

Environmental Assessment

EXCENEL* Sterile Suspension (Ceftiofur Hydrochloride)

Submitted by The Upjohn Company

July 1990

***Trademark - The Upjohn Company, 7000 Portage Road, Kalamazoo, MI 49001.**

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Ceftiofur

1. Date

July 1990

2. Name of applicant / petitioner

The Upjohn Company

3. Address

The mailing address of The Upjohn Company is 7000 Portage Road, Kalamazoo, MI 49001. The telephone number for Upjohn's headquarters in Kalamazoo is (616)323-4000.

4. Description of the proposed action

4.1 Request approval - Need for the action

This environmental assessment is necessary for the approval of the new animal drug application (NADA) for sterile suspension ceftiofur hydrochloride. Ceftiofur hydrochloride has been shown to be equally bioavailable to a marketed product, Naxcel Sterile Powder (ceftiofur sodium) and includes no changes in the maximum dosage or indications for use relative to the approved product. Sterile ceftiofur hydrochloride will meet a therapeutic need for the treatment of bovine respiratory disease as does Naxcel Sterile Powder which is approved for use in treatment of bovine respiratory disease (shipping fever).

4.2 Location where the product will be produced

The chemical manufacturing plant where the bulk drug and finished product will be produced is at Upjohn's Portage site facilities located east of Portage Road just south of Bishop Road due north of Centre Street in Portage, Michigan. This site is the Company's main pharmaceutical and chemical manufacturing complex. An existing chemical manufacturing facility will be expanded and appropriately retrofitted in order to accommodate this processing.

4.3 Location where the product will be used

Finished products will be stored in distribution centers prior to transportation for sale at veterinary clinics and animal health outlets. The ultimate use of the finished product will be on the cattle producer's farm or feedlot. It will be administered IM to cattle suffering from bovine respiratory disease. It will be used all over the rural United States but primarily in Texas, Iowa, Kansas, Nevada, Oklahoma, California, Colorado, Missouri, South Dakota, Montana, and Wisconsin. The majority of these cattle raising operations will range anywhere from 100 to 100,000 cattle. Approximately 5 to 50% of the cattle brought to these feedlots will be treated for bovine respiratory disease. If 25% of all possible feedlot calves were treated approximately 27,000 kilograms would be introduced into the environment. Current production is planned at

approximately 3,000 kg. The metabolites of ceftiofur will be excreted in the feces and urine of the treated cattle. These wet feces will be mixed with the excrement of the other cattle. This will result in the destruction of the antibiotic activity of the metabolites. When the remains of these metabolites are spread with the manure on soil, the soil organisms will convert the carbon to CO₂. Therefore, no accumulation of metabolites should occur at the site of use.

4.4 Locations where product will be disposed

Disposal of product may result during manufacturing activities in the form of discarded off specification lots, from the discarding of returned goods; or from end user disposal of individual units of empty or partly empty finished product vials. Bulk quantities of material for disposal will be generated only at the manufacturing site and will be handled with other compatible waste materials resulting from current operations. The present infrastructure at the proposed manufacturing sites provide for a recovery and/or ultimate disposal mechanism.

Individual empty or partly empty end products disposed by consumers will be handled along with household garbage by the community's solid waste management system. Only minute traces of product would be expected to remain with empty product containers.

4.5 Type of environment present at and adjacent to manufacturing locations

The Portage site complex consists of approximately 80 buildings, including chemical/pharmaceutical manufacturing operations, offices, laboratories, utility operations, and various other support buildings (see Appendix A). The plant site occupies a portion of approximately 810 hectares lying south of Bishop Road, east of Portage Road, north of Centre Street, and west of Sprinkle Road in Portage, Michigan. AGA Gas, Inc. is located south of the plant with the remainder of the plant surrounded by farm land and open spaces. The area is relatively flat and rural with the nearest school located approximately three kilometers to the southwest. The area is dominated largely by agriculture, forest land, and undeveloped open spaces. The plant is located, in terms of the Universal Transverse Mercator Coordinate System (UTM), in Zone 16 at 619.1 Km east and 4674.1 Km north, which corresponds to latitude 42° 12'42" north and longitude 85° 33'25" west.

5. Identification of chemical substances that are the subject of the proposed action

The following summary describes the main properties of the ingredients used in the formulation of the drug product:

A. Ceftiofur Hydrochloride (Vet)

7-[[2-(2-AMINO-4THIAZOLYL)-2-(METHOXYIMINO)ACETLY]AMINO]-3-[[2-FURANYL-CARBONYL]THIO]METHYL]-8-OXO-5-THIA-1-AZABICYCLO[4.2.0]OCT-2-ENE-1-CARBOXYLIC ACID MONOHYDROCHLORIDE
U-64,279A

Empirical formula: C₁₉H₁₈C₁N₅O₇S₃

M.W. = 560.01

The drug in question is a cephalosporin analogue from the Clin-Midy Research Center in France. Ceftiofur hydrochloride is an antibiotic active against B-lactamase-producing strains of bacteria and is bactericidal *in vitro*.

B. Cottonseed Oil

Fixed oil from seeds of cultivated varieties of *Gossypium herboceum L.* or other species of *Gossypium* preserved with chlorobutanol.

C. Chlorobutanol

Empirical formula: $C_4H_7Cl_3O$

M.W. = 177.47

Soluble in oils

Preservative for biological fluids, hypodermic solutions and solutions of alkaloids.

The following substances are utilized in the chemical processing for the synthesis of the Ceftiofur bulk drug.

Acetone
Activated carbon
7-Aminocephalosporanic acid
Celite 545 or equivalent
Chloromethylene dimethyliminium chloride
Dimethylformamide
Ethanol
Ethyl-2-(s-aminothiazol-4-yl)-2-methoxyiminoacetate
Ethyl acetate
2-Ethyl hexanoic acid
Furoyl chloride
Hydrochloric acid
Methanol
Methylene chloride
N-heptane
Octane
Oxalyl chloride
Phosphoric acid
Polyvinylpyridine
Pyridine
Sodium hypochlorite
Sodium hydroxide
Sodium sulfide
Tetrahydrofuran
Triethylamine
Triphenylmethyl chloride
Toluene

6. Introduction of substances into the environment - Control Systems

Portions of the materials listed in Section 5 may be released to the environment as a result of the proposed action. These would be generated from the proposed manufacturing site in the form of air emissions, liquid waste streams and solid wastes.

Material Data Safety Sheets have been prepared for ceftiofur and for other substances utilized in the synthesis of ceftiofur or for the formulated product. These are included (see Appendix B) with this EA.

There may be the opportunity for occupational exposure during the manufacture of ceftiofur from dermal or ocular contact and inhalation of dusts or aerosols containing ceftiofur. Employees wear safety glasses with sideshields, protective gloves, protective coverings for other exposed areas of skin, and, when there is a possibility for inhalation of dusts or aerosols containing ceftiofur, an approved respiratory such as M/8710 Dust and Mist Respirator. This particular respirator has been approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health for use with dusts and mists having permissible exposure limits of not less than 0.05 milligrams per cubic meter of air.

6.1 Expansion of the Chemical Processing Building

Aqueous waste streams resulting from chemical processes will be disposed on-site by deep well injection in accordance with this facility's Underground Injection Control permits granted pursuant to the Safe Drinking Water Act.

In respect to our permits to dispose of liquid waste by deep-well injection, our Federal Underground Injection Control Permits do not contain restrictions on the types or concentrations of contaminants in our injected fluid. A majority of the contaminants which are injected are also known to migrate in groundwater. Reliance upon the restriction of contaminants in the injected fluids to specific types is not the means by which groundwater protection is assured. Groundwater is protected through the construction and design of the deep-well, the operating procedures employed and the continuous monitoring program, all of which are described within the permit.

As described previously, our injection permits do not contain restrictions on types or concentrations of contaminants in our injected fluids. Methylene chloride is currently described to U.S. EPA as a component of our wastes for injection.

All chemicals listed in Section 5 may be expected to be included in the injected wastes either through direct discharge of spent materials or as trace contaminants in equipment washings.

In respect to the maintenance of environmental regulatory compliance, the environmental assessment as submitted states under Section 6.2 that waste streams resulting from chemical processes will be disposed of in accordance with this facility's Underground Injection Control permits.

The deep-well injection permit numbers for our wells as assigned by U.S. EPA are MI-077-1W-0001 and MI-007-1W-0002. The expiration date for both permits is October 30, 1990.

Enclosed (see Appendix C) is a copy of the general characterization of injected fluids. Also enclosed is a copy of EPA's UIC permit application form (see Appendix D). This form details the types of information which are required to be submitted prior to the issuance of a permit to inject. In respect to the permit application terminology, The Upjohn Company wells are identified as "Class 1" by U.S. EPA. Class 1 wells are used to inject wastes below the deepest underground source of drinking water. A confining formation consisting of an impermeable geologic strata prevents any upward migration of injected fluids into underground sources of drinking water.

A further description of EPA's requirements for the issuance of UIC permits is contained in 40 CFR Part 144.

Process waste effluents containing appreciable organic solvent concentrations will either be reclaimed at an existing on-site reclamation facility and returned to the manufacturing operations or utilized in off-site industrial fuel programs.

Resulting air emissions will be controlled through vent condensers or caustic scrubbers as applicable.

6.2 *Effect of the Approval of the Proposed Action - Statement of Compliance*

Approval of the proposed action will initially result in the construction of pharmaceutical manufacturing area, modification of existing facilities and the installation of expanded utilities. In turn, air emissions will be exhausted to the atmosphere, liquid wastewater streams will be discharged and solid wastes will be generated. As a long term effect, the approval action will result in the use of resources confined to raw materials and utilities in the manufacturing area. These will be done in compliance with applicable requirements enforced at local and federal levels as appropriate. The following regulations or standards are cited as applicable to the proposed action:

1. Clean Air Act PL 91-604, as amended.
2. Clean Water Act PL 95-217, as amended.
3. Safe Drinking Water Act PL 93-523.

4. Resources Conservation and Recovery Act of 1976 PL 94-580, as amended.
5. Occupational Safety and Health Act of 1970, as amended.
6. Standards from the American National Standards Institute.
7. National Fire Protection Agency Standards.
 - a. National Electrical Code Standards
 - b. Life Safety Requirements
8. Act #348 of 1965, Michigan Air Pollution Act.
9. Act #245 of 1929, Michigan Water Resource Commission Act.
10. Act #399 of 1976, Michigan Safe Drinking Water Act.
11. Act #136 of 1969, Michigan Liquid Industrial Waste Disposal Act.
12. Act #315 of 1969, Michigan Mineral Well Act.
13. Act #641 of 1978, Michigan Solid Waste Management Act.
14. Act #64 of 1979, Michigan Hazardous Waste Management Act.
15. Act #368 of 1978, Public Health Code.
16. Chapter 28 of the Kalamazoo City Code (Services and Wastewater) as amended by ordinance No. 1190.
17. Michigan Occupational Safety and Health Act of 1970, as amended. (Local regulation applicable to the State of Michigan.)

6.3 Use and disposal of products

It is estimated that the initial market volume of the ceftiofur hydrochloride will be approximately 5,000 bulk gallons. The ceftiofur product will constitute two vial sizes. One vial size will contain 1.08 grams of active ceftiofur in a 10 mL suspension of cottonseed oil and will have an estimated market volume of 500,000 vials per year. The other vial size will contain 10.7 grams of active ceftiofur in a 100 mL suspension of cottonseed oil and will have an estimated market volume of 200,000 vials per year. The use of this volume of product will result in minute traces of drug residue to be disposed of in the empty containers having an insignificant impact on the environment.

These containers will be disposed of with the consumer's refuse and will represent an insignificant increase in refuse volume.

7. Fate of emitted substances in the environment

Ceftiofur hydrochloride is equally bioavailable to a marketed product - Naxcel Sterile Powder (ceftiofur sodium) for which an Environmental Assessment has been prepared. The dosage, indications and conditions of use for ceftiofur hydrochloride are identical to those of the previously approved ceftiofur sodium formulation (NADA 140-338, approved by FDA 25 January 1988), and data supporting the environmental fate of ceftiofur sodium are also applicable to ceftiofur hydrochloride.

Sterile suspension of ceftiofur hydrochloride will be administered to cattle suffering from bovine respiratory disease (shipping fever) primarily in feedlots. These feedlots will be feeding anywhere from 100 to 100,000 cattle. The usual sized operation will have 20,000 cattle. If 25% of these animals came down with bovine respiratory disease, that would be 5,000 cattle. If they all weighed 500 lbs and were treated at 1 mg/lb for five days, that feedlot would be exposed to 12.5 kg of ceftiofur.

The metabolism of ceftiofur has been studied in the bovine (see NADA 140-338, Environmental Assessment Appendices F and G). About 83% of the radioactivity is excreted within 24 hours of the last dose. About 55 to 60% is excreted in the urine and about 20 to 30% in the feces. There are five urinary metabolites. These metabolites are equivalent to or less active than ceftiofur against bacteria (see NADA 140-338, Environmental Assessment Appendices H and I). See Table 1. The structures of the feces metabolites are not known. They are very polar and have no antibiotic activity (see NADA 140-338, Environmental Assessment Appendices J and K).

Table 1.

Minimum Inhibitory Concentrations for Ceftiofur and Metabolites ($\mu\text{g/mL}$)

Microorganism	<i>M. luteus</i>	<i>P. Hemolytica</i>	<i>Sal. typhinurium</i>
Ceftiofur	0.25	≤ 0.06	0.25
Metabolite 1	0.25	≤ 0.06	0.5
Metabolite 2	≤ 0.06	≤ 0.06	2.0
Metabolite 3	1.0	≤ 0.06	2.0
Metabolite 4	0.25	≤ 0.06	0.13

Because ceftiofur or its metabolites will first be released to the environment in feces and urine, their stability in these media was studied (see Appendices J and K). It was found that the metabolites lose their antibacterial activity in these matrices in this order: feces>urine/feces>urine. In Table 2 the decline is shown of the urinary metabolites from the heifer which had the highest urinary values to start with.

Table 2.

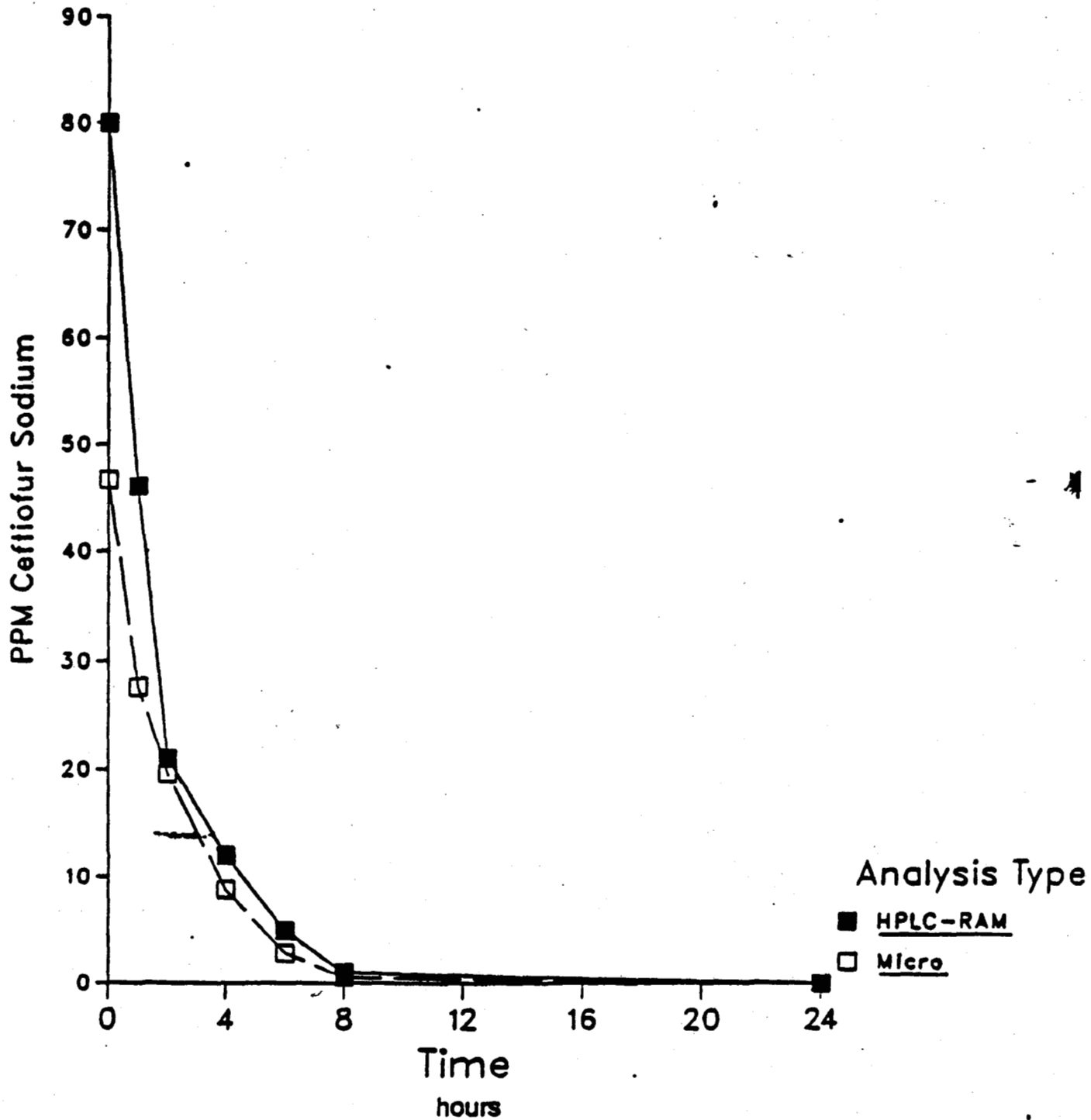
Mean Antibacterial Activity Against *M. Luteus* ($\mu\text{g/g}$)

Metric Time	Urine	1:1 Urine and Feces x 2 to Correct for Dilution
0 h	7.82	4.38
24 h	6.13	2.54
48 h	4.38	0.92
72 h	2.25	<0.01
144 h	0.16	

Figure 1 shows that the destruction is even faster in feces alone. The antibiotic activity falls below the level of detection in 24 hours. The half life is approximately 2 hours. In the typical feedlot operation, manure is stock piled for six months so the treated manure will be mixed with a large amount of untreated manure and it will have sufficient time for the antibiotic activity to be destroyed.

Figure 1

CEFTIOFUR SODIUM SPIKE IN BOVINE FECES Microbiological / HPLC-RAM Data Plot



The manure from the treated animals will be spread on the land for fertilizer in most cases. Therefore, the remains of the metabolites will be exposed to the action of soil microorganisms. The ability of these organisms to convert ceftiofur to CO₂ was studied (see NADA 140-338, Environmental Assessment Appendix L). The half lives for conversion of ceftiofur to CO₂ for three soils are shown in Table 3. The patterns of CO₂ production for these soils are shown in Figures 2, 3 and 4.

Table 3.

Half Lives for Conversion of Ceftiofur to CO₂ by Soil in Days

Origin of Soil	California	Florida	Wisconsin
Type of Soil	Clay Loam	Sand	Silty Clay Loam
T_{1/2}	22.2 d	>49 d	41.4 d

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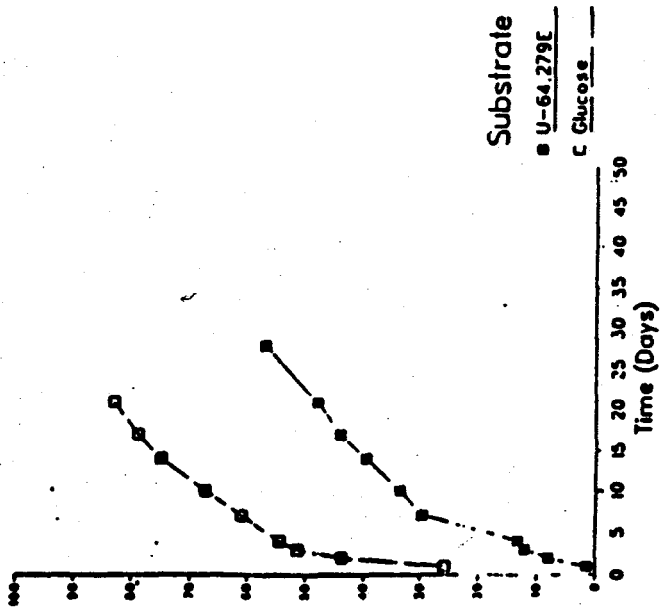


Figure 1. Production of carbon dioxide expressed as a cumulative percent of available carbon from glucose and cellular medium in California clay beam.

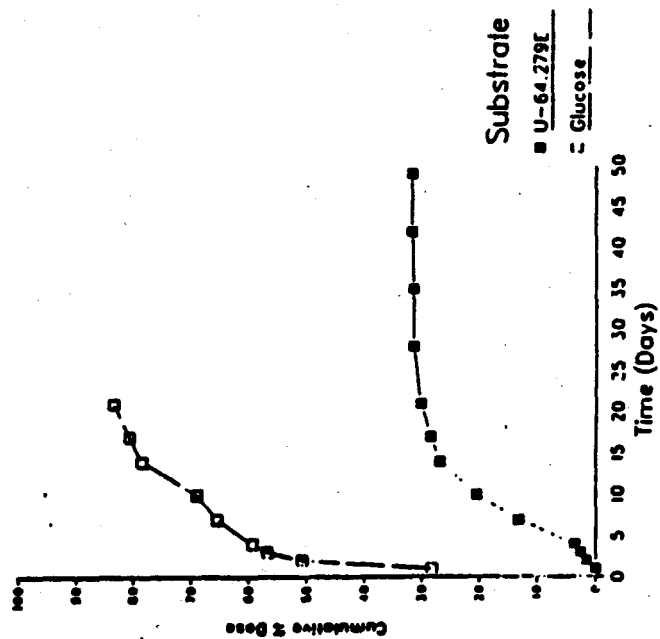


Figure 3. Production of carbon dioxide expressed as a cumulative percent of available carbon from glucose and cellular medium in Florida sand.

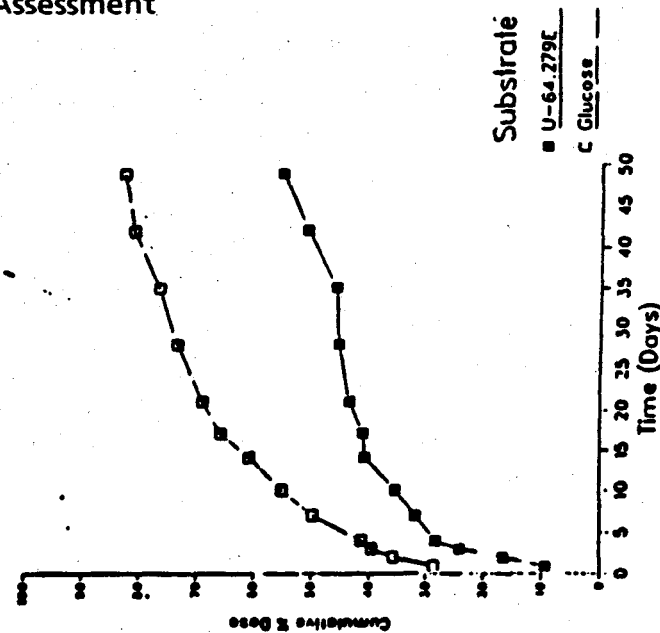


Figure 4. Production of carbon dioxide expressed as a cumulative percent of available carbon from glucose and cellular medium in Wisconsin clay beam.

Ceftiofur was readily aerobically biodegraded to carbon dioxide in excess of 50% of the available carbons in both the California and Wisconsin soils. It was degraded 32% for the Florida sandy soil in 49 days. One possible explanation is that in sandy soil, ceftiofur is degraded to a metabolite which inhibits further degradation. However, the concentration of ceftiofur used in the study, 520 ppm, is one hundred times greater than the concentration coming from the cow. In addition, mainly inactive degraded ceftiofur will reach the soil in animal wastes. Ceftiofur appears to be biodegradable. Concentrations in soil should not get high enough to cause adverse effects.

- (a) Ceftiofur decomposes above 190° without melting (see NADA 140-338, Environmental Assessment Appendix M). It is expected that the metabolites will have similar behavior. Therefore, they should not enter the air.
- (b) The ability of ceftiofur and its metabolites to enter the aqueous environment can be speculated on based on the physical properties of ceftiofur and the information that all the metabolites are more polar and water soluble than ceftiofur. The water solubility of ceftiofur sodium salt and ceftiofur free acid are 400 mg/mL and 0.249 mg/mL, respectively (see NADA 140-338, Environmental Assessment Appendix M). This suggests that ceftiofur and its metabolites could enter the aqueous environment.

The octanol/water partition coefficient gives an idea of the tendency of ceftiofur and its metabolites to remain associated with the aqueous environment. The octanol/water partition coefficients at pH 5 are 0.3 and 0.1 for the sodium salt and free acid, respectively (see NADA 140-338, Environmental Assessment Appendix O). These values can be used to calculate biological concentration factors (BCF) by the following formula (see NADA 140-338, Environmental Assessment Appendix N):

$$\log BCF = 0.76 \log K_{ow} - 0.23$$

The BCFs are 0.235 and 0.102 for the sodium salt and the free acid, respectively. Since these BCFs are less than 100, the compounds should remain in the aqueous environment and no bioaccumulation should occur.

Once ceftiofur or its metabolites reach the aqueous environment, they would be subject to degradation by hydrolysis. The hydrolysis of ceftiofur has been studied (see NADA 140-338, Environmental Assessment Appendix P). The degradation is pH and temperature dependent as is shown in Table 4.

Table 4.

Half Life of Hydrolysis of Ceftiofur in Days

pH	Temperature (°C)	T _{1/2} (Days)
5	22	100.30
5	47	5.46
7	22	8.00
7	47	2.92
9	22	4.18

The rate of hydrolysis and destruction of antibacterial activity increases with increasing temperature and pH. However, at pH 7 and 22°C (common environmental conditions), it would be half destroyed in eight days and completely destroyed in 80 days or less. Since cattle are moved through a typical feedlot in about 120 days, there should be almost twice the time needed for destruction by hydrolysis before the feedlot environment would receive more.

Even though it is unlikely that a significant portion of ceftiofur or its metabolites will be exposed to sunlight, its photodegradation was studied at 300 nm and 22°C, common environmental conditions. The results indicated that solid ceftiofur was degraded 50% in one month and then degraded only slowly (see NADA 140-338, Environmental Assessment Appendix Q). It is believed this is due to the formation of an outer layer of degradation products (which may be polymeric) which protect the inner portion from further degradation. Photolysis also destroyed its antibacterial activity. It is possible that in the aqueous environment, photolysis would contribute to the degradation of ceftiofur.

Ceftiofur is also susceptible to oxidation by H₂O₂ in aqueous solution (see NADA 140-338, Environmental Assessment Appendix M). The products are unknown but they are probably related to the oxidation of sulfur. The metabolites would be susceptible to the same oxidation.

Therefore, it is concluded that any ceftiofur or its metabolites which make it into the aqueous environment will be further degraded by hydrolysis, photolysis, and oxidation. These processes will also destroy the antibacterial activity of these compounds. Eventually they would be more completely destroyed by soil organisms.

