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Tetra and Per/Tri

COOLING TOWER WATER TREATMENT

PROGRAM OPERATING MANUAL

PPG/MAZER

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TRADE SECRETS, NOT TO BE RELEASED

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No. 91-1145

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WATER BASICSALL WATER IS NOT THE SAME

Completely pure water is non-existent. All natural water contains various types and amounts of impurities. Since water impurities cause problems in a cooling system, careful consideration must be given to the quality of the water used for this purpose.

Water is an excellent solvent; it dissolves the rocks and soil it contacts. It absorbs gases from the atmosphere and the soil it contacts. It picks up suspended matter as it runs across or percolates through the ground. In general the type of impurities water contains depends on what it contacts, and the amount of impurities depends on contact time.

The impurities which water picks up can be put into three broad groups:

1. Dissolved solids
2. Suspended solids
3. Gases

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DISSOLVED SOLIDS

The impurities (minerals in a dissolved state) which water picks up consist chiefly of calcium carbonate, calcium sulfate, magnesium sulfate, silica (sand), sodium chloride, sodium sulfate, and small quantities of iron, manganese, fluorides, aluminum and other substances.

SUSPENDED SOLIDS

Natural water may contain turbidity, color, soil, and precipitated minerals. In addition, water can contain other wastes. Turbidity may consist of very finely divided organic mater, minerals and microorganisms as well as suspended clay and silt. Color comes from decaying vegetable matter. Wastes can be oil, fats, greases, and sewage as well as a variety of effluents from many different sources.

GASSES

Gases (primarily carbon dioxide and oxygen) are absorbed from the air by water as it falls to earth. Additional carbon dioxide and oxygen are picked up from decaying matter in the soil as the water runs across and percolates through the soil

DISSOLVED SOLIDS	SUSPENDED SOLIDS	GASES
Calcium	Soil	Carbon Dioxide
Magnesium	Decaying vegetable matter	Oxygen
Silica	Precipitated minerals	Others
Iron	Oil	
Manganese	Trade waste	
Sodium	Microorganisms	
Chloride	Clay	
Sulfates		
Fluorides		
Carbonates		
Bicarbonates		
Aluminum		

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Fresh water supplies are grouped into two categories: (A) ground water and (B) surface water. Some of the water reaching the ground seeps down through the surface to form the under-ground streams and lakes. A portion of the water reaching the earth's surface runs across the soil then into brooks, streams, bayous, rivers, ponds or lakes. The former is referred to as ground water, the latter as surface water.

Because ground water (shallow and deep wells) is in contact with the rocks and soil for a longer period of time (in percolating down through the various layers of soil and rock) it will contain a higher amount of dissolved solids than surface water. Surface water on the other hand will contain a higher amount of suspended solids. As pointed out earlier, the types of impurities found in water depend on what the water contacts, the amount that it contains depends on the contact time.

One way to measure the amount of dissolved solids in water is Conductivity. The dissolved salts conduct electricity through the water. The greater the dissolved solids load, the greater the amount of electricity the water will conduct.

One measure of suspended solids in water is Turbidity. The Sabine river water used in the Lake Charles plant is clarified in the Sabine water clarification unit operated by the Plant C powerhouse operators. They use treatment chemicals to remove the suspended solids. They measure the turbidity of their outlet water. They also chlorinate the water.

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Waters which contains large amounts of calcium and magnesium are referred to as Hard water. The amount of hardness in natural water may vary from several parts per million to over 500 parts per million. 1 part per million is 1 pound per 1,000,000 pounds, and is abbreviated ppm. An average surface supply will contain about 95 ppm total hardness as opposed to an average of about 200 ppm for ground water supplies. In the Lake Charles complex the surface water we use is clarified Sabine river water, and it has a total hardness of about 25 to 30 ppm, which is below the average. Since hardness (calcium and magnesium) is relatively insoluble in water, it tends to precipitate (fall out) of solution and form deposits in the cooling water system. While all impurities found in water must be taken into consideration when used in a cooling system, special attention must be given to the hardness present.

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COOLING WATER SYSTEMS

Simply stated, a cooling water system absorbs heat from one area and dissipates it into another area. There are a number of types of cooling water systems. There is the spray pond, the once through system, the refrigeration system and the cooling tower system. Each of these systems has their own treatment problems.

The cooling tower system works by mixing warm water with cool air. The heat transfer is accomplished partially by a transfer of sensible heat which raises the temperature of the air. The majority of the cooling is due to an exchange of latent heat resulting from the evaporation of a small part of the circulating water. All cooling towers have the same basic function, to break up the water into droplets and move air across them. These functions result in a more efficient evaporation of water and in that process, dissipation of heat from the system. There are two ways in which the tower can break up the water into small droplets. One involves the use of spray nozzles in the tower, the other relies on splash plates. As the water falls from the top of the tower it hits the splash plates and small droplets are formed.

The tower can draw air across the water droplets by either natural convection or forced draft. The towers in the Lake Charles plant are all forced draft. A fan forces air across the water droplets to aid in evaporation.

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Because water is evaporated from the system, water must be added to the system. This fresh or makeup water has some of the impurities pointed out earlier. As water evaporates, it leaves as pure water vapor. The impurities stay behind in the recirculating water stream. As the impurities increase in concentration they will reach a point where they cannot stay in solution. They will precipitate out and cause problems through out the process equipment serviced by the water. The impurities Cycle up, that is their concentrations in the tower water increase to double or triple their concentration in the make up water. When their concentration becomes double that of the make up we say the tower is running at 2 cycles. The TETRA and PER/TRI towers should run at 7 cycles. The lower the number of cycles the more treatment chemicals that must be added to maintain the proper level for corrosion or scaling control.

The method of removing the impurities that accumulate in the cooling tower system is called Blowdown. Blowdown is the intentional or unintentional purging of water from the system. Blowdown should be done from the warm inlet side instead of the cool outlet side. Like wise make up should be added to the cooler basin water. The make up on the TETRA and PER/TRI towers is controlled by a LCV and LT on the tower basin. The blowdown is manually controlled using the conductivity of the recirculating water.

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The Heat Exchanger

Heat transfer between the process and the cooling tower water occurs in a heat exchanger. The heat exchanger may be a direct contact type as with a barometric condenser. It may be a shell and tube type of exchanger, where the water is on one side and the process is on the other side. A lot of the exchangers on the TETRA and PER/TRI cooling towers have the water on the tube side of the exchanger. This helps maintain good water velocity through the tubes and helps prevent suspended solids from settling out. When the water is on the shell side of the exchanger solids can settle out in the low velocity areas. We will speak later of the problems this can cause.

There are some designs that allow the shell side of an exchanger to be cleaned easily, such as with a removable bundle. If the distance between the tubes and the geometry of the tubes allow, full cleaning is possible. Some exchanger designs prevent adequate cleaning by any method. These are sometimes found in refrigeration units. Whenever possible tube side water is better from a cleaning standpoint.

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CHEMICAL TREATMENT

WHY IS CHEMICAL TREATMENT NECESSARY?

As we have already seen water contains solids which if not controlled and treated can precipitate and form scale. The gases in make up water plus gases which can be carried into the tower by the air draft are corrosive. Airborne contaminants such as dust and silt can be drawn into the tower cooling water. Biological growths such as algae, slime forming bacteria, fungi and other microorganisms can breed readily in cooling water systems. Alone or in combination, the solids, gases, airborne contaminants or microorganisms can cause serious problems in the efficient operation of a cooling system.

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SCALE

Scale deposits

One of the most serious problems which can develop in untreated cooling tower water is that caused by scale. Scale formation occurs when the solids and gases in the cooling tower water reach their limits of solubility and precipitate out onto piping and heat transfer surfaces. As the scale deposits on heat transfer surfaces, the ability of the cooling tower water to absorb heat is reduced. This results in reduced capacity and higher power consumption.

Prevention of Scale

Scale prevention is a twofold approach:

(A) Chemical treatment is added to the cooling tower water which retards or delays solids from precipitating out and forming scale.

(B) While treatment chemicals increase the solubility of solids in water so they stay in solution, a point is reached where they will precipitate (their solubility has been exceeded). When this point is reached the system must be bled.

