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# **MEMBRANE ELEMENT AUTOPSY MANUAL**



**Water Treatment Technology Program Report No. 17**

**December 1996**

**U.S. DEPARTMENT OF THE INTERIOR  
Bureau of Reclamation  
Technical Service Center  
Environmental Resources Services  
Water Treatment Engineering and Research Group**

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**by**

**Frank Leitz**

Water Treatment Engineering and Research Group  
Environmental Resources Services  
Technical Service Center  
Denver, Colorado

December 1996

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*Mission Statement*

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## INTRODUCTION

The goal of this document is to provide the reader with the tools necessary to perform a successful and informative membrane element autopsy. This document contains procedures to carry out the autopsy, forms which can be used for taking original notes and for making a formal record of the results, a list of available resources, and material safety data sheets for compounds frequently encountered in the autopsy process.

This document is still provisional. At this time it relates only to spiral wound reverse osmosis elements and similarly packaged filtration membranes. Depending on interest, information regarding hollow fine fiber, tubular or other configurations of reverse osmosis elements, and **electrodialysis** or other membrane types can be added. The resource section is particularly thin; we would appreciate hearing from organizations capable of performing analyses on membranes. The reader's or user's comments, additions, suggestions, or even anecdotal experiences would be welcomed.

Please send any feedback to:

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## PROCEDURES

### P.1 Pre-Autopsy Procedures

A membrane element autopsy is best done as soon as possible after the element has been removed from service.

The purpose of an autopsy determines the autopsy procedures and the tests performed on the components obtained during the autopsy. This determination is such a fundamental requirement that a statement of purpose should be written while the element is still in cold storage or possibly still in service. While the statement of purpose is being written, a preliminary list of tests to be performed on membranes and components should be prepared so that appropriate samples can be collected as the autopsy proceeds. A sample that undergoes less handling during collection and storage will more accurately represent the conditions under which it was last used.

The sequence in which the operations of examination and sample collecting are performed depends on the purpose of the autopsy. This sequence is best determined in advance.

For convenience, a recorder should be available to note observations and record where samples are taken. Hands or gloves tend to get wet during handling and sampling of the element leaves, which is not conducive to **good** note taking.

Analysis of samples may require prior scheduling or approval of expenditures. These actions should be taken in advance of the autopsy to minimize storage time of any samples.

At several points this procedure recommends recording certain information. Such information may never be **used**, and recording it may at first appear pointless. However, considerably less effort is required to record data which may not be used than to attempt to reconstruct lost information. You may want to know, at some point, which part of the element was at the bottom of the vessel during operation. This information is usually lost by the time the element is being autopsied.

### P.2 Exit Wet Testing

When an element is being autopsied to determine the causes for change in performance, a determination of the pre-autopsy performance of the element by an element wet test is desirable. These data can be compared to those of the initial wet test of the element, which may **be** obtained from the manufacturer. The best comparison will occur if the element is tested under the same conditions as those of the initial wet test. Conditions of interest include inlet and **outlet** pressures, temperature, and composition of feed solution. If the apparatus for testing a single element is lacking, the element may be returned to the manufacturer for wet testing.

If the element is tested under different conditions from the initial or other wet tests, the data should be normalized to a standard set of conditions for comparison. The manufacturer should be able to provide the equations required for normalization of data.

As a poorer alternative, performance of a vessel, control block, or unit measured just before the element being autopsied was removed can be compared to initial performance. As the number of elements in the group to which comparison is made increases, the comparison becomes less meaningful.

### P.3 Removal of Element Shell

Biocides, in general, are hazardous materials. An element being autopsied that is likely to contain some biocide should be thoroughly rinsed with water to remove the biocide, provided that this rinsing is not likely to remove or displace the kind of material which the autopsy is intended to find. Rinse water containing biocides should be disposed of properly. Material Safety Data Sheets (MSDSs) for formaldehyde, glutaraldehyde, and isothiazolinones, the biocides most commonly used for membrane preservation, are included in the Resources section of this manual. If the element contains another biocide, the MSDS for that biocide should be obtained prior to the autopsy. Appropriate precautions should be taken if the operators are likely to come into contact with a biocide.

To remove excess water, let the element stand in the vertical position and drain for about 30 minutes. In a particularly dry ambience a plastic cover may be placed over the top of the element to prevent excessive drying of the membrane surfaces.

Removal of the hard shell from an element is a dusty job which you may not want to do in a laboratory. Because of the dust and debris generated, the hard shell should not be removed on the autopsy table. Personnel performing this operation should wear ample eye and face protection and long-sleeved garments to avoid contaminating skin with fiberglass particles.

Elements which are not expected to have a long service life can be obtained without a hard shell. Such elements can be taken directly to the autopsy area for removal of the **soft** outer wrap.

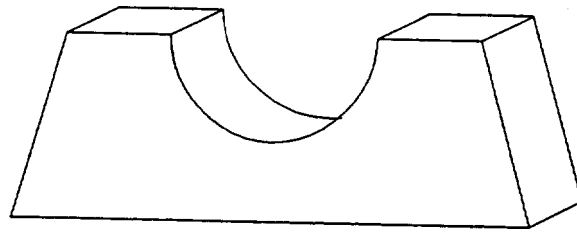
Examine the exterior of the element carefully. The brine seal, if present, should be checked for cracks, splits, or evidence of physical abuse. Check the hard shell and brine seal **carrier(s)/antitelescoping** device(s) for manufacturing flaws or damage from use or handling. Check surfaces for deposits of scale or organic growth. Samples should be taken of any unusual deposits. Note the condition of all visible components, particularly any unusual features, in the autopsy record. In some cases, the absence of visible features may be the most important observation. However, very careful observation is required to indicate the absence of features.

Note which end of the element is the feed end. Typically, this information is marked on the element shell. This information is easily lost as the outside of the element disappears, and you will want to know this information, particularly during sampling of a used element. The feed end of the first element in the first stage will accumulate bits of rubbish, which will identify this end even late in the autopsy. This accumulation does not occur on elements downstream in the system.

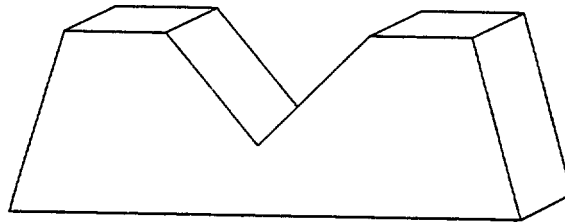
To constrain the element during removal of the hard shell, a pair of cradles similar to one of the designs shown on the following page is convenient. The V-notch cradle may be more generally useful than the semi-circular cradle if you are likely to autopsy elements of different sizes. ..

To remove the seal carrier/anti-telescoping device, make a cut through the hard shell above the carrier. With a sufficient cut, the shell can be pried loose from the carrier, and the carrier can be removed by judicious use of a hammer and a cold chisel or other persuader. Remove the carrier from both ends.





a)



b)

This laboratory has found a compressed-air cast saw to be most convenient. The first cut on an unfamiliar element should be fairly shallow and 1 to 2 inches long. The depth of cut can be increased until the hard shell is penetrated. A piece of the hard shell can then be pried loose. This procedure will indicate whether the total depth of cut needs to be altered before too much damage is done to the interior of the element.

To remove the hard shell, make a cut along the length of the element with a circular saw. A second cut along the element opposite the first cut may aid removal of the shell. This work can be done more neatly with a hand tool, **but** it is rather picky work. The shell is then removed, usually in pieces, by prying it from the element. A 1.5- to 2-foot-long pry bar is useful. Generally, pry against the remaining hard shell rather than against the soft inner part of the element. The soft outer wrap can be removed in the autopsy area.

