Kill the slime and algae in your cooling tower!
Not your employees and neighbors!

Eliminate use of toxic, hazardous chemicals with the new **MiniBrom Biocide System!**

Typical biological control technology uses costly, dangerous to handle, hazardous toxic chemicals such as chlorine, ozone, chlorine dioxide, dithiocarbamate, hydantoin, isothiazolin, and glutaraldehyde. These hazardous chemicals are used to treat over 250,000 cooling towers scattered throughout our towns and neighborhoods. The resulting commonplace transportation, storage, handling, and use of toxic chemicals represent a severe health and safety risk.

ProChemTech developed **patent pending** **MiniBrom** technology is the only effective technology for cooling water biological control that is **totally non-hazardous**. A solution of common table salt and sodium bromide is converted into a bromine biocide via electrolysis at the point of use. **No costly, hazardous chemical transport, storage, and handling!** A side benefit is that operation cost for a **MiniBrom** system is much less than traditional biocides while unit cost is comparable to many competing biocide delivery systems.

MiniBrom systems can be obtained directly from ProChemTech as part of our complete water management programs and are also available from select water management service firms in many areas of the country. Precursors used in the **MiniBrom,** PCT 3023 and 3024, are registered for biocide use by the USEPA, primary registrations number 58616-5 and 58616-3.

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Technical Information

The following pages provide toxicity and cost comparison data on commonly used hazardous chemical biocides, economic comparison data, efficacy information, specification and design data on the **MiniBrom**, **MiniBrom** operating information, and a schematic for a **MiniBrom** installation.

Toxicity Comparison Table – Typical Hazardous Biocides to MiniBrom

Product	CAS	acute oral toxicity, rat LD 50
glutaraldehyde	111-30-8	134 mg/kg
isothiazolin	26172-55-4	57.2 mg/kg
dithiocarbamate	142-59-6	395 mg/kg
hydantoin	32718-18-6	877 mg/kg
MiniBrom 3024	mixture	> 3500 mg/kg

As shown in the preceding table, the feedstock for the **MiniBrom** is substantially less toxic than any other biocide. To put this information in prospective, common table salt has an oral toxicity value of 3000 mg/kg!

Aquatic Toxicity Table – Typical Commonly Used Persistent Hazardous Biocides

Product	CAS	LC 50 aquatic toxicity	
glutaraldehyde 25%	111-30-8	rainbow trout	56.2 ppm
		daphnia	16.9 ppm
isothiazolin 1.5%	26172-55-4	rainbow trout	0.14 ppm
	and 2682-20-4	daphnia	0.13 ppm
dithiocarbamate 30%	142-59-6 and	rainbow trout	0.10 ppm
	128-04-1		
polyquat 20%	7173-51-5	bluegill sunfish	1.6 ppm
		daphnia	0.47 ppm

Many commonly used biocides do not degrade and are thus persistent, toxic pollutants when discharged in cooling tower blowdown. In contrast, the bromine produced by the **MiniBrom** does its job and then degrades back to harmless bromide ion.

Economic Use Cost Comparison Table – Typical hazardous biocides to MiniBrom

Product	Dose mg/l	lb/1000 gal	$/lb	$/1000 gal
20% polyquat	35	0.29	2.30	0.67
16% quat	65	0.54	1.80	0.97
30% carbamate	50	0.42	2.30	0.97
98% hydantoin	24	0.20	4.05	0.81
20% DBNPA	38	0.32	3.30	1.06
1.5% isothiazolin	127	1.06	3.25	3.45
15% glutaraldehyde	228	1.90	2.45	4.66
MiniBrom	3.0	0.14	1.50	0.21

This table shows that the **MiniBrom** is the **most cost effective biocide for typical cooling tower applications on the market.** It is especially cost competitive against the very toxic isothiazolin and glutaraldehyde biocides favored by such firms as Nalco and Betz. The purchase cost of a **MiniBrom** is generally comparable to, or less than, the cost of a traditional biocide feed installation when the costs of chemical pumps, double containment (not needed with the **MiniBrom**!!), safety equipment, and special feeders (for dry products) are accounted for.

A quick comparison between **MiniBrom** and a traditional program using alternating glutaraldehyde and hydantoin for a 1000 ton cooling tower operating 30 weeks a year gives the following annual costs:

Traditional Program - $2,461.50 **MiniBrom - $283.50**

The cost savings here, with a MiniBrom Model MB 20 priced at $1,650.00, pays for the MiniBrom purchase in less than one cooling season!