The control of scale then involves both chemical treatment and the limiting of solids through "bleed".

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CORROSION

Causes of Corrosion

Corrosion is simply the eating away of metal. It is actually a chemical reaction between the metal in the system and the recirculating water. Three types of corrosion can take place in a cooling water system.

(A) General corrosion is when the corrosion attack is uniform and lightly distributed over the entire area of the metal.

(B) Pitting corrosion exists when a large part of the area is protected and only a small localized area is attacked. Pitting is considered more objectionable since a large corrosive force is concentrated in a very small area and rapid penetration and failure may result.

(C) Galvanic corrosion is the third type of corrosion encountered. This can occur when dissimilar metals are in contact with each other. Conditions which foster corrosion are high oxygen concentration, high temperature, high velocity of liquid on the metal surfaces, low pH, high soluble sulfates and chloride concentration and galvanic action.

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Prevention of Corrosion

The prevention of corrosion usually requires one or more of the following approaches:

(A) Treatment of the water to make it less aggressive such as adjustment of the pH.

(B) Developing a protective coating by film-forming chemicals added to the cooling tower water. They are recirculated in the water and deposited on the system metal.

The pH is a measure of the acidity or alkalinity of a solution. It is based on a scale of 0 to 14. The mid point of the scale is 7. Solutions which measure 7 are said to be neutral, neither acid or alkaline. Solutions which measure between 0 and 7 are acid, and those between 7 and 14 are alkaline. Since pH is a logarithmic function, solutions having a pH of 6, 5, and 4 are 10, 100, and 1000 times more acidic than one with a pH of 7.

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FOULINGAirborne Contaminants

Contaminants scrubbed from the air as it passes through the tower can result in fouling of heat exchangers, condensers, piping and tower packing. The most common type are those which leave a silt-like deposit. These fall under the general heading of suspended solids. They can also enter the system through the makeup. The deposits can build up and retard heat transfer, restrict water flow, promote corrosion and harbor microorganisms.

Chemical treatment (synthetic polyelectrolytes are most commonly used) to prevent accumulation of silt is added to the cooling tower water. These polymers serve to agglomerate the silt particles and bind them into loose but coherent larger masses. The effect is to keep these larger particles suspended and remove them during "bleed".

Fouling from inorganic deposits can easily happen in low flow or low velocity areas of the system. This can happen on the shell side of exchangers. When deposits start to grow, underdeposit corrosion can start and the deposit protects the corrosion cell from the passivating effects of the treatment program.

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PPG/Mazer Chemical Treatment System

The treatment chemicals that make up the total treatment system are as follows:

Mazplex MO is a mixture of Phosphorus containing organic compounds called Phosphonates, Zinc and Molybdate. These compounds help form a protective coating in the cooling tower system. It also contains dispersants and polymers to help keep some of the impurities in solution, and prevent them from precipitating out of solution.

The component of Mazplex MO that will be monitored by chemical analysis is the Molybdate.

Maztreat 838 is a solution of Tolytriazole. This is a premium copper / copper alloy corrosion inhibitor. This is a compound common in automobile radiator rust inhibitors.

The PPG/Mazer representative will monitor the level of this component in the tower.

Mazsperse 830 is a mixture of two powerful dispersants. They are helpful in extending the solubility of iron, zinc and other dissolved solids. They also help condition the suspended solids so they may be purged from the system in the blowdown.

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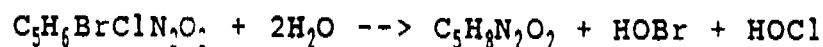
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PPG/Mazer treatment chemicals cont.

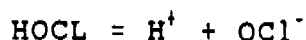
Mazide BC 915 is a Glutaraldehyde solution. This is a powerful biocide, algicide. It is fed to the system on a slug basis. The amount fed to the system should bring the glutarald hyde concentration up to 30 ppm.

Mazide Br-Cl is 1-Bromo-3-Chloro-5,5-dimethylhydantoin (BCDMH). It is used in the system to help destroy any biological growths. It is called an oxidizing biocide. These growths were explained in an earlier section of this manual.

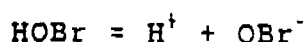
When BCDMH dissolves in water HOBr and HOCl are generated. The HOCl is called hypochlorous acid, and the HOBr is called Hypobromous acid.



They are Hypohalous acids and are the actual biocides. They can penetrate the cell membrane of the organism. A further reaction also occurs:



and



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The OCl^- and OBr^- ions are not very good at killing bioorganisms. These reactions are pH dependant. In the pH range of the Tetra and Per/Tri towers the more predominate specie will be the HOBr .

This component will be maintained in the range of .2 to .5 ppm total halogen as Cl_2 .

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SYSTEM TREATMENT REQUIREMENTSClarified Sabine River Water Make-up

Chemical constituent	Target	Controlled by:
Molybdate	6 to 10 ppm	Mazplex MO
	Tetra tower	1.5 gpd
	Per/Tri tower	0.7 gpd
Tolytriazole	16 ppm	Maztreat 838
	Tetra tower	.25 gpd
	Per/Tri tower	.12 gpd
Glutaraldehyde	30 ppm per treatment	Mazide BC 915
	Tetra tower	3 gallons / week
	Per/Tri tower	1.5 gallons / week
BCDMH	.2 to .5 ppm as Cl ₂	Mazide Br-Cl

The actual operating control parameters to be monitored by the operators will be the Molybdate and total Chlorine concentration. The lab test procedures follow in the next few pages. The Maztreat 838 feed rate should be a ratio from the Mazplex MO feed rate at 6 gallons Mazplex MO to 1 gallon Maztreat 838. The pH should run between 7.2 and 8.4

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W ll Water Make-up

When using well water as make up to the tower the following treatment chemical should be added to the normal sabine river water recipe. This is an Iron and Zinc dispersant.

Mazsperse 830 1/2 gallon / day 1 ml / minute

The pH will run higher while on well water. The pH should be kept below 9 by using blowdown. The number of cycles will run low, maybe as low as 2 to 4.

When a Sabine river water supply outage is planned, the Mazsperse 830 should be started two days ahead of time.

If the outage is unplanned or the switch over to well water is an emergency, 3.5 gallons should be added to the basin at the suction of the circulating pumps.

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Trouble Shooting GuidelinesHigh pH, greater than pH 9.5

Add additional make-up water, and increase blowdown. Try to purge the system until the pH goes back down. The lower pH sabine river water should help reduce the pH. The high pH can cause the zinc and iron in the system to precipitate out. Purge at all bleed points in the system to see if there is any milky or colored water in the system.

The Mazsperse 830 should be turned on to 1/2 gallon per day and 3.5 gallons should be shot fed after the pH is back down to normal. The Mazsperse 830 can be turned off after one week. Allow the system to cycle up to 7 cycles again.

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Low pH, Acid leak into the system, lower than pH 5

An acid leak can strip away the protective layer of inhibitor within the system. It also dissolves iron and other yellow metals. The pH must be restored as soon as possible.

The blowdown valve should be opened fully and the make-up opened. The dissolved solids must be purged from the system before redeposition can occur. If the pH cannot be restored within one hour soda ash should be added to the system. CAUSTIC SHOULD NEVER BE ADDED AS IT CAN CAUSE AN IRON HYDROXIDE FLOC TO PRECIPITATE OUT. IT IS EASY TO OVERSHOOT USING CAUSTIC.

When the pH has been restored triple the Mazplex MO, and Maztreat 838 feed rates. They may be reduced to normal levels when the Molybdate level has recovered to 10 ppm. 3.5 gallons of Mazsperse 830 should also be shot fed after the pH is back up. Feed Mazsperse 830 at a rate of 1/2 gallon per day for one week.

Allow the system to cycle up to 7 cycles again.

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Mazplex MO feed loss

Determine how much Molybdate is in the system and shot feed per the following table.

Molybdate level	Gallons of Mazplex MO
0 ppm	4 gallons
1 ppm	3.5 gallons
2 ppm	3 gallons
3 ppm	2.5 gallons
4 ppm	2 gallons
5 ppm	1 gallons

This is based on raising the Molybdate level to the minimum level of 6 ppm. The level should be worked up to the middle of the spec range, 8 ppm.

