

Detection of Asbestos in Bulk Insulation Materials
An Evaluation of the NIOSH "Test for Screening Asbestos"

Technical Progress Report WRC 210-80

Project No. 39123
Asbestos

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Based on work through May 1980

*SHARED - Under the Research Agreement between SIRM and
Shell Oil Company dated January 1, 1960, as amended.*

LAM 026494

ABS-056625

TABLE OF CONTENTS

	<u>Page</u>
Abstract.....	ii
Introduction.....	1
Experimental.....	3
Discussion.....	7
References.....	10
Appendix.....	11

LAM 026495

WRC 210-80

ABS-056626

ABSTRACT

A simple spot test (developed by NIOSH) for the presence of asbestos, a known carcinogen in insulating material, has been evaluated. It is based on the colorimetric determinations of magnesium (II) and iron (II) which serve as indicators for the likely presence of asbestos. The method was found to be reliable and suitable for field use. The necessary safety factors in performance of the test were also established.

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WRC 210-80

ABS-056627

Technical Progress Report WRC 210-80

DETECTION OF ASBESTOS IN BULK INSULATION MATERIALS

An Evaluation of the NIOSH "Test for Screening Asbestos"

by

R. E. Evans

INTRODUCTION

"Asbestos" is a generic term for groups of naturally-occurring, hydrated mineral silicates. They are economically important for their high tensile strength, flexibility, and resistance to heat and chemical attack¹⁾. The primary use of asbestos in the petroleum and petrochemical industries is as an insulating material on process units and piping. Although no longer used in new work, asbestos is regularly encountered in the removal of old insulation from many units. The removal or "rip-out" processes are of great concern as these actions provide the greatest potential for exposure to fibrous asbestos²⁾.

Exposure to asbestos has been determined to be a serious health hazard responsible for benign and sometimes malignant diseases. Short-term exposures can lead to asbestosis, a chronic respiratory disease characterized by fibrosis in the lungs. Long-term exposures have been related to upper respiratory, pulmonary and gastro-intestinal cancer.

The Occupational Safety and Health Administration and the Environmental Protection Agency emphasized the health hazard potential of asbestos exposure by listing fibrous asbestos as a carcinogen in Title 29 of the "Code of Federal Regulations" and by establishing emission standards for asbestos operations in Title 40 of the "Code of Federal Regulations". These references contain a permissible exposure limit for asbestos as well as detailed information concerning handling of asbestos materials, personal protection and monitoring, environmental monitoring, warning labels, disposal, employee exposure records, and medical examinations^{3,4)}. The monitoring, handling, and disposal of asbestos materials as discussed in these regulations can be quite expensive. It is important, therefore, that the presence or absence of asbestos in bulk insulations be determined quickly and efficiently.

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Many analytical procedures have been developed for determining asbestos content in insulation materials. They include techniques involving optical microscopy, phase-contrast microscopy, electron microscopy, polarized-light microscopy with dispersion staining, X-ray diffraction, and differential thermal analysis⁵⁾. These techniques require special equipment and trained personnel for their performance in addition to being costly and time consuming.

The National Institute for Occupational Safety & Health (NIOSH) Screening Test for Asbestos reported by Kim, Kupel, and Carter in October of 1979 is a quick, simple, inexpensive method which may be used for detecting the possible presence of asbestos in bulk insulation materials⁶⁾. It is easy to perform and suitable for field use by someone trained in the safe handling of chemicals. The test provides a sensitive detection of magnesium and iron compounds which may indicate the presence of chrysotile, amosite, and crocidolite (Table 1). These are the three most common forms of asbestos found in thermal insulation materials. Samples containing as little as 1-3% asbestos can be reliably detected with a minimum of facilities and apparatus⁷⁾.

Table 1. ELEMENTAL COMPOSITION
OF ASBESTOS TYPES

<u>Asbestos Type</u>	<u>Formulae¹⁾</u>
Chrysotile	$Mg_3 Si_2 O_5 (OH)_4$
Amosite ²⁾	$(Fe Mg)_6 Si_8 O_{22} (OH)_2$
Crocidolite	$Na_2 Fe_5 Si_8 O_{22} (OH)_2$

1) "Control Techniques for Asbestos Air Pollutants", U.S. Environmental Protection Agency, Pub. No. AP-117, 1973, P. 2-2.

2) Although amosite contains both iron and magnesium, the magnesium does not produce a positive test. See Reference 7.

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EXPERIMENTAL

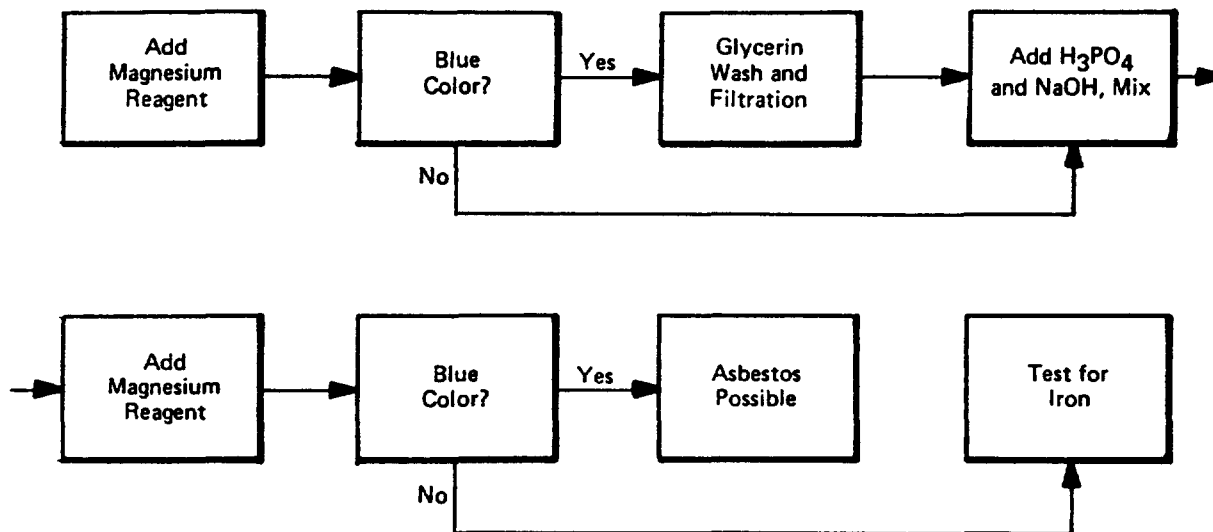
The procedures used in this evaluation followed those outlined in the NIOSH Screening Test for Asbestos⁶). A diagram of the test is shown in Figure 1. It can be divided into four basic parts, namely the interference determinations, the wash and filtration steps, the magnesium test, and the iron test. The detailed method (SRC 11A15/80) is included in the Appendix.

The presence of interfering substances is determined by placing a drop of the magnesium color reagent and the iron color reagent onto fresh portions of insulation samples. Any samples developing blue or red color complexes at this point are washed and filtered which promotes the removal of interfering substances. Samples containing plaster, mineral wool, or glass fiber materials are also washed and filtered as instructed by the method.

The wash and filtration steps are accomplished prior to the magnesium and iron tests to remove soluble, interfering compounds. Pea-sized portions of each sample are washed in a disposable beaker with glycerin before the magnesium test to eliminate interferences such as calcium and soluble magnesium compounds found in plasters and mineral wools. The washed sample is then filtered through a 0.8 um mixed cellulose ester filter held in a Swinnex filtering apparatus and rinsed five times with double de-ionized water. An acid-wash is performed on separate portions of samples before the iron test to remove soluble iron compounds. After washing with concentrated glacial acetic acid and sulfuric acid in a disposable beaker, the samples are filtered through a 5 um polyvinyl chloride filter held in a Swinnex filtering apparatus. PVC filters are used for this step as they do not dissolve in acid solutions as will mixed cellulose ester filters. It should be mentioned that all of the samples tested at Westhollow Research Center (WRC) were carried through the wash-filtration steps since the majority contained cement or plaster-like binders and others appeared to be composed of glass fiber or mineral wool materials.

After the wash and filtration steps are completed, the samples are tested for iron and magnesium. The filters are removed from their holders and placed on Teflon watch glasses. Drop-wise additions of phosphoric acid, sodium hydroxide, and magnesium color reagent are made to the glycerin-washed filters. The resulting solutions are mixed with glass stirring rods. The formation of a deep blue color complex is considered to be a positive test for

Magnesium Test:



Iron Test:

