

# **H<sub>2</sub>O MEYER**

**CONSULTING SERVICES, INC.**

## **Water Treatment 101**

### **Condenser Water Fundamentals**

With Gary Dorfman

# What is at Risk ?

- Equipment
- Water
- Energy Losses
- Downtime
- Human Health



# Water Conservation



# Water Sources

- City Water (aquifers, reservoirs)
- Well Water
- Reclaim
- Condensate
- Rain Water
- Gray Water
- Reuse

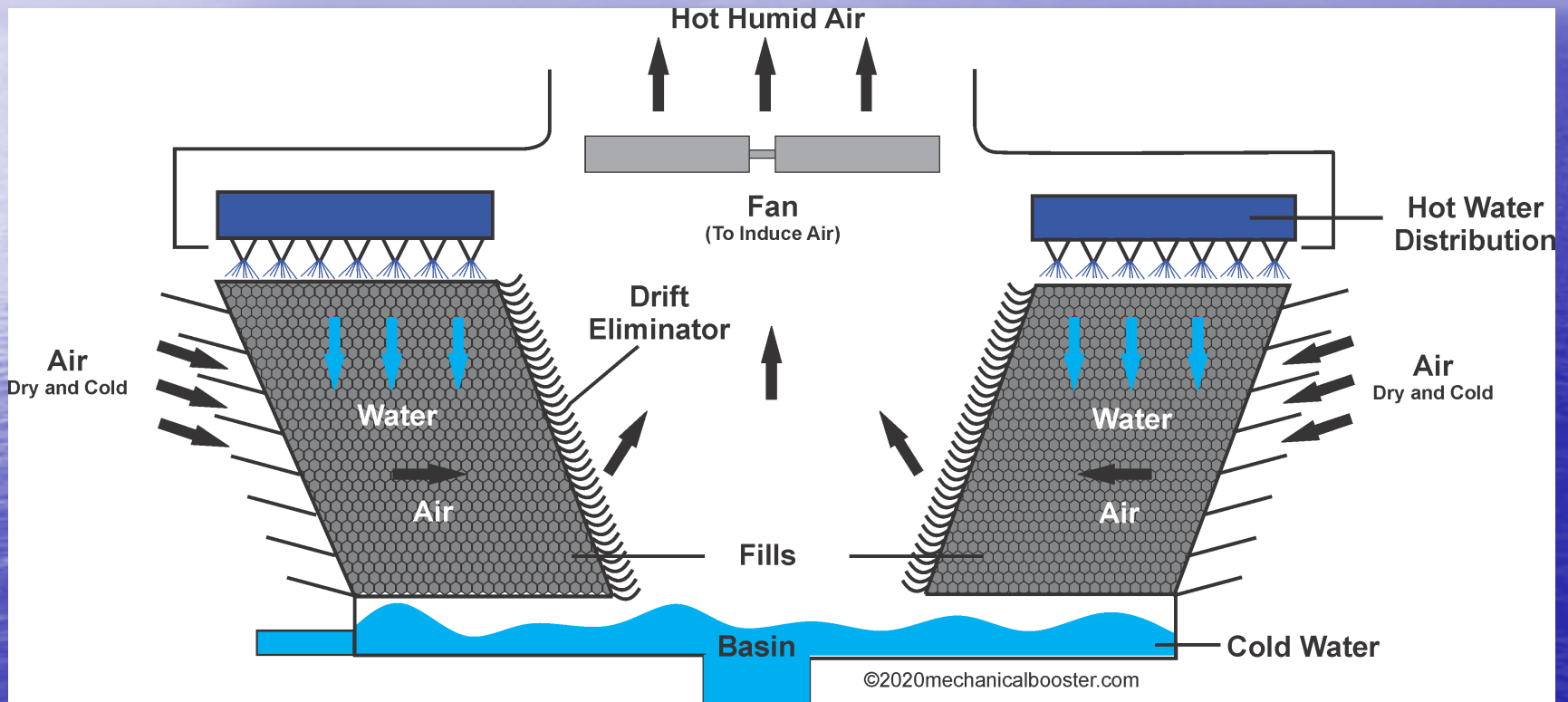


# Cooling Towers

- Various Types
- Cool by evaporation
- “Air Scrubbers”



