

What's in your cooling system ?



Biofilm increases your power use/cost and can be a health hazard !!

TAB 02/05

Biofilm: is a gelatinous mass, that forms in cooling water systems, which consists of microbial cells, the polysaccharide biopolymer they produce, and debris extracted from the cooling water. The mass is "cemented" by the produced biopolymer, which often exceeds the volume of living microorganisms by a factor of 100, or more. While **biofilm** can be responsible for many different problems in cooling water systems; such as plugging of cooling water passages/pipes due to physical blockage and accelerated corrosion under the biofilm itself; the two major problems are **reduction in heat exchanger efficiency** and **increased risk of Legionnaires' Disease**.

Biofilm and Energy Use

While mineral scale formation is commonly believed to be the major cause of increased energy usage in heat exchanger operation, **biofilm** actually has a lower thermal conductivity (a lower number indicates a greater resistance to heat transfer) than common mineral based scales. The following table illustrates this unappreciated fact:

Scale	Thermal Conductivity	Scale	Thermal Conductivity
calcium carbonate	2.6	calcium phosphate	2.6
calcium sulfate	2.3	iron oxide	2.9

Biofilm has a thermal conductivity of just 0.6 !

Thus **biofilm** is over four (4) times as resistant to heat transfer as common calcium carbonate scale ! Calculations show that a **biofilm** only 0.045 inches in thickness on the condenser tubes of a centrifugal chiller results in a **35% increase in chiller electrical power consumption**.

The economics of **biofilm** are astounding ! As an example, consider a 200 ton chiller installation operating at a 50% annual average load with power at \$0.05/kwh; the electrical power cost would be \$26,280/yr. A **biofilm** thickness of 0.045 inch on the condenser of this unit would **increase the annual power cost by \$9,198.00**. Annually, **biofilm** has been estimated to increase power costs to commercial and industrial operations in the United States by several

billion dollars.

Biofilm Control

Current **biofilm** control technology uses various costly, dangerous to handle, hazardous toxic chemicals such as chlorine, ozone, chlorine dioxide, dithiocarbamate, hydantoin, isothiazolin, and glutaraldehyde; commonly referred to as "biocides" These hazardous chemicals are used to treat cooling systems scattered throughout our towns and neighborhoods. The resulting commonplace transportation, storage, handling, and use of these toxic chemicals represents severe safety and environmental risks due to accidental spills as well as the resultant toxicity of treated cooling tower blowdown.

New Technology - MiniBrom

Bromine is very effective for **biofilm** control, but previous delivery methods suffer from hazardous chemical health & safety issues and high costs. To obtain the advantages of bromine for **biofilm** control, ProChemTech has developed a safe, cost effective technology to make aqueous bromine at the use location from a non-hazardous precursor, our patent pending



MiniBrom Biocide System tm

The **MiniBrom** can be simply "plugged" into just about any existing water management program. Due to its small size and power requirements, it can be treated exactly the same as a typical biocide chemical feed pump. Replacement of hazardous chemical biocides is easy, unplug the existing pump and plug in the

MiniBrom. The **MiniBrom** is a safe, cost effective, replacement for all of the current hazardous chemical technologies, including alternating biocides, for control of **biofilm**.

MiniBrom Economic Justification

Going back to our 200 ton chiller with an evaporative condenser cooling tower, the annual cost to provide complete control of **biofilm** using the **MiniBrom** is **just \$1086.40**. This is substantially less than the \$9198.00 excess energy use cost of having a thin **biofilm** on the condenser tubes and easily justifies an effective **MiniBrom** based **biofilm** control program.

Environmental and Health & Safety Benefits

The **MiniBrom Biocide System tm**, uses no hazardous toxic chemicals, eliminating hazardous chemical transport and handling accidents and spills of such commonly used products as:

Biocide Product	Aquatic Toxicity	Oral Toxicity
25% glutaraldehyde	56.2 ppm	134 mg/kg
1.5% isothiazolin	0.14 ppm	57.2 mg/kg
30% carbamate	0.10 ppm	395 mg/kg
98% hydantoin	0.4 ppm	578 mg/kg

Aquatic toxicity on product, LC 50 rainbow trout, oral toxicity on compound, LD 50 rat, note that the **higher the toxicity number**, the **less toxic** the product is. The bromine produced by the **MiniBrom** rapidly degrades in the cooling tower system into harmless bromide ion, thus no

toxic chemicals are discharged to the environment in the cooling tower blowdown.

Biofilm and Legionnaires' Disease



The Legionnaires' Disease bacterium, Legionella, is really quite common, being found in most soils throughout the world. It is a public health hazard when it reproduces in large numbers and is subsequently dispersed into the air. **Biofilm** in cooling towers is a **preferred site for growth of Legionella**. This **biofilm** strips and is subsequently dispersed through the aerosols produced during normal cooling tower operation. Legionnaires' Disease results when a sufficient number of the airborne bacteria are inhaled.

OSHA has recognized this problem and notes in their Technical Manual, Section III, Chapter 7, Part V, B. 2. "Biocides", b./c., that chlorine and bromine are proven effective in controlling Legionella growth in cooling towers while other commonly used hazardous biocides have been proven to be ineffective. **MiniBrom** on-site produced bromine is recognized by OSHA as one of only two biocides which are effective against Legionella bacteria in cooling towers.

The **MiniBrom Biocide System** is the safest, most cost effective, recognized means to control growth of **biofilm**, which can harbor legionella bacteria, in a cooling tower system and thus prevent spread of Legionnaires' Disease via cooling tower emissions. Failure to effectively control biofilm, and thus potential legionella growth, can expose a cooling tower operator to substantial legal liability in the event of a disease occurrence. When dealing with our legal system today, it is much better to be proactive than be in court ! The **MiniBrom** chemical precursor is registered with the USEPA as a biocide.

Specific benefits of this proven technology include:

- controlling **biofilm** reduces power costs
- effective, low cost control of the Legionella hazard
- complete, proven water management programs with no hazardous chemicals
- **ISO 14000 and LEED environmental/green impact reduction credits**

MiniBrom units are available in two sizes, the MB-10 produces up to 1.3 lb/day bromine, while the larger MB-20 can produce up to 2.6 lb/day. These two units cover cooling tower capacities from 10 to 1000 tons, evaporative condensers to 3000 tons. **MiniBrom** units are leased to eliminate your capital and maintenance costs, and are available only as part of a complete cooling water management program from:

ProChemTech International, Inc.
"The Water Management Company"

Brockway, PA 15824

814-265-0959

www.prochemtech.com

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