Appendix C
Material Safety Data Sheets

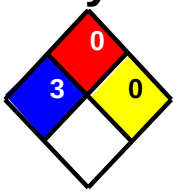
Contents

Appendix C Material Safety Data Sheets

Appendix C.1
Copper Sulphate Penthydrate

Copper Sulfate Pentahydrate

Date Prepared: May 17, 2002



NFPA RATING

HEALTH	3	
FLAMMABILITY	0	
REACTIVITY	0	
PROTECTIVE EQUIPM		

HMIS RATING

MATERIAL SAFETY DATA SHEET

SECTION I. PRODUCT IDENTIFICATION

Product Name: Copper Sulfate Pentahydrate

Synonyms: Triangle Brand Copper Sulfate; Triangle Brand Copper Sulfate Crystal; Triangle Brand Copper Sulfate Instant Powder; Triangle Brand Copper Sulfate Pentahydrate; Triangle Brand Cupric Sulfate Pentahydrate Technical; Phelps Dodge Copper Sulfate; Phelps Dodge Refining Corporation Triangle Brand Copper Sulfate; Phelps Dodge El Paso Triangle Brand; Cupric Sulfate; Copper Sulfate; Copper Sulfate Pentahydrate; Blue Vitrol; Triangle Brand Cupric Sulphate Pentahydrate Technical; Triangle Brand Copper Sulphate Instant Powder; Triangle Brand Copper Sulphate Crystal

Product Use: Industrial manufacturing, animal feed, algicide, fungicide, herbicide, pesticide or as a fertilizer.

Manufacturer/Vendor Information:
PHELPS DODGE REFINING CORP.
P.O Box 20001
El Paso, Texas

Chemtrec 24-Hour Emergency Phone:
In USA or Canada (800)424-9300
Other Information Phone: (915)778-9881

SECTION II. COMPOSITION / INFORMATION ON INGREDIENTS

CAS No.	Chemical Name	Exposure Limits	% by wt.
7758-99-8	Copper sulfate pentahydrate ($CuSO_4 \cdot 5H_2O$), (Cupric sulfate), (Blue Vitriol), (Bluestone)	ACGIH TLV TWA: 1.0 mg/m^3 (as copper dust/mist) OSHA PEL TWA: 1.0 mg/m^3 (as copper dust/mist)	99
Anhydrous Cupric Sulfate (CAS# 7758-98-7)	*Phelps Dodge Triangle Brand Copper Sulfate* *Copper Sulfate Pentahydrate (CAS 7758-99-8)* *Contains anhydrous copper sulfate* *Contains water of crystallization* *Metallic copper equivalent*		 *=99%* *=63.3%* *=35.7%* *=25.2%*

SECTION III. HAZARDS IDENTIFICATION

Emergency Overview: Odorless, transparent blue crystals, granules or powder. Can cause irreversible eye damage and slight skin irritation. Harmful if swallowed. Avoid breathing mist or dust and contact with skin, eyes or clothing.
Route(s) of Entry: Inhalation, eye contact, skin contact and ingestion.
Acute Exposure: Can cause skin, eye and respiratory irritation.
Chronic Exposure: Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated eye contact may cause conjunctivitis. Prolonged excessive inhalation of mists containing copper sulfate may cause adverse effects on the liver and kidneys.
Carcinogenicity (NTP) (IARC) (OSHA) (ACGIH): Not listed
Eye: Corrosive and may result in irreversible eye damage.
Skin Contact: Can cause slight skin irritation. May cause localized discoloration of the skin. Product specific tests in accordance with USEPA standards do not indicate skin sensitization is likely to occur.
Inhalation: Can result in irritation of the upper respiratory tract and in excessive quantities may cause ulceration and perforation of the nasal septum.
Ingestion: Can result in digestive tract irritation, nausea, vomiting, diarrhea and abdominal pain.

SECTION IV. FIRST AID MEASURES

Eyes: Immediately flush eyes with plenty of water. Hold eye open and rinse slowly and gently for at least 15-20 minutes. Contact physician for treatment advice.
Skin: Wash skin with soap and plenty of water. If irritation persists contact a physician.

SECTION IV. FIRST AID MEASURES (Continued)

Ingestion: Contact a poison control center or physician for treatment advice. Have person sip a glass of water if able to swallow. Do not give anything by mouth to an unconscious person. Do not induce vomiting unless told to do so by the poison control center or physician. If vomiting occurs spontaneously, avoid aspiration.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention.

SECTION V. FIRE FIGHTING MEASURES

Flash Pt:	Not applicable
Flammable Limits in Air-Lower:	Not applicable
Flammable Limits in Air – Upper:	Not applicable
Auto Ignition Temperature:	Not applicable
Fire Fighting Extinguishing Media:	Does not burn or support combustion. Use extinguishing media appropriate for surrounding fire (CO_2, dry chemical or water).
Fire Fighting Equipment:	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
Fire Fighting Instructions:	Evacuate area and fight fire from a safe distance.
Fire and Explosion Hazards:	Sealed containers may rupture when heated due to release of water from crystals.
Hazardous Combustion Products:	Not applicable
Explosion Data - Mechanical Impact / Static Discharge:	Not available
Unusual Hazards:	Material is acidic when dissolved in water, contact with magnesium metal may evolve hydrogen gas. Anhydrous cupric sulfate formed on water loss (white color). Anhydrous salt will ignite hydroxylamine, if present.

SECTION VI. ACCIDENTAL RELEASE MEASURES

Accidental Release Measures: Use clean-up methods that avoid dust generation (vacuum, wet). Wear a NIOSH approved respirator if dust will be generated in clean-up. Use protective clothing if skin contact is likely. If material is diluted in a water solution, and a spill occurs in a confined area, introduce lime or soda ash to form insoluble copper salts and dispose of by approved method. Prevent accidental entry of solution into streams and other water bodies. Shovel any spills into plastic bags and seal with tape. Copper sulfate solution may deteriorate concrete.

SECTION VII. HANDLING AND STORAGE

Signal Word: Danger.

Handling Information: Avoid breathing dust or solution mist. Sweep up crystals or powder, vacuum is preferred. Eye wash stations should be available in work areas. Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Storage Information: Store in closed containers in a cool, dry, well-ventilated area away from heat sources and reducing agents. Store copper sulfate in stainless steel, fiberglass, polypropylene, PVC's or plastic equipment. Keep away from galvanized pipe and nylon equipment. If container or bag is damaged, place the container or bag in a plastic bag. Use good housekeeping practices to prevent dust accumulation.

SECTION VIII. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls: Use adequate general or local ventilation to keep airborne concentrations below the exposure limits.

Eye Protection: Use protective goggles or a face-shield.

