

FYI-0794-1040

→ Will Perry

F/chemicals

CBI Available - #20-8480205-1

PHILLIPS PETROLEUM COMPANY

BARTLESVILLE, OKLAHOMA 74004  
918 661-5956

January 12, 1984

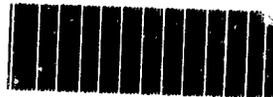


791-94-0010-40  
INIT 07/14/94

Corporate Engineering  
JOHN J. MOON  
Manager, Environment and Consumer Protection

Chemicals to be  
Reviewed by ITC

Martin Greif  
TSCA, Interagency Testing Committee  
Environmental Protection Agency (TS-792)  
401 M Street, S.W.  
Washington, D.C. 20460



64948000148

RECEIVED  
OPT CBI/C  
JUL 14 AM 9:17

Dear Mr. Greif:

This letter and attachment are in response to the November 9, 1983 Federal Register notice requesting information on 82 chemicals which will be reviewed by the Interagency Testing Committee (ITC). These comments reflect the interests of Phillips Petroleum Company and its subsidiaries.

We consider production and sales figures to be confidential. Therefore, we are also submitting a sanitized copy of the attachment.

We have particular confidentiality concerns with the production figures for tetrahydrothiophene-1,1-dioxide. We believe that this chemical is manufactured by only one company other than Phillips. Therefore, we are requesting that a total production figure for this chemical not be released to the public.

If additional information is needed, please contact M. C. Sauter of my staff at (918) 661-4642.

Sincerely,

J. J. Moon

JJM:MCS:vlw  
Attachment

- Tetrahydrothiophene 1,1-dioxide IR-434
- Methylcyclopentane IR-4.5
- 1-Hexene IR-427B
- Tert-Butyl methyl ether IR-444



12-434

# industrial hygiene and toxicology

PHILLIPS PETROLEUM COMPANY HUMAN RESOURCES - MEDICAL DIVISION BARTLESVILLE, OK 74004 918 661-6800

## TOXICITY STUDY SUMMARY

### SULFOLANE

#### Acute Oral Toxicity

Albino rats of the Sprague-Dawley strain weighing 200-300 g were selected as the experimental animals. One of five dose levels was administered to individual groups each containing male and female animals. The male animals were given a single dose of 1000, 1500, 2000, 3000 or 5000 mg/kg by oral gavage. The female animals were given a single dose of 1000, 2000, 2500, 3000, or 5000 mg/kg by oral gavage. Ten male rats were dosed at the 3000 mg/kg level. Five rats were dosed at all other levels. Test material was administered neat. The animals were then observed for 14 days. One male and five females dosed at 1000 mg/kg and four males dosed at 1500 mg/kg of body weight appeared normal from initiation to termination. Gross pharmacotoxic signs and symptoms noted in remaining animals included one or more of the following: depression, slight depression, rough coat, salivation, a hunched appearance, tremors, ataxia, urine stains, soft feces, and red stains on the nose and/or eyes. All surviving rats that showed clinical signs appeared normal by Day 3 and remained normal through termination of the study. All rats that survived to termination gained weight from initiation to termination. All rats that died lost weight with the exception of two which gained weight and two which maintained the same weight. Thorough necropsies were conducted on each animal that died during the study or was found in a moribund condition. Surviving animals were euthanized on Day 14 of the observation period then submitted to thorough necropsy. The most common gross pathological findings, among the animals that died, included alterations of the stomach and/or intestines. These alterations included compound-like material, dark red material, reddish fluid or yellowish fluid in the stomach and/or intestines. Findings in the lung and liver were noted at the 5000 mg/kg dose level only. There were no gross pathological findings noted in rats surviving to termination. The oral LD50 for Sulfolane was calculated to be 2362.5 mg/kg at the 95% confidence level. The LD16 and LD84 were calculated to be 1550.8 and 3599.3, respectively, at the 95% confidence level.

#### Acute Dermal Toxicity

Young, albino rabbits, New Zealand strain, weighing approximately 2.5 kg were selected as the test animals. Two males and two females were dosed with the undiluted test material under an occlusive plastic sheet, at each dose level. Applications were made at dose levels of 6.8, 10.2, 15.4 and 23.1 g/kg of body weight and contact was maintained for 24 hours on shaved skin. The animals were observed for 14 days. The acute percutaneous LD50 was calculated to be 12.6 g/kg of body weight. Gross toxic signs consisted of weakness, lethargy,

paralysis of the hind quarters and moderate to severe tremors. All deaths occurred within two days after the start of the application. Severe erythema and edema were noted at the application site. At necropsy no gross pathological alterations were noted.

#### Eye Irritation

Undiluted test material was instilled into the right eye of five, albino rabbits, New Zealand strain, at a volume of 0.1 ml. Observations for eye irritation were conducted according to the method of Draize.\* Corneal opacity was noted in all rabbits by 72 hours post-instillation it had cleared in all animals but one. The cornea of this latter animal was cleared by Day 7. Iridial irritancy and slight conjunctival irritancy were noted through 72 to 96 hours. By Day 7 post-instillation all eyes appeared normal.

#### Skin Irritation

Undiluted test material was applied to the shaved backs of four albino rabbits at a volume of 0.5 ml on each test site. The material was confined to shaved, abraded and intact skin sites having an area of one inch square under a gauze patch. The entire trunk was enclosed with an occlusive plastic sheet and contact was maintained for 24 hours. The primary irritation index was calculated to be 0.7.

#### Dermal Sensitization

Adult guinea pigs of the Hartley strain weighing 300-500 g were used as the experimental animals. Preliminary tests established the induction dose level (producing very slight irritation) and the challenge dose level (highest non-irritating concentration) of the test material to be 75% and 75%, respectively. The carrier vehicle used for Sulfolane was acetone. Four groups each containing five male and five female guinea pigs were used in this study. One group received induction and challenge doses of a known sensitizer, dinitrochlorobenzene. A second group served as a control, and received only the challenge dose of the known sensitizer. The remaining two groups were set up similarly, however the test material replaced the known sensitizer.

Two groups of guinea pigs were clipped free of hair in the upper left quadrant of their backs. A 0.5 ml induction dose of test material or known sensitizer was applied to the back and a patch was taped in place. Rubber damming was then wrapped around the animal to secure the patch and the guinea pig was restrained for 6 hours. This procedure was carried out once a week for three weeks. The two control groups received no treatment during this induction phase. Two weeks following the application of the last induction patch, the lower left quadrant of both test and control animals was shaved. A 0.5 ml challenge dose was applied to the shaved back for a 4 to 6 hour exposure period. A dipylatory agent was applied to this area the following day and

\*Draize, J.H., "Dermal Toxicity." Appraisal of the Safety of Chemicals in Foods and Cosmetics. 46-59, 1965

and washed off. The challenge site was scored for erythema and edema 24, 48 and 72 hours following the challenge dose according to the system of Draize.\* The animals were sacrificed following the 72 hours observation. A skin section from the challenge site was fixed in 10% neutral buffered formalin for histopathologic evaluation.

