SPECIAL PATHOGENS LABORATORY®
THE LEGIONELLA EXPERTS®

LEGIONELLA MONITORING AND RISK ASSESSMENTS

Sampling Plans, Results and Remediation

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University of Pittsburgh

Objectives

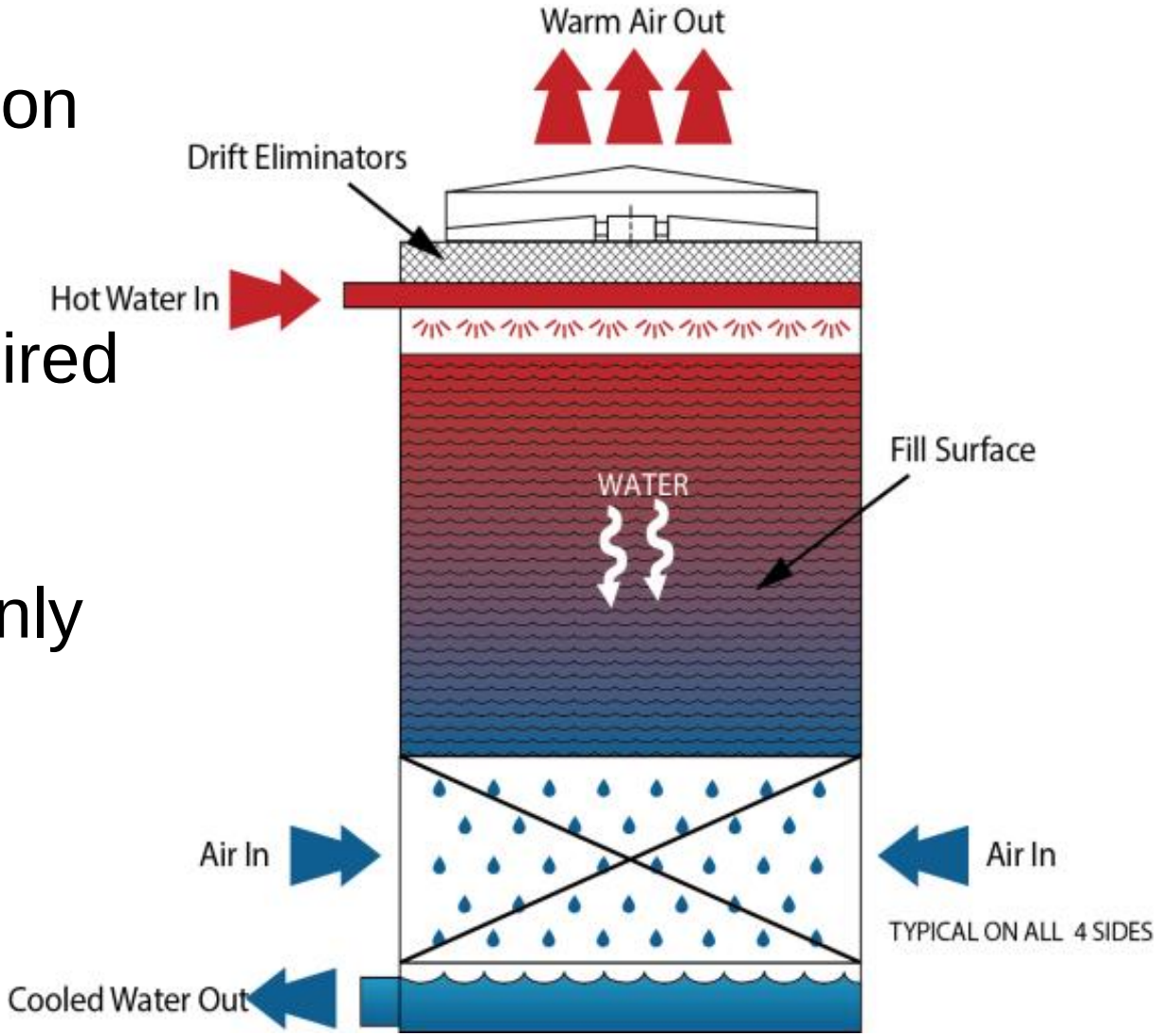
- Understanding *Legionella* in the Built environment
- Role of *Legionella* testing in disease prevention
- Review approaches to prevention (ASHRAE, CMS, CDC)

What We Know Now

Potable water especially in hospitals (and other buildings) with complex hot water systems, is the most important source of *Legionella* transmission.

Cooling Towers

- NOT a common source for sporadic and hospital-acquired cases
- More commonly associated with large community outbreaks



Sampling Plans: Where to Test?

- Sample water systems known to be associated with cases of Legionnaires' disease

Cases Linked to Water Systems

- Warm water distribution in:
  - Hospitals
  - Nursing homes
  - Rehabilitation centers
  - Office buildings
  - Apartment buildings
  - Hotels
- Other water systems:
  - Spas and hot tubs
  - Decorative fountains
  - Humidifiers
  - Cooling towers

2016 CDC Report on Legionnaires' Disease Outbreaks

Morbidity and Mortality Weekly Report

Vital Signs: Deficiencies in Environmental Control Identified in Outbreaks of Legionnaires' Disease — North America, 2000–2014

Laurel E. Garrison, MPH[1]; Jasen M. Kunz, MPH[2]; Laura A. Cooley, MD[1]; Matthew R. Moore, MD[1]; Claressa Lucas, PhD[1]; Stephanie Schrag, DPhil[1]; John Sarisky, MPH[2]; Cynthia G. Whitney, MD[1]

On June 7, 2016, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

Sources of Outbreaks

- 27 Outbreaks - Sources
  - 44% Hotels and resorts
  - 19% Long-term care facilities
  - 15% Hospitals
  - 21% Senior living facilities, workplaces, and the community

Potable Water vs. Utility (Cooling Towers)

- Potable water was the most frequent source of exposure (56%), followed by cooling towers (22%)
- Potable water sources accounted for 67% of health care–associated outbreaks (in hospitals and long-term care facilities).