Skin Protection: Use protective clothing to prevent repeated or prolonged skin contact. Applicators and other handlers must wear long-sleeved shirt and long pants, waterproof gloves, shoes plus socks, and protective eyewear. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with product's concentrate. Do not reuse them. Keep and wash PPE separately from other laundry.

SECTION VIII. EXPOSURE CONTROLS / PERSONAL PROTECTION (Continued)

Respiratory Protection: A respiratory protection program that meets OSHA 29 CFR 1910.134 requirements must be followed whenever workplace conditions warrant respirator use. For concentrations up to 10 times the exposure limit, use NIOSH approved half- or full-face, air-purifying respirator. For higher concentrations, consult a professional industrial hygienist.

SECTION IX. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Transparent blue crystals, granules or powder.
Melting Point:	Not available
Boiling Point:	-5H2O @ 150 °C (760 mmHg)
Decomposition Temperature:	Decomposition above 110 °C with –4 H_20
Density/Specific Gravity:	2.284 @ 15.6 °C
Odor/Odor Threshold:	Not available
Evaporation rate:	Not applicable
pH:	Not available
Coefficient of water/oil distribution:	Not available
Vapor Pressure:	Not applicable
Vapor Density:	Not applicable
Solubility in Water:	83.1 g/100 cc water @ 30 °C
Molecular Weight:	249.68

SECTION X. STABILITY AND REACTIVITY

Stability: Stable.
Incompatibility: Acetylene gas, aluminum powder, hydroxylamine, magnesium, moist air. Contact with magnesium metal can generate dangerous levels of hydrogen gas.
Conditions under which product is chemically unstable: Not applicable
Hazardous decomposition products: At temperatures >600 °C material decomposes to cupric oxide and sulfur dioxide.
Conditions of reactivity: Not applicable
Hazardous Polymerization: Will not occur.

SECTION XI. TOXICOLOGICAL INFORMATION

Toxicology Tests: (Triangle Brand Copper Sulfate Crystal)

Test : 1
LD/LC : LD_{50}
Test Type : Acute
Test Route : Dermal
Test Species : Rabbit
Results Amounts : >5050 mg/kg

Test : 3
LD/LC : LC_{50}
Test Type : Acute, 4 hr
Test Route : Inhalation
Test Species : Rats
Results Amounts : >2.95 mg/L

Test : 2
LD/LC : LD_{50}
Test Type : Acute
Test Route : Oral
Test Species : Rat
Results Amounts : 352 mg/kg*
*Results based on toxicity evaluation of this product.

Primary Eye Irritation: Corrosive, irreversible eye damage
Primary Skin Irritation: Slightly irritating.
Skin Sensitization: Product-specific tests in accordance with USEPA standards did not indicate that this product would cause skin sensitization.
Respiratory Tract Sensitization: Not available.
Carcinogenicity: Not listed as a carcinogen by NTP, IARC, OSHA, or ACGIH.

SECTION XI. TOXICOLOGICAL INFORMATION (Continued)

Mutagenicity: A study performed with copper sulphate on mice showed mutagenicity in a chromosomal aberration test; however, the route of exposure (*i.e.,* intraperitoneal) is not likely to be applicable to workplace use of this product.
Reproductive Toxicity: No reproductive effects were shown in a feeding test performed with copper sulphate on rats and mice.
Teratogenicity: Embryotoxicity was not seen at non-maternally toxic doses of copper sulphate in the relevant studies reviewed.
Toxicologically Synergistic Materials: Not available.
Other Chronic Effects: Long term inhalation of copper sulfate containing mists (*i.e.,* Bordeaux mixture) may cause adverse effects to the liver and kidneys. A sub-chronic test performed on rats and mice showed that at high exposure levels in feed (>4000 ppm) cupric sulfate is toxic to the liver and kidneys.

Additional Information: Inhalation of dust and mists of copper salts can result in irritation of nasal mucous membranes, sometimes of the pharynx and, on occasion ulceration with perforation of the nasal septum. Exposure to copper dust causes discoloration of the skin.
Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression and convulsions may be needed. Wilson's disease or G6PD deficiency (individual who absorbs, retains and stores copper) can be aggravated by excessive exposure. Symptoms may include nausea, vomiting, epigastric pain, diarrhea, dizziness, jaundice, and general debility.

SECTION XII. ECOLOGICAL INFORMATION

Subacute dietary LC_{50}: >10,000 ppm (quail and duck).
96 hr acute toxicity LC_{50}: 0.65 ppm (bluegill), 0.056 ppm (trout), 16 ppm (pink shrimp)
48 hr EC_{50}: 54 ppb (eastern oysters)
48 hr LC_{50}: 17 ppm (pink shrimp), 600 ppb (daphnia)
24 hr LC_{50}: 6.9 ppm (blue crab), 600 ppb (daphnia)
Bioaccumulation: Not available
Biodegradability: Not applicable

SECTION XIII. DISPOSAL CONSIDERATIONS

Waste Disposal Method: Waste must be disposed of in accordance with federal, state/provincial and local environmental control regulations. Improper disposal is a violation of law. Do not reuse empty container. If allowed by federal, state/provincial and local authorities, dispose of container in a sanitary landfill or by incineration.

SECTION XIV. TRANSPORT INFORMATION

	Proper Shipping Name:	Technical Name (If N.O.S.):	Hazard Class:	ID:	PG:
DOT:	*Environmentally Hazardous Substance, Solid, n.o.s., (Cupric Sulfate)** Reportable Quantity (RQ) = 10 pounds (4.54 kg).		9	UN3077	III

*Applicable when product is shipped in packaging of 10 pounds or greater.

SECTION XV. REGULATORY INFORMATION

US Federal
Federal Drinking Water Standards: *(Copper)* EPA 1300µg/L (action level), 1000 µg/L
Clean Water Act: This product contains compounds identified in 40 CFR 116.4.
TSCA: Listed
EPCRA, SARA Title III, Section 313 (40 CFR 372) Chemicals subject to reporting requirements (see Section II for CAS number and percentage in mixture): Section 312 and/or 313 reporting may be required for this product, depending of the amount used and/or stored on site.
CERCLA Hazardous Substances: RQ is not assigned to the broad class of copper compounds.
DOT: RQ 10 pounds (4.54 kg), See Section XIV TRANSPORT INFORMATION

Canada
This product has been classified in accordance with the hazard criteria of the *Controlled Products Regulations* and the MSDS contains all of the information required by the *Controlled Products Regulations.*

SECTION XVI. OTHER INFORMATION

Prepared By:	Phelps Dodge Corporation Department of Occupational Health and Safety One North Central Avenue Phoenix, AZ 85004 Telephone number (602.366.8398)
Reason for Revision:	Added use statement in Section I. Revised Section III and XI to reflect recent toxicity tests, Updated/revised information in other Sections with addition of Section XII in accordance with WHMIS.