Small elements can be carried in the gloved hand from the shell removal area to the autopsy table. If the element has been in contact with glutaraldehyde, the gloves should be polyethylene, butyl rubber, surgical latex rubber, or **nitrile** rubber, but not polyvinyl rubber or neoprene, which tend to absorb glutaraldehyde. A wheeled laboratory cart or a gurney is the most convenient means of moving larger elements.

#### P.4 Autopsy Table

The best surface on which to perform an autopsy is a level table, accessible from all sides, which is slightly wider than the axial length of the element and about as long as twice the leaf length. A 4- by 8-foot sheet of 3/4-inch Formica-covered plywood, suitably supported, is usable for elements up to 40 inches long and with a leaf length up to 48 inches. A table that is excessively wide for the element being autopsied is a hindrance rather than a help. Cover the table with a sheet of polyethylene larger than the

table top even if the **tabletop** is impermeable. Salty water has an undesirable effect on varnished furniture woods. The plastic-can later be used to wrap the bits and pieces of the dissected element.

The table should be located in a ventilated area but not where dust and other air-borne materials will contaminate the element during autopsy. Excessive ventilation may cause rapid drying of the membrane in a dry climate. Even with moderate concentrations of a volatile **biocide**, the quantity of material released by several element leaves suddenly exposed to the atmosphere is surprisingly large.

#### P.5 Inventorying Element Features and Observations

Place the element near the edge of the table with the ends of the leaves on which the element is sitting pointed toward the edge. In this orientation, the element can be unrolled toward the center of the table. Note somewhere on the table or on the plastic table cover which end is the feed end of the element. Remove the **soft** inner wrap. Unless you are trying to preserve a layer on the membrane, unroll the entire element toward the center of the table.

The break between the first and last leaf can often be determined by inspection of the portion of the element near the product water tube. Arrange the leaves in the element so that the first leaf is on top. With an indelible laundry marker, number the leaves in a non-critical spot, usually in the corner. If identification of the first and last leaves is not possible, start numbering at an arbitrary leaf. Subsequently in the procedure, this numbering will allow identification of the first leaf. To avoid confusion, do not renumber the leaves at this point.

Examine the top leaf. Use of a 2X to a 4X and an 8X to a 12X glass may aid your examination. Generally, what you are looking for is the unusual. Are flaws visible in the membranes or other components? Are patches of scale or areas of biological growth evident? Were pieces of foreign material included in the element during manufacture? Observe glue lines in detail. Are the joints strong? If you have a question regarding joint strength, take samples for a pull test. Observe the fold in the leaf. Scale is frequently found here because of locally unevenly distributed flow. Use the leaf number when recording any observations. To distinguish between the sides of the leaf, use **1 A** for the front (convex) side, and **1 B** for the back (concave) side. Flip the leaf over to the other side of the table and observe the back. Observe each leaf in turn.

Carefully taken photographs are good for documentation of unusual observations. However, considerable photographic skill is required to deal with the common problems of poor lighting, low contrast, and glare from wet surfaces. If the features are small enough, one can take samples and photograph the feature under better conditions than are often possible during the autopsy.

A good sketch may be better than a thousand well chosen words.

#### P.6 Measuring Effective Area

The effective area of one side of a leaf is the area bounded by the inside edges of the glue lines and the folded edge of the leaf. Some kind of approximation may be required if the area is irregular and the irregularities are large compared to the size of the leaf. Draw straight lines along the boundaries such that the dead area inside the line is equal to the live area outside the line. Bear in mind that each leaf has two active sides.

If the effective area is rectangular or if its approximation is rectangular, the area,  $A$ , is given by:

$$A = ab$$

where  $a$  is the width of the effective area and  $b$  is its length.

Frequently, the length is constant and the width irregular. In this case, a number,  $n$ , of evenly spaced measurements can be made of the width, and area can be calculated from:

$$A \approx \frac{l}{n}b(a_1 + a_2 + \dots + a_n)$$

If the effective area is trapezoidal, with sides  $a_1$  and  $a_2$  parallel, then:

$$A = \frac{l}{2}b(a_1 + a_2)$$

If the effective area is a quadrilateral with no sides parallel, then draw a line across the quadrilateral, converting it into two triangles. The length of the line is  $c$ .

$$A_n = \sqrt{s_n(s_n - a_n)(s_n - b_n)(s_n - c)}$$

where  $s_n = (a_n + b_n + c)/2$

$$A = \sum_n A_n$$

More irregular areas could be approximated by using a larger number of triangles, but the gain in accuracy would be small.

## P.6 Collection and Preservation of Samples

Sampling is much easier and more accurate if an adequate or excessive number of samples are taken at the time of the autopsy. Obtaining additional samples later may be **difficult**. All samples taken do not have to be analyzed.

Samples can be cut from the leaves with a single-sided razor blade, a sharp pocket knife, or sharp scissors. Note in the autopsy record from which leaf and where on the leaf the sample was taken. An adequate supply of sealable plastic bags of appropriate size with labels should be on hand. To preserve a fouling layer or a deposit on the membrane, great care must be exercised in opening the element, in taking the sample, and in preserving the sample. If you intend to test for microbiological activity, care must be exercised not to get the sample contaminated either through exposure to the atmosphere **or by** careless handling.

Characteristically, a layer of material is present on the surface of a used membrane. Most of this material can be removed by scraping with a 6- to 12-inch-wide soft rubber squeegee. The amount of material per unit area can be determined if the material from an entire leaf is squeegeed into a sample bottle and the effective membrane area is measured. The process of collecting solid material in a sample bottle is aided by use of a plastic squirt bottle of deionized water. This process should be done for several leaves and is easier to do on leaves that lie flat like the first few in an element being unrolled. The concave side is easier to scrape than the convex side. One may hope that this does not introduce an unintended bias into the data. Alternatively, one can scrape a convex side as well. The process of scraping probably destroys the leaf for any other analysis. Parameters of interest in this type of sample are weight of dry solids, particle size of solids, and chemical composition.

At times, a lot of solids will be found clinging to the feed/reject separator material. Much of this material can be washed off with a squirt bottle. One must recognize that this accumulation represents the material from two adjacent leaves.

If samples are to be taken for biological analysis, the autopsy should be performed in a clean room up to the point of sample collection to prevent contamination by tramp bacteria. This type of sampling should be carried out by someone skilled in the art.

Dye testing is used to demonstrate damage to the surface of some membrane materials. This procedure generally renders the tested membrane unfit for further testing. Congo Red and Rhodamine B are used on cellulose acetate membranes. Congo Red is a direct dye for cotton that bonds to the cellulose ether and hydroxyl groups. A solution concentration of about 1 percent by weight is satisfactory. On an intact, dense surface, a pale to negligible color appears if the dye is swabbed on and wiped off. A fairly intense color is seen on a damaged surface, particularly one where the damage permits access of the rather large dye molecule to the large amount of exposed surface on the porous supporting layer. A test on a piece of membrane known to be undamaged is useful to calibrate the eyeball qualitatively. Unfortunately, in a typical dye test, the dye color appears everywhere. For dye testing under pressure, a solution of about 10 mg/L of Methyl Violet can give satisfactory results. Further work is needed to develop dye testing into a reliable procedure. Material Safety Data Sheets for Congo Red, Methyl Violet, and Rhodamine B are included behind the Resources section of this manual.

