ROHM AND HAAS

KATHON™ 886 MW Microbicide Metalworking Fluid Fungicide
Microbicide for Water-Based Cutting Fluids

Description

Soluble, synthetic, and semi-synthetic metalworking fluids or coolants provide an excellent environment for the growth of various microorganisms, including bacteria, mold, and yeast. If allowed to grow, these organisms can have detrimental effects on the fluids. For example, bacteria, which can grow very quickly, can destroy the integrity of the fluid by discoloration destroying lubricity characteristics, and causing emulsions to split. Bacteria can also reduce the pH of the fluid, which can promote corrosion. Some forms of bacteria have objectionable odors. Fungi typically grow more slowly than bacteria, but can form large masses which clog filters and lines and in some cases lead to system shutdown; fungi also generate foul odors and can cause corrosion.

KATHON 886 MW microbicide is very effective against bacteria and fungi. It is recommended for use in soluble, semi-synthetic, and synthetic metalworking fluids. **Due to the wide variations in coolant formulations, laboratory or pilot tests are recommended to evaluate KATHON 886 MW microbicide in specific metalworking fluids prior to commercial use.**

KATHON 886 MW microbicide is supplied as a 14% active liquid in water. It is registered with the U.S. EPA (Environmental Protection Agency), number 707-129.

Tankside Biocide

KATHON biocides have been used safely and effectively in a variety of industries around the world for more than 20 years. In 1977 Rohm and Haas Company was granted EPA registration for KATHON 886 MW microbicide for use in metalworking fluids, in 2 piece can manufacture, hot aluminum rolling, and general machinery of ferrous and aluminum materials. In 1986, this registration was expanded to include the use of KATHON 886 MW microbicide in metal cleaners and water-based hydraulic fluids.

The information in this brochure has been compiled to familiarize users of KATHON 886 MW microbicide with its chemistry, to communicate the tremendous benefits of this product as well as the potential hazards, to provide directions for safe and efficient use of the product, and to aid the user in the event of misuse. Particular attention should be paid to the Compatibility section of this brochure which provides insight on the stability of KATHON 886 MW microbicide with individual components and additives frequently used in metalworking fluid operations.

KATHON 886 MW microbicide can be used safely and effectively by following the instructions and precautions outlined in this brochure, on the product label, and on the Rohm and Haas Material Safety Data Sheet.

Key Features and Benefits of KATHON 886 MW

Table 1
Details the features and benefits of Kathon 886 MW

Features	Benefits
Highly effective microbicide	Extends metalworking fluid life, resulting in reduced makeup fluid use and costs and lower waste fluid disposal costs
Broad spectrum activity	Provides long lasting and effective contamination prevention versus bacteria and fungi (no performance gaps)
Efficacious versus specific problem-causing microorganisms	Effective against *Mycobacterium* and endotoxin-producing bacteria (based on controlled laboratory studies)
Good temperature and pH stability	Works well in a variety of metalworking conditions up to 60°C (140°F) and pH 9.2
Highly soluble in water and does not foam	Easy to dose
Provides long lasting microbial control	Cost effective versus competitive tankside treatments
Fast acting	Quickly controls microbial activity (oxygen consumption) and odor-causing bacteria and fungi
Effective at low use rates (10 to 17 ppm ai) and biodegradable	Better for the environment
Does not contain or release formaldehyde	Not subject to formaldehyde concerns

Directions For Use

Metalworking Fluid Preservation

For maintenance of a non-fouled system, use KATHON 886 MW microbicide at 2.7 fluid ounces (0.23 pounds) per 1,000 gallons of emulsion every 4 weeks or 2.7-12.8 fluid ounces (0.23-1.1 pounds) per 1,000 gallons of emulsion every 8-12 weeks. For a noticeable fouled system use an initial dose of 5.4-12.8 fl oz (0.46-1.1 pounds) per 1,000 gallons of emulsion followed by subsequent maintenance dosages depending upon the treatment interval noted above.

A higher dosage range and/or increased frequency of treatment may be required depending upon rate of dilution of the preservative with makeup fluid, the nature and severity of contamination, level of control required, filtration effectiveness, and system design, etc. The preservative should be dispensed into the use dilution of the metal-working fluid using a metering pump and uniformly dispersed throughout the system.

Metal Cleaning Fluid Preservation

KATHON 886 MW microbicide is recommended as a preservative for the manufacture and use of alkaline, acid, and emulsion based metal cleaning fluids typically used in electroplating, phosphatizing, galvanizing, and general metal cleaning operations.

For addition to a metal cleaning concentrate add KATHON 886 MW at a level to ensure that the final use-dilution fluid contains 44 to 147 ppm as supplied (6.25 - 25 ppm active isothiazolones).

When direct addition to a fouled system, add 5.6-22.6 fl oz (0.48-1.9 lbs) of microbicide to each 1,000 gallons of use-diluted metal cleaning fluid every 3 to 4 weeks to provide 44 to 177 ppm as supplied (6.25 to 25 ppm active isothiazolones). A higher dosage range and/or increased frequency may be required depending upon dilution rate of the preservative with makeup fluid, the nature and severity of contamination, level of control required, filtration effectiveness, and system design, etc.

The preservative should be dispensed into the use-dilution metal cleaning fluid using a metering pump and uniformly dispersed throughout the system.

Water Based Hydraulic Fluid Preservation

KATHON 886 MW microbicide is recommended as a preservative for use in the manufacture and use of high water-based hydraulic fluids and invert emulsion hydraulic fluids.

For the maintenance of a nonfouled system, use KATHON 886 MW microbicide at 9-13 fluid oz (0.76-1.1 lbs) per 1,000 gallons of fluid every 8 weeks. For a noticeably fouled system use an initial dose of 13 to 20 fluid ounces (1.1-1.7 lbs) per 1,000 gallons fluid followed by subsequent maintenance doses. A higher dosage range and/or increased frequency of treatment may be required depending upon rate of dilution of the preservative with makeup fluid, the nature and severity of contamination, level of control required, filtration effectiveness, system design, etc.

The preservative should be dispensed into the use-dilution of the hydraulic fluid using a metering pump and uniformly dispersed throughout the system.

Table 2 provides minimum and maximum dosage levels of KATHON 886 MW for systems ranging from 500-100,000 gallons.