Appendix C.2
Dextrin

MATERIAL SAFETY DATA SHEET

Date Printed: 07/09/2004
Date Updated: 03/07/2004
Version 1.2

Section 1 - Product and Company Information

Product Name	DEXTRIN
Product Number	260754
Brand	ALDRICH
Company	Sigma-Aldrich
Street Address	3050 Spruce Street
City, State, Zip, Country	SAINT LOUIS MO 63103 US
Technical Phone:	314 771 5765
Emergency Phone:	414 273 3850 Ext. 5996
Fax:	800 325 5052

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
DEXTRIN	9004-53-9	No

Formula C6H12O6
RTECS Number: HH9450000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Caution: Avoid contact and inhalation.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

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

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

Section 5 - Fire Fighting Measures

FLASH POINT
N/A

AUTOIGNITION TEMP

N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Avoid breathing dust. Avoid contact with eyes, skin, and clothing.

STORAGE
Suitable: Keep container closed. Store in a cool dry place.

SPECIAL REQUIREMENTS
Hygroscopic.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Government approved respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling. Wash contaminated clothing before reuse.

Section 9 - Physical/Chemical Properties

Appearance	Color: Faintly yellow Form: Powder

Property	Value	At Temperature or Pressure
Molecular Weight	N/A	
pH	N/A	
BP/BP Range	N/A	
MP/MP Range	N/A	

Freezing Point	N/A
Vapor Pressure	N/A
Vapor Density	N/A
Saturated Vapor Conc.	N/A
SG/Density	N/A
Bulk Density	N/A
Odor Threshold	N/A
Volatile%	N/A
VOC Content	N/A
Water Content	N/A
Solvent Content	N/A
Evaporation Rate	N/A
Viscosity	N/A
Surface Tension	N/A
Partition Coefficient	N/A
Decomposition Temp.	N/A
Flash Point	N/A
Explosion Limits	N/A
Flammability	N/A
Autoignition Temp	N/A
Refractive Index	N/A
Optical Rotation	N/A
Miscellaneous Data	N/A
Solubility	N/A

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Conditions of Instability: Protect from moisture.
Conditions to Avoid: Protect from moisture.
Materials to Avoid: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Multiple Routes: May be harmful by inhalation, ingestion, or skin absorption. May cause irritation.

SIGNS AND SYMPTOMS OF EXPOSURE

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Intravenous
Mouse
350 MG(FE)/KG
LD50

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Dissolve or mix the material with a combustible solvent and burn

in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: None
Non-Hazardous for Transport: This substance is considered to be non-hazardous for transport.

IATA
Non-Hazardous for Air Transport: Non-hazardous for air transport.

Section 15 - Regulatory Information

US CLASSIFICATION AND LABEL TEXT
US Statements: Caution: Avoid contact and inhalation.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: No
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

Appendix C.3
Methyl Isobutyl Carbinol

MATERIAL SAFETY DATA SHEET

For Emergency Assistance
Involving Chemicals Call CHEMTREC
(800) 424-9300

WHMIS (Classification)
CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

Section I. Chemical Product Identification

Distributed by:
Univar Canada Ltd.
9800 Van Horne Way
Richmond, BC
V6X 1W5

Product Name	Methyl Isobutyl Carbinol	Code	LA1277
		CAS#	000108112
Synonym	Methyl Amyl Alcohol MIBC 2-Pentanol-4-Methyl		
		DSL	On the DSL list.
Chemical Name	dimethyl-1,3 butanol-1		
		CI#	Not available.
Chemical Family	Not available.		
Chemical Formula	C6H14O		
Material Uses	Industrial applications: Organic solvent		

Section II. Composition and Information on Ingredients

Name	CAS #	% by Weight	LC50/LD50
Methyl Isobutyl Carbinol	000108112	100	ORAL (LD50): Acute: >2590 mg/kg [Rat]. DERMAL (LD50): Acute: >3.5 mL/kg [Rabbit]. VAPOR (LC50): Acute: >2000 ppm 4 hours [Rat].

Section III. Hazards Identification

Potential Acute Health Effects	Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation.

Potential Chronic Health Effects	CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section IV. First Aid Measures

Eye Contact	IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention.
Skin Contact	Flush affected skin with gently flowing lukewarm water for at least 20 minutes and remove contaminated clothing while rinsing. Wash contaminated skin with mild soap and water for 15 minutes. If irritation occurs and persists, obtain medical attention.
Hazardous Skin Contact	Flush affected skin with gently flowing lukewarm water for at least 20 minutes and remove contaminated clothing while rinsing. Wash contaminated skin with mild soap and water for 15 minutes. If irritation occurs and persists, obtain medical attention.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Hazardous Inhalation	Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.
Ingestion	Do not induce vomiting. Do not give anything by mouth to an unconscious person. Guard against aspiration into lungs by having the individual turn on to their left side. If vomiting occurs spontaneously keep head below hips to prevent aspiration of liquid into the lungs. Obtain medical attention immediately.
Hazardous Ingestion	Not available.

Section V. Fire and Explosion Data

The Product is: Flammable.

Auto-Ignition Temperature	338°C (640.4°F)
Flash Points	CLOSED CUP: 44°C (111.2°F). (TAG) OPEN CUP: 51.7°C (125.1°F) (Cleveland).
Flammable Limits	LOWER: 1% UPPER: 5.5%
Products of Combustion	Carbon monoxide and carbon dioxide are produced on combustion.

Fire Hazards in Presence of Various Substances	Flammable in presence of open flames and sparks, of heat, of oxidizing materials.
Explosion Hazards in Presence of Various Substances	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of oxidizing materials.
Fire Fighting Media and Instructions	Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.
Special Remarks on Fire Hazards	Vapour forms a flammable/explosive mixture with air between upper and lower flammable limits. Do not enter confined fire space without adequate protective clothing and an approved positive pressure self-contained breathing apparatus. Containers exposed to intense heat from fires should be cooled with water to prevent vapour pressure buildup which could result in container rupture. Product will float and can be reignited on surface of water. Container areas exposed to direct flame contact should be cooled with large quantities of water as needed to prevent weakening of container structure. Caution - Combustible.
Special Remarks on Explosion Hazards	Not available.

Section VI. Accidental Release Measures

Small Spill	Absorb with an inert material and put the spilled material in an appropriate waste disposal.
Large Spill	Issue warning "Combustible". Eliminate all ignition sources. Handling equipment must be grounded. Isolate hazard area and restrict access. Try to work upwind of spill. Avoid direct contact with material. Wear appropriate breathing apparatus (if applicable) and protective clothing. Stop leak only if safe to do so. Dike and contain land spills; contain water spills by booming. Use water fog to knock down vapours; contain runoff. For large spills remove by mechanical means and place in containers. Absorb residue or small spills with absorbent material and remove to non-leaking containers for disposal. Recommended materials: Clay or Sand Flush area with water to remove trace residue. Dispose of recovered material as noted under Disposal Considerations. Notify appropriate environmental agency(ies).