- (c) In order to obtain information about the fate of ceftiofur in the terrestrial environment, an aerobic biodegradation of ceftiofur sodium in soil study was run (see NADA 140-338, Environmental Assessment Appendix L). The study showed that ceftiofur had no inhibitory effects on the soil organisms' ability to convert carbon sources to carbon dioxide. It showed that the soil

microorganisms would convert ceftiofur carbon to carbon dioxide. The half lives are shown in Table 3. The shape of the carbon dioxide production versus time curves are shown in Figures 3, 4 and 5. The results show that ceftiofur was readily biodegraded in excess of 50% of the available carbons in the California and Wisconsin soils, but to only 32% in 49 days in the Florida sand soil. Therefore, it can be concluded that ceftiofur will be readily aerobically biodegraded to carbon dioxide in soil and it will not reach concentrations in soil at which adverse effects would occur.

8. Environmental effects of released substances

Ceftiofur hydrochloride is equally bioavailable to a marketed product - Naxcel Sterile Powder (ceftiofur sodium) for which an Environmental Assessment has been prepared. The dosage, indications and conditions of use for ceftiofur hydrochloride are identical to those of the previously approved ceftiofur sodium formulation (NADA 140-338, approved by FDA 25 January 1988), and data supporting the environmental effects of ceftiofur sodium are also applicable to ceftiofur hydrochloride.

The mammalian toxicity of ceftiofur and its metabolites is low. In the dog treated orally for 90 days, the no-observed-effect level (NOEL) was 30 mg/kg/day (see NADA 140-338, Environmental Assessment Appendix R). The NOEL in the 90-day orally dosed rat was 30 mg/kg/day (see NADA 140-338, Environmental Assessment Appendix S). The reproduction NOEL in the rat was 1,000 mg/kg/day (see NADA 140-338, Environmental Assessment Appendix T). If one looks at the example of the 20,000 cattle feedlot with 25% of the cattle being treated for bovine respiratory disease in the same five-day period, one finds that 12.5 kg of ceftiofur would be used. That amount of ceftiofur or its metabolites would be mixed with the manure of the entire 20,000 cattle. For five days that would be 20,000 cattle x 23 kg of wet feces/cow/day x 5 days or 2,300,000 kg of manure. The concentration of ceftiofur would be 12,500,000 mg in 2,300,000 kg of manure or 5.4 mg/kg of manure. No mammal would consume enough manure to get even a minimal toxic effect, and the dilution would get greater with each day the animals remain in the feedlot.

The effects of ceftiofur on five species of fungi growing on three different media were studied (see NADA 140-338, Environmental Assessment Appendix U). The results shown in Table 5 indicate that the MIC's for ceftiofur are all greater than 1,000 µg/g. As can be seen from the previous example of the 20,000 animal feedlot, the concentration of drug would be 5 µg/g in the manure at day six and would have no effect on fungi.

Table 5.

Minimal Inhibitory Concentration (MIC) of Ceftiofur Vs. Environmental Fungi

Organism	MIC (µg/mL) on:		
	CMA	PDA	SDA
<i>Aspergillus carbonarius</i>	>1000	>1000	>1000
<i>Chaetomium cochliodes</i>	>1000	>1000	>1000
<i>Fusarium roseum</i>	>1000	>1000	>1000
<i>Penicillium notatum</i>	>1000	>1000	>1000
<i>Trichoderma viride</i>	>1000	>1000	>1000

Ceftiofur and its metabolites are active against a wide range of bacteria at concentrations which are less than 0.06 µg/g (see NADA 140-338, Environmental Assessment Appendix H). This concentration is much less than the concentration in the 20,000 cattle feedlot manure after 25% of the cattle have been treated for five days. However, since the cattle remain in the feedlot for 100 days or more, there is a further dilution. After 100 days, the amount of wet manure produced would be 20,000 cattle x 23 kg/cow/day x 100 days or 46,000,000 kg of wet manure for a concentration of 0.25 µg/g. This is a considerable dilution but still above the MIC for some very sensitive bacteria. If this manure were spread on the land as fertilizer, a further dilution would occur. The estimate of the weight of wet manure is converted to an estimate of the weight of dry manure by multiplying by 0.1. This gives a weight for the 100-day manure of 4,600,000 kg and a final concentration of 2.7 µg/g or 2,700 µg/kg or 2.7 mg/kg. This leads to a soil concentration of 2.7 mg/kg x 4.5 x 10³ kg/acre ÷ 9.09 x 10⁵ kg/acre = 12.2 x 10³ ÷ 9.09 x 10⁵ = 1.3 x 10² = .013 mg/kg of soil or 0.013 µg/g of soil. This concentration is below the MIC's of most but not all bacteria. However, it should be kept in mind that the antibacterial activity of ceftiofur in the manure will be declining because of hydrolysis (see NADA 140-338, Environmental Assessment Appendix P) and the degradation factor or factors associated with the feces (see NADA 140-338, Environmental Assessment Appendix J). Therefore, little or no antibacterial activity should be present by the time the manure is applied to soil. The biodegradation study (see NADA 140-338, Environmental Assessment Appendix L) showed that the carbons of ceftiofur can be converted to carbon dioxide by soil microorganisms so no residue should build up. Therefore, it is accurate to say that ceftiofur will not have an adverse effect on environmental bacteria.

9. Uses of resources and energy

Ceftiofur hydrochloride is equally bioavailable to a marketed product - Naxcel Sterile Powder (ceftiofur sodium) for which an Environmental Assessment has been prepared. The dosage, indications conditions of use for ceftiofur hydrochloride are identical to those of the previously approved ceftiofur sodium formulation (NADA 140-338, approved by FDA 25 January 1988), and data assessing the utilization of resources and energy associated with ceftiofur sodium are also applicable to ceftiofur hydrochloride.

Beef production will be more efficient because of a reduction in mortality of cattle suffering from respiratory disease and because of a more rapid return to feed. Therefore, there will be no increased demand on natural resources such as land, energy, or water caused by the use of ceftiofur. The increased use of raw materials and utilities for the manufacture should be only a small part of the \$250 million this disease is estimated to cost the cattle industry each year (see NADA 140-338, Environmental Assessment Appendix V).

10. Mitigation measures

Material safety data sheets for hazardous or potentially hazardous materials are made freely available to employees of The Upjohn Company. These documents provide information on potential hazards, personal protective equipment, safe handling practices, and emergency procedures. The material safety data sheet for ceftiofur provides an additional warning to the effect that hypersensitivity to cephalosporins or penicillins may be aggravated by exposure to ceftiofur.

Because ceftiofur may have the potential to cause irritation, and/or allergic reactions, this material has been assigned an Upjohn K precautionary label. The internal label signifies that the material may cause irritation and/or allergic reactions and provides the following warnings to employees:

**"IRRITANT AND/OR SENSITIZER
WARNING!**

Causes irritation or allergic reactions

**Do not get in eyes, on skin or clothing
Avoid breathing dusts, vapor or mist
Use with adequate ventilation
Wash thoroughly after handling**

**Consult Material Safety Data Sheet
for complete information."**

Additionally, the minimum level of personal protective equipment recommended for employees handling ceftiofur includes safety glasses with side shields, protective gloves, and an approved respiratory protective device.

The Upjohn Company has a comprehensive occupational health and safety program. This includes conduct of preplacement physical examinations of employees, and periodic health surveillance examinations of all employees in manufacturing areas. Additionally, the company operates a health clinic to address any employee illness and/or injury occurring during the course of employment. The above procedures will serve to monitor employees for the development of sensitization or other conditions attributable to ceftiofur

exposure. The firm does not conduct patch tests to detect antibiotic sensitization as this technique can contribute to sensitization.

The foregoing will assure protection for individuals handling ceftiofur.

11. Alternatives to the proposed action

No alternatives to the proposed action have been identified.

12. List of preparers

Enclosed is a list of those persons, and corresponding qualifications, that participated in the preparation of this assessment. No government agency was consulted for this specific evaluation other than for routine implementation of ongoing environmental programs conducted at existing facilities.

Mahendra I. Amin	Sr. Scientist Ph.D. Physical Pharmacy 20 years formulation experience
Jay A. Campbell	Associate Director of Chemical Process Research & Development Ph.D.ChE - 6 years of process development experience
John R. Crison	Developmental Pharmacist 9 years formulation experience
Mark W. Gauthier	B.S. Biology 13 years pharmaceutical experience
Elizabeth A. Goes	Manager, Environmental Services M.S. Environmental Health Ph.D. Environmental Health Certified Industrial Hygienist
Terry J. Gilbertson	Manager, Biochemistry & Residue Analysis Ph.D. Organic Chemistry Certified Clinical Chemist 13 years experience with pharmaceutical industry
Robert H. Lichtenheld	Sr. Project Engineer B.S.ChE - 25 years experience Licensed Professional Engineer, State of Michigan
Randal S. Senger	Environmental Engineer B.S.ChE 9 years experience as Environmental Engineer

13. Certification

The undersigned officials certify that the information presented is true, accurate, and complete to the best of their knowledge.

Melvin J. Visser

(Date) July 17, 1990

M. J. Visser

(Signature of responsible official)

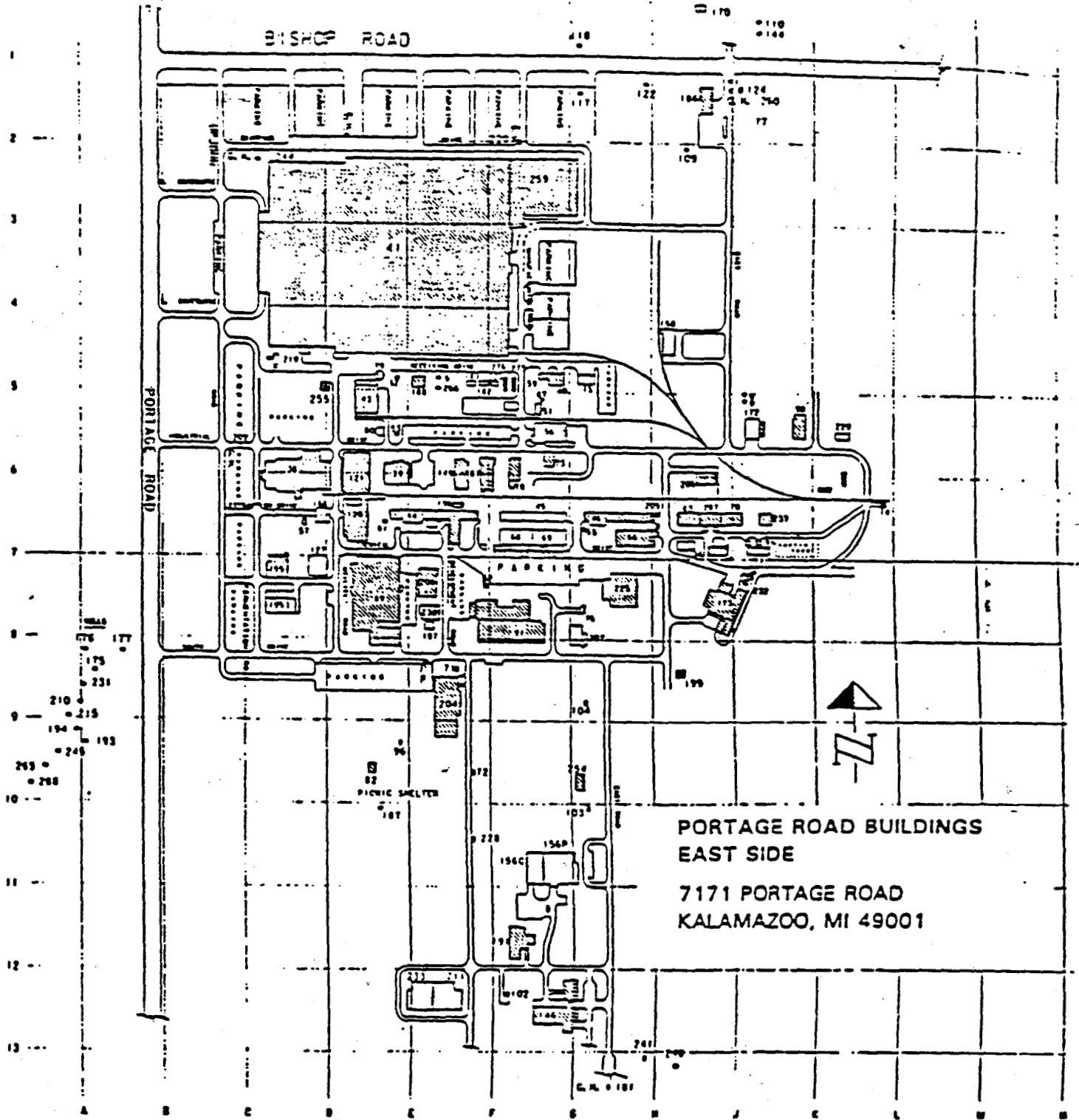
(Title) Vice President, Corporate Engineering, The Upjohn Company

14. References

References pertinent to this Environmental Assessment are included as part of the Environmental Assessment for NADA 140-338, Sterile Powder ceftiofur sodium.

15. Appendices

- A. Upjohn's Portage Site Complex - Figure 14-5**
- B. Material Safety Data Sheets**
- C. General Characteristics of Injected Fluids**
- D. EPA-UIC Permit Application Form**



Appendix B - Material Data Safety Sheets**List of MSDS**

1. Acetone
2. 7-Amino Cephalosporanic Acid
3. Ceftiofur
4. Celite 545
5. Chloromethylene Dimethyliminium Chloride
6. Dimethylformamide
7. Ethyl Alcohol
8. Ethyl Acetate
9. 2-Ethylhexoic Acid
10. 2-Furoyl Chloride
11. Hydrochloric Acid
12. Methanol
13. Methylene Chloride
14. Heptane
15. N-Octane
16. Phosphoric Acid
17. Poly (2-Vinylpyridine)
18. Pyridine
19. Sodium Hypochlorite
20. Sodium Hydroxide
21. Sodium Sulfide
22. Tetrahydrofuran
23. Triethylamine
24. Triphenyl Methyl Chloride
25. Toluene
26. Ethanedioyl Chloride
27. Thiazole
28. Potassium Phosphate Monobasic

Plus two substances used in the formulation of sterile suspension ceftiofur hydrochloride:

1. Cottonseed oil
2. Chlorobutanol

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 1 OF 2

COMMON NAME----- **CEFTIOFUR**
 UPJOHN ID NUMBER----- P-000000-77-7

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00

MANUFACTURER----- THE UPJOHN COMPANY
 7171 PORTAGE RD
 KALAMAZOO, MI 49001

EMERGENCY TELEPHONE----- 616-323-7555 (8:00 A.M. - 4:30 P.M.)
 616-323-6722 (24 HOURS)

PREPARATION DATE----- 01/22/87

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- CEFTIOFUR
 UPJOHN ID NUMBER----- P-000000-77-7

SYNONYMS----- U-64,279

MOLECULAR FORMULA----- C19-H17-O7-N5-S3-NA
 CHEMICAL FAMILY----- ANTIBIOTIC

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WHITE POWDER
 MOLECULAR WEIGHT----- 523.57
 SOLUBILITY IN WATER----- SOLUBLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT ESTABLISHED
 METHOD----- NOT ESTABLISHED

FLAMMABLE LIMITS
 LEL----- NOT ESTABLISHED
 UEL----- NOT ESTABLISHED

EXTINGUISHING MEDIA----- WATER, FOAM, CARBON DIOXIDE, OR CHEMICAL.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
 INCOMPATIBILITY----- NONE.
 CONDITIONS TO AVOID----- NONE.
 HAZARDOUS DECOMPOSITION PRODUCTS-- NONE.
 HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

PERMISSIBLE EXPOSURE LIMIT--NOT ESTABLISHED (29 CFR 1910).
 THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1984-85).
 UPJOHN EXPOSURE GUIDELINE-- NOT ESTABLISHED (1985).
 EFFECTS OF OVEREXPOSURE--- MAY CAUSE SKIN OR EYE IRRITATION AND ALLER-
 GIC REACTIONS.

TOXICITY----- AMES TEST: NOT MUTAGENIC.
 ORAL LD50 (RAT): 7760 MG/KG.
 INHALATION LC50 (RAT): > 8.3 MG/L.
 UNSCHEDULED DNA SYNTHESIS: NEGATIVE.
 MICRONUCLEUS TEST: NOT CLASTOGENIC OR MUT-
 AGENIC.
 V79 ASSAY: NOT MUTAGENIC.
 TERATOGENICITY (RAT): NEGATIVE.
 CARCINOGENICITY: NOT ESTABLISHED.
 EYE IRRITATION (RABBIT): SLIGHT IRRITATION.
 SKIN IRRITATION (RAT): MILD IRRITATION.
 SENSITIZATION (GUINEA PIG): MILD SENSITI-
 ZATION.

MEDICAL CONDITIONS

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 2 OF 2

COMMON NAME----- CEFTIOFUR
UPJOHN ID NUMBER----- P-000000-77-7

SECTION 5 - HEALTH HAZARD (CONTINUED)

AGGRAVATED BY EXPOSURE---- HYPERSENSITIVITY TO CEFTIOFUR, CEPHALOSPORINS OR PENICILLINS.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYES----- FLUSH WITH WATER FOR 15 MINUTES.
SKIN----- WASH WITH SOAP AND WATER.
INHALATION----- REMOVE FROM EXPOSURE.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- WET MOP OR VACUUM UP OR NEUTRALIZE WITH 0.1 N-SODIUM HYDROXIDE.
WASTE DISPOSAL METHOD----- INCINERATE OR SANITARY LANDFILL. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- APPROVED RESPIRATOR.
VENTILATION----- LOCAL EXHAUST: RECOMMENDED.
PROTECTIVE GLOVES----- RUBBER.
EYE PROTECTION----- SAFETY GLASSES WITH SIDE SHIELDS.
OTHER PROTECTIVE EQUIPMENT-- COVERINGS FOR OTHER EXPOSED AREAS OF SKIN.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- AVOID CONTACT WITH EYES, SKIN AND CLOTHING. WASH THOROUGHLY AFTER HANDLING.

SECTION 10 - MSDS PREPARATION INFORMATION

REVISED BY----- JEFFREY S. MEHRING
ENVIRONMENTAL SERVICES
JANUARY 22, 1987

SECTION 11 - UPJOHN DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT SHOULD ONLY BE USED AS A GUIDE. UPJOHN DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM RELIANCE ON THE ABOVE INFORMATION.

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 1 OF 2

COMMON NAME----- ACETONE
CAS NUMBER----- 000067-64-1

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- UNION CARBIDE CORPORATION
CHEMICALS AND PLASTICS
270 PARK AVENUE
NEW YORK, NY 10017

EMERGENCY TELEPHONE----- 212-551-4785 (DR. C. U. DERNEHL)
212-551-2345 (NIGHTS, WEEKENDS, AND HOLIDAYS)

PREPARATION DATE----- UNKNOWN

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- ACETONE
CAS NUMBER----- 000067-64-1

SYNONYMS----- ACETONE, 99.9+%, HPLC GRADE
ACETONE, 99.9%, SEMICONDUCTOR GRADE

MOLECULAR FORMULA----- C3-H6-O
CHEMICAL FAMILY----- KETONE

SECTION 2 - PHYSICAL DATA

APPEARANCE----- HIGHLY FLAMMABLE LIQUID
BOILING POINT----- 56.1 C (AT 760 MMHG)
EVAPORATION RATE----- 14.48 (BUTYL ACETATE = 1)
FREEZING POINT----- -94.7 C
ODOR----- SHARP, PENETRATING, AND NON-RESIDUAL ODOR
SOLUBILITY IN WATER----- COMPLETE
SPECIFIC GRAVITY----- 0.7905 AT 20/20 C; (H2O = 1)
VAPOR DENSITY----- 2.0 (AIR = 1)
VAPOR PRESSURE----- 186 MMHG (AT 20 C)
VOLATILITY----- 100 %

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- -17 C
METHOD----- CC
FLAMMABLE LIMITS
LEL----- 2.6 %
UEL----- 12.8 %
EXTINGUISHING MEDIA----- USE CARBON DIOXIDE OR CHEMICAL FOR SMALL
FIRES. USE ALCOHOL TYPE FOAM FOR LARGE
FIRES.
SPECIAL FIRE FIGHTING PROCEDURES-- DILUTION OF BURNING LIQUID WITH
WATER WILL EFFECT EXTINGUISHMENT.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- NONE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- NONE.
INCOMPATIBILITY----- AVOID CATALYSTS SUCH AS BA(OH)2, NAOH, AND
OTHER ALKALIES; SULFURIC ACID.
HAZARDOUS DECOMPOSITION PRODUCTS-- THERMAL DECOMPOSITION OR BURNING
MAY PRODUCE CARBON MONOXIDE AND/OR CARBON
DIOXIDE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.
CONDITIONS TO AVOID----- AVOID LOW TEMPERATURES WHEN IN THE PRESENCE
OF CATALYSTS-- CONDENSATION WILL OCCUR. IF
THE TEMPERATURE RISES, REACTION STOPS AND
THE MATERIAL WILL COOL DOWN.

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 2 OF 2

COMMON NAME----- ACETONE
CAS NUMBER----- 000067-64-1

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TWA: 750 PPM (ACGIH, 1983-84).
STEL: 1,000 PPM (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE--- PRODUCES A STATE OF STUPOR.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
SKIN CONTACT----- ONLY A SLIGHT HAZARD; HOWEVER, SKIN SHOULD
FLUSHED WITH WATER.
EYE CONTACT----- MODERATE HAZARD TO THE EYE, BUT LIQUID
CONTACT SHOULD BE TREATED WITH FLUSHING OF
EYE WITH WATER FOR 15 MINUTES.
INHALATION----- REMOVE TO FRESH AIR.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED-- ELIMINATE ALL
SOURCES OF IGNITION. FLUSH WITH LARGE
VOLUMES OF WATER.
WASTE DISPOSAL METHOD----- ATOMIZE INTO AN INCINERATOR.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- USE FULL FACE MASK WITH ORGANIC CHEMICAL
CANISTER OR SUPPLIED AIR.
VENTILATION----- LOCAL EXHAUST: PREFERRED.
MECHANICAL: ACCEPTABLE.
PROTECTIVE GLOVES----- RUBBER OR VINYL-COATED GLOVES.
EYE PROTECTION----- FACE SHIELD.
OTHER PROTECTIVE EQUIPMENT-- EYE BATH AND SAFETY SHOWER.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONARY LABELING---- DANGER! EXTREMELY FLAMMABLE! KEEP AWAY
FROM HEAT, SPARKS, AND OPEN FLAME. KEEP
CONTAINER CLOSED. USE WITH ADEQUATE
VENTILATION. AVOID PROLONGED OR REPEATED
CONTACT WITH SKIN. NOT FOR USE AS A DRUG
UNLESS CLEARLY ESTABLISHED AS SAFE FOR THAT
PURPOSE.

SECTION 10 -

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 CONSIDERATION, INVESTIGATION, AND VERIFICATION.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT
WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 1 OF 2

COMMON NAME----- CAL ACTIVATED CARBON
 CAS NUMBER----- 007440-44-0

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00

MANUFACTURER----- CALGON CORPORATION
 PO BOX 1346
 PITTSBURGH, PA 15230

EMERGENCY TELEPHONE----- 412-777-8000

PREPARATION DATE----- 06/26/80

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- CAL ACTIVATED CARBON
 CAS NUMBER----- 007440-44-0

SYNONYMS----- ACTIVATED CARBON
 ACTIVATED CHARCOAL, POWDER
 CARBON BLACK, CI 77266, ACTIVATED CHARCOAL
 CARBON NUCHAR ACTIVATED
 CARBON-12
 CARBON, DECOLORIZING
 CHARCOAL, ACTIVATED
 DARCO G-60
 EDP NUMBER - 119965
 FILTRASORB 200
 U-02

MOLECULAR FORMULA----- C
 CHEMICAL FAMILY----- ACTIVATED CARBON

SECTION 2 - PHYSICAL DATA

APPEARANCE----- BLACK, PARTICULATE SOLID
 BOILING POINT----- NOT PROVIDED
 SOLUBILITY IN WATER----- INSOLUBLE
 VAPOR DENSITY----- NOT PROVIDED
 VAPOR PRESSURE----- NOT PROVIDED
 VOLATILITY----- NOT PROVIDED

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
 METHOD----- NOT APPLICABLE

FLAMMABLE LIMITS
 LEL----- NOT APPLICABLE
 UEL----- NOT APPLICABLE

EXTINGUISHING MEDIA----- IF INVOLVED IN FIRE, FLOOD WITH PLENTY OF WATER.

SPECIAL FIRE FIGHTING PROCEDURES-- NONE.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- CONTACT WITH STRONG OXIDIZERS SUCH AS OZONE, LIQUID OXYGEN, CHLORINE, AND PERMANGANATE MAY RESULT IN FIRE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
 CONDITIONS TO AVOID----- NONE.

INCOMPATIBILITY----- STRONG OXIDIZERS SUCH AS OZONE, LIQUID OXYGEN, CHLORINE AND PERMANGANATE.

HAZARDOUS DECOMPOSITION PRODUCTS-- CARBON MONOXIDE MIGHT BE GENERATED IN THE EVENT OF FIRE.

HAZARDOUS POLYMERIZATION-- NO.
 CONDITIONS TO AVOID----- NONE.

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PAGE 2 OF 2

COMMON NAME----- CAL ACTIVATED CARBON
CAS NUMBER----- 007440-44-0

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT APPLICABLE (ACGIH, 1983-84).
TOXICITY----- ORAL LD50 (RAT) > 10 G/KG. NO ANIMAL MOR-
TALITIES DURING COURSE OF 14-DAY STUDY.
EFFECTS OF OVEREXPOSURE--- PRODUCT IS NOT CORROSIVE OR IRRITATING
(PRIMARY IRRITATION INDEX = 0) OR TOXIC BY
INHALATION WHEN TESTED IN ACCORDANCE WITH
REGULATION GUIDELINES OF THE FEDERAL HAZ-
ARDOUS SUBSTANCES ACT.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
EYES----- DUST MAY BE FLUSHED AWAY WITH WATER.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- SWEEP UP
UNSPENT CARBON AND DISCARD IN REFUSE CON-
TAINER.
WASTE DISPOSAL METHOD----- DISPOSE OF UNSPENT CARBON IN REFUSE CON-
TAINER.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- NIOSH-APPROVED FILTER RESPIRATOR RECOM-
MENDED FOR EXCESSIVE CARBON DUST. GOOD
VENTILATION IS ESSENTIAL DURING OPERATIONS
IN CONFINED OR ENCLOSED AREAS.
VENTILATION----- MECHANICAL: RECOMMENDED.
PROTECTIVE GLOVES----- RUBBER.
EYE PROTECTION----- NONE REQUIRED.
OTHER PROTECTIVE EQUIPMENT-- NONE REQUIRED.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- CAUTION!! WET
ACTIVATED CARBON REMOVES OXYGEN FROM AIR
CAUSING A SEVERE HAZARD TO WORKERS INSIDE
CARBON VESSELS AND ENCLOSED OR CONFINED
SPACES. BEFORE ENTERING SUCH AN AREA,
SAMPLING AND WORK PROCEDURES FOR LOW OXYGEN
LEVELS SHOULD BE TAKEN TO ENSURE AMPLE
OXYGEN AVAILABILITY, OBSERVING ALL LOCAL,
STATE AND FEDERAL REGULATIONS.
OTHER PRECAUTIONS----- NONE.