Table 2 Kathon 886 MW Use Rate

System Size Gallons	Minimum fl. oz (lbs.)		Maximum fl. oz (lbs.)	
500	1.4	(0.12)	6.2	(0.52)
1000	2.7	(0.24)	12	(1.1)
2000	5.4	(0.47)	25	(2.1)
5000	14	(1.2)	62	(5.2)
10000	28	(2.4)	123	(10)
25000	70	(5.9)	308	(26)
50000	140	(12)	616	(52)
100000	280	(24)	1,232	(104)

Minimum dose = 4 ppm active ingredient

Maximum dose = 17.5 ppm active ingredient

Physical and Chemical Properties

Table 3 Chemical Composition

Ingredients	KATHON 886 MW	
Active Ingredients	5-chloro-2-methyl-4-isothiazolin-3-one	10.4%
	2-methyl-4-isothiazolin-3-one	3.7%
	Total Active Ingredients (typical)	14.1%
Inert Ingredients	Magnesium ion	4.2 to 5.5 %
(Approximate Values)	Water	to 100%

Table 4
Typical Physical Properties
These properties are typical but do not constitute specifications.

Appearance	Amber to gold, slightly viscous liquid
Odor	Mild, aromatic
Specific Gravity, @ 25°C	1.29
Density, lb./gal.	10.8
pH	1 to 3
Viscosity, cps, @ 25°C	16
Melting Point, °C	–33
Boiling Point, °C	100
Vapor Pressure, (mm Hg), @ 23°C	0.1

The typical physical properties of KATHON 886 MW microbicide are presented in Table 2.

Solubility

KATHON 886 MW microbicide is soluble in water, methanol, ethanol, isopropyl alcohol, acetic acid, and 3.5 parts n-butanol. KATHON 886 MW microbicide is insoluble in acetone.

Stability

pH - KATHON 886 MW microbicide is stable over a wide pH range (3.0-9.2) in water and metalworking fluid systems. Its stability and performance are improved at lower pH. Whenever possible the pH of a system should be maintained below pH 9.2.

Storage - KATHON 886 MW microbicide is stable as supplied for at least one year at ambient temperatures and at least six months at 50°C.

Recommended Use Practices

General Practices When Using KATHON Biocides

- Know the size of your system and dose at the recommended use levels.
- To improve performance and longevity add KATHON 886 MW microbicide on the clean side of the filters. It may be necessary to occasionally add KATHON 886 MW microbicide to the dirty side of the filters if large populations of microorganisms are detected there.
- Minimize contamination:
  - Eliminate or minimize dead spots
  - Disconnect unused portions of the system
  - Do not throw trash in sumps
- Always remember to triple rinse (or equivalent) empty KATHON 886 MW containers to avoid incidental contact.
- Post placard with safety information and deactivation protocol near biocide handling area.

Maximizing the Performance of KATHON 886 MW Fungicide

Additional guidelines for maximizing the performance of KATHON 886 MW microbicide are as follows:

- KATHON 886 MW microbicide stability and performance is improved with lower pH. Whenever possible maintain the pH of system below pH 9.2. Lower pH also makes amines and amine-containing compounds less aggressive.
- For systems with pH greater than 9.5, we strongly recommend determination of biological efficacy and chemical stability prior to use.
- Avoid adding highly basic additives (alkaline materials with pH of 10-12) immediately prior to or after adding KATHON 886 MW microbicide to your system. If a highly basic additive must be added, allow sufficient time (at least 30 minutes) between additions.
- Minimize levels of diethanolamine (DEA) in your system. If possible use 99% triethanolamine (TEA) or monoethanolamine (MEA) instead of DEA, and use these at as low a level as possible.
- Avoid use of mercaptans such as mercaptobenzothiazole.
- Some biocides are incompatible with KATHON 886 MW and can degrade it. To maintain performance avoid using Sodium Omadine and Triadine 10 with KATHON 886 MW microbicide. If a fungicide is needed, use KATHON 893 MW fungicide; it is completely compatible with KATHON 886 MW microbicide.
- Always add KATHON 886 MW microbicide directly to the metalworking fluid sump. Never use KATHON 886 MW microbicide in a spray bottle.
- Avoid charging KATHON 886 MW microbicide in high temperature zones, since increasing temperatures accelerate other degradation effects. Ideally, add KATHON 886 MW microbicide to the fluid below 60°C (140°F).
- Avoid adding KATHON 886 MW microbicide and incompatible corrosion inhibitors directly to the tank at the same time.

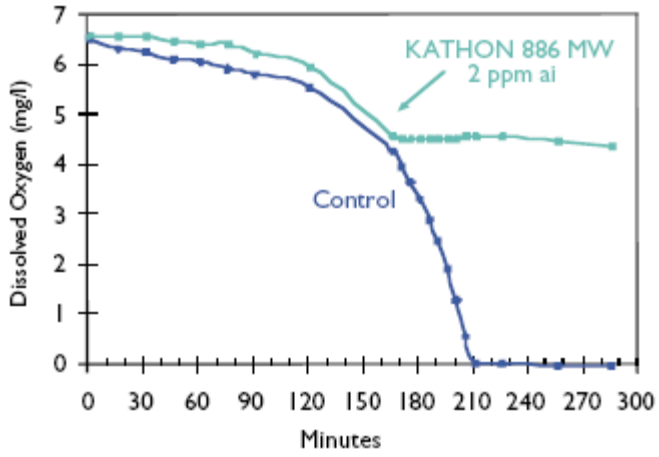
Performance Information

How Does KATHON 886 MW Work?

KATHON 886 MW biocide utilizes a two-step mechanism involving rapid growth inhibition leading to a loss of cell viability. Growth inhibition is the result of rapid disruption of the central metabolic pathways of the cell by inhibition of several specific enzymes, including dehydrogenases. The critical enzymes which are affected are associated with the Krebs cycle (alpha- ketoglutarate, pyruvate, and succinate dehydrogenase), nutrient metabolism (lactate dehydrogenase) and energy generation (NADH dehydrogenase).

The key physiological activities that are rapidly inhibited in microbial cells are respiration (oxygen consumption), energy generation (ATP synthesis), and growth (assimilation). Many of these key enzymes are present in both aerobic and anaerobic microorganisms, which explains why KATHON 886 MW is such a broad spectrum biocide.

