Cleveland Clinic

Legionella Risk Management in Healthcare Facilities: New Developments

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benvenuto
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recoger
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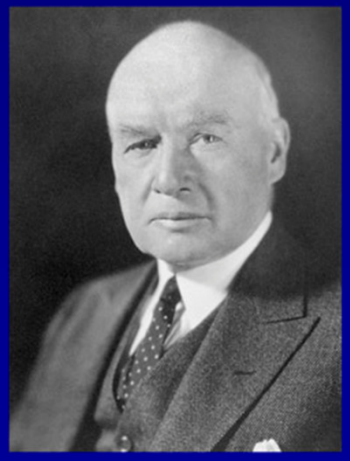
Clinic Building 1921

CCHS Mission

Dr. Frank E. Bunts

Dr. George W. Crile



Dr. William E. Lower

Dr. John Phillips

- Care for the sick
- Investigate their problems
- Educate those who serve

Cleveland Clinic: Who we are

6.6m outpatient visits, 229,000 admissions, and 208,800 surgical cases annually

1,400 hospital beds and 100 operating rooms

1,900 residents and fellows in training

1,800 allied health student rotations

1,700 participants in continuing med education

$251m in total grant / research contracts

135 lab principle investigators

Strong Reputation for Quality and Innovation

Leader in US News & World Rankings:

- #2 hospital overall
- #1 in heart for 21 consecutive years
- 12 other specialties rank in top 10

Patients travel from 170 countries

75 spin off companies since 2000

Over 700 patents

http://my.clevelandclinic.org/us_news_rankings
http://innovations.clevelandclinic.org/About-Us/Innovations-Team.aspx#.VpKITrYrK_4
http://my.clevelandclinic.org/patients-visitors/international/why-choose-us

Impact on Our Communities

Cleveland Clinic Ohio

- ✓ $12.4b economic output[1]
- ✓ 93,000 jobs
- ✓ 68,000 households supported
- ✓ $191m in visitor spending

Cleveland Clinic Weston (Florida)

- ✓ $783m economic output
- ✓ 5,300 jobs
- ✓ 4,100 households supported
- ✓ $2.2m in visitor spending

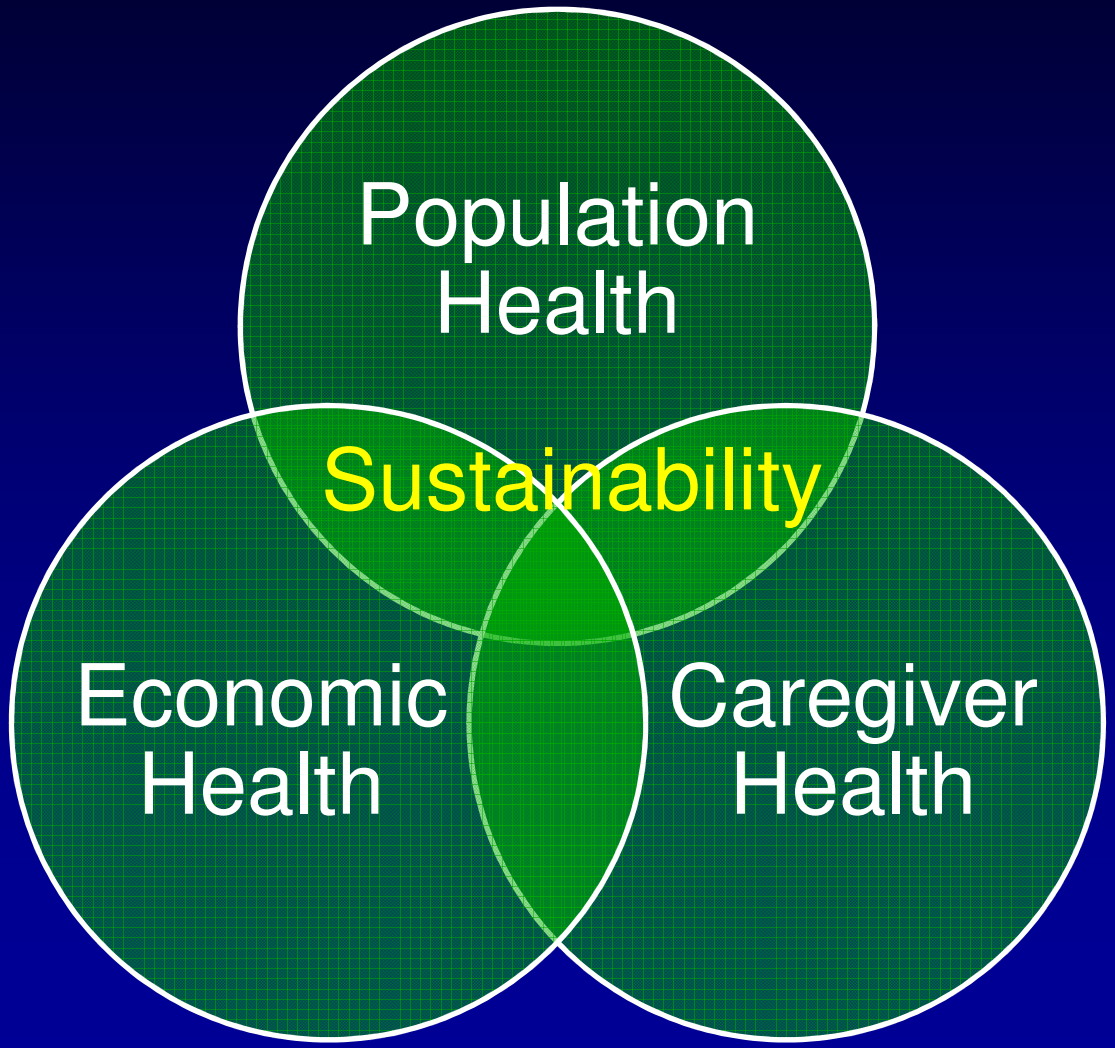
1. Regional total economic output attributed to CC
http://my.clevelandclinic.org/ccf/media/Files/About-Cleveland-Clinic/economic-impact-report/economic-impact-report-2015-Ohio.pdf?la=en
http://my.clevelandclinic.org/ccf/media/Files/About-Cleveland-Clinic/economic-impact-report/economic-impact-report-2015-Florida.pdf?la=en