Samples taken for cell performance tests should be carefully documented and stored. To produce meaningful data, a number of samples should be taken to allow for the considerable local variation of membrane properties sometimes encountered between membrane samples.

Membrane and component samples should be stored in relatively inert plastic bags. Polyethylene bags with a zip closure are convenient. Careful planning of and preparation for the autopsy will minimize storage time. Storage at a temperature of about 3 °C (37°F) will minimize chemical reactions. Use of biocides in storage is questionable because they may react with or affect materials on or in the membrane. Minimal storage time is preferable.

When the element has been inspected and samples have been taken, the major remains of the element should be put in cold storage until all test results are in and conclusions are drawn. One must steer carefully between the Scylla of having the cold storage locker full of useless rotting elements and the Charybdis of disposing of an element too soon.

## P.7 Membrane Surface Analysis by SEM-EDS

The SEM-EDS (scanning electron microscope-energy dispersive spectroscope) enables an investigator to create and examine an image of the morphological features of a material. The SEM creates a seemingly three-dimensional image of material by bombarding it with a focused electron beam. It is used to characterize particle size, shape, texture, and topography. The EDS determines chemical (elemental) composition by measuring the energy of characteristic X-rays emitted when the material is bombarded by the SEM electron beam. Scanning electron microscope-energy dispersive spectroscope capability offers timely, comprehensive, accurate data analysis and evaluation.

Applications of the SEM-EDS include: -

1. Identification of surface contaminants
2. Characterization of microstructures and surface morphology
3. Investigation of **biofilms** and scale on reverse-osmosis membranes
4. Determination of elemental composition and distribution
5. Elemental and phase identification
6. Qualitative and quantitative analysis
7. Quantification of particle morphology

Ordinarily, when examined by standard (high vacuum) SEM-EDS techniques, membranes require special preparation such as critical-point drying as well as a compromised instrument parameter such as low voltage to avoid mass loss caused by beam damage. Nevertheless, the typical analysis performed using *standard vacuum* SEM technology is acceptable. However, improved results can be obtained using an SEM-EDS with a special low vacuum capability. Low vacuum correlates to poor vacuum, that is, near atmospheric pressure investigation ability. A leak valve allows precise control of air or gas into the specimen chamber during examination, thereby allowing the operator optimal pressure regulation for specimen charge balancing while resolution is preserved. Charge balancing allows SEM examination of a nonconductive specimen such as a membrane without sputter coating (gold coating or carbon coating) or any other types of pre-examination treatment.

The low vacuum mode of operation allows elemental analyses at normal accelerating voltages as well as **BEI** (backscattered electron imaging) of a **specimen** at accelerating voltages well below 10 **kV**. Special **BEI** shadowing techniques allow observation of a smooth surfaced specimen, compositional difference elemental analysis, and three-dimensional image analysis. EDS software is available which can quantify the morphology of particles. Particle features such as area and area fraction, diameter and average diameter, perimeter, longest dimension, circularity, roughness, volume of sphere, aspect ratio, and other statistical parameters are available to numerically characterize the specimen. The analysis results can include tables of measurement with statistics, histograms, and scatter plots. Also available is a chemical classification program which allows the collected features of specimen/particles to be classified by any combination of size, shape, or elemental composition.

Accurate characterization of materials on membranes is critical to any SEM-EDS investigation. In the past, membrane samples have been stored in plastic bags with a little water added to prevent membrane drying. Current membrane research investigations have revealed the need for sample holders to prevent any **foulant** material on the membrane from inadvertently being disturbed or removed by the membrane rubbing against itself or against the plastic bag prior to SEM-EDS analysis. Specimen holders assist in providing accurate data. Appropriate membrane sample holders are currently under development.

## **P.8 Post-Autopsy Procedures**

To justify the considerable expense in elements, staff time, and tests which may be involved in an autopsy, an autopsy report should be assembled. The report should be consistent with the effort put into the autopsy. Observations, results from post-autopsy tests, and conclusions are best put down while they are fresh. Accumulating all of the test results frequently requires a fair amount of time, but all of the information concerning an autopsy should be put together in one place.

## CHECKLIST OF REQUIRED OR DESIRABLE EQUIPMENT

The equipment required depends on the purpose of the autopsy. Equipment should be assembled ahead of time to ensure the required material will be present.

**Required**    Present

- |                          |                          |  |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Rotary saw                                       |
| <input type="checkbox"/> | <input type="checkbox"/> | Hammer   |
| <input type="checkbox"/> | <input type="checkbox"/> | Cold chisel, pry bar, or similar persuaders      |
| <input type="checkbox"/> | <input type="checkbox"/> | Autopsy table                                    |
| <input type="checkbox"/> | <input type="checkbox"/> | Plastic drop cloth for covering autopsy table    |
| <input type="checkbox"/> | <input type="checkbox"/> | Trash barrel                                     |
| <input type="checkbox"/> | <input type="checkbox"/> | Indelible (laundry) marker                       |
| <input type="checkbox"/> | <input type="checkbox"/> | 3 to 4X magnifying glass                         |
| <input type="checkbox"/> | <input type="checkbox"/> | 10 to 12X magnifying glass                       |
| <input type="checkbox"/> | <input type="checkbox"/> | Tongs  |
| <input type="checkbox"/> | <input type="checkbox"/> | Spatula  |
| <input type="checkbox"/> | <input type="checkbox"/> | 6- to 12-inch squeegee                           |
| <input type="checkbox"/> | <input type="checkbox"/> | Rubber policemen                                 |
| <input type="checkbox"/> | <input type="checkbox"/> | Clipboard or laboratory notebook for note taking |
| <input type="checkbox"/> | <input type="checkbox"/> | Scissors   |
| <input type="checkbox"/> | <input type="checkbox"/> | Cutting knife or razor blades                    |
| <input type="checkbox"/> | <input type="checkbox"/> | Plastic sample bags                              |
| <input type="checkbox"/> | <input type="checkbox"/> | Plastic sample bottles                           |
| <input type="checkbox"/> | <input type="checkbox"/> | Large mouth (4- to 6-inch) funnel                |
| <input type="checkbox"/> | <input type="checkbox"/> | Squeeze bottle of deionized water                |
| <input type="checkbox"/> | <input type="checkbox"/> | Dye for dye-testing                              |
| <input type="checkbox"/> | <input type="checkbox"/> | Flame for sterilization                          |
| <input type="checkbox"/> | <input type="checkbox"/> | Measuring tape                                   |
| <input type="checkbox"/> | <input type="checkbox"/> | Rubber gloves (appropriate material)             |
| <input type="checkbox"/> | <input type="checkbox"/> | Roll of paper towels                             |
| <input type="checkbox"/> | <input type="checkbox"/> |  |
| <input type="checkbox"/> | <input type="checkbox"/> |  |
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## DOCUMENTATION (FORMS)

The forms in this section can be reproduced for taking pencil notes during the autopsy. They provide a reminder of data to be taken.

Electronic copies of these forms are **available** in WordPerfect 5.1 for making a final copy of the record. The notes should be transcribed into final form as soon as possible after the autopsy so that information which might not have been written down will not be forgotten. Post-autopsy test data can be added to the permanent record as they become available.