Section VII. Handling and Storage

Precautions	Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. DO NOT ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the

	label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids. Hot surfaces may be sufficient to ignite liquid even in the absence of sparks or flames. Extinguish pilot lights, cigarettes and turn off other sources of ignition prior to use and until all vapours are gone. Vapours may accumulate and travel to distant ignition sources and flashback. Empty containers may contain hazardous product residues. Do not pressurize drum containers to empty them. Fixed equipment as well as transfer containers and equipment should be grounded to prevent accumulation of static charge. Do not cut, drill, grind, weld or perform similar operations on or near containers. Air-dry contaminated clothing in a well ventilated area before laundering. Launder contaminated clothing prior to reuse. Use good personal hygiene.
Storage	Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Use explosion-proof ventilation to prevent vapour accumulation.

Section VIII. Exposure Controls/Personal Protection

Engineering Controls	Make up air should always be supplied to balance air exhausted (either generally or locally). Local ventilation recommended where mechanical ventilation is ineffective in controlling airborne concentrations below the recommended occupational exposure limit. Concentrations in air should be maintained below the recommended threshold limit value if unprotected personnel are involved. For personnel entry into confined spaces (i.e. bulk storage tanks) a proper confined space entry procedure must be followed including ventilation and testing of tank atmosphere. Electrical and mechanical equipment should be explosion-proof. Mechanical ventilation is recommended for all indoor situations to control fugitive emissions. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection	Chemical safety goggles and/or full face shield to protect eyes and face, if product is handled such that it could be splashed into eyes. Impervious gloves (neoprene) should be worn at all times when handling this product. Impervious clothing (apron, coveralls) should also be worn in confined workspaces or where the risk of skin exposure is much higher. Safety showers should be available for emergency use. If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. Use a NIOSH-approved chemical cartridge respirator with organic vapour cartridges or use a NIOSH-approved supplied-air respirator. For high airborne concentrations, use a NIOSH-approved supplied-air respirator, either self-contained or airline breathing apparatus, operated in positive pressure mode.
Personal Protection in Case of a Large Spill	Chemical safety goggles and/or full face shield to protect eyes and face, if product is handled such that it could be splashed into eyes. Impervious gloves (neoprene) should be worn at all times when handling this product. Impervious clothing (apron, coveralls) should also be worn in confined workspaces or where the risk of skin exposure is much higher. Safety showers should be available for emergency

	use. If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. Use a NIOSH-approved chemical cartridge respirator with organic vapour cartridges or use a NIOSH-approved supplied-air respirator. For high airborne concentrations, use a NIOSH-approved supplied-air respirator, either self-contained or airline breathing apparatus, operated in positive pressure mode.
Exposure Limits	TWA: 104 STEL: 167 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 25 STEL: 40 (ppm) from ACGIH (TLV) [United States] SKIN Consult local authorities for acceptable exposure limits.

Section IX. Physical and Chemical Properties

Physical State and Appearance	Liquid.	Odor	Sweetish. Alcohol like.
		Taste	Not available.
Molecular Weight	102.17 g/mole		
pH (1% soln/water)	Not available.	Color	Colorless.
Boiling Point	130°C - 133°C (266°F - 271.4°F)		
Melting Point	-90°C (-130°F)		
Critical Temperature	Not available.		
Specific Gravity	0.808 (Water = 1)		
Vapor Pressure	>0.4 kPa (@ 20°C)		
Vapor Density	3.5 (Air = 1)		
Volatility	Not available.		
Odor Threshold	Not available.		
Evaporation rate	0.27		
Viscosity	Not available.		
Water/Oil Dist. Coeff.	The product is more soluble in oil; log(oil/water) = 26.9		
Ionicity (in Water)	Not available.		
Dispersion Properties	Not available.		
Solubility	Very slightly soluble in cold water, hot water. Soluble in Other Solvents: Alcohol, Ether, Organic Solvents		

Section X. Stability and Reactivity Data

Stability	The product is stable.
Instability Temperature	Not available.
Conditions of Instability	Do not use with aluminum equipment at temperatures above 49 degrees Celsius. Avoid excessive heat, open flames and all ignition sources.
Incompatibility with various substances	Reactive with oxidizing agents, acids.
Corrosivity	Not available.
Special Remarks on Reactivity	Not available.
Special Remarks on Corrosivity	Not available.
Hazardous Polymerization	Will not occur.

Section XI. Toxicological Information

Routes of Entry	Absorbed through skin. Eye contact. Inhalation. Ingestion.
Toxicity to Animals	Acute oral toxicity (LD50): >2590 mg/kg [Rat]. Acute dermal toxicity (LD50): >3.5 mL/kg [Rabbit]. Acute toxicity of the vapor (LC50): >2000 ppm 4 hours [Rat].
Chronic Effects on Humans	CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.
Other Toxic Effects on Humans	Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation.
Special Remarks on Toxicity to Animals	Not available.
Special Remarks on Chronic Effects on Humans	Prolonged and repeated contact with skin can cause defatting and drying of the skin resulting in skin irritation and dermatitis. Prolonged exposure to high vapour concentration can cause headache, dizziness, nausea, blurred vision and central nervous system depression. Pre-existing Conditions: Pre-existing eye, skin and respiratory disorders may be aggravated by exposure to this product.
Special Remarks	Vapours are moderately irritating to the respiratory

on	passages.
Other Toxic Effects on Humans	Ingestion of this product may cause headache, dizziness, fatigue and central nervous system depression. Vapours are moderately irritating to the eyes.

Section XII. Ecological Information

Ecotoxicity	Do not allow product or runoff from fire control to enter storm or sanitary sewers, lakes, rivers, streams, or public waterways. Block off drains and ditches. Provincial regulations require and federal regulations may require that environmental and/or other agencies be notified of a spill incident. Spill area must be cleaned and restored to original condition or to the satisfaction of authorities. MIBC is practically non-toxic to aquatic organisms and is expected to be slightly toxic to mammalian wildlife. MIBC may deoxygenate surface waters.
BOD5 and COD	Not available.
Products of Biodegradation	Biodegradable. Not likely to bioaccumulate.
Toxicity of the Products of Biodegradation	Not available.
Special Remarks on the Products of Biodegradation	Not available.

Section XIII. Disposal Considerations

Waste Disposal	Waste management priorities (depending on volumes and concentration of waste) are: 1. recycle (reprocess), 2. energy recovery (cement kilns, thermal power generation), 3. incineration, 4. disposal at a licenced waste disposal facility. Do not attempt to combust waste on-site. Incinerate at a licenced waste disposal site with approval of environmental authority.