SECTION 10 - MSDS PREPARATION INFORMATION

PREPARED BY----- E.H. JONES

SECTION 11 -

WHILE THIS INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE
BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, CALGON CORPORATION
MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS ALL LIABILITY FROM
RELIANCE THEREON.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT
WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
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PAGE 1 OF 2

COMMON NAME----- 7-AMINO CEPHALOSPORANIC ACID
UPJOHN ID NUMBER----- P-000001-55-7

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- BRISTOL-MYERS COMPANY, INDUSTRIAL DIVISION
P.O. BOX 657
SYRACUSE, NY 13201

EMERGENCY TELEPHONE----- 315-432-2000

PREPARATION DATE----- 10/30/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- 7-AMINO CEPHALOSPORANIC ACID
UPJOHN ID NUMBER----- P-000001-55-7

MOLECULAR FORMULA----- NOT PROVIDED
CHEMICAL FAMILY----- CEPHALOSPORIN

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WHITE TO OFF-WHITE POWDER
BOILING POINT----- SOLID
EVAPORATION RATE----- NIL
VAPOR DENSITY----- SOLID
VAPOR PRESSURE----- NIL

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT PROVIDED
METHOD----- NOT PROVIDED
FLAMMABLE LIMITS
LEL----- NOT PROVIDED
UEL----- NOT PROVIDED
SPECIAL FIRE FIGHTING PROCEDURES-- NOT APPLICABLE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- DECOMPOSES IN WATER, HIGH TEMPERATURES AND
IN BASIC SOLUTIONS.
INCOMPATIBILITY----- AVOID ALKALI AND MOISTURE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1984-85).
EFFECTS OF OVEREXPOSURE--- KNOWN TO CAUSE ALLERGENIC REACTIONS UPON
REPEATED EXPOSURE.
TOXICITY----- ORAL LD50: GREATER THAN 5 G/KG.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
CONTACT----- FLUSH AREAS OF CONTACT WITH COLD WATER.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- HANDLE
WITH GLOVES AND DUST MASK.
WASTE DISPOSAL METHOD----- WASH AWAY WITH WATER PLUS SODA ASH.

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COMMON NAME----- 7-AMINO CEPHALOSPORANIC ACID
UPJOHN ID NUMBER----- P-000001-55-7

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- DUST MASK - NORTON COMPANY.
VENTILATION----- LOCAL EXHAUST: AS NEEDED.
PROTECTIVE GLOVES----- RECOMMENDED.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- SHOWER AFTER EXPO-
SURE.

SECTION 10 -

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT
WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
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PAGE 1 OF 3

COMMON NAME----- **CELITE 545**
 UPJOHN ID NUMBER----- P-000009-67-2

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00

MANUFACTURER----- MANVILLE INTERNATIONAL CORPORATION
 P.O. BOX 5108
 DENVER, CO 80217

EMERGENCY TELEPHONE----- 303-978-3120

PREPARATION DATE----- 03/27/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- CELITE 545
 UPJOHN ID NUMBER----- P-000009-67-2

MOLECULAR FORMULA----- SI-O2
 CHEMICAL FAMILY----- SILICA

SECTION 2 - PHYSICAL DATA

APPEARANCE----- FINE WHITE POWDER
 AUTOIGNITION TEMPERATURE-- NOT APPLICABLE
 BOILING POINT----- NOT APPLICABLE
 EVAPORATION RATE----- NOT APPLICABLE
 MELTING POINT----- NOT DETERMINED
 ODOR----- NO ODOR
 SOLUBILITY IN WATER----- NEGLIGIBLE
 SPECIFIC GRAVITY----- 2.3 (WATER = 1)
 VAPOR DENSITY----- NOT APPLICABLE
 VAPOR PRESSURE----- NOT APPLICABLE NOT APPLICABLE
 VOLATILITY----- NIL

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NONFLAMMABLE
 METHOD----- NOT PROVIDED

FLAMMABLE LIMITS
 LEL----- NOT APPLICABLE
 UEL----- NOT APPLICABLE

EXTINGUISHING MEDIA----- NOT APPLICABLE.
 SPECIAL FIRE FIGHTING PROCEDURES-- NONE.
 UNUSUAL FIRE OR EXPLOSION HAZARDS-- NONE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
 INCOMPATIBILITY----- HYDROFLUORIC ACID.
 CONDITIONS TO AVOID----- NONE IN DESIGNED USE.
 HAZARDOUS DECOMPOSITION PRODUCTS-- NONE DETERMINED.
 HAZARDOUS POLYMERIZATION-- CANNOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1985-86).
 EFFECTS OF OVEREXPOSURE---- ACUTE: TRANSITORY UPPER RESPIRATORY IRRITANT.
 CHRONIC: LONG TERM, UNPROTECTED EXPOSURE TO DUST LEVELS IN EXCESS OF THE PEL MAY CAUSE LUNG DISEASE (SILICOSIS). FOLLOW THE SAFE HANDLING PRACTICES SHOWN ON THE LABEL. RESPIRABLE DUST FROM THIS PRODUCT WILL TYPICALLY CONTAIN UP TO 60 % FREE CRYSTALLINE SILICA (CRISTOBALITE). AS SUCH IT REPRESENTS A RISK TO THE RESPIRATORY SYSTEM.

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COMMON NAME----- **CELITE 545**
UPJOHN ID NUMBER----- P-000009-67-2

SECTION 5 - HEALTH HAZARD (CONTINUED)

INHALATION: CONGESTION AND IRRITATION OF THE THROAT, NASAL PASSAGES AND UPPER RESPIRATORY SYSTEM.
SKIN CONTACT: NOT APPLICABLE.
SKIN ABSORPTION: NOT APPLICABLE.
INGESTION: NOT HAZARDOUS WHEN INGESTED. GENERALLY REGARDED AS SAFE BY THE FDA.
EYES: TEMPORARY IRRITATION AND INFLAMMATION.

TOXICITY----- CARCINOGENICITY: THIS PRODUCT IS NOT CONSIDERED A CARCINOGEN.

MEDICAL CONDITIONS

AGGRAVATED BY EXPOSURE----- PRE-EXISTING UPPER RESPIRATORY AND LUNG DISEASE SUCH AS, BUT NOT LIMITED TO BRONCHITIS, EMPHYSEMA AND ASTHMA.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYES----- FLUSH WITH COPIOUS QUANTITIES OF WATER FOR A MINIMUM OF 15 MINUTES.

SKIN----- NOT APPLICABLE.

INHALATION----- REMOVE TO FRESH AIR. DRINK WATER TO CLEAR THROAT AND BLOW NOSE.

INGESTION----- NOT APPLICABLE.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- VACUUM CLEAN SPILLAGE. IF SWEEPING IS NECESSARY USE A DUST SUPPRESSANT.

WASTE DISPOSAL METHOD----- WASTES GENERATED DURING APPLICATION, DEMOLITION, BREAKAGE OR SPILLAGE ARE NOT HAZARDOUS WASTES AS DEFINED BY RCRA (40 CFR PART 261). COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS. METHOD OF DISPOSAL-LANDFILL.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION----- USE A RESPIRATOR SUCH AS 3M 9900 OR EQUIVALENT FOR PROTECTION AGAINST PNEUMOCONIOSIS PRODUCING DUSTS. INSURE PROPER RESPIRATORY PROTECTION.

VENTILATION----- USE ADEQUATE EXHAUST. VENTILATION OR DUST COLLECTION.

PROTECTIVE GLOVES----- NOT NORMALLY REQUIRED.

EYE PROTECTION----- NOT NORMALLY REQUIRED.

OTHER PROTECTIVE EQUIPMENT-- NOT APPLICABLE.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- REPAIR ALL BROKEN BAGS IMMEDIATELY.

SECTION 10 - PRODUCT INGREDIENTS

FLUX CALCINED DIATONACEOUS EARTH-- 100 %.
PEL: 0.08 MG/MS RESPIRABLE CRISTOBALITE - CALCULATED ON THE BASIS THAT THIS PRODUCT MAY CONTAIN UP TO 60 % CRYSTALLINE SILICA.

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COMMON NAME----- **CELITE 545**
UPJOHN ID NUMBER----- P-000009-67-2

SECTION 11 - MSDS PREPARATION INFORMATION

PREPARED BY----- **KENNETH A. ROBERTS, MANAGER**
ENVIRONMENTAL SERVICES
MARCH 27, 1985

SECTION 12 -

AS OF THE DATE OF PREPARATION OF THIS DOCUMENT, THE FOREGOING INFORMATION IS BELIEVED TO BE ACCURATE AND IS PROVIDED IN GOOD FATHI TO COMPLY WITH APPLICABLE FEDERAL AND STATE LAW(S). HOWEVER, NO WARRANTY OR REPRESENTATION WITH RESPECT TO SUCH INFORMATION IS INTENDED OR GIVEN.

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 1 OF 2

COMMON NAME----- **CHLOROMETHYLENE DIMETHYLIMINIUM CHLORIDE**
 UPJOHN ID NUMBER----- P-000004-46-8

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00

MANUFACTURER----- THE UPJOHN COMPANY
 FINE CHEMICAL DIVISION
 410 SACKETT POINT RD.
 NORTH HAVEN, CT 06473

EMERGENCY TELEPHONE----- 203-281-2700
 203-281-2704

PREPARATION DATE----- 01/14/86

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- CHLOROMETHYLENE DIMETHYLIMINIUM CHLORIDE
 UPJOHN ID NUMBER----- P-000004-46-8

SYNONYMS----- AMIDE CHLORIDE

MOLECULAR FORMULA----- C3-H7-CL2-N
 CHEMICAL FAMILY----- NOT PROVIDED

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WHITE CRYSTALLINE
 MELTING POINT----- 160 C (DECOMPOSES)
 MOLECULAR WEIGHT----- 127.91

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT ESTABLISHED
 METHOD----- NOT ESTABLISHED

FLAMMABLE LIMITS
 LEL----- NOT ESTABLISHED
 UEL----- NOT ESTABLISHED

EXTINGUISHING MEDIA----- NO INFORMATION FOUND.
 SPECIAL FIRE FIGHTING PROCEDURES-- NO INFORMATION FOUND.
 UNUSUAL FIRE AND EXPLOSION HAZARDS-- REACTS INSTANTLY AND VIOLENTLY
 WITH WATER YIELDING HEAT, HYDROGEN CHLORIDE
 AND DIMETHYLFORMAMIDE.

SECTION 4 - REACTIVITY

STABILITY----- UNSTABLE (WATER REACTIVE).
 INCOMPATIBILITY----- REACTS WITH AMINES, ALCOHOLS.
 HAZARDOUS DECOMPOSITION PRODUCTS-- TOXIC FUMES OF HYDROGEN CHLORIDE.
 HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

PERMISSIBLE EXPOSURE LIMIT--NOT ESTABLISHED (29 CFR 1910).
 THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1985-86).
 UPJOHN EXPOSURE GUIDELINE-- NOT ESTABLISHED (1985).
 EFFECTS OF OVEREXPOSURE---- CORROSIVE TO SKIN AND EYES.
 TOXICITY----- NOT ESTABLISHED; CAUSES SEVERE EYE AND SKIN
 DAMAGE.

MEDICAL CONDITIONS
 AGGRAVATED BY EXPOSURE---- NOT ESTABLISHED.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYES----- FLUSH WITH WATER FOR 15 MINUTES.
 SKIN----- WASH WITH SOAP AND WATER.
 INHALATION----- REMOVE FROM EXPOSURE.

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***** MATERIAL SAFETY DATA SHEET *****

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COMMON NAME----- **CHLOROMETHYLENE DIMETHYLIMINIUM CHLORIDE**
UPJOHN ID NUMBER----- P-000004-46-8

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- WEAR FULL PROTECTIVE EQUIPMENT. SWEEP UP INTO PLASTIC BAGS FOR TRANSPORT TO DISPOSAL SITE. FINALLY CLEAN SPILL AREA BY FLOODING WITH WATER.

WASTE DISPOSAL METHOD----- DISPOSE OF ACCORDING TO FEDERAL, STATE AND LOCAL REGULATIONS. ADD SLOWLY AT A CONTROLLED RATE TO A LARGE VOLUME OF WATER. ADJUST PH WITH LIME.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION----- APPROVED RESPIRATOR.
VENTILATION----- LOCAL EXHAUST: RECOMMENDED.
PROTECTIVE GLOVES----- RUBBER.
EYE PROTECTION----- CHEMICAL GOGGLES AND FACE SHIELD.
OTHER PROTECTIVE EQUIPMENT-- IMPERVIOUS CLOTHING FOR OTHER AREAS OF EXPOSED SKIN.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- DANGER. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH THE SKIN. DO NOT GET IN EYES, ON SKIN OR ON CLOTHING. WASH THOROUGHLY AFTER HANDLING. STORE UNDER NITROGEN.

SECTION 10 - MSDS PREPARATION INFORMATION

REVISED BY----- JEFFREY S. MEHRING
ENVIRONMENTAL SERVICES
JANUARY 14, 1986

SECTION 11 - UPJOHN DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT SHOULD ONLY BE USED AS A GUIDE. UPJOHN DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM RELIANCE ON THE ABOVE INFORMATION.

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 1 OF 2

COMMON NAME----- **DIMETHYLFORMAMIDE**
 CAS NUMBER----- 000068-12-2

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00

MANUFACTURER----- THE UPJOHN COMPANY
 7171 PORTAGE RD
 KALAMAZOO, MI 49001

EMERGENCY TELEPHONE----- 616-323-7555 (8:00 AM - 4:30 PM)
 616-323-6722 (24 HOURS)

PREPARATION DATE----- 05/14/80

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- DIMETHYLFORMAMIDE
 CAS NUMBER----- 000068-12-2

SYNONYMS----- N,N-DIMETHYLFORMAMIDE
 N,N-DIMETHYLFORMAMIDE, 99.9+%, HPLC GRADE
 U-4,224

MOLECULAR FORMULA----- C3-H7-N-O
 CHEMICAL FAMILY----- ALKYL AMIDE

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS LIQUID WITH SLIGHT AMINE ODOR.
 BOILING POINT----- 152 C
 EVAPORATION RATE----- < 1 (BUTYL ACETATE = 1)
 ODOR----- SLIGHT AMINE ODOR
 SOLUBILITY IN WATER----- COMPLETE
 SPECIFIC GRAVITY----- 0.9
 VAPOR DENSITY----- 2.5
 VAPOR PRESSURE----- 2.7 MMHG
 VOLATILITY----- NOT APPLICABLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 67 C
 METHOD----- TOC
 FLAMMABLE LIMITS
 LEL----- 2.2 %
 UEL----- 15.2 %
 EXTINGUISHING MEDIA----- ALCOHOL FOAM.
 SPECIAL FIRE FIGHTING PROCEDURES-- NOT APPLICABLE.
 UNUSUAL FIRE AND EXPLOSION HAZARDS-- UNKNOWN.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
 INCOMPATIBILITY----- HIGHLY HALOGENATED COMPOUNDS, INORGANIC
 NITRATES, TRIETHYL ALUMINUM, CHROMIC AN-
 HYDRIDE.
 HAZARDOUS DECOMPOSITION PRODUCTS-- DIMETHYL AMINE, CARBON MONOXIDE.
 HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TWA: (SKIN) 10 PPM (ACGIH, 1983-84).
 STEL: (SKIN) 20 PPM (ACGIH, 1983-84).
 EFFECTS OF OVEREXPOSURE--- HARMFUL IF INHALED OR ABSORBED THROUGH
 SKIN. SKIN, EYE IRRITATION. NAUSEA, BURN-
 ING ON INHALATION.

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PAGE 2 OF 2

COMMON NAME----- **DIMETHYLFORMAMIDE**
CAS NUMBER----- 000068-12-2

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES-- IF INHALED, REMOVE PERSON TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. FOR DIFFICULT BREATHING GIVE OXYGEN. CALL PHYSICIAN. FLUSH SKIN OR EYES WITH PLENTY OF WATER WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- AVOID BREATHING VAPORS. AVOID CONTACT WITH EYES, SKIN, AND CLOTHING.
WASTE DISPOSAL METHOD----- FLUSH WITH WATER OR RETURN TO CONTAINER. CAN ALSO USE COMBUSTION OR BIOCHEMICAL OXIDATION.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- NONE FOR NORMAL USE.
VENTILATION----- LOCAL EXHAUST: DIRECT OR GENERAL VENTILATION.
MECHANICAL: UNKNOWN.
SPECIAL: NOT APPLICABLE.
OTHER: NOT APPLICABLE.
PROTECTIVE GLOVES----- USE MATERIAL RESISTANT TO DMF.
EYE PROTECTION----- SAFETY GLASSES OR FACE SHIELD.
OTHER PROTECTIVE EQUIPMENT-- APRONS AND BOOTS.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- POLYMERIC MATERIALS USED IN STORING AND HANDLING SHOULD BE SELECTED WITH CARE BECAUSE OF THE STRONG SOLVENT ACTION OF DMF.
OTHER PRECAUTIONS----- WASH THOROUGHLY AFTER HANDLING. WASH CLOTHING BEFORE RE-USE. DISCARD CONTAMINATED SHOES. KEEP CONTAINER CLOSED. USE WITH ADEQUATE VENTILATION.

SECTION 10 - UPJOHN DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT SHOULD ONLY BE USED AS A GUIDE. UPJOHN DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM RELIANCE ON THE ABOVE INFORMATION.

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PAGE 1 OF 3

COMMON NAME----- ETHYL ALCOHOL
CAS NUMBER----- 000064-17-5

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- U.S. INDUSTRIAL CHEMICALS COMPANY
DIV OF NATL DIST & CHEM CORP
99 PARK AVENUE
NEW YORK, NY 10016

EMERGENCY TELEPHONE----- 800-424-9300

PREPARATION DATE----- 07/01/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- ETHYL ALCOHOL
CAS NUMBER----- 000064-17-5

SYNONYMS----- ALCOHOL, ANHYDROUS, REAGENT
DEUTERATED ETHANOL, ANHYDROUS
ETHANOL-D6, ANHYDROUS
ETHYL ALCOHOL, ANHYDROUS, DENATURED
ETHYL ALCOHOL, REAGENT, DENATURED, HPLC GRADE
PROPRIETARY SOLVENT, ANHYDROUS

MOLECULAR FORMULA----- C2-H6-O
CHEMICAL FAMILY----- ALCOHOL

SECTION 2 - INGREDIENTS

INGREDIENT 1
COMMON NAME----- ETHYL ALCOHOL
PERCENT----- 99.5 %
CAS NUMBER----- 000064-17-5
TLV----- 1,000 PPM
REFERENCE----- ACGIH 1984-85

INGREDIENT 2
COMMON NAME----- TOLUENE
PERCENT----- 0.5 %
CAS NUMBER----- 000108-88-3
TLV----- 100 PPM
REFERENCE----- ACGIH 1985-86

SECTION 3 - PHYSICAL DATA

APPEARANCE----- COLORLESS LIQUID
BOILING POINT----- 78 C FOR ETHYL ALCOHOL
EVAPORATION RATE----- 2.8 (N-BUTYL ACETATE = 1); FOR ETHYL ALCOHOL
ODOR----- MILD TOLUENE ODOR
SOLUBILITY IN WATER----- COMPLETE
SPECIFIC GRAVITY----- 0.794 AT 15.6 C (WATER = 1)
VAPOR DENSITY----- 1.59 (AIR = 1); FOR ETHYL ALCOHOL
VAPOR PRESSURE----- 44.6 MMHG AT 19 C; FOR ETHYL ALCOHOL
VOLATILITY----- 100 %

SECTION 4 - FIRE AND EXPLOSION DATA

FLASH POINT----- 12 C
METHOD----- TCC ASTM D-56

FLAMMABLE LIMITS
LEL----- 3.3 % FOR ETHYL ALCOHOL
UEL----- 19 % FOR ETHYL ALCOHOL

EXTINGUISHING MEDIA----- USE DRY CHEMICAL, ALCOHOL FOAM, OR CARBON
DIOXIDE; WATER MAY BE INEFFECTIVE, BUT
WATER SHOULD BE USED TO KEEP FIRE-EXPOSED
CONTAINERS COOL.

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COMMON NAME----- **ETHYL ALCOHOL**
CAS NUMBER----- 000064-17-5

SECTION 4 - FIRE AND EXPLOSION DATA (CONTINUED)

SPECIAL FIRE FIGHTING PROCEDURES-- INDIVIDUALS SHOULD PERFORM ONLY THOSE FIRE FIGHTING PROCEDURES FOR WHICH THEY HAVE BEEN TRAINED. IF A LEAK OR SPILL HAS NOT IGNITED, USE WATER SPRAY TO DISPERSE THE VAPORS AND TO PROTECT MEN ATTEMPTING TO STOP LEAK. WATER SPRAY MAY BE USED TO FLUSH SPILLS AWAY FROM EXPOSURES AND TO DILUTE SPILLS TO NONFLAMMABLE MIXTURES.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- FIREFIGHTERS SHOULD WEAR SELF-CONTAINED BREATHING APPARATUS IN THE POSITIVE PRESSURE MODE WITH A FULL FACEPIECE WHEN THERE IS A POSSIBILITY OF EXPOSURE TO SMOKE, FUMES OR HAZARDOUS DECOMPOSITION PRODUCTS.

SECTION 5 - REACTIVITY

STABILITY----- GENERALLY STABLE.
CONDITIONS TO AVOID----- KEEP AWAY FROM HEAT OR IGNITION SOURCE.
INCOMPATIBILITY----- CONTACT WITH ACETYL CHLORIDE AND A WIDE RANGE OF OXIDIZING AGENTS MAY REACT VIOLENTLY.
HAZARDOUS DECOMPOSITION PRODUCTS-- CARBON MONOXIDE CAN FORM ON INCOMPLETE COMBUSTION.
HAZARDOUS POLYMERIZATION-- NOT LIKELY.

SECTION 6 - HEALTH HAZARD

PERMISSIBLE EXPOSURE LIMIT-1000 PPM (29 CFR 1910).
THRESHOLD LIMIT VALUE----- ETHYL ALCOHOL: 1000 PPM (ACGIH, 1985-86).
TOLUENE: 100 PPM (ACGIH, 1985-86).
EFFECTS OF OVEREXPOSURE--- INHALATION EXPOSURE TO OVER 1000 PPM MAY CAUSE HEADACHE, DROWSINESS AND LASSITUDE, LOSS OF APPETITE AND INABILITY TO CONCENTRATE. IRRITATION OF THE THROAT. INGESTION CAN CAUSE DEPRESSION OF CENTRAL NERVOUS SYSTEM, NAUSEA, VOMITING, DIARRHEA. EYE CONTACT WITH LIQUID OR VAPOR MAY CAUSE IRRITATION. SKIN CONTACT MAY CAUSE IRRITATION AND DEFATTING OF SKIN ON PROLONGED CONTACT.
TOXICITY----- INHALATION LC50 (RAT): 20,000 PPM (10 HRS)
ORAL LD50 (RAT): 7,060 MG/KG.

SECTION 7 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
EYES----- FLUSH EYES WITH WATER AND GET MEDICAL ATTENTION.
SKIN----- IMMEDIATELY FLUSH AFFECTED AREA WITH PLENTY OF COOL WATER. REMOVE AND WASH CONTAMINATED CLOTHING BEFORE REUSE.
INHALATION----- IMMEDIATELY REMOVE VICTIM TO FRESH AIR. IF VICTIM HAS STOPPED BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. GET MEDICAL ATTENTION IMMEDIATELY.
INGESTION----- IF VICTIM IS CONSCIOUS AND ABLE TO SWALLOW, HAVE VICTIM DRINK WATER OR MILK TO DILUTE. NEVER GIVE ANYTHING BY MOUTH IF VICTIM IS UNCONSCIOUS OR HAVING CONVULSIONS. CALL A PHYSICIAN OR POISON CONTROL CENTER IMMEDIATELY. INDUCE VOMITING ONLY IF ADVISED BY PHYSICIAN OR POISON CONTROL CENTER.

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***** MATERIAL SAFETY DATA SHEET *****

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COMMON NAME----- ETHYL ALCOHOL
CAS NUMBER----- 000064-17-5

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- WEAR APPROPRIATE RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING AS DESCRIBED IN SPECIAL HANDLING. CONTAIN SPILLED MATERIAL. TRANSFER TO SECURE CONTAINERS. WHERE NECESSARY, COLLECT USING ABSORBENT MEDIA. IN THE EVENT OF AN UNCONTROLLED RELEASE OF THIS MATERIAL, THE USER SHOULD DETERMINE IF THE RELEASE IS REPORTABLE UNDER APPLICABLE LAWS AND REGULATIONS.

WASTE DISPOSAL METHOD----- ALL RECOVERED MATERIAL SHOULD BE PACKAGED, LABELED, TRANSPORTED AND DISPOSED OR RECLAIMED IN CONFORMANCE WITH APPLICABLE LAWS AND REGULATIONS AND IN CONFORMANCE WITH GOOD ENGINEERING PRACTICES.

SECTION 9 - SPECIAL HANDLING

RESPIRATORY PROTECTION----- WHERE EXPOSURE IS LIKELY TO EXCEED ACCEPTABLE CRITERIA, USE NIOSH/MSHA APPROVED RESPIRATORY PROTECTION EQUIPMENT. RESPIRATORS SHOULD BE SELECTED BASED ON THE FORM AND CONCENTRATION OF CONTAMINANT IN AIR AND IN ACCORDANCE WITH OSHA (29 CFR 1910.134)

VENTILATION----- MECHANICAL.
PROTECTIVE GLOVES----- IMPERVIOUS GLOVES.
EYE PROTECTION----- SAFETY GLASSES.

SECTION 10 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- STORE AWAY FROM OXIDIZING AGENTS; KEEP AWAY FROM IGNITION SOURCES; USE ADEQUATE VENTILATION.

OTHER PRECAUTIONS----- WHEN CONTENTS ARE BEING TRANSFERRED, THE METALLIC CONTAINER MUST BE BONDED TO THE RECEIVING CONTAINER AND GROUNDED TO AVOID STATIC DISCHARGES. NEVER USE PRESSURE TO EMPTY. REPLACE CLOSURE SECURELY AFTER EACH OPENING. KEEP MATERIAL PACKAGED IN DRUMS OR BOTTLES OUT OF SUN AND AWAY FROM HEAT. REMOVE CLOSURE CAREFULLY; INTERNAL PRESSURE MAY BE PRESENT. KEEP CLOSURE UP TO PREVENT LEAKAGE. CONTAINER HAZARDOUS WHEN EMPTIED. NOT FOR HOUSEHOLD USE.

SECTION 11 - MSDS PREPARATION INFORMATION

REVISED BY----- R.J. SPOMER
U.S. INDUSTRIAL CHEMICALS CO.
JULY 1, 1985

SECTION 12 -

THE INFORMATION PRESENTED HEREIN IS BELIEVED TO BE FACTUAL AS IT HAS BEEN DERIVED FROM THE WORKS AND OPINIONS OF PERSONS BELIEVED TO BE QUALIFIED EXPERTS; HOWEVER, NOTHING CONTAINED IN THIS INFORMATION IS TO BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH NATIONAL DISTILLERS AND CHEMICAL CORPORATION BEARS LEGAL RESPONSIBILITY. THE USER SHOULD REVIEW ANY RECOMMENDATIONS IN THE SPECIFIC CONTEXT OF THE INTENDED USE TO DETERMINE WHETHER THEY ARE APPROPRIATE.