The forms can be downloaded from the world wide web at the following **URL** (uniform resource locator):

**<http://www.usbr.gov/water/reports.html>**.



SPIRAL WOUND MEMBRANE ELEMENT AUTOPSY

PURPOSE AND LOCATION OF AUTOPSY
Purpose of Autopsy:
Date and Place:
Date of This Report:
Names of Observers:

ELEMENT IDENTIFICATION	
Manufacturer:	
Element Type:	
Serial Number:	
Element Dimensions:	
Number of Leaves:	
Size of Leaves:	

DESCRIPTION OF EVENTS LEADING TO AUTOPSY

-

OPERATING HISTORY

<b>WET TEST DATA</b>					
Test Number	Procedure	Date	Element Rejection %	Product Flow GPD	Product Flux GFD

<b>SUMMARY OF PERFORMANCE TEST PROCEDURE(S)</b>

NARRATIVE DESCRIPTION OF AUTOPSY PROCEDURE

OBSERVATIONS

[Empty observation area]

**TESTS PERFORMED AFTER AUTOPSY**

11

Test and Test Objective:

Organization Performing Test:

Date:

Observations from Test:

Test and Test Objective:

Organization Performing Test:

Date:

Observations from Test:

Test and Test Objective:

Organization Performing Test:

Date:

Observations from Test:

DISCUSSION AND CONCLUSIONS

-





## RESOURCES

Reference to commercial organizations does not constitute an endorsement of any firm by the Bureau of Reclamation. No warranty as to the quality or accuracy of results is expressed or implied.

### Element Autopsy

Organization: Separation Systems Technology  
Address: 490 1 Morena Boulevard, Suite 809  
San Diego CA 92117

**Contact Person:** Bob Riley  
Telephone: (619) 581-3765  
Fax: (619) 581-1211  
Notes:

Organization: Separation Technology, Inc.  
Address: 454 S. Anderson Road, BTC Box 529  
Rock Hill, SC 29730

**Contact Person:** William Davis  
Telephone: (803) 366-5050  
Fax: (803) 366-5030  
Notes:

### Chemical Analysis

Organization: Bureau of Reclamation  
Environmental Research Chemistry Laboratory  
Address: Mail Code D-8240,  
P. O. Box 25007  
Denver, CO 80225-0007

**Contact Person:** Margaret Lake  
Telephone: (303) 236-4290 X256  
Fax: (303) 236-4383  
Notes:

### ***ICP/MS***

Organization: Coors Brewing Company  
Analytical Laboratory  
Address: 17750 West 32nd Avenue  
Golden, CO 80401

**Contact Person:**  
Telephone: (303) 277-5 190  
Fax:  
Notes:

## ***ICP/ES***

Organization: Manville Technical Center  
Address: 10 100 W. Ute Avenue  
Littleton, CO 80127  
Contact Person:  
Telephone: (303) 978-5486  
Fax:  
Notes:

## ***Neutron Activation Analysis***

Organization: General Activation Analysis  
Address: 11575 Sorrento Valley Road  
San Diego, CA 92121  
Contact Person:  
Telephone: (619) 755-5121  
Fax:  
Notes:

## Microphotography

## ***SEM/EDS***

**Organization:** Bureau of Reclamation  
Address: P. O. Box 25007  
Denver, CO 80225  
Contact Person: Karl Krill  
Telephone: (303)236-3730 ext. 428  
Fax: (303)236-4679  
Notes:

Organization: Separation Technology, Inc.  
Address: 454 S. Anderson Road, BTC Box 529  
Rock Hill, SC 29730  
Contact Person: William Davis  
Telephone: (803) 366-5050  
Fax: (803) 366-5030  
Notes:

**Other**

*Subject:*

**Organization:**

**Address:**

**Contact Person:**

**Telephone:**

**Fax:**

**Notes:**

*Subject:*

**Organization:**

**Address:**

**Contact Person:**

**Telephone:**

**Fax:**

**Notes:**

*Subject:*

**Organization:**

**Address:**

**Contact Person:**

**Telephone:**

**Fax:**

**Notes:**



## **MATERIAL SAFETY DATA SHEETS**

The material safety data sheet for any material likely to be encountered should be reviewed prior to any operation where personnel may be exposed to the material. These sheets should also be present at the autopsy. Material safety data sheets for several common biocides or preservatives and for several dyes are attached.



J. T. Baker Chemical Co.  
222 Red School Lane  
Phillipsburg, N . J . 08865  
24-Hour Emergency Telephone - (201) 859-2151  
Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

MATERIAL  
SAFETY DATA  
SHEET

**Formaldehyde, 37% Solution**

## SECTION I - PRODUCT IDENTIFICATION

Product Name: Formaldehyde, 37 % Solution  
Formula: HCHO  
Formula Wt: 30.03  
CAS No.: 50-00-0  
NIOSH/RTECS No. : **LP8925000**  
Common-Synonyms: Formalin; **Methylene** Oxide; Methyl Aldehyde; **Methanal**  
Product Codes: 2106, 2112, 2105

## PRECAUTIONARY LABELING

BAKER SAF-T-DATA™ System

Health hazard	Level 3 SEVERE (Carcinogen)	Flammability hazard	Level 2 MODERATE
Reactivity hazard	Level 2 MODERATE	Contact hazard	Level 3 SEVERE

## Laboratory Protective Equipment

Goggles and shield  
Lab coat and apron  
Vent hood  
Proper gloves  
Class B fire extinguisher

## Precautionary Label Statements

POISON! DANGER!  
CAUSES BURNS

MAY BE FATAL IF SWALLOWED OR INHALED  
**MAY CAUSE ALLERGIC SKIN REACTION • COMBUSTIBLE**

NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS. EXERCISE DUE CARE.  
Keep away **from** heat, sparks, flame. Do not get in eyes, on skin, on clothing. Avoid breathing vapor. Keep in tightly closed container. Use **with** adequate ventilation. Wash thoroughly after handling. In case of Fire, use water spray, alcohol foam, dry chemical, or carbon dioxide. Flush spill area with water spray.

## SECTION II • HAZARDOUS COMPONENTS

<u>Component</u>	<u>%</u>	<u>CAS NO.</u>
Formaldehyde, 37 % Solution	37-38	50-00-0
Methanol	10-15	67-56-1

J. T. Baker Chemical Co.  
222 Red School Lane  
Phillipsburg, N. J . 08865  
24-Hour Emergency Telephone - (201) 859-215 1  
Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

**Formaldehyde, 37% Solution**

**SECTION III - PHYSICAL DATA**

Boiling Point:	96°C (205 °F)	Vapor Pressure (mmHg):	1.3
Melting Point:	N/A	Vapor Density (air= 1):	1.0
Specific Gravity (H <sub>2</sub> O= 1)	1.08	Evaporation Rate: (Butyl Acetate = 1)	N/A
Solubility(H <sub>2</sub> O):	Complete (in all proportions)	% Volatiles by Volume:	100%

Appearance & Odor: Colorless liquid, pungent odor.

**SECTION IV - FIRE AND EXPLOSION HAZARD DATA**

Flash Point (Closed Cup):	60°C (140°F)	NFPA 704M Rating:	2-2-
Flammable Limits:	Upper - 73.0%	Lower -	7.0%

**Fire Extinguishing Media**

Use water spray, alcohol foam, dry chemical, or carbon dioxide.

**Special Fire-Fighting Procedures**

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

**Unusual Fire & Explosion Hazards**

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

**Toxic Gases Produced**

Formaldehyde, carbon monoxide, carbon dioxide



**SECTION V - HEALTH HAZARD DATA**

This substance is listed as an ACGIH suspect human carcinogen, NTP anticipated human carcinogen. Acceptable maximum peak above the acceptance ceiling concentration for an eight-hour shift = 10 ppm for 30 minutes. (PEL) Ceiling = 5 ppm.