Section XIV. Transport Information

TDG Classification	Class 3: Flammable liquid.
Shipping name	Methyl isobutyl carbinol
PIN	UN2053
Packing Group	III
Special Provisions for Transport	Not regulated under the Transportation of Dangerous Goods Act when transported by road or rail in packagings or containers of 454 L or less (waste excluded).

Section XV. Other Regulatory Information

Other Regulations	OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Section XVI. Other Information

References -Manufacturer's Material Safety Data Sheet.

Other Special Considerations Not available.

Validated by Hardev Bendick on 12/7/2000. Verified by Hardev Bendick.

Tel. number for non-emergency questions concerning MSDS: 1-866-686-4827

Notice to Reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Univar Canada Ltd. expressly disclaims all expressed or implied warranties of merchantability and fitness for a particular purpose with respect to the product provided.**

========== END OF MSDS ==========

Appendix C.4
Potassium Ethyl Xanathate

Material Safety Data Sheet

acc. to OSHA and ANSI

Printing date 02/03/2003 Reviewed on 11/01/2002

1 Identification of substance:

- **Product details:**
- **Product name:** Potassium ethyl xanthate
- **Stock number:** A11450
- **Manufacturer/Supplier:**
  Alfa Aesar, A Johnson Matthey Company
  Johnson Matthey Catalog Company, Inc.
  30 Bond Street
  Ward Hill, MA 01835-8099
  Emergency Phone: (978) 521-6300
  CHEMTREC: (800) 424-9300
  Web Site: www.alfa.com
- **Information Department:** Health, Safety and Environmental Department
- **Emergency information:**
  During normal hours the Health, Safety and Environmental Department. After normal hours call Chemtrec at (800) 424-9300.

2 Composition/Data on components:

- **Chemical characterization:**
  Description: (CAS#)
  Potassium ethyl xanthate (CAS# 140-89-6): 100%
- **Identification number(s):**
- **EINECS Number:** 205-439-3

3 Hazards identification

- **Hazard description:** Xn Harmful
- **Information pertaining to particular dangers for man and environment**
  R 22 Harmful if swallowed.
  R 36/37/38 Irritating to eyes, respiratory system and skin.
- **Classification system**
- **HMIS ratings (scale 0-4)**

  (Hazardous Materials Identification System)
  Health (acute effects) = 1
  Flammability = 1

Reactivity = 1

4 First aid measures

- **After inhalation**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm.
  Seek immediate medical advice.
- **After skin contact**
  Immediately wash with water and soap and rinse thoroughly.
  Seek immediate medical advice.
- **After eye contact**
  Rinse opened eye for several minutes under running water. Then consult a doctor.
- **After swallowing** Seek immediate medical advice.

5 Fire fighting measures

- **Suitable extinguishing agents**
  Carbon dioxide, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
- **Special hazards caused by the material, its products of combustion or resulting gases:**
  In case of fire, the following can be released:
  Carbon monoxide and carbon dioxide
  Sulfur oxides (SOx)
- **Protective equipment:**
  Wear self-contained respirator.
  Wear fully protective impervious suit.

6 Accidental release measures

- **Person-related safety precautions:**
  Wear protective equipment. Keep unprotected persons away.
  Ensure adequate ventilation
- **Measures for environmental protection:**
  Do not allow material to be released to the environment without proper governmental permits.
- **Measures for cleaning/collecting:**
  Dispose contaminated material as waste according to item 13.
  Ensure adequate ventilation.
- **Additional information:**
  See Section 7 for information on safe handling
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.

7 Handling and storage

- **Handling**
- **Information for safe handling:**
  Keep container tightly sealed.
  Store in cool, dry place in tightly closed containers.
  Ensure good ventilation at the workplace.
- **Information about protection against explosions and fires:**
  Keep ignition sources away.

- **Storage**
- **Requirements to be met by storerooms and receptacles:**
  No special requirements.
- **Information about storage in one common storage facility:**
  Store away from oxidizing agents.

- **Further information about storage conditions:**
  Keep container tightly sealed.
  Store in cool, dry conditions in well sealed containers.

8 Exposure controls and personal protection

- **Additional information about design of technical systems:**
  Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

  Components with limit values that require monitoring at the workplace:
  Not required.
- **Additional information:** No data

- **Personal protective equipment**
- **General protective and hygienic measures**
  The usual precautionary measures for handling chemicals should be followed.
  Keep away from foodstuffs, beverages and feed.
  Remove all soiled and contaminated clothing immediately.
  Wash hands before breaks and at the end of work.
  Avoid contact with the eyes and skin.
- **Breathing equipment:**
  Use suitable respirator when high concentrations are present.
- **Protection of hands:**
  Impervious gloves
  Check protective gloves prior to each use for their proper condition.
- **Material of gloves**
  The selection of suitable gloves not only depends on the material, but also on quality. Quality will vary from manufacturer to manufacturer.
- **Eye protection:** Safety glasses
- **Body protection:** Protective work clothing.

9 Physical and chemical properties:

- **General Information**

- **Form:** Powder
- **Color:** Light yellow
- **Odor:** Not determined

	Value/Range	Unit	Method
Change in condition			
Melting point/Melting range:	213	° C	dec
Boiling point/Boiling range:	Not determined		
Sublimation temperature / start:	Not determined		
Ignition temperature:	Not determined		
Decomposition temperature:	Not determined		

- **Danger of explosion:**
  Product does not present an explosion hazard.

- **Explosion limits:**
- **Lower:** Not determined
- **Upper:** Not determined

- **Vapor pressure:** Not determined

- **Density:** Not determined

- **Solubility in / Miscibility with**
- **Water:** Not determined

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:**
  Decomposition will not occur if used and stored according to specifications.
- **Materials to be avoided:** Oxidizing agents
- **Dangerous reactions** No dangerous reactions known
- **Dangerous products of decomposition:**
  Carbon monoxide and carbon dioxide
  Sulfur oxides (SOx)

11 Toxicological information

- **Acute toxicity:**
  LD/LC50 values that are relevant for classification:
  Oral: LD50: 308 mg/kg (mus)
  LD50: 1700 mg/kg (rat)
- **Primary irritant effect:**
- **on the skin:** Irritant to skin and mucous membranes.
- **on the eye:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Subacute to chronic toxicity:**
- **Subacute to chronic toxicity:**
  The Registry of Toxic Effects of Chemical Substances (RTECS) reports the following effects in laboratory animals:
  Behavioral - excitement.
  Behavioral - muscle contraction or spasticity.
  Behavioral - antipsychotic.
  Behavioral - somnolence (general depressed activity).
  Lungs, Thorax, or Respiration - respiratory depression
  Blood - changes in erythrocyte (RBC) count.
  Biochemical - Enzyme inhibition, induction, or change in blood or tissue levels - catalases.
  Biochemical - Enzyme inhibition, induction, or change in blood or tissue levels - other enzymes.
- **Additional toxicological information:**
  To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.
  No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH.