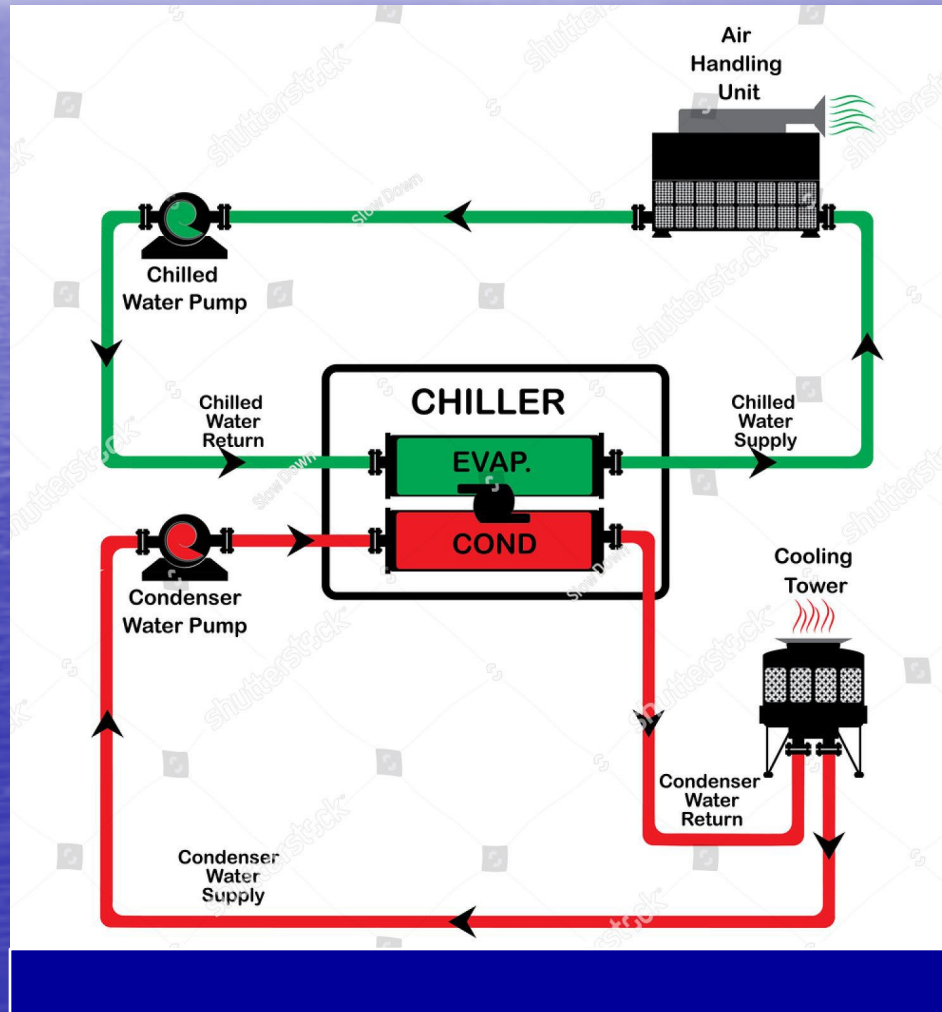
# Basic Cooling Tower Diagram



## Cross Flow Cooling Tower

(Air and Water Moves at Right Angle)