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Loss of Maztreat 838 Fe d

When the Maztreat 838 has been found to be off for awhile the PPG/Mazer representative should be notified. He will be able to analyze the water for Tolytriazole and recommend how much the feed should be increased, or if shot feeding is in order.

Loss of Blowdown

If the blowdown valve sticks and the cycles go up above 8, the make up valve should be opened to allow fresh water into the system. Blowdown should be started at any place possible in the system. The blowdown should continue until the cycles are back down to 7 or below.

The Mazspers 830 should be started at 1/2 gallon per day rate, or shot fed after the cycles are back down to normal. Turn off the Mazspers 830 after 48 hours. Check the bleeds in the system for milky or colored water. Purge where necessary to bleed the discolored water from the system. If cycles are brought too low in trying to recover, add Mazplex MO per the previous table.

Make up valve sticks open

Treat as the earlier problems of loss of Mazplex MO and Maztreat 838 feed.

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Fire Water Intrusion

There are two ways fire water can get into the cooling tower. The first way is for the sprinkler system to trip within the tower. The second way is for the level to get too low in the clear well in the Sabine River water clarification unit.

When the sprinkler system in the cooling tower is tripped, fire water from the raw water impoundment at Sabine water clarification unit is pumped into the tower. The fire water lines are not purged very often and a lot of iron builds up in them. The fire water pumps take their suction from the old sportsman lake, and they bring up a lot of silt and other suspended solids. These suspended solids and iron must be removed from the system before they can settle out.

When the level goes low in the clearwell at the sabine water clarification unit, a set of gates open to admit raw water. This water will have lot of suspended solids. Again as above, these suspended solids must be purged from the system before they can do any damage.

In either case above, the cooling tower system must be purged by opening the blowdown valve and letting the make up valve open. The bleeds at each exchanger should be blown down.

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Fire water intrusion cont.

Mazsperser 830 should be added to the system. Add 2 gallons to the basin by the suction of the circulation pumps. Start the addition pump or shot feed at 1/2 gallon per day (1.5 ml per minute). This addition should be stopped after 1 week.

3/DAYS

After the extra make up has been stopped, check the Molybdate level and add per the table on page 18 of this manual.

lower level to 4-5 3 DAYS.
MOLYBDATE - 5-6

The PPG/Mazer representative must be notified so he can determine if any other steps should be taken.

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High or Low Halogen

If the Halogen level in the tower goes up, and stays up for a prolonged period of time, it can cause damage to the wooden structure of the cooling tower. The water should be halogenated to between .2 and .5 ppm as total chlorine. If the halogen level goes up above 1 ppm for any length of time, a reason should be sought.

There could be several reasons for high or low Halogen in the tower. The flow through the Brominator should be checked. If the halogen level (Cl_2 level) is low, the flow through the brominator should be raised. If the halogen level is high, the flow through the brominator should be lowered.

The make up water from the sabine river water clarifiers is chlorinated before it is pumped into the distribution system. Check with the operators at Power House C to see if they are having a problem with the chlorinators at the clarifiers. High chlorine from the clarifiers can depress the system pH also.

Sodium Thiosulfate can be added to reduce the chlorine level if necessary. This will be necessary only on very rare occasions.

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ANALYTICAL PROCEDURES

Molybdate as MoO_4^{-2}

Safety:

All laboratory glassware should be free of chips and cracks.
Safety glasses should always be worn while in the lab.

Required reagents and apparatus:

- 1) Klett Sommerson Spectrophotometer.
- 2) Light filter number 66.
- 3) Narrow sample cell.
- 4) Hach Molybdenum 1 reagent powder pillows. *CAT NO. 23527-66 50/*
- 5) Hach Molybdenum 2 reagent solution with 1 ml dropper. *23525-37*
- 6) Mixing cylinder, 50 ml size.
- 7) Beaker, 50 ml size.
- 8) Clippers for opening powder pillows.

Procedure:

- 1) Install light filter number 66, and turn light power switch on.
- 2) Fill the 50 ml graduated mixing cylinder with 25 ml of sample. Dilute to 50 ml with distilled water.

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3) Add the contents of one Molybdenum 1 reagent powder pillow to the graduated cylinder. Stopper and shake to dissolve the reagents. This is the prepared sample. A brown color will develop.

4) Pour 25 ml of this prepared sample into the 50 ml beaker. This will be used as the blank. Leave exactly 25 ml in the graduated cylinder.

5) Add 1 ml of the Molybdenum 2 reagent to the graduated mixing cylinder. Swirl to mix and allow the sample to develop for 2 minutes. A blue green color will develop if molybdate is present.

6) Fill the narrow sample cell with the blank (brown) and insert it into the spectrophotometer, making sure the cell orientation is correct. Turn the dial until the galvanometer needle returns to the center line, and record the absorbance.

7) When the 2 minutes are over, fill the narrow sample cell with the developed sample and record the absorbance.

8) Subtract the blank absorbance reading from the developed sample absorbance reading, and read the ppm MoO_4^{2-} from the chart.

The glassware used for the test may develop a blue color. This may effect the results of the test. Rinse the glassware with a dilute

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HCL solution followed with distilled wat r.

Zero check:

Once per day the spectrophotometer galvanometer should be zeroed. The switch on the right side of the instrument should be switched off, which is down. Turn the small black knob on top of th galvanometer until the needle returns to the center line. Turn the switch back on.

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ANALYTICAL PROCEDURE TOTAL HALOGEN

Halogen as Cl_2

Safety:

All laboratory glassware should be free of chips and cracks. Safety glasses should always be worn while in the lab.

Required reagents and apparatus:

- 1) Klett Sommerson Spectrophotometer.
- 2) Light filter number 54
- 3) Wide sample cell
- 4) DPD Total Chlorine Reagent Powder Pillow.
- 5) 50 mL stoppered graduated cylinder.
- 6) Clippers for opening powder pillows.

Procedure:

- 1) Install light filter number 54, and turn light power switch on.
- 2) Fill the 50 mL graduated cylinder to 25 mL with the sample.
- 3) Add the contents of one DPD Total Chlorine Powder Pillow to the sample. Swirl to mix. A pink color will develop if chlorine is present. Accuracy is not affected by undissolved powder.

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- 4) Set the timer for three minutes for the reaction to take place.
- 5) Fill the cuvette with the untreated sample and insert it in the instrument, making sure the cell orientation is correct. Zero the spectrophotometer with this blank by turning the small black knob next to the cell chamber until the galvanometer needle returns to the center line.
- 6) When the three minutes are over, pour the sample into the sample cell and insert it into the spectrophotometer. Turn the dial until the galvanometer needle returns to the center line. Read the ppm Cl_2 from the chart.

Zero check:

Once per day the spectrophotometer galvanometer should be zeroed. The switch on the right side of the instrument should be switched off, which is down. Turn the small black knob on top of the galvanometer until the needle returns to the center line. Turn the switch back on.

To reorder reagents from HACH company, use the cat. no. 14064-66 for the DPD Total Chlorine Powder Pillows.

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LMI PUMP OPERATION

The LMI pumps used with the cooling tower treatment chemicals are positive displacement pumps. They are somewhat different than other positive displacement pumps. They have no rotating armature in their motor. The power end of the pump is a vibrating armature. The diaphragm is attached to the armature. There are ball type check valves in the suction and discharge. This type of pump can be dead-headed without damaging the diaphragm. The vibrating armature simply will not be able to overcome the pressure on the discharge side and it will stop. It will restart when the discharge side pressure is reduced to normal.

Setting the flow with these pumps is a simple matter. The pumps are rated for either 18 gpd or 14 gpd. The % speed and % stroke are a percentage of the 18 gpd or 14 gpd. If the % speed is set to 45% and the % stroke is set to 75%, the flow delivered by the pump will be $18 \times .45 \times .75 = 6\text{gpd}$, in the case of the 18 gallon per day pump.