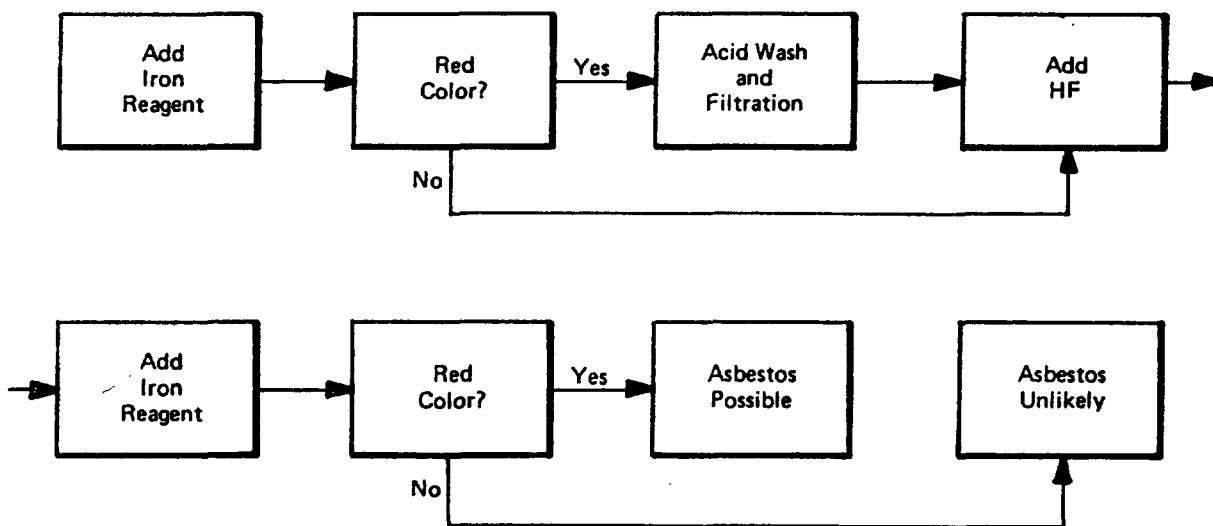


Figure 1. NIOSH Screening Test

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magnesium. For the iron test, hydrofluoric acid and iron color reagent are added to the acid-washed filter by drop-wise addition. Plastic dropping pipettes are used to add the hydrofluoric acid and stir the solutions as hydrofluoric acid is corrosive to glass materials. The formation of a red or orange color complex is considered to be a positive test for iron. If either the magnesium test or the iron test gives a positive result, then it is assumed the sample contains asbestos. The sample must then be submitted for an instrumental analysis to determine the nature and content of the asbestos in the sample. A number of the samples used in the evaluation had been analyzed by optical and scanning electron microscopy prior to the development of the Screening Test. These results were not revealed until after performance of the Screening Test, however. See Table 2.

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Table 2 COMPARISON OF ASBESTOS TEST RESULTS

Sample No.	Description	Screening Test		Bellaire Analysis
		Mg ⁺ 2	Fe ⁺ 2	
IHL 1126	Hangar Insulation (6-29-76)	-	-	No asbestos
IHL 131-144	Flasher Insulation (9-76)	+	+	Small amount
IHL 6163	Steampiping Insulation (2-3-78)	+	+	5-10% asbestos
WRC 49695 (a)	Old Insulation (3-20-79)	-	+	Mostly amosite
WRC 49695 (b)	New Cloth Insulation (3-20-79)	+	+	Mostly chrysotile
IHL 10470	Fire proofing material (6-11-79)	-	+	50% asbestos
IHL 11091	Insulation material (8-7-79)	-	+	Amosite ¹⁾
IHL 12723	Compressor insulation (1-11-80)	+	+	10% asbestos
IHL 12735	Process unit insulation (1-18-80)	-	+	10% asbestos
IHL 12736	Process unit insulation (1-18-80)	-	-	No asbestos
IHL 12737	Process unit insulation (1-18-80)	-	+	10% asbestos
IHL 12738	Piping insulation (1-18-80)	-	+	10% asbestos
IHL 12739	Piping insulation (1-18-80)	-	+	20% asbestos
IHL 12740	Process unit insulation (1-18-80)	-	+	20% asbestos
IHL 12741	Piping insulation (1-18-80)	-	+	20% asbestos
IHL 13045	Bulk insulation (2-9-80)	-	+	10% crocidolite or anthophyllite
IHL 13053	Bulk insulation (2-19-80)	-	-	No asbestos
IHL 13400	Transite board (3-13-80)	+	+	50% asbestos
IHL 13401	Brake drum lining (3-13-80)	-	+	About 1% asbestos
IHL 13558	Process unit insulation (3-20-80)	-	+	60% asbestos
IHL 13559	Process unit insulation (3-20-80)	-	+	30% asbestos
IHL 13560	Process unit insulation (3-20-80)	-	+	No asbestos
IHL 13561	Piping insulation (3-20-80)	-	+	60% asbestos
IHL 13562	Piping insulation (3-20-80)	-	+	5% asbestos
IHL 13563	Piping insulation (3-20-80)	-	+	50% asbestos
IHL 13888	Process unit insulation (4-29-80)	+	+	30-50% asbestos
IHL 13889	Process unit insulation (4-29-80)	+	+	No asbestos
IHL 13902	Pipe shields (3-5-80)	-	+	80% asbestos

1) This sample identified as amosite by Hager Laboratories of Denver, Colorado using polarized-light microscopy with dispersion staining.

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DISCUSSION

A total of 28 samples have been analyzed by the Screening Test at WRC. Confirmatory analyses were performed at the Bellaire Research Center by optical and electron microscopic and X-ray methods. The results are summarized below:

	<u>True</u> <u>Positive</u>	<u>False</u> <u>Positive</u>	<u>True</u> <u>Negative</u>	<u>False</u> <u>Negative</u>
No. of Samples	23	2	3	0
% of Total	83	7	10	0

The NIOSH results involving 198 field samples were as follows:

	<u>True</u> <u>Positive</u>	<u>False</u> <u>Positive</u>	<u>True</u> <u>Negative</u>	<u>False</u> <u>Negative</u>
No. of Samples	79	50	69	0
% of Total	40	25	35	0

These results were obtained without using the acid wash step in the iron test. Thirteen samples were later analyzed with the acid wash steps implemented and the results were:

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	<u>True</u> <u>Positive</u>	<u>False</u> <u>Positive</u>	<u>True</u> <u>Negative</u>	<u>False</u> <u>Negative</u>
No. of samples	5	0	8	0
% of total	38	0	62	0

The Screening Test method is stated to be sensitive to samples containing 1% or greater asbestos. In our evaluation of the method, the majority of the samples contained 5% or greater asbestos and positive results were obtained for these samples. One sample was estimated to contain about 1% asbestos and a positive result was achieved for the iron test. This positive result is questionable however as the sample contained a metallic powder which may have interfered with the test.

Our results and those of NIOSH showed no false negatives. Thus one can have a high degree of confidence in judging a material to be asbestos free if negative iron and magnesium results are obtained. In addition, there are relatively few false positives, so little time will be wasted on unnecessary confirmatory tests. The iron test is more reliable for detecting the presence of asbestos than the magnesium test for the samples tested. Familiarity and confidence should be developed by performing the tests on samples of known composition prior to any actual determinations.

There are several safety factors which should be noted when dealing with the reagents in the Screening Test. Several types of acids are used in the wash steps and care must be taken as splattering may occur when these acids react with the samples under test. In the magnesium test, care should be exercised in the addition of phosphoric acid and 10 N sodium hydroxide as these can react vigorously to produce fuming and splattering. Extreme caution should be used in the handling of hydrofluoric acid. The hazards of this acid cannot be overemphasized. It is an extreme irritant and can cause severe burns which occur as a delayed reaction when the acid comes in contact with the skin. Anyone performing the Screening Test should be trained in the safe handling of chemicals and be aware of the hazards involved in this test.

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WRC 210-80

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The NIOSH Screening Test is a useful method for in-plant determinations of asbestos presence in bulk insulation. It would permit the separation of materials containing asbestos from those not containing asbestos and lead to a cost reduction in the handling and disposal of non-asbestos materials.

Test kits are currently being marketed commercially with apparatus, reagents, and instructions for performing the Screening Test. They are available from:

SKC, Inc.
R.D. 1
#395 Valley View Rd.
Eighty-Four, PA 15330
(412) 941-9701

Anatole J. Sipin Co., Inc.
505 Eighth Avenue
New York, NY 10018
(212) 695-5706

Both kits are available for about \$100.00 each and will screen about 25 samples. There are minor differences in the test instructions and in the apparatus. The SKC instructions are more straightforward and its procedure appears easier to perform. The Sipin kit contained no warnings as to the hazards of the reagents either on the reagent bottle labels or in the test instructions. Anyone using the Sipin kit should possess a thorough knowledge of the test procedures and the chemicals involved. One additional difference concerned the shelf life of the reagents. Sipin claimed a shelf life of one month while SKC claimed a shelf life of three months. The Sipin claim is the same as that noted by the developers of the Screening Test. The SKC claim does not appear to be unreasonable, however. The test reagents have been used at WRC for periods of up to three months with no apparent loss in sensitivity.

It is advisable to include samples which are known to give positive results as a reagent check during each set of analyses. If a large number of samples are to be screened over a long period of time and laboratory facilities are available, it is recommended that reagents and supplies be ordered separately from scientific supply companies. Reagents could then be prepared as needed and the total cost of supplies would be reduced.

LAM 026505

REFERENCES

1. "Asbestos: An Information Resource," U.S. Department of Health, Education and Welfare Publication Number (NIH) 79-1681, 1979, p. 1.
2. Ibid., p. 48.
3. "Code of Federal Regulations," Office of the Federal Register, National Archives and Records Service, General Services Administration, 1979, 29CFR 1910.1001 pp. 580-585.
4. "Code of Federal Regulations," Office of the Federal Register, National Archives and Record Service, General Services Administration, 1979, 40CFR 61, Subpart B.
5. Labbauf, A., "Update on Asbestos," Penn Environmental Health, Pittsburgh, Pennsylvania, 1980, pp. 12-16.
6. Kim, Walter S., Kupel, Richard E., and Carter, James W. "Test for Screening Asbestos," National Institute for Occupational Safety and Health, Division of Physical Sciences and Engineering. October, 1979.
7. "Asbestos Identification and Measurement - Proceedings of a Topical Symposium, April 9, 1979, Des Plaines, Illinois," American Conference of Governmental Industrial Hygienists, 1979, pp. 18-20.