Inhibition of cellular activity and growth is rapid (within minutes), whereas cell death (cidal activity) is observed after several hours contact. In general, the higher the concentration of biocide, the shorter the contact time required for more complete kill. Cell death results from the progressive loss of protein thiols in the cell from one of multiple pathways. As cell metabolism is disrupted, free radicals are produced which also results in cell death. This unique mechanism results in the broad spectrum of activity of KATHON 886 MW biocide, low use levels for microbial control, and difficulty in attaining resistance by mutation.



How Rapidly Does KATHON 886 MW Microbicide Work?

Within minutes after addition of KATHON 886 MW microbicide to a metalworking fluid sump, the metabolic activity of the microorganisms in the system shuts down. This includes cellular respiration (oxygen uptake), growth, energy generation, and nutrient uptake. The microorganisms, although still alive, are no longer able to reproduce or metabolize metalworking fluid components. After 24 to 48 hours of contact with a lethal dose of the microbicide, most of the microorganisms have been killed.

How Long Does KATHON 886 MW Microbicide Last?

KATHON 886 MW microbicide generally retains its antimicrobial efficacy in metalworking fluid systems for 1 to 4 weeks. Variables such as degree of fluid contamination, effectiveness of the filtration system, system turnover time, compatibility between the microbicide and the metalworking fluid components, and other system additives involved, can affect the life of the microbicide in a system.

Is KATHON 886 MW Microbicide Effective in Reducing Biofilm Growth?

YES. The active ingredients in KATHON 886 MW microbicide have been shown to reduce microbial fouling and prevent biofilm development. A number of application studies have been conducted demonstrating reduction of both viable microorganisms (bacteria and fungi) as well as total biomass (total protein and dry solids) on industrial surfaces. The benefits of reduced microbial fouling include improved system performance, reduced filter plugging, reduced biocorrosion, and improved microbial control. Additional information on biofouling studies is presented in technical bulletin CS-673R.

Is KATHON 886 MW Microbicide Effective Versus Mycobacteria?

YES. The performance of KATHON 886 MW microbicide was tested in controlled laboratory studies versus a pure culture of *Mycobacterium chelonae* (ATCC 14472). Results showed 7-20 ppm active ingredient prevented the growth of the *Mycobacterium* isolate (10^6 cfu/ml) in dilute and full strength nutrient broth. An eradication study in a soluble oil fluid showed KATHON 886 MW microbicide at 9 ppm active ingredient was sufficient to provide complete kill of 10^3 bacteria/ml.

Is KATHON 886 MW Microbicide Effective Versus Endotoxin-Producing Bacteria?

YES. The term "bacterial endotoxin" is synonymous with the lipopolysaccharide (LPS) component of the outer membrane of Gram negative bacteria. It is generally regarded that the Lipid A component of the LPS is directly responsible for the endotoxic activity of certain Gram negative bacteria. The "endotoxin" terminology refers to the fact that the "toxin" is located on the exterior of the bacterial cell and is "released" from the cell into the surrounding liquid after cell death and lysis. It is important to note that not all LPS from Gram negative bacteria are endotoxins. The most heavily studied LPS are from *Escherichia*, *Shigella* and *Salmonella*, all of which are enteric or intestinal bacteria. KATHON 886 MW microbicide has been shown to be efficacious versus many Gram negative bacteria, known to produce endotoxins, under controlled laboratory studies. Minimum Inhibitory Concentrations for KATHON 886 MW microbicide are within the recommended use range for general bacterial control. In addition, KATHON 886 MW microbicide does not function by cell lysis or membrane disruption, so killed cells would be less likely to release endotoxins.

How Can I Improve the Stability and Performance of KATHON 886 MW Microbicide in Aggressive Systems?

KATHON 886 MW microbicide may encounter conditions in certain metalworking fluids where stability is reduced. Several options exist to improve it's performance and stability. Addition of inorganic or organic forms of copper to the fluid may improve the stability of the active ingredients and reduce degradation. Alternatively, KATHON MWC microbicide contains copper salts and is designed for aggressive conditions. Addition of biosurfactants or biodispersants may improve it's efficacy, especially against biofilms or heavily contaminated systems. Addition of a chelant, such as EDTA, may also boost efficacy in challenging systems.

Is KATHON 886 MW Microbicide Effective Against Thermophiles?

YES. KATHON 886 MW microbicide was evaluated for efficacy against thermophilic bacteria in 4 hot aluminum rolling oils. KATHON 886 MW microbicide at 20 ppm a.i. (143 ppm as supplied) controlled microbial growth at 54°C in all 4 of the fluids (at recommended dilutions) at least 4 weeks and in 1 fluid for 3 weeks. Results are presented in Table 5.

Table 5
Efficacy KATHON 886 MW Against Thermophiles at 54ºC

Fluid	KATHON 886 MW PPM Active	No. of CFU/ml					
		5 Days	2 Weeks	3 Weeks	4 Weeks	5 Weeks	6 Weeks
1	0	10^6	10^5	10^7	10^8	10^6	10^8
	20	$<10^3$	$<10^3$	$<10^3$	$<10^3$	$<10^4$	$<10^7$
2	0	10^4	10^5	10^4	10^6	10^6	10^6
	20	$<10^3$	$<10^3$	$<10^3$	$<10^7$	—	$<10^8$
3	0	$<10^3$	10^5	10^4	10^3	—	10^7
	20	$<10^3$	$<10^3$	$<10^3$	$<10^3$	$<10^3$	10^4
4	0	$<10^3$	10^5	10^4	10^5	10^4	10^5
	20	$<10^3$	$<10^3$	$<10^3$	$<10^3$	$<10^3$	$<10^3$
Inoculum Count		10^4	10^4	10^9	10^6	10^6	10^5

Is KATHON 886 MW Microbicide Corrosive at Recommended Use Rates or with Repeated Dosing?

NO. A study to determine if repeated doses of KATHON 886 MW microbicide or magnesium chloride in use-dilution metalworking fluids cause corrosion was conducted. This study showed no detrimental effects from either the KATHON biocide or the magnesium chloride. In this study, mild steel coupons were placed in glass bottles containing a 4% solution of a commercial metalworking fluid in demineralized water. Levels of KATHON 886 MW ranging from 200-1600 ppm, product as supplied, (2-16 times the recommended use rate) or levels of magnesium chloride ranging from 110-550 ppm were added to the bottles and stored at 35°C for 6 months. The pH of all samples was @ 9.4. All tests were performed in triplicate; no observable corrosion occurred on any of the metal coupons. Results are presented in Table 6.