12 Ecological information:

- **General notes:**
  Do not allow material to be released to the environment without proper governmental permits.

13 Disposal considerations

- **Product:**
- **Recommendation**
  Consult state, local or national regulations to ensure proper disposal.

- **Uncleaned packagings:**

- **Recommendation:**
  Disposal must be made according to official regulations.

14 Transport information

Not a hazardous material for transportation.

- **DOT regulations:**
- **Hazard class:** None

- **Land transport ADR/RID (cross-border)**
- **ADR/RID class:** None

- **Maritime transport IMDG:**
- **IMDG Class:** None

- **Air transport ICAO-TI and IATA-DGR:**
- **ICAO/IATA Class:** None

- **Transport/Additional information:**
  Not dangerous according to the above specifications.

15 Regulations

- **Product related hazard informations:**

- **Hazard symbols:** Xn Harmful

- **Risk phrases:**
  22 Harmful if swallowed.
  36/37/38 Irritating to eyes, respiratory system and skin.

- **Safety phrases:**
  26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
  36/37 Wear suitable protective clothing and gloves.

- **National regulations**
  All components of this product are listed in the U.S. Environmental Agency Toxic Substances Control Act Chemical substance Inventory.

- **Information about limitation of use:**
  For use only by technically qualified individuals.

16 Other information:

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

- **Department issuing MSDS:** Health, Safety and Environmental Department.
- **Contact:** Darrell R. Sanders

Technical Service: 1-800-343-7276
Bulk/Specialty Sales: 1-888-343-8025

ALFA AESAR
26 Parkridge Road
Ward Hill, MA 01835
USA
info@alfa.com

Alfa Aesar is an ISO-9002 certified company.

Fine chemicals for research and development from Alfa Aesar, a Johnson Matthey company

Appendix C.5
Sodium Ethyl Xanathate

VAN WATERS & ROGERS INC., SUBSIDIARY OF UNIVAR
1600 NORTON BLDG. SEATTLE, WA 98104-1564 (408) 435-8700

EMERGENCY ASSISTANCE

FOR EMERGENCY ASSISTANCE INVOLVING CHEMICALS CALL CHEMTREC (800)424-9300

FOR PRODUCT AND SALES INFORMATION

CONTACT YOUR LOCAL VAN WATERS & ROGERS BRANCH OFFICE

PRODUCT IDENTIFICATION

PRODUCT NAME: SODIUM ETHYL XANTHATE CAS NO.: UNASSIGNED
COMMON NAMES/SYNONYMS: AERO(R) 325 VW&R CODE: T1791

FORMULA: ROCS(S) NA OR ROCS(S) K DATE ISSUED: 08/89
HAZARD RATING (MANUFACTURER) SUPERCEDES: 10/87

HEALTH: 1 HAZARD RATING SCALE:
FIRE: 0 0=MINIMAL 3=SERIOUS
REACTIVITY: 0 1=SLIGHT 4=SEVERE
SPECIAL: NONE 2=MODERATE

HAZARDOUS INGREDIENTS

			EXPOSURE LIMITS, PPM			
			OSHA	ACGIH	OTHER	
COMPONENT	CAS NO.	%	PEL	TLV	LIMIT	HAZARD
SODIUM ETHYL XANTHATE	UNREPORTED	UNKNOWN	NONE	NONE	NONE	NONE
ETHANOL	64-17-5	0.5-1	1000	1000	NONE	FLAMMABLE

(R) TRADEMARK OF AMERICAN CYANIMID COMPANY.

PHYSICAL PROPERTIES

BOILING POINT, DEG F: N/A VAPOR PRESSURE, MM HG/20 DEG C: N/A
MELTING POINT, DEG F: 360-493 VAPOR DENSITY (AIR=1): N/A
SPECIFIC GRAVITY (WATER=1): N/A WATER SOLUBILITY, %: APPRECIABLE
APPEARANCE AND ODOR: N/A EVAPORATION RATE (BUTYL ACETATE=1): NIL

FIRST AID MEASURES

IF INHALED: REMOVE TO FRESH AIR. GIVE ARTIFICIAL RESPIRATION IF NOT BREATHING. GET IMMEDIATE MEDICAL ATTENTION.

IN CASE OF EYE CONTACT: IMMEDIATELY FLUSH EYES WITH LOTS OF RUNNING WATER FOR 15 MINUTES, LIFTING THE UPPER AND LOWER EYELIDS OCCASIONALLY. GET IMMEDIATE MEDICAL ATTENTION.

IN CASE OF SKIN CONTACT: IMMEDIATELY WASH SKIN WITH LOTS OF SOAP AND WATER. REMOVE CONTAMINATED CLOTHING AND SHOES; WASH BEFORE REUSE. GET MEDICAL ATTENTION IF IRRITATION PERSISTS AFTER WASHING.

IF SWALLOWED: IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING BY GIVING 2 GLASSES OF WATER AND STICKING A FINGER DOWN THE THROAT. GET IMMEDIATE

MEDICAL ATTENTION. DO NOT GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS OR CONVULSING PERSON.

----------HEALTH HAZARD INFORMATION----------

PRIMARY ROUTES OF EXPOSURE: INHALATION, SKIN OR EYE CONTACT.

SIGNS AND SYMPTOMS OF EXPOSURE
    INHALATION: BREATHING DUST MAY IRRITATE THE NOSE AND THROAT AND CAUSE COUGHING AND CHEST DISCOMFORT.

    EYE CONTACT: DUSTS MAY IRRITATE THE EYES.

    SKIN CONTACT: PROLONGED OR REPEATED CONTACT WITH THE DUST MAY IRRITATE THE SKIN.

    SWALLOWED: NONE CURRENTLY KNOWN.

CHRONIC EFFECTS OF EXPOSURE: NO SPECIFIC INFORMATION AVAILABLE.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: NONE REPORTED.

----------TOXICITY DATA----------

ORAL: NO DATA FOUND.

DERMAL: NO DATA FOUND.

INHALATION: NO DATA FOUND.

CARCINOGENICITY: THIS MATERIAL IS NOT CONSIDERED TO BE A CARCINOGEN BY THE NATIONAL TOXICOLOGY PROGRAM, THE INTERNATIONAL AGENCY FOR RESEARCH ON CANCER, OR THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

OTHER DATA: NONE

----------PERSONAL PROTECTION----------

VENTILATION: LOCAL MECHANICAL EXHAUST VENTILATION CAPABLE OF MINIMIZING DUST EMISSIONS AT THE POINT OF USE.