In this study the following results were noted. Guinea pigs receiving the test material, 75% Sulfolane in acetone, during the challenge phase only and those animals exposed to the same challenge dose following the induction with 75% Sulfolane in acetone and a rest period, exhibited no dermal irritation at 24, 48 or 72 hours. Based on this response, Sulfolane is not considered a dermal sensitizer in guinea pigs.

#### Ames Test

Five Salmonella typhimurium tester strains, TA1535, TA1537, TA1538, TA98 and TA100, were utilized as the experimental organisms. Each strain was exposed to a minimum of five test compound doses both with and without metabolic activation by an Aroclor-induced rat liver microsomal fraction. The test compound dose levels were determined by a preliminary multidose-ranging study with the optimal concentration allowing survival of about fifty percent of the cells. Sulfolane solubilized freely in deionized glass distilled water. The maximum dose selected for the mutagenicity test was approximately 52,000 µg/plate since the test material was neither toxic or insoluble.

The mutagenicity assay was done directly by the plate incorporation method. Each of 2 ml of complete top agar, 0.1 ml of an overnight broth culture of each tester strain, 0.1 ml of the test compound or diluent and 0.5 ml of the S-9 mix, for the activated tests only, were combined, mixed thoroughly, and poured onto VBE minimal agar plates. Each concentration of the compound and the positive and negative controls were plated in triplicate. Plates were gently rotated and tilted to assure uniform distribution of the top agar, allowed to harden on an even surface for 1 hour, inverted and put in a dark 37 ± 0.5°C incubator. After 2 days, the colonies on both test and control plates were counted using an electronic colony counter and the density of the background growth was noted.

Exposure to five graded doses of the test material in the presence of and in the absence of metabolic activation did not increase the reversion to histidine prototrophy of S. typhimurium strains TA1535, TA1537, TA1538, TA98 or TA100. Therefore Sulfolane is not considered to be mutagenic in this test system.

#### Mouse Lymphoma Forward Mutational Assay

This assay was performed with the TK+/- phenotype of L5178Y mouse lymphoma cells from subline 3.7.2C using a minimum of eight test compound doses with and without metabolic activation by an Aroclor-induced rat liver microsomal

\*Draize, J.H., "Dermal Toxicity." Appraisal of the Safety of Chemicals in Foods and Cosmetics, 46-59, 1965

fraction. Appropriate negative, solvent, and positive controls were included with each assay. The test compound dose levels were determined by a preliminary multidose-ranging study with the highest dose tested being selected to give approximately fifty to ninety percent inhibition of suspension cell growth depending on the solubility of the compound. Sulfolene solubilized in cell culture medium. The maximum dose selected for the mutagenicity test was 1000 µg/ml because it represents the limits of solubility of the test material.

Each test concentration was prepared to contain the test dose in 0.1 ml volumes. Six million precleaned TK+/- cells in 6 ml of F10P were added to centrifuge tubes. An additional 4 ml of the S-9 mix were added to half of the tubes. Immediately thereafter, 0.1 ml of the 100x concentrations of the test chemical dilutions or the positive controls, and 0.1 ml of the solvent were added to the appropriate tubes. Each tube was mixed, gassed with a mixture of CO<sub>2</sub> and air, and incubated at 37± 0.5°C on a revolving roller drum for 4 hours. Following this incubation the tubes were centrifuged and the treatment solutions decanted. The cells were washed twice with F10P and resuspended in 20 ml F10P after the second wash. The tube cultures were then gassed and reincubated for a 2 day expression time. The cell cultures were readjusted to 3.0 x 10<sup>5</sup> cells/ml as necessary. At the end of the expression period, a sample of each of the cultures was centrifuged and the cells resuspended at 500,000 viable cells/ml in F10P. The concentrated cells were serially diluted and appropriate dilutions were plated in triplicate in cloning medium with and without TFT. Approximately 500,000 cells were plated on each of 3 selective medium plates containing 2 µg/ml TFT, and 100 cells were cloned on each of 3 non-selective plates for each test concentration and a control tube. The plates were incubated for 12± 2 days. The mutant colonies (TK-/-) were counted on the selective TFT containing plates and the survivors (TK+/- and TK-/-) were counted on the non-selective medium plates.

Exposure to eight graded doses of the test material in the presence of and in the absence of metabolic activation increased the induction of forward mutations in L5178Y mouse lymphoma cells at the T/K. The results did not exhibit a dose-response relationship. Sulfolene is considered to be mutagenic in this test system.

#### In Vitro Sister Chromatid Exchange

This assay was performed using Chinese Hamster Ovary Cells and a minimum of five test compound doses with and without metabolic activation by an Aroclor-induced rat liver microsomal fraction. Appropriate negative, solvent and positive controls were included with each assay. The test compound dose levels were determined by a preliminary multidose-ranging study with the highest concentration of the chemical tested depending upon its solubility. Sulfolene appeared miscible at approximately 420 mg/ml in glass distilled

deionized water. The maximum dose selected for the mutagenicity test was approximately 6,400 µg/ml because it exhibited growth inhibition.

Cells were treated in an exponential stage of growth by setting up cultures with  $2$  to  $5 \times 10^5$  cells per 25 cm<sup>2</sup> flask, 24 hours prior to treatment. Cells were exposed to the chemical for 2 hours, washed twice and then 5-bromodeoxyuridine (Brd U) was added to each culture. All cultures were sampled a minimum of 24 hours after addition of Brd U to ensure completion of two full cell cycles. Duplicate cultures were set up for each dose level and all controls. Twenty-four hours after the above initiation of the cultures, the cells were treated with the test chemical in the presence of an S-9 rat liver activation system for 2 hours and washed twice in a balanced salt solution. The cells were then sampled and treated as described above. Two hours after, colcemid (0.2 µg/ml) was added to each tube and metaphases were collected by mitotic shake-off. The cells were swollen in a 0.075M KCL hypotonic, and washed three times in an acetic alcohol fixative. Slides were prepared and stained. Fifty cells in the metaphase stage of mitosis were scored at each dose level for the number of sister chromatid exchanges (SCE).

The cells were exposed to five graded doses of Sulfolane. The compound was added directly to the media at the highest dose and dissolved in glass distilled, deionized H<sub>2</sub>O for the four lower doses. A statistically significant increase in the number of SCE's per chromosome was seen at the highest dose (6,400 µg/ml) in the absence of metabolic activation, but no significant increase was seen in the remaining dose levels and none showed a two-fold increase in SCE's.

Under these conditions, the experimental compound sulfolane did not meet the criteria necessary to be considered positive and is, therefore, considered not to be mutagenic in this test system.

June 6, 1983

1K-4770  
 DATE March, 1982

**MATERIAL SAFETY DATA SHEET**  
 ("ESSENTIALLY SIMILAR" TO FORM OSHA-20)

WHERE APPLICABLE, THIS PRODUCT HAS BEEN REPORTED FOR THE EPA'S CHEMICAL SUBSTANCE INVENTORY.