Table 6

Sample No.	KATHON 886 MW PPM	$MgCl \bullet 6H_2O$ PPM	Cl^-	Average Weight Loss of Coupons
1*	0	0	0	-0.016%
2	200	–	14	-0.016%
3	400	–	28	-0.017%
4	800	–	56	-0.020%
5	1600	–	112	-0.012%
6	–	110	38	-0.016%
7	–	275	96	-0.015%
8	–	550	192	-0.018%

*control

Efficacy

Microbistatic Properties

Table 7 lists the Minimum Inhibitory Concentration (MIC) in parts per million of KATHON 886 MW microbicide (active ingredients) for microorganisms frequently found in metalworking fluid systems. The data are intended only to indicate the activity of KATHON 886 MW microbicide in aqueous solutions and do not represent a claim for recommended use concentrations.

Table 7
Minimum Inhibitory Concentration Values for
KATHON 886 MW Microbicide versus Bacteria and Fungi*

Microorganism**	ATCC Number or Rohm and Haas Code	PPM Active Ingredient KATHON 886 MW
Gram-Negative Bacteria		
Achromobacter parvulus	4334	2
Alcaligenes faecalis	8750	2
Azotobacter vinelandii	12837	5
Burkholderia cepacia	*Gibraltar* 165	0.75
Enterobacter aerogenes	3906	5
Escherichia coli	11229	8
Flavobacterium suavcolens	958	9
Mycobacterium chelonae	14472	7
Nitrobacter agilis	14123	0.1
Proteus vulgaris	8427	5
Pseudomonas aeruginosa	15442	5
Pseudomonas fluorescens	13525	2
Pseudomonas oleovorans	8062	5
Salmonella typhosa	6539	5
Shigella sonnei	9292	2
Gram Positive Bacteria		
Bacillus cereus var mycoides	R&H L5	2
Bacillus subtilis	R&H B2	2
Brevibacterium ammoniagenes	6871	2
Cellulomonas sp	21399	6
Sarcina lutea	9341	5
Staphylococcus aureus	6538	2
Staphylococcus epidermidis	155	2
Streptococcus pyogenes	624	9
Streptomyces albus	3004	1

Fungi		
Aspergillus foetidus	16878	8
Aspergillus niger	9642	9
Aspergillus oryzae	10196	5
Candida albicans (yeast)	11651	5
Cephalosporium sp.	R&H Isolate	2
Chaetomium globosum	6205	9
Cladosporium resinae	11274	5
Fusarium sp.	R&H Isolate	2
Mucor rouxii	R&H L5-83	5
Penicillium funiculosum	9644	5
Penicillium variabile	USDA Isolate	2
Rhizopus stolonifer	10404	5
Rhodotorula rubra (yeast)	9449	2
Saccharomyces cerevisiae (yeast)	2601	2
Trichophyton mentagrophytes	9533	5
Trichosporon sp. (yeast)	R&H Isolate	2

*The data in Table 7 were obtained with KATHON 886 MW microbicide as supplied or with a technical grade of the active ingredients used as an intermediate in its manufacture.

***Tests were performed by serially diluting test compounds in trypticase soy broth and 1:100 inoculation with 24-hour broth cultures of test bacterium or fungal spore suspension prepared from 7-14 day culture slants washed with 7 ml deionized water. Minimum inhibitory concentrations were determined visually after 2 days incubation at 37°C for bacteria and 7 days incubation at 28-30°C for fungi. *Mycobacterium chelonae* was tested in 1/4 X TSB media at 37°C and the MIC value recorded after 5 days.

Table 8
KATHON 886 MW Efficacy

Fluid Type	KATHON 886 MW ppm a.i.	No. of CFU/ml					
		Zero Time	3 Days	1 Week	2 Weeks	3 Weeks	4 Weeks
Soluble	0	10^7	10^7	10^7	10^7	10^7	10^7
	10	10^7	10^5	10^3	10^6	10^7	—
	17.5	10^6	10^6	10^3	$<10^3$	$<10^3$	$<10^3$
Semi-Synthetic	0	—	10^7	10^7	10^7	10^7	10^8
	10	—	10^5	$<10^3$	$<10^3$	10^5	10^8
	20	—	10^4	$<10^3$	$<10^3$	$<10^3$	$<10^3$
Synthetic	0	10^6	10^6	10^6	10^7	10^7	10^7
	10	10^6	10^5	$<10^3$	$<10^3$	$<10^3$	$<10^3$
	17.5	10^6	10^5	$<10^3$	$<10^3$	$<10^3$	$<10^3$

Metalworking Fluids

Ferrous Systems - The efficacy of KATHON 886 MW microbicide was evaluated in three use-dilution metalworking fluids designed for use in ferrous operations. Results from these tests, provided in Table 8, show that KATHON 886 MW effectively controlled microorganisms at $<10^3$ CFU/ml for greater than 4 weeks at 17.5 – 20 ppm a.i., and for 1 to 2 weeks at 10 ppm a.i.

Hot Aluminum Rolling Oils - The stability of KATHON 886 MW microbicide was determined at ambient temperature and at 54°C, in 5 hot aluminum rolling oils. KATHON 886 MW was found to be stable in all 5 fluids at both temperatures for 2 weeks. The efficacy of KATHON 886 MW microbicide in the same fluids was determined at 37°C and 54°C. KATHON 886 MW was found to be efficacious at both temperatures for 4 weeks at a level of 14 ppm active ingredient. Test results are provided in Tables 9 and 10.