RESPIRATORY PROTECTION: IF USE CONDITIONS GENERATE VAPORS OR MISTS, WEAR A NIOSH-APPROVED RESPIRATOR APPROPRIATE FOR THOSE EMISSION LEVELS. APPROPRIATE RESPIRATORS MAY BE A FULL FACEPIECE OR A HALF MASK AIR-PURIFYING CARTRIDGE RESPIRATOR EQUIPPED FOR ORGANIC VAPORS/MISTS, A SELF-CONTAINED BREATHING APPARATUS IN THE PRESSURE DEMAND MODE, OR A SUPPLIED-AIR RESPIRATOR.

EYE PROTECTION: CHEMICAL GOGGLES. IT IS GENERALLY RECOGNIZED THAT CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH CHEMICALS BECAUSE CONTACT LENSES MAY CONTRIBUTE TO THE SEVERITY OF AN EYE INJURY.

PROTECTIVE CLOTHING: LONG-SLEEVED SHIRT, TROUSERS, SAFETY SHOES, AND GLOVES.

OTHER PROTECTIVE MEASURES: AN EYEWASH AND SAFETY SHOWER SHOULD BE NEARBY AND READY FOR USE.

--------------------FIRE AND EXPLOSION INFORMATION---------------------

FLASH POINT, DEG F: N/A FLAMMABLE LIMITS IN AIR, %
METHOD USED: N/A LOWER: N/A UPPER: N/A
EXTINGUISHING MEDIA: USE WATER SPRAY, DRY CHEMICAL, CO2, OR ALCOHOL FOAM.

SPECIAL FIRE FIGHTING PROCEDURES: FIRE FIGHTERS SHOULD WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. USE WATER SPRAY TO COOL NEARBY CONTAINERS AND STRUCTURES EXPOSED TO FIRE.

UNUSUAL FIRE AND EXPLOSION HAZARDS: NONE.

------------------------HAZARDOUS REACTIVITY--------------------------

STABILITY: UNSTABLE POLYMERIZATION: WILL NOT OCCUR.
CONDITIONS TO AVOID: HEAT, MOISTURE.

MATERIALS TO AVOID: MOISTURE, ACIDS.

HAZARDOUS DECOMPOSITION PRODUCTS: CARBON DISULFIDE.

-----------------SPILL, LEAK, AND DISPOSAL PROCEDURES-------------------

ACTION TO TAKE FOR SPILLS OR LEAKS: WEAR PROTECTIVE EQUIPMENT INCLUDING RUBBER BOOTS, RUBBER GLOVES, RUBBER APRON, AND A FULL FACEPIECE OR A HALF MASK AIR-PURIFYING CARTRIDGE RESPIRATOR WITH PARTICULATE FILTERS. WEAR CHEMICAL GOGGLES IF A HALF MASK IS WORN. FOR SMALL SPILLS, SWEEP UP AND DISPOSE OF IN DOT-APPROVED WASTE CONTAINERS. FOR LARGE SPILLS, SHOVEL INTO DOT-APPROVED WASTE CONTAINERS. KEEP OUT OF SEWERS, STORM DRAINS, SURFACE WATERS, AND SOIL.
COMPLY WITH ALL APPLICABLE GOVERNMENTAL REGULATIONS ON SPILL REPORTING, AND HANDLING AND DISPOSAL OF WASTE.

DISPOSAL METHODS: DISPOSE OF CONTAMINATED PRODUCT AND MATERIALS USED IN CLEANING UP SPILLS OR LEAKS IN A MANNER APPROVED FOR THIS MATERIAL. CONSULT APPROPRIATE FEDERAL, STATE AND LOCAL REGULATORY AGENCIES TO ASCERTAIN PROPER DISPOSAL PROCEDURES.
NOTE: EMPTY CONTAINERS CAN HAVE RESIDUES, GASES AND MISTS AND ARE SUBJECT TO PROPER WASTE DISPOSAL, AS ABOVE.

------------------------SPECIAL PRECAUTIONS--------------------------

STORAGE AND HANDLING PRECAUTIONS: STORE IN A COOL, DRY, WELL-VENTILATED PLACE AWAY FROM INCOMPATIBLE MATERIALS. KEEP BAGS OR FIBER DRUMS DRY AT ALL TIMES. WASH THOROUGHLY AFTER HANDLING. DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING.

REPAIR AND MAINTENANCE PRECAUTIONS: NONE.

OTHER PRECAUTIONS: CONTAINERS, EVEN THOSE THAT HAVE BEEN EMPTIED, WILL RETAIN PRODUCT RESIDUE AND VAPORS. ALWAYS OBEY HAZARD WARNINGS AND HANDLE EMPTY CONTAINERS AS IF THEY WERE FULL.

----------------------FOR ADDITIONAL INFORMATION----------------------

CONTACT MSDS COORDINATOR, VAN WATERS & ROGERS INC.
DURING BUSINESS HOURS, PACIFIC TIME (408)435-8700

----------NOTICE----------

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----------REVISION----------

08/89: CHANGED HEADING AND CONTACT INFORMATION.

Appendix C.6
Sodium Isopropyl Xanathate

Material Safety Data Sheet

ORFOM ® SIPX (SODIUM ISOPROPYL XANTHATE)

September 30, 2001
MSDS #: 28990
Revision #0

CHEVRON PHILLIPS CHEMICAL COMPANY LP
10001 Six Pines Drive
The Woodlands, TX 77380

PHONE NUMBERS
HEALTH:
Chevron Phillips Emergency
Information Center 866.442.9628
(North America) and
1.832.813.4984(International)
TRANSPORTATION:
North America: CHEMTREC 800.424.9300
or 703.527.3887
ASIA: 1.703.527.3887
EUROPE: BIG .32.14.584545 (phone)
or .32.14.583516 (telefax)
SOUTH AMERICA SOS-Cotec
Inside Brazil: 0800.111.767
Outside Brazil: 55.19.3467.1600
Technical Services: (832) 813-4862
For Additional MSDSs: (800) 852-5530

A. Product Identification

Synonyms: Not Established
Chemical Name: Sodium Isopropyl Xanthate
Chemical Family: Dithiocarbonate
Chemical Formula: C4H7OS2Na
CAS Reg. No.: 140-93-2
Product No.: Not Established

Product and/or Components Entered on EPA's TSCA Inventory: YES
This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it may be subject to applicable TSCA provisions and restrictions.

Canadian Inventory Listing Status: DSL
All ingredients are listed in the Domestic Substances List (DSL).

Impurities are exempt in accordance with Section 3 of the Canadian Environmental Protection Act (CEPA).