2017 CDC Report Legionnaires' Disease in Healthcare Facilities

Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 66
June 6, 2017

Vital Signs: Health Care–Associated Legionnaires' Disease Surveillance Data from 20 States and a Large Metropolitan Area — United States, 2015

Elizabeth A. Soda, MD[1,2]; Albert E. Barskey, MPH[2]; Priti P. Shah, MPH[2]; Stephanie Schrag, DPhil[2]; Cynthia G. Whitney, MD[2]; Matthew J. Arduino, DrPH[3]; Sujan C. Reddy, MD[3]; Jasen M. Kunz, MPH[4]; Candis M. Hunter, MSPH[4]; Brian H. Raphael, PhD[2]; Laura A. Cooley, MD[2]

Findings

- Problem is nationwide
- 20% of the reported cases healthcare-acquired
- Deadly - 25% mortality
- Many cases associated with long-term care

New York Is Being Proactive!

State-wide regulation requires testing and water management plans for cooling towers

AND

potable water systems of healthcare facilities

CMS Weighs In

DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop C2-21-16
Baltimore, Maryland 21244-1850

CENTERS FOR MEDICARE & MEDICAID SERVICES

Center for Clinical Standards and Quality/Survey & Certification Group

Ref: S&C 17-30-ALL

DATE: **June 02, 2017**

TO: State Survey Agency Directors

FROM: Director
Survey and Certification Group

SUBJECT: Requirement to Reduce *Legionella* Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires' Disease (LD)

Requirements for Surveyors and Healthcare Facilities

- This policy memorandum applies to:
  - Hospitals, Critical Access Hospitals (CAHs) and Long-Term Care (LTC).
  - This policy memorandum is also intended to provide general awareness for all healthcare organizations.

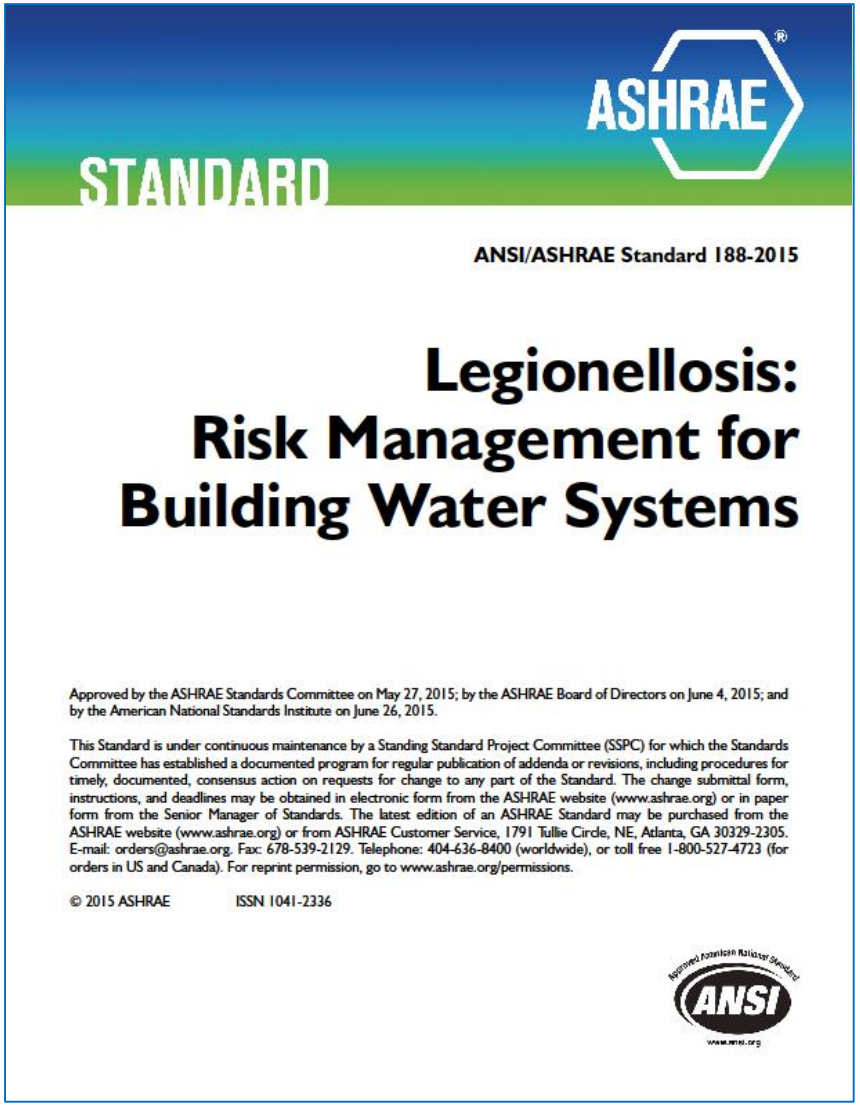
Effective Immediately

- Conduct a risk assessment to identify where *Legionella* and other opportunistic waterborne pathogens could grow and spread in the water system

Expectations

- CMS expects HCF's to have water management policies to reduce the risk of growth and spread of:
  - *Legionella* and other opportunistic pathogens in building water systems

- ANSI/ASHRAE Standard 188
- First *Legionella* standard in the United States.
- Approved June 26, 2015.