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COMMON NAME----- **ATHAET**
CAS NUMBER----- 064485-88-7

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- LONZA INC
22-10 ROUTE 208
FAIR LAWN, NJ 07410

EMERGENCY TELEPHONE----- 800-526-7850 (9 - 5 P.M.)
309-697-5400 (AFTER 5 P.M.)

PREPARATION DATE----- 08/21/84

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- ATHAET
CAS NUMBER----- 064485-88-7

SYNONYMS----- ETHYL 2-AMINO-ALPHA-(METHOXYIMINO)-4-
THIAZOLEACETATE, 97%,

MOLECULAR FORMULA----- C8-H11-N3-O3-S
CHEMICAL FAMILY----- AMINOTHIAZOLE DERIVATIVES

SECTION 2 - PHYSICAL DATA

APPEARANCE----- GREY-BROWNISH POWDER
BOILING POINT----- NOT APPLICABLE
BULK DENSITY----- 0.58 KG/L (APPROXIMATE)
EVAPORATION RATE----- NOT APPLICABLE
MELTING POINT----- 159 - 160 C
MOLECULAR WEIGHT----- 229.26
ODOR----- NOT AVAILABLE
PH OF SOLUTIONS----- NOT APPLICABLE
SOLUBILITY IN SOLVENTS----- 1.9 G/100 G AT 20 C IN ETHANOL
SOLUBILITY IN WATER----- PRACTICALLY INSOLUBLE AT 20 C
VAPOR DENSITY----- NOT APPLICABLE
VAPOR PRESSURE----- NOT APPLICABLE
VISCOSITY----- NOT APPLICABLE
VOLATILITY----- NOT APPLICABLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE

FLAMMABLE LIMITS
LEL----- NOT AVAILABLE
UEL----- NOT AVAILABLE

EXTINGUISHING MEDIA----- FOAM, DRY CHEMICAL, WATER FOG, CARBON
DIOXIDE.

SPECIAL FIRE FIGHTING PROCEDURES-- HEAR USUAL FIRE-PROTECTIVE CLOTHING
AND SELF-CONTAINED BREATHING APPARATUS IN
EMERGENCIES.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- AS WITH MOST POWDERED ORGANIC
COMPOUNDS, DUST EXPLOSION ARE POSSIBLE.

SECTION 4 - REACTIVITY

STABILITY----- MINIMUM 6 MONTHS. STORE IN A DARK PLACE.
DETAILS ON STORAGE STABILITY ARE NOT YET
KNOWN.

CONDITIONS TO AVOID----- NONE KNOWN.

HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

INCOMPATIBILITY----- STRONG OXIDIZERS.

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COMMON NAME----- **ATMAET**
CAS NUMBER----- 064485-88-7

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1985-86).
EFFECTS OF OVEREXPOSURE--- EFFECTS HAVE NOT BEEN STUDIED IN DETAIL.
AS WITH MOST ORGANIC COMPOUNDS, AVOID
OVEREXPOSURE,
TOXICITY----- ORAL LD50 (RATS): GREATER THAN 5000 MG/KG.
SKIN IRRITATION INDEX (METHOD: DOT): 0.4
(PRACTICALLY NON-IRRITANT).

SECTION 6 - HAZARDOUS MATERIALS IDENTIFICATION SYSTEM RATING

NATIONAL FIRE PROTECTION ASSOCIATION:
REACTIVITY----- 1 (SLIGHT).
HEALTH----- 1 (SLIGHT).
FIRE----- 1 (SLIGHT).

SECTION 7 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
EYES----- FLUSH WITH WATER.
SKIN----- WASH WITH WATER AND MILD SOAP.
INHALATION----- REMOVE PERSON TO FRESH AIR.
INGESTION----- INDUCE VOMITING, REFER TO PHYSICIAN IN
SEVERE CASES.

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- COLLECT
MATERIAL IN A PLASTIC CONTAINER; USE
GLOVES, GOGGLES AND A DUST FACE FILTER
MASK.
WASTE DISPOSAL METHODS---- DISPOSE IN ACCORDANCE WITH LOCAL, STATE AND
FEDERAL ORDINANCES; INCINERATE IN A
FURNACE.

SECTION 9 - SPECIAL HANDLING

VENTILATION----- MECHANICAL.
RESPIRATORY PROTECTION---- USE A DUST FACE FILTER MASK.
PROTECTIVE GLOVES----- RUBBER OR PLASTIC.
EYE PROTECTION----- SAFETY GOGGLES OR FACE SHIELD.
OTHER PROTECTIVE EQUIPMENT-- NOT REQUIRED.

SECTION 10 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- NORMAL STORAGE
TEMPERATURE; INDOOR; AVOID HEAT; REFRIGERA-
TION NOT REQUIRED; AVOID DIRECT SUN.
STORE IN A COOL, DRY PLACE, AWAY FROM
SOURCES OF LIGHT. DO NOT INGEST.

SECTION 11 - CHEMICAL NAME

ETHYL-2-(2-AMINOTHIAZOLE-4-YL)-2-
METHOXYIMINOACETATE

SECTION 12 - PRODUCT INGREDIENTS

ETHYL-2-(2-AMINOTHIAZOLE-4-YL)-2-METHOXYIMINOACETATE-- MINIMUM 98 %.

SECTION 13 -

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT
WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
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COMMON NAME----- **ETHYL ACETATE**
CAS NUMBER----- 000141-78-6

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- EASTMAN KODAK COMPANY
KINGSPORT, TN 37662

EMERGENCY TELEPHONE----- 615-247-0411 EXT. 3613 (MON. THROUGH FRI., 8:00 AM T
615-247-0411 EXT. 4666 (ALL OTHER TIMES)

PREPARATION DATE----- 05/17/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- ETHYL ACETATE
CAS NUMBER----- 000141-78-6

SYNONYMS----- ETHYL ACETATE, ANHYDROUS
ETHYL ESTER

MOLECULAR FORMULA----- C4-H8-O2
CHEMICAL FAMILY----- ESTER

SECTION 2 - INGREDIENTS

INGREDIENT 1
COMMON NAME----- ETHYL ACETATE
PERCENT----- 99 %
CAS NUMBER----- 000141-78-6
TLV----- 400 PPM
REFERENCE----- ACGIH 1984-85

INGREDIENT 2
COMMON NAME----- ETHYL ALCOHOL
PERCENT----- 1 %
CAS NUMBER----- 000064-17-5
TLV----- 1,000 PPM
REFERENCE----- ACGIH 1984-85

SECTION 3 - PHYSICAL DATA

APPEARANCE----- CLEAR VOLATILE LIQUID
BOILING POINT----- 75.5 C
EVAPORATION RATE----- 4.1 (N-BUTYL ACETATE = 1)
ODOR----- CHARACTERISTIC FRUITY ODOR
SOLUBILITY IN WATER----- MODERATE
SPECIFIC GRAVITY----- 0.901 AT 20/20 C (H2O = 1)
VAPOR DENSITY----- 3.04 (AIR = 1)
VAPOR PRESSURE----- 86 MMHG AT 20 C
VOLATILITY----- > 99 %

SECTION 4 - FIRE AND EXPLOSION DATA

FLASH POINT----- -4 C
METHOD----- TCC

FLAMMABLE LIMITS
LEL----- 2.02 %
UEL----- 10.7 %

EXTINGUISHING MEDIA----- ALCOHOL FOAM, CHEMICAL, CARBON DIOXIDE,
WATER SPRAY.

SPECIAL FIRE FIGHTING PROCEDURES-- SELF-CONTAINED BREATHING APPARATUS
AND PROTECTIVE CLOTHING SHOULD BE WORN IN
FIGHTING FIRES INVOLVING CHEMICALS.
WATER MAY BE INEFFECTIVE FOR FIRE FIGHTING.
USE WATER SPRAY TO KEEP FIRE-EXPOSED CON-
TAINERS COOL.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- FLAMMABLE LIQUID. VAPORS ARE

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COMMON NAME----- **ETHYL ACETATE**
CAS NUMBER----- 000141-78-6

SECTION 4 - FIRE AND EXPLOSION DATA (CONTINUED)

HEAVIER THAN AIR AND MAY TRAVEL CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

SECTION 5 - REACTIVITY

STABILITY----- STABLE.
CONDITONS TO AVOID----- SPARKS, OPEN FLAMES, SOURCES OF HEAT AND TEMPERATURES OVER 427 C.
INCOMPATIBILITY----- OXIDIZING MATERIALS CAN CAUSE A VIGOROUS REACTION.
HAZARDOUS DECOMPOSITION PRODUCTS-- AS WITH ANY OTHER ORGANIC MATERIAL, COMBUSTION WILL PRODUCE CARBON DIOXIDE AND PROBABLY CARBON MONOXIDE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 6 - HEALTH HAZARD

THRESHOLD LIMIT VALUES---- ETHYL ALCOHOL - TWA: 400 PPM (ACGIH, 1984-85).
EFFECTS OF OVEREXPOSURE---- CONTACT WITH LIQUID OR VAPOR MAY CAUSE EYE IRRITATION. PROLONGED OR REPEATED SKIN CONTACT MAY RESULT IN DRYING AND CRACKING OF THE SKIN. THE VAPOR IS IRRITATING TO MUCOUS MEMBRANES. HIGH VAPOR CONCENTRATIONS MAY PRODUCE NARCOTIC EFFECTS. PROLONGED INHALATION OF HIGH VAPOR CONCENTRATIONS MAY CAUSE LUNG, KIDNEY, LIVER AND HEART DAMAGE.
TOXICITY----- ORAL LD50 (RAT): 5.60 G/KG.
DERMAL LD50 (RABBIT): > 20 ML/KG.
EYE IRRITATION (RABBIT): SLIGHT.

SECTION 7 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
EYE CONTACT----- IRRIGATE IMMEDIATELY AND THOROUGHLY WITH WATER FOR AT LEAST 15 MINUTES AND GET MEDICAL ATTENTION IF ANY SYMPTOMS ARE PRESENT AFTER WASHING.
SKIN CONTACT----- WASH IMMEDIATELY AND THOROUGHLY WITH SOAP AND WATER.
INHALATION----- REMOVE FROM EXPOSURE, TREAT SYMPTOMATICALLY AND GET MEDICAL ATTENTION.

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- ELIMINATE ALL IGNITION SOURCES. FLUSH SPILL AWAY WITH WATER SPRAY. SMALL SPILLS MAY BE COLLECTED WITH ABSORBENT MATERIAL. PREVENT RUNOFF FROM ENTERING DRAINS, SEWERS, OR STREAMS.
WASTE DISPOSAL METHOD----- INCINERATION. OBSERVE ALL FEDERAL, STATE, AND LOCAL LAWS CONCERNING HEALTH AND POLLUTION.

SECTION 9 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- A NIOSH-APPROVED ORGANIC VAPOR RESPIRATOR SHOULD BE WORN IF NEEDED.
VENTILATION----- LOCAL EXHAUST: RECOMMENDED.
MECHANICAL: HOODS, EXHAUST FANS.
PROTECTIVE GLOVES----- RUBBER.
EYE PROTECTION----- SAFETY GLASSES SHOULD BE WORN IN ANY TYPE

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COMMON NAME----- **ETHYL ACETATE**
CAS NUMBER----- 000141-78-6

SECTION 9 - SPECIAL HANDLING (CONTINUED)

OF INDUSTRIAL OPERATION.
OTHER PROTECTIVE EQUIPMENT-- SAFETY SHOWER AND EYE BATH.

SECTION 10 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- MATERIAL IS CLASSIFIED AS A FLAMMABLE LIQUID. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME. KEEP CONTAINER CLOSED. AVOID EYE CONTACT AND PROLONGED OR REPEATED SKIN CONTACT. AVOID PROLONGED BREATHING OF VAPOR. USE WITH VENTILATION ADEQUATE TO MAINTAIN VAPOR CONCENTRATIONS BELOW THE TLV OF 400 PPM FOR ETHYL ACETATE AND 1000 PPM FOR ETHYL ALCOHOL.

OTHER PRECAUTIONS----- FOR SPRAYING OPERATIONS, SEE ALSO 29 CODE OF FEDERAL REGULATIONS 1910.1000, 1910.94, AND 1910.134. HAZARDOUS PRODUCT RESIDUE MAY REMAIN AFTER THE PRODUCT HAS BEEN REMOVED FROM ITS CONTAINER. DO NOT REUSE "EMPTY" CONTAINER WITHOUT COMMERCIAL CLEANING OR RECONDITIONING.

SECTION 11 -

THE INFORMATION CONTAINED HEREIN IS FURNISHED WITHOUT WARRANTY OF ANY KIND. EMPLOYERS SHOULD USE THIS INFORMATION ONLY AS A SUPPLEMENT TO OTHER INFORMATION GATHERED BY THEM AND MUST MAKE INDEPENDENT DETERMINATIONS OF SUITABILITY AND COMPLETENESS OF INFORMATION FROM ALL SOURCES TO ASSURE PROPER USE OF THESE MATERIALS AND THE SAFETY AND HEALTH OF EMPLOYEES.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- 2-ETHYLHEXOIC ACID
CAS NUMBER----- 000149-57-5

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- UNION CARBIDE CORPORATION
CHEMICALS AND PLASTICS
270 PARK AVENUE
NEW YORK, NY 10017

EMERGENCY TELEPHONE----- 304-744-3487

PREPARATION DATE----- 12/08/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- 2-ETHYLHEXOIC ACID
CAS NUMBER----- 000149-57-5

MOLECULAR FORMULA----- C8-H16-O2
CHEMICAL FAMILY----- ACIDS

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS LIQUID
AUTOIGNITION TEMPERATURE-- 315 C (ESTIMATED)
BOILING POINT----- 227 C AT 760 MMHG
EVAPORATION RATE----- < 0.01
FREEZING POINT----- -118.4 C
MOLECULAR WEIGHT----- 144.21
ODOR----- GOATY ODOR
SOLUBILITY IN WATER----- 0.1
SPECIFIC GRAVITY----- 0.9077 AT 20/20 C
VAPOR DENSITY----- 5.0
VAPOR PRESSURE----- < 0.1 MMHG
VOLATILITY----- NIL

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 126 C
METHOD----- COC
FLAMMABLE LIMITS
LEL----- 1.0 % (CALCULATED)
UEL----- 6.2 % (ESTIMATED)
EXTINGUISHING MEDIA----- CARBON DIOXIDE OR DRY CHEMICAL FOR SMALL
FIRES. "ALCOHOL"-TYPE FOAM FOR LARGE FIRES.
SPECIAL FIRE FIGHTING PROCEDURES-- NONE.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- NONE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- NONE.
INCOMPATIBILITY----- AVOID CONTAMINATION WITH STRONG ALKALIES.
HAZARDOUS DECOMPOSITION PRODUCTS-- THERMAL DECOMPOSITION MAY PRODUCE
CARBON MONOXIDE AND/OR CARBON DIOXIDE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NONE.
EFFECTS OF OVEREXPOSURE--- VAPORS MAY IRRITATE EYES, NOSE AND THROAT.
LIQUID CAUSES PRONOUNCED SKIN AND EYE IR-
RITATION.

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COMMON NAME----- **2-ETHYLHEXOIC ACID**
CAS NUMBER----- 000149-57-5

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

INHALATION----- IF INHALED, REMOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS DIFFICULT AND CALL A PHYSICIAN.

SKIN AND EYE CONTACT----- FLUSH WITH PLENTY OF WATER AND THEN WASH SKIN WITH SOAP AND WATER. GET MEDICAL CARE FOR EYES. REMOVE CONTAMINATED CLOTHING.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- FLUSH SPILLED MATERIAL WITH LARGE VOLUMES OF WATER.

WASTE DISPOSAL METHOD----- INCINERATE IN A FURNACE.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- AIR-SUPPLIED MASK IN CONFINED AREAS.

VENTILATION----- LOCAL EXHAUST: PREFERABLE.
MECHANICAL: ACCEPTABLE.

PROTECTIVE GLOVES----- RUBBER GLOVES.

EYE PROTECTION----- MONOGOGGLES.

OTHER PROTECTIVE EQUIPMENT-- SAFETY SHOWER AND EYE BATH.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONARY LABELING---- CAUTION! LIQUID CAUSES EYE AND SKIN IRRITATION. AVOID CONTACT WITH EYES OR SKIN. IN CASE OF CONTACT WITH EYES OR SKIN, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES; FOR EYES, GET MEDICAL ATTENTION. FOR INDUSTRY USE ONLY.

SECTION 10 -

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COMMON NAME----- 2-FUROYL CHLORIDE
CAS NUMBER----- 000527-69-5

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- ALDRICH CHEMICAL COMPANY, INC.
940 WEST ST. PAUL AVENUE
MILWAUKEE, WI 53233

EMERGENCY TELEPHONE----- 314-771-5765

PREPARATION DATE----- 01/28/87

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- 2-FUROYL CHLORIDE
CAS NUMBER----- 000527-69-5

MOLECULAR FORMULA----- C5-H3-CL-O2
CHEMICAL FAMILY----- NOT PROVIDED

SECTION 2 - PHYSICAL DATA

BOILING POINT----- 173 C TO 174 C
MELTING POINT----- -2 C
SPECIFIC GRAVITY----- 1.324

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 185 F
METHOD----- NOT PROVIDED
FLAMMABLE LIMITS
LEL----- NOT PROVIDED
UEL----- NOT PROVIDED
EXTINGUISHING MEDIA----- CARBON DIOXIDE, DRY CHEMICAL POWDER,
ALCOHOL OR POLYMER FOAM.
SPECIAL FIREFIGHTING PROCEDURES- WEAR SELF-CONTAINED BREATHING
APPARATUS AND PROTECTIVE CLOTHING TO
PREVENT CONTACT WITH SKIN AND EYES.
COMBUSTIBLE LIQUID.
UNUSUAL FIRE AND EXPLOSION HAZARDS- EMITS TOXIC FUMES UNDER FIRE
CONDITIONS.

SECTION 4 - REACTIVITY

INCOMPATIBILITIES----- STRONG OXIDIZING AGENTS
STRONG BASES
ALCOHOLS
MAY DECOMPOSE ON EXPOSURE TO MOIST AIR
OR WATER.
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS- TOXIC FUMES OF:
CARBON MONOXIDE AND CARBON DIOXIDE
HYDROGEN CHLORIDE GAS

SECTION 5 - HEALTH HAZARD

EFFECTS OF OVER EXPOSURE-- HARMFUL IF SWALLOWED, INHALED, OR
ABSORBED THROUGH SKIN. MATERIAL IS
EXTREMELY DESTRUCTIVE TO TISSUE OF THE
MUCOUS MEMBRANES AND UPPER RESPIRATORY
TRACT, EYES AND SKIN. INHALATION MAY BE
FATAL AS A RESULT OF SPASM, INFLAMMATION
AND EDEMA OF THE LARYNX AND BRONCHI,
CHEMICAL PNEUMONITIS AND PULMONARY EDEMA.
SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING
SENSATION, COUGHING, WHEEZING,
LARYNGITIS, SHORTNESS OF BREATH,
HEADACHE, NAUSEA AND VOMITING.

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COMMON NAME----- 2-FUROYL CHLORIDE
CAS NUMBER----- 000527-69-5

SECTION 5 - HEALTH HAZARD (CONTINUED)

TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

SECTION 6 - FIRST AID

FIRST AID----- IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. ASSURE ADEQUATE FLUSHING OF THE EYES BY SEPARATING THE EYELIDS WITH FINGERS. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN. CALL A PHYSICIAN. WASH CONTAMINATED CLOTHING BEFORE REUSE. DISCARD CONTAMINATED SHOES.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS FOR MATERIAL RELEASE OR SPILLS- EVACUATE AREA. WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES. ABSORB ON SAND OR VERMICULITE AND PLACE IN CLOSED CONTAINERS FOR DISPOSAL. VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
WASTE DISPOSAL METHODS----- THIS COMBUSTIBLE MATERIAL MAY BE BURNED IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.

SECTION 8 - SPECIAL PRECAUTIONS

PROTECTIVE EQUIPMENT/HANDLING PRECAUTIONS- WEAR APPROPRIATE OSHA/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, AND OTHER PROTECTIVE CLOTHING. SAFETY SHOWER AND EYE BATH. USE ONLY IN A CHEMICAL FUME HOOD. FACESHIELD (8-INCH MINIMUM). DO NOT BREATHE VAPOR. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. AVOID PROLONGED OR REPEATED EXPOSURE. WASH THOROUGHLY AFTER HANDLING. CORROSIVE. LACHRYMATOR. KEEP TIGHTLY CLOSED. MOISTURE-SENSITIVE. KEEP AWAY FROM HEAT AND OPEN FLAME. STORE IN A COOL DRY PLACE.

SECTION 9 - CHEMICAL NAME

2-FUROYL CHLORIDE, 95%

SECTION 10 -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA-ALDRICH SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM THE HANDLING OR FROM ANY CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

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COMMON NAME----- 2-FUROYL CHLORIDE
CAS NUMBER----- 000527-69-5

SECTION 10 - (CONTINUED)

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COMMON NAME----- **HYDROCHLORIC ACID**
CAS NUMBER----- 007647-01-0

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- THE UPJOHN COMPANY
KALAMAZOO, MI 49001

EMERGENCY TELEPHONE----- 616-323-7555 (8:00 AM - 4:30 PM)
616-323-6722 (24 HRS.)
800-424-9300 CHEMTREC

PREPARATION DATE----- 08/24/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- HYDROCHLORIC ACID
CAS NUMBER----- 007647-01-0

SYNONYMS----- CALCI SOLVE
HYDROCHLORIC ACID SOLUTION
HYDROCHLORIC ACID SOLUTION 0.05N
HYDROCHLORIC ACID, AQUEOUS
HYDROCHLORIC ACID, CONCENTRATED
HYDROCHLORIC ACID, 0.1N
HYDROCHLORIC ACID, 1N
HYDROGEN CHLORIDE, 1.0M SOLUTION IN ACETIC ACID
MURIATIC ACID

MOLECULAR FORMULA----- H-CL
CHEMICAL FAMILY----- INORGANIC ACID

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS TO LIGHT YELLOW LIQUID/COLORLESS FUMES
BOILING POINT----- 50 C AT 1 ATM.
ODOR----- SHARP, PUNGENT ODOR
SOLUBILITY IN WATER----- SOLUBLE
SPECIFIC GRAVITY----- 1.184 AT 20 C (WATER = 1)
VAPOR DENSITY----- 1.630 AIR = 1
VAPOR PRESSURE----- 210 MMHG AT 25 C

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE (NO FLASH POINT)
METHOD----- CC ASTM D-93 CLOSED CUP

FLAMMABLE LIMITS
LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
INCOMPATIBILTIIY----- METALS, UNCONTROLLED CONTACT WITH ALKALI OR
CAUSTIC.
HAZARDOUS DECOMPOSITION PRODUCTS-- NONE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- 5 PPM CEILING (AS HCL), 7 MG/M3 (ACGIH,
1983-84).

EFFECTS OF OVEREXPOSURE
INHALATION----- SEVERE IRRITATION OF UPPER RESPIRATORY
TRACT, RESULTING IN COUGH, BURNING OF THE
THROAT AND A CHOKING SENSATION.
EYE EXPOSURE----- CAUSES SEVERE IRRITATION OF THE EYES AND
EYELIDS.

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COMMON NAME----- **HYDROCHLORIC ACID**
CAS NUMBER----- 007647-01-0

SECTION 5 - HEALTH HAZARD (CONTINUED)

SKIN EXPOSURE----- CAUSES SEVERE BURNS.
INGESTION----- CAUSES SEVERE BURNS OF THE MUCOUS MEMBRANES OF THE MOUTH, ESOPHAGUS, AND STOMACH.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

INHALATION----- REMOVE VICTIM TO FRESH AIR. IF BREATHING HAS STOPPED, ARTIFICIAL RESUSITATION SHOULD BE GIVEN. THE PATIENT SHOULD BE KEPT WARM (NOT HOT) AND A PHYSICIAN SHOULD BE CALLED AS SOON AS POSSIBLE. OXYGEN SHOULD BE GIVEN IF AVAILABLE.

EYES----- IRRIGATE WITH WATER FOR 15 MINUTES AND CALL A PHYSICIAN.

SKIN----- CLOTHING SHOULD BE REMOVED WHILE VICTIM IS UNDER EMERGENCY SHOWER. CALL A PHYSICIAN. FLUSH FOR AT LEAST 15 MINUTES.

INGESTION----- IF CONSCIOUS, DRINK COPIOUS AMOUNTS OF LIME WATER, MILK OF MAGNESIA, OR WATER. SUMMON PHYSICIAN. DO NOT INDUCE VOMITING.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- FLUSH WITH LARGE AMOUNTS OF WATER. NEUTRALIZE WITH SODA ASH OR LIME. WEAR PROTECTIVE CLOTHING AND AIR MASKS TO PREVENT CONTACT WITH LIQUID OR VAPOR.

DISPOSAL METHOD----- NEUTRALIZATION WITH SODA ASH OR LIME. FLUSH TO SEWER FOLLOWING LOCAL, STATE, OR FEDERAL GUIDELINES REGARDING SALT CONTENT AND PH LIMITATIONS.

SECTION 8 - SPECIAL HANDLING

SAFETY SHOWERS AND EYE WASH STATIONS SHOULD BE ACCESSIBLE IN ALL WORK STATIONS.

VENTILATION----- LOCAL EXHAUST VENTILATION.

RESPIRATORY PROTECTION----- NIOSH APPROVED EQUIPMENT SHOULD BE WORN. AIR SUPPLIED EQUIPMENT SHOULD BE WORN WHERE TOXIC QUANTITIES MAY BE ENCOUNTERED.

PROTECTIVE CLOTHING----- RAIN SUITS AND CHEMICAL GLOVES, RUBBER BOOTS.

EYE PROTECTION----- NIOSH APPROVED CHEMICAL GOGGLES.

SECTION 9 - SPECIAL PRECAUTIONS

WARNING: PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- DO NOT GET MATERIAL IN EYES OR ON SKIN OR CLOTHING. AVOID BREATHING VAPORS. USE ADEQUATE VENTILATION. IN CASE OF CONTACT, FLUSH WITH GREAT QUANTITIES OF WATER. REMOVE CONTAMINATED SHOES AND CLOTHING.