SECTION I - IDENTIFICATION OF PRODUCT			
MANUFACTURERS NAME <b>PHILLIPS CHEMICAL COMPANY</b>	EMERGENCY TELEPHONE NUMBERS	DURING BUSINESS HOURS (918) 661-3865 OUTSIDE BUSINESS HOURS (918) 661-8118	
ADDRESS (NUMBER, STREET, CITY, STATE, & ZIP CODE) <b>BARTLESVILLE, OK 74004</b>	PRODUCT NO. <b>021300</b>		
TRADE NAME <b>Hexene-1</b>	CHEMICAL NAME AND SYNONYMS <b>Hexene-1</b>		
CHEMICAL FAMILY <b>Olefins</b>	CHEMICAL FORMULA <b>C<sub>6</sub>H<sub>10</sub></b>		
DOT SHIPPING NAME <b>Petroleum Distillate</b>	HAZARD CLASS <b>Flammable liquid</b>	ID NUMBER <b>UN1268</b>	

SECTION II - HAZARDOUS COMPONENTS OF MIXTURES			
INGREDIENTS	CAS NUMBER	% BY WT.	THRESHOLD LIMIT VALUE (UNITS)
<b>Hexene-1</b>	<b>592-41-6</b>	<b>96.8</b>	
<b>trans-Hexene-2</b>		<b>0.05</b>	
<b>cis-Hexene-2</b>		<b>0.05</b>	
<b>Hexenes-3</b>		<b>0.3</b>	
<b>normal Hexane</b>	<b>110-54-3</b>	<b>1.2</b>	<b>500 ppm</b>
<b>Isoolefins</b>		<b>1.6</b>	

SECTION III - TYPICAL PHYSICAL DATA	
BOILING POINT (°F) <b>146°F (63.3°C)</b>	APPEARANCE AND ODOR <b>Colorless liquid.</b>
VAPOR PRESSURE <b>3.0 psia (155 mm Hg) at 70°F</b>	SPECIFIC GRAVITY (H <sub>2</sub> O = 1) <b>.677 (60/60°F)</b>
VAPOR DENSITY (AIR = 1) <b>3.0</b>	PERCENT VOLATILE BY VOLUME (%) <b>100</b>
SOLUBILITY IN WATER <b>Negligible</b>	EVAPORATION RATE (Ethyl Ether = 1) <b>&lt;1</b>

SECTION IV - FIRE AND EXPLOSION - HAZARD DATA			
FLASH POINT (METHOD) <b>20°F (ASTM D56, TCC)</b>	FLAMMABLE LIMITS (% BY VOLUME)	LeL	UeL
FIRE EXTINGUISHING MEDIA <b>Foam, carbon dioxide, dry chemical.</b>			
SPECIAL FIRE FIGHTING PROCEDURES <b>Shut off source. Use water spray or fog to cool exposed equipment.</b>			
UNUSUAL FIRE AND EXPLOSION HAZARDS <b>Dangerous when exposed to heat or flame.</b>			

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**Exposure Routes:** None established.

**EFFECTS OF OVEREXPOSURE:**

**Eye contact:** May produce mild eye irritation.  
**Skin contact:** Due to its defatting action, may produce drying and cracking of skin.  
**Inhalation:** May produce dizziness, narcosis, or unconsciousness.  
**Oral:** May produce chemical pneumonitis if aspirated into the lungs. May be irritating to mucosa of gastrointestinal tract; may produce nausea & vomiting.

**EMERGENCY AND FIRST AID PROCEDURES:**

**Eye contact:** Flush from eye with clear tap water for 15 minutes. Consult a physician if irritancy develops.  
**Skin contact:** Wash with soap and warm water, consult a physician if irritancy develops.  
**Ingestion:** Do not induce vomiting. Administer large amounts of milk or water.  
**Inhalation:** Remove from contaminated atmosphere. If respiration is labored administer oxygen. If unconscious administer artificial respiration and/or oxygen as needed.

**SECTION VI - REACTIVITY DATA**

STABILITY	UNSTABLE		CONDITIONS TO AVOID: Oxidizers
	STABLE	X	
INCOMPATIBILITY (MATERIALS TO AVOID FOR PURPOSES OF TRANSPORT, HANDLING AND STORAGE ONLY):			Oxygen and strong oxidizing materials.
HAZARDOUS DECOMPOSITION PRODUCTS:			Carbon monoxide
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID:
	WILL NOT OCCUR	X	

**SECTION VII - SPILL OR LEAK PROCEDURES**

**STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:**  
Contain spill. Protect from ignition. Keep out of water sources and sewers.  
Refer to Section VIII and contact appropriate safety personnel for respiratory requirements.

**WASTE DISPOSAL (INSURE CONFORMITY WITH ALL APPLICABLE DISPOSAL REGULATIONS):**

Wash into chemical sewer or burn under controlled conditions.

**SECTION VIII - PERSONAL PROTECTION INFORMATION**

RESPIRATORY PROTECTION:		NIOSH approved equipment per requirements of 29 CFR Part 1910.136 (OSHA) and ANSI Z88.2.	
VENTILATION	LOCAL EXHAUST	Recommended	
	MECHANICAL (GENERAL)	Recommended	
	SPECIAL OR OTHER		
PROTECTIVE GLOVES:		Neoprene or Rubber	
EYE PROTECTION:		Splash goggles	
OTHER PROTECTIVE EQUIPMENT:			

**SECTION IX - HANDLING AND STORAGE PRECAUTIONS**

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:**  
Avoid sources of ignition and spills. Provide means to control leaks and spills.  
Store in cool, well-ventilated area. Bond and ground all filling connections.

**OTHER PRECAUTIONS:**

1R-415  
DATE March, 1982

**MATERIAL SAFETY DATA SHEET**  
("ESSENTIALLY SIMILAR" TO FORM OSHA-20)

WHERE APPLICABLE, THIS PRODUCT HAS BEEN REPORTED FOR THE EPA'S CHEMICAL SUBSTANCE INVENTORY.