Threshold Limit Value (TLV/TWA): 1.5 mg/m<sup>3</sup> (1 ppm)

Short-Term Exposure Limit (STEL): 3 mg/m<sup>3</sup> (2 ppm)

Permissible Exposure Limit (PEL): mg/m (3 ppm)

Toxicity: LD<sub>50</sub>, (oral-rat)(mg/kg) -800  
LD<sub>50</sub> (scu-rat)(mg/kg) -420  
LD<sub>50</sub>, (skin-rabbit)(mg/kg) -270  
LC<sub>50</sub> (inhl-rat)(mg/kg) -590

Carcinogenicity : NTP: Yes IARC: No Z List: No OSHA reg: Yes

Effects of Overexposure

Inhalation and ingestion are harmful and may be fatal.

Inhalation of vapors may cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness.

Contact with skin or eyes may cause severe irritation or burns. Prolonged contact may cause skin sensitization. Substance is readily absorbed through the skin.

Ingestion may cause blindness.

Ingestion may cause nausea, vomiting, gastrointestinal irritation, and burns to mouth and throat.

Chronic effects of overexposure may include kidney and/or liver damage.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

Inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

**CALL A PHYSICIAN.**

If swallowed, if conscious, give large amounts of water. Induce vomiting.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

Toxicity test results and safety and health effects are based on the solute.

J. T. Baker Chemical Co.  
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National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

**Formaldehyde, 37% Solution**

**SECTION VI • REACTIVITY DATA**

Stability: Stable Hazardous Polymerization: May occur

Conditions to Avoid: Heat, flame, other sources of ignition

Incompatibles: Strong oxidizing agents, strong acids, strong bases, alkalies, **alkali** metals, **amines** and ammonia, phenol, strong reducing agents

Decomposition Products: formaldehyde, carbon monoxide, carbon dioxide

**SECTION VII • SPILL AND DISPOSAL PROCEDURES**

**Steps to be taken in the event of a spill or discharge**

Wear self-contained breathing apparatus and full protective clothing.  
Shut off ignition sources; no flares, smoking or flames in area. Stop leak if you can do so without risk.  
Use water spray to reduce vapors. Take up with sand or other noncombustible absorbent material and place into container for later disposal. Flush area with water.

**Disposal Procedure**

Dispose in accordance with **all** applicable federal, state, and **local** environmental regulations.

EPA Hazardous Waste Number: U122 (Toxic Waste)

**SECTION VIII • INDUSTRIAL PROTECTIVE EQUIPMENT**

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 50 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, proper gloves are recommended.

J. T. Baker Chemical Co.  
222 Red School Lane  
Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone • (201) 859-2151  
Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

MATERIAL  
SAFETY DATA  
SHEET

**Formaldehyde, 37% Solution**

## SECTION IX • STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA" Storage Color Code: Red

### Special Precautions

Keep container tightly Closed. Store in a cool, dry, well-ventilated, flammable liquid storage area or cabinet.

Store above 15 °C .

## SECTION X • TRANSPORTATION DATA AND ADDITIONAL INFORMATION

### DOMESTIC (D.O.T.)

Proper Shipping Name	Formaldehyde solution (flash pt. below 141 °F.)
Hazard Class	Combustible liquid
UN/NA	UN198
Labels	NO LABEL REQUIRED UNDER 110 GALLONS

### INTERNATIONAL (I.M.O.)

Proper Shipping Name	Formaldehyde solutions
Hazard Class	3.3
UN/NA	UN198
Labels	FLAMMABLE LIQUID

N/A = Not Applicable or Not Available

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The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

-- LAST PAGE --



**MATERIAL SAFETY DATA SHEET**  
**MP-2, MEMBRANE PRESERVATIVE**

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**1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

PRODUCT NAME: MP-2, MEMBRANE PRESERVATIVE

OTHER/GENERIC NAMES : Glutaraldehyde, 0.8 % Aqueous Solution

PRODUCT USE: As a preservative for use on reverse osmosis membranes and/or elements during storage and shipment.

MANUFACTURER: Allied-Signal Inc. Engineered Materials Sector  
P.O. Box 1139, Morristown, NJ 07962-1139

FOR MORE INFORMATION CALL

(Monday-Friday, 9:00am-4:30pm)PST

Product Safety: (619)-695-3840

IN CASE OF EMERGENCY CALL

(24 Hours/Day, 7 Days/Week)

(201)-455-2000

**2. COMPOSITION/INFORMATION ON INGREDIENTS**

INGREDIENT NAME	CAS	WEIGHT %
Glutaraldehyde	111-30-8	0.6 - 0.99
Water	7732-18-5	99.01 - 99.4

Trace impurities and additional material names not listed above may also appear in the Regulatory Information section (#15) towards the end of the MSDS. These materials may be listed-for local "Right to Know" compliance and for other reasons.

**3. HAZARDS IDENTIFICATION**

**EMERGENCY OVERVIEW:** A clear liquid with a slight pungent odor. May cause minor skin and eye irritation. Avoid direct contact with the material.

POTENTIAL HEALTH HAZARDS:

**SKIN:** Incidental contact may cause itching with minor redness of the skin. Prolonged contact may cause moderate redness and minor swelling of the skin.

**EYES:** Liquid may cause minor conjunctivitis as observed **with** minor redness. Vapors may cause mild irritation of the eyes.

**INHALATION:** Vapors may be irritating to the respiratory system causing a very minor tingling sensation in the nose and throat.

**INGESTION:** Mildly toxic. Ingestions of large amounts may cause stomach discomfort, nausea and irritation of the mouth and throat.

**DELAYED EFFECTS:** Repeated skin exposure may cause dermatitis.

**MATERIAL SAFETY DATA SHEET**  
**MP-2. MEMBRANE PRESERVATIVE**

---

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

<u>Inredient Name</u>	<u>NTP Status</u>	<u>IARC Status</u>	<u>OSHA List</u>
*No ingredients listed in this section*			

#### 4. FIRST AID MEASURES

**SKIN:** Wash thoroughly with soap and water. Wash contaminated clothing before reuse.

**EYE:** Flush eyes with clear water for a minimum of 15 minutes. Contact a physician if irritation persists.

**INHALATION:** Remove to fresh air. If breathing is difficult administer oxygen and call a physician.

**INGESTION:** If stomach discomfort and nausea persists contact a physician.

**ADVICE TO PHYSICIAN:** No specific advice. Treat according to symptoms presented.

#### 5. FIRE FIGHTING MEASURES

**FLAMMABLE PROPERTIES:**

FLASH POINT: None  
 FLASH POINT METHOD: Not Applicable  
 AUTOIGNITION TEMPERATURE: Not Known  
 UPPER FLAME LIMIT (Volume % in air): No Information Available.  
 LOWER FLAME LIMIT (Volume % in air): No Information Available.  
 FLAME PROPAGATION **RATE** (Solids): Not Applicable  
 OSHA FLAMMABILITY CLASS: Non Flammable Liquid

EXTINGUISHING MEDIA: Not Flammable.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None

SPECIAL FIREFIGHTING PRECAUTIONS/INSTRUCTIONS: None

#### 6. ACCIDENTAL RELEASE MEASURES

**IN CASE OF SPILL OR OTHER RELEASE:** (Always wear recommended personal protective equipment.) Neoprene or other non permeable gloves and chemical safety glasses or goggles should be used during cleanup procedures. Flush to industrial waste drains. **DO NOT FLUSH TO GROUND OR STORM WATER SEWER SYSTEMS.**

**Spills and releases may have to be reported to Federal and/or local authorities. See the Regulatory Information section (#15) regarding reporting requirements.**

**MATERIAL SAFETY DATA SHEET**  
**MP-2, MEMBRANE PRESERVATIVE**

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**7. HANDLING AND STORAGE**

**NORMAL HANDLING:** (Always wear recommended personal protective equipment.)

Wear neoprene or other non permeable gloves and chemical safety glasses or goggles. If handling will allow contact with clothing wear a plastic apron.