SECTION 10 - UPJOHN DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT SHOULD ONLY BE USED AS A GUIDE. UPJOHN DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY AS TO THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- METHANOL
CAS NUMBER----- 000067-56-1

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- E.I. DU PONT DE NEMOURS & CO, INC.
WILMINGTON, DE 19898

EMERGENCY TELEPHONE----- 302-774-2421 (PRODUCT INFORMATION AND EMERGENCIES)
800-424-9300 (TRANSPORTATION EMERGENCY PHONE)

PREPARATION DATE----- 07/82

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- METHANOL
CAS NUMBER----- 000067-56-1

SYNONYMS----- AMMONIUM TETRAMETHYL HYDROXIDE
METHANAMINIUM
METHANOL PROTEIN SEQUENCING GRADE
METHYL ALCOHOL
METHYL ALCOHOL, 99.9%, SEMICONDUCTOR GRADE
POTASSIUM HYDROXIDE, 0.1N IN METHANOL
SPIRIT
TETRAMETHYLAMMONIUM HYDROXIDE

MOLECULAR FORMULA----- C-H4-O
CHEMICAL FAMILY----- ALCOHOL

SECTION 2 - PHYSICAL DATA

APPEARANCE----- CLEAR, COLORLESS LIQUID
BOILING POINT----- 64.7 C AT 760 MMHG
EVAPORATION RATE----- 12.5 AT 25 C (BUTYL ACETATE = 1)
MELTING POINT----- -97.8 C
ODOR----- FAINT ALCOHOLIC
SOLUBILITY IN WATER----- 100 %
SPECIFIC GRAVITY----- 0.792 AT 20 C
VAPOR DENSITY----- 1.1 (AIR = 1)
VAPOR PRESSURE----- 138 MMHG AT 25 C; 200 MMHG AT 37.7 C
VOLATILITY----- 100 %

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 11 C
METHOD----- TCC
FLAMMABLE LIMITS
LEL----- 6.0 %
UEL----- 36 %

FIRE AND EXPLOSION HAZARDS-- FLAMMABLE. FLAME IS INVISIBLE IN DAY-LIGHT. METHANOL-WATER MIXTURES WILL BURN UNLESS VERY DILUTE; MIXTURES WITH 25% OR MORE METHANOL ARE DOT CLASS I FLAMMABLE LIQUIDS.

EXTINGUISHING MEDIA----- CHEMICAL, CARBON DIOXIDE, WATER SPRAY, AND ALCOHOL FOAM.

SPECIAL FIRE FIGHTING INSTRUCTIONS-- USE WATER SPRAY TO COOL TANKS OR CONTAINERS.

SECTION 4 - REACTIVITY

INSTABILITY----- STABLE.
INCOMPATIBILITY----- REACTS VIGOROUSLY WITH STRONG OXIDIZERS, CHROMIC ANHYDRIDE, LEAD PERCHLORATE, PERCHLORIC ACIDS.

DECOMPOSITION----- OCCURS FROM HEAT AND REACTION WITH

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COMMON NAME----- METHANOL
CAS NUMBER----- 000067-56-1

SECTION 4 - REACTIVITY (CONTINUED)

POLYMERIZATION----- MATERIALS ABOVE.
WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

EXPOSURE LIMITS----- OSHA 8-HOUR TIME WEIGHTED AVERAGE (TWA) AND
ACGIH TLV TWA: 200 PPM (260 MG/M3). ACGIH
ADDS "SKIN" NOTATION. (ACGIH, 1983-84).

SIGNIFICANT ROUTES AND EFFECTS OF EXPOSURE-- HARMFUL IF INHALED. MAY
BE FATAL OR CAUSE BLINDNESS IF SWALLOWED.
CANNOT BE MADE NONPOISONOUS. MAY CAUSE
IRRITATION.

TOXICITY----- LD50 (ORAL, RATS) = 12,900 MG/KG.
LC50 (RATS, 1 HOUR) = 145,000 PPM.

SAFETY PRECAUTIONS----- AVOID CONTACT WITH EYES, SKIN OR CLOTHING.
AVOID PROLONGED OR REPEATED BREATHING OF
VAPOR. WASH THOROUGHLY AFTER HANDLING.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

IF SWALLOWED----- INDUCE VOMITING IMMEDIATELY BY GIVING TWO
GLASSES OF WATER AND STICKING FINGER DOWN
THROAT.

IF INHALED----- REMOVE TO FRESH AIR. IF NOT BREATHING,
GIVE ARTIFICIAL RESPIRATION; PREFERABLY
MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT,
GIVE OXYGEN. CALL A PHYSICIAN.

IN CASE OF EYE CONTACT---- IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR
AT LEAST 15 MINUTES. CALL A PHYSICIAN.

IN CASE OF SKIN CONTACT--- FLUSH WITH WATER.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

AQUATIC TOXICITY----- TLM 96: > 1000 PPM.

SPILL, LEAK OR RELEASE---- DIKE LARGE SPILLS. FLUSH SPILL AREA WITH
PLENTY OF WATER. DO NOT FLUSH TO SEWER.
COMPLY WITH FEDERAL, STATE, AND LOCAL
REGULATIONS ON REPORTING RELEASES.

WASTE DISPOSAL----- COMPLY WITH FEDERAL, STATE, AND LOCAL REGU-
LATIONS. IF APPROVED, INCINERATION, BIO-
OXIDATION, SUBSURFACE INJECTION, OR DISPOS-
AL CONTRACTOR

SECTION 8 - SPECIAL HANDLING

VENTILATION----- GOOD GENERAL VENTILATION SHOULD BE PROVIDED
TO KEEP VAPOR CONCENTRATIONS BELOW
EXPOSURE LIMITS.

PERSONAL PROTECTIVE EQUIPMENT-- HAVE AVAILABLE AND WEAR WHERE APPRO-
PRIATE: SAFETY GOGGLES, HARD HAT WITH
BRIM, FACE SHIELD (FULL LENGTH), NEOPRENE-
COATED COTTON GLOVES, SOLVENT-RESISTANT
GLOVES, RUBBER SAFETY SHOES OR RUBBER
OVERSHOES, RUBBER APRON, APPROPRIATE
RESPIRATORY PROTECTION.

SECTION 9 -

THE DATA IN THIS MATERIAL SAFETY DATA SHEET RELATES ONLY TO THE SPECI-
FIC MATERIAL DESIGNATED HEREIN AND DOES NOT RELATE TO USE IN COMBINA-
TION WITH ANY OTHER MATERIAL OR IN ANY PROCESS. THE INFORMATION SET
FORTH HEREIN IS FURNISHED FREE OF CHARGE AND IS BASED ON TECHNICAL
DATA THAT DUPONT BELIEVES TO BE RELIABLE. IT IS INTENDED FOR USE BY
PERSONS HAVING TECHNICAL SKILL AND AT THEIR OWN DISCRETION AND RISK.

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COMMON NAME----- **METHANOL**
CAS NUMBER----- 000067-56-1

SECTION 9 - (CONTINUED)

SINCE CONDITIONS OF USE ARE OUTSIDE OUR CONTROL, WE MAKE NO WARRANTIES EXPRESS OR IMPLIED, AND ASSUME NO LIABILITY IN CONNECTION WITH ANY USE OF THIS INFORMATION. NOTHING HEREIN IS TO BE TAKEN AS A LICENSE TO OPERATE UNDER OR A RECOMMENDATION TO INFRINGE ANY PATENTS.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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***** MATERIAL SAFETY DATA SHEET *****

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COMMON NAME----- METHYLENE CHLORIDE
CAS NUMBER----- 000075-09-2

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- DIAMOND SHAMROCK CORPORATION
DIVISIONAL TECHNICAL CENTER
P.O. BOX 191
PAINESVILLE, OH 44077

EMERGENCY TELEPHONE----- 000-000-0000 CONTACT LOCAL SALES OFFICE
216-357-7070

PREPARATION DATE----- 11/11/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- METHYLENE CHLORIDE
CAS NUMBER----- 000075-09-2

SYNONYMS----- DICHLOROMETHANE
DICHLOROMETHANE, RECOVERED

MOLECULAR FORMULA----- C-H2-CL2
CHEMICAL FAMILY----- CHLORINATED HYDROCARBONS

SECTION 2 - PHYSICAL DATA

APPEARANCE----- CLEAR, COLORLESS LIQUID
AUTOIGNITION TEMPERATURE-- 662 C
BOILING POINT----- 39.8 C
EVAPORATION RATE----- 0.62 ETHER = 1
FREEZING POINT----- -96.7 C
MELTING POINT----- NOT APPLICABLE
ODOR----- ETHER-LIKE ODOR
PH OF SOLUTIONS----- NOT APPLICABLE
SOLUBILITY IN WATER----- 1.3 % BY WT.
SPECIFIC GRAVITY----- 1.32 WATER = 1
VAPOR DENSITY----- 2.93 AIR = 1
VAPOR PRESSURE----- 420 MMHG AT 25 C
VOLATILITY----- 100

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NONE
METHOD----- TCC

FLAMMABLE LIMITS
LEL----- 14 %
UEL----- 25 %

EXTINGUISHING MEDIA----- FIRES INVOLVING THIS PRODUCT ARE UNLIKELY,
BUT SHOULD ONE OCCUR, IT MAY BE CONTROLLED
BY CARBON DIOXIDE, DRY CHEMICALS OR WATER
SPRAY.

SPECIAL FIRE FIGHTING PROCEDURES-- PRESSURE-DEMAND, SELF-CONTAINED
RESPIRATORY PROTECTION SHOULD BE PROVIDED
FOR FIRE FIGHTERS IN BUILDINGS OR CONFINED
AREAS WHERE THIS PRODUCT IS STORED. STORAGE
CONTAINERS EXPOSED TO FIRE SHOULD BE KEPT
COOL WITH A WATER SPRAY, IN ORDER TO PRE-
VENT PRESSURE BUILD-UP.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- THIS PRODUCT IS NONFLAMMABLE AND
NONEXPLOSIVE UNDER NORMAL CONDITIONS OF
USE. AT HIGH TEMPERATURES, THIS PRODUCT DE-
COMPOSES TO GIVE OFF HYDROCHLORIC ACID AS
GAS PLUS OTHER TOXIC AND IRRITATING VAPORS
SUCH AS PHOSGENE. IF STORAGE CONTAINERS ARE
EXPOSED TO EXCESSIVE HEAT, OVER-PRESSURI-
ZATION OF THE CONTAINERS CAN RESULT.

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COMMON NAME----- METHYLENE CHLORIDE
CAS NUMBER----- 000075-09-2

SECTION 4 - REACTIVITY

STABILITY----- UNDER NORMAL CONDITIONS OF USE, METHYLENE CHLORIDE IS STABLE.
INCOMPATIBILITY----- AVOID CONTACTING METHYLENE CHLORIDE WITH PURE OXYGEN, ALKALI METALS, OPEN FLAMES, AND ELECTRICAL ARCS.
HAZARDOUS DECOMPOSITION PRODUCTS-- AT HIGH TEMPERATURES, METHYLENE CHLORIDE DECOMPOSES TO GIVE OFF HYDROGEN CHLORIDE VAPOR AND SMALL QUANTITIES OF OTHER TOXIC AND IRRITATING VAPORS SUCH AS PHOSGENE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

PERMISSIBLE EXPOSURE LIMIT-500 PPM (8-HOUR TWA).
THRESHOLD LIMIT VALUE----- 100 PPM (ACGIH, 1985-86).
EFFECTS OF OVEREXPOSURE--- EXCESSIVE INHALATION OR INGESTION MAY PRODUCE SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION RANGING FROM LIGHT-HEADEDNESS, TO UNCONSCIOUSNESS AND DEATH. EXPOSURE OF THE EYES AND SKIN MAY PRODUCE IRRITATION. CAN CAUSE HEADACHE, MENTAL CONFUSION, DEPRESSION, FATIGUE, LOSS OF APPETITE, NAUSEA, VOMITING, COUGH, LOSS OF SENSE OF BALANCE, AND VISUAL DISTURBANCES. PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE DERMATITIS.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
EYES----- IMMEDIATELY FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES, HOLDING LIDS APART TO ENSURE FLUSHING OF THE ENTIRE EYE SURFACE. SEEK MEDICAL ATTENTION IMMEDIATELY.
SKIN----- WASH CONTAMINATED AREA WITH SOAP AND WATER. A SOOTHING OINTMENT MAY BE APPLIED TO IRRITATED SKIN AFTER CLEANSING. REMOVE CONTAMINATED CLOTHING AND FOOTWEAR AND WASH CLOTHING BEFORE REUSE. DISCARD FOOTWEAR WHICH CANNOT BE DECONTAMINATED. SEEK MEDICAL ATTENTION.
INHALATION----- GET PERSON OUT OF CONTAMINATED AREA TO FRESH AIR. IF BREATHING HAS STOPPED ARTIFICIAL RESPIRATION SHOULD BE STARTED. OXYGEN MAY BE ADMINISTERED, IF READILY AVAILABLE. SEEK MEDICAL ATTENTION IMMEDIATELY.
INGESTION----- NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. HAVE CONSCIOUS PATIENT DRINK SEVERAL GLASSES OF WATER THEN INDUCE VOMITING BY HAVING PATIENT TICKLE BACK OF THROAT WITH FINGER. KEEP AIRWAY CLEAR. SEEK MEDICAL ATTENTION IMMEDIATELY.

SECTION 7 - NOTES TO PHYSICIAN

METHYLENE CHLORIDE OVEREXPOSURE CAN PRODUCE ELEVATED CARBOXYHEMOGLOBIN LEVELS.

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED-- LEAKS SHOULD BE STOPPED. SPILLS SHOULD BE CLEANED UP
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COMMON NAME----- METHYLENE CHLORIDE
 CAS NUMBER----- 000075-09-2

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES (CONTINUED)

IMMEDIATELY. LARGE SPILLS SHOULD BE CONTAINED AND REMOVED BY VACUUM TRUCK. SMALLER SPILLS MAY BE SOAKED UP WITH ABSORBENT MATERIALS, WHICH SHOULD BE PLACED IN CLOSED CONTAINERS, LABELED AND STORED IN A SAFE IN A SAFE PLACE OUT OF DOORS TO AWAIT PROPER DISPOSAL. PERSONS PERFORMING THIS WORK SHOULD WEAR ADEQUATE PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING. THE SPILL AREA SHOULD THEN BE FLUSHED WITH WATER. ALL RINSATE SHOULD BE REMOVED AND PLACED IN APPROVED CONTAINERS TO AWAIT PROPER TREATMENT OR DISPOSAL. SPILLS ON AREAS OTHER THAN PAVEMENT MAY BE HANDLED BY REMOVING THE AFFECTED SOILS AND PLACING IN APPROVED CONTAINERS.

WASTE DISPOSAL METHOD----- THE MATERIALS RESULTING FROM CLEAN-UP OPERATIONS MAY BE HAZARDOUS WASTES AND THEREFORE, SUBJECT TO SPECIFIC REGULATIONS. PACKAGE, STORE, TRANSPORT AND DISPOSE OF ALL CLEAN-UP MATERIALS AND ANY CONTAMINATED EQUIPMENT IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL HEALTH AND ENVIRONMENTAL REGULATIONS. SHIPMENTS OF WASTE MATERIAL MAY BE SUBJECT TO MANIFESTING REQUIREMENTS PER APPLICABLE REGULATIONS. APPROPRIATE DISPOSAL WILL DEPEND ON THE NATURE OF EACH WASTE MATERIAL AND SHOULD BE PERFORMED BY COMPETENT PROPERLY PERMITTED CONTRACTORS. ENSURE THAT ALL RESPONSIBLE FEDERAL, STATE AND LOCAL AGENCIES RECEIVE TIMELY AND PROPER NOTIFICATIONS OF THE SPILL AND DISPOSAL OF WASTE.

SECTION 9 - SPECIAL HANDLING

VENTILATION----- WORK AREAS EMPLOYING METHYLENE CHLORIDE SHOULD BE ISOLATED AND CONTAINED AND PROVIDED WITH ADEQUATE LOCAL EXHAUST VENTILATION TO MAINTAIN THE AIR CONCENTRATION OF METHYLENE CHLORIDE BELOW 500 PPM (8-HOUR TWA) AS REQUIRED BY OSHA.

RESPIRATORY PROTECTION---- RESPIRATION PROTECTION IS NOT REQUIRED UNDER NORMAL USE. HOWEVER, USE A NIOSH/MSHA APPROVED RESPIRATOR FOLLOWING MANUFACTURER'S RECOMMENDATIONS WHERE VAPOR, MIST OR SPRAY MAY BE GENERATED.

EYE PROTECTION----- CHEMICAL SAFETY GOGGLES AND PLASTIC FACE SHIELD SHOULD BE WORN WHEN THERE IS A DANGER OF SPLASHING. SPECTACLE-TYPE GLASSES DO NOT PROVIDE SATISFACTORY PROTECTION.

PROTECTIVE GLOVES----- IMPERVIOUS GLOVES SHOULD BE WORN. GLOVES CONTAMINATED WITH THE PRODUCT SHOULD BE DISCARDED. POLYFLUORINATED POLYETHYLENE HAS BEEN SUGGESTED.

OTHER PROTECTIVE EQUIPMENT-- HARD HATS, CHEMICAL-RESISTANT SAFETY SHOES AND PLASTIC APRON SHOULD BE WORN WHEN HANDLING METHYLENE CHLORIDE. EYE BATH AND SAFETY SHOWER SHOULD BE PROVIDED IN ALL AREAS IN WHICH METHYLENE CHLORIDE IS USED AND/OR HANDLED.

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COMMON NAME----- METHYLENE CHLORIDE
CAS NUMBER----- 000075-09-2

SECTION 10 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- DANGER! VOLATILE SOLVENT. PROLONGED BREATHING OF VAPOR CAN CAUSE LOSS OF CONSCIOUSNESS AND MAY RESULT IN DEATH. CAUSES IRRITATION OF EYES, SKIN AND RESPIRATORY TRACT. DO NOT GET IN EYES, ON SKIN OR CLOTHING. DO TAKE INTERNALLY. AVOID BREATHING VAPORS. WASH THOROUGHLY AFTER HANDLING. AVOID CONTACT WITH FLAMES, HOT GLOWING SURFACES, OR ALKALI METALS TO PREVENT DECOMPOSITION RESULTING IN TOXIC AND IRRITATING VAPORS. KEEP CONTAINER TIGHTLY CLOSED. STORE IN COOL, VENTILATED PLACE.

SECTION 11 - REMARKS

STORAGE----- UNDER NORMAL CONDITIONS, METHYLENE CHLORIDE MAY BE STORED SATISFACTORILY IN GALVANIZED IRON, BLACK IRON OR STEEL. ALUMINUM IS NOT GENERALLY RECOMMENDED FOR STORAGE OR HANDLING. STORE DRUMS IN A COOL PLACE (BUNGS UP AND CLOSED TIGHTLY). VENTILATION SHOULD BE PROVIDED AT THE FLOOR LEVEL. DO NOT STORE IN PITS, DEPRESSIONS, BASEMENTS OR UNVENTILATED AREAS. ALL TANKS SHOULD HAVE A TOP AND BOTTOM MANHOLE AND A VENT OF A DIAMETER AT LEAST EQUAL TO THAT OF THE FILL OR DISCHARGE PIPE. VENT INDOOR TANKS OUTSIDE IN A LOCATION SUCH THAT ESCAPING VAPOR WILL NOT CONTAMINATE ANY WORK SPACE AIR. VERTICAL TANKS SHOULD BE OF THE CLOSED-TOP DESIGN. NORMALLY, A DRYER AND SAFETY SEAL ON THE VENT IS RECOMMENDED.

DISPOSAL----- THE MATERIALS RESULTING FROM CLEAN-UP OPERATIONS MAY BE HAZARDOUS WASTES AND THEREFORE, SUBJECT TO SPECIFIC REGULATIONS. PACKAGE, STORE, TRANSPORT, AND DISPOSE OF ALL CLEAN-UP MATERIALS AND ANY CONTAMINATED EQUIPMENT IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL HEALTH AND ENVIRONMENTAL REGULATIONS. SHIPMENTS OF WASTE MATERIALS MAY BE SUBJECT TO MANIFESTING REQUIREMENTS PER APPLICABLE REGULATIONS. APPROPRIATE DISPOSAL WILL DEPEND ON THE NATURE OF EACH WASTE MATERIAL AND SHOULD BE PERFORMED BY COMPETENT PROPERLY PERMITTED CONTRACTORS. ENSURE THAT ALL RESPONSIBLE FEDERAL, STATE AND LOCAL AGENCIES RECEIVE PROPER NOTIFICATION OF DISPOSAL.

SECTION 12 -

ALL INFORMATION RECOMMENDATIONS AND SUGGESTIONS APPEARING HEREIN CONCERNING OUR PRODUCT ARE BASED UPON TESTS AND DATA BELIEVED TO BE RELIABLE, HOWEVER, IT IS THE USER'S RESPONSIBILITY TO DETERMINE THE SAFETY, TOXICITY, AND SUITABILITY FOR HIS OWN USE OF THE PRODUCT DESCRIBED HEREIN. SINCE THE ACTUAL USE BY OTHERS IS BEYOND OUR CONTROL, NO GUARANTEE, EXPRESSED OR IMPLIED, IS MADE BY DIAMOND SHAMROCK CORPORATION AS TO THE EFFECTS OF SUCH USE, THE RESULTS TO BE OBTAINED OR THE SAFETY AND TOXICITY OF THE PRODUCT NOR DOES DIAMOND SHAMROCK CORPORATION ASSUME ANY LIABILITY ARISING OUT OF USE, UBY OTHERS, OF THE PRODUCT REFERRED TO HEREIN NOR IS THE INFORMATION HEREIN TO BE CONSTRUED AS ABSOLUTELY COMPLETE SINCE ADDITIONAL INFORMATION MAY BE NECESSARY OR DESIRABLE WHEN PARTICULAR OR EXCEPTIONAL CONDITIONS OR CIRCUMSTANCES EXIST OR BECAUSE OF APPLICABLE LAWS OR GOVERNMENT REG-

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COMMON NAME----- METHYLENE CHLORIDE
CAS NUMBER----- 000075-09-2

SECTION 12 - (CONTINUED)

ULATORS.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- **HEPTANE**
CAS NUMBER----- 000142-82-5

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- CHARTER INTERNATIONAL OIL CO
PO BOX 5008
HOUSTON, TX 77012

EMERGENCY TELEPHONE----- 713-923-6641
800-424-9300 (CHEMTREC)

PREPARATION DATE----- 12/02/82

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- HEPTANE
CAS NUMBER----- 000142-82-5

SYNONYMS----- DIPROPYLMETHANE
EDP NUMBER - 141200
HEPTANE, 99.8%, HPLC GRADE

MOLECULAR FORMULA----- C7-H16
CHEMICAL FAMILY----- ALIPHATIC HYDROCARBON

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WATER-WHITE LIQUID
BOILING POINT----- 96 - 99 C (ASTM D-1078)
EVAPORATION RATE----- 4.3 (N-BUTYL ACETATE = 1)
ODOR----- MILD ALIPHATIC HYDROCARBON ODOR
SOLUBILITY IN WATER----- NEGLIGIBLE
SPECIFIC GRAVITY----- 0.6926 AT 15.6/15.6 C (WATER = 1)
VAPOR DENSITY----- 3.459 (AIR = 1)
VAPOR PRESSURE----- 32 MMHG AT 15 C; 90 MMHG AT 37 C
VOLATILITY----- 100 %

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- -3 C
METHOD----- TCC

FLAMMABLE LIMITS
LEL----- 1.05 %
UEL----- 6.7 %

EXTINGUISHING MEDIA----- MECHANICAL FOAM, DRY CHEMICAL, WATER FOG,
AND CARBON DIOXIDE.

SPECIAL FIRE FIGHTING PROCEDURES-- A STRAIGHT WATER STREAM WOULD
SPREAD HYDROCARBON FIRES. AVOID BREATHING
VAPORS. USE FRESH AIR RESPIRATORS.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- A VAPOR ACCUMULATION WOULD FLASH
AND/OR EXPLODE IF IGNITED.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- AVOID HEAT, SPARKS, FLAME AND OTHER SOURCES
OF IGNITION.

INCOMPATIBILITY----- AVOID STRONG OXIDIZING AGENTS.

HAZARDOUS DECOMPOSITION PRODUCTS-- CARBON MONOXIDE IF BURNED WITH IN-
SUFFICIENT AIR.

HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- 400 PPM (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE--- VAPORS MIGHT DAMAGE CENTRAL NERVOUS SYSTEM
AND CAUSE RESPIRATORY IRRITATION, MUSCULAR

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COMMON NAME----- HEPTANE
CAS NUMBER----- 000142-82-5

SECTION 5 - HEALTH HAZARD (CONTINUED)

WEAKNESS, CONFUSION, IMPAIRED COORDINATION,
HEADACHE AND NAUSEA.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

SKIN CONTACT----- WASH IMMEDIATELY WITH SOAP AND WATER.
EYE CONTACT----- WASH IMMEDIATELY WITH PLENTY OF WATER FOR
15 MINUTES.
INHALATION----- REMOVE FROM EXPOSURE. PROVIDE FRESH AIR
AND REST. USE ARTIFICIAL RESPIRATION IF
NEEDED.
INGESTION----- DO NOT INDUCE VOMITING. CALL A PHYSICIAN
IMMEDIATELY.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- REMOVE ALL
POSSIBLE IGNITION SOURCES. AVOID BREATH-
ING VAPORS. PROVIDE ADEQUATE VENTILATION.
IN CASE OF SPILLAGE, ABSORB AND DISPOSE OF
IN ACCORDANCE WITH LOCAL APPLICABLE REGU-
LATIONS. CALL EMERGENCY NUMBER IF SPILLAGE
POSES THREAT TO MAN OR ENVIRONMENT.

WASTE DISPOSAL METHOD----- DISPOSE IN ACCORDANCE WITH LOCAL, STATE AND
FEDERAL REGULATIONS. USE QUALIFIED DIS-
POSAL COMPANY OR INCINERATE, OR OTHERWISE
DISCARD, AT AN APPROVED FACILITY. DO NOT
INCINERATE CLOSED CONTAINERS.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- IF THRESHOLD LIMIT VALUE IS EXCEEDED, USE
SELF-CONTAINED BREATHING APPARATUS.
VENTILATION----- LOCAL EXHAUST: TO A DANGER SAFE AREA.
MECHANICAL: USE EXPLOSION-PROOF EQUIPMENT.
SPECIAL: ADEQUATE VENTILATION (ADEQUATE
MEANS EQUIVALENT TO OUTDOORS VENTILATION).
OTHER: AVOID POTENTIAL IGNITION SOURCES.
PROTECTIVE GLOVES----- USE CHEMICAL RESISTANT.
EYE PROTECTION----- USE SAFETY GOGGLES.
OTHER PROTECTIVE EQUIPMENT-- AS REQUIRED TO AVOID SKIN CONTACT OR
BREATHING VAPORS.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- KEEP CLOSURES TIGHT
AND UPRIGHT TO PREVENT LEAKAGE. KEEP
CLOSED WHEN NOT IN USE. DO NOT TRANSFER
TO UNMARKED CONTAINER. READ ALL WARNING
LABELS. STORE IN COOL, WELL-VENTILATED
AREA. GROUND CONTAINERS WHEN FILLING OR
EMPTYING.

SECTION 10 -

THE INFORMATION CONTAINED HEREIN IS GIVEN IN GOOD FAITH AND IS BASED
ON DATA AND TESTS BELIEVED TO BE RELIABLE; HOWEVER, NO WARRANTY IS EX-
PRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA, THE RESULTS
TO BE OBTAINED FROM THE USE THEREOF, OR THAT ANY SUCH USE WILL NOT
INFRINGE ANY PATENT. FINAL DETERMINATION OF THE SUITABILITY OF ANY
INFORMATION OR PRODUCT FOR THE USE CONTEMPLATED, THE MANNER OF USE,
AND WHETHER THERE IS ANY INFRINGEMENT OF PATENTS IS THE SOLE RESPONSI-
BILITY OF THE USER.