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
Sodium Isopropyl Xanthate	140-93-2	>84.0	NE	NE
Sodium Hydroxide	1310-73-2	< 3.0	2 mg/m3	2 mg/m3 (C)
Water	7732-18-5	Reminder	NE	NE

C. Personal Protection Information

Ventilation: Use adequate ventilation to control exposure below recommended level.

Respiratory Protection: Not generally required unless needed to prevent respiratory irritation.

Eye Protection: Use safety glasses with side shields.

Skin Protection: No special garments required. Avoid unnecessary skin contamination. Use impervious rubber gloves.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not get in eyes, on skin or on clothing. Do not breathe vapors, mist, fume or dust. Wear protective equipment and/or garments described above if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use only with adequate ventilation.

Store in a closed containers. Store in cool, well-ventilated area away from ignition sources. Protect from moisture and oxidants.

E. Reactivity Data

Stability: Stable
Conditions to Avoid: Acid; ignition sources.

Incompatibility (Materials to Avoid): Oxidants, organic or inorganic acids

Hazardous Polymerization: Will Not Occur
Conditions to Avoid: Not Applicable
Hazardous Decomposition Products: Sulfur oxides and carbon disulfides released on heating.

F. Health Hazard Data

Recommended Exposure Limits:

Control as Particulate Not Otherwise Classified (PNOC) or Regulated:

	OSHA PEL	ACGIH TLV*
Respirable Fraction	5 mg/m3	3 mg/m3
Total Dust	15 mg/m3	10 mg/m3

* The value is for inhalable (total) particulate matter containing no asbestos and

Acute Effects of Overexposure:

Eye: Irritation possible.

Skin: Mild irritation. Dermatitis may be possible with prolonged contact.

Inhalation: Dust may cause irritation to the nose, throat, and upper respiratory tract.

Ingestion: Low to moderate toxicity possible.

Subchronic and Chronic Effects of Overexposure:

Xanthates can decompose to release carbon disulfide (CAS # 75-15-0) which may cause dizziness, headache, fatigue, nervousness, loss of appetite, psychosis and nerve, heart, kidney or liver changes.

Other Health Effects:

No known applicable information.

Health Hazard Categories:

Animal	Human		Animal	Human

Known Carcinogen	___	___	Toxic	___	___
Suspect Carcinogen	___	___	Corrosive	___	___
Mutagen	___	___	Irritant	___	___
Teratogen	___	___	Target Organ Toxin	_X_	_X_
Allergic Sensitizer	___	___	Specify - Liver, Kidney, Heart &		
Highly Toxic	___	___	Nerve Toxin		

Canadian WHIMS:

CLASS D: POISONOUS AND INFECTIOUS MATERIAL CATEGORIES

1. Materials Causing Immediate and Serious Toxic Effects

   A. Very Toxic _____
   B. Toxic _____

2. Materials Causing Other Toxic Effects

   A. Very Toxic

      1. Chronic Toxic Effects _____
      2. Teratogen/Embryo Toxin _____
      3. Carcinogen _____
      4. Reproductive Toxin _____
      5. Respiratory Tract Sensitizer _____
      6. Mutagen _____

   B. Toxic

      1. Chronic Toxic Effects __x__
      2. Skin or Eye Irritant _____
      3. Skin Sensitizer _____
      4. Mutagen _____

   Specify: Liver - Toxin; Kidney - Toxin; Heart - Toxin; Nerve - Toxin.

First Aid and Emergency Procedures:

Eye: Flush eyes with running water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Skin: Wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Inhalation: Remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.

Ingestion: Give two glasses of water and induce vomiting, only if subject is conscious. Seek medical attention.

G. Physical Data

Appearance:	Yellowish Powder or Pellets
Odor:	Slight
Boiling Point:	Not Applicable
Vapor Pressure:	Not Applicable
Vapor Density (Air = 1):	Not Applicable
Solubility in Water:	Appreciable
Specific Gravity (H_2O = 1):	Not Established
Percent Volatile by Volume:	14 maximum
Evaporation Rate (Butyl Acetate = 1):	Not Applicable
Viscosity:	Not Applicable

H. Fire and Explosion Data

Flash Point (Method Used):	Not Applicable (solid or powder)
Flammable Limits (% by Volume in Air):	LEL - Not Applicable UEL - Not Applicable
Fire Extinguishing Media:	Dry chemical, foam or carbon dioxide (CO_2)
Special Fire Fighting Procedures:	Evacuate area of all unnecessary personnel. Shut off source, if possible. Use NIOSH/MSHA approved self-contained breathing apparatus and other protective equipment and/or garments described in Section C if conditions warrant. Water fog or spray may be used to cool exposed containers and equipment.
Fire and Explosion Hazards:	Sulfur oxides and carbon disulfide released upon heating.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:

Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible and contain spill. Protect from ignition. Keep out of water sources and sewers. Follow normal clean-up procedures for solid spills. Control dust. Avoid breathing dust. Avoid contact with skin and eyes.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):

Incinerate or place in permitted waste management facility.

J. DOT Transportation

Shipping Name: Self-heating, solid, organic, n.o.s., (Sodium isopropyl xanthate)
Hazard Class: 4.2
ID Number: UN 3088
Packing Group: II
Marking: Self-heating, solid, organic, n.o.s., (Sodium isopropyl xanthate), UN 3088
Label: Spontaneously combustible
Placard: Spontaneously combustible/3088
Hazardous Substance/RQ: Not Applicable
Shipping Description: Self-heating, solid, organic, n.o.s., (Sodium isopropyl xanthate), 4.2, UN 3088, PG II
Packaging References: 49 CFR 173.212, 173.241

K. RCRA Classification - Unadulterated Product as a Waste

Reactive (D003)

Prior to disposal, consult your environmental contact to determine if the TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Use NIOSH/MSHA approved respiratory protection, such as air-supplied mask, in confined spaces or other poorly ventilated areas.

M. Hazard Classification

_X_ This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

___ Combustible Liquid	___ Flammable Aerosol	___ Oxidizer
___ Compressed Gas	___ Explosive	___ Pyrophoric
___ Flammable Gas	_X_ Health Hazard (Section F)	___ Unstable
___ Flammable Liquid	___ Organic Peroxide	___ Water Reactive
___ Flammable Solid		

___ Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

Canadian WHIMS:

Class D:Poisonous and Infectious Material
Division 2. Materials Causing Other Toxic Effects

N. Additional Comments

SARA 313

This product contains the following chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372. (See Section B).

Sodium Hydroxide
Carbon Disulfide

NFPA 704 Hazard Codes - - - - - - - - Signals

		Least - 0
Health	: 1	Slight - 1
Flammability	: 0	Moderate - 2
Reactivity	: 0	High - 3
Special Haz.	: -	Extreme - 4

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by EHS Product Stewardship Group, Chevron Phillips Chemical Company LP, 10001 Six Pines Drive, The Woodlands, TX 77380