Environment Canada
Environmental Protection Service

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Manual for Spills of Hazardous Materials

March 1984

Canada

MANUAL FOR SPILLS OF HAZARDOUS MATERIALS

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FOREWORD

This manual provides qualitative and quantitative information for those responding to, or planning for, hazardous materials spills. It is unique in that it encompasses quantitative data on chemical and physical properties, fire properties, human health and toxicity, reactivity and environmental toxicity, as well as qualitative response information. According to criteria developed by the Environmental Emergencies Technology Division, 150 top priority chemical substances, as well as fuels, oils and other frequently spilled substances, are included in the manual. There are 220 listings, many of which encompass several different forms/isomers, solutions or formulations of the basic product. This first edition will be updated and expanded upon when sufficient new information is gathered.

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A preliminary version of the manual (over 100 substances were later added) was prepared by ECO Research Ltd., under contract to EPS. It was reviewed by W. Carter, L. Solsberg and J. Bridgeland.

The many people who are not mentioned here, and who contributed to this manual, are gratefully acknowledged.

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1 DESCRIPTION OF MANUAL'S CONTENTS

This section explains the various entries of each 2-page listing in the manual. The descriptions of the entries that follow are in the order that appear in a typical listing.

1.1 Main Listing

1.1.1 Name.

- In each case, the most commonly used "transport" name has been chosen as the name to list the substance.

1.1.2 Chemical Formula.

- A standardized semi-structural formula has been given; where the substance is not a pure chemical, a typical formula is given.

1.1.3 UN Number.

- This is the Inter-governmental Maritime Organization (IMO; formerly IMCO) number for the given substance.
- In some cases several numbers apply to the product and relate to the various formulations.

1.2 Identification

1.2.1 Common Synonyms.

- Alternative chemical names and commonly used names are given.
- Commercial or trade names are shown in a few cases.
- An index of all synonyms appears at the front of the manual.

1.2.2 Observable Characteristics.

- A description of the appearance is given, followed by a description of the substance's odour.
- It should be noted that the appearance and the odour may depend on the purity or form of the substance; thus, these characteristics should not be used exclusively when identifying the product.

1.2.3 Manufacturers/Suppliers.

- The manufacturers or suppliers of the given product are listed.
- In those cases where all Canadian firms cannot be listed, only selected manufacturers are given and, where possible, these were selected on the basis of production volume.

1.2.4 Transportation and Storage Information.

Shipping State

- The physical state(s) (liquid, solid or gas) of the substance when shipped.

Classification

- The classification of the substance under the Transport of Dangerous Goods Regulations.
- The following is a summary of these classifications:

CLASS	DIVISION	
1- Explosives	1.1	Capable of producing a mass explosion
	1.2	Projection hazard but not a mass explosion hazard
	1.3	Fire hazard and either a minor blast or minor projection hazard or both, but not a mass explosion hazard
	1.4	Minor hazard if ignited or initiated during transport, not a projection hazard
	1.5	Insensitive explosive substances that may represent a mass explosion risk
2- Gases - compressed or deeply refrigerated	2.1	Flammable gases
	2.2	Nonpoisonous, nonflammable gases
	2.3	Poisonous gases
3- Flammable and Combustible Liquids	3.1	Flash point <-18°C (c.c.)
	3.2	Flash point -18°C to <37.8°C (c.c.)
	3.3	Flash point 37.8°C to 93.3°C (c.c.)
4- Flammable Solids	4.1	Readily combustible
	4.2	Combustible from spontaneous heating, or exposure to air
	4.3	Emit flammable gases, or become spontaneously combustible on contact with water or water vapour
5- Oxidizing Substances; Organic Peroxides	5.1	Oxidizer
	5.2	Organic Peroxide
6- Poisonous (toxic) and Infectious Substances	6.1	Substances that are poisonous by ingestion, inhalation or skin contact
	6.2	Infectious substances
7- Radioactive Materials and Prescribed Substances	-	Within the meaning of the "Atomic Energy Control Act" and classified by the Atomic Energy Control Board
8- Corrosives	-	Cause severe damage to living tissue by chemical action, may corrode or destroy freight or means of transport
9- Miscellaneous Dangerous Substances	-	Substances not ascribed to any other class which from experience may present some danger warranting regulation in transport
9.1 Miscellaneous Products, Substances or Organisms		
9.2 Environmentally Dangerous Substances		
9.3 Dangerous Wastes		
Packing Group I	Very Dangerous	
Packing Group II	Dangerous	
Packing Group III	Moderately Dangerous	

Labels

- The labels/placards as required under the Transport of Dangerous Goods Regulations are described.
- These labels/placards are depicted below:

Class 1
Explosive

Class 2.1
Flammable Compressed Gas

Class 2.2
Nonflammable Gas

Class 2.3
Poisonous Gas

Class 3
Flammable or Combustible Liquid

Class 4.1
Flammable Solid

Class 4.2
Combustible Solid
(on exposure to air)

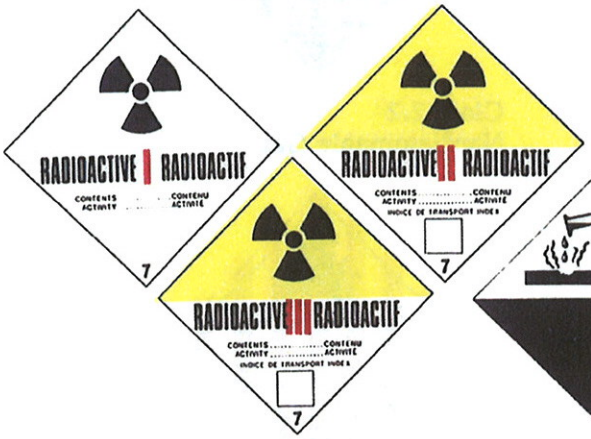
Class 4.3
Combustible Solid (on expose to water or water vapour)

Class 5
Oxidizer
(or Organic Peroxide)

Class 6.1
Poison

Class 6.1
Poison (not to be shipped with foodstuffs)

Class 6.2
Poison Infectious Substances



Class 7
Radioactive

Class 8
Corrosive

Class 9
Miscellaneous Dangerous Goods (placard only)

Mixed Loads or Goods in Limited Quantity or Consumer Goods

Inert Atmosphere

- The description of the gas which should be used with materials which react with air, or as a general safety precaution.

Venting

- The description of the venting requirements including open (no special requirements), closed (sealed container), safety-relief (a device which opens at a preset pressure) and pressure-vacuum (a device which opens at a preset pressure or vacuum).

Storage Temperature

- The temperature at which the substance is typically stored.

Pump Type; Hose Type

- Listing of the known types which are compatible with the material.

Grades or Purity

- A listing of the common commercial grades of the substance with the typical purity given.
- In some cases, the other ingredients of the commercial grade.
- Some solutions are given in °Bé (degrees Baumé), a specific gravity measurement.

Containers and Materials

- A listing of the common containers in which the product is stored or transported and the materials from which these containers are constructed.

1.2.5 Physical and Chemical Characteristics.

Physical State (at 20°C)

- The physical state (gas, liquid or solid) of the pure substance at 20°C and 1 atmosphere pressure.

Solubility (water)

- The solubility of the substance in grams per 100 millilitres of water (g/100 mL).
- g/100 mL is also equal to the percentage by weight.
- No standard scheme exists to describe solubility; the system used in this manual is as follows:

Description	Solubility (g/100 mL water)
Soluble in all proportions	>>100
Very Soluble	>50
Soluble	10 to 50
Moderately Soluble	1 to 10
Slightly Soluble	0.1 to 1
Insoluble	<0.1

- Scales used in other literature include (direct comparison of solubility by scale alone is therefore difficult):

Solubility Scale	Description	Solubility (g/100 mL water)
A	Very Soluble	>50
	Soluble	5 to 50
	Slightly Soluble	<5
B	Soluble	>25
	Slight Solubility	10 to 24
	Insoluble	<10
C	Extremely Soluble	>1
	Highly Soluble	0.1 to 1
	Moderately Soluble	0.02 to 0.1
	Slightly Soluble	0.002 to 0.02
	Practically Insoluble	<0.002

Molecular Weight

- The sum of the atomic weights of a molecule of the pure substance where the relative mass of each atom is based on a scale in which carbon-12 is assigned a mass value of 12.
- The molecular weight is useful in converting pressure, volume and temperature relationships for gases or vapours.

Vapour Pressure

- The pressure that a vapour exerts on its surroundings, given here in millimetres of mercury (mm Hg) at various temperatures.
- 760 mm Hg is 1 atmosphere (standard) pressure.
- A substance with a high vapour pressure "gives off" more vapours than a substance with a lower vapour pressure at the same temperature and thus would require consideration as a gas as well as a liquid or solid in a spill situation.

Boiling Point

- The temperature at which a substance boils, that is the temperature at which its vapour pressure equals the ambient air pressure.
- Given here in degrees Celsius (°C) and 1 atmosphere pressure (760 mm Hg) or in a few cases at lower pressures where these are the only data available.

Floatability

- The physical behaviour of the substance when spilled on water.

Odour

- A description of the odour and the odour threshold are given.
- Odour threshold as presented here is the entire range of measurements presented in literature from the 0% level - when the odour was first perceived by a person in a test panel - to the 100% recognition level - when all persons in a test panel recognized an odour.
- These odour threshold values cannot be relied upon to prevent over-exposure since human sensitivity to odours varies widely, odours could be masked by other odours, and some compounds rapidly deaden the sense of smell.

Flash Point

- The lowest temperature at which vapours above a volatile substance will ignite in air when exposed to a flame.
- Is given in degrees Celsius (°C) and followed by the method used — closed cup (c.c.) or open cup (o.c.) — the latter value generally is about 5 to 10°C higher than the closed cup value.
- Flash point values are often used to rate the flammability or combustibility of a substance; the criterion used in this manual is that any substance with a flash point (c.c.) under 60°C is flammable and those with a flash point at or greater than 60°C are combustible.
- The Canadian Transport Commission regulates as flammable liquids those with a flash point less than 23°C (73°F). Beginning January 1, 1984, those liquids having a flash point of less than 61°C (141°F) will also be regulated as flammable liquids. The United States Department of Transport regulates as flammable liquids those having flash points of less than 37.8°C (100°F) and as combustible liquids those having flash points of 37.8°C (100°F) or more but less than 93.3°C (200°F).
- For readers of this manual the following scale is proposed as a general guide to the flammability of materials:

Rating	Flash point (c.c.)
Highly Flammable	<-10°C
Very Flammable	-10°C to 20°C
Flammable	20°C to 60°C

Combustible	60°C to 120°C
Low Combustibility	>120°C

Vapour Density

- The ratio of the weight of vapour to the weight of an equal volume of dry air at the same pressure and temperature.
- A vapour density of less than 1 implies that the vapour will be buoyant and rise in air, and vice versa; it should be noted that mixing of gas with air is very dependent on atmospheric conditions and should not be solely judged by its vapour density.
- Acetylene, ammonia, ethylene, hydrogen and methane are common gases that have a vapour density of less than 1.
- Substances with vapour densities greater than 1 have a tendency under most atmospheric conditions to reside in depressions for a time before mixing with the ambient air.

Specific Gravity

- The ratio of the weight of a solid or liquid to the weight of an equal volume of water, at some specified temperature.
- If the specific gravity is less than 1.0 (or less than 1.03 in seawater), the chemical will float on water; if higher, it will sink. This, of course, presumes that the material does not entrain air or does not react.

Colour

- Description of the colour(s) of the substance; it should be noted that the purity or form of the substance may alter its colour.

Explosive Limits

- Same as "Flammability Limits" and is the concentration range of vapour in air between which propagation of a flame occurs on contact with a source of ignition.
- L.E.L. is the lower explosive limit and U.E.L. is the upper explosive limit.
- Generally, these values are given at 20°C and temperature increases extend the limits while temperature decreases narrow the limits.

Melting Point

- The temperature at which a solid turns to a liquid.
- For many substances this is similar to freezing point, the temperature at which a liquid turns to a solid. Some substances, however, are not symmetric in this regard and a range has sometimes been presented.

- The purity of a substance affects the melting point; a range has sometimes been presented for this situation too.

1.3 Hazard Data

1.3.1 Human Health.

- This section provides data on the effects of the substance on humans and will distinguish by route of entry (inhalation, contact with skin and eyes, ingestion and absorption through the skin), as well as by the form of the substance (physical state, vapour, dust, fume or mist), where these are applicable.

Symptoms

- Summary of the symptoms shown in the literature for acute (periodic and short-term rather than continuous) exposure to the substance.
- Descriptions of the symptoms are given in common terms such as pain, irritation, dizziness, etc., where these terms can be used.
- The following terms are also employed:

Abdominal	- referring to stomach and intestinal area
Alimentary Canal	- mouth, esophagus, stomach and intestines
Anaesthesia	- loss of sensation
Asphyxia (asphyxiation)	- breathing difficulty due to lack of oxygen
Bronchitis	- an inflammation (redness, swelling, etc.) of the bronchial tubes in the lungs
Central Nervous System Depression	- suppression of sensory and motor impulses to and from the brain and spinal cord as evidenced by: poor motor response, slower reflexes, slower breathing, etc.
Coma	- a state of deep unconsciousness
Convulsions	- abnormal, violent and involuntary series of contractions of the muscles
Cornea	- the transparent part of the covering of the eyeball
Corneal	- of or referring to the cornea
Cramps (stomach cramps)	- painful involuntary muscular contractions
Cyanosis	- bluish discolouration of the skin
Defatting	- removal of oils from skin tissue resulting in dry, parched skin

Delirium	- mental disturbance characterized by confusion, disordered speech and hallucinations
Dermatitis	- inflammation (redness, swelling, etc.) of the skin
Desiccant	- a moisture-absorbing (drying) agent
Distension (of stomach)	- an expansion or enlargement
Dullness	- slowness in responding to stimuli
Edema	- abnormal accumulation of fluid in body tissue
Euphoria	- abnormal feeling of well-being or elation
Extremities	- portions of the body away from the torso - e.g., hands and feet
Gastrointestinal	- relating both to the stomach and intestines
Hemorrhagic Gastritis	- inflammation and bleeding of the stomach
Impairment (mental)	- slowing or decreasing the mental ability
Inflammation	- swelling and redness of body tissue
Lesions	- injury, damage or abnormal change in a tissue or organ
Mucous Membranes	- membranes rich in mucous glands, such as those found in the nose, mouth and throat
Narcosis	- a state of stupor, unconsciousness or slowed activity produced by the influence of a chemical
Nausea	- general feeling of stomach sickness often resulting in vomiting
Opaqueness of Cornea	- whiteness or colouring of the normally transparent covering of the eye
Pallor	- paleness or loss of facial colour
Paralysis	- complete or partial loss of function in a portion of the body including loss of muscle control and/or loss of sensation
Perforation	- penetration or holing of a body tissue
Pulmonary	- relating to the lungs
Pulmonary Edema	- abnormal accumulation of fluid in lung tissue
Salivation	- excessive discharge of saliva
Shock	- deep depression of vital processes caused by a rapid fall in blood pressure
Spasm	- involuntary and sudden muscular contraction
Sputum	- spit and other expectorate matter
Ulceration (skin)	- break in skin with a loss or destruction of surface tissue

Toxicology

- Provides a relative rating (high, moderate or low) of the toxicity of the product by route (contact, inhalation or ingestion).

TLV®

- Is the "Threshold Limit Value".
- A registered trademark of the American Conference of Governmental Industrial Hygienists; values presented here are their 1981 recommendations.
- Is a workplace number used as a guide to the maximum average exposure to a chemical for 8-hour days and 5 days per week.
- Is useful for spills as a guide for evacuation (see also Short-term Inhalation Limit, below).
- When "skin" is specified, this implies that the material is percutaneous - that it is absorbed through the skin at a rate similar to or greater than that absorbed by the body through inhalation.

Short-term Inhalation Limit

- Taken here as the given STEL ("Short-term Exposure Limit") value unless otherwise noted.
- A workplace value similar in origin and meaning to the TLV® except that this is the maximum concentration to which workers can be continuously exposed for a period up to 15 minutes without suffering irritation or chronic and irreversible effects provided that no more than four of these exposures occur per day, and that there is at least 1 hour between exposure periods and that the TLV® is not exceeded (as an average).
- The value is also useful for spill situations representing a maximum exposure value without respiratory (or skin) protection.

LC_{50}

- "Lethal Concentration Fifty".
- The calculated concentration of a substance in air, exposure to which caused the death of 50% of the test population in a specified time.

TC_{Lo}

- "Toxic Concentration Low".
- The lowest concentration of a substance in air that has produced any toxic effect on the test population for any given period of time.

LC_{Lo}

- "Lethal Concentration Low".
- The lowest concentration of a substance in air for a specified period of time that has produced death in the test population.

LD_{50}

- "Lethal Dose Fifty".
- The calculated dose (in grams of substance per kilogram of body weight) that caused the death of 50% of the test population.
- The test population may have the substance administered by different routes:
  Oral - by feeding and then ingestion
  Skin - by contact with skin and subsequent absorption
  Intraperitoneal - by injection into the peritoneum (membrane lining the abdomen)
  Subcutaneous - by injection under the skin
  Intravenous - by injection into the bloodstream
  Cutaneous - by skin, exact means (skin, subcutaneous, etc.) not specified
- IMO has provided a toxicity scale which might be used as a relative guide:

Scale	Description	LD_{50} (g/kg)
4	highly hazardous	<0.005
3	moderately hazardous	0.005 to 0.05
2	slightly hazardous	0.05 to 0.5
1	practically nonhazardous	0.5 to 5.0
0	not hazardous	>5.0

LD_{Lo}

- "Lethal Dose Low".
- The lowest dose (g/kg) that caused death in a test population.
- The routes of administration are those as described in LD_{50}.

TD_{Lo}

- "Toxic Dose Low".
- The lowest dose of a substance reported to have produced any toxic effect in a test population.
- The routes of administration are described under LD_{50}.

Delayed Toxicity

- Provides information on delayed symptoms of exposure, possible long-term effects of exposure or information on suspected carcinogenicity.
- "Suspected carcinogen" means the substance was tested for carcinogenicity using animals and showed positive results, i.e., may have potential to cause cancer.

Absorption by Skin

- Certain substances are readily absorbed through the skin necessitating the use of special protective clothing.
- This property is indicated by statements such as "readily absorbed through the skin", etc.; by a TLV® for the skin; or by an LD_{50}, LD_{Lo} or TD_{Lo} that is high via the skin or subcutaneous route.
- These substances are called percutaneous (through-the-skin) materials.
- Examples of chemicals which can enter the body at least as rapidly by skin absorption as by inhalation include the following (source of these is not dealt with in the manual):

Acetonitrile	Cyanides	Morpholine
Acrylonitrile	Epichlorohydrin	Pentachlorophenol
Allyl Alcohol	Ethyl Acrylate	Phenol
Aniline	Furfural	Propyl Alcohol
n-Butyl Alcohol	Furfuryl Alcohol	Tetraethyl lead
Carbon Disulfide	Hydrazine	Toluene
Carbon Tetrachloride	Malathion	Xylene
Chlordane	Methyl Acrylate	
Cresol	Methyl Alcohol	

IDLH

- "Immediately Dangerous to Life or Health".
- A value represents a maximum concentration from which one could escape within 30 minutes without irreversible health effects. It is used as the value at which air-supplied respiratory protection is required and at which filter or chemical cartridge protection would not be suitable.
- This value has not been included in the main listings as it is often misinterpreted as a "safe" value; however, a list of some IDLH values follows.
- A "practical" definition of IDLH is suggested as the concentration at which irreversible effects on health could be expected.

A LIST OF SOME IDLH VALUES

Substance	IDLH (ppm, unless otherwise specified)		Substance	IDLH (ppm, unless otherwise specified)	
Acetaldehyde	10 000		Chlordane	500	mg/m^3
Acetic Acid	1 000		Chlorine	25	
Acetic Anhydride	1 000		Chlorobenzene	2 400	
Acetone	20 000		Chlorobromomethane	5 000	
Acetonitrile	4 000		Chloroform	1 000	
Acrolein	5		Chromium (as soluble Cr salts)	250	mg/m^3
Acrylonitrile	4		Cresol	250	
Allyl Alcohol	150		Cumene	8 000	
Allyl Chloride	300		Cyanide (KCN or NaCN)	50	mg/m^3
Ammonia	500		Cyclohexane	10 000	
n-Amyl Acetate	4 000		Cyclohexanol	3 500	
Aniline	100		Cyclohexanone	5 000	
Arsine	6		Cyclohexene	10 000	
Benzene	2 000		2,4-D	500	mg/m^3
Benzyl Chloride	10		o-Dichlorobenzene	1 700	
Boron Trifluoride	100		p-Dichlorobenzene	1 000	
Bromine	10		Dichlorodifluoromethane	50 000	
Butadiene	20 000		1,1-Dichloroethane	4 000	
2-Butanone	3 000		1,2-Dichloroethylene	4 000	
t-Butyl Acetate	8 000		Dichloromonofluoromethane	50 000	
Butyl Acetate	10 000		Dichlorotetrafluoroethane	50 000	
sec-Butyl Alcohol	10 000		Diethylamine	2 000	
t-Butyl Alcohol	8 000		Difluorodibromomethane	2 500	
n-Butyl Alcohol	8 000		Diisobutyl Ketone	2 000	
Butyl Amine	2 000		Dimethylamine	2 000	
Butyl Mercaptan	2 500		Diisopropylamine	1 000	
Calcium Oxide	250	mg/m^3	Diphenyl	300	mg/m^3
Carbon Dioxide	50 000		Epichlorohydrin	100	
Carbon Disulfide	500		Ethanolamine	1 000	
Carbon Monoxide	1 500		Ethyl Acetate	10 000	
Carbon Tetrachloride	300		Ethylacrylate	2 000	

Substance	IDLH (ppm, unless otherwise specified)		Substance	IDLH (ppm, unless otherwise specified)	
Ethylbenzene	2 000		Methyl Isobutyl Carbinol	2 000	
Ethyl Chloride	20 000		Methyl Isobutyl Ketone	3 000	
Ethyl Ether	19 000		Methyl Mercaptan	400	
Ethyl Mercaptan	2 500		Methyl Methacrylate	4 000	
Ethylamine	4 000		Methylamine	100	
Ethylene Dichloride	1 000		Methylene Chloride	5 000	
Ethylene Oxide	800		Morpholine	8 000	
Fluorine	25		Naphthalene	500	
Formaldehyde	100		Naphtha	10 000	
Formic Acid	100		Nitric Acid	100	
Furfural	250		Nitric Oxide (NO)	100	
Furfuryl Alcohol	250		Nitrobenzene	200	
Heptane	4 250		Nitrogen Dioxide		
Hexane	5 000		(NO_2 + N_2O_4)	50	
Hydrazine	80		Octane	3 750	
Hydrogen Bromide	50		Pentachlorophenol	150	mg/m^3
Hydrogen Chloride	100		Pentane	5 000	
Hydrogen Cyanide	50		Perchloroethane	300	
Hydrogen Fluoride	20		Perchloroethylene	500	
Hydrogen Peroxide	75		Phenol	100	
Hydrogen Sulfide	300		Phosgene	2	
Isoamyl Alcohol	8 000		Phosphine	200	
Isobutyl Alcohol	8 000		Phthalic Anhydride	10 000	
Isopropyl Alcohol	20 000		Propane	20 000	
LPG (liquified			Propyl Alcohol	4 000	
petroleum gas)	19 000		Propylene Oxide	2 000	
Malathion	5 000	mg/m^3	Pyridine	3 600	
Mercury	28	mg/m^3	Sodium Hydroxide	200	mg/m^3
Methyl Acetate	10 000		Styrene	5 000	
Methyl Acrylate	1 000		Sulfur Dioxide	100	
Methyl Alcohol	25 000		Sulfuric Acid	80	mg/m^3
Methyl Butyl Ketone	5 000		Terphenyls	3 500	mg/m^3
Methyl Chloride	10 000		Tetraethyl Lead	40	mg/m^3

Substance	IDLH (ppm, unless otherwise specified)	Substance	IDLH (ppm, unless otherwise specified)
Tetrahydrofuran	20 000	1,1,2-Trichloroethane	500
Toluene	2 000	Trichloroethylene	1 000
Toluene-2,4-diisocyanate	10	Turpentine	1 900
1,1,1-Trichloroethane	1 000	Xylene	10 000
		Zinc Chloride	2 000 mg/m^3

1.3.2 Fire.

Fire Extinguishing Agents

- Lists those agents reported in the literature as suitable, or indicates which agents are not suitable.

Behaviour in Fire

- Description of unusual behaviour or properties.

Ignition Temperature

- Is also equivalent to the autoignition temperature or the minimum temperature at which the substance will ignite without a spark or flame being present.

Burning Rate

- The rate (in millimetres per minute) at which the depth of a pool of liquid decreases as the substance burns.

Detonation Velocity

- Given for explosives only. It is the velocity at which the explosion shock wave propagates in the material (given in metres per second).

1.3.3 Reactivity.

With Water

- Description of reaction is given.

With Common Materials

- Other chemicals or groups of chemicals with which the substance reacts are given.
- The nature of the reaction (e.g., produces an explosion, causes fire, etc.) is not given.
- "Reacts violently with" implies a serious situation; however, the severity is not specified.
- Tertiary (three-chemical) reactions are sometimes specified and are presented with brackets and a plus sign (e.g., Acetone + Acetic Acid).

Stability

- "Stable" means that the substance will not react or decompose in a hazardous way under the temperature, pressure, contact and mechanical conditions normally encountered in storage or transportation.
- This category is not applicable to fire or accident situations.

1.3.4 Environment.

Water

- Provides descriptive information, aquatic toxicity data and BOD data.

LC_{50}

- "Lethal Concentration Fifty" or abbreviation for "Median Lethal Concentration".
- Is the concentration (in milligrams of substance per litre of water, which is approximately equivalent to ppm (parts per million)) in water at which 50% of the test population died during a specified time period.
- tns, is time period not specified.

LC_{100}

- "Lethal Concentration One Hundred".
- Is equivalent to the above except that 100% of the test population died; it is used in this manual to describe fish kill observations.

TL_m

- "Median Tolerance Limit".
- Is the concentration (mg/L) in water at which 50% of the test population will show abnormal behaviour (including death).
- IMO has provided a rating scheme as follows, which might be used as a guide to aquatic toxicity:

Rating	Description	TL_m (mg/L or ppm)
4	highly toxic	<1
3	moderately toxic	1 to 10
2	slightly toxic	10 to 100
1	practically non-toxic	100 to 1000
0	not hazardous	>1000

The following is a list of species which have been referred to in this manual:

Common Name	Latin Name
American shad	*Alosa sapidissima*
Aquatic plant	*Elodea canadensis*
Bluegill	*Lepomis macrochirus*
Blue-green algae	*Anabaena* sp.
Brine shrimp	*Artemia salina*
Brook trout	*Salvelinus fontinalis*
Brown shrimp	*Crangon crangon*
Catfish (american)	*Ameiurus nebulosus* (Le Sueur)
Channel catfish	*Ictalurus punctatus*
Chub	*Squalius cephalus* (L.)
Cockle	*Cerastoderma edule*
Cod	*Gadus morrhua*
Creek chub	*Semotilus atromaculatus*
Fathead minnow	*Pimephales promelas*
Goldfish	*Carassius auratus*
Grass shrimp	*Hippolyte zostericola*, *Palaemonetes pugio*
Green algae	*Chlorella vulgaris*, *Scenedesmus quadricauda*
Guppy	*Lebistes reticulatus*
Marine diatom	*Nitzschia linearis*
Minnow	*Phoxinus phoxinus*
Mosquito fish	*Gambusia affinis*
Perch (American, yellow)	*Perca fluviatilis flavescens* (Mitchill)
Pinfish (threespine stickleback)	*Gasterosteus aculeatus*
Prawn	*Metapenaeus monoceros*
Rainbow trout	*Salmo gairdneri*
Salmon (Atlantic)	*Salmo salar* (L.)
Stickleback (12-spined)	*Pygosteus pungitius* (L.)
Stickleback (threespine)	*Gasterosteus aculeatus*
Striped bass	*Morone saxatilis*
Sunfish (common)	*Lepomis humilis*
Water flea	*Daphnia magna*
Water shrimp	*Gammarus pulex*

Latin Name	Common name
Alosa sapidissima	American shad
Ameiurus nebulosus (Le Sueur)	Catfish (American)
Anabaena sp.	Blue-green algae
Artemia salina	Brine shrimp
Carassius auratus	Goldfish
Cerastoderma edule	Cockle
Chlorella vulgaris	Green algae
Crangon crangon	Brown shrimp
Daphnia magna	Water flea
Elodea canadensis	Aquatic plant
Gadus morrhua	Cod
Gambusia affinis	Mosquito fish
Gammarus pulex	Water shrimp
Gasterosteus aculeatus	Pinfish, threespine stickleback
Hippolyte zostericola	Grass shrimp
Ictalurus punctatus	Channel catfish
Lebistes reticulatus	Guppy
Lepomis humilis	Common sunfish
Lepomis macrochirus	Bluegill
Metapenaeus monoceros	Prawn
Morone saxatilis	Striped bass
Nitzschia linearis	Marine diatom
Palaemonetes pugio	Grass shrimp
Perca fluviatilis flavescens (Mitchill)	American yellow perch
Phoxinus phoxinus	Minnow
Pimephales promelas	Fathead minnow
Pygosteus pungitius (L.)	12-spined stickleback
Salmo gairdneri	Rainbow trout
Salmo salar (L.)	Atlantic salmon
Salvelinus fontinalis	Brook trout
Scenedesmus quadricauda	Green algae
Semotilus atromaculatus	Creek chub
Squalius cephalus (L.)	Chub

BOD

- "Biological Oxygen Demand" or sometimes "Biochemical Oxygen Demand".
- The quantity of oxygen dissolved in water which is consumed by biological oxidation of the chemical during a specified period of time.
- BOD_5 for example is the BOD in 5 days.
- It is given in this manual as percentage by weight (weight of oxygen versus the weight of the substance).
- ThOD or Theor. is the theoretical oxygen demand and is the percentage (by weight) of oxygen required to completely oxidize the spilled substance when viewed as a simple chemical reaction.

Land/Air

- Toxicity data relating to farm animals, fowl or other land species.

Food Chain Concentration Potential

- Description of bioaccumulation of the product.

1.4 Emergency Measures

1.4.1 Special Hazards.

- Summarizes immediate concerns.

1.4.2 Immediate Responses.

- Summarizes suggested "first" actions.

1.4.3 Protective Clothing and Equipment.

- Provides a summary of proper protective equipment, where this information is available.
- It should be noted that entry into a situation where the product and its concentration in air are both unknown must only be made with a totally encapsulated suit and a self-contained breathing apparatus (SCBA). Cartridge-type respirators are not to be worn in any situation where the concentrations are unknown or unpredictable.

1.4.4 Fire and Explosion.

- Summarizes fire-fighting information.

1.4.5 First Aid.

- Summarizes literature recommendations for first aid.

1.5 Environmental Protection Measures

1.5.1 Response.

- Summarizes actions which can be taken to minimize environmental damage.

1.5.2 Disposal.

- Brief recommendations for source of information, or procedures for disposal where this is possible without serious environmental consequences.

2 INDEX OF ENTRIES

Each main entry appears in this index in **CAPITALIZED, BOLD FACED TYPE.** Common synonyms and trade names are also included (in upper and lower case lettering) and are each followed by the name under which they appear in the text.