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COMMON NAME-----HEPTANE
CAS NUMBER-----000142-82-5

SECTION 10 - (CONTINUED)

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- **N-OCTANE**
CAS NUMBER----- 000111-65-9

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- CHARTER INTERNATIONAL OIL CO
PO BOX 5008
HOUSTON, TX 77012

EMERGENCY TELEPHONE----- 713-923-6641
800-424-9300 (CHEMTREC)

PREPARATION DATE----- 07/13/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- N-OCTANE
CAS NUMBER----- 000111-65-9

SYNONYMS----- NORMAL OCTANE
OCTANE
OCTANE, ANHYDROUS

MOLECULAR FORMULA----- C8-H18
CHEMICAL FAMILY----- PETROLEUM HYDROCARBON

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WATER-WHITE LIQUID
BOILING POINT----- 124 - 126 C
EVAPORATION RATE----- 1.4
ODOR----- MILD HYDROCARBON ODOR
SOLUBILITY IN WATER----- NEGLIGIBLE
SPECIFIC GRAVITY----- 0.709 AT 15.6/15.6 C
VAPOR DENSITY----- 3.9 (AIR = 1)
VAPOR PRESSURE----- 9/30 AT 15.6/37.8 C
VOLATILITY----- 100 %

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 16 C
METHOD----- TCC

FLAMMABLE LIMITS
LEL----- 0.9 %
UEL----- 6.3 %

EXTINGUISHING MEDIA----- MECHANICAL FOAM, CHEMICAL, WATER FOG, OR
CARBON DIOXIDE.

SPECIAL FIRE FIGHTING PROCEDURES-- A STRAIGHT WATER STREAM WOULD
SPREAD HYDROCARBON FIRES. AVOID BREATHING
VAPORS. USE FRESH AIR RESPIRATORS.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- A VAPOR ACCUMULATION WOULD FLASH
AND/OR EXPLODE IF IGNITED.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- AVOID HEAT, SPARKS, FLAME AND OTHER SOURCES
OF IGNITION.

INCOMPATIBILITY----- AVOID STRONG OXIDIZING AGENTS.
HAZARDOUS DECOMPOSITION PRODUCTS-- CARBON MONOXIDE IF BURNED WITH IN-
SUFFICIENT AIR.

HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TWA: 300 PPM (ACGIH, 1983-84).
STEL: 375 PPM (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE--- VAPORS MIGHT DAMAGE CENTRAL NERVOUS SYSTEM
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COMMON NAME----- **N-OCTANE**
CAS NUMBER----- 000111-65-9

SECTION 5 - HEALTH HAZARD (CONTINUED)

AND CAUSE RESPIRATORY IRRITATION, MUSCULAR WEAKNESS, CONFUSION, IMPAIRED COORDINATION, HEADACHE AND NAUSEA.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

SKIN CONTACT----- WASH IMMEDIATELY WITH SOAP AND WATER.
EYE CONTACT----- WASH IMMEDIATELY WITH WATER FOR 15 MINUTES.
INHALATION----- REMOVE FROM EXPOSURE. PROVIDE FRESH AIR AND REST. USE ARTIFICIAL RESPIRATION IF NEEDED.
INGESTION----- DO NOT INDUCE VOMITING. CALL A PHYSICIAN IMMEDIATELY.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- REMOVE ALL POSSIBLE IGNITION SOURCES AND DISPOSE OF IN ACCORDANCE WITH LOCAL APPLICABLE REGULATIONS. CALL EMERGENCY NUMBER IF SPILLAGE PPOSES THREAT TO MAN OR ENVIRONMENT.
WASTE DISPOSAL METHOD----- DISPOSE IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. USE QUALIFIED DISPOSAL COMPANY TO INCINERATE, OR OTHERWISE DISCARD AT AN APPROVED FACILITY. DO NOT INCINERATE CLOSED CONTAINERS.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION----- IF THRESHOLD LIMIT VALUE IS EXCEEDED, USE SELF-CONTAINED BREATHING APPARATUS.
VENTILATION----- LOCAL EXHAUST: TO A DANGER SAFE AREA. MECHANICAL: USE EXPLOSION-PROOF EQUIPMENT. SPECIAL: USE ONLY WITH ADEQUATE VENTILATION.
OTHER: AVOID POTENTIAL IGNITION SOURCES.
PROTECTIVE GLOVES----- USE CHEMICAL-RESISTANT GLOVES.
EYE PROTECTION----- USE SAFETY GOGGLES.
OTHER PROTECTIVE EQUIPMENT-- AS REQUIRED TO AVOID SKIN CONTACT OR BREATHING VAPORS.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- KEEP CLOSURES TIGHT AND UPRIGHT TO PREVENT LEAKAGE. KEEP CLOSED WHEN NOT IN USE. DO NOT TRANSFER TO UNMARKED CONTAINER. READ ALL WARNING LABELS. STORE IN COOL, WELL-VENTILATED AREA. GROUND CONTAINERS WHEN FILLING OR EMPTYING.

SECTION 10 -

THE INFORMATION CONTAINED HEREIN IS GIVEN IN GOOD FAITH AND IS BASED ON DATA AND TESTS BELIEVED TO BE RELIABLE; HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA, THE RESULTS TO BE OBTAINED FROM THE USE THEREOF, OR THAT ANY SUCH USE WILL NOT INFRINGE ANY PATENT. FINAL DETERMINATION OF THE SUITABILITY OF ANY INFORMATION OR PRODUCT FOR THE USE CONTEMPLATED, THE MANNER OF USE, AND WHETHER THERE IS ANY INFRINGEMENT OF PATENT IS THE SOLE RESPONSIBILITY OF THE USER.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT
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COMMON NAME----- **H-OCTANE**
CAS NUMBER----- 000111-65-9

SECTION 10 - (CONTINUED)

WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- ETHANEDIOYL CHLORIDE
CAS NUMBER----- 000079-37-8

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- MOBAY CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION
PENN-LINCOLN PARKWAY WEST
PITTSBURGH, PA 15205

EMERGENCY TELEPHONE----- 412-923-1800

PREPARATION DATE----- 01/10/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- ETHANEDIOYL CHLORIDE
CAS NUMBER----- 000079-37-8

SYNONYMS----- EDP NUMBER - 159770
ETHANDIOYL CHLORIDE
OXALYL CHLORIDE

MOLECULAR FORMULA----- C2-CL2-O2
CHEMICAL FAMILY----- ACID CHLORIDE

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS/YELLOW LIQUID; WHITE SOLID BELOW SOLIDIF.
PT
BOILING POINT----- 62 - 64 C AT 760 TORR (143.6 - 147.2 F)
ODOR----- STRONG UNPLEASANT ODOR
SOLIDIFICATION POINT----- -9.5 TO -10.5 C
SOLUBILITY IN WATER----- DECOMPOSES
SPECIFIC GRAVITY----- 1.478 (AT 20 C) (WATER = 1)

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE
FLAMMABLE LIMITS
LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE
EXTINGUISHING MEDIA----- DRY CHEMICALS, CARBON DIOXIDE, DO NOT USE
WATER.
SPECIAL FIRE FIGHTING PROCEDURES-- A SELF-CONTAINED BREATHING APPARA-
TUS SHOULD BE WORN.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- OXALYL CHLORIDE DECOMPOSES UPON
CONTACT WITH WATER TO PRODUCE TOXIC AND
CORROSIVE FUMES. WHEN HEATED TO DECOMPO-
SITION, PRODUCT EMITS TOXIC FUMES OF
CHLORIDES.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITONS TO AVOID----- AVOID TEMPERATURES ABOVE 40 C (104 F) AND
BELOW -10 C (+14 F).
INCOMPATIBILITY----- IRON, WATER, -OH BEARING MATERIAL SUCH AS
ALCOHOLS.
HAZARDOUS DECOMPOSITION--- CHLORIDES.
HAZARDOUS POLYMERIZATION--- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE---- NOT ESTABLISHED (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE-- PRODUCT IS EXTREMELY TOXIC AND CORROSIVE.
LACHRYMATOR MAY CONTAIN TRACE AMOUNTS OF
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COMMON NAME----- ETHANEDIOYL CHLORIDE
CAS NUMBER----- 000079-37-8

SECTION 5 - HEALTH HAZARD (CONTINUED)

PHOSGENE. THE VAPORS WILL ATTACK THE SKIN, EYES, AND ESPECIALLY THE MUCOUS MEMBRANES OF THE NOSE AND THROAT, AND RESPIRATORY SYSTEM.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

SKIN CONTACT----- WASH WITH COPIOUS AMOUNTS OF SOAP AND WATER.

EYE CONTACT----- FLUSH WITH WATER FOR 15 MINUTES, CONSULT EYE PHYSICIAN.

INHALATION----- REMOVE TO UNCONTAMINATED AREA, HAVE OXYGEN ADMINISTERED BY QUALIFIED PERSONNEL IF NEEDED.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- COVER WITH SODIUM BICARBONATE. IF A SMALL QUANTITY IS INVOLVED, SCOOP MIXTURE INTO A LARGE BEAKER OF WATER AND LET STAND FOR A FEW MINUTES. SLOWLY POUR INTO DRAIN WITH COPIOUS AMOUNTS OF WATER.

WASTE DISPOSAL METHOD----- IF A LARGE QUANTITY IS INVOLVED, SCOOP RESULTING BICARBONATE MIXTURE INTO PLASTIC BAG OR CARDBOARD BOX AND INCINERATE UNDER CONDITIONS WHICH MEET FEDERAL, STATE AND LOCAL ENVIRONMENTAL CONTROL REGULATIONS.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- SELF-CONTAINED BREATHING APPARATUS.

VENTILATION----- LOCAL EXHAUST: YES.

PROTECTIVE GLOVES----- RUBBER GLOVES.

EYE PROTECTION----- LIQUID GOGGLES OR FULL FACE SHIELD.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- PRODUCT IS STORABLE APPROXIMATELY 1 YEAR IN TIGHTLY SEALED DRUMS IN THE ABSENCE OF AIR, MOISTURE, AND LIGHT.

OTHER PRECAUTIONS----- STORE AT TEMPERATURE RANGE OF 0 - 25 C (32 TO 77 F) FOR MAXIMUM SHELF LIFE. PRODUCT IS SENSITIVE TO TEMPERATURES BELOW -10 C (+14 F).

SECTION 10 -

LEGAL RESPONSIBILITY IS ASSUMED ONLY FOR THE FACT THAT ALL STUDIES REPORTED HERE AND ALL OPINIONS ARE THOSE OF QUALIFIED EXPERTS.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- **PHOSPHORIC ACID**
CAS NUMBER----- 007664-38-2

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- MONSANTO COMPANY
800 NORTH LINDBERGH BLVD
ST LOUIS, MO 63167

EMERGENCY TELEPHONE----- 314-694-1000

PREPARATION DATE----- 06/16/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- PHOSPHORIC ACID
CAS NUMBER----- 007664-38-2

SYNONYMS----- ORTHO-PHOSPHORIC ACID
PHOSPHORIC ACID, A.C.S. REAGENT

MOLECULAR FORMULA----- H3-O4-P
CHEMICAL FAMILY----- PHOSPHORUS

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WATER-WHITE LIQUID
BOILING POINT----- 260 C (APPROXIMATELY)
EVAPORATION RATE----- NOT APPLICABLE
ODOR----- NO ODOR
SOLUBILITY IN WATER----- COMPLETE
SPECIFIC GRAVITY----- 1.6 AT 25 C (WATER = 1)
VAPOR PRESSURE----- 0.0285 MMHG AT 20 C
VOLATILITY----- NOT APPLICABLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE
FLAMMABLE LIMITS
LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE
EXTINGUISHING MEDIA----- NOT APPLICABLE.
SPECIAL FIRE FIGHTING PROCEDURES-- NOT APPLICABLE.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- PHOSPHORIC ACID IS NOT FLAMMABLE,
BUT IT CAN REACT WITH METALS TO LIBERATE
HYDROGEN, A FLAMMABLE GAS.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TWA: 1 MG/M3 (ACGIH, 1983-84).
STEL: 3 MG/M3 (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE--- PHOSPHORIC ACID IS A CORROSIVE ACID WHICH
MAY CAUSE BURNS ON CONTACT WITH ANY PART OF
BODY. IT MAY CAUSE LOCAL DAMAGE IF TAKEN
INTERNALLY IN CONCENTRATED DOSES.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
SKIN OR EYE CONTACT----- IN CASE OF CONTACT FLUSH SKIN OR EYES WITH
PLENTY OF WATER FOR AT LEAST 15 MINUTES.
FOR EYES, GET MEDICAL ATTENTION.

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COMMON NAME----- **PHOSPHORIC ACID**
CAS NUMBER----- 007664-38-2

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- FLUSH WITH WATER OR NEUTRALIZE WITH A BASE SUCH AS SODA ASH (SODIUM CARBONATE).
WASTE DISPOSAL METHOD----- FLUSH WITH WATER; LANDFILL NEUTRALIZED MATERIAL.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- IF EXPOSED TO PHOSPHORIC ACID VAPORS, USE BUREAU OF MINES ALL-PURPOSE CANNISTER AND MASK.
VENTILATION----- LOCAL EXHAUST; GENERAL ROOM VENTILATION.
PROTECTIVE GLOVES----- GOOD PRACTICE.
EYE PROTECTION----- SAFETY GOGGLES.
OTHER PROTECTIVE EQUIPMENT-- CLOTHING OF RUBBER OR OTHER IMPERVIOUS MATERIAL MAY BE USED TO PROTECT THE BODY AGAINST PHOSPHORIC ACID SPLASHES.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- STORE IN RUBBER-LINED OR STAINLESS STEEL TANKS DESIGNED FOR PHOSPHORIC ACID. STORE DRUMS AWAY FROM HEAT AND OUT OF DIRECT SUNLIGHT.
OTHER PRECAUTIONS----- CONSULT MANUFACTURING CHEMISTS' ASSOCIATION CHEMICAL SAFETY DATA SHEET SD-70 FOR FULL PARTICULARS ON SAFETY FOR PHOSPHORIC ACID.

SECTION 10 -

WHILE THE INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, MONSANTO COMPANY MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.
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COMMON NAME----- **POVIDONE**
 CAS NUMBER----- 009003-39-8
 MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00
 MANUFACTURER----- GAF CORPORATION
 140 WEST 51ST STREET
 NEW YORK, NY 10020
 EMERGENCY TELEPHONE----- 212-582-7600
 PREPARATION DATE----- 09/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- POVIDONE
 CAS NUMBER----- 009003-39-8
 SYNONYMS----- PLASDONE C-30
 POLYVINYL POLYPYRROLIDONE
 POLYVINYL PYRROLIDONE AV. MOL. WT. 40,000
 SPVP-40T
 POLYVINYL PYRROLIDONE, SPECIAL GRADE, M.W. 40,000
 MOLECULAR FORMULA----- (C6-H9-N-O)_x
 CHEMICAL FAMILY----- NOT PROVIDED

SECTION 2 - PHYSICAL DATA

APPEARANCE----- WHITE TO CREAMY WHITE POWDER
 BOILING POINT----- NOT APPLICABLE
 EVAPORATION RATE----- NOT VOLATILE
 MELTING POINT----- NOT APPLICABLE
 ODOR----- NO DATA FOUND
 SOLUBILITY IN WATER----- SOLUBLE
 VAPOR DENSITY----- NOT VOLATILE
 VAPOR PRESSURE----- NOT VOLATILE
 VOLATILITY----- 5 %

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NONE
 METHOD----- NOT APPLICABLE
 FLAMMABLE LIMITS
 LEL----- NO DATA FOUND
 UEL----- NO DATA FOUND
 EXTINGUISHING MEDIA----- USE MEDIA PROPER TO PRIMARY CAUSE OF FIRE.
 SPECIAL FIRE FIGHTING PROCEDURES-- NONE KNOWN.
 UNUSUAL FIRE AND EXPLOSION HAZARDS-- NONE KNOWN.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
 INCOMPATIBILITY----- STRONG OXIDIZING OR REDUCING AGENTS.
 HAZARDOUS DECOMPOSITION PRODUCTS-- NONE KNOWN.
 HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1984-85).
 EFFECTS OF OVEREXPOSURE--- NO EFFECTS OF INGESTION EXPOSURE EXPECTED.
 NO EFFECTS OF INHALATION EXPOSURE EXPECTED.
 MAY POSSIBLY CAUSE IRRITATION OR DERMATITIS
 IN SOME INDIVIDUALS UPON PROLONGED CONTACT.
 POSSIBLE EYE IRRITATION.
 TOXICITY----- ORAL LD50 (RAT): > 100,000 MG/KG.
 DERMAL: NOT ABSORBED TOPICALLY.
 INHALATION: HUMAN, GUINEA PIG AND RABBIT

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COMMON NAME----- **POVIDONE**
CAS NUMBER----- 009003-39-8

SECTION 5 - HEALTH HAZARD (CONTINUED)

EXPOSURE TO AEROSOLS AND DUSTS OF SMALL PARTICLE SIZE PRODUCED NO EVIDENCE OF HARMFUL EFFECTS.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE----- NO DATA FOUND.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

INGESTION----- INDUCE VOMITING IMMEDIATELY BY GIVING TWO GLASSES OF WATER AND STICKING FINGER DOWN THROAT. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. CALL A PHYSICIAN.

INHALATION----- NONE REQUIRED.

SKIN----- WASH AFTER EXPOSURE.

EYES----- FLUSH EYES WITH PLENTY OF WATER.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- SCOOP UP. AVOID DUSTING. DISPOSE OF WITH SOLID WASTE ACCORDING TO FEDERAL, STATE AND LOCAL REGULATIONS. FLUSH SPILL AREA WITH WATER.

WASTE DISPOSAL METHOD----- DISPOSE OF WITH SOLID WASTE ACCORDING TO FEDERAL, STATE AND LOCAL REGULATIONS.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION----- DUST MASK WHERE DUSTING CANNOT BE AVOIDED.

VENTILATION----- USE WITH ADEQUATE VENTILATION.

PROTECTIVE GLOVES----- NONE REQUIRED.

EYE PROTECTION----- SAFETY GLASSES.

OTHER PROTECTIVE EQUIPMENT-- OBSERVE ORDINARY MEASURES OF PERSONAL HYGIENE.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- AVOID BREATHING DUST.

SECTION 10 - REMARKS

DATA FROM TESTS DONE AT GAF INDICATE THAT POVIDONE DOES NOT REPRESENT POTENTIAL CARCINOGENIC THREATS TO HUMANS.

SECTION 11 -

GAF CORPORATION MANUFACTURES INDUSTRIAL PRODUCTS FOR USE AS MATERIALS IN THE PRODUCTION OF PRODUCTS BY INDUSTRIAL CUSTOMERS. THE INFORMATION HEREIN IS INTENDED FOR USE BY PERSONS WHO HAVE OR SHOULD OBTAIN PROFESSIONAL KNOWLEDGE AND EXPERIENCE IN THE SUBJECTS DISCUSSED. GAF USUALLY HAS ONLY LIMITED INFORMATION ABOUT THE PRODUCTS OF ITS CUSTOMERS AND THEIR COMPOSITION, METHODS OF MANUFACTURE AND USE. ACCORDINGLY, GAF MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, COMPLETENESS OR RELIABILITY OF INFORMATION HEREIN EXCEPT THAT SUCH INFORMATION IS TO THE BEST OF GAF'S KNOWLEDGE AND BELIEF, ACCURATE AS OF THE DATE INDICATED. GAF RECOMMENDS THAT CUSTOMERS INDEPENDENTLY TEST AND EVALUATE ITS PRODUCTS AND THEIR PRODUCTS AND PROCESSES IN WHICH GAF PRODUCTS ARE USED IN ORDER TO DECIDE THEIR SAFETY AND EFFECTIVENESS.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- PYRIDINE
CAS NUMBER----- 000110-86-1

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- REILLY TAR & CHEMICAL CORPORATION
151 NORTH DELAWARE STREET
INDIANAPOLIS, IN 46204

EMERGENCY TELEPHONE----- 317-247-8141

PREPARATION DATE----- 06/18/82

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- PYRIDINE
CAS NUMBER----- 000110-86-1

MOLECULAR FORMULA----- C5-H5-N
CHEMICAL FAMILY----- PYRIDINE

SECTION 2 - PHYSICAL DATA

APPEARANCE----- LIQUID
BOILING POINT----- 115 C
ODOR----- PUNGENT, DISAGREEABLE ODOR
SOLUBILITY IN WATER----- SOLUBLE
SPECIFIC GRAVITY----- 0.982 AT 20 C (68 F); (WATER = 1)
VAPOR DENSITY----- 2.72 (AIR = 1)
VAPOR PRESSURE----- 20 MMHG AT 25 C

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 19 C
METHOD----- TCC
FLAMMABLE LIMITS
LEL----- 1.8 %
UEL----- 12.4 %
EXTINGUISHING MEDIA----- ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE
OR WATER.
SPECIAL FIRE FIGHTING PROCEDURES-- FIRE FIGHTERS SHOULD WEAR SELF-
CONTAINED BREATHING APPARATUS.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
INCOMPATIBILITY----- ACIDS.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TMA: 5 PPM (ACGIH, 1983-84).
STEL: 10 PPM (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE--- OVEREXPOSURE INCURS SKIN DERMATITIS, EYE,
NOSE, THROAT IRRITATION. MAY CAUSE HEAD-
ACHES, DIZZINESS, WEAKNESS, NAUSEA,
ANOREXIA.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
FOR SKIN OR EYE CONTACT--- WASH WITH WATER FOR AT LEAST 15 MINUTES.
REFER EYE CASES AFTER IRRIGATION TO A
PHYSICIAN.
IF SWALLOWED----- INDUCE VOMITING.

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COMMON NAME----- **PYRIDINE**
CAS NUMBER----- 000110-86-1

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- VENTILATION; WASH WITH WATER IN EXCESS.
WASTE DISPOSAL METHOD----- INCINERATE.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- MAINTAIN VENTILATION; CANISTER OR GAS MASKS WHERE NECESSARY.
VENTILATION----- LOCAL EXHAUST: YES.
PROTECTIVE GLOVES----- COATED.
EYE PROTECTION----- GOGGLES.
OTHER PROTECTIVE EQUIPMENT-- BOOTS, RUBBER OR PLASTIC COATS, FACE SHIELDS WHERE NECESSARY.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- AVOID SKIN, EYE AND NASAL CONTACT. DO NOT STORE IN LOW PLACES. KEEP VENTILATED. MAINTAIN FIRE PRECAUTION.
OTHER PRECAUTIONS----- ELECTRICAL INSTALLATIONS IN ACCORD FOR CLASS 1, GROUP D LOCATIONS, PER ARTICLE 500. NATIONAL ELECTRICAL CODE.

SECTION 10 -

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- SODIUM HYPOCHLORITE
CAS NUMBER----- 007681-52-9

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- JONES CHEMICALS, INC.
P.O. BOX 38
WYANDOTTE, MI 48192

EMERGENCY TELEPHONE----- 313-283-0676

PREPARATION DATE----- 07/05/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- SODIUM HYPOCHLORITE
CAS NUMBER----- 007681-52-9

SYNONYMS----- SODIUM HYPOCHLORITE, SOLUTION

MOLECULAR FORMULA----- H-CL-O .NA
CHEMICAL FAMILY----- ALKALINE OXIDIZING AGENT

SECTION 2 - PHYSICAL DATA

APPEARANCE----- LIGHT STRAW-YELLOW TO GREENISH TINT
BOILING POINT----- NOT APPLICABLE
EVAPORATION RATE----- < 1
ODOR----- SLIGHT CHLORINE ODOR
SOLUBILITY IN WATER----- 0
SPECIFIC GRAVITY----- 1.09 (5.25 %); 1.15 (8.0 %) AT 20 C
VAPOR DENSITY----- NOT APPLICABLE
VAPOR PRESSURE----- NOT APPLICABLE
VOLATILITY----- NOT APPLICABLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE
FLAMMABLE LIMITS
LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE
EXTINGUISHING MEDIA----- NOT APPLICABLE.
SPECIAL FIRE FIGHTING PROCEDURES-- USE OF WATER TO KEEP SOLUTION COOL;
DILUTE PRODUCT IF A LEAK DOES OCCUR.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- HEAT WOULD CAUSE DECOMPOSITION OF
SODIUM HYPOCHLORITE WITH EVOLUTION OF
CHLORINE GAS.

SECTION 4 - REACTIVITY

STABILITY----- UNSTABLE.
CONDITIONS TO AVOID----- HIGH TEMPERATURES, EXPOSURE TO LIGHT,
TRACES OF CATALYTIC METALS (NICKEL, COPPER,
IRON, COBALT, MAGNESIUM), EXCESS AL-
KALINITY.
INCOMPATIBILITY----- ACIDIC SOLUTIONS OR READILY REDUCIBLE
MATERIALS.
HAZARDOUS DECOMPOSITION PRODUCTS-- CHLORINE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE---- IRRITATING TO SKIN, EYES, AND MUCOUS MEM-
BRANES.

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COMMON NAME----- SODIUM HYPOCHLORITE
CAS NUMBER----- 007681-52-9

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT----- REQUIRES IMMEDIATE AND THOROUGH FLUSHING WITH COPIOUS QUANTITIES OF WATER FOR AT LEAST 15 MINUTES. A PHYSICIAN SHOULD BE CONTACTED. DO NOT USE A NEUTRALIZING CHEMICAL AS A SUBSTITUTE FOR WATER.
SKIN CONTACT----- REQUIRES IMMEDIATE WASHING.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- CONTAIN IF POSSIBLE. DILUTE OR WASH DOWN WITH LARGE QUANTITIES OF WATER. KEEP TO WINDWARD WHEN EXPOSED TO FUMES.
WASTE DISPOSAL METHOD----- DILUTE AS ABOVE BEFORE DISPOSAL. IF PERMITTED BY REGULATION, FLUSH DILUTED SODIUM HYPOCHLORITE TO SEWER WITH PLENTY OF WATER.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- NONE REQUIRED.
VENTILATION----- LOCAL EXHAUST: SUFFICIENT TO ELIMINATE FUMES.
PROTECTIVE GLOVES----- RUBBER.
EYE PROTECTION----- CHEMICAL SAFETY GOGGLES OR FACE SHIELD.
OTHER PROTECTIVE EQUIPMENT-- CLOTHING IMPERMEABLE TO SODIUM HYPOCHLORITE. RUBBER FOOTWEAR.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- MOST METALS ARE RAPIDLY ATTACKED BY SODIUM HYPOCHLORITE. STORE IN WELL-VENTILATED, COOL, DARK AREA. ULTRAVIOLET LIGHT SHOULD BE EXCLUDED DURING STORAGE. VENTED CAPS SHOULD BE USED.