In the case of the 14 gallon per day pump, a high range and low range % speed are available. The high range % speed covers 100% down to about 12%. The low range covers 12.5% down to 1%. In the high range % speed scale the pump flow is variable from 14 gpd to about 1 gpd. In the low range % speed scale the pump flow is variable from $1 \frac{3}{4}$ gpd to about .05 gpd.

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A closer, more accurate measurement can be made with a stopwatch and graduated cylinder. The larger the volume of sample caught, the more accurate the measurement. Divide the volume by the elapsed time to get mL/min. Multiply the flow rate in mL/min by .3804 to get gallons per day.

LEFT SCALE = QTS/DAY

RIGHT SCALE = LITERS/DAY.

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BROMINATOR

The amount of Halogen (read as Chlorine) in the cooling tower system is dependent on the water temperature and flow through the brominator. For this reason care should be taken to make sure water flow is always maintained. The water inlet line has at least one "Y" strainer in it. If flow is lost, the strainer should be taken out and cleaned.

Because Halogen demand (Chlorine demand) can vary greatly, there is not a direct relationship between water flow and total halogen in the tower. There is a direct relationship between water flow and pounds of Mazide Br-Cl used.

Refilling the Brominator

To maintain accurate dispensing rate performance, refill the Brominator when it reaches half-capacity. The following steps describe how to fill the Brominator. Safety note: Always wear appropriate personal protective equipment when filling or servicing the Brominator. This should include rubber gloves and chemical safety goggles. Do not get Mazide Br-Cl in eyes or on skin or clothing. In case of contact with eyes or skin, flush thoroughly with water.

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Brominator cont.

1) To remove the top tank cap, close the inlet valve first and then the outlet valve. Open the drain valve to release any water pressure. Carefully unscrew and remove the top lid and then close the drain valve. A hook wrench is provided for this purpose.

2) Open the inlet valve and fill the tank half full with water.

Close the inlet valve. Using the pail and funnel, add the proper amount of chemical to the tank. Remove the O-ring while filling, so it does not fall in the top opening.

3) Clean the threads on the top lid and collar. Inspect and re-insert all O-rings.

4) Slowly open the inlet valve and allow any head space in the tank to be displaced with water. Close the inlet valve and screw the lid on the tank and tighten. Do not tighten excessively. Be very careful not to cross thread!

5) Crack open the inlet valve slightly to allow normal operating pressure to be established slowly, without inducing water hammer. Continue opening both inlet and outlet valves slowly.

6) Open the outlet valve completely. Control water through-put by throttling the inlet valve to eliminate pressure fluctuations.

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SL 002542

Brominator cont.

Readjust flowmeter level. Never quickly open or close inlet or outlet ball valves.

Storage precautions.

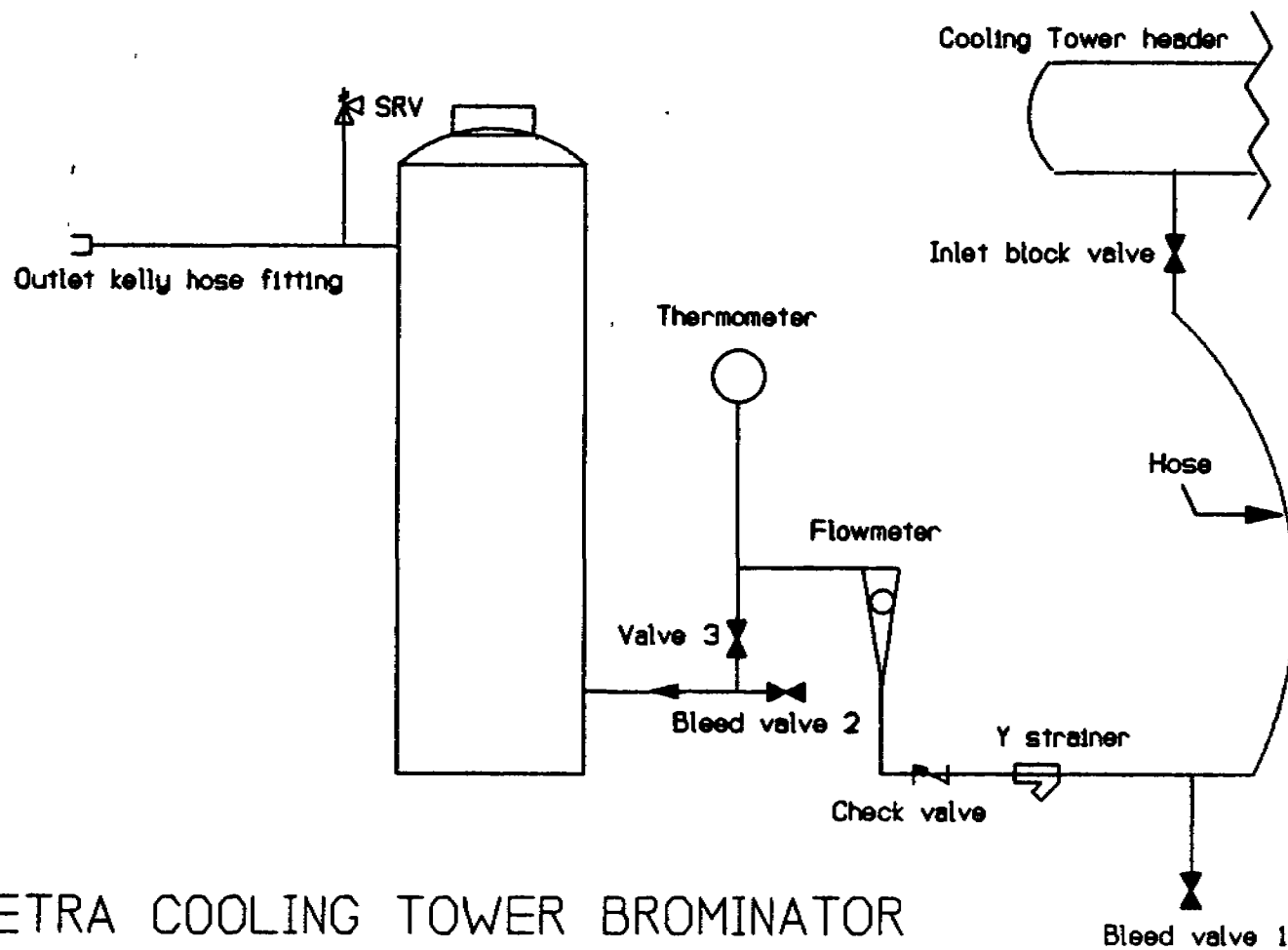
Store Mazide Br-Cl in a cool, dry, well-ventilated area. Keep away from fire or flame and organic chemicals. Contamination with moisture, organic matter, strong reducing agents, or other chemicals may start a chemical reaction with generation of heat, hazardous gases, and possible fire or explosion. Mazide Br-Cl tablets do not burn, but can liberate toxic gases upon incineration. Keep away from sunlight. Thoroughly wash containers with large quantities of water before disposal in a safe place. Containers should not be reused.

