



VODAA
SOLUTIONS



OUR MISSION

To modernize water and energy savings technologies and services that serve public interest through the provision and implementation of technologies that are impartial, high-quality with distinctive output and consistent performance designed to sustain consistent year after year savings for public and private entities.



BRIEFING OVERVIEW

- **Source;** the following data points within this briefing provided by LuminUltra - a global leader in microbial monitoring

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We appreciate your time and look forward to a fluid and open discussion at your convenience.

Thank you,

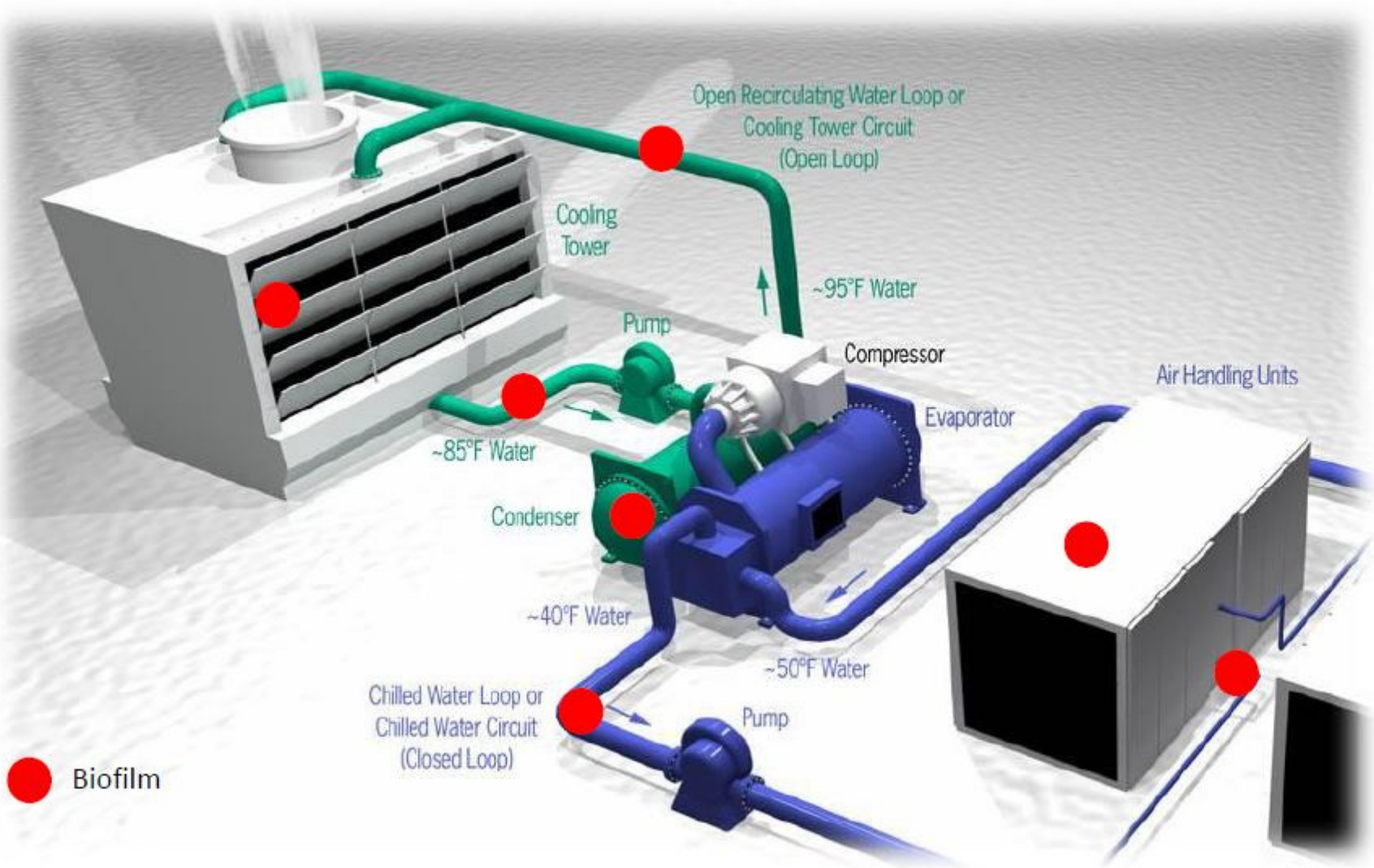
Voda Solutions



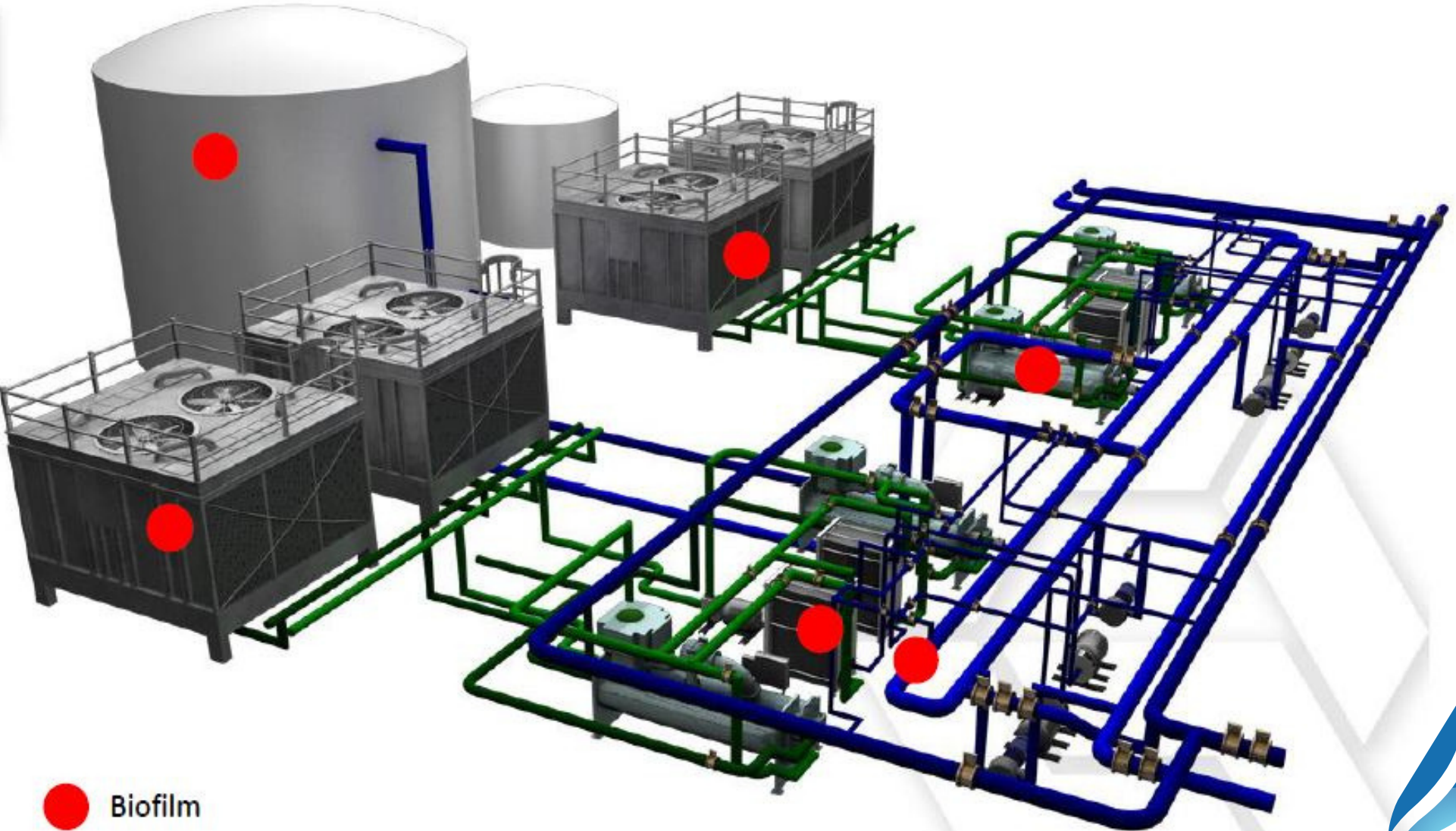
U.S. LEGIONELLA MAP



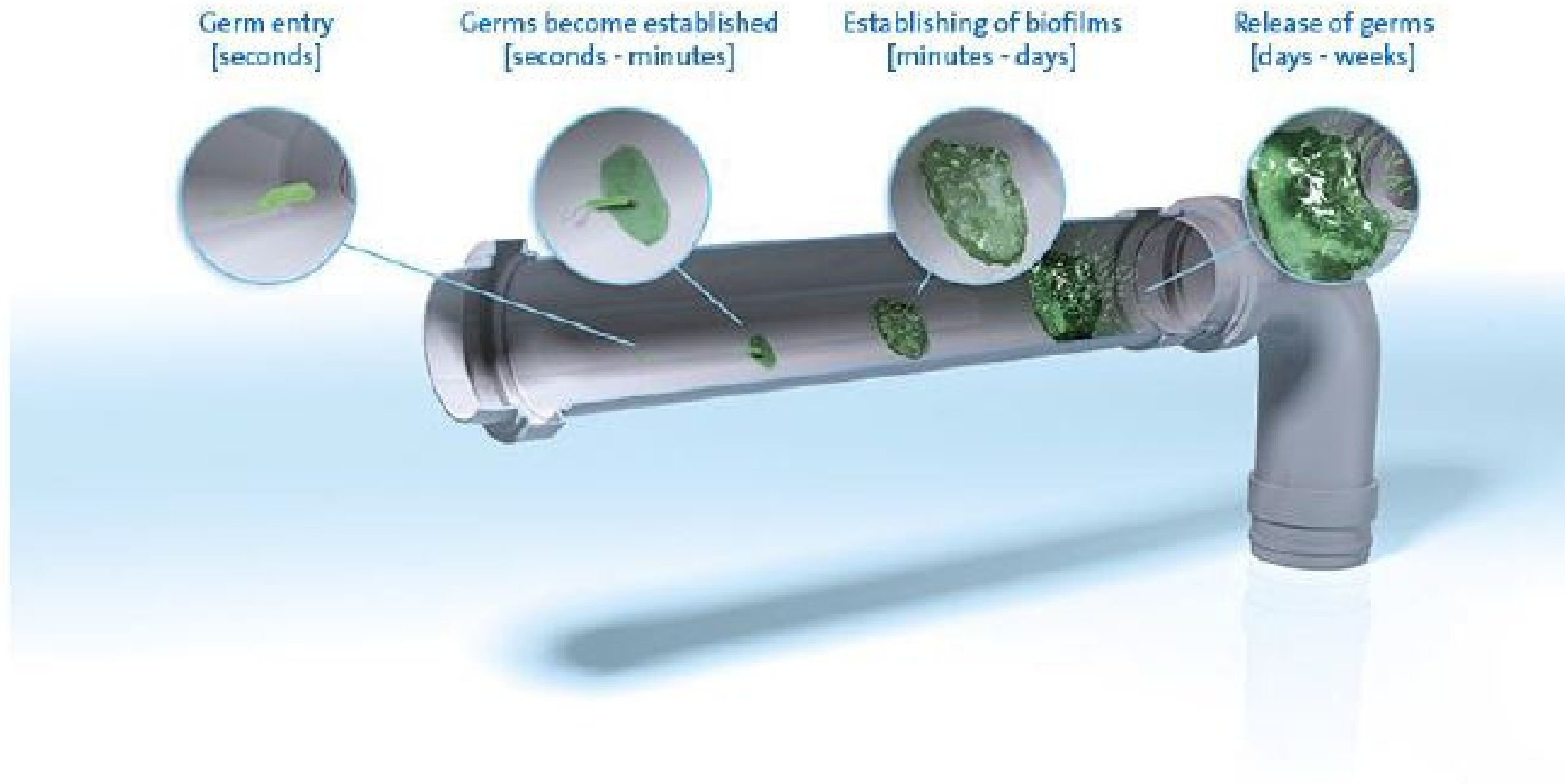
BIOFILM IN THE WATER SYSTEM



Cooling Tower - Chiller