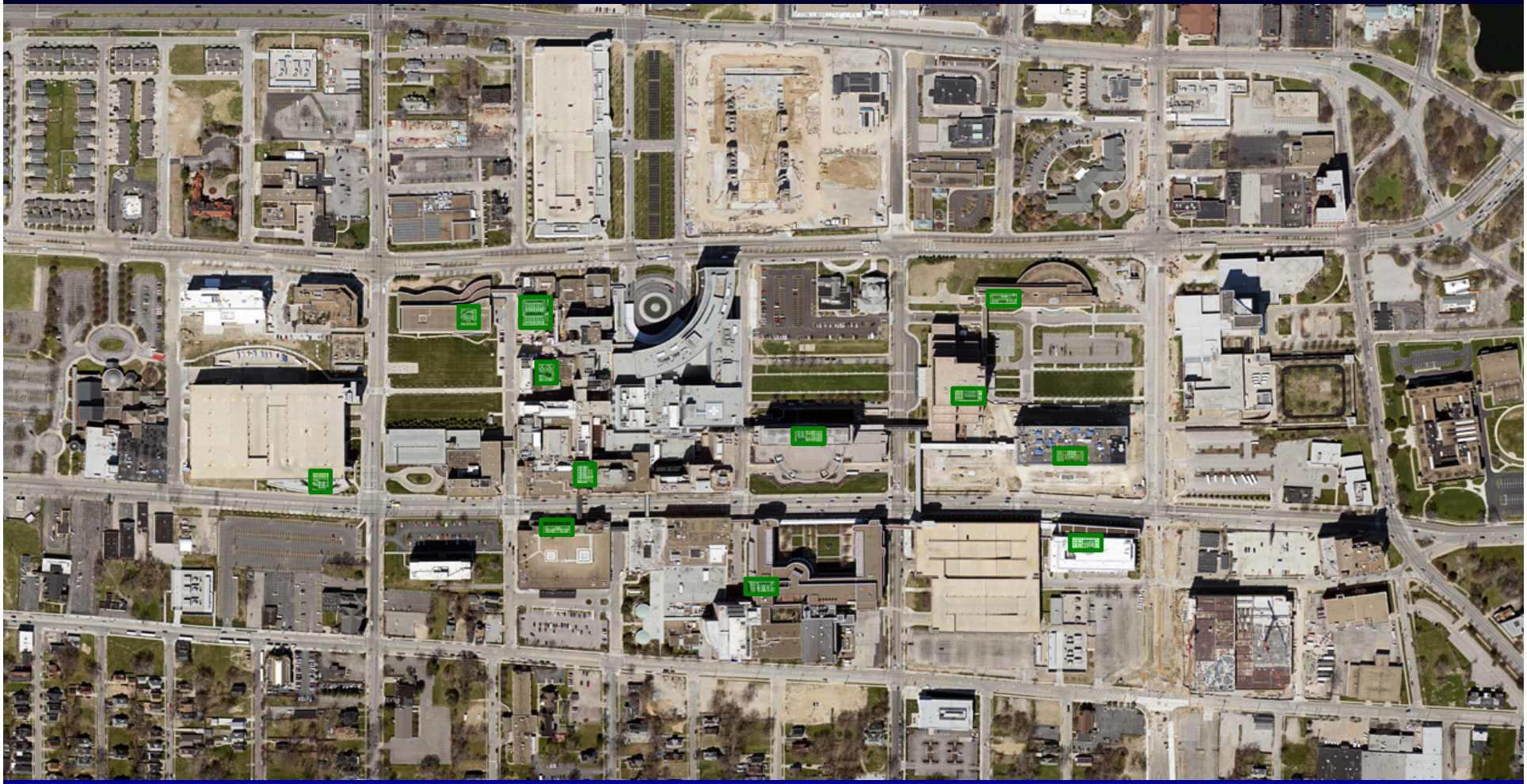

Cleveland Clinic
Sydell & Arnold Miller Family Pavilion
Euclid
E 93 St
BUS ONLY

Our Existing International Footprint

Cleveland Clinic
North East Ohio

Sustainability = Triple Bottom Line





Today's Topics

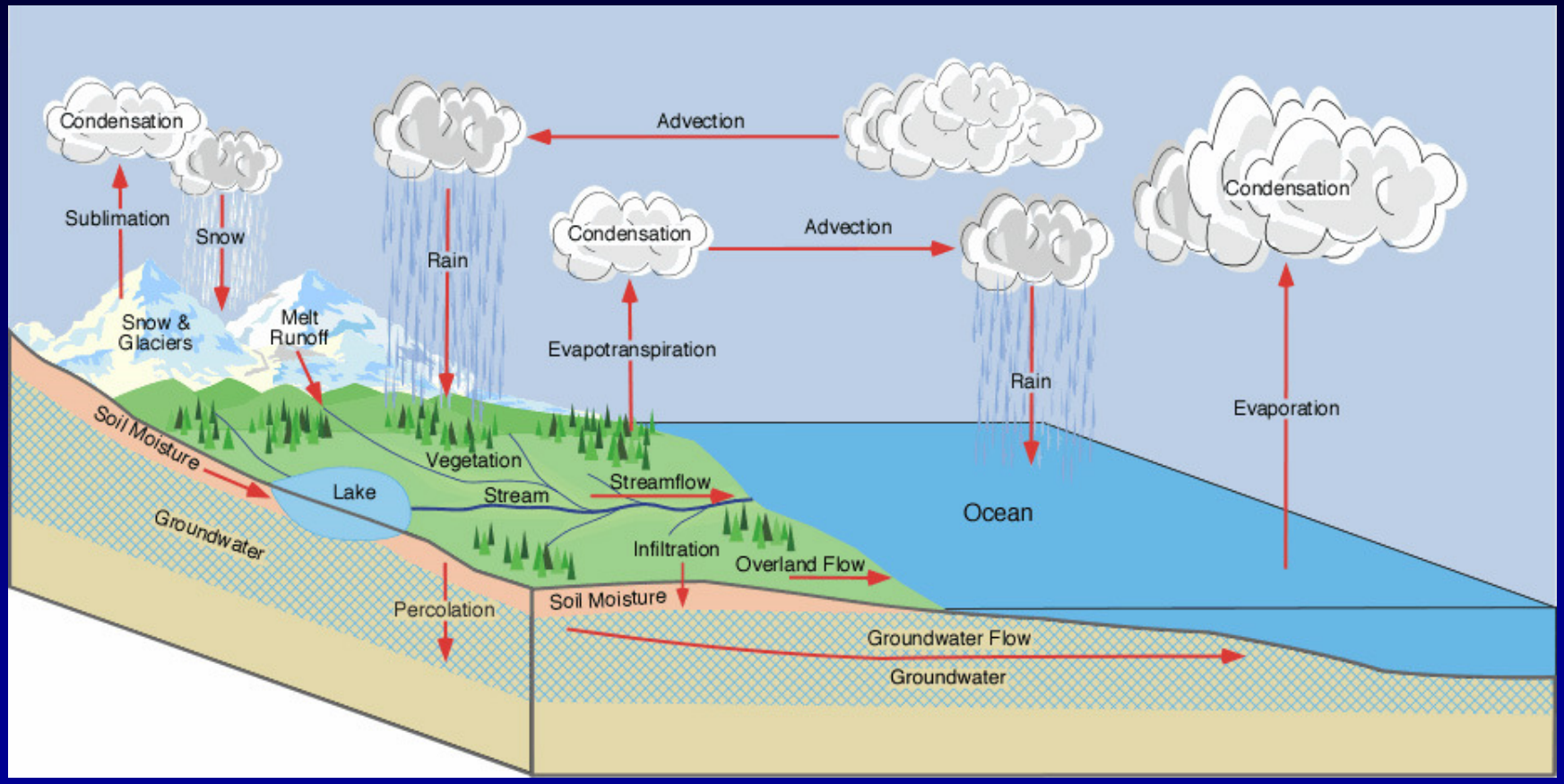
- Regulatory Developments
- Legionella 101
- ASHRAE Standard 188
- Cooling Tower Best Practices

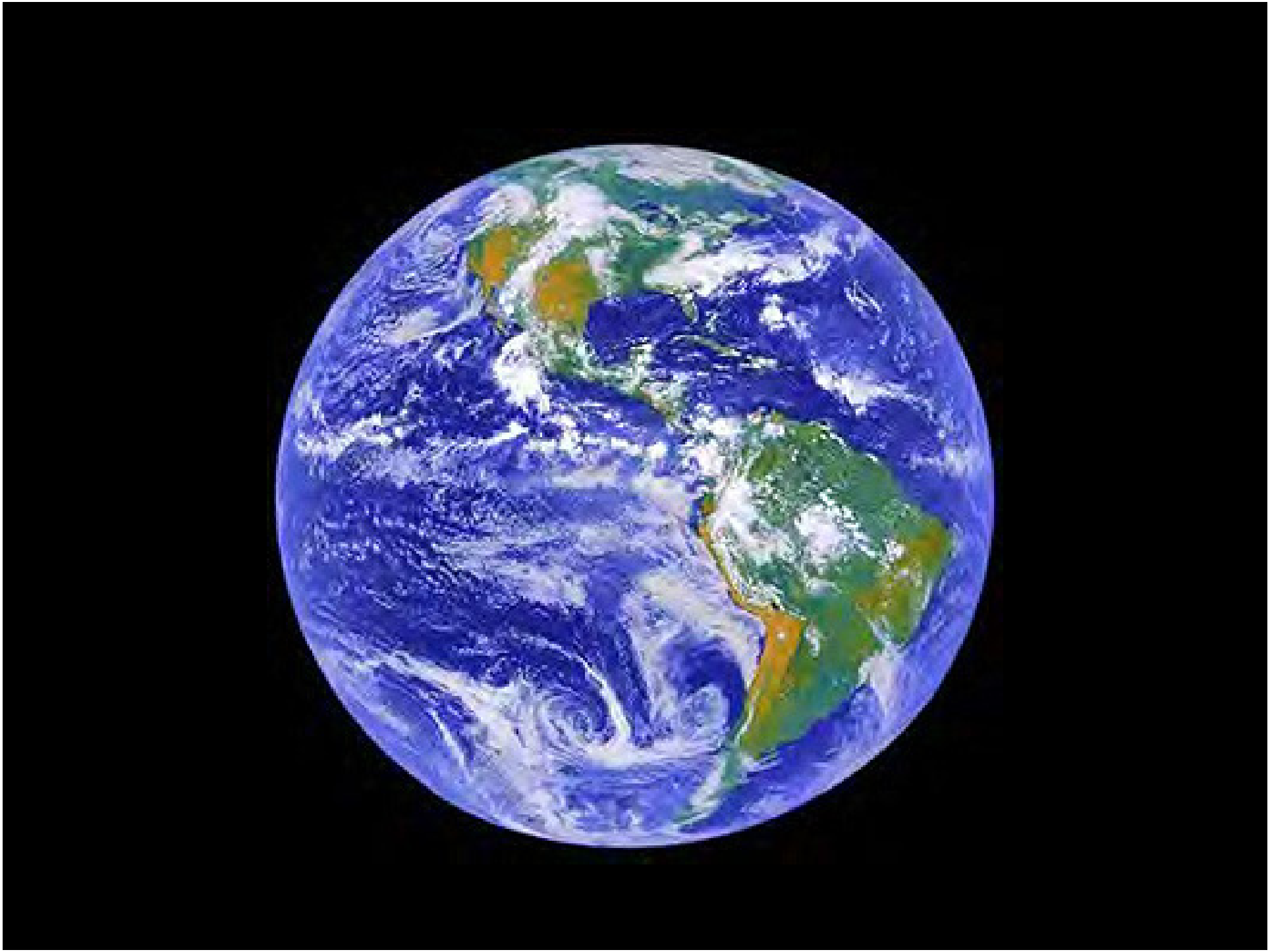
Who is Chem-Aqua?

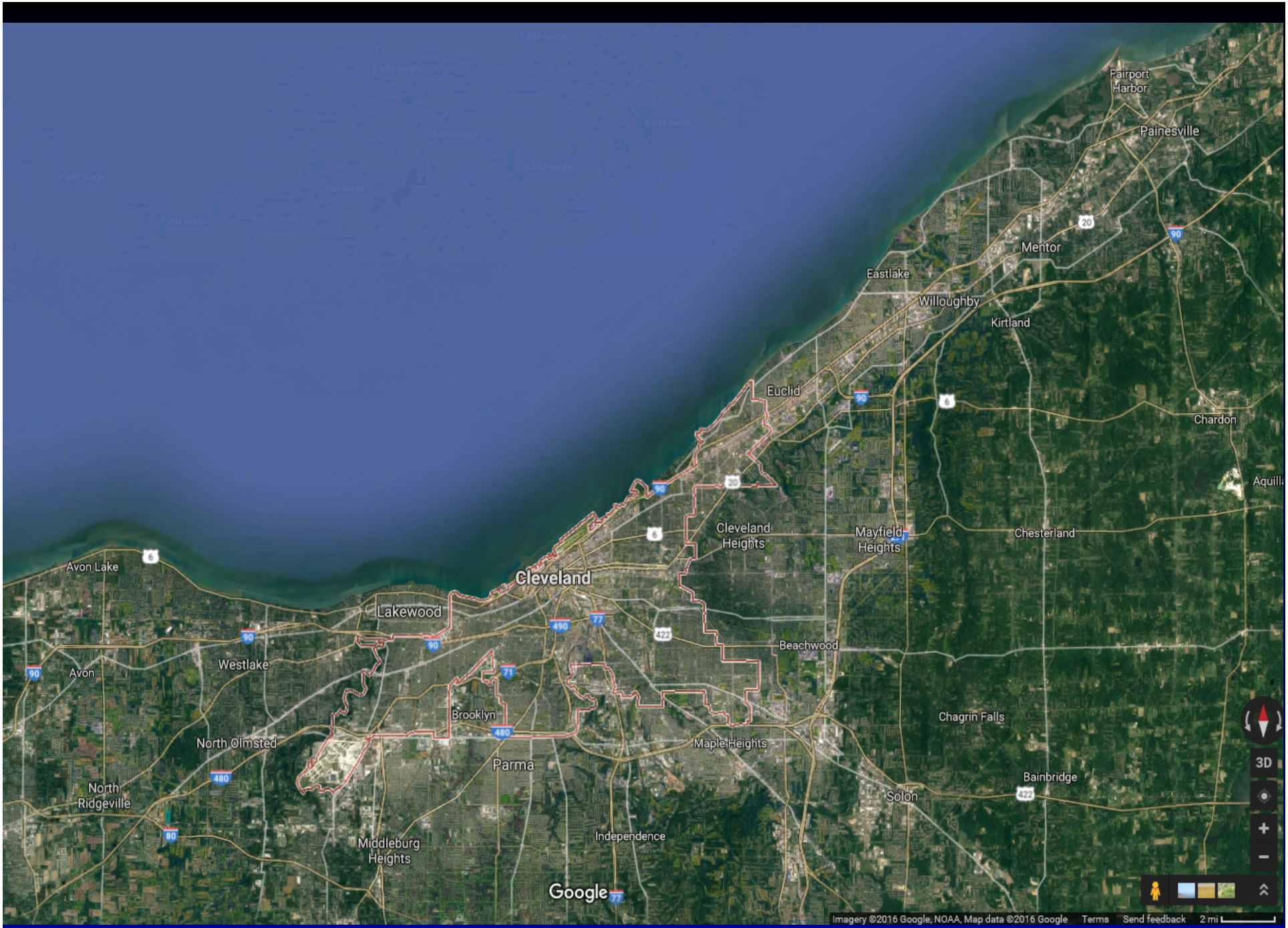
- International Water Treatment Company
- Over 400 Field Representatives and Technicians in US and Canada
- Full range of products, equipment, and services available to meet client needs
- Choice for over 1500 hospitals!
- We understand the importance of properly treated water in healthcare facilities!
- Broad Legionella risk management experience and capabilities

World Headquarters
(Irving, Texas)

The Hydrologic Cycle






Fairport Harbor
Painesville
Mentor
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Kirtland
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Cleveland Heights
Mayfield Heights
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Beachwood
Westlake
Avon
Brooklyn
Chagrin Falls
North Olmsted
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Parma
Bainbridge
North Ridgeville
Solon
Middleburg Heights
Independence
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A World Full of Water

- As a sphere, all the water on earth would be 860 miles in diameter!
- 369,840,873,301,410,000,000 gal
- 97.5% of that amount is salt water