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SL 002544

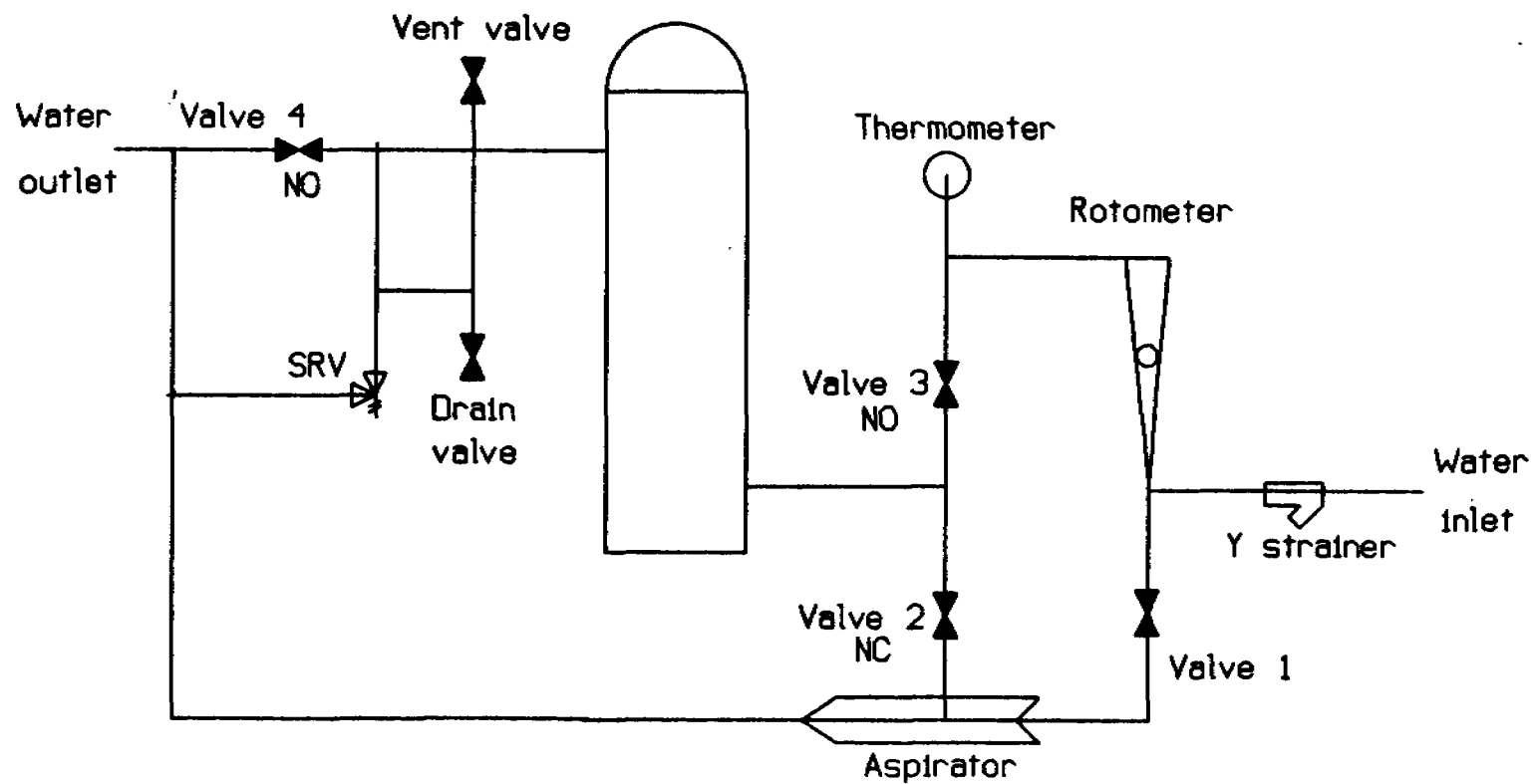
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TETRA COOLING TOWER BROMINATOR

SL 002545

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No. 91-1145



Per/Tr1 Cooling Tower Brominator

MATERIAL SAFETY DATA SHEETS

1) Mazplex MO, Maztreat 838, Mazsperser 830:

These compounds all contain caustic. They will burn any open cuts, eyes, nose or mouth. Rubber gloves and goggles should be worn while handling these materials. If skin contact is made the effected area should be washed with clean water. If contact is made with the eyes, they should be washed with clean water for 15 minutes. You should then go to first aide for further attention.

2) Mazide BC 915:

This compound contains Glutaraldehyde, a powerful biocide. It is used to kill living tissue. Prolonged skin contact may cause severe inflammation and possibly skin burns. Eye contact will cause severe conjunctivitis and corneal damage. Vapor may cause stinging sensations in the eye and excess tearing, but not injury. The vapor is irritating to the nose, throat, and lungs. If this material is swallowed - DO NOT INDUCE VOMITING. Do not give anything to drink. CALL A DOCTOR, and refer to the "notes to physician" on page 2 of the Mazide BC 915 MSDS.

When handling this material, rubber gloves, long sleeve shirt, and goggles should be worn. Small spills can be washed down with large amounts of water. Large spills should be contained and picked up for disposal. Refer to page 3 of the Mazide BC 915 MSDS.

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MAZER® CHEMICALS
A Division of PPG® INDUSTRIES, INC. Chemicals Group
3938 PORETT DRIVE GURNEE, IL 60031
Informational Phone Number: (708) 244-3410
24 Hour Emergency Phone No. (304) 843-1300

MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name: MAZPLEX MO

Name and/or Family or Description: COOLING TOWER TREATMENT

Address: 3938 Porett Drive, Gurnee, Illinois 60031

DOT Hazard Classification: NON-HAZARDOUS

DOT:

NFPA:HEALTH HAZARD-2-HAZARDOUS; FLAMMABILITY-1-ABOVE 200 DEG F.; REACTIVITY-0-STABLE

CAS NUMBER:

RCRA HAZARD CLASS: (IF DISCARDED)

EPA PRIORITY POLLUTANTS

SARA TITLE III (Sec. 313) HAZARDOUS MATERIAL

As determined by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or by the Occupational Safety and Health Administration (OSHA).

PROPRIETARY

NON HAZARDOUS

NONE

NONE

HAZARDOUS INGREDIENTS

(This material contains no ingredients which are known by Mazer Chemicals to be hazardous unless listed below.)

MATERIAL OR COMPONENT

TLV (UNITS)

APPROX %

As established by the American Conference of Governmental Industrial Hygienists and/or standards promulgated by the Occupational Safety and Health Administration.

PHYSICAL DATA

Physical Data:

BOILING POINT, °F

212 (INITIAL)

SOLUBILITY IN WATER @ 25°C

SOLUBLE

SPECIFIC GRAVITY @ 25°C

1.3

VAPOR PRESSURE, mm Hg @ 25°C

> 1

VAPOR DENSITY, (AIR=1)

> 1

APPEARANCE @ 25°C

LIQUID

ODOR

CHARACTERISTIC

FLASH POINT, PMCC, °F

> 200

FIRE AND EXPLOSION HAZARD DATA

Flash Point: (See PHYSICAL DATA section)

Flammable Limits in Air, % by Volume: Unknown LOWER: Undetermined UPPER: Undetermined

Extinguishing Media: Use Carbon Dioxide or Dry Chemical on small fires. Use foam (alcohol, polymer or ordinary) and water spray for large fires.

Special Fire Fighting Procedures: Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.

Unusual Fire & Explosion Hazards: May give off irritating and toxic fumes when exposed

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HEALTH HAZARD DATA

Threshold Limit Value: See HAZARDOUS INGREDIENTS section

Effects of Overexposure: Contact with skin or eyes will cause irritation.

Emergency and First Aid Procedures: Flush eyes with copious amounts of water for a minimum of 15 minutes. Wash contacted skin areas with soap and water. If irritation develops, consult a physician. Soaked clothing should be changed immediately! With regard to inhalation, remove person to fresh air. If artificial respiration is required, obtain medical help immediately.

REACTIVITY DATA

Stability: Stable ☒ Unstable ☐

Incompatibilities: (Materials to Avoid) Strong oxidizing material can cause a reaction.

Hazardous Decomposition Products: Thermal decomposition or burning may produce carbon mono/dioxides as well as inorganic salts.

Hazardous Polymerization: May occur ☐ Will not occur ☒

Conditions to Avoid: See above statements.

SPILL, LEAK AND DISPOSAL PROCEDURES

Action to take for spills: (Use appropriate Safety Equipment) Contain liquids and prevent discharges to streams or sewers. Leaks should be stopped. Spills, after containment should be shoveled up or removed by vacuum truck to chemical waste area.

Disposal Method: All Local, State and Federal Regulations concerning health and pollution should be reviewed to determine approved disposal procedures.

SPECIAL HANDLING INFORMATION

Ventilation:

1. Local Exhaust: None should be needed
2. Mechanical (general): Recommended
3. Respiratory Protection (type): Canister for organic/inorganic vapors (i.e. type GMB from Mine Safety Appliance Co.)

Protective Clothing: Clean, body-covering clothing. In addition, rubber gloves, boots, and apron, depending upon the exposure likely, or as required by your company.

Eye Protection: Chemical Workers Goggles recommended.