**STORAGE RECOMMENDATIONS:**

The membrane products for which this is used should not be allowed to freeze nor should they be exposed to temperatures in excess of 40°C. (104°F.)

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

**ENGINEERING CONTROLS:**

Local exhaust ventilation.

**PERSONAL PROTECTIVE EQUIPMENT:**

**SKIN PROTECTION:**

Use neoprene or other non permeable gloves. Wear plastic apron if contact with materials might cause clothing to absorb this product. Fire protective clothing should include that which is appropriate for the other materials that may be burning.

**EYE PROTECTION:**

Use chemical safety glasses or goggles.

**RESPIRATORY PROTECTION:**

Use self contained breathing apparatus in high vapor concentrations.

**ADDITIONAL RECOMMENDATIONS:**

Safety shower and eyewash facilities should be available in the immediate vicinity.

**EXPOSURE GUIDELINES**

(Guidelines exist for the following ingredients)

<u>Ingredient Name</u>	<u>ACGIH TLV</u>	<u>OSHA PEL</u>	<u>Other Limit</u>
Glutaraldehyde	0.2 ppmv (ceiling) ACGIH	0.2 ppmv (ceiling OSHA)	None

\* = **Limit** established-by Allied-Signal for internal use.

\*\* = Workplace Environmental Exposure Level (AIHA).

\*\*\* = Biological Exposure Index

Other exposure limits for the potential decomposition products are as follows:

None

**MATERIAL SAFETY DATA SHEET**  
**MP-2, MEMBRANE PRESERVATIVE**

---

**9. PHYSICAL, AND CHEMICAL PROPERTIES**

APPEARANCE:	Clear colorless liquid.		
PHYSICAL STATE:	Liquid		
ODOR:	Slight pungent odor.		
SPECIFIC GRAVITY: (Water = 1 .0)	1.0		
SOLUBILITY IN WATER: (Weight %)	100		
pH:	5.0 - 8.0		
BOILING POINT:	212°F		
MELTING POINT:	Not Applicable		
VAPOR PRESSURE:	17 mmHg @ 20°C		
VAPOR DENSITY: (Air = . 1 .0)	>1.0		
EVAPORATION RATE:	<0.9	Compared to:	Butyl Acetate = 1 .0
% VOLATILES:	1.25		
FLASH POINT:	None		

(Flash point method and additional flammability data are found in section 5.)

**10. STABILITY AND REACTIVITY**

NORMALLY STABLE? (Conditions to Avoid)

Normally Stable

INCOMPATIBILITIES:

None

HAZARDOUS DECOMPOSITION PRODUCTS:

None

HAZARDOUS POLYMERIZATION?

None

**11. TOXICOLOGICAL INFORMATION**

IMMEDIATE (ACUTE) EFFECTS:

Skin contact may aggravate existing dermatitis. Inhalation of fumes may aggravate asthma or other pulmonary diseases.

DELAYED (SUBCHRONIC & CHRONIC) EFFECTS:

May cause skin sensitization in a small portion of individuals and present as an allergic contact dermatitis. This usually results from **continued** contact with the material.

OTHER DATA:

None

**12. ECOLOGICAL INFORMATION**

Toxicity data not available, however concentrations of the ingredient **glutaraldehyde** to surface waters is toxic to aquatic life. Concentrations below 10 ppm are inactive.



MATERIAL SAFETY DATA SHEET  
MP-2, MEMBRANE PRESERVATIVE

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**13. DISPOSAL CONSIDERATIONS**

RCRA:

**Is the unused product a RCRA hazardous waste if discarded? No.**

If yes, the RCRA ID number is:

OTHER DISPOSAL CONSIDERATIONS: Product may be disposed to an industrial **waste** water treatment system.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

**14. TRANSPORT INFORMATION**

US DOT HAZARD CLASS: Not Regulated

US DOT ID NUMBER: N/A

For additional information on shipping regulations affecting this material, contact the information number found on the first page.

**15. REGULATORY INFORMATION****TOXIC SUBSTANCES CONTROL ACT (TSCA):**

TSCA INVENTORY STATUS: All ingredients are on the TSCA Inventory.

OTHER TSCA ISSUES: None

**SARA TITLE III/CERCLA:****RQs & TPQS:**

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

<u>Ingredient</u>	<u>SARA/CERCLA RQ(lbs)</u>	<u>SARA EHS TPQ(lbs)</u>
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\*No ingredients listed in this section\*

Spills resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (1-800-424-8802) and to your Local Emergency **Planning** Committee.

SECTION 311 HAZARD CLASS: None

**SARA 313 TOXIC CHEMICALS:**

The following ingredients are SARA 313 "Toxic Chemicals". CAS #'s and wt. % are found in section #2.

**Ingredient                      Comment**

\*No ingredients listed in this section\*

**MATERIAL SAFETY DATA SHEET**  
**MP-2, MEMBRANE PRESERVATIVE**

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## STATE RIGHT TO KNOW:

In addition to the ingredients found in section 2, the following are listed for state right-to-know purposes:

<u>Ingredient</u>	<u>wt. %</u>	<u>Comment</u>
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\*No ingredients listed in this section\*

## ADDITIONAL REGULATORY INFORMATION:

None

## WHMIS CLASSIFICATION (CANADA):

None

## FOREIGN INVENTORY STATUS:

None

**16. OTHER INFORMATION**

CURRENT ISSUE DATE: **01/12/94**

PREVIOUS ISSUE DATE: **06/16/93**

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:

Change in concentration of active ingredient, glutaraldehyde.

OTHER INFORMATION: None

**KATHON® CG-ICP II Biocide**

**Material** Kathon ® CG-ICP II Biocide  
**Code** 62352  
**Key** 889280-7  
**Date Issued** 11/24/86  
**DOT Hazard Class** Corrosive Material  
**Formula** Not applicable  
**Chemical Name or Synonym** **5-Chloro-2-methyl-4-isothiazolin-3-one** and **2-methyl-4-isothiazolin-3-one**  
**Hazard Rating:** 4 = Extreme 3 = High 2 = Moderate 1 = Slight 0 = Insignificant  
**Fire:** 0  
**Toxicity:** 3  
**Reactivity:** 0

**I - COMPOSITIONAL INFORMATION**

<u>Component</u>	<u>CAS Reg. NO.</u>	<u>Approx. Wt. %</u>	<u>TWA/TLV</u>			
			<u>R&amp;H</u>	<u>OSHA</u>	<u>ACGIH</u>	
<b>5-Chloro-2-methyl-4-isothiazolin-3-one</b>	26 172-55-4	1.00-1.20	*	NE	NE	mg/m <sup>3</sup>
<b>2-Methyl-4-isothiazolin-3-one</b>	2682-204	0.25-0.45	*	NE	NE	
Magnesium chloride and nitrate	Not Reqd.	1.4 -2.0	*	NE	NE	
Cupric nitrate	1003 143-3	0.15-0. 17	1	NE	NE	mg/m <sup>3</sup> (Cu)
Water	<b>Nonhaz.</b>	95.5-96.2				