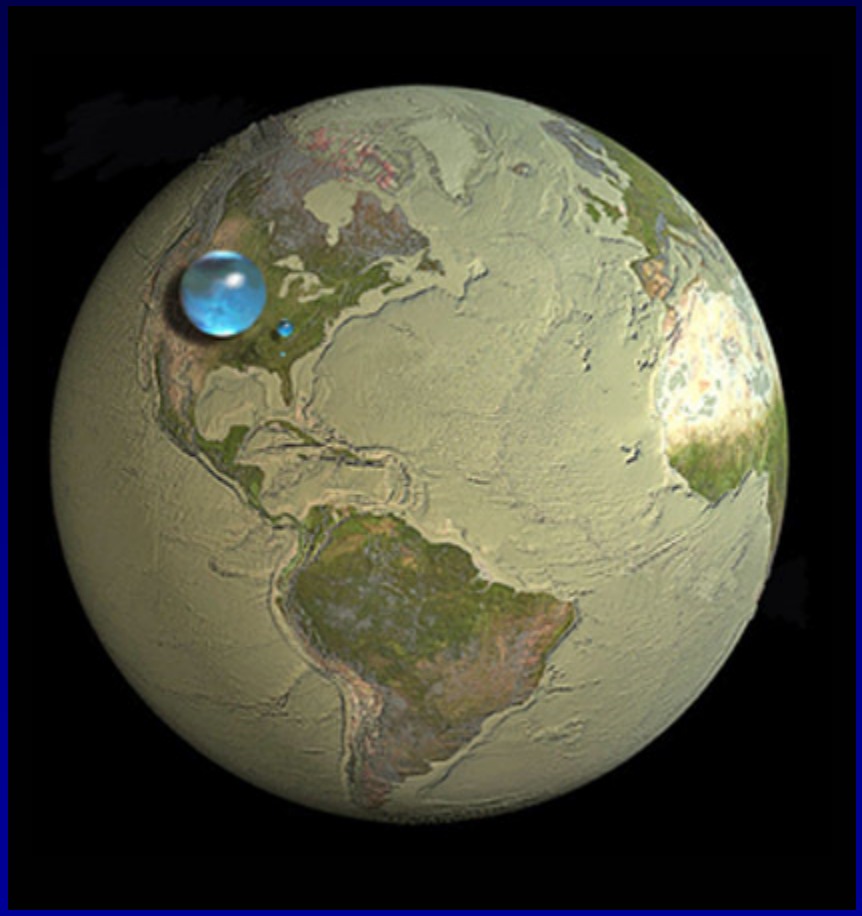
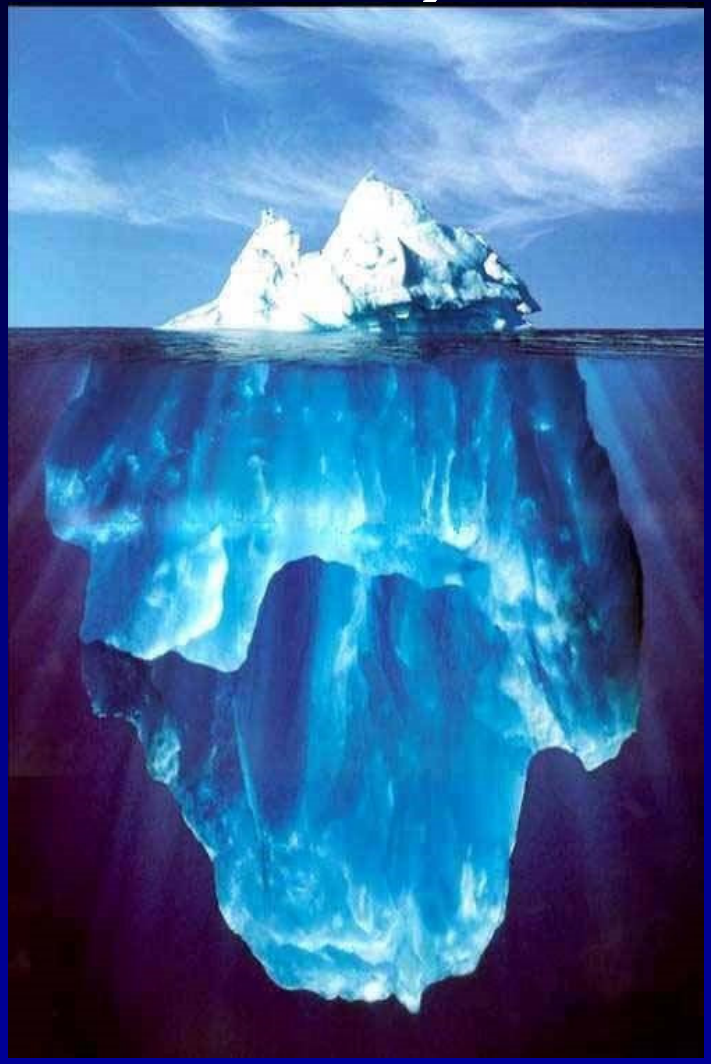


Illustration Credit & Copyright: Jack Cook, Howard Perlman

Water, water everywhere?



- Total amount of freshwater on earth = (2.5% of total) 9,246,000,000,000,000,000 gal
- However, 69% of the world's freshwater is tied up as permanent ice or snow (6 quintillion gallons)

Water, water everywhere?

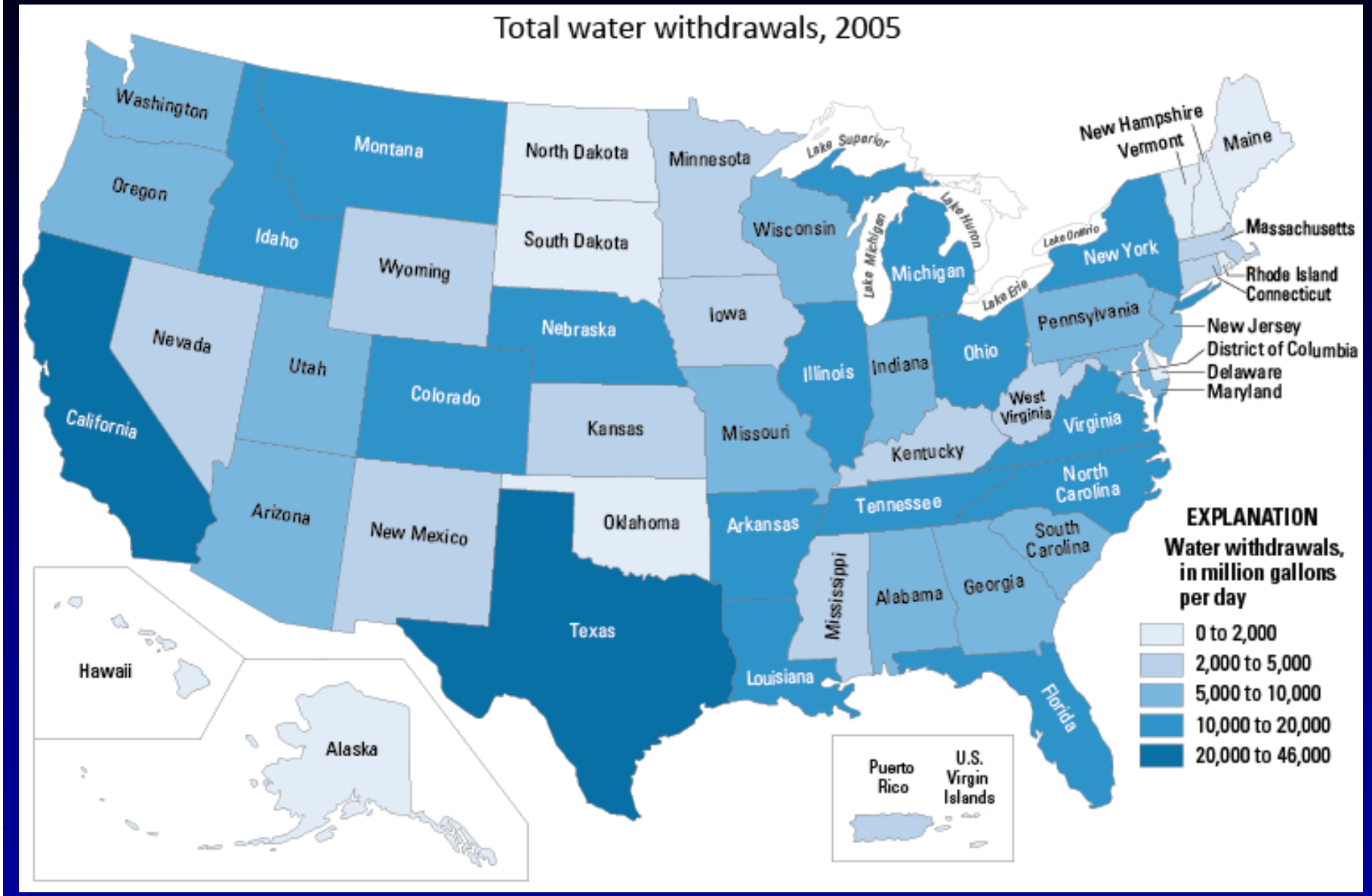
- 30% of the fresh water is stored underground (this represents 97% of the USABLE freshwater) 3 quintillion gallons

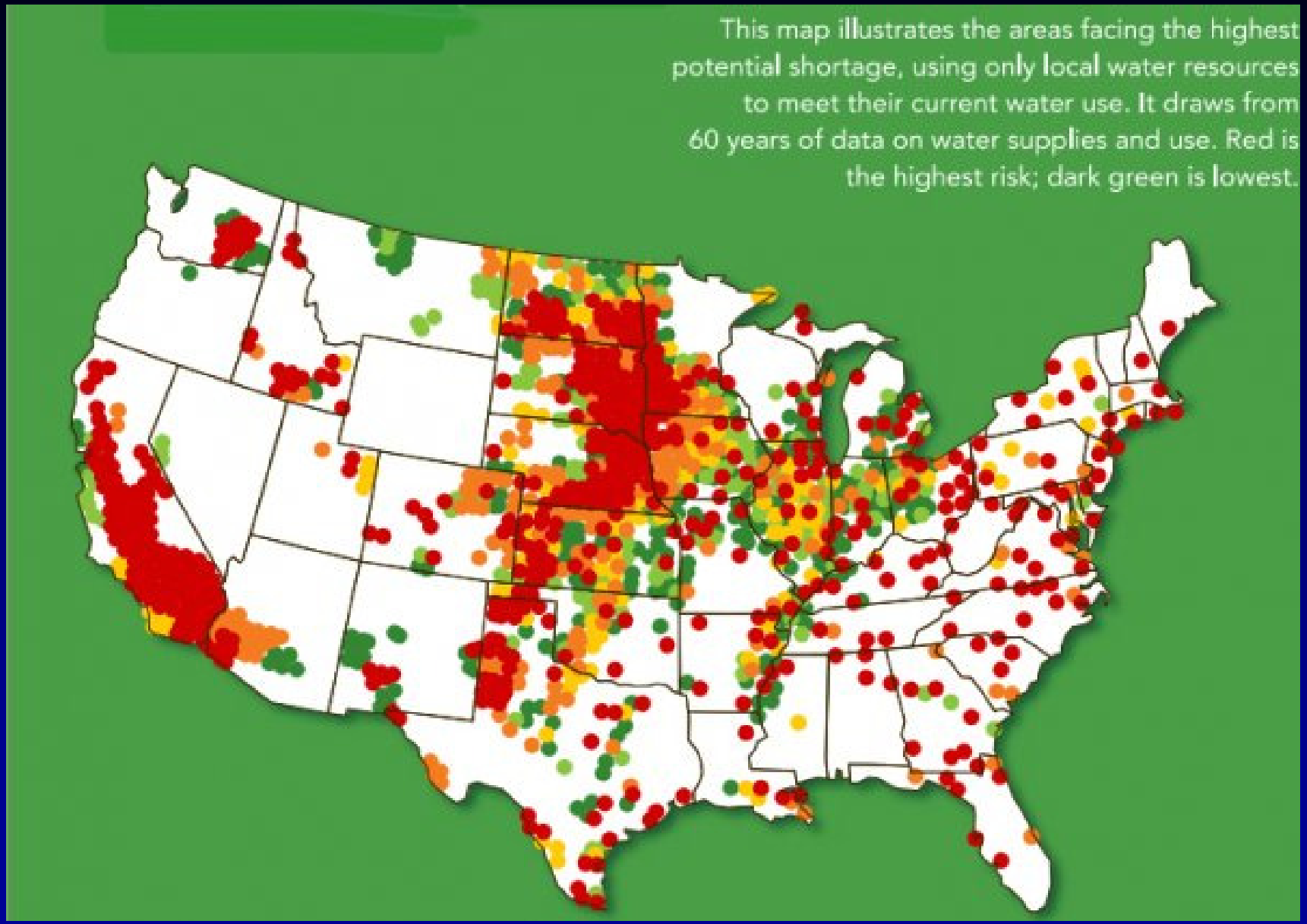
- Only 0.3% of freshwater is found at the surface (lakes and rivers)…that is 28 quadrillion gallons

But not a drop to drink!