Adipinic Acid (Adipic Acid)
Aerothene (1,1,1-Trichloroethane)
Agricultural Lime (Calcium Hydroxide)
Agricultural Limestone (Calcium Carbonate)
Agrothion (Fenitrothion)
Alcohol (Ethyl Alcohol)
Alcohol, Dehydrated (Ethyl Alcohol)
Aldehyde (Acetaldehyde)
Allyl Aldehyde (Acrolein)
Alum (Aluminum Sulfate)
Aluminatrihydrate (Aluminum Hydroxide)
ALUMINUM ALKYL COMPOUNDS
ALUMINUM CHLORIDE
Aluminum Chloride, Anhydrous (Aluminum Chloride)
Aluminum Hydrate (Aluminum Hydroxide)
ALUMINUM HYDROXIDE
Aluminum Hydroxide Gel (Aluminum Hydroxide)
Aluminum Sodium Fluoride (Cryolite)
ALUMINUM SULFATE
Aminobenzene (Aniline)
Aminocaproic Lactam (Caprolactam)
AMINOCARB
2-Aminoethanol (Ethanolamine)
β-Aminoethyl Alcohol (Ethanolamine)
Aminomethane (Methylamines)
Aminotriacetic Acid (Nitrilotriacetic Acid)
Amkil (MCPA)
AMMONIA (Anhydrous)
Ammonia Liquor (Ammonium Hydroxide)
Ammonia Solution (Ammonium Hydroxide)
AMMONIUM SULFATE
Ammonia Water (Ammonium Hydroxide)
Ammonium Acid Phosphate (Ammonium Phosphates, Monobasic)
Ammonium Biphosphate (Ammonium Phosphates, Monobasic)

AMMONIUM CHLORIDE

Ammonium Dihydrogen Phosphate (Ammonium Phosphates, Monobasic)

Ammonium Hydrate (Ammonium Hydroxide)

Ammonium Hydrogen Phosphate (Ammonium Phosphates, Monobasic)

AMMONIUM HYDROXIDE

Ammonium Muriate (Ammonium Chloride)

AMMONIUM NITRATE

AMMONIUM PHOSPHATES

Ammonium Phosphate, Dibasic (Ammonium Phosphates)

Ammonium Phosphate, Monobasic (Ammonium Phosphates)

Ammonium Phosphate, Primary (Ammonium Phosphates, Monobasic)

Ammonium Phosphate, Secondary (Ammonium Phosphates, Dibasic)

Amorphous Phosphorus (Phosphorus, Red)

AMYL ACETATE

Amylacetic Ester (Amyl Acetate)

ANILINE

Aniline Oil (Aniline)

Anilinobenzene (Diphenyl Amine)

Ant and Grub Killer (Chlordane)

Ant Oil (Furfural)

Antifreeze (Ethylene Glycol)

Antiknock (Methylcyclopentadienyl Manganese Tricarbonyl)

Aqua Ammonia (Ammonium Hydroxide)

Arconitrile Butadiene Rubber (Latex)

ARSENIC

Arsenic Hydride (Arsine)

Arsenic Sequioxide (Arsenic Trioxide)

Arsenic Trihydride (Arsine)

ARSENIC TRIOXIDE

Arsenious Oxide (Arsenic Trioxide)

Arseniuretted Hydrogen (Arsine)

Arsenous Anhydride (Arsenic Trioxide)

Arsenous Hydride (Arsine)

ARSINE

ASPHALT
Automotive Fuel (Gasoline)
Aviation Gasoline (Oils, Fuel - Aviation)
AV-gas (Gasoline)
Azacyclopropane (Ethyleneimine)
Aziridine (Ethyleneimine)

B

Banana Oil (Amyl Acetate)
Banex (Dicamba)
Banlen (Dicamba)
Barite (Barium Sulfate)
BARIUM CARBONATE
BARIUM SULFATE
Barytes (Barium Sulfate)
Basofor (Barium Sulfate)
Battery Acid (Sulfuric Acid)
Benzenamine (Aniline)
BENZENE
Benzene Chloride (Chlorobenzene)
Benzenecarboxylic Acid (Benzoic Acid)
1,4-Benzenedicarboxyl Acid (Terephthalic Acid)
p-Benzenedicarboxylic Acid (Terephthalic Acid)
1,4-Benzenedicarboxylic Acid, Dimethyl Ester (Dimethyl Terephthalate)
Benzene-Diphenyl (Terphenyls)
Benzin (Benzene)
Benzine (Naphtha Solvent)
Benzinoform (Carbon Tetrachloride)
BENZOIC ACID
Benzol (Benzene)
Bicalcium Phosphate (Calcium Phosphate, Dibasic)
Biethylene (1,3-Butadiene)
BISPHENOL A
Bitumen (Asphalt)
Bivinyl (1,3-Butadiene)

Blanc Fixe (Barium Sulfate)
Blasting Oil (Nitroglycerine)
Bleaching Powder (Calcium Hypochlorite, Hydrate)
Bluestone (Copper Sulfate)
Blue Vitriol (Copper Sulfate)
Bone Ash (Calcium Phosphate, Tribasic)
Boracic Acid (Boric Acid)
BORAX
BORIC ACID
Bran Oil (Furfural)
Brimstone (Sulfur)
Brush Killer (2,4-D)
Bunker A (Oils, Fuel - Residuals)
Bunker B (Oils, Fuel - Residuals)
Bunker C (Oils, Fuel - Residuals)
Bunker Fuel Oil (Oils, Fuel - Residuals)
Burnt Lime (Calcium Oxide)
1,3-BUTADIENE
n-Butanal (Butyraldehyde)
BUTANE
n-Butane (Butane)
1,4-Butanedicarboxylic Acid (Adipic Acid)
1-Butanol (Butyl Alcohol)
2-Butanol (Butyl Alcohol)
2-Butanone (Methyl Ethyl Ketone)
1-Butene (Butylene)
cis-2-Butene (Butylene)
trans-2-Butene (Butylene)
cis-Butenedioic Anhydride (Maleic Anhydride)
Butter of Zinc, Granular (Zinc Chloride)
BUTYL ALCOHOL
n-Butyl Alcohol (Butyl Alcohol)
s-Butyl Alcohol (Butyl Alcohol)
t-Butyl Alcohol (Butyl Alcohol)
2-sec-Butyl-4,6-Dinitrophenol (Dinoseb)

BUTYLENE

α-Butylene (Butylene)

Butyl Hydride (Butane)

BUTYRALDEHYDE

n-Butyraldehyde (Butyraldehyde)

Butyric Aldehyde (Butyraldehyde)

C

Cake Alum (Aluminum Sulfate)

Calcium Acetylide (Calcium Carbide)

Calcium Biphosphate (Calcium Phosphate, Monobasic)

CALCIUM CARBIDE

CALCIUM CARBONATE

CALCIUM CHLORIDE

Calcium Chloride, Anhydrous (Calcium Chloride)

Calcium Chloride Dihydrate (Calcium Chloride)

Calcium Chloride Hexahydrate (Calcium Chloride)

Calcium Chloride Monohydrate (Calcium Chloride)

CALCIUM CYANIDE

Calcium Hydrate (Calcium Hydroxide)

CALCIUM HYDROXIDE

CALDIUM HYPOCHLORITE

Calcium Orthophosphate (Calcium Phosphate, Tribasic)

CALCIUM OXIDE

Calcium Oxychloride (Calcium Hypochlorite, Anhydrous)

CALCIUM PHOSPHATE

Calcium Phosphate, primary (Calcium Phosphate, Monobasic)

Calmathion (Malathion)

Calx (Calcium Oxide)

CAPROLACTAM

Carbamide (Urea)

CARBARYL

Carbide (Calcium Carbide)

Carbinamine (Methylamines, Monomethylamine)

Carbinol (Methanol)

CARBOFURAN
Carbolic Acid (Phenol)
Carbon Bichloride (Perchloroethylene)
Carbon Bisulfide (Carbon Disulfide)
CARBON DIOXIDE
CARBON DISULFIDE
Carbonic Acid Gas (Carbon Dioxide)
Carbonic Anhydride (Carbon Dioxide)
Carbonic Dichloride (Phosgene)
CARBON MONOXIDE
Carbon Oxychloride (Phosgene)
Carbon Tet (Carbon Tetrachloride)
CARBON TETRACHLORIDE
Carbonyl Chloride (Phosgene)
Carbonyldiamide (Urea)
Carboxybenzene (Benzoic Acid)
N,N-bis (Carboxymethylglysine) (Nitrilotriacetic Acid)
Caustic (Sodium Hydroxide)
Caustic Lime (Calcium Hydroxide)
Caustic Soda (Sodium Hydroxide)
Celthion (Malathion)
Chalk (Calcium Carbonate)
Chile Saltpeter (Sodium Nitrate)
Chinese White (Zinc Oxide)
CHLORDANE
Chloride of Lime (Calcium Hypochlorite, Hydrate)
Chloride of Phosphorus (Phosphorus Trichloride)
CHLORINE
1-Chloro-2,3-Epoxypropane (Epichlorohydrin)
3-Chloro-1,2-Propylene Oxide (Epichlorohydrin)
CHLOROBENZENE
Chlorobenzol (Chlorobenzene)
Chlorodifluoromethane (Fluorochloromethanes, Freon 22)
Chloroethane (Ethyl Chloride)
Chloroethene (Vinyl Chloride)

Chloroethylene (Vinyl Chloride)
CHLOROFORM
Chloroformyl Chloride (Phosgene)
Chlorohydric Acid (Hydrochloric Acid)
Chloromethane (Methyl Chloride)
Chloromethyloxirane (Epichlorohydrin)
Chloropropylene Oxide (Epichlorohydrin)
CHLOROSULFONIC ACID
Chlorothene (1,1,1-Trichloroethane)
Chlorotrifluoromethane (Fluorochloromethanes, Freon 13)
Chlorox (Sodium Hypochlorite)
Chlorsulfonic Acid (Chlorosulfonic Acid)
Chlorsulfuric Acid (Chlorosulfonic Acid)
Chromic Acid (Chromic Anhydride)
Chromic Acid, Solid (Chromic Anhydride)
CHROMIC ANHYDRIDE
Chromium Oxide (Chromic Anhydride)
Chromium VI Oxide (Chromic Anhydride)
Chromium Trioxide (Chromic Anhydride)
Cinnamene (Styrene Monomer)
Coal Naphtha (Benzene)
Coal Oil (Kerosene)
COBALT
Cobalt Metal (Nonradioactive) (Cobalt)
Colamine (Ethanolamine)
COPPER
COPPER CHLORIDE
Copper II Chloride (Copper Chloride)
Copper Metal (Copper)
COPPER NAPHTHENATE
COPPER SULFATE
Copper Sulfate Pentahydrate (Copper Sulfate)
Copper 2 Sulfate Pentahydrate (Copper Sulfate)
Copper Uversol (Copper Naphthenate)

CRESOL

2-Cresol (Cresol)

3-Cresol (Cresol)

4-Cresol (Cresol)

m-Cresol (Cresol)

o-Cresol (Cresol)

p-Cresol (Cresol)

Cresylic Acid (Cresol)

Crude Arsenic (Arsenic Trioxide)

CRYOLITE

CUMENE

CUMENE HYDROPEROXIDE

Cumol (Cumene)

Cumyl Hydroperoxide (Cumene Hydroperoxide)

Cuprenol (Copper Naphthenate)

Cupric Chloride (Copper Chloride)

Cupric Cyanide (Cyanides)

Cupricin (Cyanides)

Cupric Sulfate (Copper Sulfate)

Cuprous Cyanide (Cyanides)

Curaterr (Carbofuran)

Cyanide of Calcium (Calcium Cyanide)

CYANIDES (COPPER, POTASSIUM, ZINC)

Cyanoethylene (Acrylonitrile)

Cyanogas (Calcium Cyanide)

Cyanomethane (Acetonitrile)

CYCLOHEXANE

Cythion (Malathion)

D

2,4-D

Dandelion Killer (2,4-D)

Danex (Trichlorfon)

DCB (1,2-Dichlorobenzene)

DEAC (Aluminum Alkyl Compounds)

DEAI (Aluminum Alkyl Compounds)
Denatured Alcohol (Ethyl Alcohol)
DEZ (Aluminum Alkyl Compounds)
DFA (Diphenyl Amine)
1,2-Diaminoethane (Ethylenediamine)
Diammonium Hydrogen Phosphate (Ammonium Phosphates, Dibasic)
Diammonium Sulfate (Ammonium Sulfate)
DIBAC (Aluminum Alkyl Compounds)
DIBAH (Aluminum Alkyl Compounds)
Dibasic Calcium Phosphate (Calcium Phosphate)
1,2-Dibromoethane (Ethylene Dibromide)
Dicalcium Orthophosphate (Calcium Phosphate, Dibasic)
DICAMBA
1,2-DICHLOROBENZENE
o-Dichlorobenzene (1,2-Dichlorobenzene)
Dichlorodifluoromethane (Fluorochloromethanes, Freon 12)
1,2 Dichloroethane (Ethylene Dichloride)
Dichlorofluoromethane (Fluorochloromethanes, Freon 21)
Dichloromethane (Methylene Chloride)
2,4-Dichlorophenoxyacetic Acid (2,4-D)
Diesel Oil Light (Oils, Fuel - Distillates)
Diesel Oil Medium (Oils, Fuel - Distillates)
Diethylaluminum Chloride (Aluminum Alkyl Compounds)
Diethylaluminum Iodide (Aluminum Alkyl Compounds)
Diethylenimide Oxide (Morpholine)
Diethylmercapto Succinate S-Ester with o,o-Dimethyl Phosphorodithionate (Malathion)
Diethylzinc (Aluminum Alkyl Compounds)
Dihydroazirine (Ethyleneimine)
Diisobutylaluminum Chloride (Aluminum Alkyl Compounds)
Diisobutylaluminum Hydride (Aluminum Alkyl Compounds)
Dimethylamine (Methylamines)
4-Dimethylamino-3-Methylphenol Methylcarbamate (Aminocarb)
4-Dimethylamino-M-Tolyl Methylcarbamate (Aminocarb)
1,2-Dimethylbenzene (Xylenes)
1,3-Dimethylbenzene (Xylenes)

1,4-Dimethylbenzene (Xylenes)

Dimethyl 1,4-Benzenedicarboxylate (Dimethyl Terephthalate)

α,α-Dimethylbenzyl Hydroperoxide (Cumene Hydroperoxide)

Dimethylcarbinol (Isopropyl Alcohol)

Dimethylene Oxide (Ethylene Oxide)

Dimethylenimine (Ethyleneimine)

DIMETHYL ETHER

Dimethylketone (Acetone)

Dimethylphthalate (Dimethyl Terephthalate)

DIMETHYL TEREPHTHALATE

Dinocap (Dinoseb)

DINOSEB

DIPHENYL AMINE

Diphenylbenzene (Terphenyls)

DIPHENYLMETHANE-4,4'-DIISOCYANATE

Diphenylmethane Diisocyanate (Diphenylmethane-4,4'-Diisocyanate)

Dipping Acid (Sulfuric Acid)

Disodium Hydrogen Phosphate (Sodium Phosphate, Dibasic)

Disodium Monohydrogen Phosphate (Sodium Phosphate, Dibasic)

Disodium Phosphate (Sodium Phosphate, Dibasic)

Disodium Sulfate (Sodium Sulfate)

Disulphuric Acid (Oleum)

Dithionic Acid (Oleum)

Divinyl (1,3-Butadiene)

DMP (Dimethyl Terephthalate)

DMT (Dimethyl Terephthalate)

Dowicide 7 (Pentachlorophenol)

Dowicide-G (Sodium Pentachlorophenate)

Dowtherm-E (1,2-Dichlorobenzene)

DPA (Diphenyl Amine)

Dry Cleaners Naphtha (Naphtha Solvent)

Dry Cleaning Fluid (Perchloroethylene)

Dry Ice (Carbon Dioxide)

DSP (Sodium Phosphate, Dibasic)

Dutch Oil or Liquid (Ethylene Dichloride)
Dutox (Trichlorfon)
Dyanap (Dinoseb)
Dylox (Trichlorfon)
Dytop (Dinoseb)

E

E14049 (Malathion)
EADC (Aluminum Alkyl Compounds)
EASC Aluminum Alkyl Compounds)
EB (Ethylbenzene)
ECH (Epichlorohydrin)
EDB (Ethylene Dibromide)
Elemental Arsenic (Arsenic)
Elgetol (Dinoseb)
Emmaton (Malathion)
EPI (Epichlorohydrin)
Epichlorhydrin (Epichlorohydrin)
EPICHLOROHYDRIN
1,2-Epoxyethane (Ethylene Oxide)
Epsilon-Caprolactam (Caprolactam)
Estakil (2,4-D)
Estemine (2,4-D)
Ethanal (Acetaldehyde)
1,2-Ethanediamine (Ethylenediamine)
1,2-Ethanediol (Ethylene Glycol)
Ethanenitrile (Acetonitrile)
Ethanoic Acid (Acetic Acid)
Ethanoic Anhydride (Acetic Anhydride)
Ethanol (Ethyl Alcohol)
ETHANOLAMINE
Ethene (Ethylene)
Ethenylbenzene (Styrene Monomer)
Ethine (Acetylene)
ETHYL ACETATE
ETHYL ACRYLATE

ETHYL ALCOHOL

Ethyl Aldehyde (Acetaldehyde)

Ethylaluminum Dichloride (Aluminum Alkyl Compounds)

Ethylaluminum Sesquichloride (Aluminum Alkyl Compounds)

ETHYL BENZENE

Ethyl Benzol (Ethylbenzene)

ETHYL CHLORIDE

ETHYLENE

Ethylene Bromide (Ethylene Dibromide)

Ethylene Chloride (Ethylene Dichloride)

ETHYLENEDIAMINE

ETHYLENE DIBROMIDE

ETHYLENE DICHLORIDE

Ethylene Dihydrate (Ethylene Glycol)

ETHYLENE GLYCOL

ETHYLENEIMINE

Ethyleneimine (Inhibited) (Ethyleneimine)

ETHYLENE OXIDE

Ethylene Tetrachloride (Perchloroethylene)

Ethyl Ethanoate (Ethyl Acetate)

Ethylethylene (Butylene)

2-ETHYLHEXANOL

2-Ethylhexyl Alcohol (2-Ethylhexanol)

2-Ethyl-1-Hexanol (2-Ethylhexanol)

Ethyl Hydrate (Ethyl Alcohol)

Ethyl Methyl Ketone (Methyl Ethyl Ketone)

Ethyl MMT (Methylcyclopentadienyl Manganese Tricarbonyl)

Ethyl Nitrile (Acetonitrile)

Ethylolamine (Ethanolamine)

Ethyl-2-Propenoate (Ethyl Acrylate)

Ethyne (Acetylene)

F

Far-Go (Triallate)

FENITROTHION

FERRIC CHLORIDE
Ferric Perchloride (Ferric Chloride)
Ferric Trichloride (Ferric Chloride)
Fertilizer Acid (Sulfuric Acid)
Filter Alum (Aluminum Sulfate)
Flea and Tick Spray (Malathion)
Flowers of Sulfur (Sulfur)
Fluohydric Acid (Hydrofluoric Acid)
FLUORINE
FLUOROCHLOROMETHANES
FLUOSILICIC ACID
Fluxing Lime (Calcium Oxide)
Fly Killer (Trichlorfon)
FORMALDEHYDE
Formaldehyde Solution (Formaldehyde)
Formalin (Formaldehyde)
Formalith (Formaldehyde)
FORMIC ACID
Formic Aldehyde (Formaldehyde)
Freon 11, 12, 13, 21, 22 (Fluorochloromethanes)
Fuel Oil No. 1 (Kerosene) (Oils, Fuel - Distillates)
Fuel Oil No. 2 (Oils, Fuel - Distillates)
Fuel Oil No. 2-D (Oils, Fuel - Distillates)
Fuming Sulfuric Acid (Oleum)
Furadan (Carbofuran)
Fural (Furfural)
2-Furaldehyde (Furfural)
2-Furan Carbonal (Furfural)
2,5-Furandione (Maleic Anhydride)
FURFURAL
Furfuraldehyde (Furfural)

G

Gas (Natural Gas)

GASOLINE
German Saltpeter (Ammonium Nitrate)
Glacial Acetic Acid (Acetic Acid)
Glauber's Salt (Sodium Sulfate)
GLYCERINE
Glycerol (Glycerine)
Glycerol, Nitric Acid Triester (Nitroglycerine)
Glyceryl Trinitrate (Nitroglycerine)
Glycinol (Ethanolamine)
Glycyl Alcohol (Glycerine)
Grain Alcohol (Ethyl Alcohol)
Granular Powder Zinc (Zinc)
Greenland Spar (Cryolite)
Grey Arsenic (Arsenic)
Grubex (Trichlorfon)
Gum Turpentine (Turpentine)
Gumthus (Turpentine)

H

1-Heptadecacarboxylic Acid (Stearic Acid)
Hexafluorosilicic Acid (Fluosilicic Acid)
Hexahydrobenzene (Cyclohexane)
Hexahydro-2H-Azepine-2-One (Caprolactam)
Hexamethylene (Cyclohexane)
Hexanaphthene (Cyclohexane)
n-HEXANE
Hexane (n-Hexane)
Hexanedioic Acid (Adipic Acid)
Home Heating Oil (Oils, Fuel - Distillates)
Hydrargyrum (Mercury)
Hydrated Alumina (Aluminum Hydroxide)
HYDRAZINE
HYDROCHLORIC ACID
Hydrochloric Acid, Anhydrous (Hydrogen Chloride)
Hydrochloric Ether (Ethyl Chloride)

HYDROFLUORIC ACID
Hydrofluoric Acid, Anhydrous (Hydrogen Fluoride)
Hydrofluosilicic Acid (Fluosilicic Acid)
Hydrofol Acid (Stearic Acid)
HYDROGEN
HYDROGEN CHLORIDE
Hydrogen Chloride, Aqueous (Hydrochloric Acid)
Hydrogen Dioxide (Hydrogen Peroxide)
HYDROGEN FLUORIDE
Hydrogen Fluoride, Aqueous (Hydrofluoric Acid)
HYDROGEN PEROXIDE
HYDROGEN SULFIDE
Hydrogen Sulphate (Sulfuric Acid)
Hydrogen Sulphide (Hydrogen Sulfide)
Hydroperoxide (Hydrogen Peroxide)
Hydrosilicofluoric Acid (Fluosilicic Acid)
Hydroxybenzene (Phenol)
1-Hydroxybutane (Butyl Alcohol)
Hydroxymethylbenzene (Cresol)
2,2-bis (Hydroxymethyl)-1,3-Propanediol (Pentaerythritol)
2,2-bis (4-Hydroxyphenyl) Propane (Bisphenol A)
Hydroxytoluene (Cresol)

I

Icetone (Cryolite)
Illuminating Oil (Kerosene)
Iron Chloride (Ferric Chloride)
Iron (III) Chloride (Ferric Chloride)
Iron Perchloride (Ferric Chloride)
Iron Trichloride (Ferric Chloride)
Isobutyl Methyl Ketone (Methyl Isobutyl Ketone)
Isopropanol (Isopropyl Alcohol)
ISOPROPYL ALCOHOL
Isopropylbenzene (Cumene)
Isopropylbenzene Hydroperoxide (Cumene Hydroperoxide)

4,4'-Isopropylidenediphenol (Bisphenol A)
p,p'-Isopropylidenediphenol (Bisphenol A)

J

Jet A (Oils, Fuel - Aviation)
Jet A-1 (Oils, Fuel - Aviation)
Jet B (Oils, Fuel - Aviation)
Jet C (Oils, Fuel - Aviation)
Jet Fuel: JP-1 (Kerosene)
JP-4 (Oils, Fuel - Aviation)
JP-5 (Oils, Fuel - Aviation)
JP-6 (Oils, Fuel - Aviation)

K

Kansel (Dicamba)
Karbophos (Malathion)
KEROSENE
Kerosene (Oils, Fuel - Distillates)
Kerosine (Kerosene)
2-Ketohexamethylenimine (Cryolite)
Killex (2,4-D)
Killex (Dicamba)
Kiloseb (Dinoseb)
Kil-Mor (2,4-D)
Kryolith (Cryolite)

L

LATEX
Latex, Liquid Synthetic (Latex)
Lawn Weed Killer (Dicamba)
LEAD ACETATE
Lead Acetate Trihydrate (Lead Acetate)
LEAD CHROMATE
Lead Monoxide (Lead Oxides, Yellow)
LEAD NITRATE
LEAD OXIDES

Lead Oxide, Black (Lead Oxides)
Lead Oxide, Red (Lead Oxides)
Lead Oxide, Yellow (Lead Oxides)
Lead Tetroxide (Lead Oxides, Red)
Light Naphtha (Naphtha Solvent)
Lime (Calcium Hydroxide)
Lime Chloride (Calcium Hypochlorite, Hydrate)
Lime Hydrate (Calcium Hydroxide)
Liquid Alum (Aluminum Sulfate, Tetradecahydrate)
Liquid Bleach (Sodium Hypochlorite)
Liquid Oxygen (Oxygen)
Litharge, Leaded (Lead Oxides, Black)
LNG (Natural Gas)
LOX (Oxygen)
LPG (Butane)
LPG (Butylene)
Lye (Sodium Hydroxide)

M

Magnesium Hydrate (Magnesium Hydroxide)
MAGNESIUM HYDROXIDE
Magnesium Magna (Magnesium Hydroxide)
Malaspray (Malathion)
MALATHION
Malathiozol (Malathion)
Maleic Acid, Anhydride (Maleic Anhydride)
MALEIC ANHYDRIDE
Marble (Calcium Carbonate)
Marsh Gas (Methane)
MASC (Aluminum Alkyl Compounds)
Matacil (Aminocarb)
MCB (Chlorobenzene)
MCPA
MCPA Amine (MCPA)
MDBA (Dicamba)

MDI (Diphenylmethane-4,4'-Diisocyanate)

MEA (Ethanolamine)

Mediben (Dicamba)

MEK (Methyl Ethyl Ketone)

Mercaptomethane (Methyl Mercaptan)

MERCURY

Meta-Cresol (Cresol)

Metallic Arsenic (Arsenic)

Metathion (Fenitrothion)

Methacrylate Monomer (Methyl Methacrylate)

Methacrylic Acid, Methyl Ester (Methyl Methacrylate)

Methanal (Formaldehyde)

Methanamine (Methylamines)

METHANE

Methane Carboxylic Acid (Acetic Acid)

Methane Dichloride (Methylene Chloride)

Methanethiol (Methyl Mercaptan)

METHANOL

Methenyl Trichloride (Chloroform)

METHYL ACRYLATE

Methyl Alcohol (Methanol)

Methylaluminum Sesquichloride (Aluminum Alkyl Compounds)

METHYLAMINES

Methylbenzene (Toluene)

Methylbenzol (Toluene)

METHYL CHLORIDE

Methylchloroform (1,1,1-Trichloroethane)

Methyl Cyanide (Acetonitrile)

METHYLCYCLOPENTADIENYL MANGANESE TRICARBONYL

Methylcyclopentadienylmanganesetricarbonyl
(Methylcyclopentadienyl Manganese Tricarbonyl)

METHYLENE CHLORIDE

Methylene Oxide (Formaldehyde)

Methylenedichloride (Methylene Chloride)

Methylene-bis (Phenyl Isocyanate) (Diphenylmethane-4,4'-Diisocyanate)

Methylene-Diparaphenylene Isocyanate (Diphenylmethane-4,4'-Diisocyanate)
Methyl Ether (Dimethyl Ether)
Methylethylcarbinol (Butyl Alcohol)
METHYL ETHYL KETONE
Methyl Hydride (Methane)
Methyl Hydroxide (Methanol)
METHYL ISOBUTYL KETONE
Methyl Ketone (Acetone)
METHYL MERCAPTAN
METHYL METHACRYLATE
Methyl-α-Methacrylate (Methyl Methacrylate)
Methyl 2-Methyl-2-Propenoate (Methyl Methacrylate)
Methyl Oxide (Dimethyl Ether)
2-Methyl-4-Pentanone (Methyl Isobutyl Ketone)
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone)
Methyl Phenol (Cresol)
2-Methyl-2-Propanol (Butyl Alcohol)
Methyl Propenate (Methyl Acrylate)
Methyl-2-Propenoate (Methyl Acrylate)
Methyltrinitrobenzene (Trinitrotoluene)
MIBK (Methyl Isobutyl Ketone)
Milk of Magnesia (Magnesium Hydroxide)
Minium (Lead Oxides, Red)
MME (Methyl Methacrylate)
MMT (Methylcyclopentadienyl Manganese Tricarbonyl)
Monocalcium Phosphate (Calcium Phosphate, Monobasic)
Monochlorobenzene (Chlorobenzene)
Monochloroethane (Ethyl Chloride)
Monochloromethane (Methyl Chloride)
Monoethanolamine (Ethanolamine)
Monoethylene Glycol (Ethylene Glycol)
Monomethylamine (Methylamines)
Mono PE, (Pentaerythritol)
Monosodium Dihydrogen Phosphate (Sodium Phosphate, Monobasic)
Monosodium Phosphate (Sodium Phosphate, Monobasic)

Monoxide (Carbon Monoxide)

MORPHOLINE

Moth Balls (Naphthalene)

Moth Flakes (Naphthalene)

Motor Fuel Antiknock Compound (Tetraethyl Lead)

MSP (Sodium Phosphate, Monobasic)

Muriatic Acid (Hydrochloric Acid)

N

NAPHTHALENE

Naphthalin (Naphthalene)

NAPHTHA SOLVENT

Naphthenic Acid, Copper Salt (Copper Naphthenate)

NATURAL GAS

Natural Gas (Methane)

Natural Rubber Latex (Latex)

Necatorina (Carbon Tetrachloride)

NG (Nitroglycerine)

Nitram (Ammonium Nitrate)

Nitratine (Sodium Nitrate)

NITRIC ACID

Nitric Acid, Lead II Salt (Lead Nitrate)

Nitric Acid Triester (Nitroglycerine)

NITRILOTRIACETIC ACID

NITROGLYCERINE

Nitroglycerol (Nitroglycerine)

Nitrol (Nitroglycerine)

Nitrophos (Fenitrothion)

NONYL PHENOL

Nonylphenol (Nonyl Phenol)

o-Nonyl Phenol (Nonyl Phenol)

p-Nonyl Phenol (Nonyl Phenol)

Norway Saltpeter (Ammonium Nitrate)

NTA (Nitrilotriacetic Acid)

O

Octachlor (Chlordane)
Octadecanoic Acid (Stearic Acid)
n-Octadecylic Acid (Stearic Acid)
OILS, CRUDE
OILS, FUEL (Aviation)
OILS, FUEL (Distillates)
OILS, FUEL (Residuals)
Olefiant Gas (Ethylene)
OLEUM
Orthoboric Acid (Boric Acid)
Ortho-Cresol (Cresol)
Ortho-Dichlorobenzene (1,2-Dichlorobenzene)
Ortho-Klor (Chlordane)
Orthophosphoric Acid (Phosphoric Acid)
Oxane (Ethylene Oxide)
Oxirane (Ethylene Oxide)
Oxomethane (Formaldehyde)
OXYGEN

P

Paper Maker's Alum (Aluminum Sulfate)
Para-Cresol (Cresol)
Patent Alum (Aluminum Sulfate)
PCP (Pentachlorophenol)
PE (Pentaerythritol)
Pear Oil (Amyl Acetate)
Pearl Alum (Aluminum Sulfate)
Pebble Lime (Calcium Oxide)
Penchlorol (Pentachlorophenol)
Penta (Pentachlorophenol)
PENTACHLOROPHENOL
Pentachlorophenol, Sodium Salt (Sodium Pentachlorophenate)
Pentaerythrite (Pentaerythritol)

PENTAERYTHRITOL

Pentek (Pentaerythritol)

Pentyl Acetate (Amyl Acetate)

"Per" (Perchloroethylene)

PERCHLOROETHYLENE

Perchloromethane (Carbon Tetrachloride)

Permatox (Pentachlorophenol)

Peroxide (Hydrogen Peroxide)

Petrol (Gasoline)

Petroleum Asphalt (Asphalt)

Petroleum Ether (Naphtha Solvent)

Petroleum Solvent (Naphtha Solvent)

Petroleum Spirits (Naphtha Solvent)

Phenic Acid (Phenol)

PHENOL

Phenyl Chloride (Chlorobenzene)

Phenyl Hydroxide (Phenol)

Phenylamine (Aniline)

N-Phenylaniline (Diphenyl Amine)

Phenylcarboxylic Acid (Benzoic Acid)

Phenylethane (Ethylbenzene)

Phenylethylene (Styrene Monomer)

Phenylformic Acid (Benzoic Acid)

Phenylhydride (Benzene)

Phenylic Acid (Phenol)

Phenylmethane (Toluene)

2-Phenylpropane (Cumene)

PHOSGENE

Phosphate of Soda (Sodium Phosphate, Dibasic)

PHOSPHORIC ACID

Phosphoric Sulphide (Phosphorus Pentasulfide)

Phosphorus Chloride (Phosphorus Trichloride)

PHOSPHORUS PENTASULFIDE

Phosphorus Persulfide (Phosphorus Pentasulfide)

PHOSPHORUS, RED
Phosphorus Sulphide (Phosphorus Pentasulfide)
PHOSPHORUS TRICHLORIDE
PHOSPHORUS, WHITE
p-Phthalic Acid (Terephthalic Acid)
PHTHALIC ANHYDRIDE
Pickle Alum (Aluminum Sulfate)
Plastic Latex (Latex)
Plumboplumic Oxide (Lead Oxides, Red)
Plumbous Acetate (Lead Acetate)
Plumbous Oxide (Lead Oxides, Yellow)
POLYCHLORINATED BIPHENYLS (PCBs)
POTASH (POTASSIUM CHLORIDE)
POTASSIUM CARBONATE
POTASSIUM HYDROXIDE
POTASSIUM SULFATE
Potato Top Killer (Dinoseb)
Precipitated Calcium Phosphate (Calcium Phosphate, Tribasic)
Premerge (Dinoseb)
PROPANE
1,2,3-Propanetriol (Glycerine)
1,2,3-Propanetriol Trinitrate (Nitroglycerine)
2-Propanol (Isopropyl Alcohol)
2-Propanone (Acetone)
2-Propenal (Acrolein)
2-Propenenitrile (Acrylonitrile)
2-Propenoic Ethyl Ester (Ethyl Acrylate)
Propenoic Acid, Methyl Ester (Methyl Acrylate)
sec-Propyl Alcohol (Isopropyl Alcohol)
PROPYLENE
PROPYLENE GLYCOL
PROPYLENE OXIDE
Pyromucic Aldehyde (Furfural)

Q

Quicklime (Calcium Oxide)
Quicksilver (Mercury)

R

Range Oil (Kerosene)
Red Fuming Nitric Acid (Nitric Acid)
Red Lead (Lead Oxides, Red)
Residual Fuel Oil No. 4 (Oils, Fuel - Residuals)
Residual Fuel Oil No. 5 (Oils, Fuel - Residuals)
Residual Fuel Oil No. 6 (Oils, Fuel - Residuals)
RFNA (Nitric Acid)
Rhomene (MCPA)
Roman Vitriol (Copper Sulfate)
Rubbing Alcohol (Isopropyl Alcohol)

S

Sal Ammoniac (Ammonium Chloride)
Salt Cake (Sodium Sulfate)
Sand Acid (Fluosilicic Acid)
Santophen 20 (Pentachlorophenol)
Secondary Calcium Phosphate (Calcium Phosphate, Dibasic)
Secondary Sodium Phosphate (Sodium Phosphate, Dibasic)
Sewage Gas (Methane)
Silicate of Soda (Sodium Silicate)
Silicofluoric Acid (Fluosilicic Acid)
Sinox (Dinoseb)
Slaked Lime (Calcium Hydroxide)
Soda Lye (Sodium Hydroxide)
Soda Niter (Sodium Nitrate)
SODIUM
Sodium Acid Chromate (Sodium Dichromate)
Sodium Acid Phosphate (Sodium Phosphate, Monobasic)

SODIUM ALUMINATE
SODIUM ARSENITE
Sodium Aluminum Fluoride (Cryolite)
Sodium Bichromate (Sodium Dichromate)
Sodium Bichromate Dihydrate (Sodium Dichromate)
Sodium Biphosphate (Sodium Phosphate, Monobasic)
Sodium Bisulfide (Sodium Hydrosulfide)
Sodium Bisulfite (Sodium Dithionite)
Sodium Borate, Decahydrate (Borax)
SODIUM BOROHYDRIDE
SODIUM CARBONATE
SODIUM CHLORATE
SODIUM CHLORIDE
SODIUM CYANIDE
SODIUM DICHLOROISOCYANURATE
SODIUM DICHROMATE
SODIUM DITHIONITE
Sodium Fluoaluminate (Cryolite)
Sodium Hydrate (Sodium Hydroxide)
Sodium Hydrogen Sulfide (Sodium Hydrosulfide)
SODIUM HYDROSULFIDE
Sodium Hydrosulfite (Sodium Dithionite)
SODIUM HYDROXIDE
SODIUM HYPOCHLORITE
Sodium Mercaptan (Sodium Hydrosulfide)
Sodium Metasilicate (Sodium Silicate)
SODIUM NITRATE
Sodium Orthophosphate (Sodium Phosphate, Tribasic)
Sodium Orthophosphate, Primary (Sodium Phosphate, Monobasic)
Sodium Orthophosphate, Secondary (Sodium Phosphate, Dibasic)
SODIUM PENTACHLOROPHENATE
Sodium Pentachlorophenol (Sodium Pentachlorophenate)
Sodium Pentachlorophenolate (Sodium Pentachlorophenate)
Sodium Pentachlorophenoxide (Sodium Pentachlorophenate)