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WRC 210-80

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APPENDIX

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ABS-056638

SHELL RESEARCH COMPLEX METHOD SERIES

SRC 11A15/80

SHELL DEVELOPMENT COMPANY
ANALYTICAL DEPARTMENT

Determination of

THE PRESENCE OF ASBESTOS IN BULK INSULATION MATERIALS¹⁾

Hazardous materials used in this method are designated "(*CAUTION*)" in the REAGENTS and PROCEDURE Sections. A Material Safety Data Sheet for each material so designated may be found in the PRECAUTIONARY INFORMATION at the end of the method. Operations which may present a hazard are given in the UNUSUAL OPERATIONAL HAZARDS section.

SCOPE

1. This method describes a colorimetric spot-test for determination of Magnesium (II) and Iron (II) in bulk insulation materials which may indicate the possible presence of asbestos in the chrysotile, amosite, and crocidolite forms. The method does not determine asbestos itself.

NOTE 1: Magnesium (II) is a principle component of chrysotile asbestos; Iron (II) is a principle component of amosite asbestos and crocidolite asbestos.

METHOD SUMMARY

2. Small portions of bulk insulation material are complexed with p-nitrophenylazo- α -naphthol for Magnesium (II) and 1,10-phenanthroline for Iron (II). A positive reaction for Magnesium (II) is indicated by a blue-color complex formation. A positive reaction for Iron (II) is indicated by a red-color complex formation.

INTERFERENCES

3. Soluble magnesium or iron compounds not associated with asbestos may give false-positive results. Calcium found in plaster as CaSO_4 is a positive interference in the Magnesium (II) test. Details for washing sample portions prior to testing are provided in the method to aid in the removal of interfering substances. Positive results should be confirmed by other analytical techniques. No false-negative results have been noted.

¹⁾Based on NIOSH Screening Test for Asbestos developed by Kupel, Kim and Carter in October, 1979.

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HAZARDOUS TEST CONDITIONS

4. Asbestos has been determined to be a human carcinogen. All bulk insulation samples under test should be handled as if they contained asbestos. They should be handled in a manner to avoid creation of dust in the air. Analysis should be performed in a hood with sufficient face velocity to eliminate the possibility of inhalation of fibrous asbestos material. Samples should be stored in sealed containers or air tight plastic bags. Extreme caution should be exercised in the handling of hydrofluoric acid. It is an extremely toxic irritant and may cause serious burns upon contact with skin. Fumes are also hazardous to eyes, throat, and lungs.

APPARATUS

5. (a) Teflon® watchglass: Scientific Products. 3 in. diameter. Cat. No. W2510-2.

(b) Teflon® stirring rods: Horizon Ecology Company. 6 in. length. Cat. No. 6368-10.

(c) Plastic dropping pipettes: Scientific Products. Unitary dropper. Cat. No. P5218.

(d) 30ml Teflon® beakers: Nalge Company. Griffin Beaker. Cat. No. 1500-0030.

(e) 10ml Plastic disposable syringe w/Luer fitting: VWR Scientific, Inc. B-D Plastipak. Cat. No. BD5604.

(f) 25mm Swinnex filter holder and gasket: Millipore Corporation. 25mm. Cat. No. SX00 025 01.

(g) 25mm 0.8µm Mixed cellulose ester filters: Millipore Corporation. Cat. No. AAWP 025 00.

(h) 25mm 5µm Polyvinyl chloride filter: Gelman Instrument Co. VM-1 membrane filter. Product No. 60692.

(i) Assorted glassware for preparing reagents.

NOTE 2: Kits containing reagents and apparatus for performing about 25 determinations are available from the following suppliers:

SKC-West, Inc.
P.O. Box 2805
Fullerton, California
92633

Anatole J. Sipin Co., Inc.
505 Eighth Avenue
New York, New York
10018

LAM 026509

NOTE 3: Teflon® or plastic apparatus should be used in performance of the magnesium and iron tests because of their inertness and resistance to corrosive chemicals.

REAGENTS

6. (a) Purity of chemicals. All chemicals should be of analytical reagent quality or better. Double deionized water should be used in preparation of reagents and throughout test procedures.

(b) Phosphoric acid, concentrated (*CAUTION*).

(c) 10 N Sodium hydroxide (*CAUTION*). Dissolve 40g of NaOH (*CAUTION*) in 10ml of double deionized water.

(d) Magnesium reagent. Dissolve 1mg of p-nitrophenylazo- α -naphthol (*CAUTION*) in 100ml of 2N NaOH (*CAUTION*). Age at least one day. Reagent is stable approximately one month.

(e) Hydrochloric acid, concentrated (*CAUTION*).

(f) Hydrofluoric acid (*CAUTION*). Dilute 20ml of 48% HF with 20ml of water. Add 0.6ml of concentrated HCl (*CAUTION*).

(g) Ethanol, 95% (*CAUTION*).

(h) Iron reagent. Dissolve 2g of 1,10-phenanthroline (*CAUTION*) in 50ml of 95% ethanol (*CAUTION*). Reagent is stable approximately one month.

(i) Glycerin, reagent grade.

(j) Acetic acid, concentrated glacial (*CAUTION*).

(k) Sulfuric acid, concentrated (*CAUTION*).

PROCEDURE

7. (a) Collection of samples. Several samples of bulk material should be obtained for a given area. They should be properly labeled and their color, texture, and general physical appearance should be noted. Each sample should be stored in its own sealed container or air-tight plastic bag.

NOTE 4: Due to the presence of non-asbestos insulations in repair work, patch work, and new construction, it is recommended several samples be taken to obtain a representative view of the type or types of materials being handled.

(b) Cleaning of apparatus. All apparatus should be rinsed thoroughly with double deionized water to remove any substances which might interfere with the tests.

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(c) Magnesium interferences check. Obtain a fresh, representative portion of the sample about the size of a large pea and place it on a Teflon® watchglass. Add a few drops of the magnesium color reagent to the sample. A blue color development indicates an interference is present and the sample must be washed with glycerin and filtered with water prior to the magnesium test (7e). If a color is not observed, the wash-filtration step may be eliminated.

NOTE 5: Samples containing plaster must be washed prior to the magnesium test.

(d) Glycerin Wash. Place a fresh, pea-sized portion of sample in a 30ml beaker. Add 5 drops of glycerin and mix well with a stirring rod. Rinse stirring rod with approximately 10ml of water. Draw up the resulting solution with a 10ml plastic syringe and attach the syringe to a 25mm Swinnex filtering apparatus containing a 0.8µm mixed cellulose ester filter and gasket. Filter the sample and then wash by injecting a minimum of 50ml of water into the Swinnex apparatus using the 10ml syringe. Five 10ml washes are the minimum number of washes to be performed. Remove the filter and place on a clean Teflon® watchglass for the magnesium test (7e).

(e) Magnesium Test. Place a fresh portion of the sample (or the filter from the wash step) on a clean Teflon® watchglass. Add a drop of concentrated H_3PO_4 (*CAUTION*) and mix by grinding the sample with a plastic stirring rod. Add 2 drops of 10N NaOH (*CAUTION*) and mix well. Add 5 drops of magnesium color reagent and stir briefly noting any color change. Add 5 more drops of the color reagent and note final color.

(f) Observations. A blue color formation indicates chrysotile may be present. The sample should be submitted for analysis by other techniques for a confirming determination. If a blue color does not appear the sample must be tested for iron.

(g) Iron Interference Test. Place a fresh portion of sample on a Teflon® watchglass and add several drops of the iron color reagent directly to the sample. A red color indicates an interference is present. The sample must be acid washed and filtered prior to the iron test procedure. If a red color is not observed, the iron test may be performed without the wash step.

NOTE 6: Samples containing plaster, mineral wool or fiberglass should be washed prior to the iron test.

(h) Acid Wash. Place a fresh, pea-sized portion of the sample in a 30ml beaker. Add 5 drops of concentrated acetic acid (*CAUTION*) and 5 drops of concentrated sulfuric acid (*CAUTION*).

NOTE 7: Caution should be exercised in the above steps as addition of acids with some samples will result in bubbling and spattering.

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Mix well and ultrasonicate for 5 minutes if available. Rinse stirring rod into beaker with approximately 10ml of water. Using a 10ml syringe draw up sample solution and filter through a Swinnex filter holder containing a 5µm polyvinyl chloride filter and gasket. Wash with a minimum of 5 washings or about 50ml of water. Remove the filter and place in a clean Teflon® watchglass for iron test (71).

(1) Iron Test. To a fresh portion of sample (or washed filter sample) add a drop of hydrofluoric acid (*CAUTION*). Mix well. Add 5 drops of the iron color reagent.

NOTE 8: Exercise caution as the addition of hydrofluoric acid to some samples may result in bubbling and spattering of materials.

(j) Observations. A red color indicates either amosite asbestos or crocidolite asbestos may be present. The sample should be submitted for analysis by other techniques for a confirmative identification. If no color development was noted in either the magnesium test or the iron test, the probability of asbestos being present is very low.

PRECISION AND ACCURACY

8. (a) This method may indicate the presence of as little as 1% - 3% asbestos material.