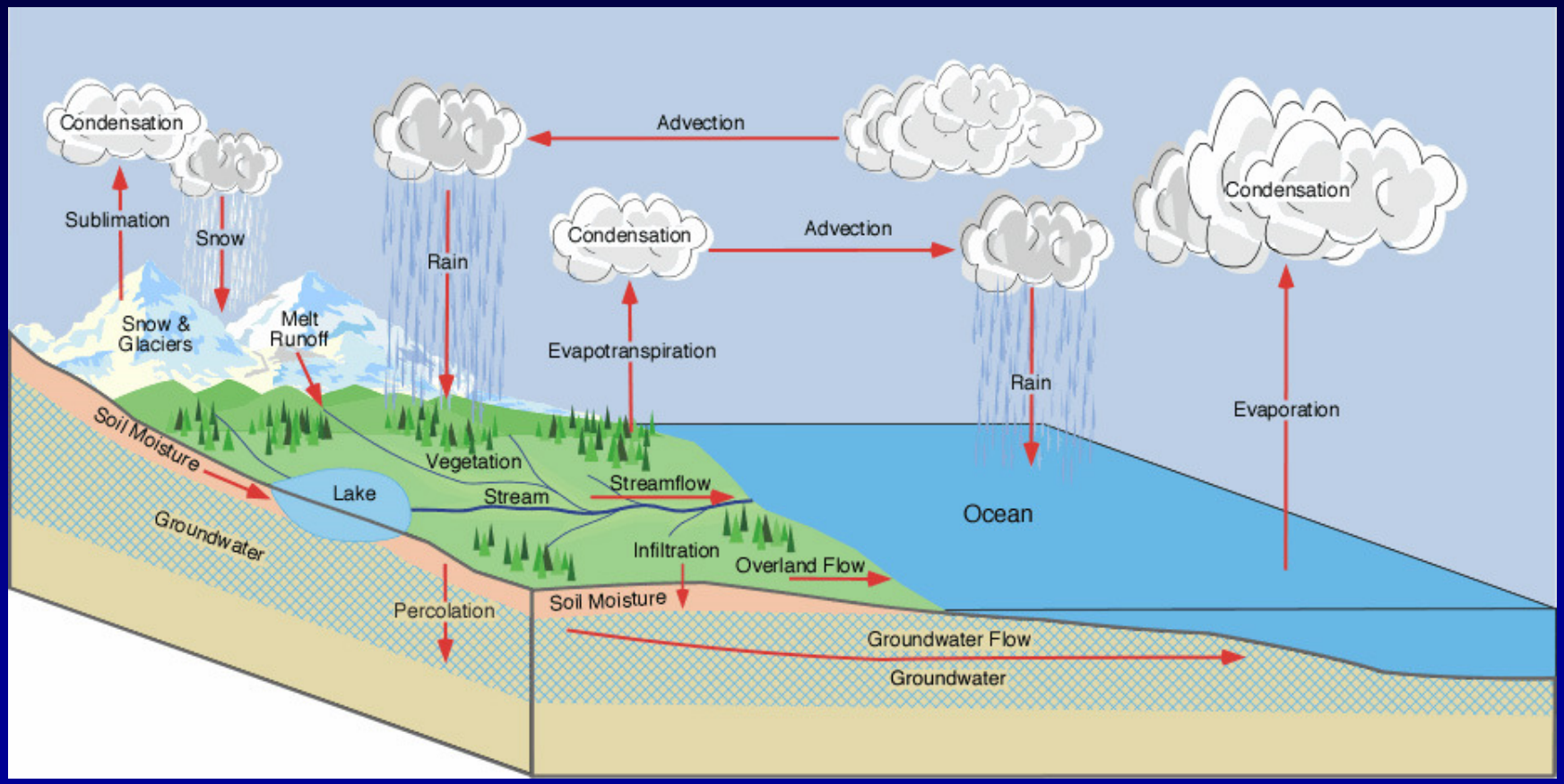
- **Only 0.6% of all freshwater on earth is usable for humans and ecosystems (that's 0.014% of all water on earth)**

- All statistics compiled from United Nations Environment Programme


Total water withdrawals, 2005
Washington
Oregon
California
Nevada
Idaho
Montana
Wyoming
Utah
Arizona
Colorado
New Mexico
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
Minnesota
Iowa
Missouri
Arkansas
Louisiana
Wisconsin
Illinois
Michigan
Indiana
Ohio
Kentucky
Tennessee
Mississippi
Alabama
Georgia
Florida
South Carolina
North Carolina
Virginia
West Virginia
Pennsylvania
New York
Maryland
Delaware
New Jersey
Connecticut
Rhode Island
Massachusetts
Vermont
New Hampshire
Maine
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Hawaii
Alaska
Puerto Rico
U.S. Virgin Islands
EXPLANATION
Water withdrawals, in million gallons per day
0 to 2,000
2,000 to 5,000
5,000 to 10,000
10,000 to 20,000
20,000 to 46,000


This map illustrates the areas facing the highest potential shortage, using only local water resources to meet their current water use. It draws from 60 years of data on water supplies and use. Red is the highest risk; dark green is lowest.

The Hydrologic Cycle



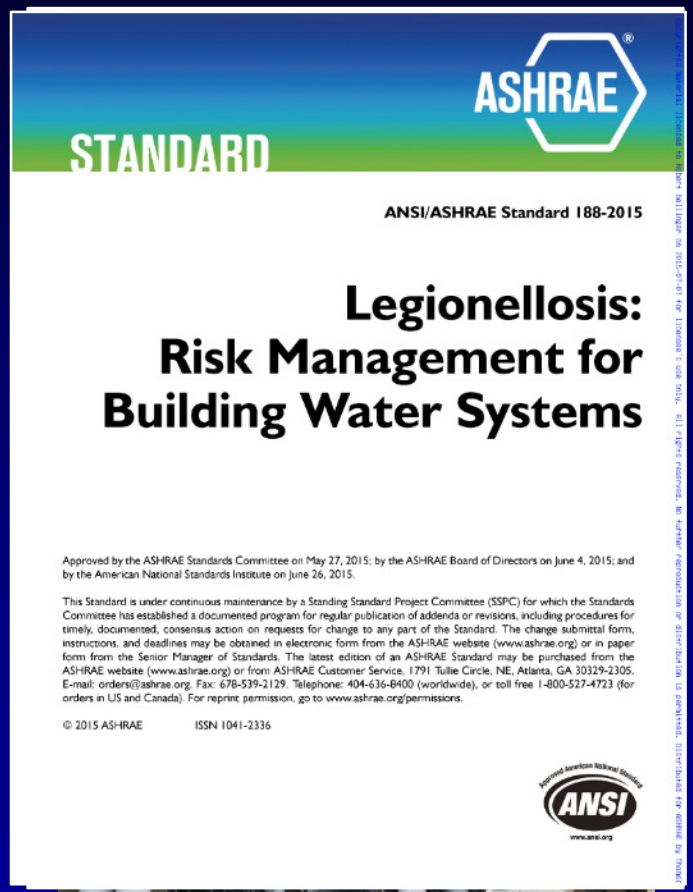
Healthcare Facilities

- High profile
- Complex building water systems
- Redundant utility systems
- Immunocompromised occupants
- Waterborne pathogens
  - Pseudomonas aeruginosa
  - Acinetobacter species
  - Legionella

REGULATORY DEVELOPMENTS

What's Driving The New Concerns?

- ASHRAE 188-2015
  - Finally adopted June 2015
- Major Outbreak in New York City
  - South Bronx, NY
  - Over 130 cases LD with 16 fatalities
  - Attributed to single cooling tower
- Legislation
  - New York City and New York State now regulating cooling towers
  - Civil and criminal penalties



New York Legionella Regulations

In both NY State and City regulations, Owners must:

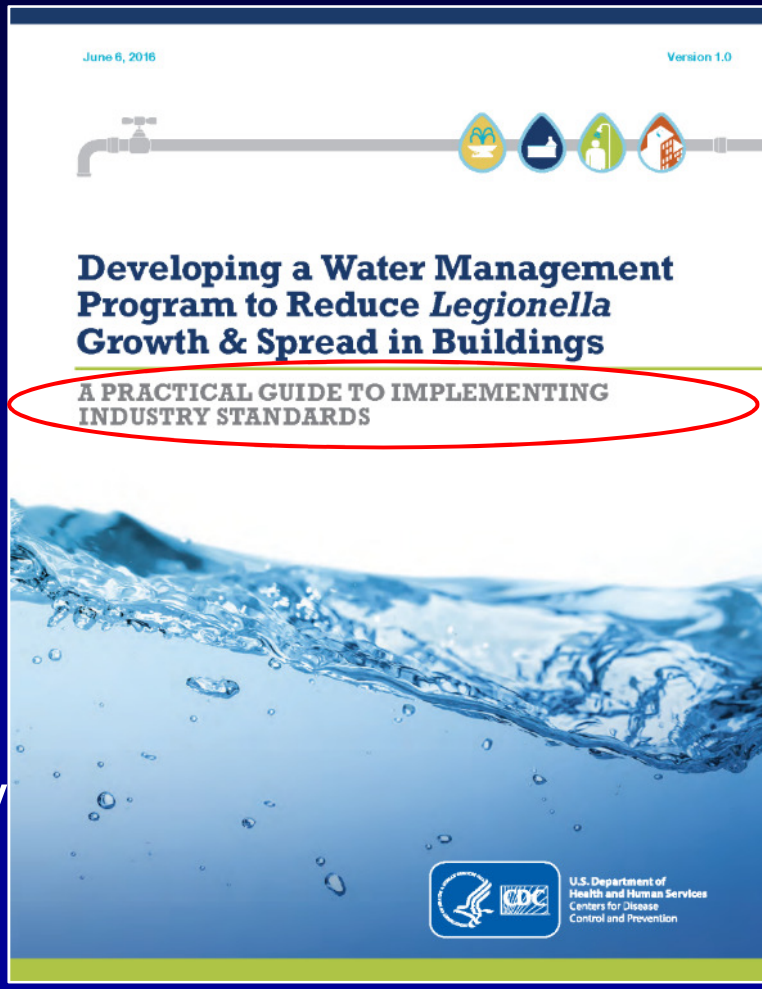
- Register all cooling towers
- Document all cooling towers have been inspected, tested, cleaned and disinfected according to the regulations
  - Reports/Certification documents must be available on site
- Obtain and implement a Cooling Tower Maintenance Plan in accordance with section 7.2 of ASHRAE 188-2015
- Annual certification verifying inspection, testing, cleaning, and disinfection requirements met and Maintenance Plan implemented (Nov 1, 2016)
- Healthcare facilities must develop and implement a Legionella Sampling Plan for potable water systems