SODIUM PHOSPHATE (Dibasic)
SODIUM PHOSPHATE (Monobasic)
SODIUM PHOSPHATE (Tribasic)
SODIUM SILICATE
SODIUM SULFATE
SODIUM SULFITE
Sodium Sulfoxylate (Sodium Dithionite)
Sodium Sulphydrate (Sodium Hydrosulfide)
Sodium Tetraborate, Decahydrate (Borax)
Spirits (Ethyl Alcohol)
Spirits of Turpentine (Turpentine)
Spurge (Dinoseb)
STEARIC ACID
Stearophanic Acid (Stearic Acid)
Stove (Range) Oil (Kerosene)
STYRENE MONOMER
Styrol (Styrene Monomer)
Sugar of Lead (Lead Acetate)
SULFUR
SULFUR DIOXIDE
Sulfur Hydride (Hydrogen Sulfide)
SULFURIC ACID
Sulfuric Chlorohydrin (Chlorosulfonic Acid)
Sulfurous Acid, Anhydride (Sulfur Dioxide)
Sulfurous Oxide (Sulfur Dioxide)
SULFURYL CHLORIDE
Sulphur (Sulfur)
Sulphuretted Hydrogen (Hydrogen Sulfide)
Sulphuric Acid, Fuming (Oleum)
Synklor (Chlordane)
Synthetic Rubber Latex (Latex)

T

TALL OIL
Tallol (Tall Oil)
Tar Camphor (Naphthalene)

TEA (Aluminum Alkyl Compounds)
TEL (Tetraethyl Lead)
TEREPHTHALIC ACID
Terephthalic Acid, Dimethyl Ester (Dimethyl Terephthalate)
TERPHENYLS
Tertiary Calcium Phosphate (Calcium Phosphate, Tribasic)
tert-Butanol (Butyl Alcohol)
Tetrachloroethylene (Perchloroethylene)
Tetrachloromethane (Carbon Tetrachloride)
TETRAETHYL LEAD
Tetraethyl Plumbane (Tetraethyl Lead)
Tetrahydro-1,4-Isoxazine (Morpholine)
Tetrahydro-p-Isoxazine (Morpholine)
Tetrahydro-1,4-Oxazine (Morpholine)
Tetrahydro-2H-1,4-Oxazine (Morpholine)
Tetrahydroxymethylmethane (Pentaerythritol)
Tetrakis (Hydroxymethyl) Methane (Pentaerythritol)
Tetramethyl Lead (Tetraethyl Lead)
Tetramethylolmethane (Pentaerythritol)
Tetraphosphorus Decasulphide (Phosphorus Pentasulfide)
Thiophosphoric Anhydride (Phosphorus Pentasulfide)
TIBA (Aluminum Alkyl Compounds)
Titanic Anhydride (Titanium Dioxide)
Titanic Oxide (Titanium Dioxide)
TITANIUM DIOXIDE
Titanium White (Titanium Dioxide)
TMA (Aluminum Alkyl Compounds)
TML (Tetraethyl Lead)
TNT (Trinitrotoluene)
TOLUENE
TOLUENE DIISOCYANATE
Toluol (Toluene)
2,4-Tolylene Diisocyanate (Toluene Diisocyanate)
Topichlor (Chlordane)
Toxilic Anhydride (Maleic Anhydride)

TPA (Terephthalic Acid)

Treflan (Trifluralin)

TRIALLATE

Tribasic Sodium Phosphate (Sodium Phosphate, Tribasic)

Tricalcium Orthophosphate (Calcium Phosphate, Tribasic)

Tricalcium Phosphate (Calcium Phosphate, Tribasic)

Tricarbonyl (Methylcyclopentadienyl Manganese Tricarbonyl)

Trichlorethane (1,1,1-Trichloroethane)

TRICHLORFON

Trichloroaluminum (Aluminum Chloride)

1,1,1-TRICHLOROETHANE

Trichlorofluoromethane (Fluorochloromethanes, Freon 11)

Trichloromethane (Chloroform)

Triethylaluminum (Aluminum Alkyl Comounds)

TRIFLURALIN

Triflurex (Trifluralin)

Triglycine (Nitrilotriacetic Acid)

Triglycollamic Acid (Nitrilotriacetic Acid)

1,2,3-Trihydroxypropane (Glycerine)

Triisobutylaluminum (Aluminum Alkyl Compounds)

Trimethylaluminum (Aluminum Alkyl Compounds)

Trimethylamine (Methylamines)

Trimethylcarbinol (Butyl Alcohol)

Trinitroglycerol (Nitroglycerine)

TRINITROTOLUENE

Trisodium Orthophosphate (Sodium Phosphate, Tribasic)

TSP (Sodium Phosphate, Tribasic)

TURPENTINE

Turps (Turpentine)

U

Unslaked Lime (Calcium Oxide)

Uranium Concentrate (Yellow Cake)

UREA

V

Vanadic Acid Anhydride (Vanadium Pentoxide)
Vanadium Oxide (Vanadium Pentoxide)
VAC (Vinyl Acetate)
VAM (Vinyl Acetate)
VANADIUM PENTOXIDE
VCM (Vinyl Chloride)
Velsicol (Dicamba)
Vinegar Acid (Acetic Acid)
Vinegar Naphtha (Ethyl Acetate)
VINYL ACETATE
Vinyl Acetate Monomer (Vinyl Acetate)
VINYL CHLORIDE
Vinyl Chloride Monomer (Vinyl Chloride)
Vinyl Cyanide (Acrylonitrile)
Vinylbenzene (Styrene Monomer)
Vinylethylene (1,3-Butadiene)
Voranate T-80™ (Toluene Diisocyanate)

W

Warble Killer (Trichlorofon)
Water Glass (Sodium Silicate)
Weed Killer (2,4-D)
Weed Preventer (Trifluralin)
Weed Stop (Trifluralin)
Weed-No-More (2,4-D)
Weedone (2,4-D)
White Arsenic (Arsenic Trioxide)
White Caustic (Sodium Hydroxide)
White Copperas (Zinc Sulfate, Heptahydrate)
White Dry Phosphorus (Phosphorus, White)
White Vitriol (Zinc Sulfate, Heptahydrate)
Wittox-C (Copper Naphthenate)
Wood Alcohol (Methanol)

Wood Ether (Dimethyl Ether)

Wood Naphtha (Methanol)

Wood Spirit (Methanol)

Wood Turpentine (Turpentine)

X

XYLENES

Xylols (Xylenes)

Y

Yaltox (Carbofuran)

YELLOW CAKE

Yellow Phosphorus (Phosphorus, White)

Z

ZINC

ZINC CHLORIDE

Zinc Dichloride Solution (Zinc Chloride)

Zinc Dust (Zinc)

Zinc Muriate Solution (Zinc Chloride)

ZINC OXIDE

ZINC SULFATE

Zinc ~~Sulfate Hept~~ahydrate (Zinc Sulfate)

Zinc Sulfate Monohydrate (Zinc Sulfate)

Zinc Sulphate (Zinc Sulfate)

Zinc Vitriol (Zinc Sulfate, Heptahydrate)

Zinc White (Zinc Oxide)

Zincite (Zinc Oxide)

3 AGRICULTURE CANADA PESTICIDE REGISTRY NUMBERS (for those pesticides included in this manual)

1083 — carbaryl

2238 — 2,4-D (present as dimethylamine salt)
2283 — 2,4-D (present as mixed butyl esters)
2592 — chlordane
2687 — 2,4-D (present as diethanolamine salt)
2760 — chlordane
2833 — chlordane
2851 — 2,4-D (present as diethanolamine salt)

3132 — dinoseb (present as free form, alkanolamine salts or mixed amine salts)
3162 — chlordane
3186 — 2,4-D (present as dimethylamine salt)
3259 — chlordane
3277 — chlordane
3465 — chlordane
3479 — chlordane
3517 — 2,4-D (present as dimethylamine salt)
3518 — chlordane
3676 — 2,4-D (present as dimethylamine salt)
3749 — 2,4-D (present as isooctyl esters)
3927 — 2,4-D (present as dimethylamine salt)
3956 — 2,4-D (present as dimethylamine salt)
3959 — 2,4-D (present as isooctyl esters)

4058 — chlordane
4067 — MCPA (present as potassium or sodium salt)
4132 — chlordane
4155 — 2,4-D (present as diethanolamine salt)
4167 — dinoseb (present as free form, alkanolamine salts or mixed amine salts)
4253 — 2,4-D (present as dimethylamine salt)
4282 — malathion
4291 — 2,4-D (present as dimethylamine salt)
4343 — MCPA (present as potassium or sodium salt)
4383 — MCPA (present as esters)
4397 — chlordane
4478 — malathion
4486 — dinoseb (present in free form, alkanolamine salts or mixed amine salts)
4535 — dinoseb (present in free form, alkanolamine salts or mixed amine salts)
4588 — malathion
4590 — malathion
4638 — malathion
4657 — malathion
4709 — malathion
4728 — 2,4-D (present as mixed butyl esters)
4734 — 2,4-D (present as mixed butyl esters)
4741 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
4748 — 2,4-D (present as mixed butyl esters)
4768 — 2,4-D (present as isooctyl esters)
4771 — 2,4-D (present as propylene glycol butyl ether ester)
4780 — 2,4-D (present as mixed butyl esters)
4860 — malathion
4916 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
4928 — malathion
4980 — 2,4-D (present as isooctyl esters)
4982 — chlordane
4983 — 2,4-D (present as isooctyl esters)
4989 — 2,4-D (present as sodium salt)

5016 — chlordane
5125 — chlordane
5141 — malathion
5206 — chlordane
5212 — malathion
5276 — malathion
5316 — MCPA (present as potassium or sodium salt)
5362 — 2,4-D (present as dimethylamine salt)
5369 — chlordane
5429 — malathion
5441 — chlordane
5449 — malathion
5460 — MCPA (present as potassium or sodium salt)
5462 — MCPA (present as esters)
5504 — 2,4-D (present as mixed butyl esters)
5508 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salt)
5639 — 2,4-D (present as dimethylamine salt)
5780 — malathion
5821 — malathion
5931 — 2,4-D (present as dimethylamine salt)
5942 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salt)
5979 — MCPA (present as esters)
5981 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salt)

6017 — trichlorfon
6022 — malathion
6024 — chlordane
6045 — MCPA (present as esters)
6047 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
6140 — 2,4-D (present as isooctyl esters)
6190 — 2,4-D (present as mixed butyl esters)
6192 — malathion
6274 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
6314 — 2,4-D (present as mixed butyl esters)
6330 — 2,4-D (present as propylene glycol butyl ether ester)
6373 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
6375 — 2,4-D (present as dimethylamine salt)
6465 — malathion
6526 — 2,4-D (present as isooctyl esters)
6530 — 2,4-D (present as dimethylamine salt)
6662 — 2,4-D (present as mixed butyl esters)
6680 — 2,4-D (present as mixed butyl esters)
6698 — 2,4-D (present as isooctyl esters)
6713 — malathion
6718 — 2,4-D (present as isooctyl esters)
6745 — chlordane
6771 — MCPA (present as esters)
6799 — chlordane
6839 — carbaryl
6840 — malathion
6860 — malathion
6965 — MCPA (present as esters)
6967 — 2,4-D (present as dimethylamine salt)
6969 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
6971 — 2,4-D (present as mixed butyl esters)
6975 — malathion

7012 — 2,4-D (present as isooctyl esters)
7108 — MCPA (present as potassium or sodium salt)
7110 — 2,4-D (present as isooctyl esters)
7207 — carbaryl
7264 — malathion
7401 — 2,4-D (present as isooctyl esters)
7446 — carbaryl
7456 — malathion
7473 — MCPA (present as esters)
7525 — 2,4-D (present as isooctyl esters)
7527 — 2,4-D (present as isooctyl esters)
7571 — 2,4-D (present as mixed butyl esters)
7647 — trichlorfon
7652 — carbaryl
7667 — trichlorfon
7754 — malathion
7757 — carbaryl
7811 — MCPA (present as esters)
7812 — MCPA (present as potassium or sodium salt)
7825 — MCPA (present as esters)
7835 — 2,4-D (present as acid)
7839 — malathion
7855 — chlordane
7947 — malathion

8021 — malathion
8022 — MCPA (present as potassium or sodium salt)
8026 — carbaryl
8042 — carbaryl
8099 — 2,4-D (present as isooctyl esters)
8125 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
8151 — carbaryl
8159 — 2,4-D (present as diethanolamine salt)
8167 — triallate
8184 — carbaryl
8211 — MCPA (present as potassium or sodium salt)
8217 — 2,4-D (present as mixed butyl esters)
8253 — MCPA (present as potassium or sodium salt)
8354 — malathion
8372 — malathion
8403 — malathion
8425 — 2,4-D (present as isooctyl esters)
8431 — 2,4-D (present as isooctyl esters)
8466 — carbaryl
8466 — malathion
8469 — 2,4-D (present as diethanolamine salt)
8469 — 2,4-D (present as dimethylamine salt)
8472 — carbaryl
8480 — malathion
8491 — 2,4-D (present as dimethylamine salt)
8495 — 2,4-D (present as isooctyl esters)
8503 — MCPA (present as esters)
8524 — 2,4-D (present as dimethylamine salt)
8543 — 2,4-D (present as isooctyl esters)
8593 — 2,4-D (present as diethanolamine salt)
8595 — 2,4-D (present as diethanolamine salt)
8624 — malathion
8631 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
8651 — 2,4-D (present as acid)
8657 — 2,4-D (present as isooctyl esters)
8662 — chlordane

8705 — dinoseb (present as free form, alkanolamine salts or mixed amine salts)
8725 — carbaryl
8765 — malathion
8810 — 2,4-D (present as dimethylamine salt)
8826 — malathion
8834 — carbaryl
8885 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
8885 — 2,4-D (present as dimethylamine salt)
8899 — 2,4-D (present as isooctyl esters)
8903 — 2,4-D (present as isooctyl esters)
8911 — MCPA (present as potassium or sodium salt)
8927 — 2,4-D (present as butoxyethyl ester)
8950 — trichlorfon
8959 — 2,4-D (present as isooctyl ester)

9001 — carbaryl
9007 — 2,4-D (present as other amine salts)
9017 — MCPA (present as potassium or sodium salt)
9023 — malathion
9031 — 2,4-D (present as mixed butyl esters)
9033 — 2,4-D (present as dimethylamine salt)
9042 — carbaryl
9061 — carbaryl
9081 — carbaryl
9083 — carbaryl
9088 — chlordane
9099 — carbaryl
9103 — 2,4-D (present as dimethylamine salt)
9150 — chlordane
9150 — malathion
9172 — carbaryl
9176 — carbaryl
9177 — 2,4-D (present as dimethylamine salt)
9178 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
9232 — 2,4-D (present as dimethylamine salt)
9257 — trifluralin
9262 — 2,4-D (present as mixed butyl ester)
9265 — malathion
9268 — 2,4-D (present as isooctyl esters)
9272 — carbaryl
9284 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
9337 — malathion
9342 — 2,4-D (present as acid)
9350 — 2,4-D (present as dimethylamine salt)
9350 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
9355 — 2,4-D (present as isooctyl esters)
9401 — malathion
9408 — trichlorfon
9419 — trichlorfon
9439 — 2,4-D (present as isooctyl esters)
9465 — 2,4-D (present as dimethylamine salt)
9465 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
9492 — carbaryl
9494 — chlordane
9506 — 2,4-D (present as isooctyl esters)
9510 — MCPA (present as esters)
9513 — chlordane
9516 — MCPA (present as diethanolamine salt, dimethylamine salt, mixed amine salts)
9524 — 2,4-D (present as acid)
9528 — 2,4-D (present as dimethylamine salt)
9537 — carbaryl
9540 — 2,4-D (present as other amine salts)
9547 — 2,4-D (present as dimethylamine salt)
9548 — MCPA (present as esters)
9550 — 2,4-D (present as mixed butyl esters)
9560 — 2,4-D (present as isooctyl esters)
9561 — 2,4-D (present as isooctyl esters)
9581 — 2,4-D (present as isooctyl esters)
9587 — 2,4-D (present as isooctyl esters)
9606 — 2,4-D (present as dimethylamine salt)
9606 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
9625 — 2,4-D (present as isooctyl esters)
9661 — chlordane
9726 — carbaryl
9740 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
9740 — 2,4-D (present as dimethylamine salt)
9750 — chlordane
9777 — 2,4-D (present as dimethylamine salt)
9802 — malathion
9809 — chlordane
9811 — 2,4-D (present as dimethylamine salt)
9811 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
9824 — malathion
9827 — trichlorfon
9853 — MCPA (present as diethanolamine salt, dimethylamine salt, mixed amine salts)
9856 — MCPA (present as esters)
9858 — MCPA (present as potassium or sodium salts)
9876 — chlordane
9885 — 2,4-D (present as isooctyl esters)

9903 — 2,4-D (present as diethanolamine salt)
9903 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
9907 — 2,4-D (present as butoxyethyl ester)
9920 — malathion
9946 — malathion
9947 — malathion
9975 — malathion
9977 — 2,4-D (present as dimethylamine salt)
9986 — malathion
9986 — carbaryl

10020 — 2,4-D (present as diethanolamine salt)
10046 — malathion
10066 — MCPA (present as diethanolamine salt, dimethylamine salt or as mixed amine salts)
10067 — MCPA (present as esters)
10068 — 2,4-D (present as dimethylamine salt)
10069 — 2,4-D (present as isooctyl esters)
10070 — 2,4-D (present as mixed butyl esters)
10121 — 2,4-D (present as isooctyl esters)
10132 — malathion
10134 — malathion
10156 — carbaryl
10159 — carbaryl
10163 — 2,4-D (present as isooctyl esters)
10164 — malathion
10166 — 2,4-D (present as acid)
10174 — malathion
10184 — 2,4-D (present as dimethylamine salt)
10187 — MCPA (present as esters)
10195 — carbaryl
10196 — carbaryl
10215 — 2,4-D (present as isooctyl esters)
10308 — trialiate
10313 — chlordane
10324 — malathion
10325 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
10325 — 2,4-D (present as dimethylamine salt)
10327 — trifluralin
10331 — 2,4-D (present as isooctyl ester)
10352 — carbaryl
10359 — carbofuran
10363 — carbofuran
10387 — carbaryl
10399 — 2,4-D (present as dimethylamine salt)
10401 — MCPA (present as diethanolamine salt, dimethylamine salt or as mixed amine salts)
10430 — 2,4-D (present as isooctyl esters)
10458 — dinoseb (present in free form, alkanolamine salts or mixed amine salts)
10460 — 2,4-D (present as dimethylamine salt)
10472 — 2,4-D (present as isooctyl esters)
10473 — 2,4-D (present as isooctyl esters)
10483 — MCPA (present as potassium or sodium salts)
10491 — 2,4-D (present as dimethylamine salt)
10509 — malathion
10559 — carbaryl
10559 — malathion
10565 — carbaryl
10565 — malathion
10567 — carbaryl
10567 — malathion
10568 — carbaryl
10568 — malathion
10579 — chlordane
10590 — 2,4-D (present as dimethylamine salt)
10590 — dicamba (present as acid, diethanolamine salt or dimethylamine salts)
10619 — carbaryl
10622 — 2,4-D (present as isooctyl esters)
10626 — chlordane
10629 — trifluralin
10637 — carbaryl
10638 — chlordane
10639 — malathion
10644 — carbaryl
10645 — carbaryl
10653 — chlordane
10658 — chlordane
10666 — carbofuran
10681 — chlordane
10684 — carbaryl
10685 — carbaryl
10687 — carbaryl
10709 — carbaryl
10711 — carbaryl
10715 — chlordane
10725 — malathion
10725 — malathion
10726 — carbaryl
10726 — malathion
10727 — carbaryl
10732 — dinoseb (present in free form, alkanolamine salts or mixed amine salts)
10734 — malathion
10742 — malathion
10757 — malathion
10758 — malathion

10776 — fenitrothion
10778 — 2,4-D (present as butoxyethyl ester)
10778 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
10793 — malathion
10794 — malathion
10802 — malathion
10817 — MCPA (present as diethanolamine salt,
dimethylamine salt or as mixed amine salts)
10826 — carbofuran
10827 — carbofuran
10828 — carbofuran
10833 — 2,4-D (present as acid)
10856 — malathion
10862 — carbaryl
10880 — malathion
10912 — 2,4-D (present as diethanolamine salt)
10916 — 2,4-D (present as dimethylamine salt)
10919 — carbaryl
10920 — carbaryl
10930 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
10930 — 2,4-D (present as acid)
10946 — carbaryl
10949 — 2,4-D (present as dimethylamine salt)
10949 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
10951 — chlordane
10964 — carbaryl
10965 — carbaryl
10967 — carbaryl
10969 — MCPA (present as diethanolamine salt,
dimethylamine salt or as mixed amine salts)
10970 — 2,4-D (present as dimethylamine salt)
10970 — 2,4-D (present as diethanolamine salt)
10971 — 2,4-D (present as dimethylamine salt)
10988 — 2,4-D (present as acid)

11003 — 2,4-D (present as other amine salts)
11013 — chlordane
11025 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11032 — 2,4-D (present as isooctyl esters)
11037 — trichlorfon
11037 — malathion
11044 — carbaryl
11055 — 2,4-D (present as dimethylamine salt)
11055 — 2,4-D (present as diethanolamine salt)
11055 — 2,4-D (present as other amine salts)
11087 — MCPA (present as potassium or sodium salt)

11090 — carbaryl
11096 — carbaryl
11113 — 2,4-D (present as dimethylamine salt)
11115 — carbaryl
11121 — malathion
11130 — malathion
11132 — trichlorfon
11137 — fenitrothion
11138 — fenitrothion
11153 — 2,4-D (present as butoxyethyl ester)
11157 — dinoseb (present in free form,
as alkanolamine salts or mixed amine salts)
11166 — carbaryl
11183 — 2,4-D (present as diethanolamine salt)
11213 — chlordane
11214 — trichlorfon
11215 — carbaryl
11218 — carbaryl
11223 — malathion
11224 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
11230 — chlordane
11231 — chlordane
11236 — 2,4-D (present as diethanolamine salt)
11242 — 2,4-D (present as dimethylamine salt)
11243 — MCPA (present as potassium or sodium salt)
11244 — MCPA (present as esters)
11245 — 2,4-D (present as mixed butyl esters)
11246 — 2,4-D (present as isooctyl esters)
11247 — MCPA (present as diethanolamine salt,
dimethylamine salt or mixed amine salts)
11249 — malathion
11249 — carbaryl
11258 — 2,4-D (present as butoxyethyl ester)
11271 — 2,4-D (present as isooctyl esters)
11273 — 2,4-D (present as dimethylamine salt)
11278 — malathion
11281 — trichlorfon
11299 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11314 — malathion
11319 — malathion
11321 — MCPA (present as potassium or sodium salt)
11333 — 2,4-D (present as isooctyl esters)
11335 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11337 — 2,4-D (present as acid)
11358 — chlordane
11364 — chlordane
11373 — chlordane

11374 — chlordane
11380 — chlordane
11397 — trichlorfon
11398 — malathion
11415 — carbaryl
11441 — 2,4-D (present as dimethylamine salt)
11442 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11448 — 2,4-D (present as dimethylamine salt)
11456 — carbaryl
11456 — malathion
11457 — carbaryl
11457 — malathion
11458 — 2,4-D (present as diethanolamine salt)
11461 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11463 — MCPA (present as potassium or sodium salt)
11479 — chlordane
11483 — carbaryl
11483 — malathion
11485 — carbaryl
11493 — 2,4-D (present as isooctyl esters)
11495 — 2,4-D (present as dimethylamine salt)
11514 — carbaryl
11515 — carbaryl
11421 — 2,4-D (present as propylene glycol butyl ether ester)
11545 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11547 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
11547 — 2,4-D (present as dimethylamine salt)
11551 — MCPA (present as diethanolamine salt,
dimethylamine salt or as mixed amine salts)
11552 — MCPA (present as esters)
11562 — 2,4-D (present as dimethylamine salt)
11571 — 2,4-D (present as dimethylamine salt)
11574 — (present as dimethylamine salt)
11591 — malathion
11599 — carbaryl
11618 — MCPA (present as diethanolamine salt,
dimethylamine salt or as mixed amine salts)
11621 — malathion
11641 — malathion
11651 — 2,4-D (present as mixed butyl esters)
11652 — trichlorfon
11681 — malathion
11708 — trichlorfon
11720 — 2,4-D (present as isooctyl ester)
11721 — 2,4-D (present as dimethylamine salt)
11726 — chlordane
11729 — malathion
11760 — dinoseb (present in free form,
as alkanolamine salts or as mixed amine salts)
11762 — 2,4-D (present as isooctyl esters)
11779 — 2,4-D (present as dimethylamine salt)
11787 — 2,4-D (present as diethanolamine salt)
11803 — 2,4-D (present as mixed butyl esters)
11804 — 2,4-D (present as mixed butyl esters)
11810 — 2,4-D (present as dimethylamine salt)
11814 — MCPA (present as potassium and sodium salt)
11817 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
11817 — 2,4-D (present as dimethylamine salt)
11827 — 2,4-D (present as isooctyl esters)
11828 — MCPA (present as esters)
11829 — MCPA (present as diethanolamine salt,
dimethylamine salt or as mixed amine salts)
11830 — MCPA (present as potassium or sodium salts)
11840 — malathion
11843 — chlordane
11851 — dicamba (present as acid,
diethanolamine salt or dimethylamine salt)
11852 — 2,4-D (present as acid)

12073 — malathion
12087 — MCPA (esters)
12090 — chlordane
12133 — chlordane
12135 — carbaryl
12137 — chlordane
12146 — carbaryl
12176 — chlordane
12216 — malathion
12231 — carbaryl
12236 — carbaryl
12278 — carbaryl
12278 — malathion
12330 — malathion
12331 — malathion
12332 — chlordane
12357 — malathion
12358 — malathion
12381 — 2,4-D (present as isooctyl esters)
12438 — 2,4-D (present as dimethylamine salt)
12438 — 2,4-D (present as diethanolamine salt)
12445 — chlordane
12455 — carbaryl
12456 — malathion
12456 — chlordane
12525 — malathion

12525 — carbaryl
12527 — malathion
12527 — carbaryl
12536 — chlordane
12560 — carbaryl
12586 — 2,4-D (present as dimethylamine salt)
12586 — dicamba (present as acid, diethanolamine salt and dimethylamine salt)
12587 — dicamba (present as acid, diethanolamine salt and dimethylamine salt)
12589 — dicamba (present as acid, diethanolamine salt and dimethylamine salt)
12590 — malathion
12611 — trifluralin
12639 — chlordane
12645 — 2,4-D (present as sodium salt)
12646 — chlordane
12859 — 2,4-D (present as dimethylamine salt)
12865 — chlordane
12931 — trifluralin
12951 — 2,4-D (present as isooctyl esters)
12959 — malathion
12968 — carbaryl

13028 — malathion
13052 — carbaryl
13064 — carbaryl
13065 — carbaryl
13241 — 2,4-D (present as dimethylamine salt)
13248 — malathion
13332 — chlordane
13335 — 2,4-D (present as isooctyl esters)
13356 — 2,4-D (present as dimethylamine salt)
13451 — chlordane
13453 — carbaryl
13491 — carbaryl
13494 — chlordane
13509 — 2,4-D (present as dimethylamine salt)
13509 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
13510 — malathion
13548 — malathion
13570 — MCPA (present as diethanolamine salt, dimethylamine salt or other amine salts)
13605 — carbaryl
13606 — carbaryl
13607 — carbaryl
13616 — carbaryl
13620 — chlordane
13622 — chlordane

13641 — chlordane
13645 — 2,4-D (present as isooctyl esters)
13646 — 2,4-D (present as isooctyl esters)
13652 — carbaryl
13661 — carbaryl
13662 — carbaryl
13700 — 2,4-D (present as isooctyl esters)
13701 — carbaryl
13723 — carbaryl
13739 — 2,4-D (present as isooctyl esters)
13750 — MCPA (present as potassium or sodium salts)
13761 — MCPA (present as diethanolamine salts, dimethylamine salt, amine salts)
13761 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
13851 — trichlorfon
13853 — malathion
13884 — carbaryl
13890 — 2,4-D (present as isooctyl esters)
13900 — carbaryl
13901 — carbaryl
13929 — carbaryl
13967 — fenitrothion

14010 — carbaryl
14017 — malathion
14017 — carbaryl
14027 — carbaryl
14102 — chlordane
14123 — trifluralin
14124 — trifluralin
14127 — carbaryl
14128 — carbaryl
14130 — carbaryl
14144 — malathion
14150 — 2,4-D (present as dimethylamine salt)
14150 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
14151 — carbaryl
14160 — carbaryl
14162 — carbaryl
14167 — 2,4-D (present as other amine salts)
14170 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
14173 — carbaryl
14186 — aminocarb
14187 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14188 — MCPA (present as potassium or sodium salt)
14211 — malathion

14214 — malathion
14223 — 2,4-D (present as diethanolamine salt)
14258 — malathion
14265 — malathion
14268 — carbaryl
14269 — malathion
14284 — dinoseb
14299 — fenitrothion
14300 — 2,4-D (present as acid)
14302 — carbaryl
14307 — trichlorfon
14313 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14336 — 2,4-D (present as mixed butyl esters)
14342 — carbaryl
14343 — carbaryl
14360 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14362 — 2,4-D (present as dimethylamine salt)
14377 — carbaryl
14384 — 2,4-D (present as isooctyl esters)
14405 — 2,4-D (present as dimethylamine salt)
14407 — malathion
14411 — trichlorfon
14412 — trichlorfon
14414 — 2,4-D (present as other amine salts)
14424 — carbaryl
14483 — 2,4-D (present as isooctyl esters)
14489 — carbaryl
14490 — carbaryl
14525 — malathion
14527 — carbaryl
14529 — carbaryl
14537 — carbaryl
14537 — malathion
14545 — trifluralin
14566 — carbaryl
14573 — carbaryl
14574 — carbaryl
14584 — malathion
14593 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
14594 — 2,4-D (present as isooctyl esters)
14622 — 2,4-D (present as dimethylamine salt)
14623 — 2,4-D (present as isooctyl esters)
14626 — 2,4-D (present as isooctyl esters)
14631 — MCPA (present as potassium or sodium salt)
14637 — 2,4-D (present as butoxyethyl ester)
14650 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14656 — malathion
14662 — MCPA (present as ester)
14663 — 2,4-D (present as isooctyl esters)
14664 — 2,4-D (present as isooctyl esters)
14666 — 2,4-D (present as mixed butyl esters)
14672 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14675 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14706 — carbaryl
14710 — chlordane
14714 — 2,4-D (present as isooctyl esters)
14715 — 2,4-D (present as mixed butyl esters)
14718 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14722 — 2,4-D (present as dimethylamine salt)
14723 — 2,4-D (present as dimethylamine salt)
14725 — 2,4-D (present as dimethylamine salt)
14726 — 2,4-D (present as dimethylamine salt)
14729 — malathion
14730 — MCPA (present as diethanolamine salt, dimethylamine salt or mixed amine salts)
14732 — dinoseb
14733 — 2,4-D (present as dimethylamine salt)
14739 — 2,4-D (present as isooctyl esters)
14743 — 2,4-D (present as isooctyl esters)
14758 — 2,4-D (present as isooctyl esters)
14764 — MCPA (present as esters)
14769 — malathion
14778 — dinoseb
14785 — dinoseb
14796 — 2,4-D (present as butoxyethyl ester)
14798 — carbaryl
14800 — 2,4-D (present as butoxyethyl ester)
14803 — 2,4-D (present as isooctyl esters)
14850 — chlordane
14852 — carbaryl
14853 — malathion
14859 — carbaryl
14861 — carbaryl
14868 — malathion
14894 — malathion
14902 — dicamba (present as acid, diethanolamine salt or dimethylamine salt)
14902 — 2,4-D (present as dimethylamine salt)
14912 — carbaryl
14965 — carbaryl

15014 — trichlorfon
15015 — 2,4-D (present as dimethylamine salt)

15015 — 2,4-D (present as diethanolamine salt)
15016 — MCPA (present as diethanolamine salt, dimethylamine salt, mixed amine salt)
15030 — carbaryl
15075 — 2,4-D (dimethylamine salt)
15075 — dicamba (present as acid, diethanolamine salt, dimethylamine salt)
15086 — dinoseb (present in free form, alkanolamine salts, mixed amine salts)
15105 — 2,4-D (present as dimethylamine salt)
15110 — 2,4-D (present as isooctyl esters)
15112 — MCPA (present as esters)
15114 — 2,4-D (present as diethanolamine salt)
15118 — malathion
15127 — MCPA (present as esters)
15130 — malathion
15135 — carbaryl
15149 — 2,4-D (present as dimethylamine salt)
15156 — carbaryl
15158 — 2,4-D (present as dimethylamine salt)
15159 — 2,4-D (isooctyl esters)
15160 — 2,4-D (isooctyl esters)
15186 — malathion
15237 — 2,4-D (present as mixed butyl esters)
15240 — MCPA (present as diethanolamine salt, dimethylamine salt, or mixed amine salts)
15244 — 2,4-D (present as isooctyl esters)
15258 — trichlorfon
15271 — 2,4-D (present as dimethylamine salt)
15278 — 2,4-D (present as isooctyl esters)
15279 — 2,4-D (present as dimethylamine salt)
15308 — 2,4-D (present as butoxyethyl ester)
15319 — trichlorfon
15325 — 2,4-D (present as diethanolamine salt)
15335 — carbaryl
15365 — 2,4-D (present as dimethylamine salt)
15374 — 2,4-D (present as diethanolamine salt)
15377 — malathion
15380 — malathion
15386 — carbaryl
15389 — carbaryl
15391 — carbaryl
15393 — 2,4-D (present as acid)
15400 — 2,4-D (present as diethanolamine salt)
15401 — 2,4-D (present as isooctyl esters)
15404 — 2,4-D (present as diethanolamine salt)
15405 — 2,4-D (present as diethanolamine salt)
15441 — 2,4-D (present as isooctyl esters)
15504 — chlordane
15521 — 2,4-D (present as dimethylamine salt)
15668 — 2,4-D (present as dimethylamine salt)
15721 — carbaryl
15730 — 2,4-D (present as dimethylamine salt)
15851 — chlordane
15857 — carbaryl
15942 — 2,4-D (present as dimethylamine salt)
15950 — 2,4-D (present as dimethylamine salt)
15984 — 2,4-D (present as dimethylamine salt)
15985 — 2,4-D (present as dimethylamine salt)

16038 — 2,4-D (present as dimethylamine salt)
16149 — 2,4-D (present as dimethylamine salt)
16167 — 2,4-D (present as dimethylamine salt)