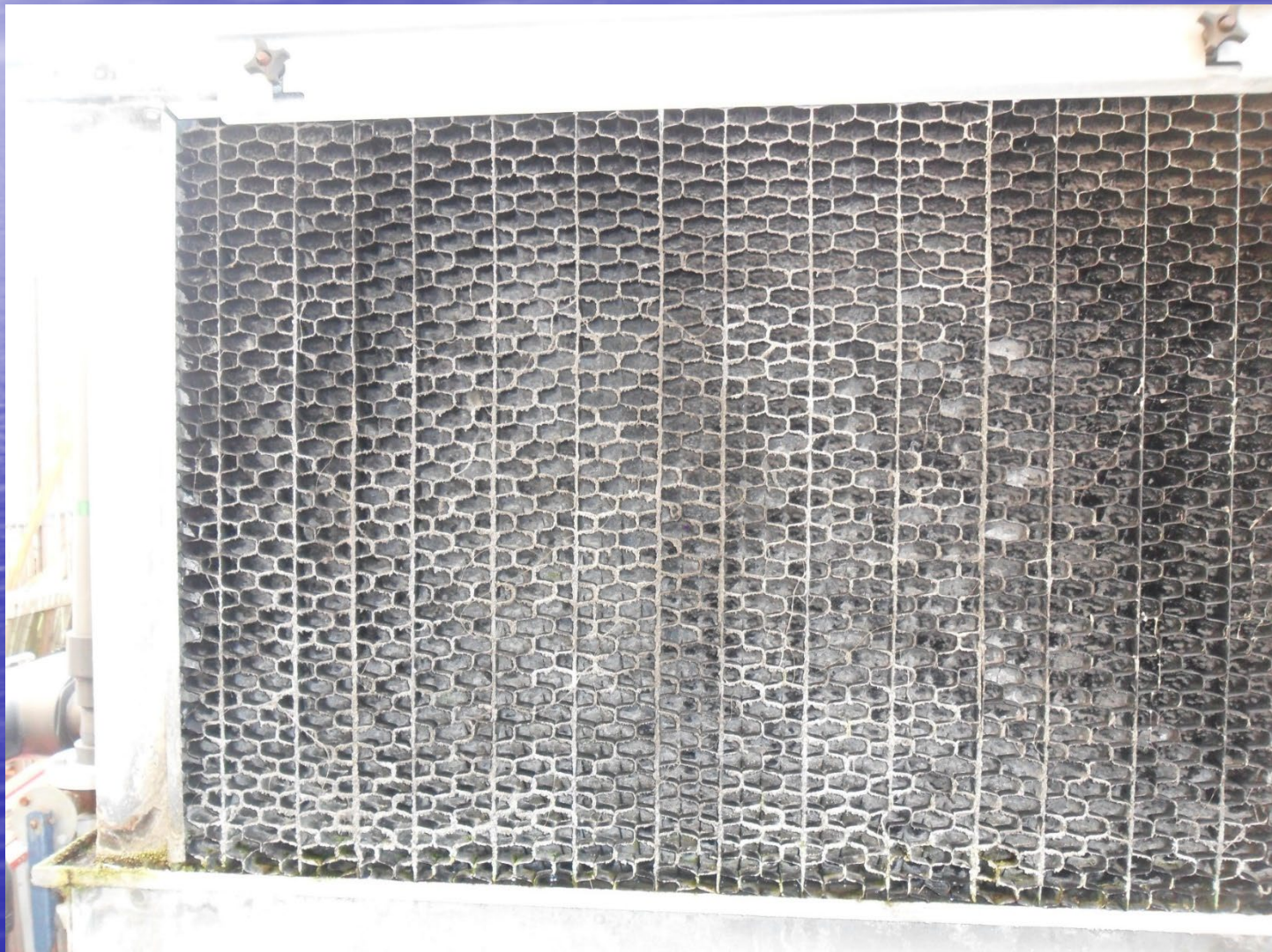
# Cooling System Diagram



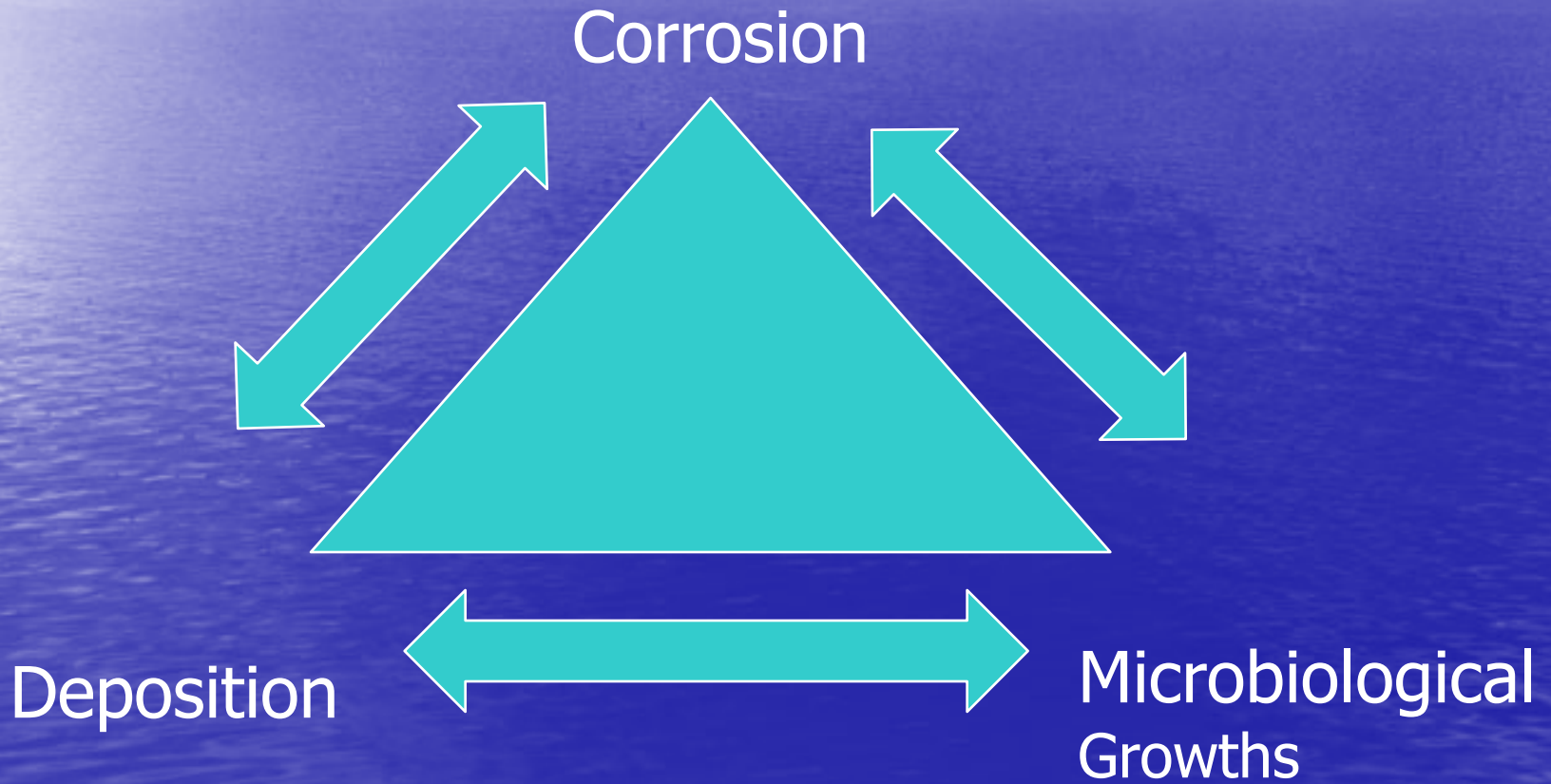
# Cooling Tower Cycles

- Cooling towers cool by evaporation
  - Pure water evaporates
  - Dissolved solids remain
    - Measure by Conductivity
  - Control by "Bleed"
- Cycles of Concentration
  - Over-cycling → Scaling of Chiller Tubes!
  - Under-cycling → Wasting Water and Possible Increased Corrosion
- Evaporation Solids