New CDC Guideline Document

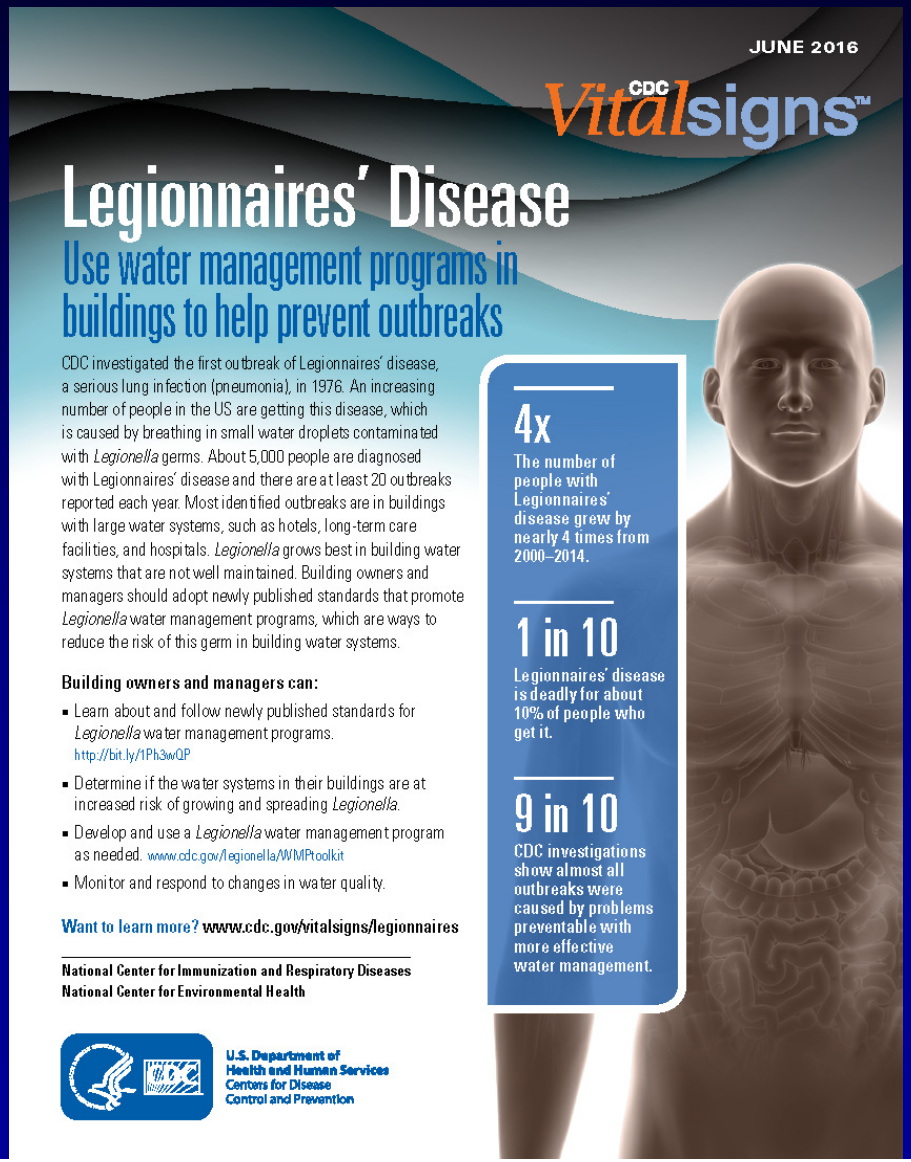
- Developing a Water Management Program (WMP) to Reduce Legionella Growth and Spread in Buildings
  - Released June 7, 2016
  - Specifically references following ASHRAE Standard 188-2015

"Legionella water management programs are now an industry standard for large buildings in the United States …"

- Media campaign launched same day
- We're receiving inquiries from informed customers



CDC Fact Sheet



JUNE 2016

CDC Vitalsigns™

Legionnaires' Disease

Use water management programs in buildings to help prevent outbreaks

CDC investigated the first outbreak of Legionnaires' disease, a serious lung infection (pneumonia), in 1976. An increasing number of people in the US are getting this disease, which is caused by breathing in small water droplets contaminated with *Legionella* germs. About 5,000 people are diagnosed with Legionnaires' disease and there are at least 20 outbreaks reported each year. Most identified outbreaks are in buildings with large water systems, such as hotels, long-term care facilities, and hospitals. *Legionella* grows best in building water systems that are not well maintained. Building owners and managers should adopt newly published standards that promote *Legionella* water management programs, which are ways to reduce the risk of this germ in building water systems.

Building owners and managers can:

- Learn about and follow newly published standards for *Legionella* water management programs. http://bit.ly/1Ph3wQP
- Determine if the water systems in their buildings are at increased risk of growing and spreading *Legionella*.
- Develop and use a *Legionella* water management program as needed. www.cdc.gov/legionella/WMPtoolkit
- Monitor and respond to changes in water quality.

Want to learn more? www.cdc.gov/vitalsigns/legionnaires

4x
The number of people with Legionnaires' disease grew by nearly 4 times from 2000–2014.

1 in 10
Legionnaires' disease is deadly for about 10% of people who get it.

9 in 10
CDC investigations show almost all outbreaks were caused by problems preventable with more effective water management.

National Center for Immunization and Respiratory Diseases
National Center for Environmental Health

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

- 9 in 10 outbreaks caused by problems preventable with more effective water management
- Federal government working towards including prevention practices in national building and public health codes
- Encouraging State/Local governments to change building and public health codes to require WMP
- Encouraging State/Local governments to incorporate WMP into licensing and accreditation for healthcare facilities

LEGIONELLA AND LEGIONNAIRES' DISEASE

What is Legionella?

- Common waterborne bacteria
- Low levels common in most natural water sources
- Can survive typical chlorine disinfection of potable water
- Can cause an illness called Legionnaires' Disease in exposed individuals
- 50+ different species Legionella bacteria; not all cause disease

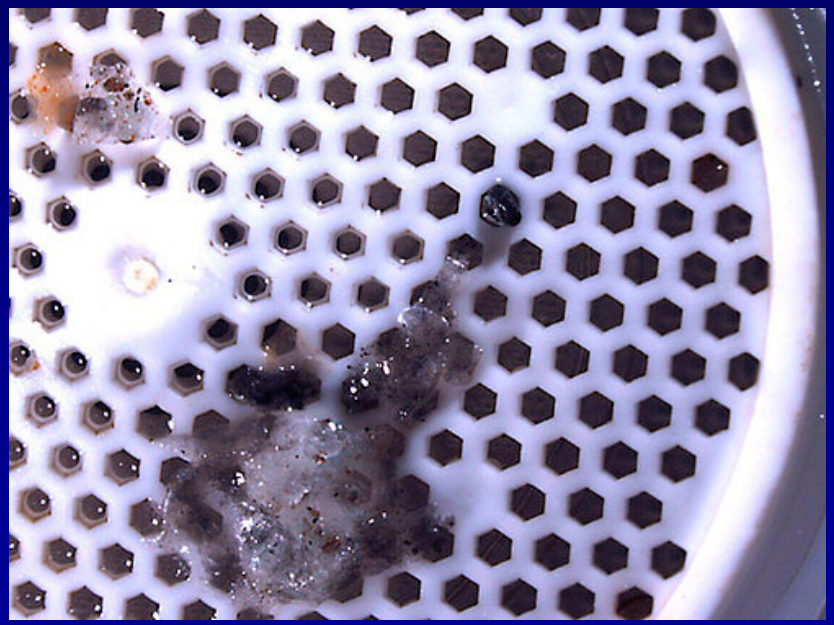
What is Legionnaires' Disease?

- An infectious disease caused by inhaling or aspirating aerosolized droplets of water containing Legionella bacteria

- Characterized by high fever, cough, lung congestion and subsequent PNEUMONIA
  - Sometimes fatal (5 – 30%)
  - Elderly, sick or immunocompromised most susceptible
- Pontiac Fever = flu like illness also caused by Legionella
  90% individuals exposed Legionella develop Pontiac Fever, not Legionnaire's Disease
- Legionellosis = any disease caused by exposure to Legionella

Conditions Favoring Growth

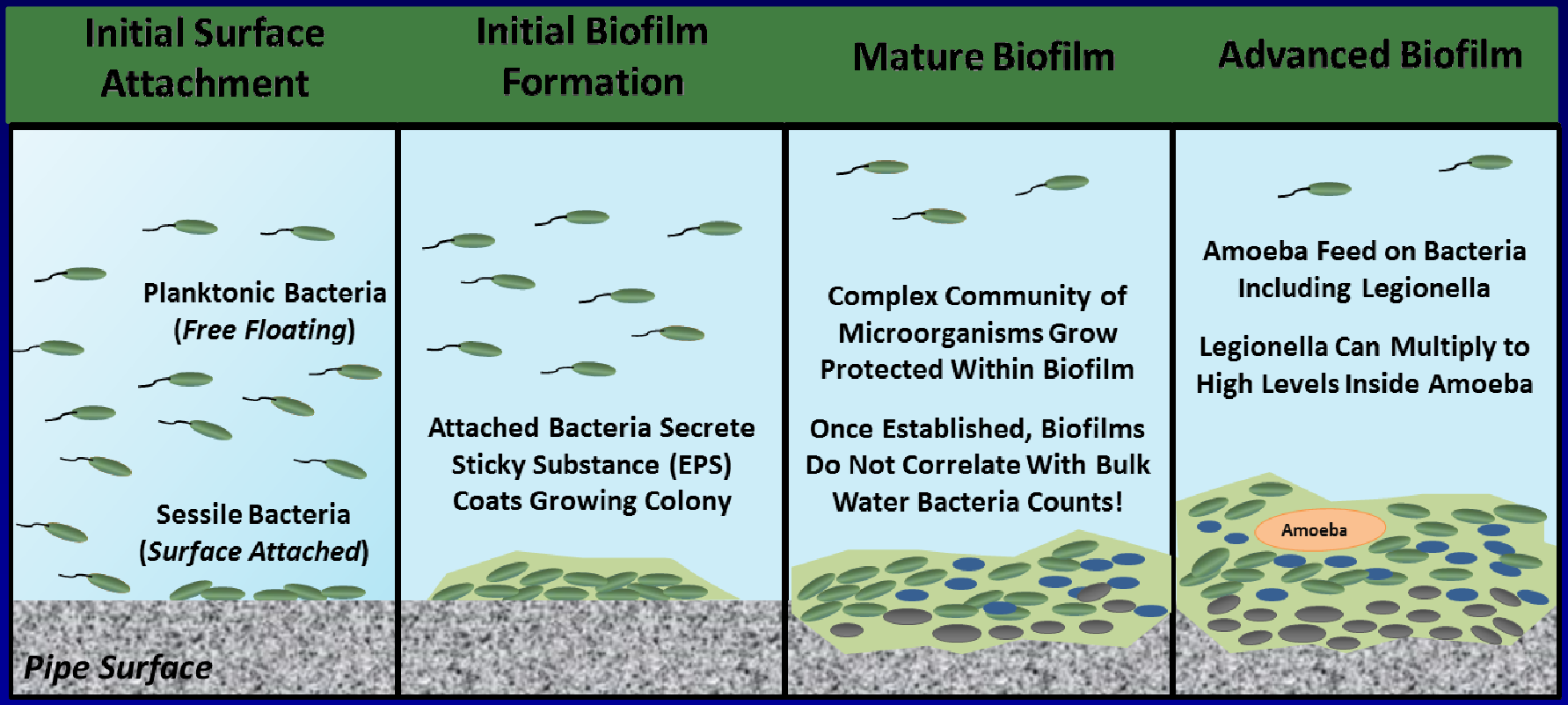
- Low levels Legionella can enter building water systems in potable water; impossible to guarantee absence
- Conditions favoring Legionella growth
  - Warm, stagnant water
  - 68° to 122°F (20° to 50°C)
  - Sludge and sediment
  - Corrosion by-products
  - Biofilm