Other Protective Equipment: Eye Fountain and Safety Shower in work area.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Store in well ventilated areas at temperatures below 120°F, segregated from oxidizers, acids and flammable materials. Avoid skin contact.

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1st revised 27 APR 1990 MJC

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MAZER[®] CHEMICALS
A Division of PPG[®] INDUSTRIES, INC. Chemicals Group
3938 PORETT DRIVE GURNEE, IL 60031
Informational Phone Number: (708) 244-3410
24 Hour Emergency Phone No. (304) 843-1300

MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name: MAZTREAT[®] 838

Name and/or Family or Description: PROPRIETARY BLEND

Address: 3938 Porett Drive, Gurnee, Illinois 60031

DOT Hazard Classification: NON-HAZARDOUS

DOT:

NFPA: HEALTH HAZARD-0-NORMAL MATERIAL; FLAMMABILITY-1-ABOVE 200 DEG F.; REACTIVITY-0-STABLE

CAS NUMBER:

RCRA HAZARD CLASS: (IF DISCARDED)

EPA PRIORITY POLLUTANTS

SARA TITLE III (Sec. 313) HAZARDOUS MATERIAL

PROPRIETARY

NON-HAZARDOUS

NONE

NONE

As determined by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or by the Occupational Safety and Health Administration (OSHA).

HAZARDOUS INGREDIENTS

(This material contains no ingredients which are known by Mazer Chemicals to be hazardous unless listed below.)

MATERIAL OR COMPONENT

TLV (UNITS)

APPROX %

As established by the American Conference of Governmental Industrial Hygienists and/or standards promulgated by the Occupational Safety and Health Administration.

PHYSICAL DATA

Physical Data:

BOILING POINT, °F	212 INITIAL
SOLUBILITY IN WATER @ 25°C	DISPERSIBLE
SPECIFIC GRAVITY @ 25°C	1.04
VAPOR PRESSURE, mm Hg @ 25°C	>1
VAPOR DENSITY, (AIR=1)	>1
VOLATILES, %, BY VOLUME	50
APPEARANCE @ 25°C	LIQUID
ODOR	MILD
FLASH POINT, PMCC, °F	>200

FIRE AND EXPLOSION HAZARD DATA

Flash Point: (See PHYSICAL DATA section)

Flammable Limits in Air, % by Volume: Unknown LOWER: Undetermined UPPER: Undetermined

Extinguishing Media: Use Carbon Dioxide or Dry Chemical on small fires. Use foam (alcohol, polymer or ordinary) and water spray for large fires.

Special Fire Fighting Procedures: Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.

Unusual Fire & Explosion Hazards: None Known to Mazer Chemicals.

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No. 91-1145

HEALTH HAZARD DATA

Threshold Limit Value: See HAZARDOUS INGREDIENTS section

Effects of Overexposure: Contact with skin or eyes may cause temporary irritation.

Emergency and First Aid Procedures: Flush eyes with copious amounts of water for a minimum of 15 minutes. Wash contacted skin areas with soap and water. If irritation develops, consult a physician. Soaked clothing should be changed immediately!

REACTIVITY DATA

Stability: Stable ☒ Unstable ☐

Incompatibilities: (Materials to Avoid) Strong oxidizing material can cause a reaction.

Hazardous Decomposition Products: Thermal decomposition or burning may produce carbon mono/dioxides and/or nitrogen oxides.

Hazardous Polymerization: May occur ☐ Will not occur ☒

Conditions to Avoid: See above statements.

SPILL, LEAK AND DISPOSAL PROCEDURES

Action to take for spills: (Use appropriate Safety Equipment) Use absorbent material to collect and contain for disposal. Contain large spills and pump into a suitable tank. Wash area with suitable detergent and thoroughly rinse.

Disposal Method: All Local, State and Federal Regulations concerning health and pollution should be reviewed to determine approved disposal procedures.

SPECIAL HANDLING INFORMATION

Ventilation:

1. Local Exhaust: None should be needed
2. Mechanical (general): Recommended
3. Respiratory Protection (type): Canister for organic vapors (i.e. type GMA from Mine Safety Appliance Co.)

Protective Clothing: Clean, body-covering clothing. In addition, rubber gloves, boots, and apron, depending upon the exposure likely, or as required by your company.

Eye Protection: Chemical Workers Goggles recommended.

Other Protective Equipment: Eye Fountain and Safety Shower in work area.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Store in well ventilated areas at temperatures below 120°F.

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No. 91-1145

MAZER® CHEMICALS
A Division of PPG® INDUSTRIES, INC. Chemicals Group
3938 PORETT DRIVE GURNEE, IL 60031
Informational Phone Number: (708) 244-3410
24 Hour Emergency Phone No. (304) 843-1300

MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name: **MAZSPERSE® 830**

Name and/or Family or Description: **PROPRIETARY BLEND**

Address: **3938 Porett Drive, Gurnee, Illinois 60031**

DOT Hazard Classification: **NON-HAZARDOUS**

DOT:

NFPA: HEALTH HAZARD-0-NORMAL MATERIAL: FLAMMABILITY-1-ABOVE 200 DEG F.; REACTIVITY-0-STABLE

CAS NUMBER:

RCRA HAZARD CLASS: (IF DISCARDED)

EPA PRIORITY POLLUTANTS

SARA TITLE III (Sec. 313) HAZARDOUS MATERIAL

As determined by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or by the Occupational Safety and Health Administration (OSHA).

PROPRIETARY

NON-HAZARDOUS

NONE

NONE

HAZARDOUS INGREDIENTS

(This material contains no ingredients which are known by Mazer Chemicals to be hazardous unless listed below)

MATERIAL OR COMPONENT

TLV (UNITS)

APPROX %

As established by the American Conference of Governmental Industrial Hygienists and/or standards promulgated by the Occupational Safety and Health Administration.

PHYSICAL DATA

Physical Data:

BOILING POINT, °F

212

SOLUBILITY IN WATER @ 25°C

SOLUBLE

SPECIFIC GRAVITY @ 25°C

1.3

VAPOR PRESSURE, mm Hg @ 25°C

>1

VAPOR DENSITY, (AIR=1)

>1

VOLATILES, %, BY VOLUME

70

APPEARANCE @ 25°C

LIQUID

ODOR

MILD

FLASH POINT, PMCC, °F

>200

POUR POINT, °C

0

FIRE AND EXPLOSION HAZARD DATA

Flash Point: (See PHYSICAL DATA section)

Flammable Limits in Air, % by Volume: Unknown LOWER: Undetermined UPPER: Undetermined

Extinguishing Media: Use Carbon Dioxide or Dry Chemical on small fires. Use foam (alcohol, polymer or ordinary) and water spray for large fires.

Special Fire Fighting Procedures: Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.

Unusual Fire & Explosion Hazards: None Known to Mazer Chemicals.

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No. 91-1145

SL 002551

HEALTH HAZARD DATA

Threshold Limit Value: See HAZARDOUS INGREDIENTS section

Effects of Overexposure: Contact with skin or eyes may cause temporary irritation.

Emergency and First Aid Procedures: Flush eyes with copious amounts of water for a minimum of 15 minutes. Wash contacted skin areas with soap and water. If irritation develops, consult a physician. Soaked clothing should be changed immediately!

REACTIVITY DATA

Stability: Stable [X] Unstable []

Incompatibilities: (Materials to Avoid) Strong oxidizing material can cause a reaction.

Hazardous Decomposition Products: Thermal decomposition or burning may produce carbon mono/dioxides.

Hazardous Polymerization: May occur [] Will not occur [X]

Conditions to Avoid: See above statements.

SPILL, LEAK AND DISPOSAL PROCEDURES

Action to take for spills: (Use appropriate Safety Equipment) Use absorbent material to collect and contain for disposal. Contain large spills and pump into a suitable tank. Wash area with suitable detergent and thoroughly rinse.

Disposal Method: All Local, State and Federal Regulations concerning health and pollution should be reviewed to determine approved disposal procedures.