# Evaporation Solids



# Why treat the water?



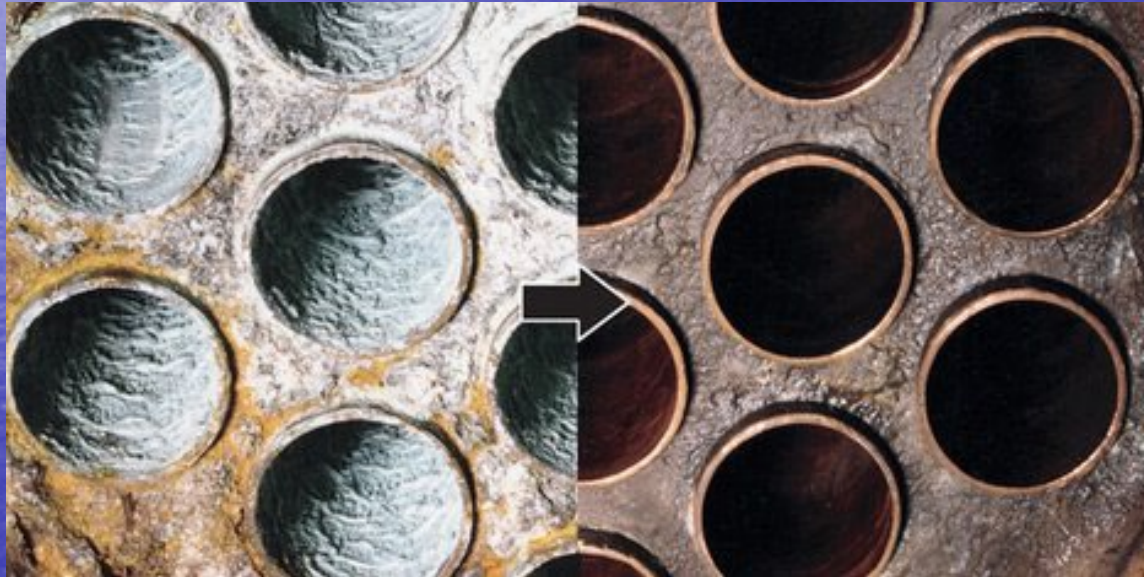
# Corrosion



# Deposition: Scaling Versus Fouling

- Scaling, also called Mineral Scaling, occurs when dissolved solids precipitate.
- Fouling is from Insoluble Material
  - Insoluble Material can be removed by filtration.
- **Inhibits Heat Transfer – Increases Energy Costs!**

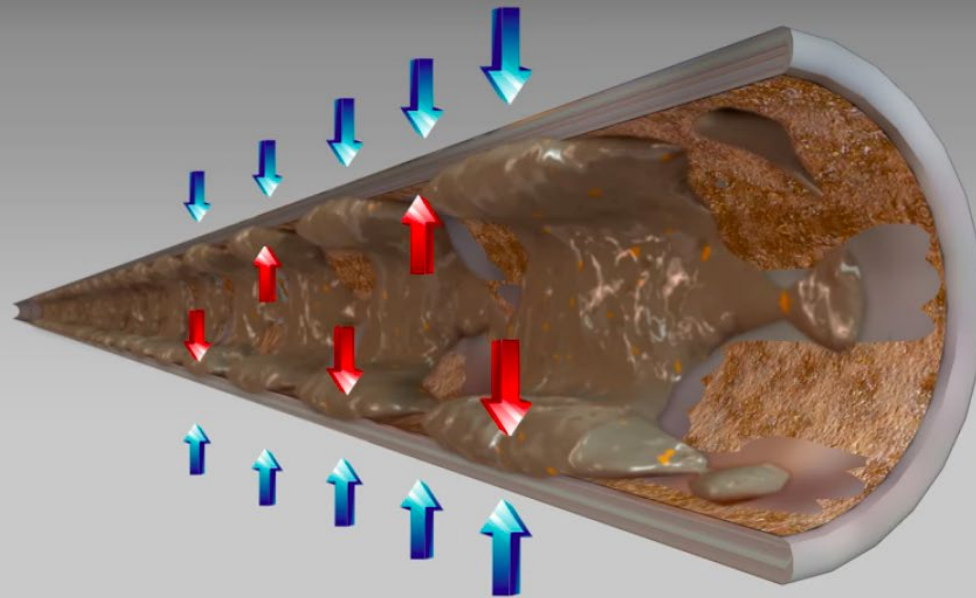
# Scaling



# Scale Development

- Hardness Salts
  - Hardness Salts have *Inverse Solubility(!?)*
  - Scaling will occur in the hottest areas of the system
- Other Scaling Concerns
  - Phosphate, Silica, Iron, Copper

# Deposition (Scaling / Fouling)



Build-up of a **0.6mm** thick layer of fouling & scaling  
Reduces chiller efficiency by **20%**