Table 9
KATHON 886 MW Stability

Ambient Temperature

Fluid NO.	KATHON 886 MW ppm a.i. added	1 Week RH-651*	1 Week RH-573**	1 Week Total a.i.	2 Weeks RH-651	2 Weeks RH-573	2 Weeks Total a.i.
1	20	14.6	5.0	19.6	14.3	5.1	19.4
2	20	14.4	4.9	19.3	14.5	4.9	19.4
3	20	15.6	5.1	20.7	15.3	5.0	20.3
4	20	14.8	4.9	19.7	15.0	5.4	20.4
5	20	15.2	5.0	20.2	15.7	5.1	20.8

54°C

Fluid No.	KATHON 886 MW ppm a.i. added	1 Week RH-651	1 Week RH-573	1 Week Total a.i.	2 Weeks RH-651	2 Weeks RH-573	2 Weeks Total a.i.
1	20	7.5	5.0	12.5	4.2	4.9	9.1
2	20	9.6	5.0	14.6	7.1	4.9	12.0
3	20	14.2	5.0	19.2	13.0	4.9	17.9
4	20	13.1	5.1	18.2	11.8	5.4	17.2
5	20	13.8	5.0	18.8	11.6	4.9	16.5

*RH- 651 = Chlorinated component of KATHON 886 MW
**RH- 573 = Unchlorinated component of KATHON 886 MW

Table 10
KATHON 886 MW Efficacy

Fluid No.	KATHON 886 MW PPM Active	Temp C°	No. of Bacterial CFU/ml 1 Week	2 Weeks	3 Weeks	4 Weeks
1	0	37	1.8×10^6	$<10^6$	7.7×10^6	1.9×10^5
	21	37	$<10^3$	$<10^3$	$<10^3$	$<10^3$
	0	54	9.6×10^5	8×10^5	2.1×10^4	2.3×10^4
	14	54	$<10^3$	$<10^3$	$<10^3$	$<10^3$
2	0	37	9.5×10^5	$<10^6$	$<10^6$	1.6×10^5
	14	37	$<10^3$	$<10^3$	$<10^3$	$<10^3$
	0	54	$<10^6$	$<10^6$	2.7×10^4	$<10^6$
	14	54	$<10^3$	$<10^3$	$<10^3$	$<10^3$
3	0	37	1.7×10^6	1.2×10^6	2.3×10^5	3.0×10^5
	14	37	$<10^3$	$<10^3$	$<10^3$	$<10^3$
	0	54	8.2×10^4	2.1×10^5	1.1×10^5	7.8×10^4
	14	54	$<10^3$	$<10^3$	$<10^3$	$<10^3$
4	0	37	1.1×10^4	2.5×10^5	1.4×10^6	9.6×10^5
	14	37	$<10^3$	$<10^3$	$<10^3$	$<10^3$
	0	54	$<10^3$	6.6×10^5	1.4×10^5	7×10^3
	14	54	$<10^3$	$<10^3$	$<10^3$	$<10^3$
5	0	37	2.4×10^6	10^7	$<10^6$	9.3×10^5
	14	37	$<10^3$	$<10^3$	$<10^3$	$<10^3$
	0	54	3×10^5	2.1×10^5	$9.0 \times 1\ 0^4$	3.8×10^5
	14	54	$<10^3$	$<10^3$	$<10^3$	$<10^3$

Aluminum Can Forming Fluids

The stability and efficacy of KATHON 886 MW microbicide in 3 use-dilution aluminum can forming fluids were determined at 25°C and 38°C. The pH of the fluids was 7.4-7.6. The chemical stability after 4 weeks indicated good stability at 25°C and fair stability at 38°C. KATHON 886 MW microbicide was efficacious at both temperatures at 17.5 ppm active ingredient for 4 weeks. Test results are provided in Tables 11 and 12.

Table 11
KATHON 886 MW Stability

Fluid No.	KATHON 886 MW PPM Active	Temp C°	1 Week		2 Weeks		3 Weeks	
			RH-651*	RH-573**	RH-651	RH-573	RH-651	RH-573
1	17.5	25	14.7	4.9	12.6	4.9	10.3	4.5
	17.5	38	10.3	5.0	6.0	4.8	1.7	4.8
2	17.5	25	14.2	4.9	13.3	4.8	11.7	4.8
	17.5	38	11.8	4.8	7.7	4.7	2.9	5.0
3	17.5	25	13.8	4.8	12.5	4.7	9.4	4.8
	17.5	38	10.0	4.8	4.8	4.7	0.8	5.9

Table 12
KATHON 886 MW Efficacy

Fluid No.	KATHON 886 MW PPM Active	Temp C°	No. of Bacterial CFU/ml			
			1 Week	2 Weeks	3 Weeks	4 Weeks
1	0	25	3.9×10^5	5.5×10^6	$>10^7$	$>10^5$
	17.5	25	$<10^3$	2.4×10^5	3.5×10^3	1.5×10^4
	0	38	2400 (F)*	5.5×10^6	$>10^7$	$>10^7$
	17.5	38	$<10^3$	$<10^3$	$<10^3$	$<10^3$
2	0	25	2.8×10^5	9.6×10^6	$>10^7$	$>10^7$
	17.5	25	$<10^3$	3×10^5	3×10^3	1.5×10^4
	0	38	3.3×10^5	1.2×10^6	$>10^7$	$<10^7$
	17.5	38	$<10^3$	$<10^3$	$<10^3$	$<10^3$
3	0	25	2.8×10^5	3.3×10^6	$>10^7$	$>10^7$
	17.5	25	$<10^3$	$<10^3$	$<10^3$	1.3×10^3
	0	38	10^3	1.6×10^6	$>10^7$	$>10^7$
	17.5	38	$<10^3$	$<10^3$	$<10^3$	$<10^3$

Metal Cleaners

Four metal cleaning wash water samples taken from 2 different washer lines from a can plant were used to determine the efficacy of KATHON 886 MW microbiocide. KATHON 886 MW microbicide at 140 ppm as supplied (~20 ppm a.i.) successfully inhibited growth of microorganisms in all 4 samples for 2 weeks. Results are provided in Table 13.

Table 13

Sample No. and Location	KATHON MW 886 PPM Product	cru/ml Incubation at 37°C 1 Week	2 Weeks
Line 1, Drag Out	0	1.7×10^7	1.7×10^7
	140	20	20
Line 1, Washer	0	2.3×10^6	1.5×10^6
	140	<10	<10
Line 2, Drag Out	0	5.4×10^5	8.3×10^6
	140	<10	<10
Line 2, Washer	0	2.3×10^5	2.5×10^6
	140	<10	<10

Compatibility With Metalworking Additives

More than 200 metalworking fluid additives, including emulsifiers, corrosion inhibitors, EP additives, etc., have been tested for their effect on the stability of KATHON 886 MW microbicide. Table 14 lists these compounds and their primary function by degree of compatibility with KATHON 886 MW microbicide ranging from EXCELLENT COMPATIBILITY to NOT COMPATIBLE. Table 15 cross-references Table 14 and lists these additives by type. The data in Tables 14 and 15 should be used in conjunction with the guidelines below:

1. Assume KATHON 886 MW microbicide will work. It can be used with all metalworking fluid additives except those listed as NOT COMPATIBLE.