SECTION 10 -

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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COMMON NAME----- SODIUM HYDROXIDE
CAS NUMBER----- 001310-73-2

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- DOM CHEMICAL USA
MIDLAND, MI 48640

EMERGENCY TELEPHONE----- 517-636-4400

PREPARATION DATE----- 12/04/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- SODIUM HYDROXIDE
CAS NUMBER----- 001310-73-2

SYNONYMS----- ASCARITE II
CAUSTIC SODA
SODIUM HYDROXIDE SOLUTION (1.0N)
SODIUM HYDROXIDE SOLUTIONS
SODIUM HYDROXIDE, PELLETS, 99.99+%, SEMICONDUCTOR
GRADE, GOL
SODIUM HYDROXIDE, 1N
SODIUM HYDROXIDE, 20% SOLUTION

MOLECULAR FORMULA----- H-NA-O
CHEMICAL FAMILY----- NOT PROVIDED

SECTION 2 - INGREDIENTS

INGREDIENT 1
COMMON NAME----- SODIUM HYDROXIDE
PERCENT----- 48.5 - 50.5 %
CAS NUMBER----- 001310-73-2
NOTES----- WATER = BALANCE

INGREDIENT 2
COMMON NAME----- SODIUM CARBONATE
PERCENT----- < 0.2 %
CAS NUMBER----- 000497-19-8

INGREDIENT 3
COMMON NAME----- SODIUM CHLORATE
PERCENT----- < 0.2 %
CAS NUMBER----- 007775-09-9

INGREDIENT 4
COMMON NAME----- SODIUM CHLORIDE
PERCENT----- < 1.0 %
CAS NUMBER----- 007647-14-5

SECTION 3 - PHYSICAL DATA

APPEARANCE----- COLORLESS TO SLIGHTLY COLORED LIQUID
BOILING POINT----- 145 C APPROX. (293 F)
DENSITY----- 1.52 G/ML AT 20 C
ODOR----- NO ODOR
SOLUBILITY IN WATER----- WATER SOLUTION
SPECIFIC GRAVITY----- 1.52 AT 20 C
VAPOR PRESSURE----- 1.5 MMHG AT 20 C
VOLATILITY----- LOM (WATER)

SECTION 4 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE

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COMMON NAME----- SODIUM HYDROXIDE
CAS NUMBER----- 001310-73-2

SECTION 4 - FIRE AND EXPLOSION DATA (CONTINUED)

FLAMMABLE LIMITS

LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE

EXTINGUISHING MEDIA----- NON-COMBUSTIBLE.

SPECIAL FIRE FIGHTING EQUIPMENT AND HAZARDS-- IN WATER SOLUTION CAUSTIC CAN REACT WITH AMPHOTERIC METALS (SUCH AS ALUMINUM) GENERATING HYDROGEN WHICH IS FLAMMABLE AND/OR EXPLOSIVE WHEN IGNITED.

SECTION 5 - REACTIVITY

STABILITY----- PRODUCT ABSORBS CARBON DIOXIDE FROM THE AIR.

INCOMPATIBILITY----- WATER AND ACID. PRODUCT IS STRONG CAUSTIC ALKALI. MAY REACT VIOLENTLY WITH WATER, ACID, AND A NUMBER OF ORGANIC COMPOUNDS. CAUSTIC REACTS RAPIDLY WITH ALUMINUM, TIN, AND ZINC. IT WILL ALSO REACT WITH BRONZE AND BRASS.

HAZARDOUS DECOMPOSITION PRODUCTS-- NONE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 6 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TWA (CEILING): 2 MG/M3 (ACGIH, 1984-85).
EFFECTS OF OVEREXPOSURE--- DUSTS OR CONCENTRATED MIST MAY CAUSE DAMAGE TO UPPER RESPIRATORY TRACT AND EVEN TO THE LUNGS PROPER; RANGES FROM MILD IRRITATION TO SEVERE PNEUMONITIS. MAIN EFFECT: TISSUE DAMAGE.

INGESTION----- MOST SERIOUS EFFECT IS CORROSION OF TISSUES. LOWEST LETHAL DOSE IN RABBIT IS 500 MGKG CAUSTIC.

EYE CONTACT----- SEVERE BURN AND POSSIBLE BLINDNESS.

SKIN CONTACT----- BURNS, FREQUENTLY DEEP ULCERATION AND ULTIMATE SCARRING.

SKIN ABSORPTION----- NOT LIKELY A PROBLEM.

INHALATION----- ACGIH TLV AND OSHA GUIDE IS 2 MG/M3 DUSTS AND MISTS, BASED ON SODIUM HYDROXIDE.

SECTION 7 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYES----- IMMEDIATE AND CONTINUOUS IRRIGATION WITH FLOWING WATER AT LEAST 30 MINUTES IS IMPERATIVE. PROMPT MEDICAL CONSULTATION ESSENTIAL.

SKIN----- SKIN BURN LIKELY. IMMEDIATE AND CONTINUOUS AND THOROUGH WASHING IN FLOWING WATER FOR 30 MINUTES IS INDICATED. REMOVE CLOTHING IMMEDIATELY. CALL PHYSICIAN AND/OR TRANSPORT TO MEDICAL FACILITY. DESTROY CONTAMINATED SHOES. WASH CLOTHING BEFORE REUSE.

INHALATION----- REMOVE TO FRESH AIR IF EFFECTS OCCUR. CALL PHYSICIAN AND/OR TRANSPORT TO MEDICAL FACILITY.

INGESTION----- CORROSIVE. DO NOT INDUCE VOMITING. GIVE LARGE AMOUNTS OF WATER OR MILK IF IMMEDIATELY AVAILABLE AND TRANSPORT TO MEDICAL FACILITY.

SECTION 8 - NOTES TO PHYSICIAN

EYES----- MAY CAUSE SEVERE CORNEAL INJURY OR BURN. MAY CAUSE IMPAIRMENT OF VISION. STAIN FOR

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COMMON NAME----- SODIUM HYDROXIDE
CAS NUMBER----- 001310-73-2

SECTION 12 - (CONTINUED)

WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
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COMMON NAME----- **SODIUM SULFIDE**
CAS NUMBER----- 001313-82-2

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- FISHER SCIENTIFIC COMPANY
CHEMICAL MANUFACTURING DIV
P.O. BOX 375, 1 REAGENT LANE
FAIR LAWN, NJ 07410

EMERGENCY TELEPHONE----- 201-796-7100

PREPARATION DATE----- 01/18/80

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- SODIUM SULFIDE
CAS NUMBER----- 001313-82-2

MOLECULAR FORMULA----- NA2-S
CHEMICAL FAMILY----- NOT PROVIDED

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS TO YELLOW CRYSTALS.
BOILING POINT----- DECOMPOSES
EVAPORATION RATE----- NOT APPLICABLE
MELTING POINT----- 50 C
ODOR----- ODOR OF HYDROGEN SULFIDE.
SOLUBILITY IN WATER----- 125 %
SPECIFIC GRAVITY----- 1.43
VAPOR DENSITY----- NOT APPLICABLE
VAPOR PRESSURE----- NOT APPLICABLE
VOLATILITY----- NOT APPLICABLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE
FLAMMABLE LIMITS
LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE
EXTINGUISHING MEDIA----- CARBONS DIOXIDE, DRY CHEMICAL.
SPECIAL FIRE FIGHTING PROCEDURES-- WEAR GOGGLES AND SELF-CONTAINED
BREATHING APPARATUS.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- MODERATELY FLAMMABLE SOLID.
YIELDS FLAMMABLE HYDROGEN SULFIDE ON CON-
TACT WITH ACIDS AND SULFUR DIOXIDE. WHEN
BURNING, FINELY DIVIDED SODIUM SULFIDE
FORMS EXPLOSIVE MIXTURES IN AIR.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- DISCOLORS UPON EXPOSURE TO LIGHT AND AIR.
INCOMPATIBILITY----- LIBERATES HYDROGEN SULFIDES GAS ON CONTACT
WITH WATER OR ACIDS.
HAZARDOUS DECOMPOSITION PRODUCTS-- HYDROGEN SULFIDE GAS.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NONE LISTED (ACGIH, 1985-86).
EFFECTS OF OVEREXPOSURE-- HARMFUL IF SWALLOWED. CAUSES BURNS TO SKIN
AND EYES.

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COMMON NAME----- SODIUM SULFIDE
CAS NUMBER----- 001313-82-2

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYES----- IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. GET MEDICAL ATTENTION.

SKIN----- IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

INGESTION----- CALL PHYSICIAN.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- SCOOP UP, AND PUT IN A SUITABLE CONTAINER.

WASTE DISPOSAL METHOD----- DISPOSE OF BY MEANS AS TO COMPLY WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS OR CONTACT AN APPROVED AND LICENSED DISPOSAL AGENCY.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- SELF CONTAINED BREATHING APPARATUS.

VENTILATION----- MECHANICAL: FUME HOOD.

PROTECTIVE GLOVES----- RUBBER.

EYE PROTECTION----- SAFETY GLASSES.

OTHER PROTECTIVE EQUIPMENT-- RUBBER APRON.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- KEEP CONTAINER CLOSED AND IN A COOL PLACE. SEPARATE FROM ACIDS, OXIDIZING MATERIAL, AND POSSIBLE SOURCES OF IGNITION. PROTECT FROM LIGHT.

SECTION 10 - MSDS PREPARATION INFORMATION

PREPARED BY----- GASTON L. PILLORI, MANAGER
QUALITY ASSURANCE
JANUARY 18, 1980

SECTION 11 -

THE ABOVE INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OR MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

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COMMON NAME----- **TETRAHYDROFURAN**
 CAS NUMBER----- 000109-99-9

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
 UNIT 6101-041-00

MANUFACTURER----- BASF WYANDOTTE CORP
 100 CHERRY HILL ROAD
 PARSIPPANY, NJ 07054

EMERGENCY TELEPHONE----- 201-263-0200

PREPARATION DATE----- 09/13/85

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- TETRAHYDROFURAN
 CAS NUMBER----- 000109-99-9

SYNONYMS----- OXIDE
 TETRAHYDROFURAN, 99.9+%, HPLC GRADE, INHIBITOR-FREE
 THF
 186679 - EDP NUMBER

MOLECULAR FORMULA----- C₄H₈O
 CHEMICAL FAMILY----- FURANS

SECTION 2 - PHYSICAL DATA

APPEARANCE----- CLEAR COLORLESS LIQUID
 BOILING POINT----- 66 C
 FREEZING POINT----- -108.5 C
 ODOR----- ETHER-LIKE ODOR
 PH OF SOLUTIONS----- NEUTRAL
 SOLUBILITY IN WATER----- GOOD
 SPECIFIC GRAVITY----- 0.89 AT 20 C (WATER = 1)
 VAPOR DENSITY----- 2.5 (AIR = 1)
 VAPOR PRESSURE----- 129 MMHG AT 15 C

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- -15 C
 METHOD----- CC
 FLAMMABLE LIMITS
 LEL----- 2.3 %
 UEL----- 11.8 %

EXTINGUISHING MEDIA----- ALCOHOL FOAM, CARBON DIOXIDE, DRY CHEMICAL.
 SPECIAL FIRE FIGHTING PROCEDURES-- FIREFIGHTERS SHOULD BE EQUIPPED
 WITH SELF-CONTAINED BREATHING APPARATUS AND
 TURN-OUT GEAR. WATER MAY BE INEFFECTIVE BUT
 MAY BE USED TO FLUSH AWAY AND DILUTE
 SPILLS.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- DANGEROUS. WHEN EXPOSURE TO HEAT
 OR FLAMES, EMITS TOXIC FUMES. CAN FORM
 EXPLOSIVE PEROXIDE COMPOUNDS. CAN REACT
 WITH OXIDIZING MATERIALS.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
 CONDITIONS TO AVOID----- EXPOSURE TO LIGHT, PROLONGED EXPOSURE TO
 AIR.

INCOMPATIBILITY----- LITHIUM ALUMINUM HYDRIDE, ALKALINE EARTH
 HYDROXIDES, OXIDIZERS.

HAZARDOUS DECOMPOSITION PRODUCTS-- PEROXIDES FORM ON STORAGE.
 HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

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COMMON NAME----- **TETRAHYDROFURAN**
CAS NUMBER----- 000109-99-9

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- TWA: 200 PPM (ACGIH, 1985-86).
STEL: 250 PPM (ACGIH, 1985-86).
EFFECTS OF OVEREXPOSURE--- ACUTE EXPOSURE TO TETRAHYDROFURAN MAY BE IRRITATING TO THE EYES, SKIN AND MUCOUS MEMBRANES. OVEREXPOSURE BY INHALATION, INGESTION OR SKIN CONTACT MAY PRODUCE NAUSEA, DIZZINESS, HEADACHES, RESPIRATORY IRRITATION AND POSSIBLE SKIN BURNS. SEVERE OVEREXPOSURE TO VAPORS MAY PRODUCE NARCOSIS.
TOXICITY----- ORAL LDLO (RAT): 3 G/KG.
INHALATION LCLO (RAT): 9,000 PPM/2 HOURS.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
EYES----- FLUSH EYES WITH FLOWING WATER AT LEAST 15 MINUTES. GET MEDICAL ATTENTION.
SKIN----- WASH AFFECTED SKIN AREAS THOROUGHLY WITH WATER WHILE REMOVING CONTAMINATED CLOTHING BEFORE REUSE.
INGESTION----- IF SWALLOWED, DILUTE WITH WATER OR MILK. DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION.
INHALATION----- IF INHALED, MOVE TO FRESH AIR. AID IN BREATHING IF NECESSARY; AND, GET MEDICAL ATTENTION.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- SPILLS SHOULD BE CONTAINED, SOLIDIFIED, AND PLACED IN SUITABLE CONTAINERS FOR DISPOSAL IN A RCRA LICENSED FACILITY. THIS MATERIAL IS RCRA HAZARDOUS.
WASTE DISPOSAL METHOD----- INCINERATE OR BURY AS A SOLID ONLY IN A RCRA LICENSED FACILITY. DO NOT DISCHARGE INTO WATERWAYS OR SEWER SYSTEMS. EMPTY CONTAINERS WITH LESS THAN 1 INCH OF RESIDUE MAY BE LANDFILLED AT A LICENSED FACILITY. RECOMMEND CRUSHING OR OTHER MEANS TO PREVENT UNAUTHORIZED REUSE. OTHER CONTAINERS MUST BE DISPOSED OF IN A RCRA LICENSED FACILITY.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- APPROVED ORGANIC VAPOR RESPIRATOR.
VENTILATION----- LOCAL EXHAUST: PREFERRED.
MECHANICAL: IF SUFFICIENT TO MAINTAIN TLV.
PROTECTIVE GLOVES----- POLYVINYL ALCOHOL GLOVES.
EYE PROTECTION----- CHEMICAL GOGGLES.
OTHER PROTECTIVE EQUIPMENT-- POLYVINYL ALCOHOL COVERALLS, APRON, BOOTS AS NECESSARY TO MINIMIZE SKIN CONTACT. EYEWASH FOUNTAINS SHOULD BE EASILY ACCESSIBLE.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- REGULATED BY IATA.
OTHER PRECAUTIONS----- AVOID EXPOSURE TO LIGHT.

SECTION 10 -

WHILE BASF WYANDOTTE CORPORATION BELIEVES THE DATA SET FORTH HEREIN ARE ACCURATE AS OF THE DATE HEREOF, BASF WYANDOTTE CORPORATION MAKES
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COMMON NAME----- **TETRAHYDROFURAN**
CAS NUMBER----- 000109-99-9

SECTION 10 - (CONTINUED)

NO WARRANTY WITH RESPECT THERETO AND EXPRESSLY DISCLAIMS ALL LIABILITY FOR RELIANCE THEREON. SUCH DATA ARE OFFERED SOLELY FOR YOUR CONSIDERATION, INVESTIGATION, AND VERIFICATION.

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COMMON NAME----- **TRIETHYLAMINE**
CAS NUMBER----- 000121-44-8

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- PENNMALT CORPORATION
THREE PARKWAY
PHILADELPHIA, PA 19102

EMERGENCY TELEPHONE----- 215-587-7707

PREPARATION DATE----- 06/02/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- TRIETHYLAMINE
CAS NUMBER----- 000121-44-8

SYNONYMS----- N,N-DIETHYLETHANAMINE
189287 - EDP NUMBER
1-ETHANAMINE, N,N-DIETHYL

MOLECULAR FORMULA----- C6-H15-N
CHEMICAL FAMILY----- AMINE

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS LIQUID
BOILING POINT----- 90 C
ODOR----- AMMONIACAL
SOLUBILITY IN WATER----- APPRECIABLE
SPECIFIC GRAVITY----- 0.728 (WATER = 1)
VAPOR DENSITY----- 3.5 (AIR = 1)
VAPOR PRESSURE----- 52 MMHG
VOLATILITY----- 100 %

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- -6 C
METHOD----- OC
FLAMMABLE LIMITS
LEL----- 1.2 %
UEL----- 8.0 %
EXTINGUISHING MEDIA----- CARBON DIOXIDE, FOAM AND DRY CHEMICAL.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- DANGEROUS WHEN EXPOSED TO HEAT OR
FLAME.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
INCOMPATIBILITY----- OXIDIZING MATERIALS.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- 10 PPM. (ACGIH, 1983-84).
EFFECTS OF OVEREXPOSURE--- CORROSIVE TO SKIN AND MUCOUS MEMBRANES.
CAUSES SEVERE AND RAPID BURNS.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES-- WASH AFFECTED AREAS WITH LARGE
AMOUNTS OF WATER.

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COMMON NAME----- **TRIETHYLAMINE**
CAS NUMBER----- 000121-44-8

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- AVOID CONTACT.
WASTE DISPOSAL METHOD----- WASH WITH LARGE AMOUNTS OF WATER.

SECTION 8 - SPECIAL HANDLING

VENTILATION----- MECHANICAL.
PROTECTIVE GLOVES----- PLASTIC.
EYE PROTECTION----- GOGGLES.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- KEEP AWAY FROM HEAT AND OPEN FLAME.

SECTION 10 -

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COMMON NAME----- **TRIPHENYL METHYL CHLORIDE**
CAS NUMBER----- 000076-83-5

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- CHEMICAL DYNAMICS CORPORATION
3001 HADLEY RD
P.O. BOX 395
SOUTH PLAINFIELD, NJ 07080

EMERGENCY TELEPHONE----- 201-753-5000

PREPARATION DATE----- 07/12/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- TRIPHENYL METHYL CHLORIDE
CAS NUMBER----- 000076-83-5

MOLECULAR FORMULA----- C19-H15-CL
CHEMICAL FAMILY----- NOT PROVIDED

SECTION 2 - PHYSICAL DATA

MELTING POINT----- 110.5 C

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE

FLAMMABLE LIMITS

LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE

SPECIAL FIRE FIGHTING PROCEDURES-- WEAR FULL PROTECTIVE CLOTHING AND
SELF-CONTAINED BREATHING APPARATUS AS TOXIC
FUMES MAY EVOLVE.

SECTION 4 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1983-84).

SECTION 5 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

SKIN CONTACT----- IN THE EVENT OF CONTAMINATION, THOROUGHLY
WASH EXPOSED SKIN.

EYE CONTACT----- IN THE CASE OF EYE CONTACT GIVE PROLONGED
IRRIGATION WITH WATER AND OBTAIN MEDICAL
ATTENTION.

SECTION 6 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- IN CASE OF
SPILLAGE SWEEP UP THE MATERIAL WITH THE AID
OF SODA ASH OR LIME OR OTHER ABSORBENT
MATERIAL AND PLACE IN SUITABLE CONTAINER
FOR SAFE DISPOSAL. WASH AWAY RESIDUE WITH
WATER. BE AWARE OF POSSIBLE EVOLUTION OF
HYDROGEN CHLORIDE GAS.

SECTION 7 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- RESPIRATOR WITH ACID TYPE CARTRIDGE.

PROTECTIVE GLOVES----- YES.

OTHER PROTECTIVE EQUIPMENT-- PROTECTIVE CLOTHING.

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COMMON NAME----- **TRIPHENYL METHYL CHLORIDE**
CAS NUMBER----- 000076-83-5

SECTION 8 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- STORE UNDER DRY CON-
DITIONS, AVOID CONTACT WITH WATER AS THIS
WILL FORM HYDROGEN CHLORIDE GAS.

OTHER PRECAUTIONS----- CONTACT WITH SKIN, EYES AND RESPIRATORY
SYSTEM SHOULD BE AVOIDED.

SECTION 9 -

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WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD
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COMMON NAME----- **TOLUENE**
CAS NUMBER----- 000108-88-3

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- ASHLAND CHEMICAL COMPANY
DIVISION OF ASHLAND OIL, INC.
P.O. BOX 2219
COLUMBUS, OH 43216

EMERGENCY TELEPHONE----- 606-324-1133 (24 HRS)
614-889-3333

PREPARATION DATE----- 12/81

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- TOLUENE
CAS NUMBER----- 000108-88-3

SYNONYMS----- METHYLBENZENE
TOLUENE, 99.9+%, HPLC GRADE
TOLUOL

MOLECULAR FORMULA----- C7-H8
CHEMICAL FAMILY----- AROMATIC HYDROCARBON

SECTION 2 - INGREDIENTS

INGREDIENT 1
COMMON NAME----- TOLUENE
PERCENT----- 100 %
CAS NUMBER----- 000108-88-3
TLV----- 100 PPM
REFERENCE----- ACGIH 1985-86

SECTION 3 - PHYSICAL DATA

BOILING POINT----- 111 C (AT 760 MMHG)
EVAPORATION RATE----- 4.5 (ETHER = 1)
SPECIFIC GRAVITY----- 0.871 (AT 15.55 C)
VAPOR DENSITY----- 3.2 (AIR = 1)
VAPOR PRESSURE----- 22 MMHG (AT 20 C)
VOLATILITY----- 100 %

SECTION 4 - FIRE AND EXPLOSION DATA

FLASH POINT----- 7.22 C
METHOD----- CC

FLAMMABLE LIMITS
LEL----- 1.2 %
UEL----- 7.1 %

EXTINGUISHING MEDIA----- REGULAR FOAM OR CARBON DIOXIDE OR DRY
CHEMICAL.

HAZARDOUS DECOMPOSITION PRODUCTS-- MAY FORM TOXIC MATERIALS: CARBON
DIOXIDE AND CARBON MONOXIDE, VARIOUS HYDRO-
CARBONS, ETC.

SPECIAL FIREFIGHTING PROCEDURES-- SELF-CONTAINED BREATHING APPARATUS
WITH A FULL FACEPIECE OPERATED IN PRESSURE-
DEMAND OR OTHER POSITIVE PRESSURE MODE.

UNUSUAL FIRE AND EXPLOSION HAZARDS-- VAPORS ARE HEAVIER THAN AIR AND
MAY TRAVEL ALONG THE GROUND OR MAY BE MOVED
BY VENTILATION AND IGNITED BY PILOT LIGHTS,
OTHER FLAMES, SPARKS, HEATERS, SMOKING,
ELECTRIC MOTORS, STATIC DISCHARGE, OR OTHER
IGNITION SOURCES AT LOCATIONS DISTANT FROM
MATERIAL HANDLING POINT. NEVER USE WELDING
OR CUTTING TORCH ON OR NEAR DRUM (EVEN

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 2 OF 3

COMMON NAME----- **TOLUENE**
CAS NUMBER----- 000108-88-3

SECTION 4 - FIRE AND EXPLOSION DATA (CONTINUED)

EMPTY) BECAUSE PRODUCT (EVEN JUST RESIDUE) CAN IGNITE EXPLOSIVELY.

SECTION 5 - REACTIVITY

HAZARDOUS POLYMERIZATION-- CANNOT OCCUR.
STABILITY----- STABLE.
INCOMPATIBILITY----- AVOID CONTACT WITH STRONG OXIDIZING AGENTS.
HAZARDOUS DECOMPOSITION PRODUCTS-- CARBON MONOXIDE AND ASPHYXIANTS.

SECTION 6 - HEALTH HAZARD

PERMISSIBLE EXPOSURE LEVEL-- 200 PPM.
THRESHOLD LIMIT VALUE----- TWA: (SKIN) 100 PPM (ACGIH, 1984-85).
STEL: (SKIN) 150 PPM (ACGIH, 1984-85).
EFFECTS OF OVEREXPOSURE
EYES----- CAN CAUSE SEVERE IRRITATION, REDNESS, TEAR-
ING, BLURRED VISION.
SKIN----- PROLONGED OR REPEATED CONTACT CAN CAUSE
MODERATE IRRITATION, DEFATTING, DERMATITIS.
BREATHING----- EXCESSIVE INHALATION OF VAPORS CAN CAUSE
NASAL AND RESPIRATORY IRRITATION, DIZZI-
NESS, WEAKNESS, FATIGUE, NAUSEA, HEADACHE,
POSSIBLE UNCONSCIOUSNESS, AND EVEN ASPHYXI-
ATION.
INGESTION----- CAN CAUSE GASTROINTESTINAL IRRITATION, NAU-
SEA, VOMITING, AND DIARRHEA. ASPIRATION OF
MATERIAL INTO THE LUNGS CAN CAUSE CHEMICAL
PNEUMONITIS WHICH CAN BE FATAL.

SECTION 7 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
SKIN----- THOROUGHLY WASH EXPOSED AREA WITH SOAP AND
WATER. REMOVE CONTAMINATED CLOTHING.
LAUNDRY CONTAMINATED CLOTHING BEFORE REUSE.
EYES----- FLUSH WITH LARGE AMOUNTS OF WATER, LIFTING
UPPER AND LOWER LIDS OCCASIONALLY. GET
MEDICAL ATTENTION.
INGESTION----- DO NOT INDUCE VOMITING. KEEP PERSON WARM,
QUIET, AND GET MEDICAL ATTENTION. ASPIRA-
TION OF MATERIAL INTO THE LUNGS DUE TO
VOMITING CAN CAUSE CHEMICAL PNEUMONITIS
WHICH CAN BE FATAL.
INHALATION----- IF AFFECTED, REMOVE INDIVIDUAL TO FRESH
AIR. IF BREATHING IS DIFFICULT, ADMINISTER
OXYGEN. IF BREATHING HAS STOPPED GIVE
ARTIFICIAL RESPIRATION. KEEP PERSON WARM,
QUIET AND GET MEDICAL ATTENTION.

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED--
SMALL SPILL: ABSORB LIQUID ON PAPER, VER-
MICULITE, FLOOR ABSORBENT, OR OTHER ABSORB-
ENT MATERIAL AND TRANSFER TO HOOD.
LARGE SPILL: ELIMINATE ALL IGNITION
SOURCES (FLARES, FLAMES INCLUDING PILOT
LIGHTS, ELECTRICAL SPARKS). PERSONS NOT
WEARING PROTECTIVE EQUIPMENT SHOULD BE
EXCLUDED FROM AREA OF SPILL UNTIL CLEAN-UP
HAS BEEN COMPLETED. STOP SPILL AT SOURCE,
DIKE AREA OF SPILL TO PREVENT SPREADING,
PUMP LIQUID TO SALVAGE TANK. REMAINING
LIQUID MAY BE TAKEN UP ON SAND, CLAY,

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PAGE 3 OF 3

COMMON NAME----- **TOLUENE**
CAS NUMBER----- 000108-88-3

SECTION 8 - SPILL, LEAK AND DISPOSAL PROCEDURES (CONTINUED)

WASTE DISPOSAL METHOD----- EARTH, FLOOR ABSORBENT, OR OTHER ABSORBENT MATERIAL AND SHOVELED INTO CONTAINERS.
SMALL SPILL: ALLOW VOLATILE PORTION TO EVAPORATE IN HOOD. ALLOW SUFFICIENT TIME FOR VAPORS TO COMPLETELY CLEAR HOOD DUCT WORK. DESTROY REMAINING MATERIAL BY BURNING IN AN IRON PAN.
LARGE SPILL: DESTROY BY LIQUID INCINERATION. CONTAMINATED ABSORBENT MAY BE DEPOSITED IN A LANDFILL IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION 9 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- IF TLV OF THE PRODUCT OR ANY COMPONENT IS EXCEEDED, A NIOSH/MSHA JOINTLY APPROVED AIR SUPPLIED RESPIRATOR IS ADVISED IN ABSENCE OF PROPER ENVIRONMENTAL CONTROL. OSHA REGULATIONS ALSO PERMIT OTHER NIOSH/MSHA RESPIRATORS UNDER SPECIFIED CONDITIONS. (SEE YOUR SAFETY EQUIPMENT SUPPLIER). ENGINEERING OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.
VENTILATION----- PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).
PROTECTIVE GLOVES----- WEAR RESISTANT GLOVES SUCH AS VITON.
EYE PROTECTION----- CHEMICAL SPLASH GOGGLES IN COMPLIANCE WITH OSHA REGULATIONS ARE ADVISED, HOWEVER, OSHA REGULATIONS ALSO PERMIT OTHER TYPE SAFETY GLASSES. (CONSULT YOUR SAFETY EQUIPMENT SUPPLIER).
OTHER PROTECTIVE EQUIPMENT-- TO PREVENT REPEATED OR PROLONGED SKIN CONTACT, WEAR IMPERVIOUS CLOTHING AND BOOTS.