STANDARD

ASHRAE

ANSI/ASHRAE Standard 188-2015

Legionellosis: Risk Management for Building Water Systems

Approved by the ASHRAE Standards Committee on May 27, 2015; by the ASHRAE Board of Directors on June 4, 2015; and by the American National Standards Institute on June 26, 2015.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

 ISSN 1041-2336

ANSI

CDC Emphasizes Water Management

CMS Expectations

- Implement a water management program that includes:
  - Control measures
  - Temperature management
  - Disinfectant level control, and
  - Environmental testing for pathogens

Questions to Ask When Testing

- Was *Legionella* found in the water system?
  - Pathogenic species?
  - Extent of colonization?
  - Colonization in sensitive areas?

TESTING PLAYS AN IMPORTANT ROLE IN DISEASE PREVENTION

Why Test?

- Assess the risk
- Control the risk (through engineering controls or water treatment)
- Before cases occur
- Prevent Legionnaires' disease!

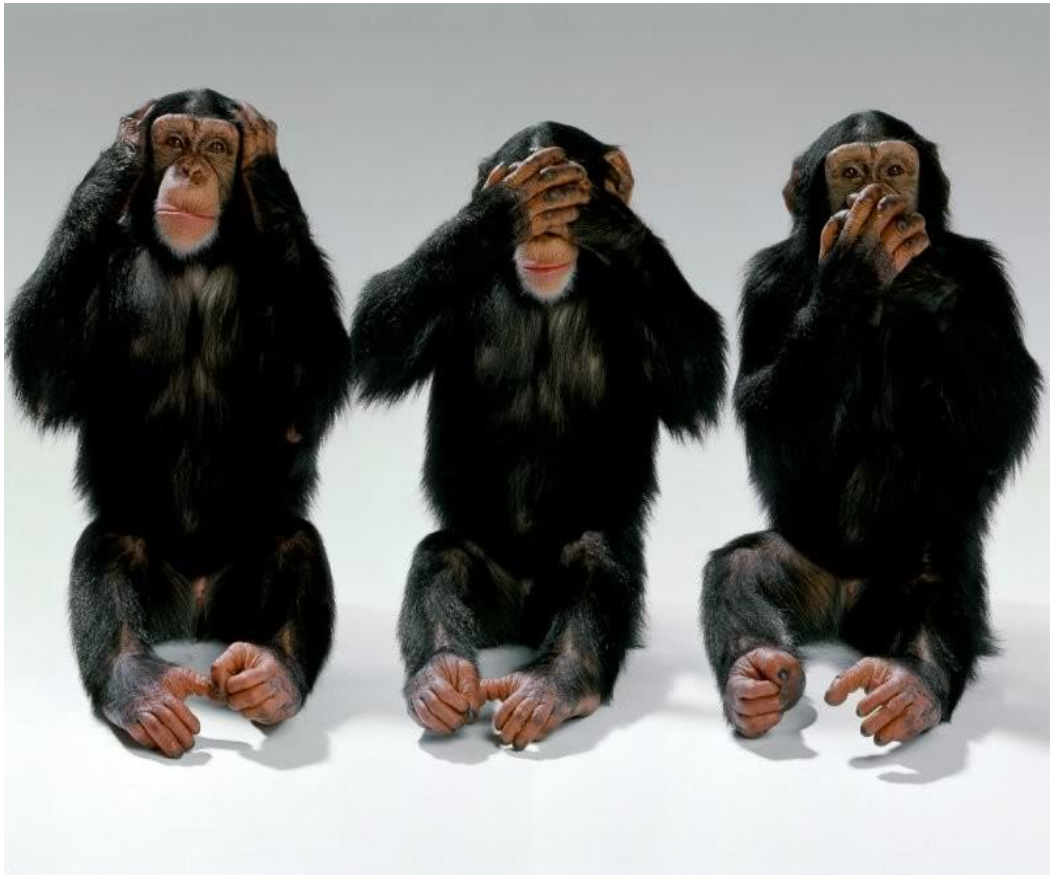
Why Test?

If you don't look for it, you won't find it.

If you don't find it, you don't think you have a problem.

If you don't think you have a problem, you don't do anything about it.

–Bruce Dixon, M.D.
Director, Pittsburgh ACHD



Test to Find Out Where You Stand

- Is your facility in the 50% of buildings with or without *Legionella*?
- Myth – *Legionella* is not everywhere (ubiquitous)
- Healthcare facilities – greater risk?

Test to Find Out Where You Stand

- If you find *Legionella* – was it *Legionella pneumophila*, serogroup 1?
  - Not all *Legionella* have the same risk
  - *L. pneumophila* serogroup 1 has highest risk for disease
  - Directs diagnostic approach

Approaches to Prevention

CDC REACTIVE

- After 1 transplant patient or 2+ cases within 6 months
  - Combined epidemiologic and environmental investigation
  - *Legionella* source identified = decontaminate

PROACTIVE

- Perform environmental surveillance **before cases**
- Perform clinical surveillance to identify unrecognized cases
  - *Legionella* source identified = decontaminate

CDC Changes Position on Testing

"We are not against testing water for the presence of *Legionella*…

We think it has its place, particularly in healthcare facilities."

Cynthia Whitney, MD, Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, CDC. June 8, 2016 Pittsburgh Post Gazette

Approach to Environmental Sampling

- Select a minimum of 10 distal sites (faucets or showers) that roughly represent the water distribution system, plus hot water tanks or recirc. line.

- Include sites on multiple floors and wings, high risk areas like oncology, transplant units, medical surgical units.

Assessing Risk – Potable Water

Risk of Legionnaires' disease was better predicted by the **proportion** of water system sites testing positive for *Legionella* than by the concentration of *Legionella* bacteria.