SECTION I - IDENTIFICATION OF PRODUCT			
MANUFACTURERS NAME <b>PHILLIPS CHEMICAL COMPANY</b>	EMERGENCY TELEPHONE NUMBERS	DURING BUSINESS HOURS (918) 661-3885	OUTSIDE BUSINESS HOURS (918) 661-8116
ADDRESS (NUMBER, STREET, CITY, STATE, & ZIP CODE) <b>BARTLESVILLE, OK 74004</b>	PRODUCT NO. <b>N26300</b>		
TRADE NAME <b>Methylcyclopentane</b>	CHEMICAL NAME AND SYNONYMS <b>Methylcyclopentane</b>		
CHEMICAL FAMILY <b>Cycloparaffin</b>	CHEMICAL FORMULA <b>CH<sub>3</sub>-C<sub>5</sub>H<sub>9</sub></b>		
DOT SHIPPING NAME <b>Methylcyclopentane</b>	HAZARD CLASS <b>Flammable Liquid</b>	ID NUMBER <b>UN2298</b>	

SECTION II - HAZARDOUS COMPONENTS OF MIXTURES			
INGREDIENTS	CAS NUMBER	% BY WT.	THRESHOLD LIMIT VALUE (UNITS)
<b>methylcyclopentane</b>	<b>96-37-7</b>	<b>approx. 96.5</b>	<b>---</b>
<b>n-hexane</b>	<b>110-54-3</b>	<b>approx. 2.0</b>	<b>100 ppm</b>
<b>cyclohexane</b>	<b>110-82-7</b>	<b>approx. 1.5</b>	<b>300 ppm</b>

SECTION III - TYPICAL PHYSICAL DATA	
BOILING POINT (°F) <b>161 (71.7°C)</b>	APPEARANCE AND ODOR <b>Colorless liquid - Sweetish odor.</b>
VAPOR PRESSURE <b>4.5 psia (233 mm Hg) at 100°F</b>	SPECIFIC GRAVITY (H <sub>2</sub> O = 1) <b>0.754 (60/60°F)</b>
VAPOR DENSITY (AIR = 1) <b>2.53</b>	PERCENT VOLATILE BY VOLUME (%) <b>100</b>
SOLUBILITY IN WATER <b>Negligible</b>	EVAPORATION RATE ( <b>butyl acetate</b> = 1) <b>&gt;1</b>

SECTION IV - FIRE AND EXPLOSION - HAZARD DATA			
FLASH POINT (METHOD) <b>-17°F (TCC, ASTM D56)</b>	FLAMMABLE LIMITS (% BY VOLUME)	Lel <b>1.2%</b>	Uel <b>8.4%</b>
FIRE EXTINGUISHING MEDIA <b>Dry chemical, foam, carbon dioxide</b>			
SPECIAL FIRE FIGHTING PROCEDURES <b>Shut off source of flow. Use water spray or fog to cool exposed equipment &amp; containers.</b>			
<b>For large fires, or fires in confined areas, self-contained breathing apparatus may be necessary.</b>			
UNUSUAL FIRE AND EXPLOSION HAZARDS <b>Moderate explosion hazard when exposed to heat or flame.</b>			

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## SECTION V - HEALTH HAZARD DATA

EXPOSURE LIMIT VALUE: **None established.**

## EFFECTS OF OVER-EXPOSURE:

**Inhalation:** May produce dizziness, incoordination, nausea, prostration and unconsciousness.

**Eye contact:** May produce a stinging irritation.

## EMERGENCY AND FIRST AID PROCEDURES:

**Eye contact:** Flush with running water for at least 15 minutes. If irritation persists, refer to a physician.

**Inhalation:** Remove to fresh air and administer oxygen. If respiration is very low or breathing has ceased, apply artificial respiration; keep patient warm; obtain medical assistance as quickly as possible.

## SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID:
	STABLE	X	
INCOMPATIBILITY (MATERIALS TO AVOID FOR PURPOSES OF TRANSPORT, HANDLING AND STORAGE ONLY):			Oxygen or strong oxidizing materials.
HAZARDOUS DECOMPOSITION PRODUCTS:			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID:
	WILL NOT OCCUR	X	

## SECTION VII - SPILL OR LEAK PROCEDURES

## STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

**Contain spill. Protect from ignition, absorb in earth or sorbent material. Refer to Section VIII and contact appropriate safety personnel for respirator requirements. Keep out of water sources and sewers. If spill reaches water, confine to as small an area as possible and remove for proper disposal.**

## WASTE DISPOSAL (INSURE CONFORMITY WITH ALL APPLICABLE DISPOSAL REGULATIONS):

**Incinerate or bury.**

## SECTION VIII - PERSONAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:		NIOSH approved equipment per requirements of 29 CFR Part 1910.134 (OSHA) and ANSI Z88.2.	
VENTILATION	LOCAL EXHAUST	Recommended	
	MECHANICAL (GENERAL)	Recommended	
	SPECIAL OR OTHER		
PROTECTIVE GLOVES:		If contact with liquid is unavoidable.	
EYE PROTECTION:		Protective goggles where contact with liquid could occur.	
OTHER PROTECTIVE EQUIPMENT:			

## SECTION IX - HANDLING AND STORAGE PRECAUTIONS

## PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

**Provide means of controlling leaks and spills. Store in cool, well-ventilated area away from ignition sources. Bond and ground during liquid transfer.**

## OTHER PRECAUTIONS:

DATE January 1983

**MATERIAL SAFETY DATA SHEET**  
 ("ESSENTIALLY SIMILAR" TO FORM OSHA-20)

*IR-444*

WHERE APPLICABLE, THIS PRODUCT HAS BEEN REPORTED FOR THE EPA'S CHEMICAL SUBSTANCE INVENTORY.

SECTION I - IDENTIFICATION OF PRODUCT			
MANUFACTURERS NAME <b>PHILLIPS PETROLEUM COMPANY</b>	EMERGENCY TELEPHONE NUMBERS	DURING BUSINESS HOURS (918) 661-3885	OUTSIDE BUSINESS HOURS (918) 661-8118
ADDRESS (NUMBER, STREET, CITY, STATE, & ZIP CODE) <b>BARTLESVILLE, OK 74004</b>		PRODUCT NO.	
TRADE NAME <b>Methyl tertiary-Butyl Ether</b>	CHEMICAL NAME AND SYNONYMS <b>Methyl tertiary-Butyl Ether</b>		
CHEMICAL FAMILY <b>Aliphatic ether</b>	CHEMICAL FORMULA <b>(CH<sub>3</sub>)<sub>3</sub>C-O-CH<sub>3</sub></b>		
DOT SHIPPING NAME <b>Petroleum Ether</b>		HAZARD CLASS <b>Flammable liquid</b>	ID NUMBER <b>UN1271</b>

SECTION II - HAZARDOUS COMPONENTS OF MIXTURES			
INGREDIENTS	CAS NUMBER	% BY WT.	THRESHOLD LIMIT VALUE (UNITS)
<b>Methyl tertiary-butyl ether</b>	<b>1634-04-4</b>		<b>None Established</b>

SECTION III - TYPICAL PHYSICAL DATA	
BOILING POINT (°F) <b>131 (55°C)</b>	APPEARANCE AND ODOR <b>Clear liquid, pleasant hydrocarbon odor</b>
VAPOR PRESSURE <b>8.0 psia (414 mm Hg) @ 100°F</b>	SPECIFIC GRAVITY (H <sub>2</sub> O = 1) <b>0.7405 (20/4°C)</b>
VAPOR DENSITY (AIR = 1) <b>3.04</b>	PERCENT VOLATILE BY VOLUME (%) <b>100</b>
SOLUBILITY IN WATER <b>Moderate</b>	EVAPORATION RATE ( <b>Ethyl Ether</b> = 1) <b>&lt; 1</b>

SECTION IV - FIRE AND EXPLOSION - HAZARD DATA			
FLASH POINT (METHOD) <b>-28°C (Abel-Pensky)</b>	FLAMMABLE LIMITS (% BY VOLUME) <b>Explosion</b>	Lower <b>1.65</b>	Upper <b>8.4</b>
FIRE EXTINGUISHING MEDIA <b>Foam, carbon dioxide, or dry chemical</b>			
SPECIAL FIRE FIGHTING PROCEDURES <b>Self-contained breathing apparatus may be necessary. Shut off source of fuel. Use water fog or spray to cool adjacent equipment and containers.</b>			
UNUSUAL FIRE AND EXPLOSION HAZARDS			

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N.E. - NOT ESTABLISHED

N.A. - NOT APPLICABLE

FORM 10912-N 8-81

0 0 1 3

## SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: None established

## EFFECTS OF OVEREXPOSURE:

Eye contact: Slight to moderate irritation.