2. Use the data in Tables 14 and 15 to assess the relative effect of your formulation additives.

3. If possible, select alternative additives in higher compatibility categories to improve the stability of KATHON 886 MW microbicide.

4. Lower the pH or the levels of aggressive additives to improve compatibility.

5. Contact Rohm and Haas Company for information on KATHON MWC microbicide which has enhanced stability and efficacy in certain metalworking fluids which are antagonistic toward KATHON 886 MW microbicide.

Table 14

	Common Name	Function*
Excellent Compatibility	Amphoteric Surfactants	Corrosion Inhibitor
	Benzotriazole	Corrosion Inhibitor
	Biocides**	Biocide
	Borax	Corrosion Inhibitor
	Chlorinated Fatty Esters	EP Additive
	Chlorinated Paraffins	EP Additive
	Dinonylnaphthalene Sulfonates	Corrosion Inhibitor
	Dioctyl Sulfosuccinates	Emulsifier
	EO-PO Polymers	Wetting Agent
	Fatty Acids	Emulsifier
	Fatty Acid - TEA Salts	Emulsifier
	Fatty Esters	Lubricant
	Glycols	Coupler
	KATHON[1] 893 MW	Fungicide
	Morpholine	Corrosion Inhibitor
	Non-silicone Defoamers	Defoamer
	Oxazoline Surfactants	Emulsifier
	PEG Esters	Emulsifier
	Petroleum Sulfonates	Emulsifier
	Phosphate Esters	EP Additive
	Polyglycols	Coupler
	Sarcosinate Surfactants	Emulsifier
	Silicone Defoamers	Defoamer
	Triton[2] N-Series Surfactants	Emulsifier
	Triton RW-Series Surfactants	Emulsifier
	Triton X-Series Surfactants	Emulsifier
Good Compatibility	Fatty Acid - DEA Salts	Corrosion Inhibitor
	Fatty Acid - Diesters	Lubricant
	Fatty Alkanolamides - DEA	Emulsifier
	MEA - Borate Esters	Corrosion Inhibitor
	Monoethanolamine	Corrosion Inhibitor
	Sulfurized Compounds	EP Additive
	Triethanolamine (99%)	Corrosion Inhibitor
	Triisopropanolamine	Corrosion Inhibitor
Fair Compatibility	Aminomethylpropanol	Corrosion Inhibitor
	Boramides - DEA	Corrosion Inhibitor
	Diethanolamine	Corrosion Inhibitor
	Diisopropanolamine	Corrosion Inhibitor
	Monoisopropanolamine	Corrosion Inhibitor
	TEA - borate esters	Corrosion Inhibitor
	Triethanolamine (technical grade)	Corrosion Inhibitor
Not Compatible	Mercaptobenzothiazole	Corrosion Inhibitor
	Sodium Omadine[3]	Biocide
	Triadine 10[3]	Biocide

* Many compounds may serve more than one function.

** All biocides tested showed excellent compatibility except Sodium Omadine2 and Triadine 102.

1 KATHON is a trademark of Rohm and Haas Company.

2 Triton is a registered trademark of Dow Chemical.

3 Omadine and Triadine are trademarks of Arch Chemical.

Table 15

Function	Biocides	Compatibility
Biocides	Biocides*	Excellent
	KATHON 893 MW Fungicide	Excellent
	Sodium Omadine	Not Compatible
	Triadine 10	Not Compatible
Corrosion Inhibitors	Aminomethylpropanol	Fair
	Amphoteric surfactants	Excellent
	Benzotriazole	Excellent
	Boramides - DEA	Fair
	Borax	Excellent
	Diethanolamines	Fair
	Diisopropanolamine	Fair
	Dinonylnaphthalene Sulfonates	Excellent
	Fatty Acid - DEA Salts	Good
	Mercaptobenzothiazole	Not Compatible
	MEA - Borate Esters	Good
	Monoethanolamine	Good
	Monoisopropanolamine	Fair
	Morpholine	Excellent
	TEA - Borate Esters	Fair
	Triethanolamine (technical grade)	Fair
	Triethanolamine (99%)	Good
	Triisopropanolamines	Good
Couplers	Glycols	Excellent
	Polygolycols	Excellent
Defoamers	Non-Silicone Defoamers	Excellent
	Silicone Defoamer	Excellent
Emulsifiers	Dioctyl Sulfosuccinates	Excellent
	Fatty Acids	Excellent
	Fatty Acids - TEA Salts	Excellent
	Fatty Alkanolamides - DEA	Good
	Oxazoline Surfactants	Excellent
	PEG Esters	Excellent
	Petroleum Sulfonates	Excellent
	Sarcosinate Surfactants	Excellent
	Triton N-Series Surfactants	Excellent
	Triton RW-Series Surfactants	Excellent
	Triton X-Series Surfactants	Excellent
EP Additives	Chlorinated Fatty Esters	Excellent
	Chlorinated Paraffins	Excellent
	Phosphate Esters	Excellent
	Sulfurized Compounds	Good
Lubricants	Fatty Acid - Diesters	Good
	Fatty Esters	Excellent
Wetting Agents	EO-PO Polymers	Excellent

Safe Handling and Storage

Product in Use Dilution Metalworking Fluids

At recommended levels of 4 to 17.5 ppm active ingredient (2.7-12.8 fl oz per 1,000 gallons of use-dilution metalworking fluid), KATHON 886 MW microbicide is judged to be safe at recommended concentrations when used as directed.

Product As Supplied

Results of extensive animal toxicity and human sensitization/irritation studies are provided in Table 14. These data indicate that KATHON 886 MW microbicide as supplied is a severe skin irritant, may cause burns to the skin, is corrosive to the eyes and may cause skin sensitization (allergic contact dermititis).

Therefore, contact with skin and eyes should be avoided. It is important that individuals who handle KATHON 886 MW microbicide in its concentrated form review the safety and handling procedures outlined in the next section of this brochure, as well as the product label and the Rohm and Haas Material Safety Data Sheet.