SPECIAL HANDLING INFORMATION

Ventilation:

1. Local Exhaust: None should be needed
2. Mechanical (general): Recommended
3. Respiratory Protection (type): Canister for organic vapors (i.e. type GMA from Mine Safety Appliance Co.)

Protective Clothing: Clean, body-covering clothing. In addition, rubber gloves, boots, and apron, depending upon the exposure likely, or as required by your company.

Eye Protection: Chemical Workers Goggles recommended.

Other Protective Equipment: Eye Fountain and Safety Shower in work area.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Store in well ventilated areas at temperatures below 120°F.

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of 14th Judicial District Court
No. 91-1145

PPG/MAZER® CHEMICALS
A Business Unit of PPG® Industries, Inc., Chemicals Group
3938 Porett Drive Gurnee, IL 60031
Informational phone number: (800) 552-1912
24 hour emergency phone number: (304) 843-1300

MATERIAL SAFETY DATA SHEET

PRODUCT INFORMATION

Trade Name: MAZIDE® BC 915 / ITEM 919158701

Name and/or Family or Description: WATER TREATMENT MICROBIOCIDES

DOT Hazard Classification: HAZARDOUS

DOT: CORROSIVE LIQUID, N.O.S., (GLUTARALDEHYDE SOLUTION), CORROSIVE MATERIAL, UN 1760, ERG# 60

NFPA: HEALTH HAZARD-2-HAZARDOUS; FLAMMABILITY-1-ABOVE 200 DEG F.; REACTIVITY-0-STABLE

CAS NUMBER:

111-30-8

RCRA HAZARD CLASS: (IF DISCARDED)

NON-HAZARDOUS

EPA PRIORITY POLLUTANTS

NONE

SARA TITLE III (Sec. 313) HAZARDOUS MATERIAL

NONE

COMPOSITION

MATERIAL OR COMPONENT

APPROX %

GLUTARALDEHYDE

15

INERT INGREDIENTS

85

HAZARDOUS INGREDIENTS

(This material contains no ingredients which are known by Mazer Chemicals to be hazardous unless listed below.)

MATERIAL OR COMPONENT

TLV (UNITS)

APPROX %

GLUTARALDEHYDE

0.2ppm ceiling

15

CAS#: 111-30-8

As established by the American Conference of Governmental Industrial Hygienists and/or standards promulgated by the Occupational Safety and Health Administration.

PHYSICAL DATA

BOILING POINT, °F

212 INITIAL

SOLUBILITY IN WATER @ 25°C

SOLUBLE

SPECIFIC GRAVITY @ 25°C

1.042

VAPOR PRESSURE, mm Hg @ 25°C

>1

VAPOR DENSITY, (AIR=1)

>1

VOLATILES, %, BY VOLUME

100

APPEARANCE @ 25°C

CLEAR LIQUID

FLASH POINT, PMCC, °F

>200

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No. 91-1145

FIRE AND EXPLOSION HAZARD DATA

Flash Point: (See PHYSICAL DATA section)

Flammable Limits in Air, % by Volume: Unknown LOWER: Undetermined UPPER: Undetermined

Extinguishing Media: Use Carbon Dioxide or Dry Chemical on small fires. Use foam (alcohol, polymer or ordinary) and water spray for large fires.

Special Fire Fighting Procedures: Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.

Unusual Fire & Explosion Hazards: None Known to Mazer Chemicals.

HEALTH HAZARD DATA

Thresh Id Limit Value: 0.2 ppmv, ceiling

Effects of Overexposure: Contact with skin or eyes will cause temporary irritation.

Effects of a Single Overexposure:

Swallowing: May cause moderate to severe irritation or burns of the mouth, throat, esophagus, and stomach, with abdominal and chest discomfort or pain, nausea, vomiting, diarrhea, dizziness, faintness, weakness, circulatory shock and collapse.

Skin Absorption: Toxicology studies indicate that prolonged or widespread contact could result in the absorption of potentially harmful amounts of material.

Skin Contact: Brief contact will cause local reddening and swelling. More prolonged contact may result in severe inflammation and possibly skin burns.

Eye Contact: Liquid will cause severe conjunctivitis and marked corneal injury. Vapor may cause stinging sensations in the eye and excess lachrymation but not injury.

Inhalation: Vapor is irritating to the respiratory tract causing stinging sensations in the nose and throat, coughing, chest discomfort and tightness, difficulty with breathing, and headache.

Effects of Repeated Overexposure: May cause skin sensitization in a small proportion of individuals, and presenting as a typical allergic contact dermatitis.

Emergency and First Aid Procedures: Flush eyes with copious amounts of water for a minimum of 15 minutes. Wash contacted skin areas with soap and water. If irritation develops, consult a physician. Soaked clothing should be changed immediately! Remove to fresh air. Ingestion-DO NOT INDUCE VOMITING. Do not give anything to drink. Obtain medical advice with urgency.

Significant Laboratory Data with Possible Relevance to Human Health Hazard Evaluation:

Laboratory studies have shown glutaraldehyde is not teratogenic, and in vitro studies have demonstrated an absence of mutagenic effects.

Medical Conditions Aggravated by Overexposure: May aggravate existing dermatitis.

NOTES TO PHYSICIAN: Moderately toxic perorally and by sustained contact. Most of the adverse effects are due to the intensely irritating nature of this material. Due to its' corrosive effects on mucosal surfaces, any material aspirated during vomiting may cause lung injury. Thus, induction of emesis is NOT recommended. If evacuation of stomach contents is considered necessary, the means least likely to cause aspiration should be undertaken (i.e., gastric lavage in the presence of endotracheal intubation). Due to irritation and possible ulceration of the upper alimentary tract, there may be blood and fluid loss resulting in electrolyte and fluid imbalance. Also, large swallowed volumes could result in perforation of the esophagus or stomach, causing mediastinitis or peritonitis and complications thereof.

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No. 91-1145

REACTIVITY DATA

Stability: Stable [X] Unstable []
Incompatibilities: (Materials to Avoid) Acidic or basic materials catalyze an aldol-type condensation (exothermic, but not expected to be violent).
Hazardous Decomposition Products: Thermal decomposition or burning may produce carbon monoxide and/or carbon dioxide.
Hazardous Polymerization: May occur [] Will not occur [X]
Conditions to Avoid: Avoid high temperatures (removal of water, >200°F).

SPILL, LEAK AND DISPOSAL PROCEDURES

Action to take for spills: (Use appropriate Safety Equipment) Wear suitable protective equipment. Toxic to fish; avoid discharge to natural waters. VERY LOW concentrations (10 ppm or less) can be degraded in a biological treatment system. Thus, SMALL spills can be flushed with LARGE quantities of water.

Large quantities can be harmful to the treatment system. Thus, large spills should be collected for disposal. It may also be possible to decontaminate spilled material by careful application of aqueous ammonium hydroxide or sodium bisulfite solution. Considerable heat and fumes can be liberated by the decontamination reaction; wear suitable protective equipment.

Disposal Method: All Local, State and Federal Regulations concerning health and pollution should be reviewed to determine approved disposal procedures. Atomize into a very hot incinerator fire, or mix with a suitable flammable solvent and incinerate under appropriate regulations. High water content may dampen flame.

SPECIAL HANDLING INFORMATION

Ventilation:

1. Local Exhaust: Sufficient exhaust ventilation to maintain exposure below TLV.
2. Mechanical (general): Recommended
3. Respiratory Protection (type): Canister for organic vapor and dust/mist (i.e. OV/DM #8741 or #8751A from 3M)

Protective Clothing: Clean, full body-covering clothing. In addition, rubber gloves, boots, and apron, depending upon the exposure likely, or as required by your company

Eye Protection: Chemical Workers Goggles recommended. Full body protection recommended when transferring material

Other Protective Equipment: Eye Fountain and Safety Shower in work area.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Avoid breathing vapor. Avoid contact with eyes, skin, and clothing. Keep container closed. Use adequate ventilation. Wash thoroughly after handling.