4 CONVERSION FACTORS

AREA

acres	x 0.405	= ha
	x 0.004 05	= km^2
	x 4 050	= m^2
	x 0.001 56	= mi^2
ft^2	x 0.092 9	= m^2
	x 0.111	= yd^2
m^2	x 10.8	= ft^2
	x 0.000 1	= ha
	x 1.20	= yd^2
mi^2	x 640	= acres
	x 259	= ha
	x 2.59	= km^2

CONCENTRATIONS (by weight)

mg/L (in water)	x 1	= ppm
	x 0.000 1	= %
mg/m^3 (in air)	x 24.1/(mol. wt.)	= ppm (at 20°C)
	x 20.8/(mol. wt.)	= ppm (at -20°C)
	x 0.002 41/(mol. wt.)	= % (at 20°C)
	x 0.002 08/(mol. wt.)	= % (at -20°C)
ppm (in water)	x 0.000 1	= %
	x 1	= mg/L
ppm (in air)	x 0.0415 (mol. wt.)	= mg/m^3 (at 20°C)
	x 0.0481 (mol. wt.)	= mg/m^3 (at -20°C)
	x 0.000 1	= %
% (in water and air)	x 10 000	= ppm

DENSITY

g/cm^3	x 62.4	= lb/ft^3
	x 1 690	= lb/yd^3
kg/m^3	x 0.001	= g/cm^3
	x 0.062 4	= lb/ft^3
	x 1.69	= lb/yd^3
lb/ft^3	x 0.016 0	= g/cm^3
	x 16.0	= kg/m^3
	x 27	= lb/yd^3

FLOW

gal/s	x 0.160	= ft^3/s
	x 60	= gal/min
	x 72	= gal (U.S.)/min
	x 4.55	= L/s
	x 16.4	= m^3/h
L/s	x 0.035 3	= ft^3/s
	x 13.2	= gal/min
	x 15.9	= gal (U.S.)/min

LENGTH

cm	x 0.032 8	= ft
	x 0.394	= in
ft	x 30.5	= cm
	x 0.305	= m
in	x 2.54	= cm
	x 25.4	= mm
km	x 3 280	= ft
	x 0.621	= mi
	x 0.540	= mi (naut)
	x 1 090	= yd
m	x 3.28	= ft
	x 1.09	= yd
mi	x 5 280	= ft
	x 1.61	= km
	x 1 610	= m
	x 0.869	= mi (naut)
	x 1 760	= yd
mi (naut)	x 6 080	= ft
	x 1.85	= km
	x 185	= m
	x 1.15	= mi
	x 2 030	= yd

MASS/WEIGHT

g	x 0.002 20	= lb
	x 0.035 2	= oz
kg	x 2.20	= lb
lb	x 454	= g
	x 0.454	= kg
	x 16	= oz
oz	x 28.4	= g
	x 0.028 4	= kg

MASS/WEIGHT (cont'd)

ton (long)	x 1 020	= kg
	x 2 240	= lb
	x 1.12	= ton (short)
	x 1.02	= t
ton (short)	x 907	= kg
	x 2 000	= lb
	x 0.893	= ton (long)
	x 0.907	= t
t	x 1 000	= kg
	x 2 200	= lb
	x 1.10	= ton (short)
	x 0.984	= ton (long)

PRESSURE

atm	x 1.01	= bars
	x 101	= kPa
	x 760	= mm Hg (0°C)
	x 14.7	= psia
bars	x 0.987	= atm
	x 100	= kPa
	x 750	= mm Hg (0°C)
	x 14.5	= psia
kPa	x 0.009 87	= atm
	x 0.01	= bars
	x 7.50	= mm Hg
	x 0.145	= psia
mm Hg (0°C)	x 0.001 32	= atm
	x 0.001 33	= bars
	x 0.133	= kPa
	x 0.019 3	= psia
psia	x 0.068 0	= atm
	x 0.068 9	= bars
	x 6.89	= kPa
	x 51.7	= mm Hg (0°C)
	- 14.7	= psig

SPILL VOLUMES and WEIGHTS

barrels	x 0.159 (s.g.)	= t
gal	x 0.004 55 (s.g.)	= t
gal (U.S.)	x 0.003 79 (s.g.)	= t
L	x 0.001 (s.g.)	= t
MMCF (gas)	x 36.6 (v.d.)	= t
m^3 (gas)	x 0.001 29 (v.d.)	= t

SOLUBILITY (in water)

g/100 mL	x 10 000	= mg/L
	x 10 000	= ppm
	x 1	= %
mg/L	x 0.000 1	= g/100 mL
	x 1	= ppm
	x 0.000 1	= %
ppm	x 0.000 1	= g/100 mL (or %)
	x 1	= mg/L
%	x 1	= g/100 mL
	x 10 000	= mg/L (or ppm)

TEMPERATURE

°C	x 1.8 + 32	= °F
	+ 273	= K
°F	-32) x 0.556	= °C
	-32) x 0.556) + 273	= K
K	- 273	= °C
	- 273) x 1.8) + 32	= °F

VELOCITY

ft/s	x 1.10	= km/h
	x 0.592	= kn
	x 0.305	= m/s
	x 0.682	= mi/h
km/h	x 0.911	= ft/s
	x 0.540	= kn
	x 0.278	= m/s
	x 0.621	= mi/h
kn	x 1.69	= ft/s
	x 1.85	= km/h
	x 0.514	= m/s
	x 1.15	= mi/h
m/s	x 3.28	= ft/s
	x 3.6	= km/h
	x 1.94	= kn
	x 2.24	= mi/h
mi/h	x 1.47	= ft/s
	x 1.61	= km/h
	x 0.869	= kn
	x 0.447	= m/s

VOLUME

cm^3	x 0.061 0	= in^3
ft^3	x 1 730	= in^3
	x 0.028 3	= m^3
	x 0.037 0	= yd^3
in^3	x 16.4	= cm^3
m^3	x 35.3	= ft^3
	x 1.31	= yd^3
yd^3	x 27	= ft^3
	x 0.765	= m^3

VOLUME (liquid measure)

barrel	x 35.0	= gal
	x 42	= gal (U.S.)
	x 159	= L
	x 0.159	= m^3
gal	x 0.028 6	= barrel
	x 1.20	= gal (U.S.)
	x 4.55	= L
gal (U.S.)	x 0.023 8	= barrel
	x 0.832	= gal
	x 3.79	= L
L	x 0.006 29	= barrel
	x 0.220	= gal
	x 0.264	= gal (U.S.)

4.1 ABBREVIATIONS USED IN CONVERSIONS

atm	-	atmosphere
cm	-	centimetre
cm^3	-	cubic centimetre
ft^3	-	cubic foot
in^3	-	cubic inch
m^3	-	cubic metre
yd^3	-	cubic yard
°C	-	degree Celsius
°F	-	degree Fahrenheit
ft	-	foot
ft/s	-	foot per second
g	-	gram
gal (U.S.)	-	United States gallon
g/100 mL	-	grams per 100 millilitres
ha	-	hectare
h	-	hour
gal	-	Canadian gallon
in	-	inch
K	-	kelvin (temperature)
kg	-	kilogram
km	-	kilometre
km/h	-	kilometres per hour
kPa	-	kilopascal
kn	-	knot
L	-	litre
m	-	metre
MCF	-	thousand cubic feet
m/s	-	metres per second
mi	-	mile (statute)
mi (naut)	-	nautical mile
mi/h	-	miles per hour
MMCF	-	million cubic feet
mg/m^3	-	milligrams per cubic metre
mg/L	-	milligrams per litre
mm	-	millimetre
mm Hg	-	millimetres of mercury
min	-	minute
oz	-	ounce (avdp.)
ppb	-	parts per billion
ppm	-	parts per million
ppt	-	parts per trillion
%	-	percent
lb	-	pound (avdp.)
psia	-	pounds per square inch, absolute
psig	-	pounds per square inch, gauge
s	-	second
s.g.	-	specific gravity
t	-	tonne
T	-	temperature
v.d.	-	vapour density
yd	-	yard

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HAZARDOUS MATERIALS: TWO-PAGE ENTRIES

ACETALDEHYDE CH_3CHO

IDENTIFICATION

UN No. 1089

Common Synonyms	Observable Characteristics	Manufacturers
ETHANAL ACETIC ALDEHYDE ETHYL ALDEHYDE ALDEHYDE	Clear, colourless, liquid. Sharp fruity odour.	Celanese Canada Limited, Edmonton, Alberta.

Transportation and Storage Information

Shipping State: Liquid (boiling).
Classification: Flammable liquid.
Inert Atmosphere: Inerted.
Venting: Safety relief.
Pump Type: Centrifugal; stainless steel.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.1, Group I.
Storage Temperature: Ambient.
Hose Type: Neoprene, polyethylene, polypropylene, PVC. Rubber not suitable.

Grades or Purity: Technical (>99%).
Containers and Materials: Drums, tank cars, tank trucks; lined or treated carbon steel, aluminum, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): Miscible in all proportions.
Molecular Weight: 44.1
Vapour Pressure: 740 mm Hg (20°C).
Boiling Point: 20.4°C.

Floatability (Water): Floats and mixes.
Odour: Sharp fruity odour, penetrating, pungent (0.01 to 0.21 ppm, odour threshold).
Flash Point: -50°C (o.c.); -38°C (c.c.).
Vapour Density: 1.5
Specific Gravity: 0.78 (20°C).

Colour: Colourless.
Explosive Limits: 4 to 60%.
Melting Point: -123.5°C.

HAZARD DATA

Human Health

Symptoms: Contact: exposure to vapours causes severe irritation of mucous membranes, blurred vision, reddening of skin, coughing, pulmonary edema and narcosis. Ingestion: nausea, vomiting, diarrhea, narcosis and respiratory failure.
Toxicology: Moderately toxic by ingestion, inhalation and contact.

TLV®- 100 ppm; 180 mg/m^3.
Short-term Inhalation Limits - 150 ppm; 270 mg/m^3 (15 min).

LC_{50} - 20,000 ppm/30 min.
LC_{Lo} - Inhalation: rat = 4 000 ppm/4 h
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 1.93 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, carbon dioxide, alcohol foam. Water may be ineffective, but may be used to cool fire-exposed containers. Water spray may be used to control vapours.
Behaviour in Fire: Flashback may occur along vapour trail.
Ignition Temperature: 185°C.
Burning Rate: 3.3 mm/min.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Can react vigorously with acid anhydrides, phenols, anhydrous ammonia, halogens, phosphorus, acetic acid and strong alkalis. May form explosive peroxide mixtures.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 53 ppm/96 h/sunfish/TLm/freshwater; 237 to 249 mg/L/96 h/Nitzschia linearis (alga) /LC_{50}/freshwater; 70 ppm/24 h/pin perch/TLm/saltwater; BOD: 93 to 127%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. Low boiling point.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call fire department. Eliminate all sources of ignition. Avoid contact and inhalation. Stay upwind and use water spray to control vapour. Stop or reduce discharge, if this can be done without risk. Contact supplier for guidance. Dike to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Acid suit - (jacket and pants) or coveralls. Boots - high, rubber (pants worn outside boots). Gloves - rubber or plastic.

Fire and Explosion

Maintain safe distance when fighting fire. Use dry chemical, carbon dioxide or alcohol foam. Water may be ineffective, but may be used to cool fire-exposed containers. Water spray may be used to control vapours. Flashback may occur along vapour trail.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped. Give oxygen if breathing is laboured. Contact: remove contaminated clothing. Wash eyes and skin with plenty of warm water for at least 15 minutes. Ingestion: give water to conscious victim to drink. If medical assistance is not immediately available, transport victim to hospital, clinic or doctor.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ACETIC ACID CH_3COOH

IDENTIFICATION

UN No. 2789 (glacial >80%)

Common Synonyms	Observable Characteristics	Manufacturers
GLACIAL ACETIC ACID ETHANOIC ACID METHANE CARBOXYLIC ACID VINEGAR ACID	Clear, colourless, liquid. Strong pungent vinegar odour.	Celanese Canada Limited, Edmonton, Alberta. Caledon Lab. Ltd. (glacial), Georgetown, Ontario.

Transportation and Storage Information

Shipping State: Liquid or solid.
Classification: Corrosive liquid.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: Centrifugal; stainless steel or plastic.

Label(s): Black and white label - CORROSIVE; Class 8, Group II.
Storage Temperature: Ambient.
Hose Type: Polyethylene, polypropylene, PVC.

Grades or Purity: Technical grades, 28%; 56%; 80%; 92%; glacial C.P., U.S.P. Glacial, 99.4%
Containers and Materials: Plastic containers, polylined steel drums; tank trucks, tank cars; aluminum; stainless steel; various plastics. For strengths greater than 98%, aluminum.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): Miscible in all proportions.
Molecular Weight: 60.1
Vapour Pressure: 11.4 mm Hg (20°C); 20 mm Hg (30°C).
Boiling Point: 118°C (glacial); 103°C (85% solution).

Floatability (Water): Sinks and mixes.
Odour: Strong, sharp, vinegar odour (0.21 to 1.0 ppm, odour threshold).
Flash Point: 43°C (o.c.); 40°C (c.c.).
Vapour Density: 2.1 (glacial); 2.0 (85%).
Specific Gravity: 1.05 (20°C) (glacial); 1.1 (85%).

Colour: Colourless.
Explosive Limits: 5.4 to 16%.
Melting Point: 16.6°C (glacial); -15°C (85%).

HAZARD DATA

Human Health

Symptoms: Contact: solutions are very corrosive and can cause severe burns to tissue. Inhalation: concentrated vapour can cause coughing, chest pain, irritation of nose and throat, nausea. Ingestion: burning sensation, nausea and vomiting, convulsions.
Toxicology: Corrosive upon inhalation, ingestion and contact.

TLV®- 10 ppm; 25 mg/m^3.
Short-term Inhalation Limits - 15 ppm; 37 mg/m^3 (15 min).

LC_{50} - Inhalation: mouse = 5 620 ppm/1 h
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 3.3 g/kg

Fire

Fire Extinguishing Agents: Use water spray, alcohol foam, dry chemical or carbon dioxide. Water spray may be used to cool fire-exposed containers, to control vapours, and to protect men effecting shut off.
Behaviour in Fire: At high temperture and in absence of O_2, decomposes releasing toxic fumes.
Ignition Temperature: 427°C (glacial). **Burning Rate:** 1.6 mm/min.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Can react vigorously with oxidizing materials including: acetaldehyde, chlorosulfonic acid, chromates, chromic acid, hydrogen peroxide, nitric acid, oleum, permanganates, sodium hydroxide and sodium peroxide.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 75 ppm/96 h/bluegill/TLm/freshwater; 47 mg/L/124 h/*Daphnia magna* (water flea)/LC_{50}/freshwater; 251 mg/L/96 h/mosquito fish/TLm/freshwater; BOD: 52 to 62%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Call Fire Department. Avoid contact and inhalation. Eliminate all ignition sources. Stay upwind and use water spray to control vapours. Stop or reduce discharge, if this can be done without risk. Contact supplier for guidance. Dike or dam to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection: self-contained breathing apparatus. Acid suit - (jacket and pants), rubber or plastic. Boots - high, rubber (pants worn outside boots). Gloves - rubber or plastic.

Fire and Explosion

Use water spray, dry chemical, alcohol foam or carbon dioxide. Cool fire-exposed containers with water.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped (not mouth-to-mouth method). Give oxygen if breathing is laboured. Contact: remove contaminated clothing. Wash eyes and skin with plenty of warm water for at least 15 minutes. Ingestion: give milk or water to conscious victim. Do not induce vomiting. If vomiting occurs, give more water to further dilute the chemical. Keep patient warm and quiet. If medical assistance is not immediately available, transport victim to hospital, clinic or doctor.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Neutralize contaminated area with lime.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ACETIC ANHYDRIDE $CH_3CO{\cdot}O{\cdot}COCH_3$

IDENTIFICATION

UN No. 1715

Common Synonyms	Observable Characteristics	Manufacturers
ETHANOIC ANHYDRIDE ACETIC OXIDE ACETYL OXIDE ACETIC ACID, ANHYDRIDE	Clear, colourless, liquid. Strong pungent vinegar-like odour.	Celanese Canada Limited, Edmonton, Alberta.

Transportation and Storage Information

Shipping State: Liquid. **Classification:** Corrosive liquid. **Inert Atmosphere:** No requirement. **Venting:** Pressure-vacuum. **Pump Type:** Centrifugal; stainless steel.	**Label(s):** Black and white label - CORROSIVE; Class 8, Group II. **Storage Temperature:** Ambient. **Hose Type:** Polyethylene, polypropylene, PVC.	**Grades or Purity:** Pure, 99% min. Technical, 75 to 98.5%. **Containers and Materials:** Drums, tank cars, tank trucks; aluminum, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid. **Solubility** (Water): Reacts to form acetic acid. **Molecular Weight:** 102.1 **Vapour Pressure:** 3.5 mm Hg (20°C); 7 mm Hg (30°C); 10 mm Hg (36°C). **Boiling Point:** 140°C.	**Floatability** (Water): Sinks and reacts, producing acetic acid. **Odour:** Strong, pungent, vinegar-like odour, (0.14 to 0.36 ppm, odour threshold). **Flash Point:** 58°C (o.c.); 49°C (c.c.). **Vapour Density:** 3.5 **Specific Gravity:** 1.08 (20°C).	**Colour:** Colourless. **Explosive Limits:** 2.7 to 10.3%. **Melting Point:** -73.1°C.

HAZARD DATA

Human Health

Symptoms: Contact: acetic anhydride is very corrosive and can cause severe burns to tissue. Inhalation: concentrated vapour can cause coughing, chest pain, irritation of nose and throat, nausea and vomiting. Ingestion: burning sensation, nausea, vomiting and convulsions.
Toxicology: Corrosive upon inhalation, ingestion and contact.

TLV®- 5 ppm; 20 mg/m^3. Short-term Inhalation Limits - No information.	LC_{50} - No information. LC_{Lo} - Inhalation: rat = 1 000 ppm/4 h Delayed Toxicity - No information.	LD_{50} - Oral: rat = 1.78 g/kg

Fire

Fire Extinguishing Agents: Use water spray, dry chemical and alcohol foam or carbon dioxide. Water spray may be used to cool fire-exposed containers, to control vapours, and to protect men effecting shut off.
Behaviour in Fire: No information.

Ignition Temperature: 390°C.	**Burning Rate:** 3.3 mm/min.

Reactivity

With Water: Reacts; forming acetic acid. Reaction is exothermic and may progress rapidly, causing a violent reaction after 15-30 minutes. Reacts violently if strong acid present.
With Common Materials: Reacts violenty with alkalis, chlorosulfonic acid, chromic anhydride, hydrochloric acid, nitric acid, oleum, hydrogen peroxide, hydrofluoric acid, permanganates, sodium hydroxide, glycerol and sulfuric acid.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 75 ppm/96 h/bluegill/TLm/fresh-water; 100 to 300 ppm/4 h/shrimp/LC_{50}/saltwater; BOD: 53%, 1 to 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Call Fire Department. Eliminate all ignition sources. Avoid contact and inhalation. Stay upwind and use water spray to control vapours. Stop or reduce discharge, if this can be done without risk. Contact supplier for guidance. Dike or dam to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self contained breathing apparatus. Acid suit - (jacket and pants) rubber or plastic. Boots - high, rubber (pants worn outside boots). Gloves - rubber or plastic.

Fire and Explosion

Fight fire from safe distance. Use water spray, dry chemical, alcohol foam or carbon dioxide. Cool fire-exposed containers with water.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped (not mouth-to-mouth method); give oxygen if breathing is laboured. Contact: remove contaminated clothing, wash eyes and skin with plenty of warm water for at least 15 minutes. Ingestion: give milk or water to conscious victim to drink. Do not induce vomiting. If vomiting occurs, give more water to further dilute the chemical. Keep patient warm and quiet. If medical assistance is not immediately available, transport victim to hospital, clinic or doctor.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Neutralize contaminated area with lime.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ACETONE CH_3COCH_3

IDENTIFICATION

UN No. 1090

Common Synonyms	Observable Characteristics	Manufacturers
DIMETHYLKETONE 2-PROPANONE METHYL KETONE	Clear, colourless, liquid. Sweet, fragrant odour.	Gulf Canada Limited, Montreal East, Quebec. Shell Canada Limited, Montreal, Quebec.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Through flame arrester or pressure-vacuum
Pump Type: Centrifugal, gear.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.1, Group II.
Storage Temperature: Ambient.
Hose Type: Polyethylene, Hypalon, natural rubber, butyl.

Grade or Purity: Technical and reagent - 99.5% + 0.5% water.
Containers and Materials: Drums, tank cars, tank trucks. Steel, stainless steel and aluminum.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): Soluble in all proportions.
Molecular Weight: 58.1
Vapour Pressure: 89 mm Hg (5°C); 182 mm Hg (20°C); 270 mm Hg (30°C).
Boiling Point: 56.2°C.

Floatability (Water): Floats and mixes.
Odour: Sweet, fragrant (0.46 to 140 ppm, odour threshold).
Flash Point: -15°C (o.c.); -18°C (c.c.).
Vapour Density: 2.0
Specific Gravity: 0.79 (20°C).

Colour: Colourless.
Explosive Limits: 2.2% to 13%.
Melting Point: -94.3°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - slight reddening and dryness; eyes - redness and irritation. Inhalation: coughing, headache, nausea, dizziness and narcosis. Ingestion: sore throat, headache, dizziness, narcosis and coma.
Toxicology: Only slightly toxic upon contact, inhalation and ingestion.

TLV® - 750 ppm; 1 780 mg/m^3.
Short-term Inhalation Limits - 1 000 ppm; 2 375 mg/m^3 (15 min).

LC_{50} - No information.
LC_{Lo} - Inhalation: rat = 64 000 ppm/4 h
Delayed Toxicity - No information.

LD_{50} - Oral : rat = 9.75 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, carbon dioxide or alcohol foam. Water in straight hose stream should not be used as it will scatter and spread fire. Water may be used to cool fire-exposed containers, control vapours and protect men effecting shut off.
Behaviour in Fire: Extremely flammable. Flash back may occur along vapour trail.
Ignition Temperature: 465°C.
Burning Rate: 3.9 mm/min.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Reacts violently with chromic oxide, chloroform, hydrogen peroxide (nitric and acetic acids), (nitric and sulfuric acids).
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 14 250 ppm/24 h/sunfish/killed/tap water; 11 493 to 11 727 ppm/120 h/Nitzchia linearis (alga)/LC_{50}/freshwater; 10 mg/L/36 h/TLm/Daphnia magna/freshwater; BOD: 38 to 81%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Eliminate all ignition sources. Notify manufacturer. Avoid contact or inhalation. Stop or reduce discharge, if safe to do so. Contain spill by diking. In fire, stay upwind and use water spray to control vapours. Notify environmental authorities.

Protective Clothing and Equipment

In fires and confined spaces: Respiratory protection - self-contained breathing apparatus. Goggles - (mono), tight fitting (or face shield). Gloves - rubber. Boots - high, rubber (pants worn outside boots). Coveralls - of impervious material.

Fire and Explosion

Use dry chemical, carbon dioxide or alcohol foam. Do not use water in straight hose stream, as it may scatter and spread the fire. Water may be used to cool fire-exposed containers. Flash back may occur along vapour trail.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped; give oxygen if breathing is laboured. Contact: skin - remove contaminated clothing and wash affected areas; eyes - flush and irrigate thoroughly water. Ingestion: give plenty of warm water to conscious victim to drink and induce vomiting. If medical assistance is not immediately available, transport to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ACETONITRILE CH_3CN

IDENTIFICATION

UN No. 1638

Common Synonyms	Observable Characteristics	Manufacturers
METHYL CYANIDE CYANOMETHANE ETHANENITRILE ETHYL NITRILE	Clear, colourless, liquid. Sweet, ethereal odour.	Caledon Laboratories, Georgetown, Ont. U.S. Manufacturer: Eastman Chemical Products, Inc., Kingston, TN.

Transportation and Storage Information

Shipping State: Liquid. **Classification:** Flammable liquid; poison. **Inert Atmosphere:** No requirement. **Venting:** Pressure-vacuum. **Pump Type:** No information.	**Label(s):** Red label - FLAMMABLE LIQUID; Class 3.2, Group II. White label - POISON; Class 6.1, Group II. **Storage Temperature:** Ambient. **Hose Type:** No information.	**Grades or Purity:** Technical. **Containers and Materials:** Drums, tank cars, tank trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid. **Solubility (Water):** Miscible in all proportions. **Molecular Weight:** 41.1 **Vapour Pressure:** 74 mm Hg (20°C); 115 mm Hg (30°C). **Boiling Point:** 81.6°C.	**Floatability (Water):** Floats and mixes. **Odour:** Sweet, etheral (39.8 ppm, odour threshold). **Flash Point:** 5.6°C (o.c.); 12.8°C (c.c.). **Vapour Density:** 1.4 **Specific Gravity:** 0.79 (20°C).	**Colour:** Colourless. **Explosive Limits:** 4.4% to 16%. **Melting Point:** -44 to -47°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - may be absorbed yielding symptoms similar to inhalation; eyes - redness. Inhalation: nose and throat irritation, headache, dizziness, laboured breathing. Ingestion: headache, dizziness, delirium, convulsions, paralysis and death due to central nervous system depression.
Toxicology: Toxic by contact, ingestion and inhalation.

TLV® (skin) 40 ppm; 70 mg/m^3. Short-term Inhalation Limits - (skin) 60 ppm; 105 mg/m^3 (15 min).	LC_{50} - No information. LC_{Lo} - Inhalation : rat = 8 000 ppm/4 h Delayed Toxicity - No information.	LD_{50} - Oral: rat = 3.8 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, alcohol foam or carbon dioxide. Can react with hot water or steam to produce toxic cyanide gas, therefore, water should not be employed. Water spray may be used, however, to cool fire-exposed containers and knock vapour down.
Behaviour in Fire: Flash back may occur along vapour trail.

Ignition Temperature: 524°C.	**Burning Rate:** 2.7 mm/min.

Reactivity

With Water: No reaction with cold water; soluble. Can react with hot water or steam to produce toxic cyanide gas.
With Common Materials: Reacts with acids to produce cyanide gas. Can react violently with sulfuric acid, oleum, chlorosulfonic acid, and perchlorates.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: I 150 ppm/24 h/fathead minnow/TLm/hard water; I 850 mg/L/96 h/bluegill/TLm/freshwater; BOD: 17%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE; POISON. Poisonous gases produced.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE; POISON". CALL FIRE DEPARTMENT. Eliminate all ignition sources. Call supplier for guidance. Avoid contact and inhalation. Stop or reduce discharge, if this can be done without risk. Dike to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Protective clothing - suit, coveralls; rubber. Gloves - rubber. Boots - rubber.

Fire and Explosion

Use dry chemical, alcohol foam or carbon dioxide. Can react with hot water or steam to produce toxic cyanide gases, therefore, water should not be used. Flash back may occur along vapour trail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped give artificial respiration. If breathing is laboured give oxygen. Contact: remove contaminated clothing. Wash eyes and affected skin with plenty of water for at least 15 minutes. Ingestion: give water or milk to conscious victim to drink. Keep warm and quiet. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Remove contaminated soil for disposal.
8. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ACETYLENE C_2H_2

IDENTIFICATION

UN No. 1001

Common Synonyms	Observable Characteristics	Manufacturers
ETHYNE ETHINE	Pure acetylene is a colourless, odourless gas. Typical, commercial acetylene has a garlic-like odour, due to impurities.	Canadian Liquidair Ltd., Montreal, Que., London, Ont., Winnipeg, Man., Regina, Sask., Union Carbide Canada Ltd., Oakville, Ontario; Montreal, Que. Gulf Oil Canada Ltd., Shawinigan, Que., Varennes, Que.

Transportation and Storage Information

Shipping State: Gas or acetylene dissolved in acetone.
Classification: Flammable gas.
Inert Atmosphere: Not required.
Venting: Closed.
Pump Type: Not pertinent.

Label(s): Red label - FLAMMABLE GAS; Class 2.1.
Storage Temperature: Ambient.
Hose Type: Special - high pressure.

Grades or Purity: Commercial (dissolved in acetone), Technical 98% acetylene <0.05% by volume of phosphine or hydrogen sulfide.
Containers and Materials: Cylinders; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility (Water): 0.11g/100mL (0°C).
Molecular Weight: 26.0
Vapour Pressure: 33 600 mm Hg (21°C).
Boiling Point: -84°C.

Floatability (Water): Floats (liquefied).
Odour: Garlic-like (commercial product); odourless (pure).
Flash Point: -17.8°C (c.c.)
Vapour Density: 0.91
Specific Gravity: 0.62 (-80°C, liquid).

Colour: Colourless.
Explosive Limits: 2.5 to 82%.
Melting Point: -81.8°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: asphyxiant, 10% in air - no symptoms; 25%, reversible narcosis; 40%, collapse.
Toxicology: Relatively nontoxic but can cause asphyxiation by exclusion of oxygen.
TLV® - No information.
LC_{50} - No information.
LD_{50} - No information.
Short-term Inhalation Limits - No information.
Delayed Toxicity - None.
OSHA Standard - CL 2 500 ppm (based on pure acetylene).

Fire

Fire Extinguishing Agents: Allow escaping acetylene to burn if flow cannot be shut off safely. Carbon dioxide, water spray or dry chemical may be used. Cool cylinders exposed to heat and flame with water spray.
Behaviour in Fire: The heat from a small fire can melt the cylinder fusible plug, resulting in increased flow and much larger fire. Exposed containers may rupture.
Ignition Temperature: 305°C.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: Under certain conditions, acetylene forms explosive compounds with copper, silver, mercury and their compounds. May react violently with fluorine, chlorine, bromine, iodine, and nitric acid. Can react vigorously with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 1 000 cc/L/1 h/sunfish/not killed/freshwater; 200 mg/L/33 h/rainbow trout/TLm/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. Reactive with many compounds.

Immediate Responses

Keep non-involved people away and upwind from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Notify manufacturer or supplier. Extinguish all sources of ignition. Allow cylinder to burn unless shutoff can be effected. Call environmental authorities.

Protective Clothing and Equipment

In fires or enclosed spaces: Respiratory protection - use self-contained breathing apparatus.

Fire and Explosion

Allow to burn unless shutoff can be effected. Fight fires from safe distance. Acetylene forms explosive mixture in confined space. Danger of container rupture in fire. Use water to cool fire-exposed, adjacent containers. Use carbon dioxide, dry chemical to extinguish.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ACROLEIN CH_2CHCHO

IDENTIFICATION

UN No. 1092 inhibited
2607 dimer

Common Synonyms	Observable Characteristics	Manufacturers
ACRYLALDEHYDE 2-PROPENAL ALLYL ALDEHYDE ACRALDEHYDE	Colourless to yellow liquid. Pungent, acrid odour.	No Canadian manufacturer. Selected U.S. manufacturers: Shell Chemical Company, Houston, Texas. Union Carbide Corp., New York, NY.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: (material for seals) Garlock 233, 929; Duraplastic 22, Durametallic 10, Raybestos (Raybestos-Manhattan Inc.)

Label(s): Red label - FLAMMABLE LIQUID; dimer, Class 3.3, Group II; inhibited, Class 3.1, Group I.
Storage Temperature: Ambient.
Hose Type: Natural rubber, Thiokol 262T, Silastic 180, Garlock 7021, butyl.
DO NOT USE NEOPRENE.

Grades or Purity: Industrial (92+%) inhibited with hydroquinone.
Containers and Materials: Drums, tank cars.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 20.6 g/100 mL (20°C).
Molecular Weight: 56.1
Vapour Pressure: 220 mm Hg (20°C); 330 mm Hg (30°C).
Boiling Point: 52.5°C.

Floatability (Water): Floats.
Odour: Pungent, acrid (0.05 to 1.5 ppm, odour threshold).
Flash Point: -17°C (o.c.); -26°C (c.c.).
Vapour Density: 1.94
Specific Gravity: 0.84 (20°C).

Colour: Colourless to yellow.
Explosive Limits: 2.8 to 31%.
Melting Point: -87°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin-smarting, burning sensation, inflammation and blistering; eyes - burning sensation, watering, inflammation, loss of sight. Inhalation: irritation of mucous membranes, difficulty breathing, headache, nausea, muscular weakness and chemical bronchitis. Ingestion: sore throat, intense thirst, abdominal cramps, nausea and vomiting, difficulty breathing, convulsions.
Toxicology: Toxic by contact, ingestion and inhalation.
TLV® - 0.1 ppm; 0.25 mg/m^3.
Short-term Inhalation Limits - 0.3 ppm; 0.8 mg/m^3 (15 min).

LC_{50} - No information.
LC_{Lo} - Inhalation: human = 153 ppm (10 min).
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 0.046 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, alcohol foam or carbon dioxide. Water may be ineffective but may be used to keep fire-exposed containers cool and knock down vapours.
Behaviour in Fire: In fire, polymerization may occur which may cause violent container rupture. Flash back may occur along vapour trail.
Ignition Temperature: 234°C.
Burning Rate: 3.8 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Extremely violent polymerization reaction results when in contact with alkaline materials, such as caustics, ammonia or amines, or with strong acids, such as sulfuric or nitric acids. Reacts with oxidizing materials.
Stability: Unstable if not inhibited (0.1 to 0.25% hydroquinone).

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 0.5 ppm/24 h/Elodea sp. (plant)/kills all cells/freshwater; 0.08 pm/24 h/salmon/TLm/freshwater; 0.065 ppm/24 h/rainbow trout/TLm/freshwater; BOD: Not available.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. POISONOUS. CAN POLYMERIZE VIOLENTLY.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE; POISON". CALL FIRE DEPARTMENT. Eliminate all ignition sources. Call manufacturer or supplier for advice. Dike to prevent runoff. Avoid inhalation or contact. Shutoff discharge if this can be done without risk. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves - rubber. Outer protective clothing as required - acid suit, coveralls. Boots - high, rubber (pants worn outside boots).

Fire and Explosion

Dry chemical, alcohol foam or carbon dioxide may be used. Water may be ineffective but may be used to keep fire-exposed containers cool and knock down vapours. Flash back may occur along vapour trail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if not breathing, apply artificial respiration (not mouth-to-mouth method). If breathing is laboured, give oxygen. Contact: wash eyes and affected skin with plenty of water for at least 15 minutes. Remove contaminated clothing at same time. Ingestion: if conscious, victim should drink large amounts of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Remove contaminated soil for disposal.
8. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ACRYLONITRILE CH_2CHCN

IDENTIFICATION

UN No. 1093

Common Synonyms	Observable Characteristics	Manufacturers	
VINYL CYANIDE CYANOETHYLENE 2-PROPENENITRILE	Colourless to light yellow liquid. Irritating peach-like odour.	No Canadian manufacturers. Canadian Supplier: Du Pont Canada, Maitland, Ont. Monsanto Canada, Sarnia, Ont. Borg-Warner, Cobourg, Ont. Polysar, Sarnia, Ont.	Originating from: E.I. Du Pont de Nemours & Co. Inc. Wilmington, DE Monsanto Co., St. Louis, MO Vistron Corp., Cleveland, OH

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable; poison.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: No information.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.2, Group I. White label - POISON; Class 6.1, Group I.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Technical, 98 to 100%.
Containers and Materials: Barrels, tank cars, tank trucks; steel, stainless steel (no copper or copper alloys).