Biofilm on Faucet Aerator

Biofilm Formation

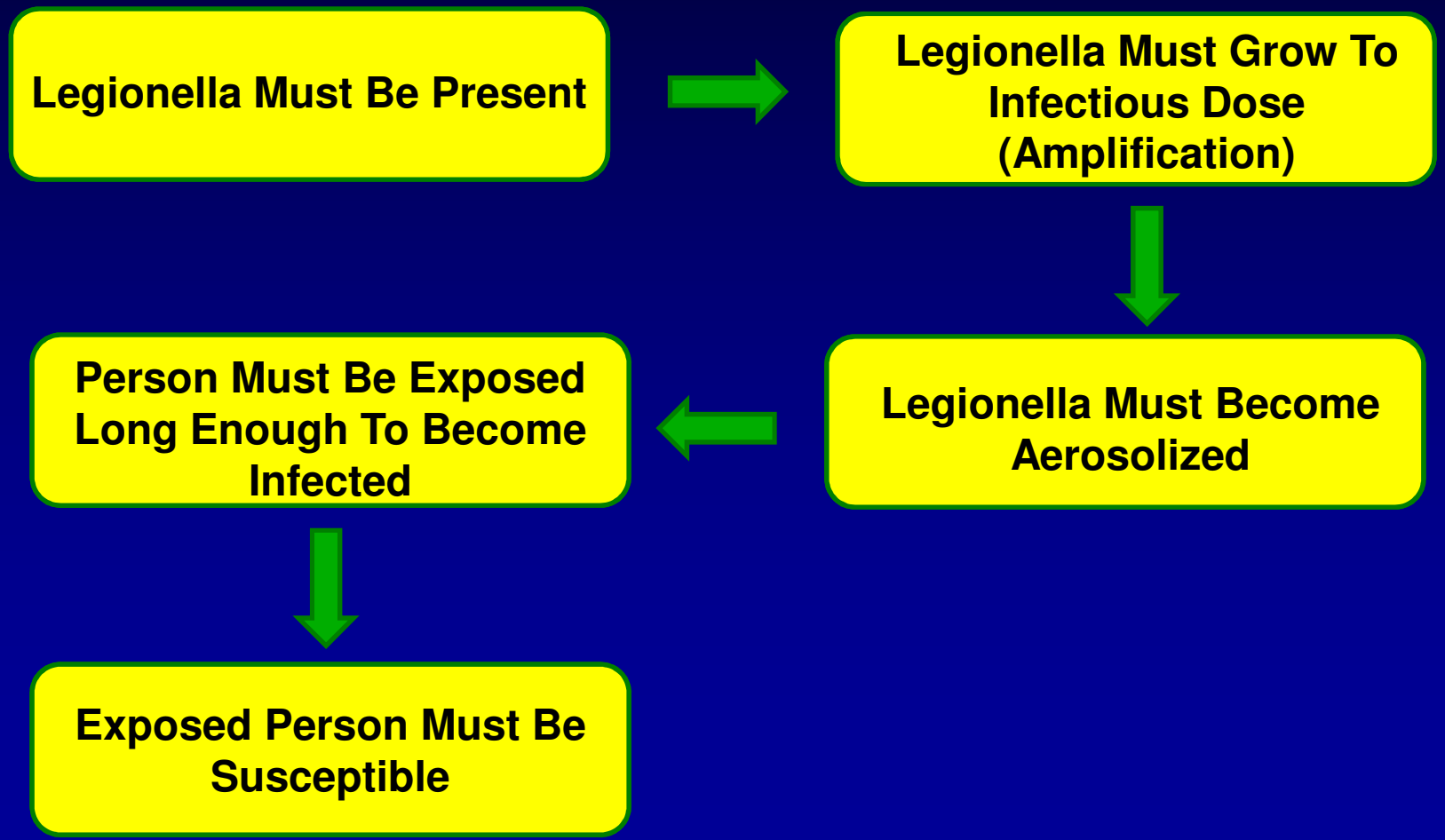
- Complex community of surface attached microorganisms held together by a sticky bacterial secretion



Legionella Amplifiers

- Amplifier = any water system that provides conditions for Legionella to multiply
- Known amplifiers that generate aerosols
  - Cooling towers
  - Domestic central hot water systems
  - Shower heads
  - Faucet aerators
  - Decorative fountains
  - Whirlpool spas

Infection Is A Complex Chain of Events



How Common Is Legionnaires' Disease?

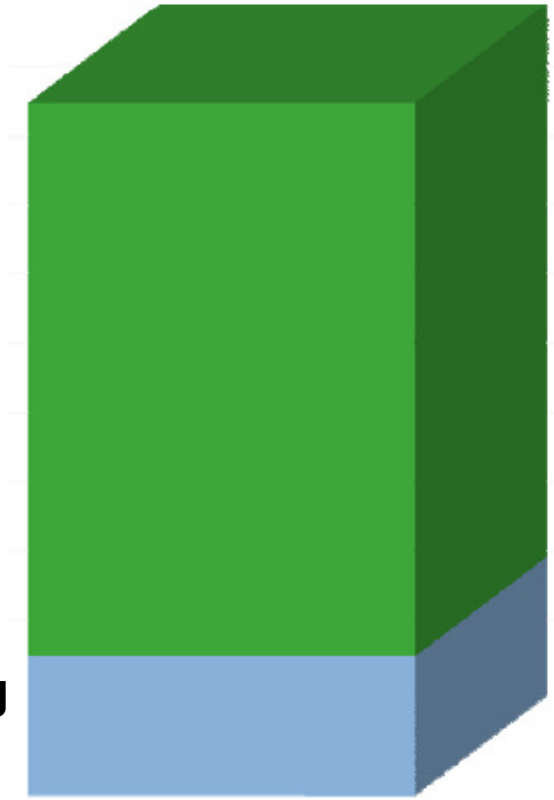
- No one knows for sure!
  - Under-reported
  - OSHA (10,000 to 50,000 cases annually)
  - CDC (8,000 to 18,000 hospitalized annually)
- From 2000 to 2015, reported cases in US increased from 1110 to 5335 annually
  - Increased incidence can be attributed to a variety of factors

How Serious Is Legionnaires' Disease?

- No one knows for sure!
  - 5% mortality rate = 500 to 2500 deaths annually
  - 30% mortality rate = 3000 to 15,000 death annually
- Comparison to other hazards
  - 3,000 deaths annually due to foodborne diseases
  - 4,821 deaths annually due to workplace accidents (2014)
  - 3,275 deaths annually due to fires (2014)

Legionnaires' Disease Outbreaks

Where is *Legionella* Bacteria Found in a Typical Outbreak?



80% from Potable Water

20% from Cooling Tower Water

Legionnaires' Disease Outbreak = 2 or more cases occurring in close proximity

25% - 45% of all cases of Legionnaire's Disease are Healthcare acquired

Source: US Centers for Disease Control (CDC)

ASHRAE STANDARD 188-2015

ASHRAE Standard 188

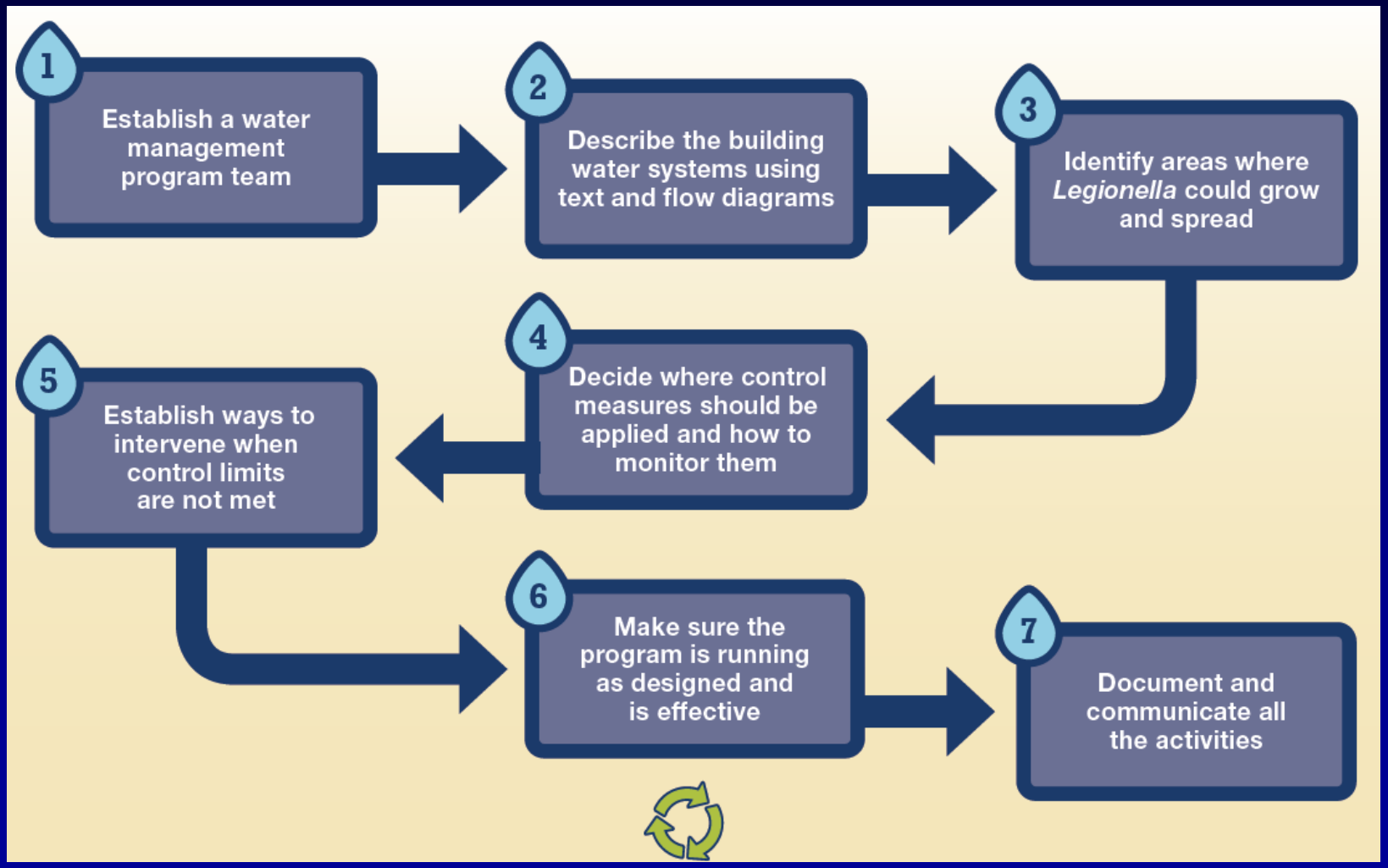
- Consensus industry standard, not a regulation or law
- Establishes industry standard process and minimum components for developing a Legionellosis risk management plan

- Much broader in scope than New York regulations
  - Covers all building water systems, not just cooling towers
  - Site specific plan developed based on hazard analysis
  - Does not dictate specific methods or maintenance procedures