\* TWA = 0.1 mg/m<sup>3</sup> STEL = 0.3 mg/m<sup>3</sup> for total isothiazolinones

**II - PHYSICAL PROPERTY INFORMATION**

<b>Appearance &amp; Odor:</b>	Pale yellow to green liquid, mild aromatic odor.		
<b>Viscosity</b>	3 cps / 77F	<b>pH</b>	3-5
<b>Melting Point</b>	-3C /12F	<b>Vapor Density (air= 1)</b>	NA
<b>Boiling Point</b>	<b>100C</b> / 212F est.	<b>Vapor Pressure (mmHg)</b>	17 est.
<b>Specific Gravity (H<sub>2</sub>O= 1)</b>	1.02	<b>Evaporation Rate: (Butyl Acetate = 1)</b>	< 1
<b>Solubility in water</b>	Complete	<b>% Volatiles by Weight ~</b>	95-96

KATHON® CG-ICP II Biocide

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**III • FIRE AND EXPLOSION HAZARD INFORMATION**

Flash Point NA Auto ignition temperature NA  
Explosion Limits: Upper • NA Lower • NA

Fire Extinguishing Media

[ ] Foam [ ] "Alcohol" foam [ ] CO<sub>2</sub> [ ] Dry chemical [ ] Water spray [x] Other. Noncombustible.

Special Fire-Fighting Procedures

Wear breathing apparatus (MSHA/NIOSH-approved, pressure-demand, self-contained or equivalent) and full protective clothing. Use water spray to cool fire-exposed containers.

Unusual Fire & Explosion Hazards

Avoid exposure to fumes and vapors from a fire--can possibly include sulfur dioxide and hydrogen chloride and oxides of nitrogen.

**IV • HEALTH HAZARD INFORMATION**

Effects of Overexposure

Inhalation: Harmful if inhaled.

Eve Contact: Contact with skin or eyes may cause severe irritation or burns.

Skin Contact: Corrosive to skin; causes skin burns; these effects may be delayed for hours. Can cause allergic contact dermatitis.

Emergency and First Aid Procedures

Inhalation: Move subject to fresh air. Apply artificial respiration if needed.

Eye and Skin Contact: Immediately flush eyes with plenty of water and continue for at least 15 minutes.

Ingestion: If swallowed dilute by giving 2 glasses of water to drink and call a physician. Never give anything by mouth to an unconscious person.

Note to Physician: Mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsions may be needed.

KATHON® CG-ICP II Biocide

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**V . REACTIVITY INFORMATION**

Stability Stable Conditions to Avoid: No data

Hazardous Decomposition Products Hydrogen chloride and oxides of sulfur.

Hazardous Polymerization Will not occur. Conditions to Avoid: NA

Incompatibility (Materials to Avoid) None known.

**VI - SPILL OR LEAK PROCEDURE INFORMATION**

**Steps to be taken in case material is released or spilled**

Wear protective clothing, splashproof goggles and impervious overshoes. Remove contaminated clothing promptly; launder thoroughly before reuse. Wash skin with soap and water.

CAUTION: KEEP SPILLS OUT OF MUNICIPAL SEWERS AND OPEN BODIES OF WATER. Dike and absorb spill with inert material (dry earth, sand). Shovel all contaminated solids--diking material, absorbent and soil--into corrosion-proof drums. Seal drums before disposal.

**Waste Disposal Methods**

For discard, this is a hazardous waste: RCRA No. D002; reportable quantity: 1 lb. (CERCLA (Superfund) Sec. 103). Landfill contaminated solids in sealed drums in accordance with local, state, and federal regulations.

**VII . SPECIAL PROTECTION INFORMATION**

Ventilation Type Mechanical local exhaust at point of contaminant (vapor, mist) release.

Respiratory Protection Wear MSHA/NIOSH-approved respirator suitable for concentrations encountered where exposure limits are exceeded.

Protective Gloves Impervious

Eye Protection Splashproof goggles and face shield (ANSI 287.1 or equiv.)

Other Protective Equipment Impervious apron, eyewash facility, emergency shower

**KATHON®** CG-ICP II Biocide

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**VIII • STORAGE AND HANDLING INFORMATION**

Indoor storage:         Yes         No  
Outdoor storage        Yes         No

**IX • TOXICITY INFORMATION**        -

Oral LD50 (rat): 3.81 g/kg  
Rat aerosol inhalation **LC50**; 4 hr; 23C • 1.4 mg/L males; 1.5 mg/L females; (Nominal, a.i.)  
Dermal **LD50** (rabbit): Greater than 5 g/kg  
Eye irritation (rabbit): corrosive. Corneal injury.  
Skin irritation (rabbit): Corrosive under test conditions for DOT skin corrosivity.  
Sensitization (human): Can cause allergic contact dermatitis.  
Rat vapor inhalation **LC50** • 4.62 mg/L (nominal a.i.)

**X • MISCELLANEOUS INFORMATION**

**KATHON®** IS A TRADEMARK OF ROHM AND **HAAS** OR ONE OF ITS SUBSIDIARIES OR AFFILIATES.  
NA = Not applicable  
C = Ceiling value

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data of the results **to be** obtained from the use thereof.

Rohm and **Haas** Company assumes no responsibility for personal injury or property damage to vendees, users or third parties caused by the material. Such vendees or users assume all risks associated with the use of the material.

-- LAST PAGE --

### SECTION I - PRODUCT IDENTIFICATION

Product Name: Congo Red  
Formula:  $C_{32}H_{22}O_6N_6S_2Na_2$   
Formula Wt: 696.68  
CAS No.: 00573-58-0  
NIOSH/RTECS No.: QK1400000  
Common-Synonyms: Sodium Diphenyl-bis-alpha-naphthylamine Sulfonate; Direct Red 28  
Product Codes: F788, F787

### PRECAUTIONARY LABELING

#### Precautionary Label Statements

WARNING!  
HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN  
CAUSES IRRITATION

There is insufficient data in the published literature to assign complete numerical SAF-T-DATA ratings and laboratory protective equipment for this product. Special precautions must be used in storage, use and handling. Protective equipment for laboratory bench use should be chosen using professional judgement based on the size and type of reaction or test to be conducted and the available ventilation, with overriding consideration to minimize contact with the chemical.

Avoid contact with eyes, skin, clothing.

Keep in tightly closed container. Wash thoroughly after handling.

### SECTION II - HAZARDOUS COMPONENTS

<u>Component</u>	<u>%</u>	<u>NA So</u>
Congo Red	90-100	573-58-0

### SECTION III - PHYSICAL DATA

Boiling Point:	N/A	Vapor Pressure (mmHg):	N/A
Melting Point:	N/A	Vapor Density (air= 1):	N/A
Specific Gravity ( $H_2O=1$ )	N/A	Evaporation Rate:	N/A -- (Butyl Acetate = 1)
Solubility( $H_2O$ ):	Appreciable (more than 10%)	% Volatiles by Volume:	N/A
Appearance & Odor:	Brown red, odorless powder.		





## SECTION VII - SPILL AND DISPOSAL PROCEDURES

### Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.

With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

### Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

## SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Eye/Skin Protection: Since some of the hazards of this product are unknown, an Industrial Hygienist should be consulted on ventilation and personal protective equipment. Cover the body as much as possible to avoid contact with the chemical. Wear safety goggles, gloves and impervious clothing.

## SECTION IX - STORAGE AND HANDLING PRECAUTIONS

### Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

## SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION.

### DOMESTIC (D.O.T.)

Proper Shipping Name            Chemicals, n.o.s.