Kool J L, et al. Infect. Control Hosp. Epid. 1999 20:797-805

Calculate Distal Site Positivity

- Number of outlets positive for *Legionella* of 10 distal sites (faucets or showers) that were tested
- Estimates the probability of a patient "bumping into" *Legionella* (percent positive)
- If >30% risk increases, especially if *L. pneumophila*, serogroup 1 is present (now part of NYS regulation)

What This Means for You

Sampling the water system of a building can give you a meaningful “snapshot” of the colonization status.

How to Test?

- Method of sample collection and processing can dramatically affect the results
  - Cooling towers
  - Potable water – building water distribution systems
    - Hot water primary reservoir

SAMPLE COLLECTION: FIRST DRAW HOT WATER

Do Not Flush Prior to Sample Collection

- No Flush
  - Collect immediately after opening faucet or shower valve
  - Flushing reduces recovery
- If CFU >0.5 log in the sample:
  - Immediate draw 97.7% positive
  - 2 min. flush 69.1% positive

SAMPLE COLLECTION: FROM THE BASIN

You Can’t Tell by Looking

Automated dosing of chemical biocides and clean

>3000 CFU/mL *Legionella pneumophila* serogroup 1

First Method Used to Detect *Legionella*

Legionella Testing According to CDC

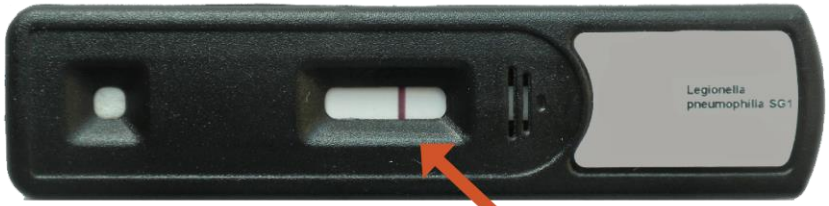
- CDC recommends using a testing method capable of detecting all members of the *Legionella* genus but also one that provides material for typing. At the moment, this means culture.
- Particularly true during an investigation and in the immediate aftermath

Legionella Testing

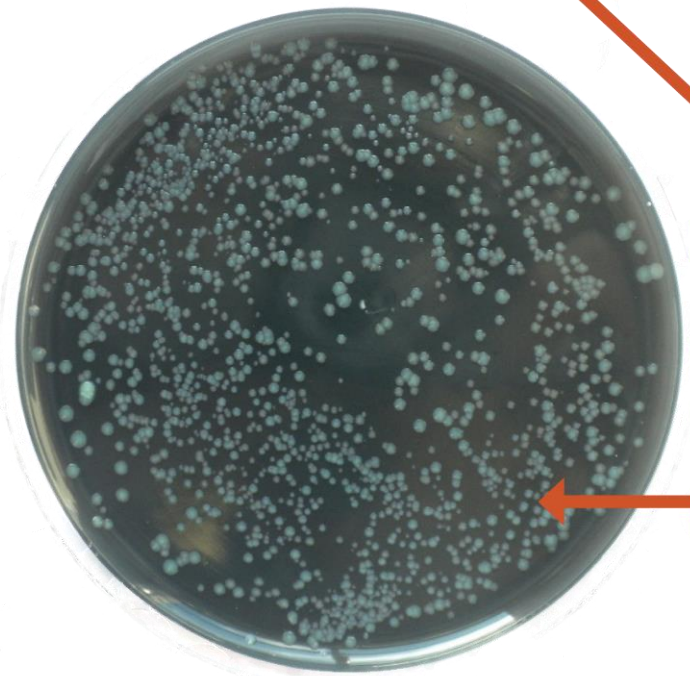
- Culture is more reliable (sensitive & specific) than other “rapid tests”

- New methods/approaches
  - Molecular (qPCR and microarray)
  - Most Probable Number (MPN)

ICT-Type Test: Quick But Inaccurate?



Fails to detect Legionella pneumophila serogroup 1



> 3,000 CFU/ml

Legionella culture succesfully detects *Legionella pneumophila* serogroup 1

Molecular Testing: Quantitative PCR (qPCR)

- Benefits
  - Rapid
  - Genus and species specific probes
  - Good agreement with culture with *Legionella pneumophila* and *L. pneumophila*, serogroup 1 probes
- Limitations
  - Cannot discriminate between live and dead cells
  - Genomic units (GU) do not directly correlate to CFU

MPN (Legiolert)

- Detects *Legionella pneumophila* using substrate reaction.
- Water samples are incubated at 39°C (± 0.5°C) for 7 days.
- Serotyping or species identification requires additional steps.
- Easy-to-use platform, similar to that of Colilert®.

Culture Methods for *Legionella* Testing & Identification:

Did You Know That Labs Differ in Their Methods?

Laboratory Testing

"Apples to apples
or
apples to oranges" ?

Culture Method

- Processing Methods
  - Pretreatment (heat and/or acid)
  - Filtration (yes/no or how much)
  - Culture media (types and how many)
- Identification (ID) Methods
  - Only presumptive agglutination test?
  - Definitive ID with DFA or sequencing for unusual species?