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 7 g/100 mL (20°C).
Molecular Weight: 53.1
Vapour Pressure: 100 mm Hg (22.8°C); 137 mm Hg (30°C).
Boiling Point: 77.4°C.

Floatability (Water): Floats.
Odour: Irritating, pungent, peach-like, (1.7 to 23 ppm, odour threshold).
Flash Point: 0°C (o.c.); -4°C (c.c.).
Vapour Density: 1.8
Specific Gravity: 0.80 (20°C).

Colour: Colourless to light yellow.
Explosive Limits: 3 to 17%.
Melting Point: -83.6°C.

HAZARD DATA

Human Health

Symptoms: Ingestion: sore throat, difficulty breathing, nausea, vomiting, abdominal pain. Inhalation or skin contact: nausea, vomiting, weakness, shortness of breath, collapse and loss of consciousness.
Toxicology: Extremely toxic by inhalation, ingestion or skin contact.
TLV®- (inhalation) 2 ppm; 4.5 mg/m^3.
Short-term Inhalation Limits - No information.
LC_{50} - Inhalation: guinea pig = 576 ppm/4 h
Delayed Toxicity - Potential carcinogen.
LD_{50} - Oral: rat = 0.082 g/kg

Fire

Fire Extinguishing Agents: Use alcohol foam, carbon dioxide or dry chemical. Water spray may be ineffective, but may be used to keep fire-exposed containers cool and knock down vapours.
Behaviour in Fire: Flashback may occur along vapour trail. Thermal decomposition may produce oxides of nitrogen, carbon monoxide and carbon dioxide. Exposed containers may rupture.
Ignition Temperature: 481°C.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: Can react violently with strong acids, alkalis, and bromine. Can react vigorously with oxidizing agents.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 11.8 mg/L/96 h/bluegill/TLm/soft water; 25 mg/L/24 h/sunfish/TLm/soft water; 14.3 mg/L/96 h/fathead minnow/TLm/freshwater; BOD: 70%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE; POISON". CALL FIRE DEPARTMENT. Eliminate all ignition sources. Call manufacturer for advice. Avoid contact and inhalation. Stay upwind and use water spray to control vapour. Dike spill area. Stop or reduce discharge, if this can be done without risk. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and full protective clothing.

Fire and Explosion

Use dry chemical, alcohol foam or carbon dioxide to extinguish. Water may be ineffective, but may be used to cool fire-exposed containers. Burning acrylonitrile may release cyanide gases. Flash back may occur along vapour trail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: flush eyes and skin with plenty of water and remove contaminated clothing. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method), if laboured give oxygen. Ingestion: give plenty of water to conscious victim to drink, and induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on material or synthetic sorbents.
7. Remove contaminated soil for disposal.
8. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ADIPIC ACID $COOH(CH_2)_4COOH$

IDENTIFICATION

UN No. Na 9077

Common Synonyms

ADIPIC ACID
1,4-BUTANEDICARBOXYLIC ACID
HEXANEDIOIC ACID

Observable Characteristics

White crystals or powder. Odourless.

Manufacturers

Du Pont Canada,
Maitland, Ontario.

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not regulated. Class 9.2, Group III.
Storage Temperature: Ambient.

Grades or Purity: Commercial, 99.8%.
Containers and Materials: Bottles, tins, multi-wall paper bags and drums.

Physical and Chemical Characteristics

Physical State Solid.
Solubility (Water): 1.5 g/100 mL (15°C); 1.6 g/100 mL (20°C).
Molecular Weight: 146.1
Vapour Pressure: 0.28 mm Hg (97°C).
Boiling Point: 337°C (decomposes).

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: 196°C (c.c.).
Vapour Density: 5.0
Specific Gravity: 1.36 (20°C).

Colour: White.
Explosive Limits: 10 to 15 mg/L (dust).
Melting Point: 151 to 153°C.

HAZARD DATA

Human Health

Symptoms: Contact (liquid): eyes - irritation; skin - pronounced drying effect. Inhalation (dust, vapour): irritation of mucous membranes causing sneezing and coughing. Ingestion: sore throat and abdominal pain.
Toxicology: Relatively non-toxic.
TLV® - No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: mouse = 1.9 g/kg

Fire

Fire Extinguishing Agents: Use foam, water fog, dry chemical or carbon dioxide.
Behaviour in Fire: Melts and may decompose to produce volatile acidic vapours of valeric acid and other substances. Dust may form explosive mixture with air.
Ignition Temperature: 420°C.

Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: <330 ppm/24 h/bluegill/TLm/freshwater; BOD: 36 to 60%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Call Fire Department. Avoid contact or inhalation of dust or fumes. Dike to prevent runoff. Call manufacturer for advice. Contact environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces, Respiratory protection - self-contained breathing apparatus. Otherwise, protective clothing as required.

Fire and Explosion

Use foam, water fog, dry chemical or carbon dioxide to extinguish. Dust may form explosive mixture with air.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes and skin - flush with large amounts of water and remove contaminated clothing. Ingestion: give water to conscious victim to drink. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ALUMINUM ALKYL COMPOUNDS

IDENTIFICATION

UN No. 1101 diethylaluminum chloride
1925 EASC
2220 solution } aluminum alkyl halides
2221 pure }

Common Synonyms

TMA $(CH_3)_3Al$ Trimethylaluminum;
MASC $(CH_3)_3Al_2Cl_3$ Methylaluminum Sesquichloride;
TEA $(C_2H_5)_3Al$ Triethylaluminum*;
DEAC $(C_2H_5)_2AlCl$ Diethylaluminum Chloride;
EASC $(C_2H_5)_3Al_2Cl_3$ Ethylaluminum Sesquichloride;
EADC $C_2H_5AlCl_2$ Ethylaluminum Dichloride;
DEAI $(C_2H_5)_2AlI$ Diethylaluminum Iodide;
TIBA $(iC_4H_9)_3Al$ Triisobutylaluminum*;
DIBAH $(iC_4H_9)_2AlH$ Diisobutylaluminum Hydride;
DIBAC $(iC_4H_9)_2AlCl$ Diisobutylaluminum Chloride;
DEZ $(C_2H_5)_2Zn$ Diethylzinc.
(*most common).

Observable Characteristics

Typically clear liquids, which fume or burn on contact with air.

Manufacturers

Ethyl Corporation of Canada Ltd.
Corunna, Ontario
Toronto, Ontario
U.S. manufacturer:
Ethyl Corporation,
Houston, Texas.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: Nitrogen.
Venting: No venting, special container.
Pump Type: Pumped by nitrogen gas pressure.

Label(s): Red, black and white label - FLAMMABLE LIQUID; Class 4.2.
Storage Temperature: Ambient.
Hose Type: Stainless steel, flexible stainless steel, KEL-F, graphite - asbestos.

Grades or Purity: 88 to 94%.
Containers and Materials: Special containers. Alkyltainer (1 gallon); Dual valve (3, 5, 26 gallon); portable tank (250, 430, 1 980 gallon); tank trailer (6 200 to 7 200 gallon) and tank car (11 100 gallon).

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility: (Water): Reacts violently.
Molecular Weight: TMA, 72.1; TEA, 114.2; TIBA, 198.3
Vapour Pressure: 0.76 mm Hg (60°C) (TMA).
Boiling Point: TMA, 126°C; TEA, 187°C; TIBA, 114°C (decomposes).

Floatability (Water): Reacts violently and ignites.
Odour: No information.
Flash Point: TEA, -53°C; TIBA, 0°C; TMA <-18°C.
Vapour Density: TMA, 2.0
Specific Gravity: TMA, 0.6; TEA, 0.83; TIBA, 0.78 (25°C).

Colour: Colourless.
Explosive Limits: No information.
Melting Point: TMA, 15.4°C; MASC, 22.8°C; TEA, -46°C; DEAC, -74°C; DASC, -21°C; EADC, 32°C; DEAI, -43°C; TIBA, 1°C; DIBA, -80°C; DIBAC, -39°C; DEZ, -28°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - produce severe chemical and thermal burns. Inhalation: sore throat, laboured breathing, may cause metal fume fever.
Toxicology: Relatively toxic by contact and inhalation.
TLV® - 2 mg/m³.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - No information.

Fire

Fire Extinguishing Agents: Stop or reduce discharge. Use dry chemical extinguishers. DO NOT USE WATER.
Behaviour in Fire: PYROPHORIC - IGNITES ON CONTACT WITH AIR. REACTS EXPLOSIVELY WITH WATER. Residue may reignite when disturbed.
Ignition Temperature: TMA, 190°C; TIBA, <4°C. **Burning Rate:** No information.

Reactivity

With Water: Reacts explosively with water.
With Common Materials: Reacts with air, acids, alcohols, oxidizers, carbon tetrachloride and other halogenated hydrocarbons.
Stability: Stable, when not exposed to water or air.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating: 100 to 1 000 mg/L/TLm/freshwater (for TEA).
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

PYROPHORIC - IGNITES ON CONTACT WITH AIR, REACTS EXPLOSIVELY WITH WATER.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT (but warn them about the pyrophoric properties -NO WATER). Contact manufacturer for assistance. Do not attempt to control discharge without advice or assistance from the manufacturer, or other knowledgeable person. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves - loose fitting, rubber, asbestos or leather. Other protective equipment - full aluminized proximity type suit when transferring material from one container to another on large scale.

Fire and Explosion

PYROPHORIC - ignites on contact with air. Reacts explosively with water. Extinguishing agent - dry powder extinguisher. DO NOT USE WATER, Avoid - water, air, acids, alcohols, oxidizers, carbon tetrachloride and other halogenated compounds. Also avoid high temperature and shock.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - irrigate gently with water for at least 15 minutes; skin - wash with plenty of water for at least 15 minutes and remove contaminated clothing. Inhalation: remove from exposure to smoke and fumes of combustion. Ingestion: wash out mouth promptly. Get medical attention at once. If medical attention is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ALUMINUM CHLORIDE $AlCl_3$

IDENTIFICATION

UN No. 1726 anhydrous
2581 solution

Common Synonyms	Observable Characteristics	Manufacturers
ALUMINUM CHLORIDE, ANHYDROUS TRICHLOROALUMINUM	Orange to yellow, through grey to white crystalline solid or powder. Hydrogen chloride odour.	Welland Chemical of Canada Ltd., Sarnia, Ontario.

Transportation and Storage Information

Shipping State: Solid.
Classification: Corrosive.
Inert Atmosphere: No information.
Venting: No information.

Label(s): Black and white label - CORROSIVE; Class 8, Group III.
Storage Temperature: Ambient.

Grades or Purity: Technical, 98.5% $AlCl_3$ min.
Containers and Materials: Drums, flow bins, trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 69.9 g/100 mL (15°C) (reacts).
Molecular Weight: 133.5
Vapour Pressure: No information.
Boiling Point: 183°C.

Floatability (Water): Sinks and mixes with violent exothermic reaction, evolving hydrogen chloride gas.
Odour: Hydrogen chloride odour. (1 to 10 ppm, HCl odour threshold).
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 2.4 (25°C).

Colour: Orange to yellow, through grey to white.
Explosive Limits: Not flammable.
Melting Point: 194°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes - redness, pain, blurred vision; skin - redness and pain. Inhalation: sore throat, coughing, laboured breathing. Ingestion: burning sensation, stomach cramps, dizziness, diarrhea, shock, convulsions, coma.
Toxicology: Moderately toxic, corrosive by ingestion and contact.
TLV® - 5 ppm; 7 mg/m^3 (as HCl). LC_{50} - No information. LD_{50} - Oral: rat = 3.7 g/kg
Short-term Inhalation Limits - No information. Delayed Toxicity - No information.

Fire

Fire Extinguishing Agents: Not flammable or combustible. Most fire extinguishing agents may be used, but a violent reaction will result (hydrogen chloride evolution) if streams of water are directed on aluminum chloride.
Behaviour in Fire: May react in fires to produce chloride gases.
Ignition Temperature: Not flammable. **Burning Rate:** Not flammable.

Reactivity

With Water: Reacts exothermically evolving hydrogen chloride gas.
With Common Materials: Old containers can explode upon opening. Can react violently with allyl chloride, ethylene, ethylene oxide, sodium and potassium.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

CORROSIVE. REACTS WITH WATER.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". If Fire Department is called, warn them against use of water. Avoid contact or inhalation. If dry, shovel or scoop up as much as possible. If wet or on fire, contain spill by diking with dry earth or other available material. Stop or reduce discharge, if this can be done without risk. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - use self-contained breathing apparatus. Gloves - rubber. Boots - rubber, safety (pants worn outside boots).
Outerwear - as required; with aquatic spills, acid suits may be needed.

Fire and Explosion

Most fire extinguishing agents (except water) may be used on fires involving aluminum chloride.
Aluminum chloride is not explosive or flammable, but a violent exothermic reaction results (hydrogen chloride evolution) on contact with water.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - irrigate immediately with plenty of water for at least 15 minutes; skin: flush with plenty of water for at least 15 minutes. Contaminated clothing should be removed at once. (When no moisture is present, minor skin irritation only may occur.) Ingestion: is most unlikely, but if it occurred, the immediate local reaction would cause severe burns, not dependent on any toxic action. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ALUMINUM HYDROXIDE $Al_2O_3.3H_2O$ or $Al(OH)_3$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
ALUMINUM HYDROXIDE GEL ALUMINUM HYDRATE HYDRATED ALUMINA ALUMINATRIHYDRATE	White, crystals, powder or granules. Odourless.	Aluminum Co. of Canada Ltd., Montreal, Quebec. Exolon Co. of Canada Ltd., Thorold, Ontario. General Abrasive (Can.) Ltd., Niagara Falls, Ont. Norton Co., Niagara Falls, Ontario. Welland Chemical Ltd., Mississauga, Ontario.

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not regulated.
Storage Temperature: Ambient.

Grades or Purity: Technical.
Containers and Materials: Bags, drums, bulk lots.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.01 g/100 mL (18°C).
Molecular Weight: 78
Vapour Pressure: No information.
Boiling Point: Loses H_2O at 300°C.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 2.4 (20°C).

Colour: White.
Explosive Limits: Not flammable.
Melting Point: Loses H_2O at 300°C.

HAZARD DATA

Human Health

Symptoms: Inhalation (dust): aluminum containing dust or fumes can cause pulmonary reactions and long-term effects.
Toxicology: Relatively nontoxic material.
TLV® 10 mg/m^3 (dust).
Short-term Inhalation Limits - (dust) 20 mg/m^3 (15 min).

LC_{50} - No information.
Delayed Toxicity - Chronic exposure to dust can cause respiratory problems.

LD_{50} - No information.
LD_{Lo} - Intraperitoneal: rat = 0.15 g/kg

Fire

Fire Extinguishing Agents: Most fire extinguishing agents may be used on fires involving aluminum hydroxide.
Behaviour in Fire: Not flammable or combustible.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: No known reactions.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Toxic to aquatic life; but of low solubility.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Dust respirator may be required in confined areas. Protective clothing as required.

Fire and Explosion

Not flammable or combustible. Most fire extinghishing agents may be used on fires involving aluminum hydroxide.

First Aid

Move victim out of spill area. Contact: skin and eyes - flush with water and remove contaminated clothing. Ingestion: induce vomiting by giving salt water to drink. Transport to medical aid if unsure of victim's condition upon inhalation.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids, and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ALUMINUM SULFATE $Al_2(SO_4)_3$

IDENTIFICATION

UN No. 1750 anhydrous

Common Synonyms	Observable Characteristics	Manufacturers
ALUM CAKE ALUM FILTER ALUM PAPER MAKER'S ALUM PATENT ALUM PICKLE ALUM PEARL ALUM (tetradecahydrate also known as Liquid Alum), $Al_2(SO_4)_3 \cdot 14H_2O$).	Granular white powder. Odourless.	Allied Chemical, Valleyfield, Que., Dalhousie, N.B., Thorhold, Ont., Barnett, B.C. Inland Chemicals Canada Ltd., Fort Saskatchewan, Alta. Alcan Smelters and Chemicals Ltd., Jonquière, Que.

Transportation and Storage Information

Shipping State: Solid and liquid (aqueous solution).
Classification: Corrosive.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Black and white label - CORROSIVE; Class 8, Group I.
Storage Temperature: Ambient.

Grades or Purity: Technical, 45% solution.
Containers and Materials: Bags, fibre drums, multi-wall paper sacks, bulk by truck or train. Solution (45% $Al(SO_4)_3 \cdot 14\ H_2O$ in water); drums, tank trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 27.8 g/100 mL (25°C); anhydrous: 87 g/100 mL (0°C) hydrate.
Molecular Weight: 342 anhydrous; 594 hydrate.
Vapour Pressure: No information.
Boiling Point: Anhydrous 770°C (decomposes); hydrate solution 101°C.

Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not combustible.
Vapour Density: No information.
Specific Gravity: 2.7 anhydrous (20°C); 1.7 hydrate (17°C); solution 1.34 (20°C)

Colour: White.
Explosive Limits: Not combustible.
Melting Point: Anhydrous 770°C (decomposes); hydrate solution -16°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin and eyes - irritated by dust. Ingestion: nausea, vomiting. Inhalation: sore throat, coughing, irritation of nose and throat.
Toxicology: Relatively non-toxic.
TLV® - No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Intraperitoneal: mouse = 0.27 g/kg
LD_{50} - Oral: mouse = 6.1 g/kg

Fire

Fire Extinguishing Agents: Most fire extinguishing agents may be used on fires involving aluminum sulfate.
Behaviour in Fire: Not flammable or combustible. May evolve toxic SO_3 gas at high temperatures (above 760°C).
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: Reacts with water to produce sulfuric acid.
With Common Materials: May corrode metals in presence of moisture.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 240 ppm/48 h/mosquito fish/TLm/freshwater; BOD: Not available.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Avoid contact. Stop or reduce discharge, if this can be done without risk. Notify supplier. Notify environmental authorities.

Protective Clothing and Equipment

Goggles - (mono) type, tight fitting. Coveralls, gloves and boots - all acid resistant.

Fire and Explosion

Not flammable or combustible. Most fire extinguishing agents may be used on fires involving aluminum sulfate.

First Aid

Move victim away from spill site to fresh air. Call for medical assistance, but start first aid at once. Contact - skin with water and remove contaminated clothing; eyes - flush with plenty of warm water for at least 15 minutes. Ingestion - give milk or water to conscious victim. Keep victim warm and quiet. If medical assistance is not immediately available, transport victim to hospital, clinic or doctor.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pumps to remove contaminants, liquids, and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMINOCARB $C_{11}H_{16}N_2O_2$

IDENTIFICATION

UN No. 2757
Danger Group According to Active Substance
Group II >60 to 100%
Group III Solid 6 to 60%
Liquid 1 to 60%

Common Synonyms	Observable Characteristics	Manufacturers
4-DIMETHYLAMINO-M-TOLYL METHYLCARBAMATE 4-DIMETHYLAMINO-3-METHYLPHENOL METHYLCARBAMATE	Light brown solid or liquid.	Chemagro Corp., Kansas City, Mo.

Common Trade Names

MATACIL
(An insecticide often used for spruce bud worm control.)

Transportation and Storage Information

Shipping State: Solid or liquid (formulations).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: No information.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Solution of typically 18%.
Containers and Materials: Drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid (technical).
Solubility (Water): Slightly soluble (technical).
Molecular Weight: 208.3
Vapour Pressure: No information.
Boiling Point: No information.

Floatability (Water): Sinks.
Odour: No information.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: >1.0 (technical).

Colour: Light brown.
Explosive Limits: Not flammable.
Melting Point: 93 to 94°C.

HAZARD DATA

Human Health

Symptoms: Inhalation, Ingestion or Contact (absorbed by skin): dizziness nausea, salivation, tearing, abdominal cramps, vomiting, sweating, slow pulse, impairment of visual acuity.
Toxicology: Highly toxic by all routes.
TLV® - No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 0.030 g/kg
LD_{50} - Intraperitoneal: mouse = 0.007 g/kg

Fire

Fire Extinguishing Agents: Use carbon dioxide, foam or dry chemical.
Behaviour in Fire: Releases toxic fumes in fires.
Ignition Temperature: No information.

Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 0.13 - 0.16 ppm/rainbow trout/LC_{50}/96h/freshwater.
Land-Air: LD_{50}: Oral: Wild bird = 0.05 g/kg
Food Chain Concentration Potential: Unknown.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces - Respiratory Protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion

Use carbon dioxide, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim to drink and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available, transport victim to hospital, doctor, or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats

3. If possible contain discharge by booming.
4. If floating, skim and remove.

Sinks or mixes

3. If possible contain discharge by damming or water diversions.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Absorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Available Formulations

Technical Grade: Purity: 99%
Properties: combustible, sinks in water.

SN Solution

Purity:
- typically 18%, remainder is organic, polar solvent

Properties:
- combustible, possibly miscible in water

AMMONIA (anhydrous) NH_3

IDENTIFICATION

UN No. 1005

Common Synonyms	Observable Characteristics	Manufacturers
	Colourless gas. Sharp, irritating, ammonia odour.	Canadian Industries Limited, Courtright, Ontario. Cominco Limited, Carseland, Alta. Cyanamid of Canada Limited, Niagara Falls, Ont. Canadian Fertilizers Ltd., Medicine Hat, Alta.

Transportation and Storage Information

Shipping State: Liquid (compressed gas). **Classification:** Poisonous gas. **Inert Atmosphere:** No requirement. **Venting:** Relief valve (250 psi) on all pressure containers except cylinders. **Pump Type:** No information.	**Label(s):** White label - POISONOUS GAS; Class 2.3. **Storage Temperature:** Ambient. **Hose Type:** No information.	**Grades or Purity:** Commercial 99.5%; refrigeration 99.95%. **Containers and Materials:** Cylinders, tank cars, tank trucks; most metals except tin, copper, aluminum or lead.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas. **Solubility** (Water): 89.9 g/100 mL (0°C); 36.4 g/100 mL (20°C); 7.4 g/100 mL (100°C). **Molecular Weight:** 17.0 **Vapour Pressure:** 6657 mm Hg (21.1°C); 4 800 mm Hg (15.5°C). **Boiling Point:** -33.4°C.	**Floatability** (Water): Floats, boils and mixes. **Odour:** Sharp, irritating, pungent. (47 ppm, odour threshold). **Flash Point:** Not flammable. **Vapour Density:** 0.60 (0°C). **Specific Gravity:** 0.68 (-33.4°C) (liquid); 0.6 (25°C).	**Colour:** Colourless. **Explosive Limits:** 16 to 25% by volume. **Freezing Point:** -77.7°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes - extremely irritating, can cause loss of vision; skin - burning and blistering, liquid ammonia causes frostbite. Inhalation: suffocation, difficulty breathing, coughing.
Toxicology: Toxic by inhalation.

TLV®- 25 ppm; 18 mg/m^3. Short-term Inhalation Limits - 35 ppm, 27 mg/m^3 (15 min).	LC_{50} - Inhalation: rat = 4 837 ppm/1 h Delayed Toxicity - No information.	LD_{50} - Oral: rat = 0.35 g/kg

Fire

Fire Extinguishing Agents: Stop discharge before attempting to extinguish fire. Water may be used to cool fire-exposed containers and knock down vapours.
Behaviour in Fire: Low fire hazard. Slight danger of explosion (gas) in enclosed space at 16 to 25% by volume with air, under certain conditions.
Ignition Temperature: 650°C. **Burning Rate:** 1 mm/min.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Forms explosive compounds in contact with silver, acetaldehyde, acrolein, halogens, chlorates, chlorites, chromates, ethylene oxide, nitric acid, nitrogen tetroxide and silver chloride. Corrodes copper, tin, lead, brass, bronze and galvanized steel.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in very low concentrations. Aquatic toxicity rating = 1 to 10 ppm/96 h/TLm/freshwater; 0.66 ppm/48 h/Daphnia magna/LC_{50}/freshwater; 8.2 ppm/96 h/fathead minnow/TLm/freshwater; 0.5 ppm/24 h/rainbow trout/TLm/freshwater.
Land-Air: Widely used for direct application to soil as source of nitrogen.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

POISONOUS GAS.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISONOUS GAS". Call Fire Department. Evacuate area in case of large leaks or tank rupture. Stay upwind. Stop or reduce discharge if this can be done without risk. Contact manufacturer for guidance. Use water spray to knock vapours down. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and gastight suit.

Fire and Explosion

Stop discharge before attempting to extinguish fire. Water may be used to cool fire-exposed containers and knock down vapours.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, start artificial respiration immediately; if breathing is laboured, oxygen may be given. Contact: eyes - hold lids open and irrigate constantly for at least 30 min with warm water; skin: remove clothing immediately and flood affected area for at least 15 min with warm water. If medical aid is not immediately available, transport victim to hospital doctor, or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMMONIUM CHLORIDE NH_4Cl

IDENTIFICATION

UN No. Na 9085

Common Synonyms	Observable Characteristics	Manufacturers	
SAL AMMONIAC AMMONIUM MURIATE	White crystals. Odourless.	No Canadian manufacturers. Canadian supplier: Allied Chemical Mississauga, Ontario. Chemical Industries Ltd., Montreal, Quebec.	Originating from: Allied Chemical, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: Not regulated.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): None. Class 9.2, Group II
Storage Temperature: Ambient.

Grades or Purity: Technical 99+%.
Containers and Materials: Multiwall paper bags and barrels.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 30 g/100 mL (0°C); 37.2 g/100 mL (20°C); 77 g/100 mL (100°C).
Molecular Weight: 53.5
Vapour Pressure: 1 mm Hg (160.4°C).
Boiling Point: 520°C.

Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: 1.9
Specific Gravity: 1.53 (20°C).

Colour: White.
Explosive Limits: Not flammable.
Melting Point: Sublimes at 340°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes and skin - irritating. Inhalation: irritates nose, throat and respiratory passages. Ingestion: nausea and vomiting.
Toxicology: Moderately toxic upon ingestion and inhalation.
TLV®- 10 mg/m^3 (fume).
Short-term Inhalation Limits - 20 mg/m^3 (fume) (15 min).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 1.65 g/kg

Fire

Fire Extinguishing Agents: Most fire extinguishing agents may be used on fires involving ammonium chloride. Water spray may be used to knock down fumes.
Behaviour in Fire: Not flammable or combustible; at very high temperatures evolves ammonia and hydrogen chloride.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Can react violently with ammonium nitrate and potassium chlorate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 6 ppm/96 h/sunfish/TLm/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Dike to prevent runoff from water application. Call manufacturer or supplier. Call environmental authorities.

Protective Clothing and Equipment

In fires; Respiratory protection - self-contained breathing apparatus. Goggles. Gloves - rubber. Boots, coveralls - rubber.

Fire and Explosion

Not flammable or combustible. Most fire extinguishing agents may be used on fires involving ammonium chloride. Water spray may be used to knock down fumes.

First Aid

Move victim from spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: skin - remove contaminated clothing and wash skin thoroughly with warm water; eyes - irrigate with plenty of warm water. Ingestion: give milk or water to conscious victim. Keep victim warm and quiet. If medical aid is not immediately available, transport victim to doctor, hospital or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMMONIUM HYDROXIDE NH_4OH

IDENTIFICATION

UN No. 2672

Common Synonyms	Observable Characteristics	Manufacturers
AQUA AMMONIA AMMONIUM HYDRATE AMMONIA SOLUTION AMMONIA WATER AMMONIA LIQUOR	Colourless liquid. Sharp, irritating, ammonia odour.	Canadian Industries Ltd., Courtright, Ont. Canadian Fertilizers Ltd., Medicine Hat, Alta. Cominco Ltd., Carseland, Alta. Cyanamid Canada Ltd., Niagara Falls, Ont. Simplot Chemical Ltd., Brandon, Man. Western Co-op Fertilizers Ltd., Calgary, Alta.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Corrosive liquid.
Inert Atmosphere: No requirement.
Venting: Pressure - vacuum.
Pump Type: Centrifugal; all iron or stainless steel. No copper alloys, brass or bronze.

Label(s): Black and white label - CORROSIVE LIQUID; Class 8, Group II.
Storage Temperature: Ambient.
Hose Type: PVC, rubber, polyethylene (steel or SS fittings only).

Grades or Purity: Grade A: 29.4% NH_3; B: 25%; C: 15%; USP: 27 to 29%; CP: 28%.
Containers and Materials: Plastic bottles, drums, tank trucks, tank cars (steel, steel polylined).

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): Soluble in all proportions.
Molecular Weight: 35.1 (solute).
Vapour Pressure: 10% NH_3, 31 mm Hg (0°C); 159 mm Hg (27°C). 20% NH_3, 88 mm Hg (0°C); 310 mm Hg (27°C); 30% NH_3, 238 mm Hg (0°C); 786 mm Hg (27°C).
Boiling Point: 25% NH_3, 36°C.

Floatability (Water): Floats and mixes.
Odour: Sharp, characteristic. (50 ppm, odour threshold).
Flash Point: Flammable as NH_3.
Vapour Density: 0.6
Specific Gravity: 0.90 (15.5°C).

Colour: Colourless.
Explosive Limits: Mixtures of air and NH_3 (16% to 25% NH_3) by volume may ignite or explode in an enclosed space if sparked or exposed to temperatures exceeding 649°C (1 200°F).
Melting Point: 25% NH_3, 77°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - redness, pain, burns; eyes - pain, watering, burns and damage. Inhalation: (of NH_3 vapours) irritation of nose, eyes and throat, difficulty breathing, coughing, chemical bronchitis. Ingestion: burning sensation in mouth, throat and stomach, pain in swallowing, nausea and vomiting of blood, stomach cramps, rapid breathing, diarrhea.
Toxicology: Relatively toxic by ingestion and inhalation.
TLV® 25 ppm; 18 mg/m^3 (as NH_3).
Short-term Inhalation Limits - 35 ppm, 27 mg/m^3 (as NH_3) (15 min).
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - Oral: rat = 0.35 g/kg

Fire

Fire Extinguishing Agents: Not flammable. Most fire extinguishing agents may be used on fires involving ammonium hydroxide.
Behaviour in Fire: Not flammable. Mixtures of ammonia and air in an enclosed space with an ignition source could be explosive. When heated, releases ammonia gas.
Ignition Temperature: Not flammable as solution; flammable as NH_3, 649°C.
Burning Rate: Not flammable.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Copper, tin, zinc and alloys are readily corroded. Reacts with acrolein, acrylic acid, chlorosulfonic acid, dimethyl sulfate, halogens, hydrochloric acid, hydrofluoric acid, nitric acid, sulfuric acid, oleum, propylene oxide and silver nitrate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 6.25 ppm/24 h/rainbow trout/lethal/freshwater; 20 ppm/96 h/Daphnia magna/static bioassay/TLm/acute/freshwater; Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: Not available.
Land-Air: Ammonium hydroxide is widely used as a source of nitrogen for application to farm land.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Call Fire Department (keep upwind). Call manufacturer for guidance. Avoid contact and inhalation of vapours. Stop or reduce discharge, if this can be done without risk. Dike spill to prevent runoff. Use water spray to knock down vapours, and to cool containers exposed to fire. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Acid suit. Gloves - gauntlet type - rubber or plastic coated. Boots - high, rubber (pants worn outside boots).

Fire and Explosion

Not flammable, but when heated releases ammonia gas. Most fire extinguishing agents may be used on fires involving ammonium hydroxide. Use water spray to knock down vapours and cool containers.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, start artificial respiration at once (not mouth-to-mouth method). If breathing is laboured, give oxygen. Contact: eyes - hold lids open and irrigate constantly for at least 30 minutes; skin - remove clothing immediately and flood affected area with water for at least 15 minutes. Ingestion: if victim is conscious, give large quantity of water to dilute the ammonia. Do not induce vomiting. If medical assistance is not quickly available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge, by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMMONIUM NITRATE NH_6NO_3

IDENTIFICATION

UN No. 1942 <0.2% combustible substances
0222 ammonium nitrate
0223, 2068, 2069, 2070, 2071 fertilizers

Common Synonyms	Observable Characteristics	Manufacturers
GERMAN SALTPETER NORWAY SALTPETER NITRAM	White to grey or brown. Odourless.	Canadian Industries Ltd., Courtright, Ontario; Nobel, Ont., Carseland, Alta., McMasterville, Que. Cominco Limited, Calgary, Alta. Cyanamid of Canada Ltd., Niagara Falls, Ontario. Esso Chemical Canada, Redwater, Alta. Du Pont Canada, North Bay, Ont.

Transportation and Storage Information

Shipping State: Solid.
Classification: Oxidizing material.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Yellow label - OXIDIZER; Class 5.1, Group III.
Storage Temperature: Ambient.

Grades or Purity: Reagent grade. Fertilizer and explosive grades.
Containers and Materials: Bags (poly); bulk, trucks, rail cars.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 118 g/100 mL (0°C); 192 g/100 mL (20°C).
Molecular Weight: 80.1
Vapour Pressure: No information.
Boiling Point: Decomposes >210°C.

Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Detonates under certain circumstances.
Vapour Density: No information.
Specific Gravity: 1.7 (20°C).

Colour: White to grey or brown.
Explosive Limits: Detonates under certain circumstances.
Melting Point: 170°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin and eyes - irritation of eyes and mucous membranes. Inhalation: sore throat, coughing, shortness of breath. Ingestion: large amounts cause dizziness, cramps and vomiting.
Toxicology: Moderately toxic by contact and ingestion.
TLV® - No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - No information.

Fire

Fire Extinguishing Agents: Use flooding amounts of water in early stages of fire. Exercise caution in application of water on molten material to stop spread of fire.
Behaviour in Fire: In decomposition or burning, generates poisonous NO_X fumes. May explode if heated in container.
Ignition Temperature: Detonates under certain circumstances.
Burning Rate: No information.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Ammonium nitrate is an oxidizing material and can cause any organic materials to burn. Can react with powdered metals, chlorides, phosphorus, sodium and sulfur.
Stability: Stable, within the limits of the foregoing.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; Fish toxicity: 800 µg/L/3.9 h/bluegill/killed/tapwater; 4 545 µg/L/90 h/goldfish/killed/distilled water.
Land-Air: Ammonium nitrate is widely used as a fertilizer. Livestock toxicity: 400 ppm (water).
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

OXIDIZER. Can detonate under certain circumstances.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "OXIDIZER". Call Fire Department. Evacuate hazard area. Fight fires by water flooding. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Use self-contained breathing apparatus and gastight suit, if involved in a fire. Chemical goggles - (tight fitting). Gloves - rubber or plastic. Acid suit - (jacket and pants) or coveralls (if gastight suit not available). Boots - high, rubber (pants worn over boots). When not involved with fire - gloves, boots and coveralls.