FOR INDUSTRIAL USE ONLY

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No. 91-1145

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last revised 04 NOV 1991 MJC

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No. 91-1145

MAZER TREATMENT NOTES

- ① NO PINTS SHOULD BE ADJUSTED WITH THE
% SPEED (SMALL KNOB)
- ② SAMING WATER SHOULD NEVER BE OVER 130 MICRO METER'S

Read

Represent

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For
Shooting

Communication

Note
the

SL 002557

CONFIDENTIAL:
Subject to Protective Order
of 14th Judicial District Court
No. 91-1145

10/30/91

TO: Op rators and Charles Long

October 21, 1991

FROM: Carey Brazitis *CAB*

SUBJECT: Cooling tower
Responsibilities

The following is an outline of individual responsibilities for the operation of the Tetra and Per/Tri cooling towers.

OPERATIONS:

Operations is responsible for controlling and maintaining the Tetra and Per/Tri cooling tower's treatment systems based on the control variables and guidelines as stated below.

Perform at least once per shift:

Analyze the tower water for the following control parameters and make adjustments as necessary.

<u>Molybdate</u>	6 to 10 ppm	Mazplex MO
@ Tetra	4 ml per min.	1.5 gpd.
@ Per/Tri	2 ml per min.	0.8 gpd.

Conductivity of Make-up and Blowdown:

Cycles should be controlled between 6.5 -- 7.5 based on conductivity of blow-down divided by conductivity of make-up.

pH: Maintain the basin water pH between 7.2 -- 8.4. Low pH should be controlled by adding soda ash.

Maintain water flow through the brominator at 3 GPM. Order Bromicide tablets from the warehouse as needed.

Perform Daily, on Days:

Measure the Mazplex MO and Maztreat 838 flow with a stopwatch and graduated cylinder. If not flowing, troubleshoot and correct.

Check the calibration of the lab pH meter.

Weekly Checks and Duties:

Check the calibration of the conductivity meter on Saturday days.

Add Mazide BC 915 (Biocide)	Add on Saturdays	
@ Tetra		3 gallons
@ Per/Tri		1.5 gallons

Read each new report from the PPG Specialty Chemicals Service Representative for any new instructions or suggestions.

Upsets & Special Procedures:

For non-routine operations and problems refer to the Trouble Shooting and Special Procedures section in the operating manual.

Communications:

Note any adjustments, changes, chemical additions or problems in the Tetra/Bottoms Plant Logbook.

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PPG Specialty Chemicals Service Representative:

The service representative is responsible for reviewing the chemical treatment system operation and recommending procedures and special instructions for proper system operations. The service representative is also responsible for reporting on the integrity of the cooling towers treatments.

Weekly Duties:

Perform necessary water analysis.

Perform microbiological testing.

Maintain adequate chemical inventory.

Check chemical feed pumps for proper operation.

Review operator logsheets for consistency and problems.

Adjust Maztreat 838 pumps as needed to maintain proper level of Tolytriazol in the tower system.

Provide system review reports outlining special instructions and procedures necessary for proper tower operation.

Monthly Duties:

Perform corrosion coupon testing.

Other Responsibilities:

Assist in developing statistical tools to improve tower operation and control.

Discuss operator problems and suggestions.

Perform equipment inspections and deposit analysis.

Evaluate new treatment chemicals and biocides, and make recommendations for system improvements.

Provide quarterly chemical usage reports.

Provide a semi-annual report outlining chemical usage, existing project status, and new project plans.

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SL 002560

Mazer Chemicals P. O. Box 1000 Lake Charles, Louisiana 70602 Telephone: (318) 491-4271

To: Cary Brazitis

September 29, 1991

From: Charles Long

Subject: Cooling Tower Chemical Pumps

Th LMI pumps used with the cooling tower treatment chemicals are positive displacement pumps. They have no rotating armature in th ir motor. The armature part of the motor in these pumps moves in and out like the solenoid part of a solenoid valve. A diaphragm is attached to the armature. There are ball type check valves in the suction and discharge ports of the pump head. This type of pump can be dead-headed without damaging the diaphragm because the motor is not as strong as the diaphragm. The pump will just stop pumping when dead-headed and will restart when the discharge side pressure is returned to normal.

These pumps have two main controls on them. One control is for the speed, and the other controls the length of stroke of the motor armature. The speed controller is the small knob and the stroke controller is the larger knob. You should adjust the flow from these pumps using only the speed knob. Your service representative will adjust the stroke knob if necessary. A high and low speed range are available using the toggle switch in the upper left corner of the pump. The Mazplex MO pump should normally be used on th high range speed setting, while the Maztreat 838 pump should be us d on the low range speed setting.

Setting the flow with these pumps is a simple matter, and can be done by measuring the amount of liquid pumped during a certain length of time such as one minute. You will need to us a stopwatch and graduated cylinder. Divide the volume, measured in milliliters, by the elapsed time, measured in minutes, to get ml/min. Multiply the flow rate in ml/min by .3804 to get gallons p r day.

The Mazplex MO pump at TETRA should deliver about 1 1/2 to 2 gallons per day. This is 4 to 5 ml/min.

The Mazplex MO pump at PER/TRI should deliver about 3/4 to 1 1/2 gallons per day. This is 2 to 4 ml/min.

Routine adjustments to these pumps should be made in small amounts. A normal adjustment would be to raise or lower the speed by 2%. A large adjustment would be 5%. During upsets, larger adjustment may need to b mad , such as 10 to 20%.

If you have any question please call me at 4271.

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COOLING TOWER

Control Guide

When using Clarified Sabine River Water as make-up:

Chemical constituent:	Target:	Controlled by:
Molybdate	6 to 10 ppm	Mazplex MO
@ Tetra	4 ml per min.	1.5 gpd.
@ Per/Tri	2 ml per min.	0.8 gpd.
Tolytriazole	Your service representative will set pump.	Maztreat 838
@ Tetra	This pump should always be on the low range.	.25 gpd.
@ Per/Tri		.12 gpd.
Biocide	Biocide to be added once per week.	Mazide BC 915
@ Tetra	Add on Saturdays.	3 gallons per week
@ Per/Tri		1.5 gallons per week

Cycles should be controlled between 6.5 and 7.5 based on conductivity of blow-down divided by conductivity of make-up. The conductivity of the make-up should not be greater than 130 uM. If the reading is high the make-up should be resampled to confirm, and Power House C should be notified.

The pH should run between 7.2 and 8.4. High pH should be controlled through lowering cycles by increasing Blowdown. Low pH should be controlled by adding soda ash.

When using Well Water as make-up:

When using well water as make up to the tower the following treatment chemical should be added.

Mazspers 830	25 ppm	Iron, dispersant
1 mL per minute	1/2 gal per day	

The pH will run higher while on well water. The pH should be kept below 9 by using blowdown. The number of cycles will run low, maybe as low as 2 to 4.

When a Sabine River Water outage is planned the Mazspers 830 should be started two days ahead of time. If the outage is unplanned or the switch over to well water is an emergency, 3.5 gallons should be added to the basin at the suction of the circulating pumps.

Emergency Response Guidelines:

In case of abnormal operating conditions call the PPG Specialty Chemicals representative, Charles Long, at 491 4271 or page him at 437 2303.

(This would include switch-over to well water, oil intrusion, acid, caustic, firewater or brine leaks into the tower and sudden changes in MoO_4^{2-}) In case of an emergency involving our chemicals call the PPG 24 hour Emergency Phone No. (304) 843-1300.

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Mazer Chemicals P. O. Box 1000 Lake Charles, Louisiana 70602 Telephone: (318) 491-4271

EMERGENCY CONTACTS FOR WATER TREATMENT PROBLEMS

1. Charles Long. Lake Charles Area Representative.
Office 491 4271
Home 855 9442
Pager local 437 2303
Pager Nationwide 1 800 999 6710 access number 37404
2. Bob Hatch. Business Manager, Water Treatment PPG
Office 1 800 447 0825 or 1 708 249 6365
Home 1 708 816 7405
Auto 1 708 370 0595
3. Gary Herchian. Technical Service Representative.
Office 1 800 447 0825 or 1 708 249 6361
4. John Pratt. Sales / Service Representative
Home / Office 1 805 589 2274
Auto 1 805 332 3081
5. Ed Gannon. Sales / Service Representative
Home / Office 1 406 252 5120

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