Confirm the Lab Meets These Requirements

- Labs performing testing should be
  - Accredited for microbiology testing, quality (ISO 17025) and for *Legionella* testing as a specific field of testing
  - Not just CDC ELITE certified

2017 *Legionella* ISO Culture Method

INTERNATIONAL STANDARD

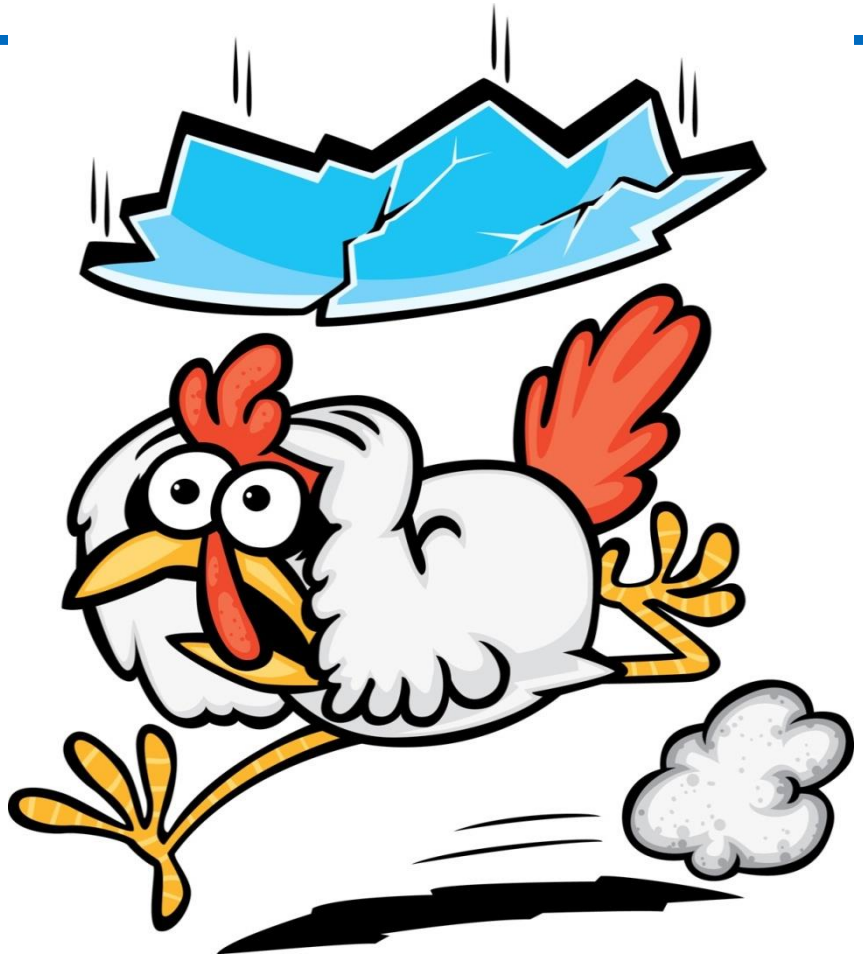
ISO 11731

Second edition
2017-05

Water quality — Enumeration of *Legionella*

Qualité de l'eau — Dénombrement des Legionella

Is the Sky Falling?



If I find some *Legionella*?

Preventing Legionnaires' Disease

- Controlling *Legionella* is about preventing disease—not about reaching zero *Legionella* in water

- Zero cases is the goal

- Zero *Legionella* is not necessary to avoid outbreaks

WATER SAFETY PLAN (RISK MANAGEMENT)

Legionella Water Safety

- Fundamentals of *Legionella* water safety
  - Perform an assessment to understand *Legionella* risk in your facility
  - Implement water safety plan to:
    - Understand the water system
    - Assess risks
    - Control risks
    - Verify and validate *Legionella* control through testing

Legionella Water Safety

- Know who is at risk for Legionnaires' disease in your facility
  - Highest risk: smokers, elderly and immune suppressed
  - But, can affect those with no risk factors

- Identify key players who are responsible for water safety
  - Facility managers, maintenance, occupants, regulators, engineers, water treatment providers, *Legionella* experts, etc.

Legionella Risk

- Know what part of a water system could lead to *Legionella* exposure
  - Highest risk: Hot potable water systems
  - Not all buildings have *Legionella*
  - Risk is a function of
    - susceptibility of occupants
    - extent of colonization or exposure
    - pathogenicity of *Legionella* species

Essential Steps in *Legionella* Water Safety Plan

1. Pre-Assessment information
2. Onsite assessment
3. Baseline data assessment
4. Create water system flow diagrams
5. Water safety plan implementation

Evidenced-Based Plans

- Facility and occupant risk
- Field assessment data
- *Legionella* culture results
- Peer-reviewed literature
- Standards and guidelines

Final Thoughts

- Legionnaires' disease and *Legionella* bacteria contamination can occur in old and new buildings and during renovation

- Risk can be managed:
  - Assessment and water safety plans
  - Think *Legionella,* particularly in healthcare facilities (CMS)
  - Test for *Legionella* before cases occur

New Responsibilities (Liabilities?)

With Compliance Comes More Protection

Compliance with new standards (ASHRAE) and regulations (CMS & NYS) will provide a compelling defense against claims of negligence.