Skin contact: Slight irritation, skin drying and cracking.

Ingestion: May irritate mucous membrane of intestinal tract.

Inhalation: Headache, dizziness, sleepiness, anesthetic effects. May be slightly irritating to mucous membranes of nose, throat and respiratory tract.

## EMERGENCY AND FIRST AID PROCEDURES:

Eye contact: Flush the eye with tap water for 15 minutes. If irritation develops consult a physician.

Skin contact: Wash with soap and warm water. If irritation develops consult a physician.

Ingestion: Do not induce vomiting. A physician may conduct a gastric lavage using a cuffed endotracheal tube, at his discretion.

Inhalation: Remove from contaminated area. If breathing is difficult or victim is semi-conscious, administer oxygen.

## SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID:
	STABLE	X	

INCOMPATIBILITY (MATERIALS TO AVOID FOR PURPOSES OF TRANSPORT, HANDLING AND STORAGE ONLY):

## HAZARDOUS DECOMPOSITION PRODUCTS:

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID:
	WILL NOT OCCUR	X	

## SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

Contain spill. Protect from ignition. Refer to Section VIII and contact appropriate safety personnel for respirator requirements. Keep out of water sources and sewers.

WASTE DISPOSAL (INSURE CONFORMITY WITH ALL APPLICABLE DISPOSAL REGULATIONS):

Incinerate.

## SECTION VIII - PERSONAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: NIOSH approved equipment per requirements of 29 CFR Part 1910.134 (OSHA) and ANSI Z88.2

VENTILATION	LOCAL EXHAUST	Recommended
	MECHANICAL (GENERAL)	Recommended
	SPECIAL OR OTHER	

PROTECTIVE GLOVES: Yes

EYE PROTECTION: Goggles if splashes could occur

OTHER PROTECTIVE EQUIPMENT:

## SECTION IX - HANDLING AND STORAGE PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

Store in a cool well-ventilated area. Protect from ignition. Provide means of controlling leaks and spills. Bond and ground during liquid transfer.

OTHER PRECAUTIONS: Many ethers tend to form dangerous peroxides on storage. Methyl tert-butyl ether has been observed to be relatively stable. In one test, no peroxides were detected after 52 months of storage (Ref. Oil &amp; Gas Jour. 77, 15, 149-152, Table 6, 4/6/79). Nevertheless, we do not recommend extended storage of the product.

0014

# 424  
DATE March, 1983

**MATERIAL SAFETY DATA SHEET**  
("ESSENTIALLY SIMILAR" TO FORM OSHA-20)

WHERE APPLICABLE, THIS PRODUCT HAS BEEN REPORTED FOR THE EPA'S CHEMICAL SUBSTANCE INVENTORY.

**SECTION I - IDENTIFICATION OF PRODUCT**

MANUFACTURER'S NAME <b>PHILLIPS CHEMICAL COMPANY</b>		EMERGENCY TELEPHONE NUMBERS	DURING BUSINESS HOURS (918) 661-3885
ADDRESS (NUMBER, STREET, CITY, STATE, & ZIP CODE) <b>BARTLESVILLE, OK 74004</b>		PRODUCT NO. <b>57000</b>	OUTSIDE BUSINESS HOURS (918) 661-8118
TRADE NAME <b>Sulfolane</b>		CHEMICAL NAME AND SYNONYMS <b>Tetrahydrothiophene-1,1-Dioxide</b>	
CHEMICAL FAMILY <b>Sulfones</b>		CHEMICAL FORMULA <b>C<sub>4</sub>H<sub>8</sub>SO<sub>2</sub></b>	
DOT SHIPPING NAME <b>N.A.</b>		HAZARD CLASS <b>N.A.</b>	DOT NUMBER <b>N.A.</b>

**SECTION II - HAZARDOUS COMPONENTS OF MIXTURES**

INGREDIENTS	CAS NUMBER	% BY WT	THRESHOLD LIMIT VALUE (UNITS)
<b>Sulfolane</b>	<b>126-30-0</b>	<b>100</b>	

**SECTION III - TYPICAL PHYSICAL DATA**

BOILING POINT (°F) <b>545 (285°C)</b>	APPEARANCE AND ODOR <b>Clear liquid.</b>
VAPOR PRESSURE <b>N.A.</b>	SPECIFIC GRAVITY (H <sub>2</sub> O = 1) <b>30/45 (60°F/30°F) 1.261</b>
VAPOR DENSITY (AIR = 1) <b>4.14</b>	PERCENT VOLATILE BY VOLUME (%) <b>100</b>
SOLUBILITY IN WATER <b>Appreciable</b>	EVAPORATION RATE ( <b>Butyl Acetate</b> = 1) <b>&lt;1</b>

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

FLASH POINT (METHOD) <b>330 F, (COC, ASTM D 92)</b>	FLAMMABLE LIMITS (% BY VOLUME)		
FIRE EXTINGUISHING MEDIA <b>Dry chemical, carbon dioxide (CO<sub>2</sub>), or foam.</b>			
SPECIAL FIRE FIGHTING PROCEDURES <b>Shut off source. Use water fog or spray to cool exposed equipment and containers.</b>			
UNUSUAL FIRE AND EXPLOSION HAZARDS <b>Sulfur oxides liberated when burned.</b>			

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**SECTION V - HEALTH HAZARD DATA**

**THRESHOLD LIMIT VALUE:**

**5 ppm Phillips recommended limit.**

**EFFECTS OF OVEREXPOSURE:**

**Eye contact: Can produce moderate irritation.**

**Skin contact: May produce slight transient irritation, however prolonged exposure to massive amounts may lead to severe irritation.**

**Ingestion, inhalation and skin absorption may cause lethargy, tremors and convulsions.**

**EMERGENCY AND FIRST AID PROCEDURES:**

**Eye: Immediately flush with running water for 15 minutes. If irritation develops, seek medical attention.**

**Skin: Wash with soap and water. If irritation develops, seek medical attention.**

**Inhalation: Remove from exposure. If symptoms develop, seek medical attention.**

**Ingestion: Dilute with 2 glasses of water and induce vomiting. If symptoms continue or develop, seek medical attention.**

**SECTION VI - REACTIVITY DATA**

STABILITY	UNSTABLE	X	CONDITIONS TO AVOID:
	STABLE		

**INCOMPATIBILITY (MATERIALS TO AVOID FOR PURPOSES OF TRANSPORT, HANDLING AND STORAGE ONLY):** Oxygen or strong oxidizing materials.