(b) NIOSH results using the Screening Test on 198 building material samples were as follows:

Without Acid Wash Step				
	True Positive	False Positive	True Negative	False Negative
No. of Samples	79	50	69	0
With Acid Wash Step (13 Samples)				
	True Positive	False Positive	True Negative	False Negative
No. of Samples	5	0	8	0

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PRECAUTIONARY
INFORMATION

The precautionary information presented in the MSDS's in this section represents the best information available at the time of publication. The MSDS file is continually updated. If a significant time period has elapsed since publication of the method, the user is urged to check for changes in or additions to the information presented here. Current information may be obtained by contacting:

Manager, Analytical Chemical/Oil
Shell Development Co.
Westhollow Research Center
P.O. Box 1380
Houston, TX 77001

Precautionary Statements

Materials For Which No MSDS Is Available

MSDS's are in preparation for the following materials. Contact Manager, Analytical Chemical/Oil at the address given on the title page of this section for completed MSDS's.

p-nitrophenylazo- α -naphthol

LAM 026513

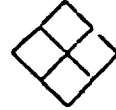
FORM NO. 133-003-1-MAY 1963



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY
SHELL PIPE LINE CORPORATION

MSDS 306,980-78

RATING



NFPA

MATERIAL SAFETY DATA SHEET

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or on state grounds for legal action.

SECTION I	
MANUFACTURER'S NAME Hooker Chemicals & Plastics Corp.	EMERGENCY TELEPHONE NO. 716-278-7777
ADDRESS (Number, Street, City, State, and ZIP Code) Niagara Falls, New York 14302	
CHEMICAL NAME AND SYNONYMS	TRADE NAME Phosphoric Acid
CHEMICAL FAMILY	FORMULA

SECTION II HAZARDOUS INGREDIENTS*
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.

SECTION III PHYSICAL DATA	
BOILING POINT (°F)	SPECIFIC GRAVITY (H ₂ O = 1)
VAPOR PRESSURE (mm Hg)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR = 1)	EVAPORATION RATE (H ₂ O = 1)
SOLUBILITY IN WATER	
APPEARANCE AND COLOR	

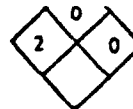
SECTION IV FIRE AND EXPLOSION HAZARD DATA			
Flash Point (Method used)	FLAMMABLE LIMITS	Exp	Det
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

*Modified by Shell Oil Company

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Hooker Industrial chemicals

DIVISION


 ADAPTED FROM USOL
 FORM NO. L38 - 805-A

MATERIAL SAFETY DATA SHEET

NFPA Designation

CHEMICAL NAME: Phosphoric Acid		PLANT CODE	MATERIAL CODE NO.
MANUFACTURER'S NAME: Hooker Chemicals & Plastics Corp.		EMERGENCY TELEPHONE NO. (716) - 278-7777	
ADDRESS: NUMBER, STREET, CITY, STATE AND ZIP CODE: Niagara Falls, New York 14302			
CHEMICAL NAME AND SYNONYMS Orthophosphoric Acid		TRADE NAME Phosphoric Acid	
CHEMICAL FORMULA H₃PO₄	MOL. WT. 98.00	USES Mfg of chemicals, food additives; metal-treating etc	

BOILING POINT (°F) (75% Soln)	275	SPECIFIC GRAVITY (H ₂ O = 1)	1.574
VAPOR PRESSURE (mmHg) @ 25°C	5.0	PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR=1)		EVAPORATION RATE	
SOLUBILITY IN WATER	very sol.		
APPEARANCE AND COLOR	Odorless, viscous liquid		

Fire and Explosion Hazard Data

FLASH POINT	METHOD	FLAMMABLE LIMITS	AUTOIGNITION TEMP.
none °F		UEL -- LEL --	none °F

EXTINGUISHING MEDIA --

SPECIAL FIRE FIGHTING PROCEDURES As appropriate for surrounding fire.

 UNUSUAL FIRE AND EXPLOSION HAZARDS Will liberate hydrogen upon contact with many metals.
Protect personnel against mist, vapor or splashes.

Reactivity

 INCOMPATIBILITY Reacts vigorously with alkalis, producing heat; with many metals, producing heat and flammable hydrogen gas.

 HAZARDOUS DECOMPOSITION PRODUCTS Heating to decomposition yields fumes of toxic phosphorus pentoxide.

 CONDITIONS TO AVOID Avoid contact with skin and eyes. Avoid contact with strong alkalis or with metals except certain stainless steels.

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ABS-056646

WRC 2

THRESHOLD LIMIT VALUE 1 MILLIGRAM PER CUBIC METER.

EFFECTS OF OVEREXPOSURE (SKIN, EYE, INHALATION, ETC.) Contact with skin and eyes causes irritation and can produce burns. Ingestion can cause irritation and burning of the mucous membranes of the gastro-intestinal tract. Inhalation of mist may cause irritation of the respiratory tract.

EMERGENCY AND FIRST AID PROCEDURES EYES & SKIN: Flush with large amounts of water. INGESTION: Dilute by drinking large amounts of water, induce vomiting. INHALATION: Removal to clean air is usually sufficient; for severe exposure, oxygen may be administered.

SPECIAL MEDICAL PROCEDURES Get medical attention for all over-exposures. Treatment is symptomatic and no specific antidotes are known.

Special Protection Information

VENTILATION General room ventilation.

RESPIRATORY (TYPE) Mist protection where appropriate.

GLOVES (TYPE) Rubber, neoprene.

EYE (TYPE) Chemical safety goggles, plus face shield where appropriate.

OTHER Rubber over leather shoes or rubber safety shoes. Rubber, or other impervious, clothing to protect against splashes.

SPECIAL PRECAUTIONS FOR HANDLING AND STORAGE Store away from heat and separately from alkalis. Neutralizing agents or absorbents and a ready supply of water should be available for emergency use.

STEPS TO TAKE IN EVENT OF SPILL OR RELEASE Get personnel protective equipment. Large spills, contain by dikes of sand, etc. If spill enters sewer, dilute with water.

Small spill, neutralize carefully with limestone or soda ash -- avoid caustic soda -- then rinse area with water.

WASTE DISPOSAL Place in retention area, neutralize with limestone or controlled dilute caustic soda before discharge to stream or sewer. Bury acid-soaked clay as land fill.

REMARKS _____

REFERENCES MCA Chemical Safety Data Sheet SD-70: Phosphoric Acid (1958).

The information presented herein, while not guaranteed, was prepared by technically knowledgeable personnel and to the best of our knowledge is true and accurate. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other or additional considerations.

NAME G. W. Darling

LOC. Niagara

DATE February 1977

Revised Dec. 1976

LAM 026516

ADAPTED FROM MSDS
FORM NO. 155-003-4-MAY 1969



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY MSDS NO. 30004-78
SHELL PIPE LINE CORPORATION

300,040

HAZARD
RATING

MATERIAL SAFETY DATA SHEET

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or create liability grounds for legal action.

SECTION I	
MANUFACTURER'S NAME Diamond Shamrock Chemical Co., Electro Chem. Division	EMERGENCY TELEPHONE NO.
ADDRESS (Number, Street, City, State, and ZIP Code) 300 Union Commerce Building, Cleveland, Ohio 44115	
CHEMICAL NAME AND SYNONYMS	TRADE NAME Pelka Caustic Soda
CHEMICAL FAMILY	FORMULA

SECTION II HAZARDOUS INGREDIENTS*
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.

SECTION III PHYSICAL DATA	
BOILING POINT (°F)	SPECIFIC GRAVITY (H ₂ O=1)
VAPOR PRESSURE (mmHg)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR=1)	EVAPORATION RATE (g/m ² hr)
SOLUBILITY IN WATER	
APPEARANCE AND ODOR	

SECTION IV FIRE AND EXPLOSION HAZARD DATA	
FLASH POINT (Method used)	FLAMMABLE LIMITS Lower Upper
EXTINGUISHING MEDIA	
SPECIAL FIRE FIGHTING PROCEDURES	
UNUSUAL FIRE AND EXPLOSION HAZARDS	

*Modified by Shell Oil Company

LAM 026517

Diamond Shamrock Chemical Company

ELECTRO CHEMICALS DIVISION

MATERIAL SAFETY
DATA SHEET

CHEMICAL NAME (in full)

SODIUM HYDROXIDE

PRODUCT NAME

Flake Caustic Soda

FORMULA

NaOH

GENERAL INFORMATION

Caustic soda is one of the work-horses of the chemical industry, sharing this position only with soda ash and sulfuric acid. There is scarcely a single chemical which does not require one or more of these three basic chemicals for its production, and furthermore, there is hardly an industrial product which does not depend upon caustic soda. Caustic soda is normally marketed as a 50% (by weight) liquid solution in tank trucks, tank cars, and barges. When a dry form of caustic soda is required, it normally is shipped in bags, drums, bulk trucks, or rail cars.

Flake caustic soda has been cleared for use under the "Food Additives Amendment of 1958."

HAZARD CLASSIFICATION

Flake caustic soda is classified by the Department of Transportation as a CORROSIVE.