SECTION 10 - SPECIAL PRECAUTIONS

SPECIAL PRECAUTIONS----- CONTAINERS OF THIS MATERIAL MAY BE HAZARDOUS WHEN EMPTIED. SINCE EMPTIED CONTAINERS RETAIN PRODUCT RESIDUES (VAPOR, LIQUID, AND/OR SOLIDS), ALL HAZARD PRECAUTIONS GIVEN IN THIS DATA SHEET MUST BE OBSERVED. OVEREXPOSURE TO MATERIAL HAS APPARENTLY BEEN FOUND TO CAUSE THE FOLLOWING EFFECTS IN LABORATORY ANIMALS: LIVER ABNORMALITIES, KIDNEY DAMAGE, LUNG DAMAGE, SPLEEN DAMAGE. OVEREXPOSURE TO MATERIAL HAS BEEN SUGGESTED AS A CAUSE OF THE FOLLOWING EFFECTS IN HUMANS: LIVER ABNORMALITIES.

SECTION 11 -

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE BUT IS NOT WARRANTED TO BE WHETHER ORIGINATING WITH ASHLAND OR NOT. RECIPIENTS ARE ADVISED TO CONFIRM IN ADVANCE OF NEED THAT THE INFORMATION IS CURRENT, APPLICABLE, AND SUITABLE TO THEIR CIRCUMSTANCES.
BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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Material Safety Data Sheets for 2 Substances

Substances used in the formulation of ceftiofur hydrochloride

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***** MATERIAL SAFETY DATA SHEET *****

PAGE 1 OF 2

COMMON NAME----- COTTON SEED OIL
CAS NUMBER----- 008001-29-4

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- THE UPJOHN COMPANY
KALAMAZOO, MI 49001

EMERGENCY TELEPHONE----- 616-323-6150

PREPARATION DATE----- 04/15/81

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- COTTON SEED OIL
CAS NUMBER----- 008001-29-4

MOLECULAR FORMULA----- UNKNOWN
CHEMICAL FAMILY----- GOSSYPIUM SEED OIL

SECTION 2 - PHYSICAL DATA

APPEARANCE----- GREENISH-YELLOW TO ALMOST COLORLESS OIL
BOILING POINT----- NOT APPLICABLE
EVAPORATION RATE----- NOT APPLICABLE
SOLUBILITY IN WATER----- NEGLIGIBLE
SPECIFIC GRAVITY----- 0.916
VAPOR DENSITY----- NOT APPLICABLE
VAPOR PRESSURE----- NOT APPLICABLE
VOLATILITY----- NOT APPLICABLE

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- 283 C
METHOD----- NOT PROVIDED
FLAMMABLE LIMITS
LEL----- NOT PROVIDED
UEL----- NOT PROVIDED
EXTINGUISHING MEDIA----- WATER; CARBON DIOXIDE; CHEMICAL.
SPECIAL FIRE FIGHTING PROCEDURES-- NONE.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- NONE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE.
CONDITIONS TO AVOID----- NONE.
INCOMPATIBILITY----- NONE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

PERMISSIBLE EXPOSURE LIMIT-- NOT ESTABLISHED, (29 CFR 1910).
THRESHOLD LIMIT VALUE----- NOT ESTABLISHED, (ACGIH, 1986-87).
EFFECTS OF OVEREXPOSURE--- MILD PRIMARY SKIN IRRITANT.
TOXICITY----- SKIN IRRITATION (HUMANS): 300 MG/3D.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES
SKIN----- WASH THOROUGHLY AFTER HANDLING.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- COVER WITH
ABSORBENT MATERIAL AND SWEEP OR SCOOP UP.
WASTE DISPOSAL METHOD----- LANDFILL OR INCINERATION.

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PAGE 2 OF 2

COMMON NAME----- COTTON SEED OIL
CAS NUMBER----- 008001-29-4

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- NONE REQUIRED.
VENTILATION----- LOCAL EXHAUST: NONE REQUIRED. MECHANICAL:
NONE REQUIRED.
PROTECTIVE GLOVES----- IMPERMEABLE GLOVES.
EYE PROTECTION----- SAFETY GLASSES.
OTHER PROTECTIVE EQUIPMENT-- NONE.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- NO IN-HOUSE LABEL
REQUIRED ACCORDING TO "SYSTEMATIC UTILI-
ZATION OF PRECAUTIONARY LABELING."

SECTION 10 - PRODUCT INGREDIENTS

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES-- NONE.

SECTION 11 - UPJOHN DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT SHOULD ONLY BE
USED AS A GUIDE. UPJOHN DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY AS
TO THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE
FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM
RELIANCE ON THE ABOVE INFORMATION.

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PAGE 1 OF 2

COMMON NAME----- **CHLOROBUTANOL**
CAS NUMBER----- 000057-15-8

MSDS RECIPIENT----- ENVIRONMENTAL AFFAIRS
UNIT 6101-041-00

MANUFACTURER----- STAUFFER CHEMICAL CO
STAUFFER; R.W. GREEF
IL

DATA SOURCE----- THE UPJOHN COMPANY
7171 PORTAGE RD
KALAMAZOO, MI 49001

EMERGENCY TELEPHONE----- 616-323-7555 (8:00 - 4:30)
616-323-6722 (24 HRS)

PREPARATION DATE----- 05/18/83

SECTION 1 - MATERIAL IDENTIFICATION

COMMON NAME----- CHLOROBUTANOL
CAS NUMBER----- 000057-15-8

SYNONYMS----- ACETONE CHLOROFORM
2-PROPANOL , 1,1,1-TRICHLORO-2-METHYL-

MOLECULAR FORMULA----- C4-H7-CL3-O
CHEMICAL FAMILY----- ANTIMICROBIAL

SECTION 2 - PHYSICAL DATA

APPEARANCE----- COLORLESS TO WHITE CRYSTALLINE MATERIAL
BOILING POINT----- 167 C
MELTING POINT----- 76 C
ODOR----- CAMPHOR-LIKE ODOR
SOLUBILITY IN WATER----- SLIGHTLY SOLUBLE IN WATER

SECTION 3 - FIRE AND EXPLOSION DATA

FLASH POINT----- NOT APPLICABLE
METHOD----- NOT APPLICABLE
FLAMMABLE LIMITS
LEL----- NOT APPLICABLE
UEL----- NOT APPLICABLE
EXTINGUISHING MEDIA----- WATER, CARBON DIOXIDE, OR CHEMICAL.
SPECIAL FIRE FIGHTING PROCEDURES-- AS IN ANY FIRE, PREVENT HUMAN EXPO-
SURE TO FIRE, SMOKE, FUMES OR PRODUCTS OF
COMBUSTION. FIREFIGHTERS SHOULD WEAR FULL-
FACE, SELF-CONTAINED BREATHING APPARATUS
AND IMPERVIOUS PROTECTIVE CLOTHING.
UNUSUAL FIRE AND EXPLOSION HAZARDS-- NONE.

SECTION 4 - REACTIVITY

STABILITY----- STABLE AT AMBIENT TEMPERATURES AND ATMOS-
PHERIC PRESSURE. AVOID PROLONGED EXPOSURE
TO AIR. ANHYDROUS GRADE IS HYGROSCOPIC.

CONDITIONS TO AVOID----- SUBLIMES EASILY.
INCOMPATIBILITY----- NONE.
HAZARDOUS DECOMPOSITION PRODUCTS-- NONE.
HAZARDOUS POLYMERIZATION-- WILL NOT OCCUR.

SECTION 5 - HEALTH HAZARD

THRESHOLD LIMIT VALUE----- NOT ESTABLISHED (ACGIH, 1985-86).
EFFECTS OF OVEREXPOSURE---- CHLOROBUTANOL IS A CENTRAL NERVOUS SYSTEM
DEPRESSANT THAT HAS BEEN USED AS A SEDATIVE
AND HYPNOTIC. REPEATED INGESTION OF THE

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PAGE 2 OF 2

COMMON NAME----- **CHLOROBUTANOL**
CAS NUMBER----- 000057-15-8

SECTION 5 - HEALTH HAZARD (CONTINUED)

MATERIAL MAY BE ADDICTIVE. INGESTION OF THE MATERIAL IN LARGE QUANTITIES IS CAPABLE OF PRODUCING NARCOSIS, UNCONSCIOUSNESS AND DEATH.

TOXICITY----- LDLO (DOG): 238 MG/KG.
ORAL LD50 (RAT-FEMALE): 283 MG/KG.
ORAL LD50 (RAT-MALE): 317 MG/KG.
MUTAGENICITY: NEGATIVE.

SECTION 6 - FIRST AID

EMERGENCY AND FIRST AID PROCEDURES

EYES----- FLUSH FOR 15 MINUTES WITH WATER.
SKIN----- WASH THOROUGHLY AFTER HANDLING.
INGESTION----- IMMEDIATELY GIVE SEVERAL GLASSES OF WATER AND INDUCE VOMITING. GIVE FLUIDS UNTIL VOMITUS IS CLEAR.
INHALATION----- REMOVE TO FRESH AIR.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED-- SWEEP OR VACUUM UP. WASH RESIDUE TO DRAIN.
WASTE DISPOSAL METHOD----- LANDFILL OR FLUSH TO DRAIN WITH COPIOUS QUANTITIES OF WATER. DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION 8 - SPECIAL HANDLING

RESPIRATORY PROTECTION---- APPROVED DUST OR VAPOR RESPIRATOR.
VENTILATION----- LOCAL EXHAUST: RECOMMENDED.
MECHANICAL: ACCEPTABLE.
PROTECTIVE GLOVES----- RUBBER.
EYE PROTECTION----- SAFETY GLASSES.
OTHER PROTECTIVE EQUIPMENT-- NONE.

SECTION 9 - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING-- DO NOT GET IN EYES, ON SKIN OR CLOTHING. AVOID BREATHING DUST OR VAPOR. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING.
OTHER PRECAUTIONS----- ABUSE MAY LEAD TO HABITUATION OR ADDICTION.

SECTION 10 - MSDS PREPARATION INFORMATION

PREPARED BY----- PAUL F. WOOLRICH
ENVIRONMENTAL SERVICES
APRIL 16, 1981

SECTION 11 -

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH, BUT NO WARRANTY, EXPRESS OR IMPLIED, IS MADE.

BECAUSE THE ABOVE INFORMATION IS PROVIDED BY A VENDOR, UPJOHN DOES NOT WARRANT THE ACCURACY OF THE ABOVE INFORMATION AND SHALL NOT BE HELD LIABLE FOR RELIANCE ON THE ABOVE INFORMATION.

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Appendix C

General Characterization of Injected Fluids

<u>Parameter</u>	<u>Concentration</u>		
Arsenic	<	.1	ppm
Barium	0	- 1	ppm
Cadmium	0	- .1	ppm
Copper	0	- 25	ppm
Chromium	100	- 500	ppm
Chromium + 6	<	.1	ppm
Lead	0	- .1	ppm
Mercury	<	0.01	ppm
Selenium	<	0.1	ppm
Silver	<	0.005	ppm
Zinc	5	- 200	ppm
Cyanide	0		ppm
Sulfide	0		ppm
Suspended Solids	50	- 60	ppm
Methanol	0	- 3	%
Ethanol	0	- 2	%
Acetone	0	- 1	%
Isopropyl Alcohol	0	- 1	%
t-Butanol	0	- .5	%
n-Propanol	0	- .2	%
THF	0	- .5	%
MIBK	0	- .1	%
Methylene Chloride	0	- .1	%
Aqueous Solution	95	- 100	%
pH	4.5	- 5.5	
Specific gravity	1.0		

Appendix A—Underground Injection Control Permit Application

Form 4 UIC	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY UNDERGROUND INJECTION CONTROL PERMIT APPLICATION <small>(Conducted under the authority of the Safe Drinking Water Act, Sections 1421, 1432, 40 CFR 143)</small>	FORM RESPONSE UNDER THE AUTOMATIC RESPONSE SYSTEM I. EPA ID NUMBER T/A/C																								
READ ATTACHED INSTRUCTIONS BEFORE STARTING FOR OFFICIAL USE ONLY																										
Applicant Address No. St. City State ZIP Code	Date Received Mo. Day Year	Permit/Well Number Comments																								
IV. FACILITY NAME AND ADDRESS Facility Name Street Address City State ZIP Code		III. OWNER/OPERATOR AND ADDRESS Owner/Operator Name Street Address City State ZIP Code																								
IV. OWNERSHIP STATUS (Mark 'X') <input type="checkbox"/> A. Federal <input type="checkbox"/> B. State <input type="checkbox"/> C. Private <input type="checkbox"/> D. Public <input type="checkbox"/> E. Other (Specify)		V. SIC CODES																								
VI. WELL STATUS (Mark 'X') <input type="checkbox"/> A. <table border="1" style="font-size: x-small;"> <tr> <th colspan="3">Date Started</th> </tr> <tr> <td>Mo.</td> <td>Day</td> <td>Year</td> </tr> </table> <input type="checkbox"/> B. Modification/Conversion <input type="checkbox"/> C. Proposed			Date Started			Mo.	Day	Year																		
Date Started																										
Mo.	Day	Year																								
VII. TYPE OF PERMIT REQUESTED (Mark 'X' and specify if required) <input type="checkbox"/> A. Individual <input type="checkbox"/> B. Area Number of Existing wells Number of Proposed wells Number of Field(s) or projects																										
VIII. CLASS AND TYPE OF WELL (See Remarks) A. Class (enter number) B. Type (enter number) C. If class is "other" or type is class "2," explain D. Number of wells per type (if area permit)																										
IX. LOCATION OF WELL(S) OR APPROXIMATE CENTER OF FIELD OR PROJECT G. <table border="1" style="font-size: x-small;"> <tr> <th colspan="3">A. Longitude</th> <th colspan="3">B. Latitude</th> <th colspan="2">Township and Range</th> </tr> <tr> <td>Deg</td><td>Min</td><td>Sec</td> <td>Deg</td><td>Min</td><td>Sec</td> <td>Town</td><td>Range</td> </tr> <tr> <td colspan="2">Foot from Line</td> <td colspan="2">Foot from Line</td> <td colspan="2"></td> <td colspan="2"></td> </tr> </table>		A. Longitude			B. Latitude			Township and Range		Deg	Min	Sec	Deg	Min	Sec	Town	Range	Foot from Line		Foot from Line						X. INDIAN LANDS (Mark 'X') <input type="checkbox"/> Yes <input type="checkbox"/> No
A. Longitude			B. Latitude			Township and Range																				
Deg	Min	Sec	Deg	Min	Sec	Town	Range																			
Foot from Line		Foot from Line																								
XI. ATTACHMENTS (Complete the following questions on a separate sheet(s) and number accordingly; see instructions) FOR CLASSES I, II, III (and other classes) complete and submit on separate sheets) Attachments A — U (pg 2-6) as appropriate. Attach maps where required. List attachments by letter which are applicable and are included with your application.																										
XII. CERTIFICATION I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)																										
A. Name and Title (Type or Print)		B. Phone No. (Area Code and No.)																								
C. Signature		D. Date Signed																								

Well Class and Type Codes

Class I	Wells used to inject waste below the deepest underground source of drinking water
Type "T"	Nonhazardous industrial disposal well
"M"	Nonhazardous municipal disposal well
"W"	Hazardous waste disposal well injecting below USDWs
"X"	Other Class I wells (not included in Type "T," "M," or "W")
Class II	Oil and gas production and storage related injection wells.
Type "D"	Produced fluid disposal well
"R"	Enhanced recovery well
"H"	Hydrocarbon storage well (excluding natural gas)
"X"	Other Class II wells (not included in Type "D," "R," or "H")
Class III	Special process injection wells.
Type "G"	Solution mining well
"S"	Sulfur mining well by Frasch process
"U"	Uranium mining well (excluding solution mining of conventional mines)
"X"	Other Class III wells (not included in Type "G," "S," or "U")
Other Classes	Wells not included in classes above.
	Class V wells which may be permitted under §144.12
	Wells not currently classified as Class I, II, III, or V.

Attachments to Permit Application

Class	Attachments
I new well	A, B, C, D, F, H - S, U
existing	A, B, C, D, F, H - U
II new well	A, B, C, E, G, H, M, Q, R; optional - I, J, K, O, P, U
existing	A, E, G, H, M, Q, R - U; optional - J, K, O, P, Q
III new well	A, B, C, D, F, H, I, J, K, M - S, U
existing	A, B, C, D, F, H, J, K, M - U
Other Classes	To be specified by the permitting authority

INSTRUCTIONS — Form 4 — Underground Injection Control (UIC) Permit Application

Form 4 must be completed by all owners or operators of Class I, II, and III injection wells and others who may be directed to apply for a UIC permit by the Director.

I. EPA I.D. NUMBER — Fill in your EPA Identification Number. If you do not have a number, leave blank.

II. FACILITY NAME AND ADDRESS — Name of well, well field or company and address.

III. OWNER/OPERATOR NAME AND ADDRESS — Name and address of owner/operator of well or well field.

IV. OWNERSHIP STATUS — Mark the appropriate box to indicate the type of ownership.

V. SIC CODES — List at least one and no more than four Standard Industrial Classification (SIC) Codes that best describe the nature of the business in order of priority.

VI. WELL STATUS — Mark Box A if the well(s) were operating as injection wells on the effective date of the UIC Program for the State. Mark Box B if the well(s) existed on the effective date of the UIC Program for the State but were not utilized for injection. Box C should be marked if the application is for an underground injection project not constructed or not completed by the effective date of the UIC Program for the State.

VII. TYPE OF PERMIT — Mark "Individual" or "Area" to indicate the type of permit desired. Note that area permits are at the discretion of the Director and that wells covered by an area permit must be at one site, under the control of one person and do not inject hazardous waste. If an area permit is requested the number of wells to be included in the permit must be specified and the wells described and identified by location. If the area has a commonly used name, such as the "Jay Field," submit the name in the space provided. In the case of a project or field which crosses State lines, it may be possible to consider an area permit if EPA has jurisdiction in both States. Each such case will be considered individually, if the owner/operator elects to seek an area permit.

VIII. CLASS AND TYPE OF WELL — Enter in these two positions the Class and type of injection well for which a permit is requested. Use the most pertinent code selected from the list on the reverse side of Form 4. When selecting type X please explain in the space provided.

IX. LOCATION OF WELL — Enter the latitude and longitude of the existing or proposed well expressed in degrees, minutes, and seconds or the location by township, and range, and section, as required by 40 CFR 146. If an area permit is being requested, give the latitude and longitude of the approximate center of the area.

X. INDIAN LANDS — Place an "X" in the box if any part of the facility is located on Indian lands.

XI. ATTACHMENTS — Note that information requirements vary depending on the injection well class and status. Attachments for Class I, II, and III are described on pages 4 and 5 of this document and listed by Class on page 2. Place EPA ID number in the upper right hand corner of each page.

XII. CERTIFICATION — All permit applications (except Class II) must be signed by a responsible corporate officer for a corporation, by a general partner for a partnership, by the proprietor of a sole proprietorship, and by a principal executive or ranking elected official for a public agency. For Class II, the person described above should sign, or a representative duly authorized in writing.

INSTRUCTIONS — Attachments to Form 4

Attachments to be submitted with permit application for Class I, II, III and other wells

A. AREA OF REVIEW METHODS — Give the methods and, if appropriate, the calculations used to determine the size of the area of review (fixed radius or equation). The area of review shall be a fixed radius of $\frac{1}{2}$ mile from the well bore unless the use of an equation is approved in advance by the Director

B. MAPS OF WELLS/AREA AND AREA OF REVIEW — Submit a topographic map, extending one mile beyond the property boundaries, showing the injection well(s) or project area for which a permit is sought and the applicable area of review. The map must show all intake and discharge structures and all hazardous waste, treatment, storage, or disposal facilities. If the application is for an area permit, the map should show the distribution manifold (if applicable) applying injection fluid to all wells in the area, including all system monitoring points. Within the area of review, the map must show the following:

Class I

The number, or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, mines (surface and subsurface), quarries, and other pertinent surface features, including residences and roads, and faults, if known or suspected. In addition, the map must identify those wells, springs, other surface water bodies, and drinking water wells located within one quarter mile of the facility property boundary. Only information of public record is required to be included on this map:

Class II

In addition to requirements for Class I, include pertinent information known to the applicant. This requirement does not apply to existing Class II wells:

Class III

In addition to requirements for Class I, include public water systems and pertinent information known to the applicant.

C. CORRECTIVE ACTION PLAN AND WELL DATA — Submit a tabulation of data reasonably available from public records or otherwise known to the applicant on all wells within the area of review, including those on the map required in B, which penetrate the proposed injection zone. Such data shall include the following:

Class I

A description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Director may require. In the case of new injection wells, include the corrective action proposed to be taken by the applicant under 40 CFR 144.55

Class II

In addition to requirements for Class I, in the case of Class II wells operating over the fracture pressure of the injection formation, all known wells within the area of review which penetrate formations affected by the increase in pressure. This requirement does not apply to existing Class II wells.

Class III

In addition to requirements for Class I, the corrective action proposed under 40 CFR 144.55 for all Class III wells.

D. MAPS AND CROSS SECTIONS OF USDWs — Submit maps and cross sections indicating the vertical limits of all underground indicating the vertical limits of all underground sources of drinking water within the area of review (both vertical and lateral limits for Class II), their position relative to the injection formation and the direction of water movement, where known, in every underground source of drinking water which may be affected by the proposed injection. (Does not apply to Class II wells.)

E. NAME AND DEPTH OF USDWs (CLASS II) — For Class II wells, submit geologic name, and depth to bottom of all underground sources of drinking water which may be affected by the injection.

F. MAPS AND CROSS SECTIONS OF GEOLOGIC STRUCTURE OF AREA — Submit maps and cross sections detailing the geologic structure of the local area (including the lithology of injection and confining intervals) and generalized maps and cross sections illustrating the regional geologic setting. (Does not apply to Class II wells.)

G. GEOLOGICAL DATA ON INJECTION AND CONFINING ZONES (CLASS II) — For Class II wells, submit appropriate geological data on the injection zone and confining zones including lithologic description, geological name, thickness, depth and fracture pressure.

- H. OPERATING DATA** — Submit the following proposed operating data for each well (including all those to be covered by area permits): (1) average and maximum daily rate and volume of the fluids to be injected; (2) average and maximum injection pressure; (3) nature of annulus fluid; (4) for Class I wells, source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids; (5) for Class II wells, source and analysis of the physical and chemical characteristics of the injection fluid; (6) for Class III wells, a qualitative analysis and ranges in concentrations of all constituents of injected fluids. If the information is proprietary, maximum concentrations only may be submitted, but all records must be retained.
- I. FORMATION TESTING PROGRAM** — Describe the proposed formation testing program. For Class I wells the program must be designed to obtain data on fluid pressure, temperature, fracture pressure, other physical, chemical, and radiological characteristics of the injection matrix and physical and chemical characteristics of the formation fluids.
- For Class II wells the testing program must be designed to obtain data on fluid pressure, estimated fracture pressure, physical and chemical characteristics of the injection zone. (Does not apply to existing Class II wells or projects.)
- For Class III wells the program must be designed to obtain data on fluid pressure, fracture pressure, and physical and chemical characteristics of the formation fluids if the formation is naturally water bearing. Only fracture pressure is required if the formation is not water bearing. (Does not apply to existing Class III wells or projects.)
- J. STIMULATION PROGRAM** — Outline any proposed stimulation program.
- K. INJECTION PROCEDURES** — Describe the proposed injection procedures including pump, surge, tank, etc.
- L. CONSTRUCTION PROCEDURES** — Discuss the construction procedures (according to §146.12 for Class I, §146.22 for Class II, and §146.32 for Class III) to be utilized. This should include details of the casing and cementing program, logging procedures, deviation checks, and the drilling, testing and coring programs, and proposed annulus fluid. (Request and submission of justifying data must be made to use an alternative to a packer for Class I.)
- M. CONSTRUCTION DETAILS** — Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.
- N. CHANGES IN INJECTED FLUID** — Discuss expected changes in pressure, native fluid displacement, and direction of movement of injected fluid. (Class III wells only.)
- O. PLANS FOR WELL FAILURES** — Outline contingency plans (proposed plans, if any, for Class II) to cope with all shut-ins or well failures, so as to prevent migration of fluids into any USDW.
- P. MONITORING PROGRAM** — Discuss the planned monitoring program. This should be thorough, including maps showing the number and location of monitoring wells as appropriate and a discussion of monitoring devices, sampling frequency, and parameters measured. If a manifold monitoring program is utilized, pursuant to §146.23(b)(5), describe the program and compare it to individual well monitoring.
- Q. PLUGGING AND ABANDONMENT PLAN** — Submit a plan for plugging and abandonment of the well including (1) describe the type, number, and placement (including the elevation of the top and bottom) of plugs to be used; (2) describe the type, grade, and quantity of cement to be used; and (3) describe the method to be used to place plugs, including the method used to place the well in a state of static equilibrium prior to placement of the plugs. Also for a Class III well that underlies or is in an exempted aquifer, demonstrate adequate protection of USDWs. Submit this information on EPA Form 7520-14, Plugging and Abandonment Plan.
- R. NECESSARY RESOURCES** — Submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.
- S. AQUIFER EXEMPTIONS** — If an aquifer exemption is requested, submit data necessary to demonstrate that the aquifer meets the following criteria: (1) does not serve as a source of drinking water; (2) cannot now and will not in the future serve as a source of drinking water; and (3) the TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and is not reasonably expected to supply a public water system. Data to demonstrate that the aquifer is expected to be mineral or hydrocarbon producing, such as general description of the mining zone, analysis of the amenability of the mining zone to the proposed method, and time table for proposed development must also be included. For additional information on aquifer exemptions, see 40 CFR 144.7 and 146.04.
- T. EXISTING EPA PERMITS** — List program and permit number of any existing EPA permits, for example, NPOES, PSD, RCRA, etc.
- U. DESCRIPTION OF BUSINESS** — Give a brief description of the nature of the business.