**HAZARDOUS DECOMPOSITION PRODUCTS:**

HAZARDOUS POLYMERIZATION	MAY OCCUR	X	CONDITIONS TO AVOID:
	WILL NOT OCCUR		

**SECTION VII - SPILL OR LEAK PROCEDURES**

**STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Contain spill.**

**Protect from ignition.**

**Absorb in dry, inert material (sand, clay, sawdust, etc.).**

**Refer to Section VIII and contact appropriate safety personnel for respirator requirements.**

**Keep out of water sources and sewers.**

**WASTE DISPOSAL (INCLUDE CONFORMITY WITH ALL APPLICABLE DISPOSAL REGULATIONS):**

**Bury in approved landfill or burn under controlled conditions.**

**SECTION VIII - PERSONAL PROTECTION INFORMATION**

**RESPIRATORY PROTECTION: NIOSH approved equipment per requirements of 29 CFR Part 1910.134 (OSHA) and ANSI Z88.2.**

VENTILATION	LOCAL EXHAUST	Recommended
	MECHANICAL (GENERAL)	Recommended
	SPECIAL OR OTHER	

**PROTECTIVE GLOVES: Neoprene or rubber.**

**EYE PROTECTION: Goggles if splashes could occur.**

**OTHER PROTECTIVE EQUIPMENT:**

**SECTION IX - HANDLING AND STORAGE PRECAUTIONS**

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store in cool, well-ventilated area.**

**Provide means of controlling leaks and spills.**

**Protect from sources of ignition.**

**Bond and ground during liquid transfer.**

**OTHER PRECAUTIONS:**

**Avoid inhalation and skin or eye contact.**

0016

## ATTACHMENT

As indicated below, several of the chemicals appearing on the ITC list of 82 chemicals appear in finished gasoline. We urge that the presence of these chemicals in motor fuel not be used as the basis for recommending testing. Any recommended testing should be relevant to these compounds as they are distributed in commerce. It is our view that when the exposure of concern is raised by individual components in complex mixtures or by the mixtures themselves, the obvious place to start evaluating the need for testing is with the mixtures. The question of gasoline and its components should therefore be approached as a whole and not as a series of disconnected parts.

1. Methylcyclopentane 1R-419

This chemical is prevalent in natural gas liquids and refinery straight run naphtha. It is also a conversion product of C<sub>6</sub> naphthenes and benzene which is concentrated and rerun through conversion units to product 98% cyclohexane. The concentration contains 60-80% methylcyclopentane. In 1983, our Chemicals Group sold \_\_\_\_\_ of 98% methylcyclopentane. The portion of methylcyclopentane not converted or sold ends up in hexane solvents and motor fuel. Our hexane solvent stream contains 7-15% methylcyclopentane and amounts to \_\_\_\_\_ per year.

Our Medical Department has completed air monitoring for workplaces using this chemical. They have taken 5589 samples and have found an average exposure of 0.25 ppm (8 hr. TWA). We do not have any unpublished health or safety information on methylcyclopentane or any of the other chemicals on the ITC list.

Our Material Safety Data Sheet (MSDS) for this product is part of this submission.

2. Acetylenes, Dienes and Olefins 1R-427B

These chemicals appear on the list under a variety of separate names. These compounds are found in trace to measurable amounts in cat cracker gasoline and debutanized aromatic concentrate generated from ethylene units. They are produced incidental to the processes and generally end up in finished gasoline.

The MSDS for 1-hexane is part of this submission. In 1983, Phillips sold approximately \_\_\_\_\_ of 1-hexane.

Air monitoring for 1-hexane has been completed by Phillips. We have found that the average exposure in our plants was 0.12 ppm (8 hr. TWA). This figure represents a total of 59 separate measurements.

3. t-Butyl Methyl Ether (MTBE) 1R-444

This chemical is produced from methanol and isobutene. It is blended into gasoline or sold as is. Currently, Phillips blends \_\_\_\_\_ of this chemical into premium unleaded gasoline. This represents 5-8% of the total premium unleaded gasoline.

We have conducted limited air monitoring on this chemical. The 17 samples which have been taken show an average exposure of 1.42 ppm (8 hr. TWA).

The MSDS for this chemical has also been included.

4. Tetrahydrothiophene-1,1-Dioxide 12-434

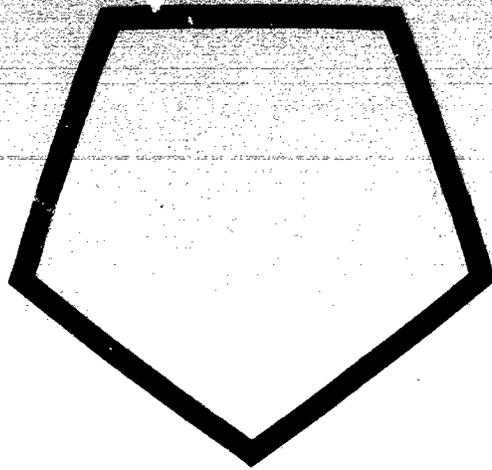
Phillips markets this chemical under the name of Sulfolane. We have included, as part of this submission, a brochure describing the uses and applications of Sulfolane.

We have no information concerning occupational exposures to this chemical. Our Medical Department has prepared a Toxicity Study Summary (TSS) which is sent to customers upon request. The MSDS has also been included.

Phillips sold \_\_\_\_\_ in 1982 and approximately \_\_\_\_\_ in 1983. We expect the 1984 figure to be unchanged from 1983.

All of these chemicals are manufactured in closed systems which allow for very little occupational or environmental exposure.

MCS:dsg/003



*technical information on . . .*

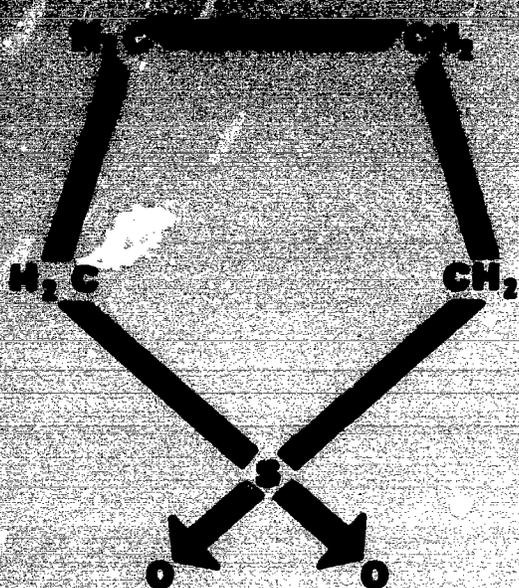
# SULFOLANE

*• specifications • applications • typical properties • storage & handling • toxicity • shipping information*



0 0 1 9

# SULFOLANE



## SPECIFICATIONS OF PHILLIPS SULFOLANE

Property	Limits	Test Method
Density, 20°C, g/ml	1.260 min. - 1.270 max.	ASTM D 941*
Bulk, weight %	26.0 min. - 27.0 max.**	ASTM D 129
Thermal Stability	20 mg SO <sub>2</sub> maximum	Phillips WK
Purity, weight %***	99.0 minimum	Phillips VU (rev.)
Water Content, weight %	0.25 maximum	ASTM D 1744
Ash Content, weight %	0.10 maximum	ASTM D 462
Distribution, % maximum °C	95 min. at 200 99% max. at 300	ASTM D 1078

\*Qualified to permit measurement at temperatures above freezing point of product.