Power cost to operate a **MiniBrom** system is insignificant. For example, an MB 20 operating at three doses per week treating a 1000 ton cooling system for 30 weeks with power at $0.10/kwh would use $7.31 worth of electrical power.

Efficacy

Traditional biocide programs generally require use of an oxidizing and non-oxidizing biocide to prevent long term development of a resistant biota in a treated system. Due to the fact that resistance cannot be developed to a strong oxidizer, like the electrolytic bromine produced by the **MiniBrom,** it replaces two products with one product.

Shown is a biofouled filter from a cooling system using not just two, but four, traditional biocides with poor results. Installation of a **MiniBrom** system permanently eliminated this major biofouling problem.

The **MiniBrom** is much more effective in high pH cooling waters than traditional chlorine based biocides as shown in the following table:

pH of water	% available chlorine	% available bromine
6.5	95	100
7.0	90	100
7.5	50	94
8.0	24	83
8.5	9	60
9.0	3	33
9.5	0	11

Oxidizing biocides, like the **MiniBrom,** are recognized to be effective against the bacteria that cause Legionnaire's Disease by both OSHA and CDC; many traditional, commonly specified biocides are not recognized as being effective. As the **MiniBrom** produces a bromine residual in the cooling water, it is effective against both planktonic and sessile microorganisms throughout the entire cooling system. This is in contrast to UV and ultrasonic devices, which can kill only the planktonic organisms that pass through the device. Sessile (including algae) organisms are responsible for most under deposit corrosion and commonly harbor legionella bacteria. Note that the residual bromine can be easily measured in the field for control purposes to ensure control of sessile organisms throughout the cooling system.

Algae Control: With addition of a low cost stabilizer to the **MiniBrom** feed solution, the **MiniBrom** produces a stabilized electrolytic bromine solution that has been shown to very effective against algae in open design cooling towers. Open cooling towers, such as the one on the left, are prone to algae problems due to good sunlight access to the cooling water. In this particular installation, operation of a **MiniBrom** system with our stabilizer eliminated a long standing problem with algae growth in the fill and cold water basin.

MiniBrom Specifications

MiniBrom units are self contained units housed in a 14.5" X 12" X 6.5" NEMA 12 steel panel box with the **patent pending MiniBrom** electrode assembly mounted in a plastic box that is 10" X 10" X 8" located near the panel box and supplied with an appropriate solution pump. Construction is to NEC specifications, input voltage is 110 v ac, with a maximum electrode voltage of 5 volt dc. Units can be controlled using any stand alone timer, an optional timer supplied with the unit, or any existing time based biocide controller. Existing day tanks can be used for solution makedown, or an optional solution tank, in various capacities, can be purchased with the unit. Three **MiniBrom** units are presently offered with the following specifications:

Model	Br Output	Power Use	3024 Use	3023 Use	Solution Use
MB 10	0.054 lb/hr	0.06 kwh	0.3 lb/hr	0.15 lb/hr	0.2 gal/hr
MB 20	0.11 lb/hr	0.12 kwh	0.6 lb/hr	0.30 lb/hr	0.4 gal/hr
MB 40	0.21 lb/hr	0.12 kwh	1.2 lb/hr	0.60 lb/hr	0.8 gal/hr

MiniBrom Sizing/Use Calculations

To properly select a unit and calculate its chemical use, you must first determine the volume of cooling water to be treated. The volume can be obtained by engineering calculations, dilution techniques, or use the "rule of thumb" values of 15 gal/ton for standard cooling towers and 2 gal/ton for evaporative condenser cooling towers. We also assume a dose of 3 mg/l, oftentimes much less is needed, as bromine to obtain the desired residual one hour after the dose of 0.5 to 1.0 mg/l as total bromine in the cooling water. As an example, using a 1000 ton standard cooling tower, our calculations are:

bromine dose = (3 mg/l Br X 1000 ton X 15 gal/ton X 8.345 lb/gal)/1,000,000 = 0.376 lb/dose

operating time MB 10 = 0.376 lb/dose/0.054 lb/hr = 6.9 hr/dose

operating time MB 20 = 0.376 lb/dose/0.11 lb/hr = 3.4 hr/dose

Since we like to complete a dose in less than four (4) hours, we select a **MiniBrom** MB 20 unit operating 3.4 hours/dose. Solution and precursor chemical use can then be readily calculated:

Solution use per dose = 3.4 hr/dose X 0.4 gal/hr = 1.4 gal/dose

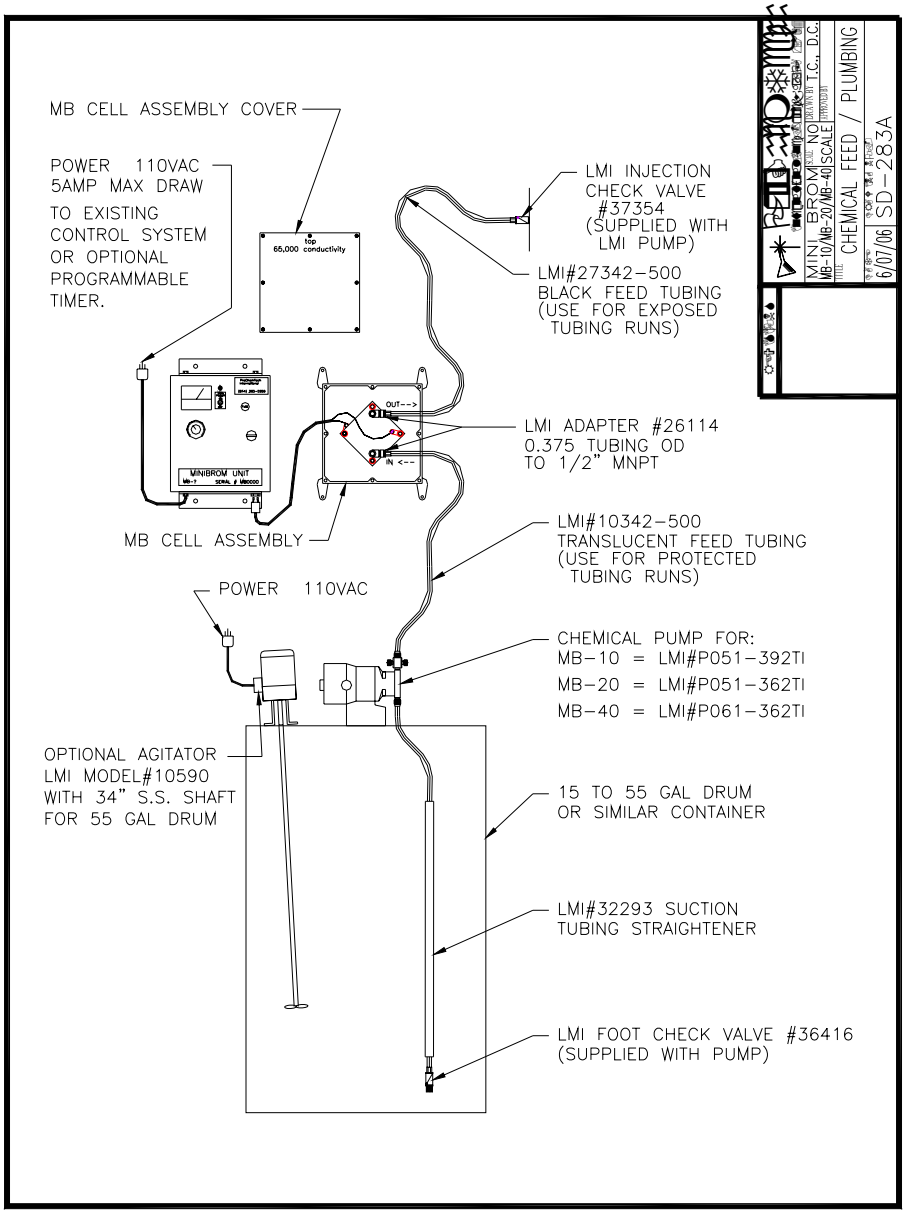
PCT 3023 product use per dose = 3.4 hr/dose X 0.3 lb/hr = 1.02 lb/dose

PCT 3024 product use per dose = 3.4 hr/dose X 0.6 lb/hr = 2.0 lb/dose

For field use making up **MiniBrom** feed solutions, we recommend the following dilution ratios:

PCT 3022 bromine stabilizer: 1 qt (3 lb)/25 gal water
PCT 3023 solid bromine product: 20 lb/50 gal water
PCT 3024 liquid bromine product: 5 gal (55 lb)/35 gal water

The following drawing shows a typical **MiniBrom** field



installation.