KATHON 886 MW Toxicity Profile

KATHON 886 MW microbicide is considered safe at recommended use levels. Based on assessment of extensive toxicological data, experts conclude that the active ingredient in KATHON 886 MW microbicide is:

- non-genotoxic
- non-carcinogenic
- non-teratogenic.

Air Monitoring Study

A study was conducted to monitor the air in the worker breathing zone and work area when a worker was dosing metalworking fluid sumps with KATHON 886 MW microbicide. Workroom air was also sampled and analyzed for KATHON 886 MW active ingredients in a work area with a relatively large area of flowing, splashing, and misting coolant. Monitoring locations and times were chosen to measure worst-case situations. No airborne active ingredients were found at an analytical detection limit of approximately 0.05 part per million (w/w) in the absorbing solution in any samples taken. (Depending on the volume of absorbing-trapping solution and the amount of air sampled, the detection limit of active ingredient in air in this study ranged from 0.006 to 0.06 milligrams per cubic meter of air (mg/m^3).) Assuming the plant in which this study was conducted is representative of other plants doing general cast iron machining, overexposure to KATHON 886 MW microbicide via inhalation is highly unlikely in any reasonable anticipated situation involving normal use. This study was published in Lubrication Engineering, Volume 44,3 (262-264). Reprints are available on request.

Effects of Exposure to the Concentrated Product

CORROSIVE, CAUSES IRREVERSIBLE EYE DAMAGE AND SKIN BURNS. THESE EFFECTS MAY BE DELAYED FOR HOURS. MAY CAUSE ALLERGIC SKIN REACTIONS. MAY BE HARMFUL IF INHALED. MAY BE FATAL IF SWALLOWED OR ABSORBED THROUGH THE SKIN IN LARGE AMOUNTS.

Handling Procedures

Do not get in eyes, on skin, on clothing. Wear goggles or face shield and rubber gloves when handling. Avoid breathing vapor or mist. Avoid contamination of food. Do not take internally. Wash thoroughly after handling.

First Aid Procedures Following Contact with the Concentrate

Eye Contact: FLUSH IMMEDIATELY with copious amounts of water for at least 15 minutes. Hold eye open during the washing process so that the water may clear the chemical from the eye. Seek prompt medical attention, but FLUSH EYES FIRST.

Skin Contact: IMMEDIATELY WASH the contacted area with plenty of soap and water and continue washing for at least 15 minutes AND obtain immediate medical attention.

Contact with Clothing: Remove contaminated clothing immediately. Wash separately with detergent before wearing. Treat skin under splashed clothing as if it were contacted directly.

Inhalation: Remove subject immediately to fresh air. If not breathing, apply artificial respiration; if breathing is difficult use oxygen. Call a physician immediately.

Swallowing: Promptly drink a large quantity of egg whites, gelatin solution, or if these are not available, water. Avoid alcohol. Seek medical attention immediately.

Note to Physician: KATHON 886 MW microbicide is a corrosive material. It may not be advisable to induce vomiting after swallowing. Possible mucosal damage may contraindicate the use of gastric lavage.

End Use-Dilution

Good industrial hygiene practices should be recommended to downstream users of biocide containing fluids to reduce exposure to the extent feasible. Repeated or continual dermal contact with fluids containing >15 ppm active isothiazolones could result in allergic skin reactions in susceptible individuals.

The Facts About Safe Handling

Fact: KATHON 886 MW microbicide is a corrosive material (can cause skin burns or eye damage) as supplied and may cause an allergic skin reaction with repeated skin contact. Therefore, when dosing a system with KATHON 886 MW microbicide protect skin and eyes with the following protective equipment: neoprene or nitrile gloves, impervious apron, overshoes, and splash goggles or face shield.

Note: Rohm and Haas Company offers an in-depth safety video on KATHON 886 MW microbicide. Contact your KATHON biocide distributor or Rohm and Haas Company Philadelphia, PA for a copy.

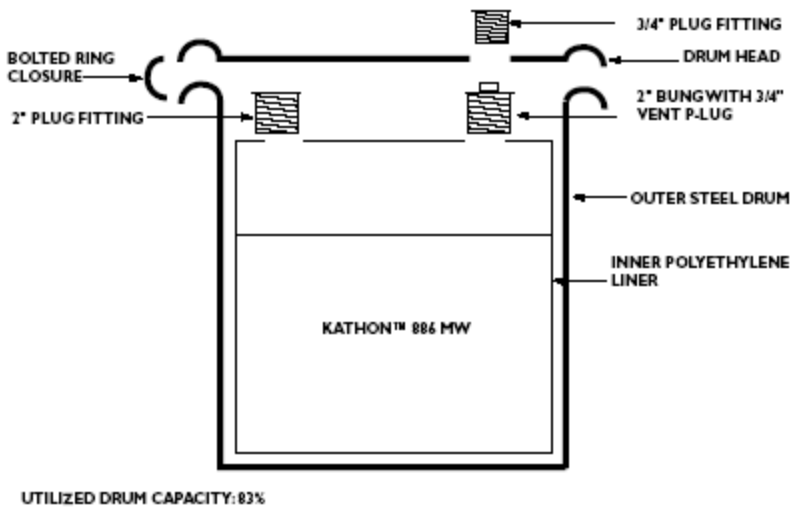
The procedures used for handling concentrated biocide solutions are similar to those used for handling concentrated acids and alkalis. The purpose is to prevent all eye and skin contact, including inhalation of mists, and thereby prevent possibly injury and sensitization.

Personnel handling KATHON 886 MW microbicide as supplied should always wear protective clothing which includes chemical splash goggles, an impervious apron or rain suit, overshoes, and chemical resistant gloves (nitrile, butyl rubber, polyvinyl chloride or neoprene coated). Employees working with concentrated KATHON 886 MW microbicide, should thoroughly wash with soap and water after handling and prior to eating, drinking or smoking, or applying cosmetics. Special care should be taken to avoid contamination of surfaces or materials that may later be handled by unprotected personnel, for example door, tap handles, rags, gloves and tools.

Work areas used for dispensing KATHON 886 MW microbicide into metalworking fluid systems should be well ventilated. Enclosed areas should be equipped with mechanical ventilation capable of removing contaminated air. In laboratories, solutions of KATHON 886 MW microbicide should always be handled with the proper protective equipment as discussed above.