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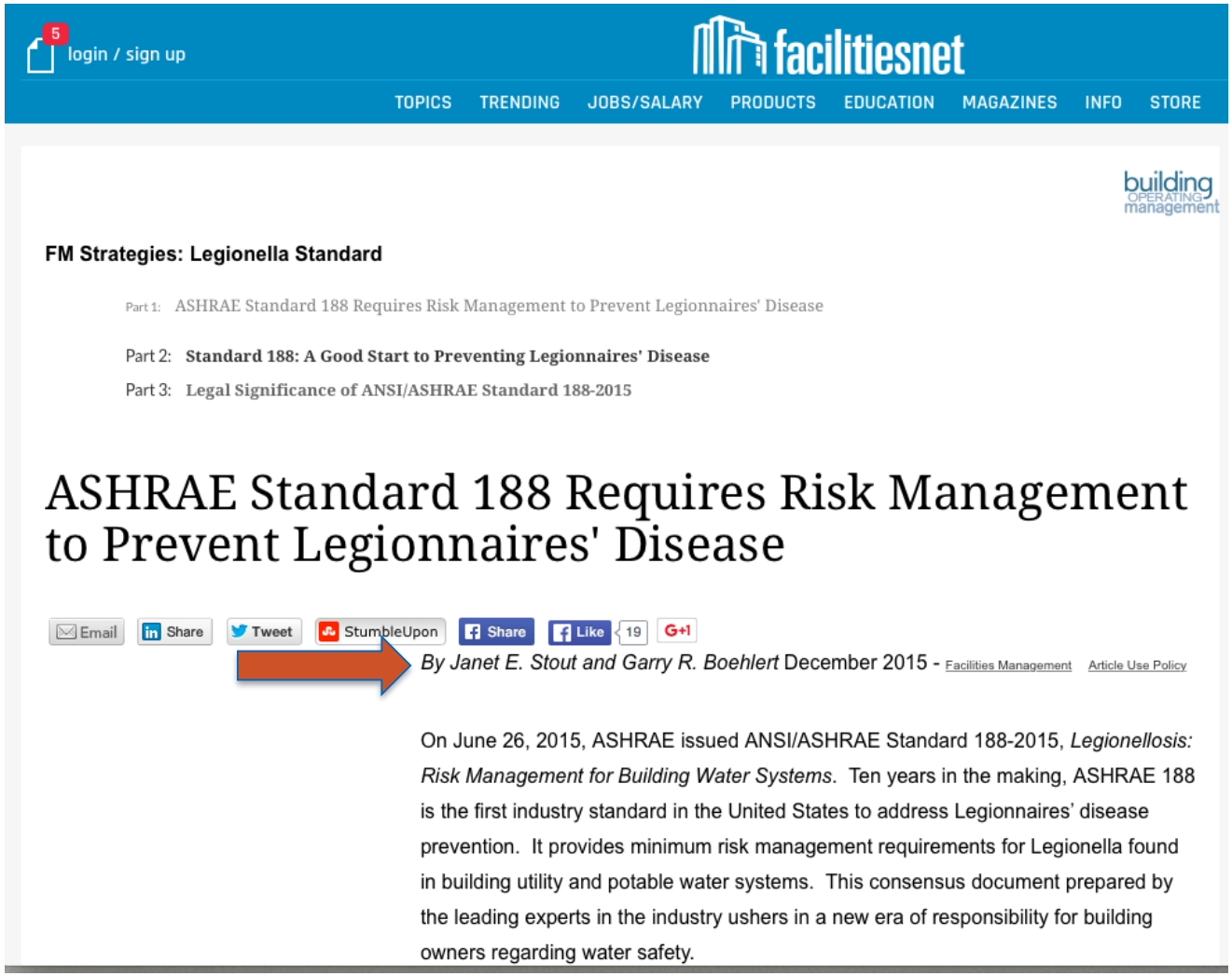
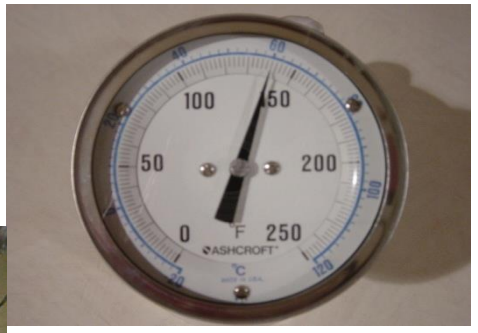
Building Operating Management (Facilitiesnet.com) ASHRAE 188



Water Safety Plans

- Once you have a plan, follow it!

- Compliance is measured by:
  - ASHRAE 188 Elements
  - CDC Tool Kit
  - How your plan meets or exceeds compliance requirements
  - Whether you have followed your plan



Hospitals are often required to perform a supplemental disinfection of their water systems to protect individuals from hospital-acquired Legionnaires' disease. The authors of this article recently studied one hospital where three cases of hospital-acquired Legionnaires' disease were detected in less than two years. These cases were linked to *Legionella* colonization of the hospital's water system. Chlorine dioxide (ClO_2) was considered a cost-effective approach to disinfection given that ClO_2 generators could treat the 23 buildings comprising the hospital complex from one central location. The authors evaluated the efficacy of maintaining a residual of 0.5 to 0.8 mg/L of ClO_2 for *Legionella* control in the secondary distribution system of this 437-bed hospital over a two-year period. Monthly monitoring showed mean *Legionella* positivity at hot water outlets and cold building source water areas decreased from 23 to 12% and 9 to 0%, respectively ($p < 0.05$). ClO_2 residuals decreased with increasing distance from the application point and temperature. Mean ClO_2 concentrations were lowest in hot water outlets (0.08 mg/L) followed by cold water outlets (0.33 mg/L) and reservoirs (0.68 mg/L). Complete eradication (0% positivity) of *Legionella* was achieved after 1.75 years, and no cases of Legionnaires' disease were reported during this time.