I. IMPORTANT PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Solid	FLAMMABLE LIMITS	Non-flammable	VAPOR PRESSURE	1030°C. - 42 mm
COLOR	White	LIGHT SENSITIVITY	No		1050°C. - 69 mm
ODOR	None	SOLUBILITY (20°C)	Completely soluble		1100°C. - 109 mm
FLASH POINT (Closed Cup)	None	SPECIFIC GRAVITY (H ₂ O = 1.0)	2.130 @ 20 °C.		1200°C. - 232 mm
BOILING POINT	1338°C. @ 760mm Hg Pressure	THRESHOLD LIMIT VALUE (AIR CORNE)	2 mg/m ³	% VOLATILE (Volume)	Not volatile
AUTOIGNITION TEMPERATURE	Non-flammable	VAPOR DENSITY AIR = 1.0	Does not apply	EVAPORATION RATE (Ether = 1.0)	Does not apply
CRITICAL TEMP.	Does not apply	VISCOSITY 20°C	4.0 centipoise @ 350°C.	REACTIVITY	Considerable heat is given when water is added to caustic soda.
DENSITY AT 60°F	Approx. 60 lb./cu.ft.	MINIMAL LETHAL DOSE	•		Caustic can react violently explosively with strong acids and organic chemicals.
HEAT OF COMBUSTION	Does not apply	LOS0 TEST	•		

II. CHEMICAL REACTIVITY DATA

STABLE ☒ Yes☐ No

SELF-POLYMERIZE

☐ Yes☒ No

HAZARDOUS DECOMPOSITION PRODUCTS

None

AVOID CONTACTS WITH THESE MATERIALS

When handling flake caustic, avoid contact with such materials as aluminum, leather, wool, tin, and zinc and alloys containing these metals.

CONDITIONS TO AVOID

Avoid handling conditions which may allow for leaks and spills of caustic soda. Do not permit personnel to handle caustic soda without proper training or work without protective equipment.

*Data not available.

Electro Chemicals Division / Diamond Shamrock Chemical Company / 300 Union Commerce Building, Cleveland, Ohio 44114
This material is supplied as a service to the chemical industry and is not intended for use in the production of explosives or other hazardous materials. It is the responsibility of the user to determine the compatibility of this material with other materials and to take appropriate precautions. The user should consult the Material Safety Data Sheet for this material and the Material Safety Data Sheet for the other materials involved. The user should also consult the relevant regulations and standards for the handling and storage of this material. The user should also consult the relevant regulations and standards for the handling and storage of the other materials involved. The user should also consult the relevant regulations and standards for the handling and storage of the other materials involved.

LAM 026518

Caustic soda is a strong alkali and is dangerous when improperly handled. The solid caustic and concentrated solutions are destructive to tissues which they may contact, producing severe burns. Contact with the eyes, either in solid form or in solution, causes severe damage to the eye. Inhalation of the dust or mist of this compound is capable of causing injury to the entire respiratory tract. Swallowing usually results in severe injury.

A. FIRST AID PROCEDURES

Ingestion	Ingestion of caustic causes severe burns of mucous membranes of the mouth, throat, esophagus and stomach. Dilution of the chemical by drinking large quantities of water or milk may be attempted. After this, dilute vinegar or fruit juice may be given to accomplish neutralization. Vomiting may occur spontaneously, but should not be induced nor should stomach tube be used except on advice of physician.
Inhalation	If discomfort is experienced from exposure to caustic mist or dust, the employee should leave the contaminated atmosphere until proper ventilation is restored and report for medical evaluation.
Skin Contact	Wash skin area with large quantities of water. Continue washing for as long as 1-2 hours or until medical help arrives. No salves/ointments should be used on chemical burns for at least 24 hours. Clothing/shoes wetted with caustic should not be worn until after they have been thoroughly washed and decontaminated. A physician should see all cases other than minor exposures.
Contact with Eyes	If even minute quantities of caustic, solid or solution, enter the eyes, they should be irrigated immediately with copious water for a minimum of 15 minutes. Eyelids should be held apart while patient rolls eyes in circular motion during irrigation to insure contact with all tissues of eye and lid. A physician should be called in attendance at the first possible moment.

B. PERSONAL PROTECTIVE EQUIPMENT

Chemical safety goggles: Plastic or rubber frames equipped with resistant glass or plastic lens.

Face shields: Plastic shields may be worn in addition to goggles.

Eye wash fountains and safety showers must be immediately available. Hard hats should be worn where there is danger from falling objects. Safety shoes or rubber boots should be worn when handling caustic soda.

IV. FIRE and EXPLOSION

General

Caustic soda is non-combustible.

Fire Fighting (Procedure, Equipment)

Caustic soda is non-combustible. However, fire extinguishing equipment and adequate water for fire fighting should be available to workmen in all process or storage areas for welding jobs and where combustible material of any kind is present. Workmen should be trained to prevent welding fires by thoroughly wetting down wooden scaffolds and tarps.

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SAMPLE WARNING LABEL

This is a copy of the label which appears on all containers of this chemical. It should be noted that the information shown is for a general class of chemicals and should not be used in place of the more detailed information presented in this booklet.

**THIS PACKAGE CONTAINS
SODIUM HYDROXIDE (CAUSTIC SODA)**
Danger! Burns Skin and Eyes.

Do not get in eyes, on skin, or on clothing.
Do not take internally.

When handling, wear goggles or face shield. While making solutions, add Sodium Hydroxide slowly to surface of solution to avoid violent spattering.

In case of contact, immediately flush skin with plenty of water and wash with vinegar; for eyes, flush with plenty of water for at least 15 minutes and get medical attention.

DAGD 1454-1A

Sales Offices

BOSTON 31 Milk Street Boston, Massachusetts 02109 (617) 542-0594	HOUSTON 1701 C and I Life Building 1005 Main Street Houston, Texas 77002 (713) 224-5351	PITTSBURGH 9300 McKnight Road Pittsburgh, Pennsylvania 15237 (412) 931-4830
CHICAGO 20 North Wacker Drive Chicago, Illinois 60605 (312) 641-3000	MEMPHIS P. O. Box 4950 Crosstown Station Memphis, Tennessee 38104 (901) 278-5650	REDWOOD CITY P. O. Box 829 Redwood City, California 94064 (415) 369-0071
CINCINNATI 4701 Paddock Road Cincinnati, Ohio 45229 (513) 242-2900	NEW YORK 99 Park Avenue New York, New York 10016 (212) 697-0440	ST. LOUIS 7701 Forsyth Boulevard St. Louis, Missouri 63105 (314) 721-7900
CLEVELAND 631 Hanna Building 1422 Euclid Avenue Cleveland, Ohio 44115 (216) 781-8683	PHILADELPHIA 320 Walnut Street Philadelphia, Pennsylvania 19105 (215) 923-7250	LOS ANGELES 4814 Loma Vista Los Angeles, California 90059 (213) 583-5521



Diamond Shamrock Chemical Company

Electro Chemicals Division

300 Union Commerce Building Cleveland, Ohio 44115 216-621-6100

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ECL

LAM 026520

WRC 210-80

ABS-056651

should be available for emergency use in dissolving or diluting and flushing away spilled caustic. Spilled solid forms of caustic may be shoveled up, followed by flushing with water. Dilute acid, preferably acetic acid, may be used to neutralize the final traces of caustic immediately after flushing. Washing or mopping similar leaks may be followed by a liberal covering of sodium bicarbonate for removing the last traces of caustic.

WASTE DISPOSAL

Waste disposal of caustic soda depends to a great extent upon local requirements. Be sure that all federal, state, and local regulations regarding health and pollution are followed.

Waste caustic soda solution should not be discharged directly into sewers or streams. The caustic soda should first be converted to a neutral salt, as by neutralization with acid, and then well diluted with water.

Strong alkali tends to diminish bacterial activity needed for proper sewage disposal by increasing the alkalinity to unfavorable levels.

In the event of accidental spillage, advise the municipal sewage plant if the discharge will enter a municipal system or the state water pollution control board if the chemical will be discharged into state waters.

DISPOSAL and RETURN PROCEDURES

(Returnable Containers)

Returnable containers should be shipped in accordance with the supplier's recommendations. Return shipment should comply with all federal, state, and Department of Transportation regulations.

NON-RETURNABLE CONTAINERS

All residual caustic soda should be removed from the container prior to disposal.

SPECIAL HANDLING and STORAGE PROCEDURES

The Department of Transportation has proposed an amendment to their regulations which will classify flake caustic soda as corrosive. Personal protective clothing and handling equipment should be used when handling flake caustic. Storage should be provided in an area which will not allow pick up of moisture.

LAM 026521

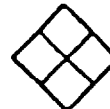
ADAPTED FROM MSDS
FORM NO. 132-005-4-MAY 1989



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY
SHELL PIPE LINE CORPORATION

MSDS 326,320-78
MSDS 32632-78

HAZARD
RATING



MATERIAL SAFETY DATA SHEET

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SECTION I	
MANUFACTURER'S NAME Mallinckrodt, Inc.	EMERGENCY TEL. NO. 314-231-8980
ADDRESS (No., Street, City, State, and ZIP Code) Mallinckrodt & Second Streets, St. Louis 63147	
CHEMICAL NAME AND SYNONYMS	TRADE NAME Hydrochloric Acid
CHEMICAL FAMILY	FORMULA

SECTION II HAZARDOUS INGREDIENTS*
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.