Condenser Water Tank
Pump



Biofilm in the piping system

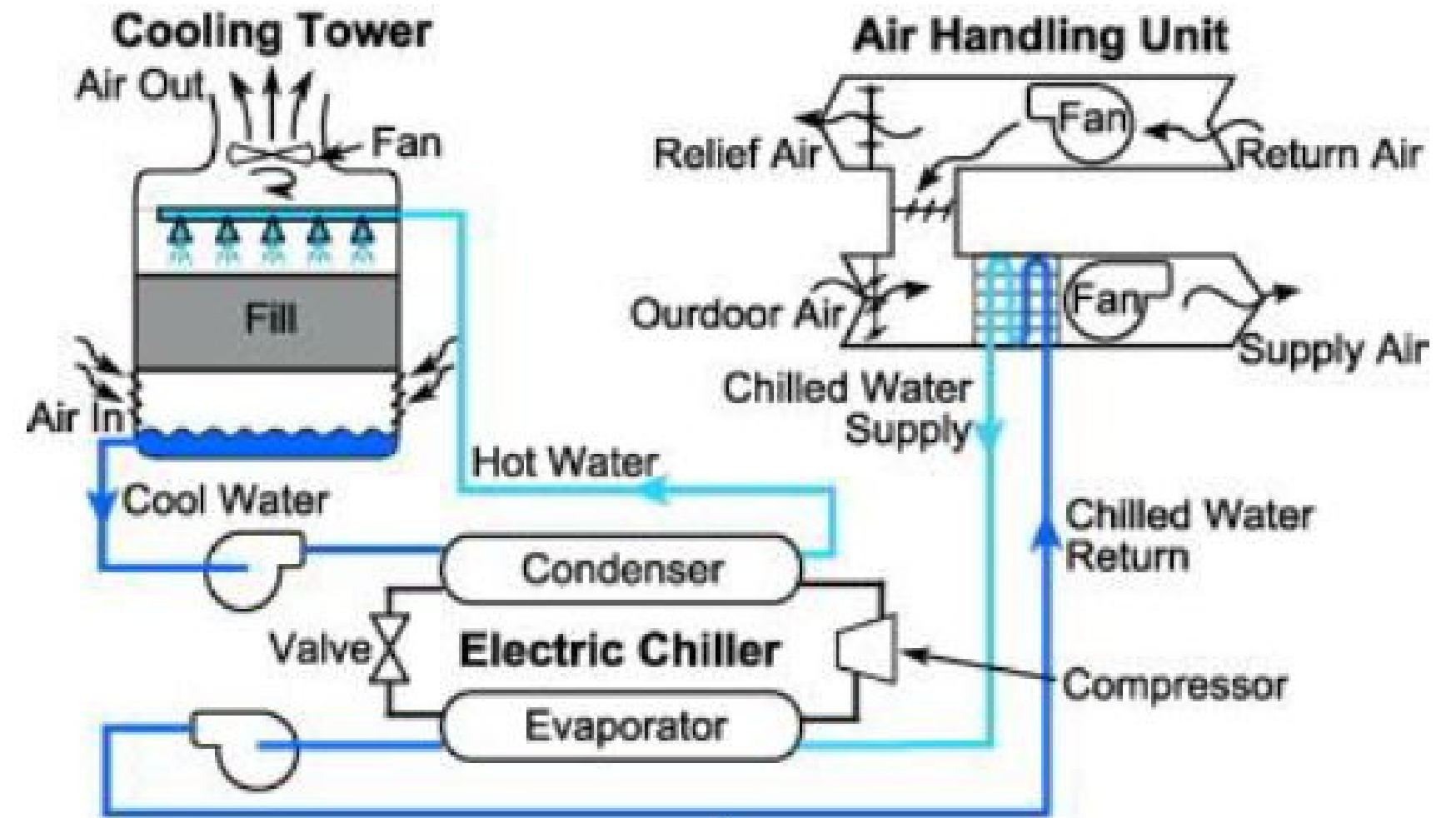


Microorganisms settle on wet surfaces and over time form a biofilm there. After several days, a biofilm can have already reached its stationary phase when continuous release of germs takes place.