\*\*Measured as received and corrected to original bulk.

\*\*\*Purity specifications apply to nitrogen residue only. Minimum residue value should not be based on total residue. Residue testing for hydrocarbons, H<sub>2</sub>S, and H<sub>2</sub>O should not be performed. The amount of total residue of weight percent, hydrocarbons and H<sub>2</sub>S residue should not exceed 0.10%.

# APPLICATIONS

Sulfolane is a highly stable polar aprotic possessing excellent properties and unusual thermal and chemical stability. Sulfolane is a preferred solvent for the extraction of benzene, toluene, and xylene from oil refinery streams as well as for the removal of acid gas constituents from various gas streams. Following are some of its major uses and potential applications.

---

Sulfolane can be used profitably as a solvent in conjunction with the Universal Oil Products aromatic extraction process for the removal of benzene, toluene and xylene from oil refinery catalytically reformed streams. The advantages of this process using sulfolane are:

- higher solvent loading
- less heat – lower utility costs
- greater stability – less chemical and thermal degradation

## AROMATIC EXTRACTION

A patented process employing a tertiary mixture of sulfolane, diisopropanolamine (DIPA) and water is currently being used for the removal of acid gas constituents ( $\text{CO}_2$ ,  $\text{H}_2\text{S}$ , COS, mercaptans) from natural gas and from methane reform gas ( $\text{CO}_2$ ) in ammonia plants.

Reasons . . .

- less corrosion
- lower utility costs
- less solvent degradation problems

## ACID GAS REMOVAL

Other suggested applications of sulfolane include its use as a dielectric fluid, a plasticizing agent, a solvent for polymer solution, a reaction solvent for anhydrous systems, a selective solvent, a solvent used in removal of sulfur dioxide and a solvent in the extractive distillation of narrow boiling fractions.

## OTHER APPLICATIONS

# DIETHYLENE GLYCOL

Formula	$C_4H_{10}O_2$
Molecular Weight	126.17
Appearance	Clear Liquid
Density, 60°F	1.261
Specific Gravity, 60°F/60°F	1.2012
Density, 60°F/60°F	10.5
Density, 60°F/60°F	1.276
Boiling Point, °F	546
Freezing Point, °F (99.5+ wt. % Diethylene)	78.8
Flash Point, °F	330
Vapor Pressure, mmHg, at 302°F	14.53
320°F	21.56
392°F	85.23
410°F	115.1
500°F	421.4
Viscosity, cp, at 30°C	10.3
50°C	6.1
100°C	2.5
180°C	1.4
250°C	1.0
Refractive Index, 20°C/D	1.48
Heat of Vaporization, Btu/lb. mole, at 212°F	27,000
392°F	26,500
Heat Capacity of Liquid, Btu/lb. °F, at 212°F	0.40
392°F	0.46
Heat of Fusion, Btu/lb	4.92
Dilution Constant (30°C)	44.0
Coefficient of Thermal Expansion at 52°F per °F	$3.83 \times 10^{-4}$ (1)
Thermal Conductivity (2), Btu/hr. (Sq. Ft.) (°F/ft.)	
80	0.107 (3)
95	0.098 (4)
105	0.114
125	0.112

(1) This value calculated from the empirical equation  $\alpha = 0.000383 + 2.5 \times 10^{-7} (t-52)$ .

where  $\alpha$  = coefficient of expansion

$t$  = temperature, °F in the applicable range of 52°F to 400°F. Base temperature is 52°F which is the melting point of pure diethylene.

(2) The diethylene used in the conductivity test contained 1.5 wt. % water as determined by freezing point and Karl Fisher water analysis.

(3) Below the freezing point.

(4) The diethylene used in this conductivity test contained 1.5 wt. % water as determined by freezing point and Karl Fisher water analysis.

*Typical solvent properties of*

# SULFOLANE

## SOLUBILITY OF SULFOLANE IN VARIOUS CHEMICAL COMPOUNDS

CHEMICAL COMPOUND	TEMP., °F	GRAMS SULFOLANE PER 100 GMS OF CHEMICAL
Benzene	77°	Miscible
Cyclohexane	77°	0.4
2,3-Dimethylbutane	77°	0.3
Hexane-1	77°	1.0
Normal Hexane	77°	0.3
Perchloroethylene	76°	1.6
Toluene	77°	Miscible
Mixed Xylenes	77°	Miscible

## SOLUBILITY OF VARIOUS CHEMICAL COMPOUNDS IN SULFOLANE

CHEMICAL COMPOUND	TEMP., °F	GRAMS CHEMICAL PER 100 GMS OF SULFOLANE
Hydrogen Chloride (gas)	77°	9.3
Ethyl Mercaptan	80°	Miscible
Methyl Mercaptan	32°	Miscible
Methyl Mercaptan	77°	21.7*
Tertiary Dodecyl Mercaptan	77°	2.0
Perchloroethylene	76°	37.5
Polystyrene	392°	0.02
Trichloroethylene	76°	Miscible

\*Test performed at atmospheric pressure and approximately 34°F above the normal boiling point (42.6°F) of methyl mercaptan.

## *thermal stability of* SULFOLANE

Thermal stability is an important property of sulfolane because the commercial processes using this compound normally operate at elevated temperatures. For this reason tests were made to determine the relative stability of sulfolane containing 10 mg. of SO<sub>2</sub> per 250 ml. at various temperatures. Phillips Test Method WK<sup>†</sup> was used.

TEMPERATURE		MG SO <sub>2</sub> LIBERATED PER HOUR FROM 250 ML. SULFOLANE
°C	°F	
180	356	0.6
200	392	2.8
220	428	3.3
240	464	24.1

These tests show that sulfolane has good thermal stability up to and including 428°F but has a rather steep decomposition rate beyond this temperature. Excessive temperatures will cause sulfolane "to crack" to a dark polymer and SO<sub>2</sub>.

† Available upon request.

# SULFOLANE

## Approximate Freezing Point Depression

Sample	Vol. % Depress. Required to Lower Freezing Point 1°
Pure Sulfolane	0.296
2% Water	0.296
4% Water	0.296
6% Water	0.188
8% Water	0.163

Figure 1 shows graphically how a small addition of water has a marked effect in depressing the freezing point up to approximately 3% water; beyond this the effect diminishes considerably.