SECTION III PHYSICAL DATA	
BOILING POINT (°F)	SPECIFIC GRAVITY (H ₂ O = 1)
VAPOR PRESSURE (mmHg)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR = 1)	EVAPORATION RATE (H ₂ O = 1)
SOLUBILITY IN WATER	
APPEARANCE AND COLOR	

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	FLAMMABLE LIMITS	Lo*	Hi*
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

*Modified by Shell Oil Company

LAM 026522

WRC 210-80

ABS-056653

Form Approved
Budget Bureau No. 46-R1387



Form No. OSHA-20
May 1971

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
MATERIAL SAFETY DATA SHEET

SECTION I	
MANUFACTURER'S NAME MALLINCKRODT, INC.	EMERGENCY TELEPHONE NO. 314-231-8980
ADDRESS (Number, Street, City, State, and ZIP Code) MALLINCKRODT & SECOND STREETS, ST. LOUIS, MO. 63147	
CHEMICAL NAME AND SYNONYMS Hydrochloric Acid	TRADE NAME AND SYNONYMS
CHEMICAL FAMILY Inorganic acid	FORMULA CH1(aqueous soln)

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR COPE FLUX		
ADDITIVES			OTHERS		
OTHERS					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES					% TLV (Units)

SECTION III PHYSICAL DATA			
BOILING POINT (°F.)		SPECIFIC GRAVITY (H ₂ O = 1)	1.18
VAPOR PRESSURE (mm Hg.)		PERCENT VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR = 1)	1.3	EVAPORATION RATE (WATER = 1)	about 1
SOLUBILITY IN WATER	Infinitely miscible		
APPEARANCE AND ODOR	Clear, colorless solution, pungent odor of hydrogen chloride.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	FLAMMABLE LIMITS	Let	Uet
EXTINGUISHING MEDIA	Any media suitable for the supporting fire.		
SPECIAL FIRE FIGHTING PROCEDURES	Wear full protective clothing and self contained breathing apparatus.		
UNUSUAL FIRE AND EXPLOSION HAZARDS	Contact with metals produces hydrogen which forms explosive mixtures with air.		

NO. 357-A-8/71

LAM 026523

SECTION V HEALTH HAZARD DATA			
THRESHOLD LIMIT VALUE 5 ppm			
EFFECTS OF OVEREXPOSURE Concentrated solutions causes severe burns, permanent visual damage may occur.			
Inhalation: Cough, choking, inflammation of respiratory tract. Ingestion: corrosive EMERGENCY AND FIRST AID PROCEDURES of mucous membranes, nausea, vomiting, diarrhea.			
Contact areas: wash well for 15 minutes with water.			
Ingestion and inhalation: see physician.			
SECTION VI REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATIBILITY (Materials to avoid) Acids and metals			
HAZARDOUS DECOMPOSITION PRODUCTS Mixes of hydrogen chloride and hydrogen in contact with metals, chlorine from oxidizers.			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	
SECTION VII SPILL OR LEAK PROCEDURES			
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Cover contaminated surface with sodium bicarbonate or a soda ash, slaked lime mixture (50-50). Mix and add water if necessary to form a slurry. Scoop up slurry and wash down drain with excess water. Wash site with soda ash solutions.			
WASTE DISPOSAL METHOD Add slowly to large volume of agitated solution of soda ash or slaked lime. Add neutralized solution to excess running water to sewer. As an added precaution, the sink can be lined with protective material and filled with coarse chipped marble.			
SECTION VIII SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type) Mask with acid vapor canister or self breathing apparatus			
VENTILATION	LOCAL EXHAUST		SPECIAL
	MECHANICAL (General)	X	OTHER
PROTECTIVE GLOVES	Rubber	EYE PROTECTION	Goggles
OTHER PROTECTIVE EQUIPMENT Rubber suit or lab coat.			
SECTION IX SPECIAL PRECAUTIONS			
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Protect against physical damage. Store in a cool, well ventilated place, separate from all oxidizing agents.			
OTHER PRECAUTIONS See Chemical Safety Data Sheet SD-39(MCA)			

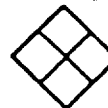
LAM 026524

ADAPTED FROM MSDS
FORM NO. 150-003-MAY 1969



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY
SHELL PIPE LINE CORPORATION

HAZARD
RATING



MATERIAL SAFETY DATA SHEET

MSDS 313,740-78

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SECTION I	
MANUFACTURER'S NAME Olin Corporation	EMERGENCY TELEPHONE NO. (203) 777-7911, Ext. 1430 or 1784
ADDRESS (Number, Street, City, State, and ZIP Code) Research Center, 215 Winchester Avenue, New Haven, CT 06504	
CHEMICAL NAME AND SYNONYMS	TRADE NAME hydro fluoric acid
CHEMICAL FAMILY	FORMULA

SECTION II HAZARDOUS INGREDIENTS*
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.

SECTION III PHYSICAL DATA	
BOILING POINT (°F)	SPECIFIC GRAVITY IN H_2O @ 20°C
VAPOR PRESSURE (mmHg)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR=1)	EVAPORATION RATE (g/m ² /hr)
SOLUBILITY IN WATER	
APPEARANCE AND ODOR	

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	FLAMMABLE LIMITS	LoL	UoL
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

* Modified by Shell Oil Company

LAM 026525



RESEARCH CENTER • 375 WINCHESTER AVENUE, NEW HAVEN, CONNECTICUT 06504
Telephone: (203):777-7911, Extensions 1430, 1784

MATERIAL SAFETY DATA SHEET

SECTION I					
MANUFACTURER'S NAME				EMERGENCY TELEPHONE NO.	
ADDRESS (Number, Street, City, State, and ZIP Code)					
CHEMICAL NAME AND SYNONYMS Hydrofluoric Acid			TRADE NAME AND SYNONYMS Same		
CHEMICAL FAMILY			FORMULA HF		

SECTION II HAZARDOUS INGREDIENTS					
PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PAINTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL		
ADDITIVES			PLUS COATING OR C-JOB FLUX		
OTHERS			OTHERS		

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES		%	TLV (Units)

SECTION III PHYSICAL DATA			
BOILING POINT (°F.)	19.4°C	SPECIFIC GRAVITY (H ₂ O=1)	liquid 0.98
VAPOR PRESSURE (mm Hg) 400 mm Hg at	2.5°C	PERCENT VOLATILE BY VOLUME (%)	N.A.
VAPOR DENSITY (AIR = 1)	N.A.	EVAPORATION RATE	N.A.
SOLUBILITY IN WATER	complete		
APPEARANCE AND ODOR	colorless, fuming liquid		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (°F) (Closed Cup)	N.A.	FLAMMABLE LIMITS	
EXTINGUISHING MEDIA	CO ₂ , foam, water		
SPECIAL FIRE FIGHTING PROCEDURES	N.A.		
UNUSUAL FIRE AND EXPLOSION HAZARDS			
HF attacks glass or stoneware. Store only in plastic, wax, paraffin or lead containers.			

LAM 026526

SECTION V HEALTH HAZARD DATA	
THRESHOLD LIMIT VALUE	3 ppm
EFFECTS OF OVEREXPOSURE	Vapors and liquid are <u>corrosive</u> to tissues. Chronic exposure may cause fluorosis.
EMERGENCY AND FIRST AID PROCEDURES	if spilled on skin or in eyes, flush with flowing water for 15 min.
Ingestion	- give magnesia, chalk, milk or egg white. DO NOT INDUCE VOMITTING.
Inhalation	- remove to fresh air. For all above, see a physician <u>immediately</u> .

SECTION VI REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATIBILITY (Materials to avoid)	oxidizing materials, <u>CYANIDES</u>		
HAZARDOUS DECOMPOSITION PRODUCTS	toxic fumes of fluorides		
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES	
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	Wearing protective equipment, slowly neutralize with alkalis and/or flood area with copious quantities of water.
WASTE DISPOSAL METHOD	Neutralize with alkalis - bury in sanitary land-fill.

SECTION VIII SPECIAL PROTECTION INFORMATION			
Respirator with canister of soda lime and activated carbon.			
VENTILATION	LOCAL EXHAUST	X	SPECIAL
	MECHANICAL (General)		OTHER
PROTECTIVE CLOVES	neoprene		EYE PROTECTION
		Goggles (splash shields)	
Neoprene boots & suits in areas of large spills. Aprons (neoprene)			

SECTION IX SPECIAL PRECAUTIONS	
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE	
Store in cool, dry, well ventilated place.	
OTHER PRECAUTIONS	

Information furnished by: Dr. John H. Wedig
 Title: Toxicologist
 Company: Olin Corporation
 Address: 275 Winchester Avenue, New Haven, Connecticut 06501

Date: 2/9/72

LAM 026527

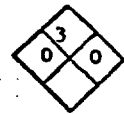
ADAPTED FROM MSDS
FORM NO. 150-003-0 MAY 1983



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY
SHELL PIPE LINE CORPORATION

5100

RATING



MATERIAL SAFETY DATA SHEET

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SECTION I	
MANUFACTURER'S NAME Shell Chemical Company	EMERGENCY TELEPHONE NO. 713-473-9461
ADDRESS (Number, Street, City, State, and ZIP Code) One Shell Plaza, P. O. Box 2403, Houston, Texas 77001	
CHEMICAL NAME AND SYNONYMS Ethyl Alcohol/Ethanol	TRADE NAME
CHEMICAL FAMILY Alcohol	FORMULA CH₃CH₂OH

SECTION II HAZARDOUS INGREDIENTS*						
COMPOSITION	%	SPECIES	LD ₅₀		LC ₅₀	
			ORAL	DERMAL	CONCENTRATION	WPPS
PIGMENTS						
CATALYST						
VEHICLE						
SOLVENTS	100	Ret	13.6 g/kg			
ADDITIVES		Ret			20,000 - 23,000 PPM	10
OTHERS						

SECTION III PHYSICAL DATA			
BOILING POINT (°F)	172	SPECIFIC GRAVITY (H ₂ O=1)	0.79
VAPOR PRESSURE (mmHg) @ 68°F	44	PERCENT VOLATILE BY VOLUME (%)	0
VAPOR DENSITY (AIR=1)	1.6	EVAPORATION RATE (VS. WATER =1)	1.6
SOLUBILITY IN WATER	100%		
APPEARANCE AND ODOR	Colorless, mobile liquid, pleasant odor		

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	55°F TCC	FLAMMABLE LIMITS	Lo: 4.3 Hi: 19
EXTINGUISHING MEDIA	CO ₂ , dry chemical, steam, alcohol foam		
SPECIAL FIRE FIGHTING CONSIDERATIONS	as used for flammable, water soluble liquid.		
UNUSUAL FIRE AND EXPLOSION HAZARDS			

*Modified by Shell Oil Company

MSDS-510

LAM 026528

EFFECTS OF OVEREXPOSURE	Anesthesia, nausea, headaches, and dizziness. May cause some dehydration of the skin.
EMERGENCY AND FIRST AID PROCEDURES	Remove victim to fresh air, give artificial respiration if breathing has stopped.