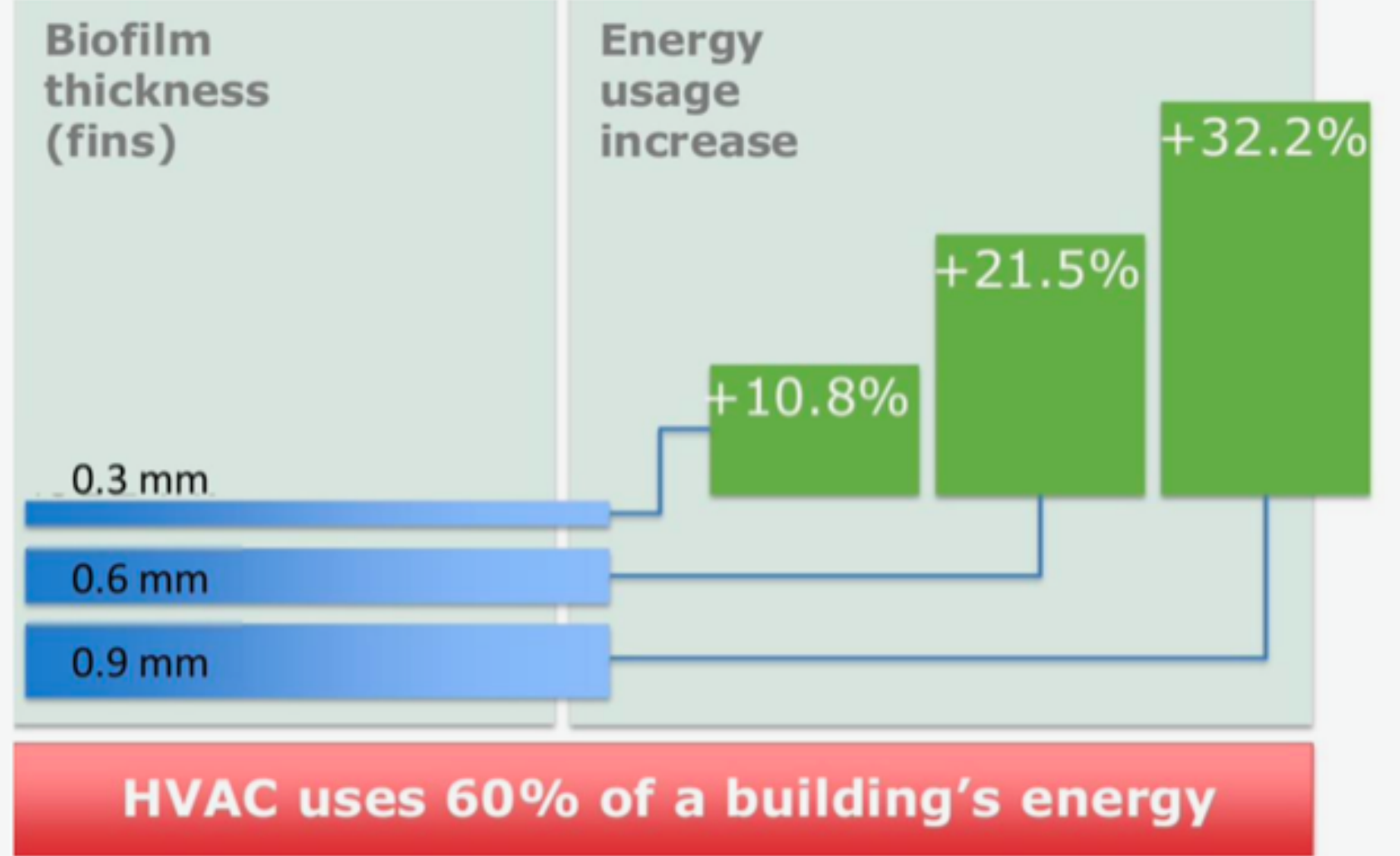
What biofilm could cause at HVAC System

- Energy cost increase
- Hard Maintenance work
- Electrical overload of pump (trip off)
- Health danger(Legionella)
- Equipment life time(Corrosion)



Slidenote: In open circuit cooling towers, biofilms reduce system efficiency through formation in the condenser. It is estimated that 1mm of biofilm in a centrifugal chiller can reduce heat transfer by up to 35%, which could cost an additional \$9,000 per year for a 200 ton chiller operating at 50% load.