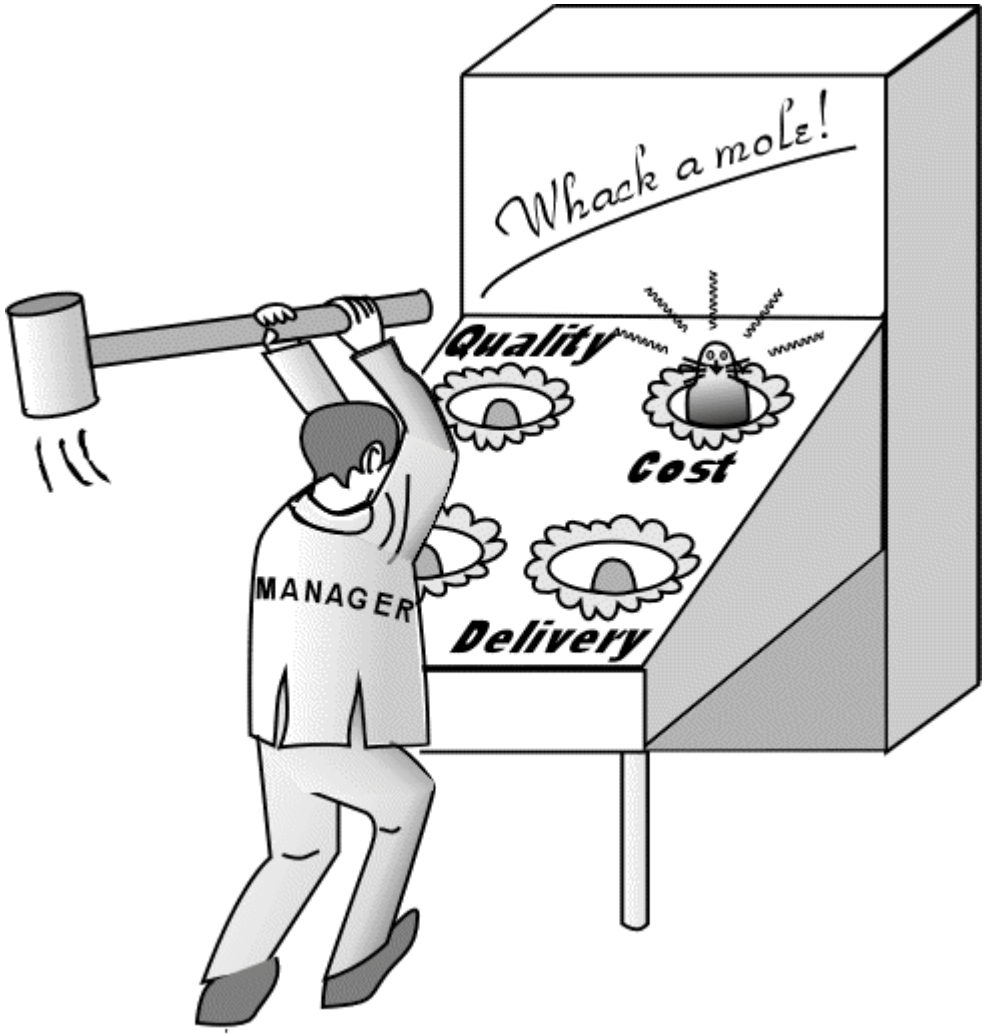
keeping
Legionella
out of water systems

DISINFECTION OPTIONS (AKA REMEDIATION)

Secondary Disinfection Methods

- Thermal shock treatment (heat & flush)
- Shock chlorination (>10 mg/L residual), may require water tanks to be 20-50 mg/L
- Continuous supplemental chlorination (2-4 mg/L)
- Copper-silver ionization (continuous)
- Chlorine Dioxide (ClO2)
- Monochloramine
- Point-of-use filtration

Short-Term Disinfection Is Whack-a-Mole



Our Review In Journal of AWWA 2014

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FRANK P. SIDARI III, JANET E. STOUT, SCOTT DUDA, DOUG GRUBB, AND ALAN NEUNER

Maintaining *Legionella* control in building water systems

THIS ARTICLE REVIEWS HOW *LEGIONELLA* AND OTHER WATERBORNE PATHOGENS CAN PRESENT A RISK TO CONSUMERS OF POTABLE WATER. SECONDARY

Legionella and other waterborne pathogens can present a risk to consumers of potable water. In particular, building hot water systems have been established as the primary reservoir for bacteria linked to cases of Legionnaires' disease (LD). These systems provide ideal conditions for *Legionella* proliferation because of their elevated temperature and lack of disinfection residual. Control of *Legionella* in potable water systems has become a focus for health care facilities because they serve a population that is particularly susceptible to LD from underlying health conditions, such as suppressed immune systems. In

Journal Am Water Works Assoc 2014; 106(10): 24-32

Interested in Learning More?