SECTION VI REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Sparks and open flame.
INCOMPATIBILITY (Materials to avoid)		Strong oxidizing agents	
HAZARDOUS DECOMPOSITION PRODUCTS			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES	
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	Flush with water, avoid contact with sparks or open flame.
WASTE DISPOSAL METHOD	Flush with water or controlled burning. Do not flush into a confined area.

SECTION VIII SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type)			
VENTILATION	LOCAL EXHAUST	Desirable	SPECIAL
	MECHANICAL (General)	As required to maintain TLV.	OTHER
PROTECTIVE GLOVES	Rubber	EYE PROTECTION	Goggles
OTHER PROTECTIVE EQUIPMENT			

SECTION IX SPECIAL PRECAUTIONS	
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE	Avoid flame or sparks. Polymeric pure product can attack aluminum at elevated temperature.
OTHER PRECAUTIONS	Handle as flammable liquid.

NAME	D. W. Sheets	THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THIS DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF. VENDOR ASSUMES NO RESPONSIBILITY FOR INJURY TO PERSONS OR THINGS CAUSED BY THE MATERIAL IF REASONABLE SAFETY PROCEDURES ARE NOT ADHERED TO AS STIPULATED IN THE DATA SHEET. ADDITIONALLY, VENDOR ASSUMES NO RESPONSIBILITY FOR INJURY TO PERSONS OR THINGS CAUSED BY MISUSE OF THE MATERIAL, EVEN IF REASONABLE SAFETY PROCEDURES ARE FOLLOWED. FURTHERMORE, VENDOR ASSUMES THE RISK IN THE USE OF THE MATERIAL.
TITLE	Product Development-Resins	
COMPANY	Shell Chemical Company	
SIGNATURE	<i>D. W. Sheets</i>	
DATE	October 1971	

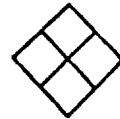
LAM 026529



Shell

Material Safety Data Sheet

RATING



S-11764-2 (2-79)

Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

SECTION I	
MANUFACTURER'S NAME Eastman Kodak	EMERGENCY TELEPHONE NO.
ADDRESS (NUMBER, STREET, CITY, STATE, AND ZIP CODE)	
CHEMICAL NAME AND SYNONYMS	TRADE NAME 1,10-phenanthroline
CHEMICAL FAMILY	MANUFACTURER'S DATE OF ISSUE: 10/9/73

SECTION II		INGREDIENTS			
COMPOSITION	%	SPECIES	LD ₅₀		LC ₅₀
			ORAL	DERMAL	CONCENTRATION
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.					

SECTION III		PHYSICAL DATA	
BOILING POINT (°F)		SPECIFIC GRAVITY (H ₂ O = 1)	
VAPOR PRESSURE (mmHg)		PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR = 1)		EVAPORATION RATE (____ = 1)	
SOLUBILITY IN WATER			
APPEARANCE AND ODOR			

SECTION IV		FIRE AND EXPLOSION HAZARD DATA	
FLASH POINT (METHOD USED)		FLAMMABLE LIMITS	LEL UEL
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

LAM 026530

EASTMAN KODAK COMPANY
APPROVED BY U.S. DEPARTMENT OF LABOR
"ESSENTIALLY SIMILAR" TO FORM OSHA-20



903289

MATERIAL SAFETY DATA SHEET

SECTION I

PRODUCT NAME:	SIZE: 1 g. and 5 g.
CHEMICAL NAME: 1,10-Phenanthroline	
FORMULA: $\text{CH:CHCH:NC:CH:CHC:CN:CHCH:CH:H}_2\text{O}$	
MANUFACTURER: Eastman Kodak Company	
ADDRESS: 343 State Street Rochester, New York 14650	
FOR INFORMATION ON HEALTH HAZARDS CALL: (716) 458-1000 ext. 85556	
FOR OTHER INFORMATION CALL: (716) 458-1000 ext. 72277	INFORMATION EFFECTIVE AS OF: October 9, 1973

SECTION II HAZARDOUS INGREDIENTS OF MIXTURES

PRINCIPAL HAZARDOUS COMPONENT (S)	%	TLV (Units)

SECTION III PHYSICAL DATA

BOILING POINT (°F.)		SPECIFIC GRAVITY (H ₂ O = 1)	
VAPOR PRESSURE (mm Hg.)		PERCENT VOLATILE BY VOLUME (%)	
VAPOR DENSITY (AIR = 1)		EVAPORATION RATE (_____ = 1)	
SOLUBILITY IN WATER	soluble in about 300 parts water		
APPEARANCE AND ODOR	white crystalline powder		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	LeI	UeI
EXTINGUISHING MEDIA	CO ₂ , dry chemical		
SPECIAL FIRE FIGHTING PROCEDURES			

UNUSUAL FIRE AND
EXPLOSION HAZARDS

LAM 026531

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

None assigned by A.C.G.I.H.

EFFECTS OF OVEREXPOSURE

Appears to be of low hazard to health.

EMERGENCY AND FIRST AID PROCEDURES

None appear indicated.

SECTION VI REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATIBILITY (Materials to avoid)			
HAZARDOUS DECOMPOSITION PRODUCTS		toxic fumes	
HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID	
May Occur	Will Not Occur		
	X		

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN
IN CASE MATERIAL IS
RELEASED OR SPILLED

Remove all sources of ignition. Wearing suitable protective clothing, sweep material onto paper. Place in fiber carton. Incinerate. Wash spill area well with soap and water.

WASTE DISPOSAL METHOD

Make up small packages in paper or other flammable material. Burn in incinerator. State and local laws take precedence.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)		
VENTILATION	LOCAL EXHAUST MECHANICAL (general) X	SPECIAL OTHER
PROTECTIVE GLOVES	rubber	EYE PROTECTION safety goggles
OTHER PROTECTIVE EQUIPMENT		

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN
IN HANDLING AND STORING

OTHER PRECAUTIONS

AP-43255A

LAM 026532

ADAPTED FROM MSDS
FORM NO. 150-003-4 MAY 1969



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY MSDS NO. 30221-78
SHELL PIPE LINE CORPORATION

MATERIAL SAFETY DATA SHEET

302, 210

HAZARD
RATING



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SECTION I	
MANUFACTURER'S NAME Union Carbide	EMERGENCY TELEPHONE NO. 304-744-3487
ADDRESS (Number, Street, City, State, and ZIP Code) 270 Park Avenue, New York, New York 10017	
CHEMICAL NAME AND SYNONYMS	TRADE NAME Acetic Acid, Glacial
CHEMICAL FAMILY	FORMULA

SECTION II HAZARDOUS INGREDIENTS*
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.

SECTION III PHYSICAL DATA	
BOILING POINT (°F)	SPECIFIC GRAVITY (H ₂ O = 1)
VAPOR PRESSURE (mmHg)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR = 1)	EVAPORATION RATE (H ₂ O = 1)
SOLUBILITY IN WATER	
APPEARANCE AND ODOR	

SECTION IV FIRE AND EXPLOSION HAZARD DATA	
Flash point (Method used)	FLAMMABLE LIMITS Lel Uel
EXTINGUISHING MEDIA	
SPECIAL FIRE FIGHTING PROCEDURES	
UNUSUAL FIRE AND EXPLOSION HAZARDS	

*Modified by Shell Oil Company

LAM 026533



MATERIAL SAFETY DATA SHEET

(Approved by U.S. Department of Labor "Essentially Similar" to Form LSA-005-4)



PRODUCT NAME:	ACETIC ACID, GLACIAL		
CHEMICAL NAME:	Acetic Acid	CHEMICAL FAMILY:	Acids
FORMULA:	CH ₃ COOH	MOLECULAR WEIGHT:	60.05
SYNONYMS:	Ethanoic Acid; Methane Carboxylic Acid		

I. PHYSICAL DATA			
BOILING POINT, 760 mm. Hg	117.9 °C. (244.2 °F.)	FREEZING POINT	16.7 °C.
SPECIFIC GRAVITY (H ₂ O = 1)	1.0512 at 20/20 °C.	VAPOR PRESSURE AT 20 °C.	11 mm. Hg
VAPOR DENSITY (air = 1)	2.1	SOLUBILITY IN WATER, % by wt.	Complete
PER CENT VOLATILES BY VOLUME	100	EVAPORATION RATE (Butyl Acetate = 1)	0.97
APPEARANCE AND ODOR	Water-white liquid; sharp odor.		