Untreated cooling towers could result in 32.2% higher energy consumption



On condensers, Biofilms form insulating layers 1mm biofilm thickness > 32%+ energy loss



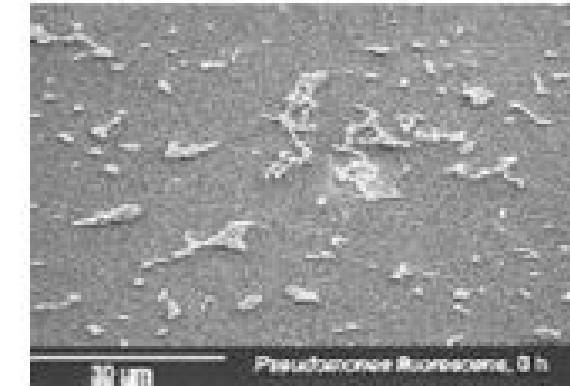
Biofilm growth

Phase	Time
Colonization	15 minutes
Growth detection	2 days
Biofilm formation (minimum)	5 days
Maximum biofilm growth (8-10 cells thick)	14 days
Full Mature Biofil Matrix	31 – 40 days

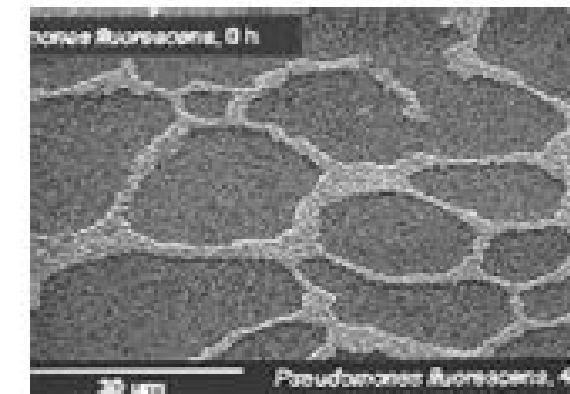
Destroying the biofilm support the goal of getting a more effective cooling towers in two ways.

1. Control biofilm growth is equal to Legionella control.
2. Control biofilm growth increase the efficiency

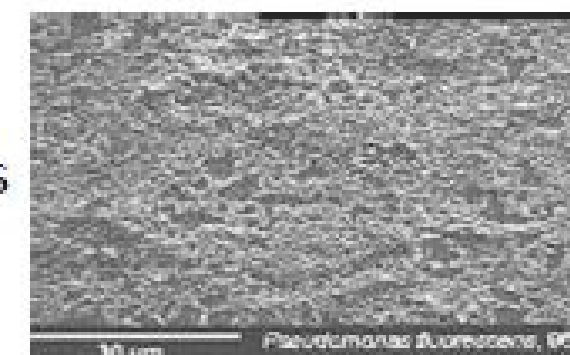
2 hours



2 days



4 days



100 micron

Slidenote: Cooling towers are a common site for biofilm build-up on the cooling tower fill. If permitted to accumulate in the fill, they can restrict or completely impede flow, reducing heat rejection and increasing energy costs.



Microbial Influenced Corrosion

- APB – Acid Producing Bacteria
- IRB – Iron Depositing Bacteria
- Sulfate Reducing Bacteria



Slidenote: Cost implications of corrosion are significant. It is estimated that corrosion costs the global economy \$2.5 trillion per year and research supports 20% of corrosion is microbiologically influenced.



**THANK YOU FOR
YOUR CONSIDERATION**

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