Fire and Explosion

Apply water immediately in as large a volume as possible. Cool any fire-exposed containers with water and continue after fire is out.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid immediately. Inhalation: if breathing has stopped, give artificial respiration. If breathing is laboured, give oxygen. Contact: eyes - rinse eyes thoroughly with plenty of water; skin - remove contaminated clothing and wash affected areas thoroughly with water. Ingestion: give milk or water to conscious victim. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMMONIUM PHOSPHATES

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
AMMONIUM PHOSPHATE, monobasic $NH_4H_2PO_4$ AMMONIUM ACID PHOSPHATE AMMONIUM BIPHOSPHATE AMMONIUM DIHYDROGEN PHOSPHATE AMMONIUM PHOSPHATE, primary AMMONIUM PHOSPHATE, dibasic $(NH_4)_2HPO_4$ AMMONIUM PHOSPHATE, secondary DIAMMONIUM HYDROGEN PHOSPHATE	White crystals or powder. Odourless.	Esso Chemical Canada Ltd., Redwater, Alta. Simplot Chemical Ltd., Brandon, Man. Belledune Fertilizer Ltd., Belledune, NB Cominco Ltd., Kimberley; Trail, B.C.

Transportation and Storage Information

Shipping State: Solid. **Classification:** None. **Inert Atmosphere:** No requirement. **Venting:** Open.	**Label(s):** None. **Storage Temperature:** Ambient.	**Grades or Purity:** Technical; fertilizer (dibasic). **Containers and Materials:** Multiwall paper bags, barrels, bulk lots.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid. **Solubility** (Water): monobasic; 22.7 g/100 mL (0°C); 173.2 g/100 mL (100°C). dibasic, 57 g/100 mL (10°C); 106 g/100 mL (70°C). **Molecular Weight:** monobasic, 115; dibasic, 132.1 **Vapour Pressure:** No information. **Boiling Point:** monobasic decomposes at >150°C; dibasic decomposes at 155°C.	**Floatability** (Water): Sinks and mixes. **Odour:** Odourless. **Flash Point:** Not flammable. **Vapour Density:** No information. **Specific Gravity:** dibasic: 1.6 at 20°C; monobasic 1.8 at 20°C.	**Colour:** White. **Explosive Limits:** Not flammable. **Melting Point:** Monobasic 190°C; dibasic decomposes at 155°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: monobasic form causes irritation of mucous membranes; dibasic form; ammonia vapours in closed area can cause lung irritation and asphyxia. Contact: causes skin and eye irritation.
Toxicology: Low order of toxicity by inhalation, contact or ingestion.

TLV® No information. Short-term Inhalation Limits - No information.	LC_{50} - No information. Delayed Toxicity - No information.	LD_{50} - No information.

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving ammonium phosphates.
Behaviour in Fire: Not combustible. Toxic and irritating fumes of ammonia and nitrogen oxides may form in fires.

Ignition Temperature: Not combustible.	**Burning Rate:** Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Monobasic reacts violently with sodium hypochlorite.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 155 ppm/96 h/fathead minnow/LC_{50}/freshwater; Aquatic toxicity rating = 100 to 1 000 ppm/96 h/TLm/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Dike to prevent water runoff. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined areas Respiratory protection - self-contained breathing apparatus. Otherwise, protective clothing as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving ammonium phosphates.

First Aid

Remove victim from spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped give artificial respiration; if laboured, give oxygen. Contact: skin and eyes - wash with large amounts of water. Ingestion: give water or milk to conscious victim. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Dike to prevent runoff from rainwater or water application.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMMONIUM SULFATE $(NH_4)_2SO_4$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
DIAMMONIUM SULFATE	White to brownish-grey crystals. Odourless.	Cominco Ltd., Trail, B.C. Sherritt Gordon Mines, Fort Saskatchewan, Alta.

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): None.
Storage Temperature: Ambient.

Grades or Purity: Commercial, technical.
Containers and Materials: Multiwall paper bags, drums, railroad cars, trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 41 g/100 mL (0°C); 43.4 g/100 mL (25°C); 50.4 g/100 mL (100°C).
Molecular Weight: 132.1
Vapour Pressure: No information.
Boiling Point: Decomposes at 230°C.

Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 1.77 (20°C).

Colour: White to brownish-grey.
Explosive Limits: Not flammable.
Melting Point: Decomposes at 230°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation from dust. Ingestion: abdominal pain and nausea.
Toxicology: Relatively nontoxic.
TLV® No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 3 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire fighting agents may be used on fires involving ammonium sulfate. Water spray or flooding may be effective.
Behaviour in Fire: When heated above 235°C releases toxic gases such as ammonia, SO_2 and SO_3.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Reacts violently with potassium chlorate, potassium nitrate and (potassium and ammonium nitrate).
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 1 290 ppm/96 h/mosquito fish/TLm/freshwater; 292 ppm/96 h/Daphnia magna/TLm/freshwater; BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Dike to prevent water runoff. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined areas Respiratory protection - self-contained breathing apparatus. Otherwise, protective clothing as required.

Fire and Explosion

Decomposition above 235°C releases toxic gases; ammonia, SO_2 and SO_3.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: skin and eyes - wash with large amounts of water. Ingestion: give water or milk to conscious victim. If medical aid is not immediately available, transport victim to doctor, hospital or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Dike to prevent runoff from rainwater or water application.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

AMYL ACETATE $CH_3COOC_5H_{11}$

IDENTIFICATION

UN No. 1104

Common Synonyms	Observable Characteristics	Manufacturers
ACETIC ACID AMYL ESTER AMYLACETIC ESTER BANANA OIL PEAR OIL PENTYL ACETATE ACETIC ACID PENTYL ESTER	Clear, colourless to yellow liquid. Fruity, banana-like or pear-like odour.	Cosmos Chemlac Limited, Port Hope, Ontario.

Transportation and Storage Information

Shipping State: Liquid. **Classification:** Flammable liquid. **Inert Atmosphere:** No requirement. **Venting:** Open. **Pump Type:** Gear or centrifugal (grounded).	**Label(s):** Red label - FLAMMABLE LIQUID; Class 3.2, Group II. **Storage Temperature:** Ambient. **Hose Type:** Polyethylene, polypropylene, etc.	**Grades or Purity:** Commercial 85 to 88%; technical 90 to 95%; pure 95 to 99%. **Containers and Materials:** Drums, tank cars, tank trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid. **Solubility** (Water): 0.18 g/100 mL (20°C). **Molecular Weight:** 130.2 **Vapour Pressure:** 9 mm Hg (25°C); 10 mm Hg (35.2°C). **Boiling Point:** 146 to 149°C.	**Floatability** (Water): Floats. **Odour:** Banana-like or pear-like (0.002 to 0.86 ppm, odour threshold). **Flash Point:** 27°C (o.c.); 25°C (c.c.). **Vapour Density:** 4.5 **Specific Gravity:** 0.88 (20°C).	**Colour:** Colourless to yellow. **Explosive Limits:** 1.0-7.5% **Melting Point:** -100°C (pure); (-71°C lesser purities).

HAZARD DATA

Human Health

Symptoms: Inhalation: high concentrations cause irritation of eyes, nose and throat; anaesthetic effect; dizziness, nausea and vomiting, coughing, chest pain and shortness of breath. Contact: causes skin and eye irritation. Ingestion: can cause nausea, vomiting, narcosis, drowsiness, loss of consciousness.
Toxicology: Moderately toxic by inhalation and ingestion.

TLV® 100 ppm; 530 mg/m^3. Short-term Inhalation Limits - 150 ppm, 800 mg/m^3 (15 min).	LC_{50} - No information. LC_{Lo} - Inhalation: rat = 5 200 ppm/8 h Delayed Toxicity - No information.	LD_{50} - Oral: rat = 6.5 g/kg

Fire

Fire Extinguishing Agents: Use alcohol foam, dry chemical or carbon dioxide. Water may be ineffective, but may be used to keep fire-exposed containers cool.
Behaviour in Fire: Containers may rupture violently when exposed to heat or flame. Flash back may occur along vapour trail.

Ignition Temperature: 360°C.	**Burning Rate:** 4.1 mm/min.	**Electrical Hazard:** Class 1, Group D.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicities: 120 ppm/48 h/Daphnia magna /TLm/turbid water; 65 mg/L/48 h/mosquito fish/TLm/freshwater; 180 ppm/96 h/Scenedesmus (algae)/TLm/freshwater; Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: 0.3 to 0.8 lb/lb, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Eliminate all ignition sources. Notify manufacturer or supplier. Avoid contact and inhalation. Stop or reduce discharge, if safe to do so. Contain spill by diking. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - In fires or confined spaces, use self-contained breathing apparatus. Otherwise, Goggles - (mono), tight fitting. Gloves - rubber. Boots - high, rubber (pants worn outside boots). Outer protective clothing as required.

Fire and Explosion

Use dry chemical, alcohol foam or carbon dioxide. Water may be ineffective, but may be used to cool fire-exposed containers. Flash back may occur along vapour trail.

First Aid

Move victim out of spill area, to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped. Give oxygen if breathing is laboured. Contact: skin and eyes - irrigate eyes with water for at least 15 minutes. Flush skin with plenty of water, while removing contaminated clothes. Ingestion: give milk or water to conscious victim. If medical assistance is not quickly available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ANILINE $C_6H_5NH_2$

IDENTIFICATION

UN No. 1547

Common Synonyms	Observable Characteristics	Manufacturers	
ANILINE OIL PHENYLAMINE AMINOBENZENE BENZENAMINE	Colourless to yellow-brown, oily liquid. Amine-like odour.	No Canadian manufacturer. Canadian supplier: Uniroyal Chemical, Elmira, Ont.	Originating from: Rubicon, USA

Transportation and Storage Information

Shipping State: Liquid.
Classification: Poisonous liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: Positive displacement, centrifugal; carbon steel, stainless steel.

Label(s): White label - POISONOUS LIQUID; Class 6.1, Group II.
Storage Temperature: Ambient.
Hose Type: Viton, butyl, polyethylene.

Grades or Purity: Commercial, 99.5% min.
Containers and Materials: Drums, tank cars, tank trucks; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 3.7 g/100 mL (30°C); 6.4 g/100 mL (100°C).
Molecular Weight: 93.1
Vapour Pressure: 0.3 mm Hg (20°C); 1 mm Hg (35°C); 2.4 mm Hg (50°C).
Boiling Point: 184.2°C.

Floatability (Water): Sinks. (May not sink in very saline water.)
Odour: Amine-like (0.095 to 1.0 ppm, odour threshold).
Flash Point: 75.6°C (o.c.); 70.0°C (c.c.).
Vapour Density: 3.2
Specific Gravity: 1.02 (20°C).

Colour: Colourless to yellow-brown.
Explosive Limits: 1.3% (LEL).
Melting Point: -6.1°C.

HAZARD DATA

Human Health

Symptoms: Toxic by inhalation, ingestion and skin absorption: headache, nausea, dizziness, cyanosis, abdominal pain, convulsions.
Toxicology: High order of toxicity through skin absorption, ingestion or inhalation.
TLV® (inhalation and skin) 2 ppm; 10 mg/m^3
Short-term Inhalation Limits - 5 ppm; 20 mg/m^3 (15 min).

LC_{50} - Inhalation: mouse = 175 ppm/7 h
Delayed Toxicity - Damage to red blood cells, liver and kidney. May cause embryo or fetal damages.

LD_{50} - Oral: rat = 0.44 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, foam or carbon dioxide. Use water to cool fire-exposed containers and knock down vapours.
Behaviour in Fire: Flammable toxic NO_x and CO may be given off in a fire.
Ignition Temperature: 650°C.
Burning Rate: 3.0 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Reacts vigorously with oxidizing materials. Reacts moderately to violently with acetic anhydride, chlorosulfonic acid, nitric acid, sulfuric acid, oleum, perchromates, performic acid and silver perchlorate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 1 020 ppm/1 h/sunfish/killed/freshwater; Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: 150%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Call Fire Department. Avoid contact and inhalation. Contact manufacturer or supplier for advice. Stay upwind and use water spray to control vapour. Dike runoff. Stop or reduce discharge, if safe to do so. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - use only self-contained breathing apparatus. Totally encapsulated protective clothing. Boots - high, rubber (pants worn outside boots). Gloves - rubber.

Fire and Explosion

Use dry chemical, alcohol foam, carbon dioxide. Water may be ineffective, but may be used to cool fire-exposed containers.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if not breathing give artificial respiration (not mouth-to-mouth method), if breathing is laboured give oxygen. Contact: remove contaminated clothing; wash affected areas with warm water and soap if available for at least 15 minutes; eyes - irrigate, holding lids apart for at least 15 minutes. Ingestion: induce vomiting, but only in conscious victim. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Remove material by manual or mechanical means.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Remove contaminated soil for disposal.
8. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ARSENIC As

IDENTIFICATION

UN No. 1557

Common Synonyms	Observable Characteristics	Manufacturers	
GREY ARSENIC METALLIC ARSENIC ELEMENTAL ARSENIC	Silver-grey lustrous, crystalline solid or black amorphous powder. Odourless.	No Canadian manufacturers. U.S. manufacturer and supplier: ASARCO Incorporated, 120 Broadway, New York, NY	Major Canadian users: Degussa, Burlington, Ontario. International Chemical, Brampton, Ontario. Kingsley and Keith Canada Ltd., Montreal, Quebec.

Transportation and Storage Information

Shipping State: Solid.
Classification: Poisonous solid.
Inert Atmosphere: No requirement.
Venting: No requirement.

Label(s): White label - POISONOUS SOLID; Class 6.1, Group II.
Storage Temperature: Ambient.

Grades or Purity: Technical, refined, crude 90 to 95%.
Containers and Materials: Drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): <0.003 g/100 mL (20°C).
Atomic Weight: 74.9
Vapour Pressure: 1 mm Hg (372°C).
Boiling Point: Sublimes at 613°C.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 5.7 (20°C) (metallic); 4.7 (20°C) (black amorphous).

Colour: Silver-grey to black.
Explosive Limits: Not flammable (dust concentrations may explode).
Melting Point: 814°C (28 atm); sublimes 613°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - burning and stinging sensation, tightness in chest, nausea, bronzing of skin. Inhalation: (dust) restlessness, difficulty breathing, cyanosis, cough and foamy sputum. Ingestion: nausea, vomiting, abdominal pain, diarrhea, convulsions and coma.
Toxicology: Extremely toxic upon inhalation of dust, fumes; ingestion and skin contact.
TLV® 0.2 mg/m^3.
Short-term Inhalation Limits - No Information.
LC_{50} - Information not available.
Delayed Toxicity - Liver and kidney damage.
LD_{50} - No information.
LD_{Lo} - Intramuscular: rat = 0.02 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving arsenic.
Behaviour in Fire: Not combustible; but highly toxic As, and As_x fumes released.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Emits highly toxic gas (arsine) on contact with hydrogen gas and also with acids plus reducing metals (e.g. Zn, Fe); burns spontaneously with gaseous chlorine. Reacts with bromates, chlorates, iodate, peroxides, potassium nitrate, potassium permanganate, silver nitrate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. EPA criterion = 57 mg/L/24 h/average; maximum of 130 mg/L at any time (freshwater); 29 mg/L/24 h/average should not exceed 67 mg/L at anytime (saltwater).
Land-Air: No information.
Food Chain Concentration Potential: Arsenic may be accumulated in food chain.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISONOUS". Avoid contact and inhalation. Prevent dust dispersion. Use full protective clothing and self-contained breathing apparatus. If possible, stop discharge, if safe to do so. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus, and totally encapsulated protective clothing.

Fire and Explosion

Not combustible, but most fire extinguishing agents may be used on fires involving arsenic.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: skin - remove contaminated clothing and wash eyes and affected skin thoroughly with plenty of water. Ingestion: keep victim warm and quiet. Treat as a severe emergency. Transport victim to hospital, doctor or clinic immediately.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove materials by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ARSENIC TRIOXIDE As_2O_3

IDENTIFICATION

UN No. 1561

Common Synonyms	Observable Characteristics	Manufacturers
WHITE ARSENIC CRUDE ARSENIC ARSENIOUS OXIDE ARSENOUS ANHYDRIDE ARSENIC SESQUIOXIDE	White powder. Odourless.	No known Canadian producer or supplier. U.S. producer: ASARCO Incorporated, 120 Broadway, New York, NY. Major Canadian Users: Degussa, Burlington, Ontario. International Chemical, Brampton, Ontario. Kingsley and Keith Canada Ltd., Montreal, Quebec.

Transportation and Storage Information

Shipping State: Solid. **Classification:** Poisonous solid. **Inert Atmosphere:** No requirement. **Venting:** No requirement.	**Label(s):** White label - POISONOUS SOLID; Class 6.1, Group II. **Storage Temperature:** Ambient.	**Grades or Purity:** Crude, 95%; refined, 99%. **Containers and Materials:** Drums, barrels, truck lots.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid. **Solubility (Water):** 1.2 g/100 mL (0°C); 2.1 g/100 mL (25°C). **Molecular Weight:** 197.8 **Vapour Pressure:** No information. **Boiling Point:** 457°C.	**Floatability (Water):** Sinks (finely divided powder may temporarily float). **Odour:** Odourless. **Flash Point:** Not flammable. **Vapour Density:** No information. **Specific Gravity:** 3.87 (25°C).	**Colour:** White. **Explosive Limits:** Not flammable. **Melting Point:** 312 to 315°C; sublimes at 193°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - may be absorbed, redness, pain, serious skin burns, other symptoms as for inhalation may appear. Inhalation: sore throat, coughing, vomiting, weakness, thirst, shallow breathing, convulsions. Ingestion: nausea, vomiting, severe abdominal pain, diarrhea.
Toxicology: Extremely toxic upon inhalation of dust, fumes; ingestion and skin contact.

TLV® 0.2 mg/m^3 (as arsenic). Short-term Inhalation Limits - No information.	LC_{50} - No information. Delayed Toxicity - Carcinogen.	LD_{50} - Oral: rat = 0.02 g/kg LD_{50} - Oral: mouse = 0.045 g/kg LD_{50} - Oral: human = 0.0014 g/kg

Fire

Fire Extinguishing Agents: Not combustible, but most fire extinguishing agents may be used on fires involving arsenic trioxide.
Behaviour in Fire: At high temperatures, As_2O_3 will volatilize, giving off dangerous fumes, such as arsenic trioxide, arsine.
Ignition Temperature: Not combustible. **Burning Rate:** Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Metals and other substances containing As_2O_3 in contact with acids will liberate arsine (AsH_3), a colourless, highly toxic gas. Reacts vigorously with fluorine and chlorate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in very low concentrations. Aquatic toxicity rating = 1 to 10ppm/96 h/TLm/freshwater; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: Accumulation in shellfish is a known example.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Avoid contact. Stop or reduce discharge, if safe to do so. If water is being used to fight fire, dike area to contain toxic runoff. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and fully encapsulated protective clothing.

Fire and Explosion

Not combustible; most fire extinguishing agents may be used on fires involving arsenic trioxide.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: skin and eyes - remove contaminated clothing and wash eyes and affected skin thoroughly with plenty of water. Ingestion: keep victim warm and quiet. Treat as a severe emergency. Transport victim to hospital, doctor or clinic immediately.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove materials by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ARSINE AsH_3

IDENTIFICATION

UN No. 2188

Common Synonyms	Observable Characteristics	Manufacturers
ARSENIC HYDRIDE ARSENIURETTED HYDROGEN ARSENIC TRIHYDRIDE ARSENOUS HYDRIDE	Colourless gas. Garlic-like odour.	

Transportation and Storage Information

Shipping State: Liquid (compressed gas). **Classification:** Poison, flammable. **Inert Atmosphere:** No requirement. **Venting:** Safety, relief. **Pump Type:** No information.	**Label(s):** White label - POISON; Red label - FLAMMABLE. **Storage Temperature:** Ambient. **Hose Type:** No information.	**Grades or Purity:** Technical. **Containers and Materials:** Cylinders; steel.

Physical and Chemical Characteristics

Physical State (20°C), 1 atm): Gas. **Solubility** (Water): 0.07 g/100 mL (20°C). **Molecular Weight:** 78.0 **Vapour Pressure:** 765 mm Hg (-62°C); 11 360 mm Hg (21°C). **Boiling Point:** -62.5°C.	**Floatability** (Water): Sinks and boils. **Odour:** Garlic-like. **Flash Point:** No information (flammable). **Vapour Density:** 2.7 **Specific Gravity:** 1.65 (liquid) (-73.2°C).	**Colour:** Colourless. **Explosive Limits:** No information (flammable). **Melting Point:** -117°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: headache, dizziness, nausea, difficulty breathing, cyanosis, dry cough, abdominal pain, convulsions, bronzing of skin; Contact: skin - frostbite, painful irritation, inflammation, blisters - symptoms similar to inhalation; eyes - irritation, watering, inflammation and burning.
Toxicology: Highly toxic by inhalation.

TLV®- 0.05 ppm; 0.2 mg/m^3. Short-term Inhalation Limits - No information.	LD_{50} - No information. LCL_o - Inhalation: human = 25 ppm/30 min LCL_o - Inhalation: rat = 300 mg/m^3/15 min Delayed Toxicity - Symptoms may be delayed up to two days.	LD_{50} - No information.

Fire

Fire Extinguishing Agents: Shut off leak before attempting to extinguish fire. Most fire extinguishing agents may be used in fires involving arsine.
Behaviour in Fire: Releases toxic fumes in fire. Flash back may occur along vapour trail.
Ignition Temperature: No information. **Burning Rate:** No information.

Reactivity

With Water: No reaction.
With Common Materials: Can react vigorously with oxidizing materials. Reacts violently with chlorine, nitric acid and (potassium and ammonia).
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. 57 µg/L freshwater EPA criterion 24 h average (as Arsenic); 29 µg/L saltwater EPA criterion 24 h average (as arsenic).
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON. FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning "POISON; FLAMMABLE". CALL FIRE DEPARTMENT. Avoid contact and inhalation. Evacuate from downwind. Notify manufacturer or supplier. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally-encapsulated suit.

Fire and Explosion

Shut off leak before attempting to extinguish fire. Most fire extinguishing agents may be used on fires involving arsine. Releases toxic fumes in fire.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; treat as for frostbite; eyes - irrigate with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Recover undamaged containers.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ASPHALT

IDENTIFICATION

UN No. 1993

Common Synonyms	Observable Characteristics	Manufacturers
PETROLEUM ASPHALT BITUMEN	Dark brown to black solid (unheated) or thick liquid (heated). Strong tarry odour.	Most oil refineries.

Transportation and Storage Information

Shipping State: Solid; liquid (heated).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not regulated.
Storage Temperature: Ambient or elevated.

Grades or Purity: Various grades. Industrial, special, paving, rapid curing, medium curing, slow curing and emulsified.
Containers and Materials: Drums, bulk lots, tank cars, tank trucks, steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Insoluble.
Molecular Weight: Variable.
Vapour Pressure: Variable.
Boiling Point: 190 to 400°C.

Floatability (Water): May float or sink.
Odour: Tarry.
Flash Point: 10 to 200°C.
Vapour Density: No information.
Specific Gravity: Variable; 0.9 to 1.2 (20°C).

Colour: Brown to black.
Explosive Limits: No information.
Melting Point: Variable; >40°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritates respiratory tract. Contact: skin and eyes - fumes irritate.
Toxicology: Low order of toxicity.
TLV - (petroleum fumes) 5 mg/m^3
Short-term Inhalation Limits - 10 mg/m^3 (15 min) (petroleum fumes).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - No information.
TD_{Lo} - Intramuscular: rat = 5.4 g/kg

Fire

Fire Extinguishing Agents: Dry chemical or carbon dioxide. Water or foam may cause frothing.
Behaviour in Fire: No information.
Ignition Temperature: 300 to 485°C.

Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials. Reacts with fluorine.
Stability: Stable.

Environment

Water: Prevent entry into water intakes or waterways. Fouling to shoreline is major hazard.
Land-Air: Fouling to landscape.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

COMBUSTIBLE.

Immediate Responses

Keep non-involved people away from spill site. Call Fire Department. Avoid contact. Stop or reduce discharge, if this can be done without risk. Dike to contain spill or runoff. Notify supplier and environmental authorities.

Protective Clothing and Equipment

Goggles or face shield. Coveralls. Gloves - rubber. Boots - rubber.

Fire and Explosion

Use dry chemical or carbon dioxide to extinguish. Water or foam may cause frothing.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: skin - cover burns with sterile dressing if possible. Victim should be taken to hospital, doctor or clinic, if medical attention is required.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. If possible contain discharge by damming or water diversion.
6. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BARIUM CARBONATE $BaCO_3$

IDENTIFICATION

UN No. 1564 Barium Compounds

Common Synonyms	Observable Characteristics	Manufacturers	
	White crystals or powder. Odourless.	No Canadian manufacturer. Canadian suppliers: FMC of Canada Ltd., Vancouver, B.C. Philipp Brothers (Canada) Ltd., Montreal, Quebec.	Originating from: FMC Corp. USA

Transportation and Storage Information

Shipping State: Solid.
Classification: Poison.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): White label - POISON; Class 6.1, Group I.
Storage Temperature: Ambient.

Grades or Purity: Technical.
Containers and Materials: Bags, bulk by rail or truck.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.0022 g/100 mL (18°C); 0.0065 g/100 mL (100°C).
Molecular Weight: 197.4
Vapour Pressure: No information.
Boiling Point: 1 450°C (decomposes).

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 4.3 (20°C).

Colour: White.
Explosive Limits: Not flammable.
Melting Point: Decomposes 1 450°C; Melts at 1 740°C (90 atm).

HAZARD DATA

Human Health

Symptoms: Contact: eyes and skin - redness and pain. Ingestion: excessive salivation, coughing, vomiting, diarrhea, difficulty breathing, convulsions, muscular paralysis. Inhalation: symptoms similar to ingestion.
Toxicology: Toxic by ingestion.
TLV® (air) 0.5 mg/m^3 (as soluble Ba).
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 0.63 g/kg
LD_{Lo} - Oral: human = 0.057 g/kg

Fire

Fire Extinguishing Agents: Not combustible; most fire extinguishing agents may be used on fires involving barium carbonate.
Behaviour in Fire: No information.
Ignition Temperature: Not combustible.

Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Stop or reduce discharge if possible. Avoid contact. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - where dust is present use approved dust mask; in confined areas use self-contained breathing apparatus. Clothing - coveralls, or as necessary to avoid excessive skin contact. Protective gloves - general purpose. Safety goggles - tight fitting, or safety glasses.

Fire and Explosion

Not combustible; most fire extinguishing agents may be used on fires involving barium carbonate.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Ingestion: give conscious victim plenty of water to drink and induce vomiting. Contact: eyes - irrigate with plenty of water; skin - wash with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

BARIUM SULFATE $BaSO_4$

IDENTIFICATION

UN No. 1564 Barium Compounds

Common Synonyms	Observable Characteristics	Manufacturers
BARITE BLANC FIXE BARYTES BASOFOR	White or yellowish powder. Odourless.	Mountain Minerals Ltd., Lethbridge, Alberta.

Transportation and Storage Information

Shipping State: Solid.
Classification: Not required.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not required.
Storage Temperature: Ambient.

Grades or Purity: Technical, pulp and bleach.
Containers and Materials: Drums, barrels, paper sacks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.00025 g/100 mL (25°C); 0.00034 g/100 mL (50°C); 0.00041 g/100 mL (100°C).
Molecular Weight: 233.4
Vapour Pressure: No information.
Boiling Point: >1 580°C.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 4.3 to 4.5 (20°C).

Colour: White to yellowish.
Explosive Limits: Not flammable.
Melting Point: 1 580°C.

HAZARD DATA

Human Health

Symptoms: Contact (with dust): eyes and skin - redness and pain. Ingestion: excessive salivation, coughing, vomiting, diarrhea, difficulty breathing, convulsions, muscular paralysis. Inhalation: of dust produces symptoms similar to ingestion.
Toxicology: Toxic by ingestion.

TLV®- (air) 0.5 mg/m^3 (as soluble Ba).	LC_{50} - No information.	LD_{50} - No information.
Short-term Inhalation Limits - No information.	Delayed Toxicity - No information.	TD_{Lo} - Intraperitoneal: rat = 0.2 g/kg

Fire

Fire Extinguishing Agents: Not combustible; most fire extinguishing agents may be used on fires involving barium sulfate.
Behaviour in Fire: No information.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Can react explosively with aluminum when heated.
Stability: Stable.

Environment

Water: BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Stop discharge if possible. Avoid contact. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - where dust is present, use approved dust mask. Clothing - coveralls, or as necessary to avoid excessive skin contact. Protective gloves - general purpose. Safety goggles - tight fitting, or safety glasses.

Fire and Explosion

Not combustible; most fire extinguishing agents may be used on fires involving barium sulfate.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Ingestion: give conscious victim plenty of water to drink and induce vomiting. Contact: eyes - irrigate with plenty of water; skin - wash with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

BENZENE C_6H_6

IDENTIFICATION

UN No. 1114

Common Synonyms	Observable Characteristics	Manufacturers	
BENZOL COAL NAPHTHA BENZIN PHENYLHYDRIDE	Colourless liquid. Aromatic odour.	Gulf Oil Canada Ltd., Montreal, Que. Finachem Canada Ltd., Montreal, Quebec.	Shell Canada Ltd., Corunna, Ont. Petrosar, Corunna, Ont. Esso Chemical Canada, Sarnia, Ontario.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: Gear or centrifugal, explosion-proof, grounded.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.2, Group II.
Storage Temperature: Ambient.
Hose Type: Viton, polypropylene, Teflon, stainless steel.

Grades or Purity: Industrial, pure, 99+%; thiophene free, 99+%; nitration, 99+%; industrial, 90%, 85+%; reagent, 99+%.
Containers and Materials: Drums, tank cars, tank trucks; steel and stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 0.18 g/100 mL (20°C).
Molecular Weight: 78.1
Vapour Pressure: 60 mm Hg (15°C); 76 mm Hg (20°C); 118 mm Hg (30°C).
Boiling Point: 80.1°C.

Floatability (Water): Floats.
Odour: Aromatic (0.16 to 4.7 ppm, odour threshold).
Flash Point: -11°C (c.c.).
Vapour Density: 2.8
Specific Gravity: 0.88 (20°C).

Colour: Colourless.
Explosive Limits: 1.3 to 7.1%.
Melting Point: 5.5°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation, headache, dizziness, dullness, nausea, euphoria, respiratory paralysis, unconsciousness. Contact: skin - skin irritation; prolonged skin exposure, same symptoms as inhalation. Ingestion: sore throat, nausea, vomiting, headache, unconsciousness.
Toxicology: Toxic upon inhalation, ingestion and contact.
TLV®- (inhalation, skin); 10 ppm; 30 mg/m^3.
Short-term Inhalation Limits - 25 ppm; 75 mg/m^3 (15 min).
LC_{50} - Inhalation: rat = 10 000 ppm/7 h
Delayed Toxicity - Suspected carcinogen.
LD_{50} - Oral: rodent = 3.8 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, foam or carbon dioxide. Water may be ineffective, but may be used to cool fire-exposed containers.
Behaviour in Fire: Flashback may occur along vapour trail.
Ignition Temperature: 562°C.
Burning Rate: 6.0 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials. Reacts vigorously with chlorine, chromates and perchlorates.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 5 ppm/6 h/minnow/lethal/distilled water; 20 ppm/24 h/sunfish/TLm/tapwater; 386 ppm/96 h/mosquito fish/TLm/freshwater; Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: 1.2 lb/lb, 10 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Avoid contact. Evacuate downwind. CALL FIRE DEPARTMENT. Eliminate all sources of ignition. Notify manufacturer. Stop or reduce discharge, if this can be done without risk. Contain spill by diking to prevent runoff. In fire, stay upwind and use water spray to control vapours. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated protective clothing. Boots - high, synthetic rubber (pants worn outside boots). Gloves - synthetic rubber or suitable plastic.

Fire and Explosion

Extinguish with dry chemical, foam or carbon dioxide. Water may be ineffective but may be used to cool fire-exposed containers.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if victim is not breathing, give artificial respiration; if breathing is laboured, give oxygen. Contact: skin - flush with plenty of water; use soap if available and remove contaminated clothing; eyes - irrigate with plenty of water. Ingestion: do not induce vomiting. Keep victim warm and quiet. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with vacuum pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BENZOIC ACID C_6H_5COOH

IDENTIFICATION

UN No. 9094

Common Synonyms	Observable Characteristics	Manufacturers
BENZENECARBOXYLIC ACID CARBOXYBENZENE PHENYLFORMIC ACID PHENYLCARBOXYLIC ACID	Colourless to white crystals, powder or flake. Faint, pleasant, aromatic odour.	Dow Chemical Canada Inc., Delta, B.C.

Transportation and Storage Information

Shipping State: Solid.
Classification: Not regulated.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): None.
Storage Temperature: Ambient.

Grades or Purity: Technical.
Containers and Materials: Paper bags, barrels, drums, tank trucks, tank cars; stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.29 g/100 mL (25°C).
Molecular Weight: 122.1
Vapour Pressure: 1 mm Hg (96°C); 6.5 mm Hg (121°)C.
Boiling Point: 249.2°C.

Floatability (Water): Sinks.
Odour: Faint, pleasant, slightly aromatic odour.
Flash Point: 121°C (c.c.).
Vapour Density: 4.2
Specific Gravity: 1.27 (15°C); 1.32 (28°C).

Colour: Clear to white.
Explosive Limits: No information.
Melting Point: 121.7 to 122.4°C; (sublimes at 100°C).

HAZARD DATA

Human Health

Symptoms: Inhalation (dust): irritation of respiratory tract, nose, throat. Contact: irritation of skin and corrosive and irritating to eyes. Ingestion: nausea, gastrointestinal problems.
Toxicology: Moderately toxic by contact, inhalation and ingestion.
TLV*- No information.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - None known.
LD_{50} - Oral: rat = 2.53 g/kg
Oral: mouse = 2.37 g/kg

Fire

Fire Extinguishing Agents: Dry powder, chemical foam, water fog, carbon dioxide.
Behaviour in Fire: No information.
Ignition Temperature: 570 to 574°C.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 200 ppm/7 h/goldfish/lethal/freshwater; 500 ppm/1 h/sunfish/lethal/freshwater; 180 mg/L/96 h/mosquito fish/TLm/freshwater; BOD: 125 to 165%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. If there is a fire, call Fire Department. Avoid contact and inhalation (dust and fumes). Fight fire from upwind. If water is used, dike area to prevent runoff. Notify supplier. Notify environmental authorities.