# Microbiological Growth



# Microbiological Growth

- Aerobic Bacteria – Free floating organisms
- **Anaerobic Bacteria – Slime forming**
- Algae – Need wet surfaces and sunlight

# Tower Water Corrosion & Scale Control

- Control cycles of concentration
- Control pH
- Use Inhibitor (chemical coating on metal surfaces)
  - Phosphonate, Azole, Polymers
  - Luminescent trace
- Galvanized Steel – White Rust



# Tower Water Biological Control

- Oxidizers (Halogens) – Chlorine, Bromine
  - Residual
  - ORP Curves
  - Retention Time
  - Demand
  - Flow
    - Cooling Towers need to be circulating for all biocide feeds
- Non-Oxidizers
  - Glutaraldehyde/Isothiazoline
- Aerobic vs Anaerobic bacteria
  - Dip Slides
  - DMA's



# Tower Water Biological Control

- **EVERY DROP OF WATER NEEDS TO SEE EVERY MICROBIOCIDAL FEED!**
- Multiple Chillers
- Multiple tower cells – Equalization Lines
- Intermittent Use
- Dead legs

# Biological Control

- Bulk Water Disinfection
  - Halogens
    - 3x / Week; 4 hours; 1.0 PPM free
    - Continuous 0.3-0.5 PPM free
  - ORP
- Anaerobic Bacteria Control
  - Glutaraldehyde – >120 PPM 45%
  - 1x / week; <1 Hour
  - Isothiazoline - >240 PPM
- Dip Slides once per week
  - Incubator set at 35 degrees C; 48 hours



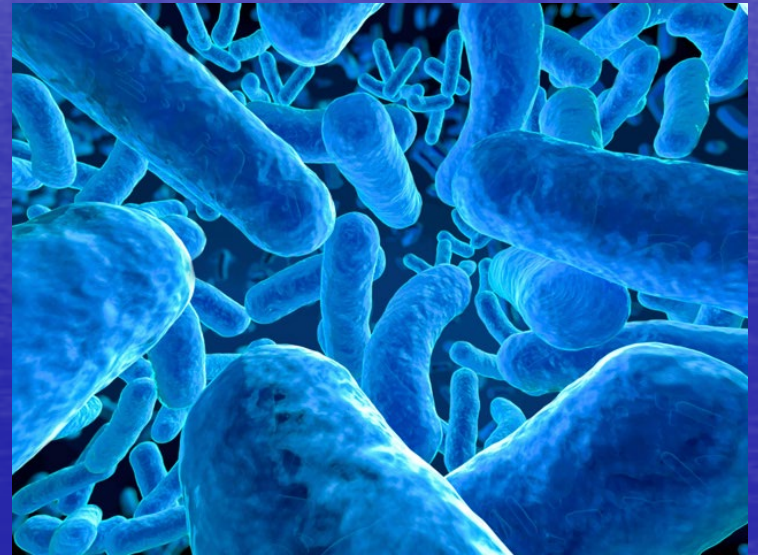
# Control

- New Controllers
  - Luminescent Trace (PTSA)
  - pH
  - Conductivity
  - ORP
  - Water Meter Inputs
  - Polymer Stress
  - Call Outs (alarms)
  - Data Logging



# Legionella

- Ubiquitous Organism (70 species; 15 are human pathenogenic)
- Fatal Cases: >1,000 cells/ml Serogroup 1
- Mists/Aerosols
- Compromised Immune Systems
- **Thrives in Biofilms**
- OSHA
  - Clean Towers twice per year
- Domestic Hot Water
  - $\geq 140$  Degrees F @ Tank
  - $\geq 122$  Degrees F @ Tap
- ASHRAE 188
- Legionella Testing (4x per year - NY)
- Reaction Protocols



# 3<sup>rd</sup> Party Oversight of Water Treatment Programs

- Water treatment vendors frequently
  - Do not maintain “best practices” dosages for inhibitors (phosphonates and azoles) for cooling systems
  - Rely on controllers rather than actual testing
  - Miss warning signs of biological activity in cooling tower systems and closed loops
- We provide independent analyses of your treated water systems!
- We consult over 6,800 sites in 10 countries. Our clients are the who’s who in each of the market we service
- We have the largest water lab in the country



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