Dr. Janet E. Stout podcast: *Legionella*
for Water Treatment Professionals

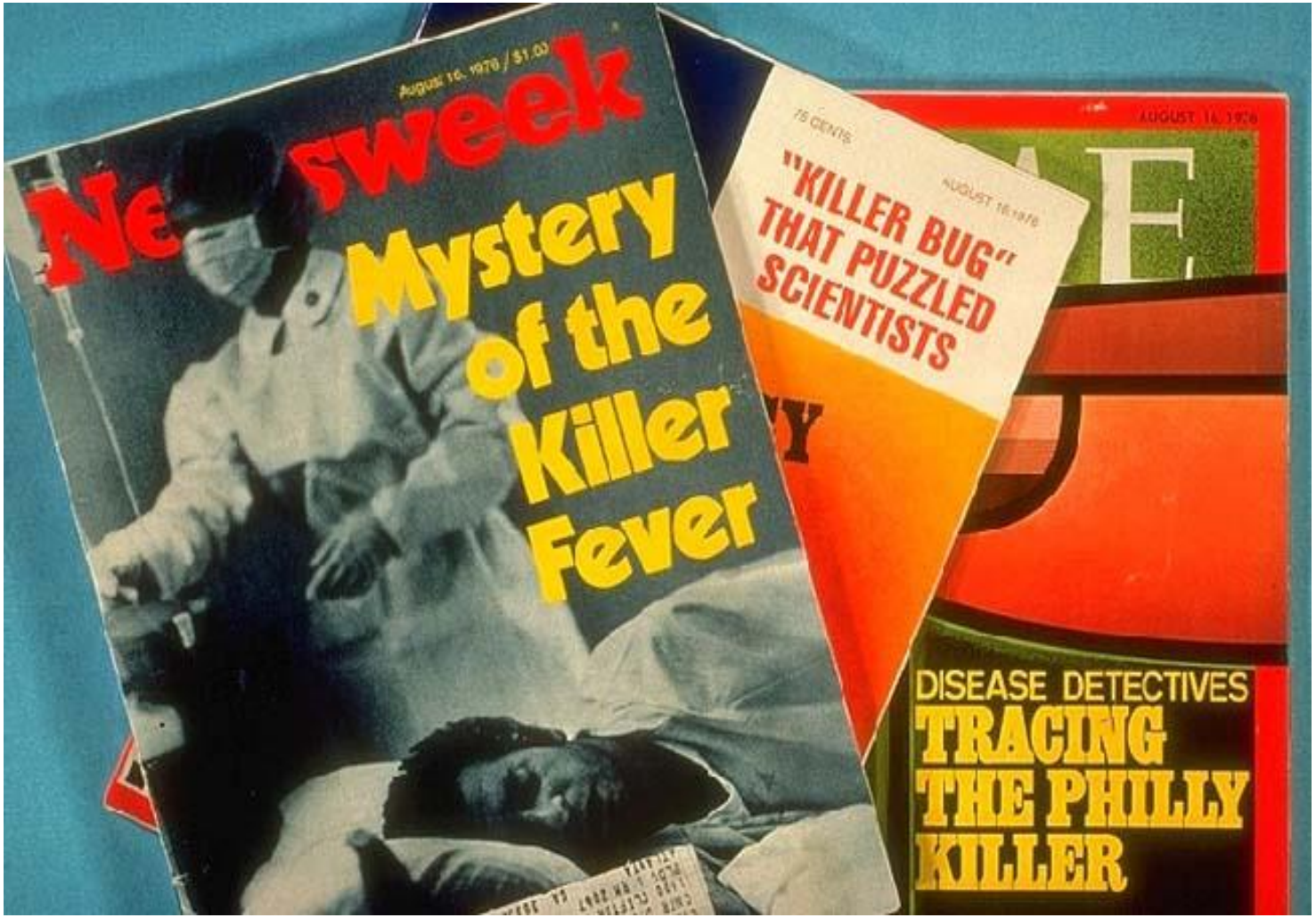
http://scalinguph2o.com

How are we doing?

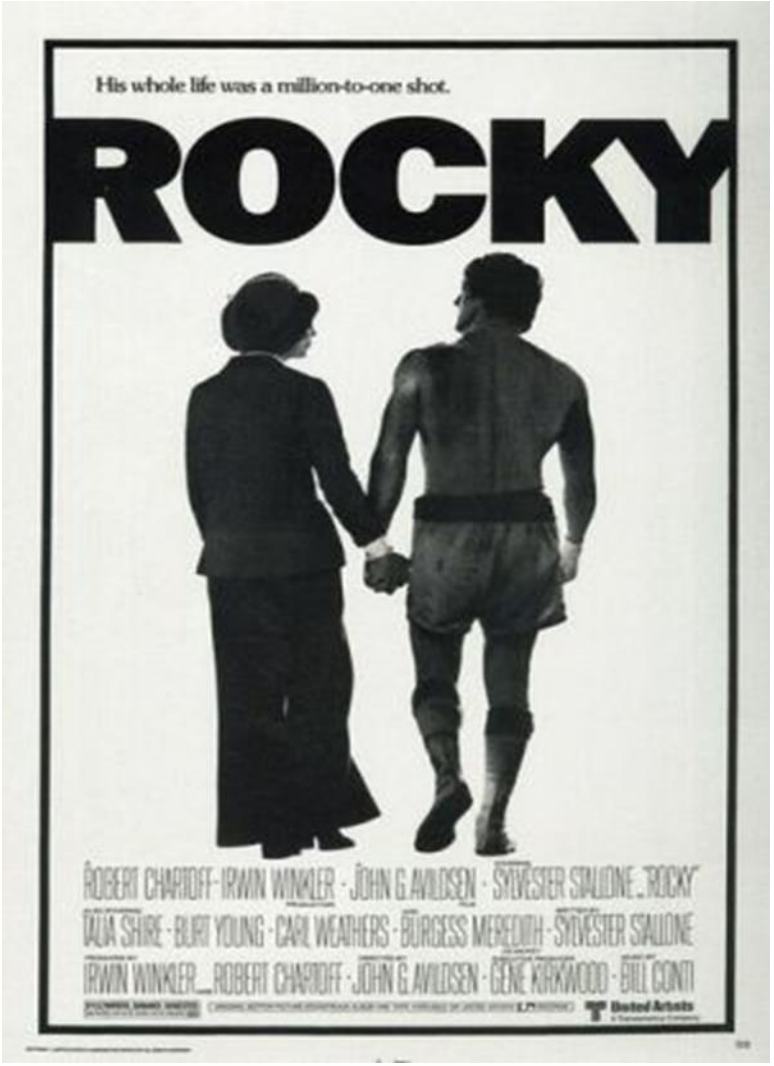
PREVENTING LEGIONNAIRES' DISEASE

Progress Has Been Slow… Really Slow!

Celebrating More Than 40 Years of Making Headlines



Things That Happened in 1976 in Philadelphia



40 years is a long time!

Our Mission:
End Legionnaires' Disease

- No one should die from a preventable disease caused by a bacteria in water.
- Legionnaires' disease can and should be prevented.

Let’s End LD Together

SPECIAL PATHOGENS LABORATORY®
THE LEGIONELLA EXPERTS®

THANK YOU

Dr. Janet E. Stout

President, Microbiologist

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