Protective Clothing and Equipment

In fire, Respiratory protection - self-contained breathing apparatus and suit. Otherwise, dust respirator. Goggles - (mono), tight fitting. Gloves - rubber or plastic. Coveralls.

Fire and Explosion

Use water fog, dry chemical, foam or carbon dioxide to extinguish.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: remove contaminated clothing, wash eyes and skin with plenty of warm water. Ingestion: give plenty of water to conscious victim to drink. Keep victim warm and quiet. If medical assistance is not immediately available, transport victim to hospital, doctor, or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BISPHENOL A $(CH_3)_2C(C_6H_4OH)_2$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
4-4' - ISOPROPYLIDENEDIPHENOL p-p' -ISOPROPYLIDENEDIPHENOL 2,2-bis (4-hydroxyphenyl) propane	White crystals or flakes. Weak phenolic odour.	Gulf Canada Ltd., Montreal, Quebec.
Transportation and Storage Information		
Shipping State: Solid. **Classification:** None. **Inert Atmosphere:** No requirement. **Venting:** Open.	**Label(s):** Not regulated. **Storage Temperature:** Ambient.	**Grades or Purity:** Commercial; high purity. **Containers and Materials:** Bags and drums.
Physical and Chemical Characteristics		
Physical State (20°C, 1 atm): Solid. **Solubility (Water):** Insoluble. **Molecular Weight:** 228.3 **Vapour Pressure:** 5.2 mm Hg (220°C). **Boiling Point:** 220°C (4 mm Hg).	**Floatability (Water):** Sinks. **Odour:** Very weak phenolic. **Flash Point:** 79°C (c.c.) **Vapour Density:** 7.9 **Specific Gravity:** 1.2 (25°C).	**Colour:** White. **Explosive Limits:** No information. **Melting Point:** 153°C.

HAZARD DATA

Human Health		
Symptoms: Inhalation: dust is irritating to respiratory passages, coughing and sneezing. Contact: eyes - dust is irritating. Ingestion: nausea and vomiting. **Toxicology:** Moderately toxic by inhalation and ingestion. TLV - No information. Short-term Inhalation Limits - No information.	LC_{50} - No information. Delayed Toxicity - No information.	LD_{50} - Oral: rat = 4.04 g/kg
Fire		
Fire Extinguishing Agents: Use foam, dry chemical, carbon dioxide or water. **Behaviour in Fire:** No information. **Ignition Temperature:** No information.	**Burning Rate:** No information.	
Reactivity		
With Water: No reaction. **With Common Materials:** No reactions known. **Stability:** Stable.		
Environment		
Water: Prevent entry into water intakes and waterways. Hazardous to aquatic life. Little information available on the hazards of this material. **Land-Air:** No information. **Food Chain Concentration Potential:** No information.		

EMERGENCY MEASURES

Special Hazards

COMBUSTIBLE.

Immediate Responses

Keep non-involved people away from spill site. Call Fire Department. Notify manufacturer for advice. Notify environmental authorities.

Protective Clothing and Equipment

Suitable dust respirator and protective clothing as required.

Fire and Explosion

Use foam, dry chemical, carbon dioxide or water to extinguish fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped give artificial respiration; if laboured, give oxygen. Contact: skin and eyes - flush with large amounts of water. Ingestion: give water to conscious victim to drink. If medical help is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Remove material by manual or mechanical means.
4. Recover undamaged containers.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BORAX $Na_2B_4O_7.10H_2O$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers	
SODIUM BORATE, decahydrate SODIUM TETRABORATE, decahydrate	White crystals or powder. Odourless.	No Canadian manufacturers. Canadian suppliers: Bate Chemical, Toronto, Ontario. Canada Colours and Chemicals, Toronto, Ontario. Lawrason, SF, London, Ontario. Van Waters and Rogers, Vancouver, B.C. Canadian Industries Ltd., Toronto, Ontario. Harrisons and Crosfield, Toronto, Ontario. Pigment and Chemical, Montreal, Quebec. St. Lawrence Chemical, Montreal, Quebec.	Originating from: U.S. Borax, USA Kerr-McGee, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.
Label(s): Not regulated.
Storage Temperature: Ambient.
Grades or Purity: Refined and technical.
Containers and Materials: Barrels, bags.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 2.0 g/100 mL (0°C); 170 g/100 mL (100°C).
Molecular Weight: 381.4
Vapour Pressure: No information.
Boiling Point: Loses 10 H_2O at 320°C.
Floatability (Water): Sinks and mixes.
Odour: None.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 1.7 (20°C).
Colour: White.
Explosive Limits: Not flammable.
Melting Point: Loses 8 H_2O (60°C); after which it is metaborate, which melts at 75°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin and eyes - redness and pain. Ingestion: nausea, vomiting and diarrhea.
Toxicology: Relatively nontoxic.
TLV - 5 mg/m^3 (dust).
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - Oral: rat = 2.7 g/kg
LD_{Lo} - Oral: human = 0.71 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving borax.
Behaviour in Fire: Not combustible.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Reacts with zirconium.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Aquatic toxicity rating = 100 to 1 000 ppm/96 h/TLm/freshwater; 8 200 ppm/48 h/mosquito fish/TLm/freshwater; BOD: no information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Dike area to prevent runoff from rainwater or water application. Contact manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Suitable dust respirator and protective clothing as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving borax.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if victim is not breathing, give artificial respiration; if laboured, give oxygen. Contact: eyes and skin - irrigate with plenty of water. Ingestion: give water to conscious victim to drink. If medical help is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
4. Recover undamaged containers.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

BORIC ACID H_3BO_3

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers	
ORTHOBORIC ACID BORACIC ACID	Colourless or white crystals or powder. Odourless.	No Canadian manufacturers. Canadian suppliers: Canada Colours and Chemicals, Toronto, Ont. S.F. Lawrason and Co., London, Ont. McArthur Chemical.	Originating from: US Borax, USA
		Canadian Industries Ltd., Toronto, Ont. Harrisons and Crosfield, Toronto, Ont. Pigment and Chemical, Montreal, Que. St. Lawrence Chemical, Montreal, Que.	Kerr - McGee, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.
Label(s): Not regulated.
Storage Temperature: Ambient.
Grades or Purity: Technical, 99.9%.
Containers and Materials: Cans, kegs, drums.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 6.4 g/100 mL (20°C); 27.6 g/100mL (100°C).
Molecular Weight: 61.8
Vapour Pressure: 15 mm Hg (21°C); 46 mm Hg (38°C).
Boiling Point: Loses 1.5 H_2O at 300°C. Converts to HBO_2 (169°C).
Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 1.4 (20°C).
Colour: Colourless to white.
Explosive Limits: Not flammable.
Melting Point: Loses 1.5 H_2O at 300°C. Converts to HBO_2 at 169°C.

HAZARD DATA

Human Health

Symptoms: Toxic by skin absorption. Contact: skin - rash, blistering, vomiting, diarrhea, convulsions, anemia; eyes - redness and pain. Ingestion: vomiting and diarrhea, lethargy, convulsions, jaundice, cyanosis, collapse.
Toxicology: Highly toxic by oral route; moderate by other routes.
TLV - No information.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - Oral: rat = 2.7 g/kg
LD_{Lo} - Oral: human = 0.214 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving boric acid.
Behaviour in Fire: Not combustible.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; moderately soluble.
With Common Materials: Reacts with potassium and acetic anhydride.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 1 800 ppm/24 h/mosquito fish/TLm/freshwater; BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Dike area to prevent runoff from rainwater or water application. Contact manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Suitable dust respirator and protective clothing as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving boric acid.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: eyes and skin - irrigate with large amounts of water. Ingestion: give water to conscious victim to drink. If medical help is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
4. Recover undamaged containers.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

1,3-BUTADIENE $CH_2=CHCH=CH_2$

IDENTIFICATION

UN No. 1010

Common Synonyms	Observable Characteristics	Manufacturers	
BIETHYLENE DIVINYL VINYLETHYLENE BIVINYL	Colourless gas. Mildly aromatic odour.	Canadian manufacturer. Polysar, Sarnia, Ontario. Canadian supplier: Dow Chemical Canada Inc., Sarnia, Ontario. Monsanto Canada, Sarnia, Ontario. Polysar, Sarnia, Ontario.	Originating from: Dow Chemical, USA Monsanto, USA Northern Petrochem, USA

Transportation and Storage Information

Shipping State: Liquid (compressed gas).
Classification: Flammable gas.
Inert Atmosphere: No requirement.
Venting: Safety-relief.
Pump Type: Centrifugal, gear, etc. Explosion-proof.

Label(s): Red label - FLAMMABLE GAS; Class 2.1.
Storage Temperature: Ambient.
Hose Type: Rubber, Hypalon, Viton, flexible stainless steel.

Grades or Purity: Commercial, 98% (inhibited).
Containers and Materials: Cylinders, tank cars, tank trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility (Water): 0.074 g/100 mL (20°C).
Molecular Weight: 54.1
Vapour Pressure: 900 mm Hg (0°C); 1 500 mm Hg (14°C).
Boiling Point: -4.4°C.

Floatability (Water): Floats and boils.
Odour: Mildly aromatic (4 mg/m^3, odour threshold).
Flash Point: -76°C (c.c.).
Vapour Density: 1.9 (20°C).
Specific Gravity: (liquid) 0.62 (20°C).

Colour: Colourless.
Explosive Limits: 2 to 12 %.
Melting Point: -108.9°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: coughing, dizziness, dullness, unconsciousness. Contact: skin - frostbite; burns.
Toxicology: Moderately toxic by Inhalation.
TLV® - Inhalation 1 000 ppm; 2 200 mg/m^3.
Short-term Inhalation Limits - 1 250 ppm; 2 750 mg/m^3 (15 min).

Inhalation - rat = 2 280 ppm/4 h
LC_{50} - No information.
Delayed Toxicity - Suspected carcinogen.

LD_{50} - Oral: rat = 5.48 g/kg

Fire

Fire Extinguishing Agents: Stop flow of gas before attempting to extinguish fire. Use dry chemical, carbon dioxide, foam or water spray. Use water spray to cool fire-exposed containers and protect men effecting shut off.
Behaviour in Fire: At elevated temperatures (as in fire) polymerization may occur. If this takes place in a container, violent rupture may occur.
Ignition Temperature: 420°C.
Burning Rate: 8.0 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: May polymerize. Reacts with phenol and crotonaldehyde. May form explosive peroxides when exposed to air. Can react with oxidizing agents.
Stability: Stable if inhibited.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; 71.5 mg/L/24 h/pin perch/TLm/freshwater; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. DANGER OF VIOLENT POLYMERIZATION.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call Fire Department. Eliminate all sources of ignition. Contact manufacturer for advice. Dike to prevent runoff. Stop or reduce discharge, if this can be done without risk. Notify environmental authorities.

Protective Clothing and Equipment

In fires; Respiratory protection - self-contained breathing apparatus and standard fire protection suits. Gloves - rubber. Outer protective clothing - as required. Acid suit or coveralls. Boots - high, rubber (pants worn outside boots).

Fire and Explosion

Stop flow of gas before attempting to extinguish fires. For small fires, use dry chemical or carbon dioxide. In large fires, use foam or water spray. In fire, polymerization may occur. If this takes place in a container, violent rupture may occur. Cool tanks with straight streams of water. Beware of tank explosion. Use unmanned monitor nozzle. Apply from side. Keep clear of tank heads. If in doubt, withdraw from area and let fire burn.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - (liquid or vapour) irrigate immediately with plenty of water for at least 15 minutes; skin - flush skin with plenty of water for at least 15 minutes; at the same time, remove contaminated clothing. Inhalation: if breathing has stopped, give artificial respiration; if breathing is laboured, give oxygen. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BUTANE $n\text{-}C_4H_{10}$

IDENTIFICATION

UN No. 1011

Common Synonyms	Observable Characteristics	Manufacturers
BUTYL HYDRIDE n-BUTANE LPG (see also propane)	Colourless. Mild natural gas-like odour.	Dome Petroleum Limited, Calgary, Alta. Pacific Petroleums, Ltd., Calgary, Alta. Mobil Oil Canada Ltd., Calgary, Alta. Home Oil Co. Ltd., Calgary, Alta.

Transportation and Storage Information

Shipping State: Liquid (compressed gas).
Classification: Flammable gas.
Inert Atmosphere: No requirement.
Venting: Safety relief.
Pump Type: Rotary, LPG, compressor.

Label(s): Red label - FLAMMABLE GAS; Class 2.1.
Storage Temperature: Ambient.
Hose Type: Special LPG type, reinforced high pressure.

Grades or Purity: Pure 99.4%; commercial; technical (97.6%).
Containers and Materials: Cylinders, tank cars, tank trucks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility (Water): 0.003 g/100 mL (15°C); 0.0008 g/100 mL (20°C); 0.0021 g/100 mL (38°C).
Molecular Weight: 58.1
Vapour Pressure: 1 823 mm Hg (25°C).
Boiling Point: -1°C.

Floatability (Water): Floats and boils.
Odour: Mild, natural gas-like (~5 000 ppm, odour threshold.
Flash Point: -60°C (c.c.).
Vapour Density: 2.0
Specific Gravity: (liquid) 0.60 (-1°C).

Colour: Colourless.
Explosive Limits: 1.6 to 8.5%.
Melting Point: -138°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - no effect from gas; liquid causes "frostbite"; eyes - gas has no effect but liquid splashed in eyes causes stinging, watering, inflammation and cloudiness. Inhalation: asphyxia, irregular breathing, headache, fatigue, mental confusion, nausea and vomiting, loss of consciousness.
Toxicology: An asphyxiant.
TLV - (inhalation) 800 ppm; 1 900 mg/m^3
Short-term Inhalation Limits - No information.

LC_{50} - Inhalation: rat = 658 $g/m^3/4$ h
Delayed Toxicity - No information.

LD_{50} - No information.

Fire

Fire Extinguishing Agents: Do not attempt to extinguish fire until leak has been shut off. For small fires use dry chemical. Let large fire burn. Use water spray to cool tanks exposed to fire and protect fire fighters.
Behaviour in Fire: When exposed to heat and flame, containers may rupture. Flash back may occur along vapour trail.
Ignition Temperature: 360°C.
Burning Rate: 7.9 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: May react with oxidizing agents.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Toxic to aquatic life in high concentrations; which may not be achievable because of solubility. Aquatic toxicity rating >1 000 ppm/96 h/TLm/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. Containers may rupture violently.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call Fire Department. Eliminate all ignition sources. Use only non-sparking tools. Contact supplier or producer for guidance and assistance. Stay upwind. Use water spray to control vapour. Let fire burn. Do not attempt to extinguish fire until leak has been shut off. Notify environmental authorities.

Protective Clothing and Equipment

In fires, Respiratory protection - self-contained breathing apparatus and standard fire protection suit. Gloves - rubber. Outer protective clothing - as required. Acid suit or coveralls. Boots - high, rubber (pants worn outside boots).

Fire and Explosion

Do not put out fire until leak has been shut off. Use water spray to cool fire-exposed containers and to protect fire fighters. Beware of tank explosion.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration. If breathing is laboured, give oxygen. Contact: if exposed to liquefied butane, remove clothing, irrigate eyes and flush skin with water. Treat as for frostbite; do not rub affected areas. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so.	1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.	2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.	3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BUTYL ALCOHOL C_4H_9OH

IDENTIFICATION

UN No. UN No. 1120

Common Synonyms	Observable Characteristics	Manufacturers
n-BUTYL ALCOHOL $CH_3(CH_2)_2CH_2OH$ 1-butanol, 1-hydroxybutane, n-propylcarbinol TERT-BUTYL ALCOHOL $(CH_3)_3COH$ 2-methyl-2-propanol, t-butyl alcohol, tert-butanol, trimethylcarbinol SEC-BUTYL ALCOHOL $CH_3CH_2CH\ OH\ CH_3$ 2-butanol, s-butyl alcohol, methylethylcarbinol	Colourless liquids or crystals. Strong alcohol-like odour for n-butanol. Camphor-like odour for tert-butanol.	BASF Canada Ltd., Laval, Quebec.

Transportation and Storage Information		
Shipping State: Liquid or solid. **Classification:** Flammable liquids. **Inert Atmosphere:** No requirement. **Venting:** Open (flame arrester); or pressure-vacuum.	**Label(s):** Red label - FLAMMABLE LIQUID; Class 3.2, Group I, II or III. **Storage Temperature:** Ambient. **Hose Type:** Natural rubber, polyethylene, butyl. **Pump Type:** Standard flammable liquid types.	**Grades or Purity:** 99+% technical. **Containers and Materials:** Cans, drums, tank trucks; steel, stainless steel and aluminum.

Physical and Chemical Characteristics		
Physical State (20°C, 1 atm): Liquid (n and sec); solid (tert). **Solubility (Water):** n: 7.7 g/100 mL (20°C); sec: 12.5 g/100 mL (20°C); tert: soluble in all proportions. **Molecular Weight:** 74.1 **Vapour Pressure:** n: 4.4 mm Hg (20°C), 6.5 mm Hg (25°C); 10 mm Hg (30°C); sec: 12 mm Hg (20°C), 24 mm Hg (30°C); tert: 31 mm Hg (20°C), 42 mm Hg (25°C), 56 mm Hg (30°C).	**Floatability** (Water): Floats and mixes. **Odour:** Sharp alcohol odour, pungent, strong, non-residual. Tert. is camphor-like (0.3 to 2.0 ppm (n); 0.12 to 0.56 ppm (sec) odour threshold). **Flash Point:** n: 35°C (c.c.); sec: 23.9°C (c.c.); tert: 11.0°C (c.c.). **Vapour Density:** 2.6 **Specific Gravity:** (liquid) 0.81 (20°C) (n); 0.81 (20°C) (sec); 0.79 (20°C) (tert). **Boiling Point:** 117.7°C (n); 99.5°C (sec); 83°C (tert).	**Colour:** Colourless. **Explosive Limits:** 1.4 to 11.2% (n); 1.7 to 9.8% (sec); 2.4 to 8.0% (tert). **Melting Point:** -89.3°C (n); -89°C (sec); 25.7°C (tert).

HAZARD DATA

Human Health

Symptoms: Contact: skin - dermatitis; eyes - redness and burns. Inhalation: headache, dizziness, nausea and narcosis. Ingestion: abdominal pains; nausea, dullness.
Toxicology: Moderately toxic by exposure and inhalation; n-butyl alcohol can be absorbed by the skin giving symptoms similar to inhalation.

TLV®- (skin) 50 ppm, 150 mg/m^3 (n); 100 ppm, 305 mg/m^3 (sec); 100 ppm, 300 mg/m^3 (tert).	LC_{50} - No information. Delayed Toxicity - No information.	LD_{50} - Oral: rat = 0.79 g/kg (n) LD_{50} - Oral: rat = 6.48 g/kg (sec). LD_{50} - Oral: rat = 3.5 g/kg (tert).

Short-term Inhalation Limits - 150 ppm; 455 mg/m^3 (15 min) (sec); 150 ppm; 450 mg/m^3 (15 min) (tert).

Fire

Fire Extinguishing Agents: Use carbon dioxide, dry chemical or alcohol foam. Water may be ineffective.
Behaviour in Fire: Flashback may occur along vapour trail.
Ignition Temperature: 343°C (n); 405°C (sec); 478°C (tert).
Burning Rate: 3.2 mm/min (n); 3.1 mm/min (sec); 3.4 mm/min (tert).

Reactivity

With Water: No reaction; soluble. **With Common Materials:** May react with oxidizers. **Stability:** Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicities: (n) = 1 400 mg/L/24 h/creek chub/LC_{100}/freshwater; (sec) = 4 300 mg/L/24 h/goldfish/LD_{50}/freshwater; (tert) = 6 000 mg/L/24 h/goldfish/LC_{100}/freshwater; Aquatic toxicity rating >1 000 ppm/96 h/TLm/freshwater; BOD: (n) 150%, 5 days, (sec) 187%, 5 days; (tert) 0%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards
FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call fire department. Eliminate all sources of ignition. Stop or reduce discharge, if safe to do so. Work from upwind and use water spray to control vapours. Dike to contain spill. Notify manufacturer or supplier. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves - rubber or plastic. Coveralls - rubber or plastic. Suit, rubber or plastic. Gastight suit. Boots - rubber, high (pants worn outside boots).

Fire and Explosion

Use dry chemical, carbon dioxide or alcohol foam to extinguish. Water may be ineffective on fire, but may be used to cool fire-exposed containers.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped and oxygen if breathing is laboured. Contact: remove contaminated clothing and irrigate eyes and affected skin thoroughly with plenty of warm water. Ingestion: give milk or water to conscious victim to drink and induce vomiting. If medical assistance is not immediately available, transport victim to hospital, clinic or doctor.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

BUTYLENE $CH_3CH_2CH = CH_2$

IDENTIFICATION

UN No. 1012

Common Synonyms

LPG 1-BUTENE, α-BUTYLENE, ETHYLETHYLENE, cis-2-butene, trans-2-butene are also available and have similar properties to 1-butene.

Observable Characteristics

Colourless gas. Slightly aromatic odour.

Manufacturers

Polysar, Sarnia, Ontario.
Finachem Canada, Montreal, Quebec.
Esso Chemical Canada, Dartmouth, Nova Scotia.

Transportation and Storage Information

Shipping State: Liquid (compressed gas).
Classification: Flammable gas.
Inter Atmosphere: No requirement.
Venting: Safety relief.
Pump Type: Steel, stainless steel.

Label(s): Red and white label - FLAMMABLE GAS; Class 2.1.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Technical 95%; CP 99.0%.
Containers and Materials: Cylinders, tanks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility: Insoluble.
Molecular Weight: 56.1
Vapour Pressure: 430 mm Hg (-20°C); 960 mm Hg (0°C); 1976 mm Hg (21°C).
Boiling Point: -6.3°C.

Floatability (Water): Floats and boils.
Odour: Slightly aromatic (69 ppb, odour threshold).
Flash Point: -80°C (c.c.).
Vapour Density: 1.9
Specific Gravity: 0.68 (-40°C).

Colour: Colourless.
Explosive Limits: 1.6 to 10%.
Melting Point: -185°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - liquid causes frosbite. Inhalation: rapid respiration, gasping for air, fatigue, nausea and vomiting.
Toxicology: Asphyxiant.
TLV® No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - No information.

Fire

Fire Extinguishing Agents: Stop flow of gas before attempting to extinguish fire. Most fire extinguishing agents may be used. Cool fire-exposed containers with water.
Behaviour in Fire: Flash back may occur along vapour trail.
Ignition Temperature: 385°C.
Burning Rate: 8.8 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Toxicity to aquatic life unknown.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Shut off flow of gas if it can be done without risk. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires and confined spaces Respiratory protection - self-contained breathing apparatus; otherwise, protective outer clothing as required.

Fire and Explosion

Stop flow of gas before attempting to extinguish fire. Most fire extinguishing agents may be used. Water may be used to cool fire-exposed containers. Flash back may occur along vapour trail.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: skin - treat as for frostbite, do not rub affected areas; flush affected areas with water; eyes - irrigate with water. Inhalation: if breathing has stopped give artificial respiration; if laboured, give oxygen. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so.	1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.	2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.	3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Contents of contaminated cylinders may be incinerated (with approval of environmental authorities).

BUTYRALDEHYDE (NORMAL) $CH_3(CH_2)_2CHO$

IDENTIFICATION

UN No. 1129

Common Synonyms	Observable Characteristics	Manufacturers
n-BUTYRALDEHYDE BUTYRIC ALDEHYDE n-BUTANAL	Colourless liquid. Pungent odour.	Canadian Manufacturer: BASF Canada Ltd., Laval, Quebec.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: No information.

Label(s): Red Label - FLAMMABLE LIQUID; Class 3.2, Group II.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Water-saturated, 97%; dry , 99.5%.
Containers and Materials: Drums, tank cars, tank trucks, steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 3.7 g/100 mL (0°C); 7.1 m/100 mL (20°C).
Molecular Weight: 72
Vapour Pressure: 71 mm Hg (20°C).
Boiling Point: 75 to 76°C.

Floatability (Water): Floats and mixes.
Odour: Pungent (0.005 to 0.048 ppm, odour threshold).
Flash Point: -6.6 (c.c.)
Vapour Density: 2.5
Specific Gravity: 0.81 (20°C).

Colour: Colourless.
Explosive Limits: 1.9 to 12.5%.
Melting Point: -96 to -99°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - burning sensation and blisters; eyes - watering, burning sensation. Inhalation: irritation of mucous membranes, difficulty breathing, headache, cyanosis, nausea, muscular weakness. Ingestion: burning sensation, difficulty breathing, nausea and vomiting, convulsions.
Toxicology: Moderately toxic by dermal route.
TLV - No information.
Short-term Inhalation Limits - No information.
LC_{50} - Inhalation: rat = 60 000 ppm/1/2 h
Delayed Toxicity - No information.
LD_{50} - Oral: rat = 2.49 g/kg

Fire

Fire Extinguishing Agents: Use foam, carbon dioxide or dry chemical. Water may be ineffective but may be used to cool fire-exposed tanks or disperse vapours.
Behaviour in Fire: Flash back may occur along vapour trail. Fire may be difficult to control due to ease of reignition.
Ignition Temperature: 230°C.
Burning Rate: 4.4 mm/min.

Reactivity

With Water: No reaction, slightly soluble.
With Common Materials: Reacts vigorously with chlorosulfonic acid, nitric acid, sulfuric acid and oleum. Can react with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating = 1 to 10 ppm/96 h/TLm/freshwater; BOD: 106%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Eliminate all sources of ignition. Call manufacturer or supplier for advice. Stop or reduce discharge, if this can be done without risk. Avoid contact and inhalation. Contain spill area by diking. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self contained breathing apparatus. Gloves - rubber or plastic. Boots - high, rubber (pants worn outside boots). Outerwear - as required, coveralls, acid suit.

Fire and Explosion

Use foam, dry chemical or carbon dioxide. Water may be ineffective but may be used to cool fire-exposed containers and to knock down vapours. Flash back may occur along vapour trail.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: eyes - immediately irrigate with water for at least 15 min; skin: flush with plenty of water and remove contaminated clothing. Ingestion: rinse mouth with water, keep calm and warm. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

CALCIUM CARBIDE CaC_2

IDENTIFICATION

UN No. 1402

Common Synonyms	Observable Characteristics	Manufacturers
CARBIDE ACETYLENOGEN CALCIUM ACETYLIDE	Grey to black powder or lumps. Odourless when dry; weak acetylene (garlic-like) odour when damp.	Cyanamid of Canada Ltd., Niagara Falls, Ontario. Gulf Oil Canada Ltd., Shawinigan, Quebec.

Transportation and Storage Information

Shipping State: Solid.
Classification: Dangerous when wet.
Inert Atmosphere: No requirement (dry).
Venting: Closed.

Label(s): Blue label - DANGEROUS WHEN WET; Class 4.3, Group II.
Storage Temperature: Ambient.

Grades or Purity: According to granule size.
Containers and Materials: Airtight and watertight metal containers.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Decomposes in water.
Molecular Weight: 64.1
Vapour Pressure: No information.
Boiling Point: >2 300°C (melts at 2 300°C).

Floatability (Water): Sinks and reacts to form acetylene gas and calcium hydroxide.
Odour: Acetylene (garlic-like).
Flash Point: -17.8°C (c.c.) (as acetylene).
Vapour Density: 0.91 (as acetylene).
Specific Gravity: 2.22 (18°C).

Colour: Grey to black.
Explosive Limits: 2.5 to 100%.
Melting Point: 2 300°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin and eyes - burns, ulceration, damage to mucous membranes. Inhalation (acetylene): burning sensation in nose and throat, difficulty breathing, coughing, chemical bronchitis. Ingestion: painful swallowing, mouth cavity turns white, vomiting, stomach cramps, rapid breathing, diarrhea, unconsciousness.
Toxicology: Moderate toxicity upon contact.
TLV - No information.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - No information.

Fire

Fire Extinguishing Agents: Use a suitable dry powder. Carbon dioxide is ineffective. Do not use water, vaporizing liquid or foam.
Behaviour in Fire: Not flammable in dry state but produces acetylene gas on contact with water or moisture. Will generate sufficient heat on contact with water to ignite acetylene formed.
Ignition Temperature: 305°C (as acetylene).
Burning Rate: No information (as acetylene).

Reactivity

With Water: Reacts exothermically to form acetylene gas and calcium hydroxide.
With Common Materials: Reacts with selenium, hydrogen chloride, magnesium, silver nitrate, stannous chloride, and sulfur.
Stability: Stable in absence of moisture.

Environment

Water: Prevent entry into water intakes and waterways. Toxicity to aquatic life is unknown.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

DANGEROUS WHEN WET. Hazardous acetylene gas generated on contact with water.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "DANGEROUS WHEN WET". Call Fire Department (Caution - no water or foam). Contact manufacturer for advice. If there is any possibility of acetylene gas being generated, proceed as follows: Eliminate all sources of ignition. Use only spark-proof tools. Stop or reduce discharge, if this can be done without risk. Contain spill by diking, particularly if water is present. Allow acetylene gas to disperse - but evacuate area downwind as explosion hazard may exist. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves - cotton or rubber work gloves. Clothing - as required, coveralls, etc.

Fire and Explosion

Use a suitable dry powder. Carbon dioxide is ineffective. Do not use water, vaporizing liquids or foam.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - irrigate with water for at least 15 minutes; skin - remove contaminated clothing and flush affected areas with plenty of water. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Make sure that material does not contact water moist materials.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CALCIUM CARBONATE $CaCO_3$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
CHALK AGRICULTURAL LIMESTONE MARBLE	White powder or crystals. Odourless.	WR Barnes, Perth, Ontario. Industrial Fillers, St. Armand, Quebec.

Transportation and Storage Information

Shipping State: Solid. **Classification:** None. **Inert Atmosphere:** No requirements. **Venting:** Open.	**Label(s):** Not regulated. **Storage Temperature:** Ambient.	**Grades or Purity:** Variable. Commercial $CaCO_3$ has various proportions of magnesium oxide, silicon dioxide and a number of other compounds. **Containers and Materials:** Multiwall paper bags; bulk in carlots, trucklots.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid. **Solubility** (Water): 0.0015 g/100 mL (25°C); 0.0019 g/100 mL (75°C). **Molecular Weight:** 100.1 **Vapour Pressure:** No information. **Boiling Point:** Decomposes 825°C.	**Floatability** (Water): Sinks. **Odour:** Odourless. **Flash Point:** Not flammable. **Vapour Density:** No information. **Specific Gravity:** 2.7 to 2.95 (20°C).	**Colour:** White. **Explosive Limits:** Not flammable. **Melting Point:** Turns to calcite 520°C; decomposes 825°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: sneezing and slight nose irritation. Can be irritating to respiratory tract. Ingestion: no symptoms. Contact: skin - no symptoms; eyes - watering, irritation.
Toxicology: Relatively nontoxic.

TLV - (dust) 30 mppcf or 10 mg/3 (total dust); 5 mg/m^3 (respirable dust). Short-term Inhalation Limits - 20 mg/m^3 (dust).	LC_{50} - None. Delayed Toxicity - No information.	LD_{50} - None.

Fire

Fire Extinguishing Agents: Not combustible. Nost fire extinguishing agents may be used on fires involving calcium carbonate.
Behaviour in Fire: Not combustible. Releases carbon dioxide upon decomposition between 600 and 825°C.
Ignition Temperature: Not combustible. **Burning Rate:** Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with fluorine.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating = >1 000 ppm/96 h/TLm/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Dust respirator may be required under certain circumstances. Outer protective clothing as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving calcium carbonate.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: have victim blow nose to remove dust. Ingestion: induce vomiting in conscious victim. Contact: skin and eyes - remove contaminated clothing and flush affected areas with water. If necessary, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Remove material by manual or mechanical means.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. May be dumped in a municipal landfill (approval of environmental authorities required).

CALCIUM CHLORIDE $CaCl_2.xH_2O$ (x = 0,1,2,6)

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers	
CALCIUM CHLORIDE, ANHYDROUS ($CaCl_2$) CALCIUM CHLORIDE MONOHYDRATE ($CaCl_2 \cdot H_2O$) CALCIUM CHLORIDE DIHYDRATE ($CaCl_2 \cdot 2H_2O$) CALCIUM CHLORIDE HEXAHYDRATE ($CaCl_2 \cdot 6H_2O$)	Colourless to white crystals, flake, or solutions. Odourless.	Allied Chemical Amherstburg, Ontario. Canadian suppliers: Allied Chemical, Mississauga, Ont. Dow Chemical Canada Inc., Sarnia, Ont.	Originating from: Allied Chemical, USA Dow Chemical, USA

Transportation and Storage Information

Shipping State: Solid or liquid (aqueous solution).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: Teflon, Viton, neoprene.
Pump Type: Centrifugal or displacement; stainless steel.

Grades or Purity: Technical, solutions from 30 to 95%.
Containers and Materials:
Bags, drums; bulk by truck or train.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Anhydrous 74.5 g/100 mL (20°C), 159 g/100 mL (100°C); monohydrate 76.8 g/100 mL (0°C), 249 g/100 mL (100°C); dihydrate 97.7 g/100 mL (0°C), 326 g/100 mL (60°C); hexahydrate 279 g/100 mL (0°C), 536 g/100 mL (20°C).
Molecular Weight: Anhydrous 111.0; monohydrate 129.0; dihydrate 147.0; hexahydrate 219.1.
Vapour Pressure: 9 mm Hg (21°C) (35.5% solution).

Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: Anhydrous 2.15 (25°C); dihydrate 0.84 (25°C); hexahydrate 1.7 (25°C).
Boiling Point: Anhydrous >1 600°C; hexahydrate loses $4H_2O$ at 30°C; loses 6 H_2O at 200°C.

Colour: Colourless to white.
Explosive Limits: Not flammable.
Melting Point: Anhydrous, 782°C; monohydrate, 260°C; hexahydrate, 29.9°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation of nose and throat. Ingestion: irritation of mouth and stomach, nausea and vomiting. Dust can cause eye irritation and possible transient corneal injury. Skin contact with dry solid causes mild irritation; strong solutions - marked irritation, even superficial burns.
Toxicology: Relatively nontoxic.
TLV® - No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - None.

LD_{50} - Oral: rat = 1 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving calcium chloride.
Behaviour in Fire: Not combustible.
Ignition Temperature: Not combustible.