### INTERNATIONAL (I.M.O.)

Proper Shipping Name            Chemicals, n.o.s.

N/A = Not Applicable or Not Available

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J. T. Baker Chemical Co.  
222 Red School Lane  
Phillipsburg, N.J. 08865  
24-Hour Emergency Telephone - (201) 859-2151  
Chemtrec # (800) 424-9300  
National Response Center # (800) 424-8802

**MATERIAL  
SAFETY DATA  
SHEET**

**Methyl Violet 2B**

**SECTION I • PRODUCT IDENTIFICATION**

Product Name: Methyl Violet 2B  
Formula:  $C_{24}H_{27}N_3 \cdot HCl$   
Formula Wt: 393.97  
CAS No.: 08004-87-3  
NIOSH/RTECS No. : **GC8425000**  
Common-Synonyms: C. I. Basic Violet; Methyl Violet  
Product Codes: R275

**PRECAUTIONARY LABELING**

BAKER SAF-T-DATA™ System

Health hazard	Level 2 MODERATE	Flammability hazard	Level 1 SLIGHT
Reactivity hazard	Level 1 SLIGHT	Contact hazard	Level 2 MODERATE

Laboratory Protective Equipment

Safety Glasses  
Lab coat  
Vent hood  
Proper gloves

Precautionary Label Statements

**WARNING!**  
**HARMFUL IF SWALLOWED**  
**CAUSES IRRITATION**

Avoid contact with eyes, **skin**, clothing.  
Keep in tightly closed container. Wash thoroughly after handling.

**SECTION II • HAZARDOUS COMPONENTS**

<u>Component</u>	<u>%</u>	<u>CAS No.</u>
Methyl Violet 2B	90-100	8004-87-3

**SECTION III • PHYSICAL DATA**

Boiling Point:	N/A	Vapor Pressure (mmHg):	N/A
Melting Point:	N/A	Vapor Density (air = 1):	N/A
Specific Gravity (H <sub>2</sub> O = 1)	N/A	Evaporation Rate: (Butyl Acetate = 1)	N/A
Solubility(H <sub>2</sub> O):	Moderate (1 to 10%)	% Volatiles by Volume:	N/A
Appearance & Odor:	Green crystals.		

**SECTION IV • FIRE AND EXPLOSION HAZARD DATA**

Flash Point: N/A

Fire Extinguishing Media

Use extinguishing media, appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

Toxic Gases Produced

Hydrogen chloride, nitrogen oxides

**SECTION V • HEALTH HAZARD DATA**

Toxicity: LD,, (oral-mouse)(mg/kg) • 105  
LD,, (ipr-mouse)(mg/kg) • 6

Effects of Overexposure

No effects of overexposure were documented.

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, if conscious, immediately induce vomiting.

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

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**MATERIAL  
SAFETY DATA  
SHEET**

**Methyl Violet 2B**

**SECTION VI - REACTMITY DATA**

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: heat

Incompatibles: strong oxidizing agents

Decomposition Products: hydrogen chloride, oxides of nitrogen

**SECTION VII - SPILL AND DISPOSAL PROCEDURES**

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.

With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

**SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT**

Ventilation: Use adequate general or local exhaust ventilation to keep fume or dust levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask.

Eye/Skin Protection: Safety glasses with sideshields, uniform, rubber gloves are recommended.

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**MATERIAL  
SAFETY DATA  
SHEET**

**Methyl Violet 2B**

**SECTION IX - STORAGE AND HANDLING PRECAUTIONS**

SAF-T-DATA <sup>TM</sup> Storage Color Code: Orange

Special Precaution5

Keep container tightly closed. Suitable for any general chemical storage area.

**SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION**

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s.

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s.

N/A = Not Applicable or Not Available

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**MATERIAL  
SAFETY DATA  
SHEET**

**Rhodamine B, Hydrochloride**

**SECTION I - PRODUCT IDENTIFICATION**

Product Name: Rhodamine B, Hydrochloride  
Formula:  $\text{HOCOC}_6\text{H}_4\text{C}:\text{C}_6\text{H}_3[:\text{N}(\text{C}_2\text{H}_5)_2\text{Cl}]\text{OC}_6\text{H}_3\text{N}(\text{C}_2\text{H}_5)_2$   
Formula Wt : 479.02  
CAS No.: 0008 1-88-9  
NIOSH/RTECS No. : BP3675000  
Common-Synonyms: Rhodamine B; Tetraethylrhodamine, hydrochloride  
Product Codes: U872

**PRECAUTIONARY LABELING**

BAKER SAF-T-DATA™ System

Health hazard	Level 2 MODERATE	Flammability hazard	Level 1 SLIGHT
Reactivity hazard	Level 1 SLIGHT	Contact hazard	Level 2 MODERATE

Laboratory Protective Equipment

Safety Glasses  
Lab coat  
Vent hood  
Proper gloves

Precautionary Label Statements

**WARNING!**  
**HARMFUL IF SWALLOWED**  
**CAUSES IRRITATION**

Avoid contact with eyes, skin, clothing.  
Keep in tightly closed container. Wash thoroughly after handling.

**SECTION II - HAZARDOUS COMPONENTS**

<u>Component</u>	<u>%</u>	<u>CAS No.</u>
Rhodamine B, hydrochloride	90-100	8 1-88-9

**SECTION III - PHYSICAL DATA**

Boiling Point:	N/A	Vapor Pressure (mmHg):	N/A
Melting Point:	165°C (329°F)	Vapor Density (air = 1):	N/A
Specific Gravity (H <sub>2</sub> O = 1)	N/A	Evaporation Rate: (Butyl Acetate = 1)	N/A

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**MATERIAL  
SAFETY DATA  
SHEET**

**Rhodamine B, Hydrochloride**

**Solubility(H<sub>2</sub>O):** Complete (in all proportions) % Volatiles by Volume: 0

Appearance & Odor: Green crystals or reddish-violet powder.

**SECTION IV - FIRE AND EXPLOSION HAZARD DATA**

Flash Point: N/A

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

**SECTION V - HEALTH HAZARD DATA**

Toxicity: LD<sub>50</sub> (ipr-rat)(mg/kg) - 112  
LD<sub>50</sub> (oral-mouse)(mg/kg) • 887

Effects of Overexposure

No effects of overexposure were documented.

Emergency and First Aid Procedures

If swallowed, if conscious, immediately induce vomiting.

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

**SECTION VI - REACTIVITY DATA**

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: none documented

Decomposition Products: hydrogen chloride

**SECTION VII - SPILL AND DISPOSAL PROCEDURES**

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.

With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.



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**MATERIAL  
SAFETY DATA  
SHEET**

**Rhodamine B, Hydrochloride**

**SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT**

Ventilation: Use adequate general or local exhaust ventilation to keep fume or dust levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask.

Eye/Skin Protection: Safety glasses with sideshields, uniform, rubber gloves are recommended.

**SECTION IX - STORAGE AND HANDLING PRECAUTIONS**

SAF-T-DATA™ Storage Color Code: Orange

**Special Precautions**

Keep container tightly closed. Suitable for any general chemical storage area.

**SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION**

**DOMESTIC (D.O.T.)**

Proper Shipping Name Chemicals, n.o.s.

**INTERNATIONAL**

Proper Shipping Name Chemicals, n.o.s.

N/A = Not Applicable or Not Available

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-- LAST PAGE --



### **Mission**

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American Public.

