manager, Infection Control and Epidemiology
  - Manager, Engineering Services
  - Director, Facility Services
  - Vice President, Facility Management
  - Phigenics Independent HACCP Manager

- **Describe How Water is Processed in the Facility Using Process Flow Diagrams**

- **Perform Systematic Hazard Analysis and Select Critical Control Points (CCPs)**

- **For every CCP, select critical limits, monitoring, frequency of monitoring and corrective action**

- **Set Validation Criteria and establish Verification schedule**
Evidence-Based Verification of Hazard Control

**Results:** Figure 1 shows monthly average results from on-line continuous chlorine residual monitoring. The critical limit range for Chlorine is indicated by green shading. When a deviation from the critical limit range occurred, an alert was sent by email and corrective actions were implemented. The hazard control (chlorine feed), hazard monitoring and corrective action alerts were performed in real-time, on-line using a web-based data management application.
Evidence Based Validation of WMP Success

Cases Associated with *Mycobacterium fortuitum*

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**Results:** Table 1 shows that cases associated with *Mycobacterium fortuitum* have been significantly reduced since the 2009 formation of the Water Management Team and the implementation of the HACCP Water Management Program.
Conclusions

- Hazard analysis, hazard control with on-line data management and validation by evidence-based outcomes with a well-defined Water Management Program is required in order to properly manage the risk of hospital-acquired infections associated with building water systems.

- Implementation in accordance with the SDWA is straightforward, not expensive nor are requirements onerous.

- A Water Management Team, comprised of cross functional leadership, is critical to develop strategic direction and effective Water Management Program execution.

- There are many secondary disinfection options available for Hazard Control. The supplementation of chlorine is proven, cost effective, and safe.
OverView

- 183 licensed beds
- Comprehensive cardiac services through the Wayne and Patricia Kocourek Family Cardiac Center, including electrophysiology, catherization and open heart surgeries.
- Emergency and trauma services with a 56,000 sq. ft. state-of-the-art Level II trauma center
- Physicians and Diagnostic Services – Algonquin – offering medical specialists, full-service imaging and cardio-diagnostic services.
- State-of-the-art labor, delivery and birthing center offers the “Pampered Pregnancy”
- Health and fitness center with occupational therapy, physical therapy, physical fitness programs and personal trainers.
- Level II “Plus” birthing center with a special care nursery
- Outpatient Centers opened in Crystal Lake and Lake Zurich and an Immediate Care Center staffed by 100% emergency department physicians opened in Crystal Lake.
GSH Water System History

- Only hospital-owned well system in the state of IL
- Historically a 3 well system
- 2011/2012 – drilled a 4th well
  - 1475 ft deep
  - Goal - control high iron levels (iron-forming bacteria)
GSH Water System History

- Non-Transient Non-Community Public Water System based upon chlorination process
- IDPH program – Federal Safe Drinking Water Act requirements
  - Coliforms
  - Lead and Copper
  - Disinfection By-Products
  - Nitrite/Nitrate
  - Arsenic (well-source)
2012 GSH WMP Accomplishments

• Develop HACCP Plan
  – Documentation of Water Processing Steps
  – Selection of Critical Control Points
  – Definition of Hazard Control Plan/Monitoring
  – Evaluation of Existing Hazard Controls
  – Verification of Plan Implementation

• Validation Baseline
  – Four quarters of test results

• Documentation Strategy
2013 GSH Water Management Goals

• Validation/Verification of HACCP Plan
  – Evidence that plan is implemented as defined
    • Corrective Actions – Hazard Control Monitoring
  – Re-assess based on any process changes
    • Construction Project
  – Determine validation frequency after first year baseline

• Cost Savings Opportunities – Utility Water
  – RO System: reduce $20K maintenance events
  – Cooling Water: prevent scaling/improve heat transfer efficiency
  – Benchmark performance and costs
Open Discussion