FIGURE I

Shipping Container for Kathon™ 886 MW Microbicide



Vented Containers and Their Storage

KATHON 886 MW microbicide as supplied evolves gas slowly. The liberated gas consist largely of carbon dioxide. To prevent the buildup of pressure, the material is packaged and shipped in 30-gallon and 5-gallon double containers of the design shown in Figure 1 and a 1 gallon container (nominal).

The 30-gallon and 5-gallon containers consist of a polyethylene liner fitted with 2-inch bungs and enclosed within an open-head steel drum sealed by a bolted-ring closure having no gasket.

One plug on the liner is a vented fitting that allows gas to bleed slowly at atmospheric pressure through the space where the gasket would normally be. The one gallon plastic container is also fitted with a vented opening.

All containers must be stored and transported in an upright position to prevent spilling the contents through the vent. *NOTE: The plug fitting on the cover should be cracked with caution because it may be under pressure.*

Spills

The list below describes the proper deactivation and cleanup steps to take when handling spills of Kathon biocides.

1. Protective clothing, including chemical splash goggles, butyl rubber gloves, rubber overshoes, chemical resistant apron and a NIOSH approved (or equivalent) respirator (with organic vapor/acid gas cartridge and a prefilter) must be worn during any clean-up of spilled Kathon biocide.
2. Dike and adsorb as much of the spill as possible with spill control pillows or inert solids such as clay or vermiculite. Scoop the adsorbed material into a waste pail (preferably five gallon or 20 liters plastic) and cover the pail immediately. Do NOT add deactivation solution to the waste pail to deactivate the adsorbed Kathon product.
3. Estimate the volume of remaining spilled material on the floor and prepare 10 times as much deactivation solution as in the next step.
4. An aqueous solution consisting of 3 to 5% sodium bicarbonate (or potassium bicarbonate) and 5% sodium hypochlorite (household bleach) is prepared away from the immediate area of the spill in a screwcap polyethylene gallon (or 5 liters) container. Depending on the estimate of deactivation solution required as in step 3 above, add to this container the sodium bicarbonate (or potassium bicarbonate) followed by the household bleach. Close the container securely and shake well for one minute.
5. Apply the deactivation solution to the residual spill on the floor. Wait approximately 30 minutes and flush the solution on the floor into a chemical sewer (if in accordance with local, state and national procedures, permits and regulations).

6. Rinse the one gallon (or 5 liters) container used to make up the deactivation solution with water and dispose of the empty container in the trash or store the empty container for future use.

7. Before removing gloves, rinse them with water. Carefully peel the contaminated gloves off by pulling on the outside of the glove sleeve, turning the gloves inside out as they are removed, and place the used gloves into the waste pail. Close and seal the waste pail again. Again, do NOT add deactivation solution to the waste pail.

8. Dispose of the sealed waste pail as hazardous waste in compliance with local, state, and federal laws; our recommended method of disposal is incineration.

Reporting Medical Accidents

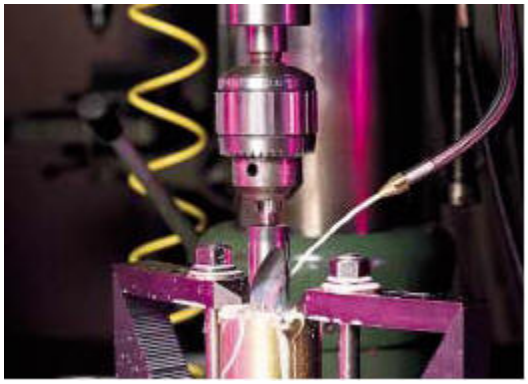
Please report all incidents of contact with KATHON 886 MW microbicide having medical significance to the Rohm and Haas Company location below:

Rohm and Haas Company
Independence Mall West
Philadelphia, PA 19106-2399
(215) 592-3000
Attn: Corporate Medical Department

Fate in the Environment

Modes and rates of dissipation of KATHON 886 MW microbicide active ingredients were determined over a range of conditions likely to occur in the environment. Degradation of both active ingredients at levels near 1 ppm was observed to occur by hydrolytic, photochemical, and biological action in the aquatic and terrestrial environments. The decomposition of the active ingredients by several chemical and biological mechanisms ensures that the active ingredients of KATHON 886 MW microbicide will not linger in the environment. Details of this study are provided in Bulletin CS-494, which is available upon request from Rohm and Haas Company.

Additional published studies on the fate and ecotoxicity of KATHON 886 MW active ingredient are available in Bulletin CS-693R. These studies showed that in aquatic environments, the isothiazolones rapidly biodegrade with half-lives significantly less than 24 hours. Microbial metabolism involves cleavage of the isothiazolone ring and oxidation of the organic carbon to CO_2. Model systems studies have shown that typical use rates of the active ingredients in KATHON 886 MW microbiocide have no significant impact on biological waste treatment and do not generate halogenated by-products.



Material Safety Data Sheets

Rohm and Haas Company maintains Material Safety Data Sheets for all of its products. These sheets contain pertinent information that you may need to protect your employees and customers against any known health or safety hazards associated with our products.

We recommend that you obtain and review Material Safety Data Sheets for our products from your distributor or Rohm and Haas technical representative before using our products in your facility. We also suggest that you contact your supplier of other materials recommended for use with our product for appropriate health and safety precautions before using them.

Rohm and Haas Company Technical Support

Rohm and Haas Sales Service and Technical Service personnel have more than 20 years of experience evaluating KATHON biocide performance in a variety of applications. In the area of metalworking fluids, we can offer advice on determining KATHON biocide stability and efficacy in dilute as well as concentrated metalworking fluids. We can make recommendations on how to evaluate the level and type of system contamination you may be experiencing. In addition, Rohm and Haas personnel can assist you with questions on KATHON biocides chemistry, environmental issues, toxicity, safe storage, handling and use. For further information contact your local Rohm and Haas sales representative or contact Rohm and Haas Company, Independence Mall West, Philadelphia, PA 19106-2399.

Shipping Information

KATHON 886 MW microbicide is available in the following containers.

Container Size	Net Weight
30 gallon drums	275 lbs
5 gallon pails	44 lbs

To obtain samples, technical assistance, a Material Safety Data Sheet (MSDS) or to have a technical representative call for an appointment, contact the nearest Rohm and Haas office.

September 2006