ASHRAE Standard 188

- Normative Annex A (Health Care Facilities)
  - Alternate compliance path for healthcare facilities
- Must meet qualifications of Section 4.3.2
  - Accredited by a regional, national, or international agency
  - Must have a certified infection preventionist, or an epidemiologist with a minimum of a master's degree or equivalent on staff
- Reflects that healthcare facilities have additional capabilities and must address risks beyond Legionella
- Demonstrates compliance with Joint Commission Environment of Care Standard EC 02.05.01

Elements of a ASHRAE 188 WMP

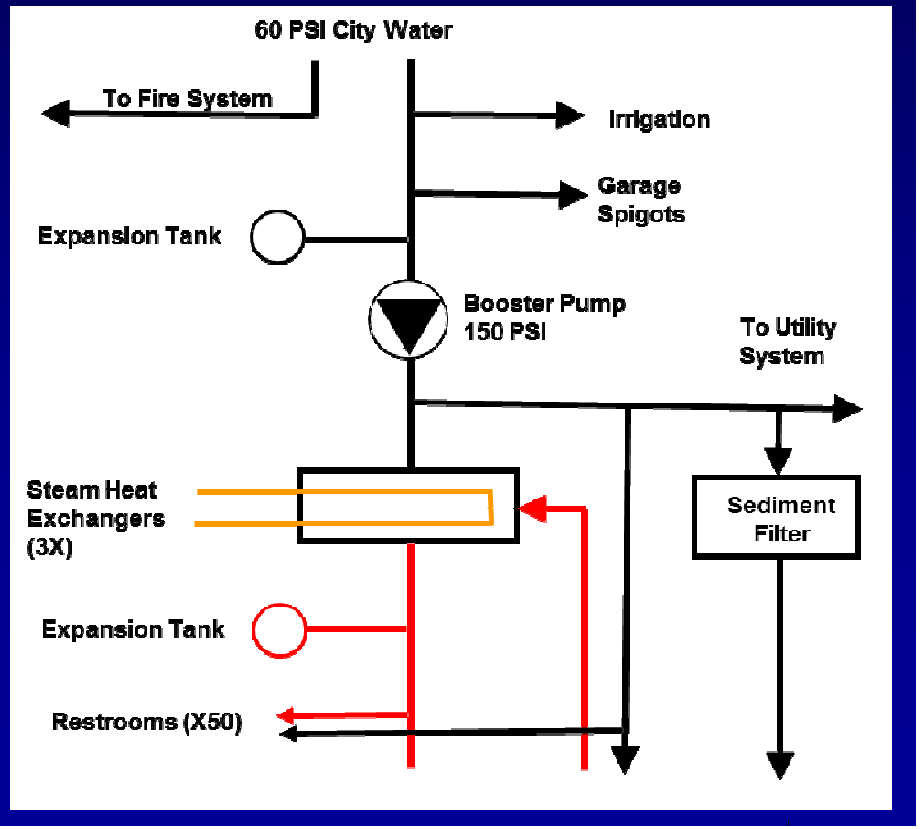


1. Program Team

- Responsible for developing and implementing a water management plan that meets the requirements of Standard 188
- For healthcare facilities (Normative Annex A), Program Team must include the following:
  - Person with senior leadership authority to make command decisions about water restrictions or other response measures
  - Person on facilities maintenance staff familiar with the building water systems
  - Credentialed member of the facility Infection Prevention and Control (IC) program

2. Describe Water Systems

- Program Team must develop detailed process flow diagram that describes all potable and non-potable building water systems
- Process flow diagram must include
  - End-point uses
  - Location of water processing equipment such as softeners, filters, etc.
  - How water is received and conditioned, stored, heated, cooled, recirculated, and delivered to end-point uses



3. Analysis of Building Water Systems

- Program Team must evaluate where hazardous conditions may occur in water systems and where control measures can be applied
- Analysis identify areas with higher probability of infection based on the intended use of water and vulnerability of patients
- Based on hazard analysis, Program Team must determine systems and locations where control measures are required (Control Locations)

Legionella Hazard Analysis

System / Device		Hazard Analysis	Significant Risk	Control Location
Description	Location			
Cooling Tower / Condenser Water	CT1&2	Significant potential for Legionella growth and exposure to aersols with at risk building occupants.	Yes	Yes
HVAC Chilled Water	CW1	Low potential for Legionella growth and exposure to aersols.	No	No
Heating Hot Water	HW1	Low potential for Legionella growth and exposure to aersols.	No	No

4. Control Measures

- For each control location, Program Team must determine appropriate control measures and control ranges based the hazard analysis and governmental and/or industry guidelines
- Includes treatment methods, actions, or procedures
  - Chlorine, temperature, cleanliness, flow, etc.
- Keep it simple
  - If it's supposed to be hot, keep it hot
  - If it's supposed to be cold, keep it cold
  - Keep it clean
  - Keep it moving

5. Monitoring & Corrective Actions

- Program Team must establish procedures for monitoring whether control measures are operating within established limits, and if not, take corrective actions

Cooling Tower Control Measures

Control Measure	Control Limit	Monitoring	Monitoring Frequency	Corrective Actions
Maintain effective microbiological control using stabilized bromine biocide	Achieve 1.0 ppm Free Halogen Residual (as Cl2) during 4 hour biocide feed 3X week	Approved Free Chlorine Test Method, ORP Feed Verification	On-Site - 3X Week Vendor Service Visits - Monthly	Adjust biocide pump feed rate/timer setting as necessary to achieve target residual.
Maintain effective microbiological control	Total Aerobic Bacteria Count < 10,000 CFU/mL	On-Site - Dip Slide w/ Incubator, Laboratory using Plate Counts	On-Site - Weekly, Laboratory - Quarterly	Follow Bacteria Testing Response Protocol (TB2-054)
Minimize stagnation in offline cooling towers, chillers, heat exchangers, and system piping.	No part of cooling tower / condenser water system should be off line more than 5 days.	Rotate equipment to ensure none is offline more than 5 days, or establish flow through off line equipment once evey 5 days.	Monthly	Correct Non-compliance
Keep cooling tower basins, fill, and drift eliminators clean and free of sediment	Buildup should be < 1" with no visible algae or biofilm	Physically inspect for sediment, algae, or biofilm	Monthly. Comprehensive inspection with report every 90 days while tower is in operation.	Disinfect and clean tower as required. Consider installation of side stream filtration system.

6. Confirmation Procedures

- Program Team must establish procedures to confirm that:
  - Program is being implemented as designed (recordkeeping)
  - Effectively controls hazardous conditions
- Validation that program is controlling Legionella is defined in WMP, and may include the following:
  - Evidence in scientific literature showing Legionella less prevalent in water systems where similar control measures were applied.
  - Surveillance for disease
  - Routinely testing certain building water systems for Legionella

7. Documentation

- Program Team must establish documentation and communication procedures for all activities of the Program
- Control measures generally documented via electronic reporting system, paper logs, or vendor reports
- A master document providing the location of all Program documents shall be maintained
- A lot of recordkeeping!

COOLING TOWER BEST PRACTICES

Cooling Tower Best Practices

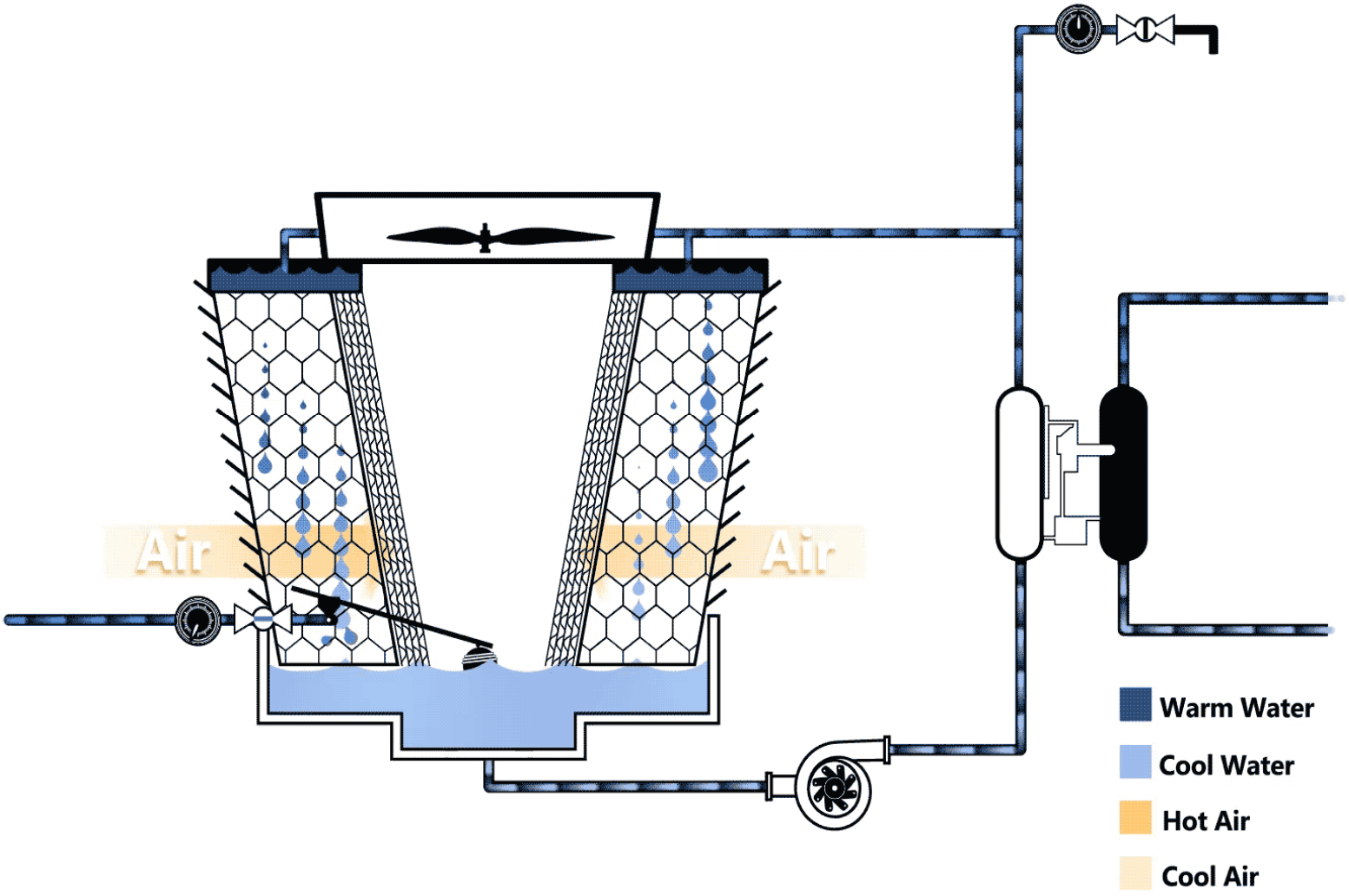
- ASHRAE 188 Section 7.2 lists specific requirements that must be included in the Water Management Plan:
  - Description of all water treatment chemicals, equipment, testing protocols, control ranges, and corrective measures
  - Schedule for physically inspecting and cleaning cooling towers
  - Procedures for disinfections, commissioning new systems, system shutdown, startup of drained and stagnant systems
  - Contingency Plans if Legionella testing is performed or cases of Legionnaires' disease are known or suspected
  - Responsible person and documentation designated for each step

Operation, Maintenance, and Documentation Practices Are Just As Important As The Chemical Treatment Program!