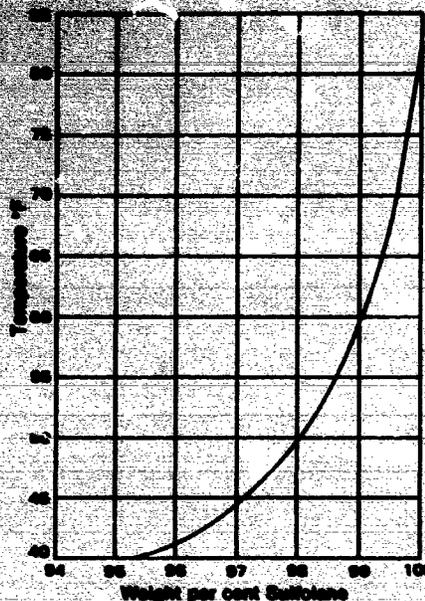


Figure 1  
Freezing point curve for Sulfolane — water mixtures

## STORAGE AND HANDLING OF SULFOLANE

Sulfolane is normally manufactured as an anhydrous product, but can be shipped either as an anhydrous product, or containing 2 wt. % water. Plain carbon steel tanks or galvanized carbon steel drums are normally used for shipping and storage. Because of the excellent solvent properties of dry sulfolane, storage vessels should be thoroughly cleaned and dried to prevent contamination. Sulfolane is sensitive to pyrophoric. When low moisture content is important, a dry air or nitrogen blanket or a desiccant chamber located on the tank vent will prevent moisture pickup from the atmosphere. Care is advised in handling high freezing salts or other materials. Process piping should be insulated and equipped with heating elements, in accordance with the following

particularly where the water content is relatively low, some type of heating elements should definitely be used with process piping and storage tanks. Any standard centrifugal, positive displacement or rotary vane type pump is satisfactory for transfer service. Similar materials of construction used in process storage vessels are suitable for pump cases, impellers, etc. Because of freezing problems all pumps and piping should be warm before or while put in service. Unheated pump case should be jacket. Tight storage packing is advised for pump shafts. A plastic gasket should prevent for storage tanks in winter.

100-100-100

100-100-100

The specific gravity at 60/60°F for the ternary system, Sulfolane - Diisopropanolamine (DIPA) - Water, is shown in Figure 2. This figure is useful in Sulfolane gas treating applications where the specific gravity of the ternary treating solution of a known composition is desired. Figure 2 can also be used for estimating the total pounds of each component required if the exact composition of the blend and the system volume is known.

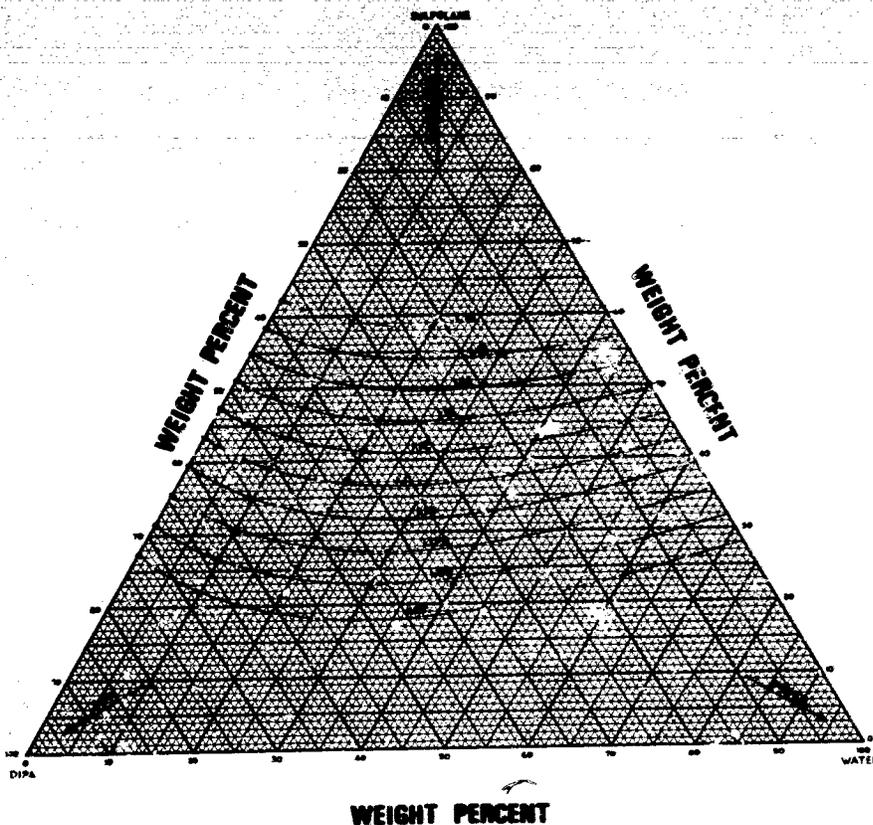


FIGURE 2: Special Gravity (60/60°F) for blends of Sulfolane - Water - Diisopropanolamine (DIPA)

## TOXICITY OF SULFOLANE

The single dose (acute) oral toxicity of sulfolane (tetrahydrothiophene-1,1-dioxide) is relatively low and test reports show that even at dosages of 2000 milligrams per kilogram of body weight in small animals the compound is essentially inert and devoid of physiological activity. Further evidence of its low toxicity is confirmed by intravenous administration in mice which required dosages of about 1000 milligrams per kilogram to initiate strong central nervous system stimulation.

Toxicity via skin absorption is shown to be equally low and skin application in doses as high as 10,000 milligrams per kilogram of body weight did not produce any signs or symptoms of physiological activity.

Skin irritation and eye irritation tests conducted with the undiluted compound showed that the substance is only slightly irritating to the skin from prolonged or repeated contact and moderately but transiently irritating to the eye from liquid contact. Vapor toxicity tests were not conducted because of low vapor pressure of the compound.

On the basis of these tests as well as our experience, we do not believe any special protective measures are required other than that usually practiced in handling such chemicals as ethyl and isopropyl alcohol, acetone, dilute acetic acid and similar industrial materials.

00025

# SULFOLANE

## SHIPPING INFORMATION

Sulfolane is normally shipped in anhydrous form in tank car, tank truck and drum quantities. Water-added material can be provided on request.

Pounds Per Gallon at 60°F (Anhydrous)	10.5
Net Container Contents, Lb.	
1-Gallon Drum	10
5-Gallon Drum	50
55-Gallon Drum	550
ICC Warning Labels Required	None
Freight Description	Petroleum Oil, NOIBN

For complete price schedules and further information concerning sulfolane please contact:



**PHILLIPS CHEMICAL COMPANY**  
A SUBSIDIARY OF PHILLIPS PETROLEUM COMPANY

Specialty Chemicals  
14 Phillips Building  
Bartlesville, OK 74004  
918 661-7135

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