II. HAZARDOUS INGREDIENTS		
MATERIAL	%	TLV (Units)
Acetic Acid	~ 100	10 ppm. v
(See Sections III through VIII)		

III. FIRE AND EXPLOSION HAZARD DATA				
FLASH POINT (test method(s))	106 °F., Tag closed cup ASTM D 55			
FLAMMABLE LIMITS IN AIR, % by volume	LOWER	5.4	UPPER	16.0
EXTINGUISHING MEDIA	Use carbon dioxide or dry chemical for small fires. Use alcohol foam or water spray for large fires.			
SPECIAL FIRE FIGHTING PROCEDURES	Fire fighting personnel should be cautious of irritating vapors that may be evolved from an acetic acid fire. Personnel should be protected by self-contained breathing apparatus and complete protective clothing as needed.			
UNUSUAL FIRE AND EXPLOSION HAZARDS	None			

IV. EMERGENCY PHONE NUMBER	
304/744-3487	
This number is available days, nights, weekends, and holidays.	

While Union Carbide Corporation believes that the data contained herein are factual and the opinions expressed are those of qualified experts regarding the results of the tests conducted, the data are not to be taken as a warranty or representation for which Union Carbide Corporation assumes legal responsibility. They are offered solely for your consultation, investigation, and verification. Any use of these data and information must be determined by the user to be in accordance with applicable Federal, State, and local laws and regulations.

UNION CARBIDE CORPORATION • CHEMICALS AND PLASTICS • 270 PARK AVENUE, NEW YORK, N.Y. 10017

LAM 026534

IV. HEALTH HAZARD DATA	
THRESHOLD LIMIT VALUE	10 ppm. ACGIH (1977) OSHA CFR 29 § 1000 Table G1
EFFECTS OF OVEREXPOSURE	Contact with skin and eye causes burns. Breathing of vapors causes coughing, chest pain, and irritation of nose and throat. May cause nausea and vomiting.
EMERGENCY AND FIRST AID PROCEDURES	Immediately flush skin and eye contact with plenty of water for at least 15 minutes. Get medical care for eyes. If inhaled, remove to fresh air. Give oxygen if breathing is difficult. Call a physician.

V. REACTIVITY DATA			
STABILITY		CONDITIONS TO AVOID	None
UNSTABLE	STABLE		
--	✓		
INCOMPATIBILITY (materials to avoid)		Avoid contamination with alkalies, amines, and nitric acid.	
HAZARDOUS DECOMPOSITION PRODUCTS		Burning can produce carbon monoxide and/or carbon dioxide.	
HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID	None
May Occur	Will not Occur		
--	✓		

VI. SPILL OR LEAK PROCEDURES	
STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	Wear suitable protective equipment. Collect for disposal. See Section VIII. Toxic to fish! Avoid discharge to natural waters.
WASTE DISPOSAL METHOD	Incinerate in a furnace where permitted under appropriate Federal, State, and local regulations. Some supplementary fuel may be required for burning.

LAM 026535

VII. SPECIAL PROTECTION INFORMATION				
RESPIRATORY PROTECTION (specify type)		Fresh-air mask in confined areas		
VENTILATION	LOCAL EXHAUST	Preferable	SPECIAL	--
	MECHANICAL (general)	May not be sufficient	OTHER	--
PROTECTIVE GLOVES		Rubber gloves	EYE PROTECTION	Vapor-proof goggles
OTHER PROTECTIVE EQUIPMENT		Full face mask, impervious apron, eye bath, and safety shower		

VIII. SPECIAL PRECAUTIONS	
PRECAUTIONARY LABELING	ACETIC ACID, GLACIAL DANGER: CAUSES BURNS HARMFUL IF INHALED COMBUSTIBLE Do not get in eyes, on skin, on clothing. Avoid breathing vapor. Keep away from heat and open flame. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling. FIRST AID: In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician. FOR INDUSTRY USE ONLY
OTHER HANDLING AND STORAGE CONDITIONS	Waste streams containing acetic acid could be diluted and neutralized with caustic. The neutralized solutions containing sodium acetate salt should be amenable to biological degradation. Aqueous solutions containing 500 ppm. of sodium acetate have been degraded in acclimated laboratory biological systems.

LAM 026536

ADAPTED FROM MSDS
FORM NO. 113-007-4-MAY 1983



SHELL OIL COMPANY
SHELL CHEMICAL COMPANY
SHELL DEVELOPMENT COMPANY MSDS NO. 30052-78
SHELL PIPE LINE CORPORATION
300,520

HAZARD
RATING



N72A

MATERIAL SAFETY DATA SHEET

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SECTION I	
MANUFACTURER'S NAME Olin Chemicals	EMERGENCY TELEPHONE NO. 203-777-7911
ADDRESS (Number, Street, City, State, and ZIP Code) 120 Long Ridge Road, Stamford, Connecticut 06904	
CHEMICAL NAME AND SYNONYMS	TRADE NAME Sulfuric Acid
CHEMICAL FAMILY	FORMULA

SECTION II HAZARDOUS INGREDIENTS*
THIS PRODUCT IS A PURCHASED MATERIAL. SEE ATTACHED MATERIAL SAFETY DATA SHEET FROM THE MANUFACTURER.

SECTION III PHYSICAL DATA	
BOILING POINT (°F)	SPECIFIC GRAVITY (H ₂ O = 1)
VAPOR PRESSURE (mm-Hg)	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR = 1)	EVAPORATION RATE (H ₂ O = 1)
SOLUBILITY IN WATER	
APPEARANCE AND ODOR	

SECTION IV FIRE AND EXPLOSION HAZARD DATA			
Flash point (Method used)	FLAMMABLE LIMITS	Exp	Det
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

LAM 026537



MATERIAL SAFETY DATA

SECTION I									
Chemical Name & Synonyms Sulfuric Acid (66° Ba°)									
Optical Units Sulfuric Acid			Formula H ₂ SO ₄			Trade Name			
Manufacturer's Name Olim Corporation, 120 Long Ridge Road			Address (Street, Box, City, State, and Zip Code) 120 Long Ridge Road, Stamford, Connecticut 06904				Emergency Telephone No. (203) 344-2241		
SECTION II HAZARDOUS INGREDIENTS									
Component	%	TLV	Component	%	TLV	Component	%	TLV	
Hazardous Materials of Other Liquids, Solids, or Gases									
Corrosive Action on Materials (metals, rubber, plastics, etc.)									
SECTION III PHYSICAL DATA									
Melting Point (°F)		Vapor Pressure (mm Hg @ 20°C)		1		Percent Volatile by Volume (%)			
						Unknown			
Boiling Point (°F)		Vapor Density (Air = 1)		Unknown		Evaporation Rate (Water = 1)			
550									
Specific Gravity (H₂O = 1)		Solubility in Water		Complete		Other			
1.8354									
Appearance and Odor Colorless to cloudy liquid and no odor.									
SECTION IV FIRE AND EXPLOSION HAZARD DATA									
Flash Point (Closed Cup)				Flammable Limits		Exp		Sto	
Extinction Media									
Special Fire Fighting Procedures Cool tank with water if exposed to fire.									
Unusual Fire and Explosion Hazards Explosive concentration of hydrogen gas can accumulate inside metal tanks containing acid.									
SECTION V HEALTH HAZARD DATA									
Inhalation Limit Value 1 mg/m ³		Effects of Overexposure Rapid destruction of tissue on contact, severe burns, corrosive to skin, eyes and mucous membranes.							
Respiratory Irritant.									
Emergency and First Aid Procedures									
Eyes Flush with flowing water at least 15 minutes. Call a physician immediately.									
Ingestion Wash out mouth with water and give plenty of water to drink followed by milk of magnesia; DO NOT INDUCE vomiting. Call a physician.									
Inhalation Remove to fresh air. Call a physician.									
Toxicology Acute Oral LD₅₀ 2140 mg/kg (H ₂ SO ₄)				Eye Irritation Causes severe burns					
Acute Dermal Toxicity				Primary Skin Irritation Corrosive					
Acute Inhalation Toxicity				Other					

Olim CHEMICALS

Olim Corporation, 120 Long Ridge Road, Stamford, Connecticut 06904

LAM 026538

SECTION VI REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	Violent reaction if water spills in acid
HAZARDOUS DECOMPOSITION PRODUCTS NONE			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	
SECTION VII SPILL OR LEAK PROCEDURES			
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Keep people from area and flush area with a plentiful quantity of water — traces of acid can be neutralized with lime or soda ash.			
WASTE DISPOSAL METHOD Neutralize with soda ash or lime and dispose of in accordance with local, state and federal regulations.			
SECTION VIII SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type) Self-contained breathing apparatus (oxygen) or cannister type gas mask.			
VENTILATION	LOCAL EXHAUST	Adequate to keep TLV in Section V below acceptable limits	SPECIAL N A
	MECHANICAL (Specify)	Fan inside building	OTHER
PROTECTIVE CLOVES Gauntlet type rubber or plastic		EYE PROTECTION Chemical safety goggles and face shield.	
OTHER PROTECTIVE EQUIPMENT Rubber poncho, hat, long sleeve shirt, and boots or complete safety suit.			
SECTION IX SPECIAL PRECAUTIONS			
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Do not add water to sulfuric acid storage tank as large amount of heat will be produced.			
OTHER PRECAUTIONS Do not get in eyes, on skin, on clothing. In case of contact, immediately flush with plenty of water for 15 minutes and get medical attention.			
SECTION X REMARKS			

INFORMATION FURNISHED BY: Department of Environmental
Hygiene and Toxicology
(203) 777-7911 (ext. 1734, 416, 1430)

DATE: 5/16/77

Steven J. Barbee, Ph.D.
Toxicologist

Olin CHEMICALS
Olin Corporation, 120 Long Ridge Road, Stamford, Connecticut 06904

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LAM 026539