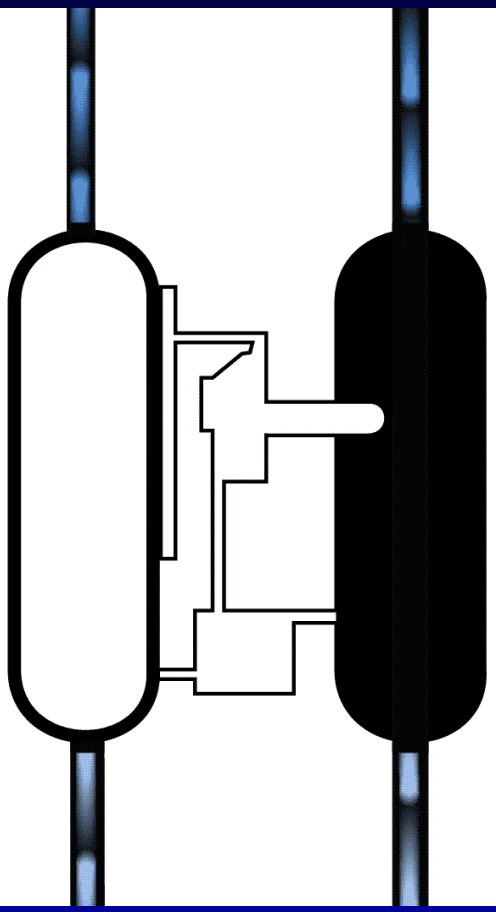
Idle/Standby Equipment

- Biofilm formation in dead legs and idle equipment closely associated with Legionella and Legionnaires' disease
  - Idle towers
  - Lag chillers
  - Free Cooling heat exchangers
- NYS/NYC regulations require cooling tower systems to be disinfected or cleaned/disinfected before start-up after being idle or off line for more than 5 days
- NYC regulations require all equipment receive continuous flow or include procedures to provide effective microbiological control in off line or idle systems/components

Flow Is Our Friend

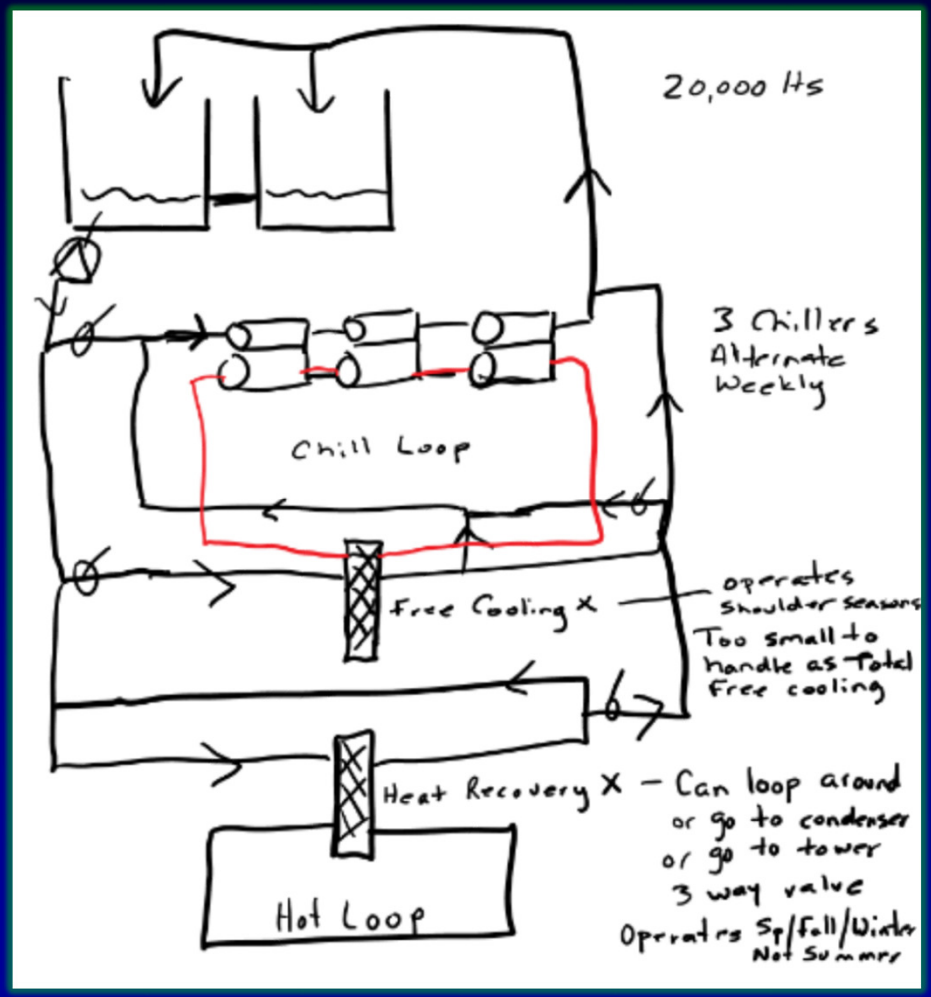


Dead Legs & Low Flow Are The Enemy!



- Stand By /Redundant Chillers and Towers
- Redundant Pumps/Lines
- Free Cooling Exchangers
- Equalization Lines

Understanding Water Flow is IMPORTANT!



Proper water treatment requires:

EVERY DROP OF WATER

Sees biocide feed at least twice weekly

Cooling Tower Cleaning / Disinfection

- Routine cleaning and disinfection essential preventative maintenance to help reduce incidence of Legionella (2X year)
- Corrective measure whenever tower visibly dirty or indications of microbiological problems including high bacteria/Legionella counts
- Preferred Process
  - Pre-cleaning disinfection
  - Physically clean cooling tower
  - Post cleaning disinfection
- 15+ ppm Free Chlorine for 2 hours with flow through all equipment
- Documentation critical

On-Site Monitoring Program

- At least weekly on-site monitoring by trained site personnel
- Typical on-site monitoring program includes:
  - Water quality testing (conductivity, inhibitor, free chlorine)
  - Visual inspection of cooling tower
  - Visual inspection of water treatment equipment and chemical inventory levels
- NYS regulations specify monthly bacteria testing
- NYC regulations specify weekly bacteria testing

Murky Tower Water Indicates A Concern

WHAT SHOULD I DO NEXT?

Next Steps

- Understand organizational goals
- Consult with appropriate departments within organization
- Developing an ASHRAE 188 WMP is a significant undertaking
- Implementation requires a higher standard for owner and supplier involvement, routine maintenance, and recordkeeping

Water Risk Management Capabilities

- Chem-Aqua has broad Legionella Risk Management capabilities and expertise
  - ASHRAE 188 Water Management Plans
  - Risk Assessments
  - Best Practices Treatment Programs
  - Legionella Testing
  - Cooling Tower Cleaning and Disinfection
  - Secondary Disinfection
- Water Risk Management Group can help you address the requirements associated with your ASHRAE 188 Water Management Program

CHEM-AQUA®
Water Risk Management

It’s A Process

- A good first step might be a Cooling Tower Water Management Program based on Section 7.2 of ASHRAE 188 (NY Requirement)
  - Not same level of risk reduction as an ASHRAE 188 WMP
  - Developed so that can be readily incorporated into a full building ASHRAE 188 WMP

Important To Understand

- Effective Legionella Risk Management requires more stringent water treatment, maintenance, and monitoring measures than required to prevent waterside problems and maintain operational efficiencies
- No plan, program, or maintenance measures can guarantee the absence of Legionella, or eliminate the potential for associated disease
- Facility is responsible for their developing, maintaining, implementing and updating their site specific WMP

P.S. Air Cooled Is Not The Answer!

- 500 Ton Chiller @ 60% Load
- Water Cooled Vs. Air Cooled Chiller
  - 47% less energy to operate water cooled chiller
  - 565,000 kwh energy savings
  - 765,000 lb/year less CO_2 emissions
  - 45% lower Peak Energy Demand
- Clear economic and environmental advantage for water cooled chillers!

Conservation vs. Legionella

- Sometimes our conservation measures run counter to Legionella control measures:
  - SHEA study in 2016
  - Perform a risk assessment when considering new equipment, such as high efficiency Hot Water Heaters

Water Treatment Is a Partnership

Effective water treatment involves a lot more than adding chemicals, testing water, and maintaining the levels

- Knowledgeable water treatment partner with broad capabilities
- Trained and involved site personnel
- Good communication

Questions?

Cleveland Clinic

Every life deserves world class care.

Disclaimer

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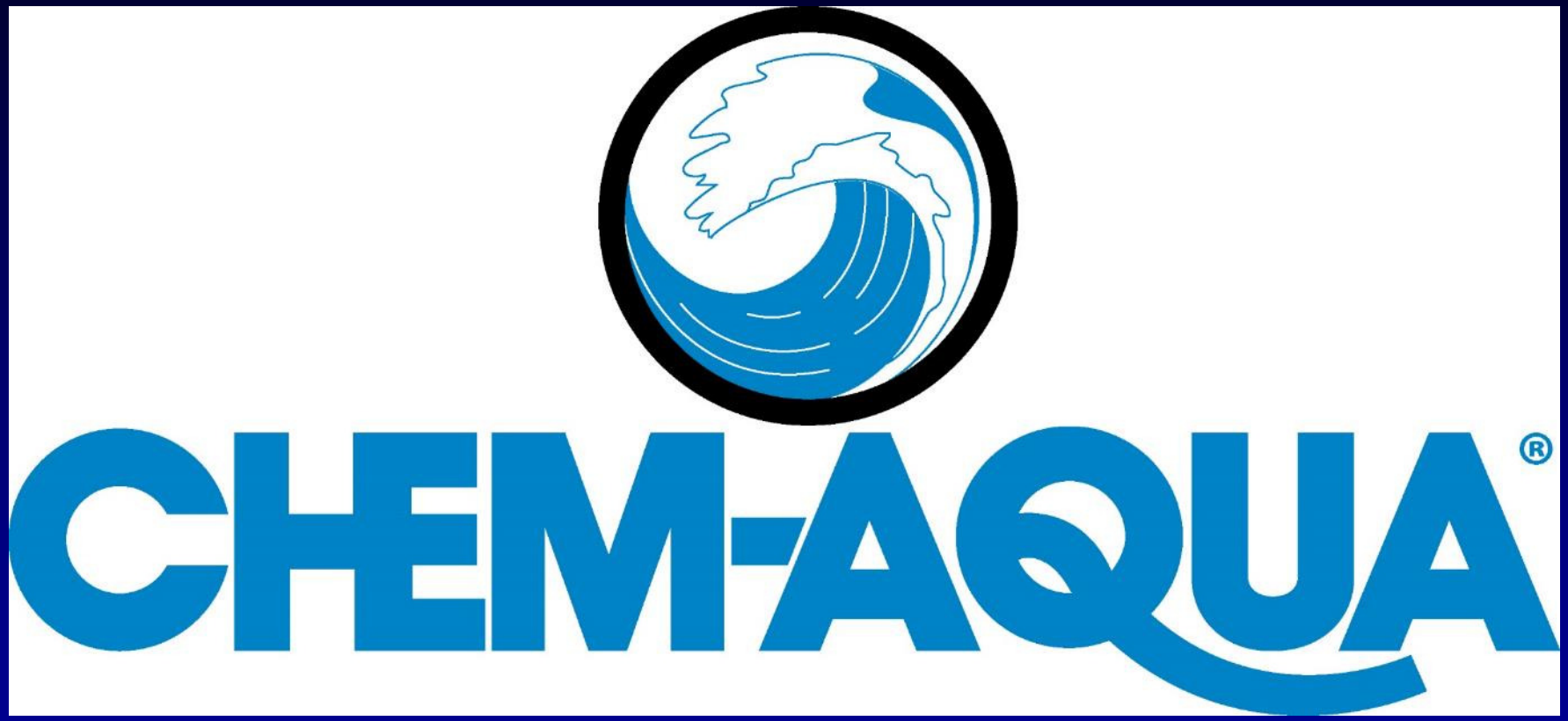
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