Burning Rate: Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Reacts violently with (boric oxide and calcium oxide).
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 10 650 ppm/96 h/sunfish/TLm/freshwater; 13 400 ppm/96 h/mosquito fish/TLm/freshwater; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Dust respirator may be required under certain conditions. Rubber, neoprene and vinyl protective clothing as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving calcium chloride.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped; oxygen, if breathing is laboured. Ingestion: give water to conscious victim to drink and rinse mouth. Contact: skin and eyes - remove contaminated clothing and flush affected areas with water. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CALCIUM CYANIDE $Ca(CN)_2$

IDENTIFICATION

UN No. 1575

Common Synonyms	Observable Characteristics	Manufacturers
CYANOGAS CYANIDE OF CALCIUM	White, to grey, to black crystals or powder. Odourless when dry, faint almond-like odour when wet.	Cyanamid Canada Ltd., Niagara Falls, Ontario.

Transportation and Storage Information

Shipping State: Solid.	**Label(s):** White label - POISON; Class 6.1, Group I.	**Grades or Purity:** No information.
Classification: Poison.	**Storage Temperature:** Ambient.	**Containers and Materials:** Drums; steel.
Inert Atmosphere: No requirement.		
Venting: Closed.		

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.	**Floatability** (Water): Reacts to form HCN gas.	**Colour:** White, to grey, to black.
Solubility (Water): Reacts to form HCN gas.	**Odour:** Odourless (dry); almond-like (wet).	**Explosive Limits:** Not flammable.
Molecular Weight: 92.1	**Flash Point:** Not flammable.	**Melting Point:** Decomposes >350°C.
Vapour Pressure: No information.	**Vapour Density:** No information.	
Boiling Point: Decomposes >350°C.	**Specific Gravity:** 2.4 (20°C).	

HAZARD DATA

Human Health

Symptoms: Inhalation (HCN gas): breathing cyanide gas or dust causes headache, nausea, vomiting and profound weakness, wheezing, convulsions. Contact and ingestion: similar symptoms as inhalation. High concentrations are rapidly fatal.
Toxicology: Highly toxic by inhalation and ingestion.

TLV*- as CN (skin) 5 mg/m^3.	LC_{50} - No information.	LD_{50} - Oral: rat = 0.4 g/kg
Short-term Inhalation Limits - No information.	**Delayed Toxicity** - No information.	

Fire

Fire Extinguishing Agents: DO NOT USE WATER OR CARBON DIOXIDE. Use dry chemical, sand or earth. If possible, allow fire from wet cyanide to burn out.
Behaviour in Fire: At high temperatures decomposes to cyanides.

Ignition Temperature: Not combustible.	**Burning Rate:** Not combustible.

Reactivity

With Water: Reacts to form HCN gas.
With Common Materials: Reacts with acids producing hydrogen cyanide and acetylene.
Stability: Stable if dry.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 0.21 ppm/96 h/sunfish/TLm/freshwater; >25 ppm/48 h/cockle/LC_{50}/saltwater.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON. Toxic and flammable HCN gas produced on contact with water.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Call Fire Department. Eliminate all sources of ignition (for HCN gas). Contact supplier for guidance. Avoid contact and inhalation. Do not attempt to extinguish fire with water. Evacuate people downwind from spill or fire. If water is present, dike to contain runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated protective clothing.

Fire and Explosion

DO NOT USE WATER OR CARBON DIOXIDE. Use dry chemical, sand or earth. If possible, allow fire from wet cyanide to burn out.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: If victim is conscious, simply keep warm and quiet. If victim is not breathing, initiate artificial respiration (not by mouth-to-mouth). If breathing is laboured, give oxygen. Contact: skin and eyes - remove contaminated clothing and flush affected areas with large amounts of water. Ingestion: induce vomiting. If medical assistance is not immediately available, transport victim to hospital, clinic, or doctor.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CALCIUM HYDROXIDE $Ca(OH)_2$

IDENTIFICATION

UN No. 9098

Common Synonyms	Observable Characteristics	Manufacturers
LIME CALCIUM HYDRATE HYDRATED LIME LIME HYDRATE SLAKED LIME CAUSTIC LIME AGRICULTURAL LIME	White or greyish-white powder or lumps.	Domtar Chemicals, Beachville, Ontario. Joliette, Quebec. BeachviLime, Beachville, Ontario. Algoma Steel, Sault-Ste-Marie, Ontario.

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): None. Class 9.2, Group III.
Storage Temperature: Ambient.

Grades or Purity: Agricultural, 65 to 71%; industrial 70 to 73%; chemical, 71 to 73% (may contain magnesium hydroxide, magnesium oxide, silicon dioxide and others in trace amounts).
Containers and Materials: Multiwall paper bags; bulk by truck or tank; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.185 g/100 mL (0°C); 0.077 g/100 mL (100°C).
Molecular Weight: 74.1
Vapour Pressure: No information.
Boiling Point: Decomposes >580°C.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 2.08-2.34 (20°C).

Colour: White or greyish-white.
Explosive Limits: Not flammable.
Melting Point: Decomposes 580°C (loses H_2O).

HAZARD DATA

Human Health

Symptoms: Contact: skin - burning sensation and inflammation; eyes - pain and watering. Inhalation: irritation of respiratory tract, difficulty breathing, coughing, sneezing. Ingestion: burning sensation, pain, stomach cramps.
Toxicology:
TLV® (inhalation) 5 mg/m^3 (dust).
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - None known.

LD_{50} - Oral: rat = 7.34 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving calcium hydroxide.
Behaviour in Fire: Not combustible.
Ignition Temperature: Not combustible.

Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with phosphorus, maleic anhydride, nitromethane, nitroethane, nitropropane and nitroparaffins.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways, toxic to aquatic life. Fish toxicity: 92 ppm/7 h/trout/toxic/freshwater; Aquatic toxicity rating = 10 to 1 000 ppm/96 h/TLm/freshwater; 240 ppm/24 h/mosquito fish/TLm/freshwater; 160 ppm/96 h/mosquito fish/TLm/freshwater; BOD: None.
Land-Air: Frequently used in agriculture to neutralize acidic soils.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Stop discharge. Notify supplier. Notify environmental authorities.

Protective Clothing and Equipment

If dust level is high, use suitable dust respirators.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving calcium hydroxide.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: (dust) make victim blow nose. Contact: skin - remove contaminated clothing and flush affected areas with water. Ingestion: give water to conscious victim to rinse mouth. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.,
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Absorb residual liquid on natural or synthetic sorbents.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Apply to farmer's fields (approval of environmental authorities required).
4. May be buried in municipal landfill sites (approval of environmental authorities required).

CALCIUM HYPOCHLORITE $Ca(OCl)_2$ $CaCl(ClO).4H_2O$ (hydrate)

IDENTIFICATION

UN No. 2880 hydrate
1748 dry >38% Cl
2208 dry 10 to 39% Cl

Common Synonyms	Observable Characteristics	Manufacturers
ANHYDROUS $Ca(OCl)_2$ Calcium Oxychloride HYDRATE $CaCl(ClO)\cdot 4H_2O$ Chloride of Lime Bleaching Powder Lime Chloride	White powder or crystals. Strong chlorine odour.	Canadian manufacturer: CIL Industries Ltd., Shawinigan, Quebec. Selected U.S. manufacturers: Olin Corporation, Stamford, Conn. Pennwalt Corp., Indchem Division, Philadelphia, Pa. Canadian suppliers: Canadian Industries Limited, General Chemicals Division, Toronto, Ont. Pennwalt of Canada Ltd., Oakville, Ont. Standard Chemical Ltd., Montreal, Que.

Transportation and Storage Information

Shipping State: Solid.
Classification: Oxidizing material.
Inert Atmosphere: No requirement.
Venting: Open or closed.

Label(s): Yellow label - OXIDIZER; Class 5.2, Group III.
Storage Temperature: Ambient.

Grades or Purity: Anhydrous - Commercial 70%; high purity 99.2%; hydrate 35 to 37% active chlorine or technical.
Containers and Materials: Cans, drums; steel, plastic.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Decomposes.
Molecular Weight: 143 anhydrous; 199 hydrate (varies).
Vapour Pressure: No information.
Boiling Point: Decomposes >100°C.

Floatability (Water): Sinks and decomposes.
Odour: Chlorine odour.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 2.35 (20°C) (anhydrous); hydrate is similar, but varies.

Colour: White.
Explosive Limits: Not flammable.
Melting Point: Decomposes >100°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - itching, burning, sensation, inflammation; eyes - stinging, watering, inflammation. Inhalation: irritation of nose and eyes, coughing, difficulty breathing, cyanosis. Ingestion: burning sensation in mouth and throat, stomach cramps, nausea, vomiting, weakness, shock, convulsion, coma.
Toxicology: Highly toxic by ingestion and inhalation (as chlorine).
TLV® 1 ppm; 3 mg/m³ (as chlorine).
Short-term Inhalation Limits - 3 ppm; 9 mg/m³ (as chlorine) (15 min).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 0.85 g/kg (anhydrous).

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents (preferably water spray) may be used on fires involving calcium hypochlorite.
Behaviour in Fire: Not combustible, but evolves O_2 and Cl_2 at high temperatures. Readily ignites organic materials when in contact.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: Reacts with water to produce chlorine.
With Common Materials: Readily oxidizes combustible and organic substances. Reacts violently with carbon tetrachloride and amines.
Stability: Stable when dry and not exposed to heat or organic materials.

Environment

Water: Prevent entry into water intakes and waterways; harmful to aquatic life in very low concentrations. Fish toxicity: 0.5 ppm/tns/trout/killed/freshwater; Aquatic toxicity rating = 1 to 10 ppm/96 h/TLm/freshwater; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

OXIDIZER. Releases chlorine upon decomposition by heat or on contact with water.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "OXIDIZER". Call Fire Department. Avoid contact and inhalation. Contact supplier or manufacturer. Stop discharge, if this can be done without risk. Move undamaged containers out of spill or fire area if this can be done without risk. Dike to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - in the case of a fire or in enclosed spaces, self-contained breathing apparatus. Otherwise, chemical goggles - (mono), tight fitting. Rubber gloves. Protective outerwear - suitable for the situation. If high rubber boots are worn, pants should be outside boots.

Fire and Explosion

Not combustible. Most fire extinguishing agents (preferably water spray) may be used on fires involving calcium hypochlorite.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - irrigate immediately with plenty of water for at least 15 minutes; skin - remove contaminated clothing and flood affected skin with water for at least 15 minutes. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Ingestion: wash out mouth thoroughly with water. Give conscious victim plenty of water to drink. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CALCIUM OXIDE CaO

IDENTIFICATION

UN No. 1910

Common Synonyms	Observable Characteristics	Manufacturers
BURNT LIME CALX FLUXING LIME LIME QUICKLIME UNSLAKED LIME PEBBLE LIME	White or greyish-white powder or lumps. Odourless.	Domtar, Beachville, Ontario. Joliette, Québec. BeachviLime, Beachville, Ontario. Algoma Steel, Sault Ste-Marie, Ontario.

Transportation and Storage Information

Shipping State: Solid.
Classification: Corrosive.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): White and black label - CORROSIVE; Class 8, Group III.
Storage Temperature: Ambient.

Grades or Purity: Technical; agriculture; construction. Typically contains magnesium oxide; silicon dioxide, aluminum oxide, and other trace minerals..
Containers and Materials: Multiwall paper bags, barrels; bulklots by truck or train.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Reacts to form $Ca(OH)_2$
Molecular Weight: 56.1
Vapour Pressure: No information.
Boiling Point: 2 850°C.

Floatability (Water): Reacts to form $Ca(OH)_2$.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 3.3 to 3.4 (20°C).

Colour: White or greyish-white.
Explosive Limits: Not flammable.
Melting Point: 2 570°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - pain, ulceration, shock; eyes - pain, watering, burns, ulceration of eyes, perforation, blindness. Inhalation: burning sensation in nose and throat, difficulty breathing, coughing, chemical bronchitis. Ingestion: burning sensation in mouth, throat, stomach, pain, stomach cramps, vomiting, diarrhea, unconsciousness.
Toxicology: Toxic by all routes.
TLV® 2 mg/m^3 (dust).
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - None known.

LD_{50} - No information.

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents, except water, may be used in fires involving calcium oxide. Use water only in flooding amounts.
Behaviour in Fire: Not combustible.
Ignition Temperature: Not combustible.

Burning Rate: Not combustible.

Reactivity

With Water: Reacts exothermically to form calcium hydroxide.
With Common Materials: May oxidize organic materials. Reacts violently with boron trifluoride, chlorine trifluoride, fluorine, hydrofluoric acid and phosphorous pentoxide.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 92 ppm/7 h/(trout)/toxic/freshwater; 240 ppm/24 h/mosquito fish/TLm/freshwater
BOD: None.
Land-Air: Frequently used in agriculture to neutralize acidic soils.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning "CORROSIVE". Stop discharge, if possible. Exercise caution with water application Notify manufacturer or supplier. Notify environmental authorities.

Protective Clothing and Equipment

Dusty conditions, suitable dust mask. Gloves - work gloves with gauntlets. Coveralls. Boots - safety or high rubber (pants worn outside boots).

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving calcium oxide. If water is used, use flooding amounts.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: (dust) make victim blow nose. Contact: skin - remove contaminated clothing and flush affected areas with water; eyes - immediately flush with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Dump in a municipal landfill site (approval of environmental authorities required).

CALCIUM PHOSPHATE

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers	
MONOBASIC CALCIUM PHOSHATE ($Ca(H_2PO_4)_2H_2O$) calcium biphosphate acid calcium phosphate calcium phosphate, primary monocalcium phosphate	Colourless to white powder or crystals. Odourless.	International Minerals and Chemical Co. Port Maitland, Ont. Cyanamid, Niagara Falls, Ont.	
DIBASIC CALCIUM PHOSPHATE $CaHPO_4.2H_2O$ dicalcium orthophosphate bicalcium phosphate secondary calcium phosphate		Canadian suppliers: Agricultural Chemical London, Ont. Erco Industries, Toronto, Ont. Harrison's and Crosfield, Toronto, Ont.	Originating from: Agrico, USA Stauffer, USA
TRIBASIC CALCIUM PHOSPHATE $Ca_3(PO_4)_2$ bone ash — tricalcium phosphate calcium orthophosphate — precipitated calcium phosphate tricalcium orthophosphate — tertiary calcium phosphate		Occidental Petroleum	Occidental Petroleum, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not regulated.
Storage Temperature: Ambient.

Grades or Purity: Technical, by percentage of P (phosphorus).
Containers and Materials: Bags, barrels; bulklot by truck or train.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): monobasic 1.8 g/100 mL (20°C); dibasic: 0.03 g/100 mL (20°), 0.075 g/100 mL (100°C); tribasic: 0.002 g/100 mL (20°C).
Molecular Weight: 252.1 (mono); 172.1 (di); 310.2 (tri).
Vapour Pressure: No information.
Boiling Point: monobasic: decomposes 203°C. dibasic and tribasic: greater than melting point.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: monobasic 2.2; dibasic 2.3; tribasic 3.1 (20°C).

Colour: Colourless to white.
Explosive Limits: Not flammable.
Melting Point: monobasic and dibasic lose H_2O (109°C); tribasic: 1 670°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin and eyes - redness, irritation. Inhalation: irritation of upper respiratory tract. Ingestion: may cause nausea, vomiting, stomach cramps, diarrhea.
Toxicology: Relatively nontoxic by all routes.
TLV - No information.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - No information.

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving calcium phosphate.
Behaviour in Fire: Not combustible, but releases toxic PO_x fumes at high temperatures.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with magnesium.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Effects on aquatic life have not been determined.
Land-Air: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Protective outer clothing as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving calcium phosphate.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped; if laboured, give oxygen. Ingestion: give water to conscious victim to drink. Contact: skin - remove contaminated clothing and flush affected areas with water; eyes - flush immediately with water. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Dump in municipal landfill site (approval of environmental authorities required).

CAPROLACTAM $CH_2(CH_2)_4NHCO$

IDENTIFICATION

Common Synonyms
AMINOCAPROIC LACTAM
2-KETOHEXAMETHYLENIMINE
2-OXOHEXAMETHYLENEIMINE
EPSILON-CAPROLACTAM
HEXAHYDRO-2H-AZEPINE-2-ONE

Observable Characteristics
White crystals or flakes.
Mild odour.

Manufacturers
Re-refined: Dow Badische Canada Ltd., Arnprior, Ontario.

Canadian Supplier:	Originating from:
Badische Canada, Arnprior, Ont.	Badische, USA
Firestone Textiles, Woodstock, Ont.	Firestone, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): Not regulated.
Storage Temperature: Ambient.

Grades or Purity: 99% flakes.
Containers and Materials: Multiwall paper bags, fibre drums.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 82 g/100 mL (20°C).
Molecular Weight: 113.2
Vapour Pressure: 0.001 mm Hg (20°C); 0.0035 mm Hg (30°C).
Boiling Point: 268°C.

Floatability (Water): Sinks and mixes.
Odour: Mild (63 ppb, odour threshold).
Flash Point: 110°C (c.c.); 125°C (o.c.).
Vapour Density: 3.9
Specific Gravity: 1.1 (20°C).

Colour: White.
Explosive Limits: 1.4 to 8%.
Melting Point: 69 to 71°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes and skin - irritation. Inhalation: coughing or mild irritation. Ingestion: nausea.
Toxicology: Moderately toxic by contact and ingestion. Toxic by inhalation.
TLV® 1 mg/m^3; (dust) 5 ppm, 20 mg/m^3 (vapour). TC_{Lo} - Inhalation: human = 100 ppm LD_{50} - Oral: rat = 2.14 g/kg
Short-term Inhalation Limits - 3 mg/m^3 (dust) Delayed Toxicity - No information.
15 min; 10 ppm, 40 mg/m^3 (vapour) (15 min).

Fire

Fire Extinguishing Agents: Use water, dry chemical, foam, or carbon dioxide.
Behaviour in Fire: Emits toxic NO_x fumes when heated to decomposition.
Ignition Temperature: 375°C. **Burning Rate:** 2.4 mm/min.

Reactivity

With Water: No reaction; soluble.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 5 g/L/18 h/catfish/killed/freshwater; BOD: 60%, 20 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. If there is a fire call Fire Department. Avoid contact and inhalation. Dike to prevent runoff. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Other protective clothing as required.

Fire and Explosion

Use water, dry chemical, foam or carbon dioxide.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: skin and eyes - remove contaminated clothing, flush affected areas with water. Inhalation: if breathing has stopped give artificial respiration; if laboured, give oxygen. Ingestion: give conscious victim water to drink. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CARBARYL $C_{10}H_7OOCNHCH_3$

IDENTIFICATION

UN No. 2757
Danger Group According to Percentage of Active Substance
Group III - solid 80 to 100%
- liquid 20 to 100%

Common Synonyms	Observable Characteristics	Manufacturers
1-NAPHTHYL-N-METHYLCARBAMATE **Common Trade Names** SEVIN (A general purpose insecticide).	White to grey powder or solution. Weak odour.	Ciba-Geigy, Cambridge Ont. Chipman Chemical Ltd., Stoney Creek, Ontario. Interprovincial Cooperatives, Saskatoon, Sask.

Transportation and Storage Information

Shipping State: Solid or liquid (formulation).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: No information.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Various purities as described below.
Containers and Materials: Glass bottles, metal cans and drums.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid (technical).
Solubility (Water): All types insoluble, WP, EC and SU are dispersible; 0.012 g/100 mL (30°C) (technical).
Molecular Weight: 201.2
Vapour Pressure: 0.002 mm Hg (40°C) technical.
Boiling Point: No information.

Floatability (Water): Technical sinks; EC, WP and SU are dispersible in water. DU and SN may float.
Odour: Weak.
Flash Point: PP products flammable.
Vapour Density: No information.
Specific Gravity: 1.23 (20°C) (technical); DU 0.46 to 0.58 (20°C).

Colour: White to grey.
Explosive Limits: PP products flammable.
Melting Point: 142°C (technical).

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation of eyes, nose and throat. Contact: skin - irritation; eyes - watering. Ingestion: salivation, sweating, abdominal cramps, nausea, vomiting, diarrhea, cyanosis, tremors and convulsions.
Toxicology: Highly toxic by inhalation and ingestion.

TLV® (inhalation) 5 mg/m^3
Short-term Inhalation Limits - (inhalation) - 10 mg/m^3 (15 min).

LC_{50} - No information.
Delayed Toxicity - Liver damage.

LD_{50} - Oral: rat = 0.250 g/kg
LD_{50} - Inhalation: rat = 0.721 g/kg

Fire

Fire Extinguishing Agents: Use carbon dioxide or dry chemical to extinguish.
Behaviour in Fire: Only PP is flammable, toxic fumes are released in fires.
Ignition Temperature: No information.
Burning Rate: No information.

Reactivity

With Water: No reaction, EC, WP and SU dispersible in water.
With Common Materials: May react with oxidizing agents.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating = 1 to 10 ppm/96 h/TLm/freshwater; 1.47 mg/L/LC_{50}/rainbow trout/96 h/freshwater; 13.0 mg/L/LC_{50}/fathead minnow/96 h/freshwater; 0.038 mg/L/LC_{50}/grass shrimp/24h/saltwater.
Land-Air: LD_{50} - Oral: Chicken = 0.197 g/kg, LD_{50} - Oral: wild bird = 0.056 g/kg
Food Chain Concentration Potential: Unknown.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces - Respiratory Protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion

Use carbon dioxode, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats	Sinks or mixes
3. If possible contain discharge by booming.	3. If possible contain discharge by damming or water diversions.
4. If floating, skim and remove.	4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Absorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Available Formulations

Technical Grade: Purity: typically 99% carbaryl.
Properties: solid, sinks in water, immiscible with water.

Formulations:

Type:	Purity:	Properties:
DU - dust	- typically 5% carbaryl	- insoluble in water, floats
EC - emulsifiable concentrate	- typically 5% carbaryl	- dispersible in water
WP - wettable powder	- typically 5% carbaryl	- combustible, dispersible in water
SU - suspension	- typically 38% carbaryl	- miscible in water
SN - solution	- typically 25% carbaryl in petroleum distillates	- combustible
PP - pressurized product	- typically 1% carbaryl	- flammable, insoluble in water.

Other Possible Ingredients Found in Formulations: Zineb, Folpet, Sulfur, Malathion, pyrethrins, Methoxychlor, rotenone, captan.

CARBOFURAN $C_{12}H_{15}NO_3$

IDENTIFICATION

UN No. 2757
Danger Group According to Percentage of Active Substance
Group II >10 to 100%
Group III solid 1 to 10%
liquid >0 to 10%

Common Synonyms
2,3-DIHYDRO-2,2-DIMETHYL-7-BENZO-FURANYL METHYLCARBAMATE

Common Trade Names
FURADAN
(A systemic insecticide.)

Observable Characteristics
White solid. Odourless.

Manufacturers
FMC of Canada, Regina, Sask.
Chipman Chemicals, Hamilton, Ont.

Transportation and Storage Information

Shipping State: Solid or liquid (formulation).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: No information.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Various, as described below.
Containers and Materials: Glass bottles; cans, drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.07 g/100 mL (20°C)
Molecular Weight: 221.3
Vapour Pressure: 0.00002 mm Hg (33°C).
Boiling Point: No information.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 1.18 (20°C) (technical).

Colour: White.
Explosive Limits: Not flammable.
Melting Point: 150 to 153°C (technical).

HAZARD DATA

Human Health

Symptoms: Inhalation, Ingestion and Contact: headaches, dizziness, salivation, tearing, nausea, vomiting, sweating, abdominal cramps, diarrhea. Absorbed by skin.
Toxicology: Highly toxic by all routes.
TLV® (inhalation) 0.1 mg/m^3
Short-term Inhalation Limits - No information.

LC_{50} - Inhalation: rat = 85 mg/m^3
LC_{50} - Inhalation: guinea pig = 43 mg/m^3/4 h
Delayed Toxicity - No information.

LD_{50} - Oral: human = 0.011 g/kg
LD_{50} - Oral: rat = 0.0053 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical or carbon dioxide to extinguish.
Behaviour in Fire: Only PP flammable. Toxic fumes are released in fires.
Ignition Temperature: No information.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity = 0.64 mg/L/96 h/bluegill/LC_{50}/freshwater; 0.0046 mg/L/48 h/pink shrimp/LC_{50}/salt-water; 0.28 mg/L/96 h/rainbow trout/LC_{50}/freshwater.
Land-Air: Oral: wild bird = 0.00042 g/kg; LD_{50} - skin: wild bird = 0.10 g/kg/LD_{50}. LD_{50} - Oral: chicken = 0.006 g/kg; LD_{50} - Oral: duck = 0.000415 g/kg.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces - Respiratory Protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion

Use carbon dioxide, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats

3. If possible contain discharge by booming.
4. If floating, skim and remove.

Sinks or mixes

3. If possible contain discharge by damming or water diversions.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Absorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Available Formulations

Technical Grade: Purity: typically 99%
Properties: sinks in water, combustible.

Formulations:

Type:	Purity:	Properties:
GR - granular	- typically 10%	- sinks in water
SU - suspension	- typically 47%	- disperses in water

CARBON DIOXIDE CO_2

IDENTIFICATION

UN No. 1013

Common Synonyms	Observable Characteristics	Manufacturers
CARBONIC ACID GAS CARBONIC ANHYDRIDE DRY ICE	Colourless liquid or gas, or white solid. Odourless.	Cominco, Calgary, Alta. Canadian Fertilizers, Medicine Hat, Alta. Liquid Carbonic Canada, Montreal, Quebec.

Transportation and Storage Information

Shipping State: Liquid (compressed gas); solid (frozen liquid).
Classification: Nonpoisonous, nonflammable gas.
Inert Atmosphere: No requirement.
Venting: Liquid - safety relief; solid - open.
Pump type: No information.

Label(s): Green and white label - NONPOISONOUS; NONFLAMMABLE gas.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Commercial, 99.5%.
Containers and Materials: Liquid - cylinders, tank trucks; steel. Solid - food containers.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility (Water): 0.35 g/100 mL (0°C); 0.15 g/100 mL (25°C); 0.097 (40°C); 0.058 (60°C).
Molecular Weight: 44.0
Vapour Pressure: 569.1 mm Hg (-82°C).
Boiling Point: Sublimes, -79°C.

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: 1.5
Specific Gravity: 1.56 (-79°C) solid; 1.1 (-37°C) liquid.

Colour: Colourless (gas); solid is white.
Explosive Limits: Not flammable.
Melting Point: -78.5°C (sublimes).

HAZARD DATA

Human Health

Symptoms: Inhalation: increased respiration rate, headache, dizziness, drowsiness, shortness of breath, weakness and ringing in the ears. Contact: skin and eyes - solid can cause cold contact burns. Liquid or cold gas can cause freezing injury to skin or eyes similar to a burn.
Toxicology: An asphyxiant.
TLV®- 5 000 ppm; 9 000 mg/m^3.
Short-term Inhalation Limits - 15 000 ppm; 27 000 mg/m^3 (15 min).

LC_{Lo} - Inhalation: rat = 657 190 ppm (15 min).
LC_{Lo} - Inhalation: human = 100 000 ppm (1 min).
Delayed Toxicity - None.

LD_{50} - No information.

Fire

Fire Extinguishing Agents: Not combustible. Use water to cool fire-exposed containers.
Behaviour in Fire: Will not support fires and is frequently used as a fire fighting agent. Tanks may rupture in fires.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with diethyl magnesium, lithium, potassium, sodium and titanium.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 100 to 200 mg/L/tns/various organisms/LC_{50}/freshwater; BOD: None.
Land-Air: Waterfowl - Inhalation 5 to 8%; no effect.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Avoid contact and inhalation. Notify supplier. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Protective outer clothing as required.

Fire and Explosion

Not combustible.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: skin (frostbite) do not rub affected areas, treat as a burn. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Allow to disperse to atmosphere in a controlled manner (environmental authorities approval required).

CARBON DISULFIDE CS_2

IDENTIFICATION

UN No. 1131

Common Synonyms	Observable Characteristics	Manufacturers
CARBON DISULFIDE	Clear, colourless to yellow liquid. Disagreeable, pungent, decaying cabbage odour (almost odourless when pure).	Cornwall Chemicals Ltd., Cornwall, Ontario. Thio Pet Chemicals Limited, Fort Saskachewan, Alta.

Transportation and Storage Information

Shipping State: Liquid. **Classification:** Flammable; poison. **Inert Atmosphere:** Nitrogen or other inert gas. **Venting:** Pressure-vacuum (flame arrester). **Pump Type:** Centrifugal, gear, etc., steel or stainless steel.	**Label(s):** Red label - FLAMMABLE LIQUID; Class 3.1, Group I. White label - POISON; Class 6.1, Group I. **Storage Temperature:** Ambient. **Hose Type:** Polyethylene, polypropylene flexible, steel, stainless steel.	**Grades or Purity:** Technical grade, 99.95% min.; commercial, 99.9%. **Containers and Materials:** Drums, tank cars, tank trucks; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid. **Solubility** (Water): 0.23 g/100 mL (20°C). **Molecular Weight:** 76.1 **Vapour Pressure:** 200 mm Hg (10°C); 260 mm Hg (20°); 430 mm Hg (30°C). **Boiling Point:** 46.3°C.	**Floatability** (Water): Sinks. **Odour:** Disagreeable, cabbage, pungent. (0.1 to 0.21 ppm, odour threshold). **Flash Point:** -30°C, (c.c.). **Vapour Density:** 2.6 **Specific Gravity:** 1.26 (20°C).	**Colour:** Colourless to faint yellow. **Explosive Limits:** 1.3 to 50%. **Melting Point:** -111°C.

HAZARD DATA

Human Health

Symptoms: Ingestion: vomiting, headache, cyanosis, respiratory depression, convulsions, unconsciousness. Inhalation: vapours are rapidly absorbed, headache, nausea and dizziness, followed by restlessness, depression, nausea, vomiting, blurred vision and unconsciousness. Contact: (eyes and skin) liquid rapidly absorbed by skin producing symptoms similar to inhalation. Causes redness, burning, cracking and peeling.

Toxicology: Highly toxic by all routes.

TLV*- (skin) 10 ppm; 30 mg/m^3.	LC_{Lo} - Inhalation: human = 4 000 ppm (30 min).	LD_{Lo}- Oral: human = 0.014 g/kg
Short-term Inhalation Limits - No information.	Delayed Toxicity - No information.	

Fire

Fire Extinguishing Agents: Use dry chemical, carbon dioxide or inert gases. Foam is ineffective. Water may be ineffective but may be used to cool fire-exposed containers.

Behaviour in Fire: Flashback may occur along vapour trail. Burning CS_2 releases toxic SO_x fumes.

Ignition Temperature: 90°C. **Burning Rate:** 2.7 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with aluminum, chlorine, azides, fluorine, zinc, potassium and chlorine.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 135 ppm/48 h/mosquito fish/TLm/freshwater; Aquatic toxicity rating = 100 to 1 000 ppm/96 h/TLm/freshwater; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE; POISON". CALL FIRE DEPARTMENT. Eliminate all ignition sources. Stop or reduce discharge if safe to do so. Contact manufacturer for assistance. Avoid contact or inhalation. Dike to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus, and totally encapsulated suit.

Fire and Explosion

Use dry chemical, carbon dioxide or inert gases to extinguish. Foam is ineffective. Water is ineffective but may be used to cool fire-exposed containers. Flashback may occur along vapour trail. Burning CS_2 releases toxic SO_x fumes.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: irrigate eyes with plenty of water; skin - immediately flush affected areas with plenty of water; remove contaminated clothing. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method), if breathing is laboured give oxygen. Ingestion: if victim is conscious, induce vomiting and give water to drink. Repeat until vomitus is clear. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CARBON MONOXIDE CO

IDENTIFICATION

UN No. 1016

Common Synonyms	Observable Characteristics	Manufacturers
MONOXIDE	Colourless gas or liquid. Odourless.	No Canadian manufacturer. Canadian supplier: Liquid Carbonic Canada Ltd., Montreal, Quebec, Scarborough, Ontario, Vancouver, B.C., Regina, Sask.

Transportation and Storage Information

Shipping State: Liquid (compressed gas). **Classification:** Flammable gas; poison. **Inert Atmosphere:** No requirement. **Venting:** Pressure-relief. **Pump Type:** No requirement.	**Label(s):** Red label - FLAMMABLE GAS; Class 3. White label - POISONOUS GAS; Class 2.3. **Storage Temperature:** Ambient. **Hose Type:** No information.	**Grades or Purity:** Commercial, 98%. Also generated in various percentages from carbon combustion. **Containers and Materials:** Cylinders, special trucks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas. **Solubility** (Water): 0.0044 g/100 mL (0°C); 0.0019 g/100 mL (60°C). **Molecular Weight:** 28 **Vapour Pressure:** 760 mm Hg (-191°C); 4 406 mm Hg (20°C). **Boiling Point:** -191.5°C.	**Floatability** (Water): Floats and boils. **Odour:** Odourless. **Flash Point:** No information. **Vapour Density:** 0.97 (0°C). **Specific Gravity:** 0.791 (-191.5°C) liquid; 0.97 (20°C) gas.	**Colour:** Colourless. **Explosive Limits:** 12.5 to 74%. **Melting Point:** -199 to -207°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: headache, nausea, irritability, increased respiration rate, chest pain, confusion, impaired judgement, unconsciousness. Contact: skin - liquid causes frostbite.
Toxicology: Highly toxic by inhalation.

TLV® (inhalation) 50 ppm; 55 mg/m^3. Short-term Inhalation Limits - 400 ppm; 440 mg/m^3 (15 min).	LC_{50} - Inhalation: rat = 1 807 ppm (4 h). Delayed Toxicity - No information.	LD_{50} - No information.

Fire

Fire Extinguishing Agents: Do not put out fire until leak has been shut off. Use water, carbon dioxide, dry chemical to extinguish.
Behaviour in Fire: No information.
Ignition Temperature: 609°C.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with bromine trifluoride, chlorine trifluoride, (lithium and water), oxygen, oxygen difluoride, (potassium and oxygen), silver oxide, (sodium and ammonia).
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 1.5 ppm/1 to 6 h/minnows and sunfish/killed/freshwater; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON. FLAMMABLE.

Immediate Responses

Keep non-involved people away and upwind from spill site. Issue warning: "POISON; FLAMMABLE". CALL FIRE DEPARTMENT. Extinguish all ignition sources. Notify manufacturer. Stop or reduce discharge if safe to do so. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Protective outer clothing as required.

Fire and Explosion

Do not put out fire until leak has been shut off, allow escaping carbon monoxide to burn. Fight fire from safe distance. Use water, carbon dioxide or dry chemical to extinguish. Use water to cool fire-exposed, adjacent containers.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: administer oxygen if available; use artificial respiration (not mouth-to-mouth method) if necessary. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so.	1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.	2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.	3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CARBON TETRACHLORIDE CCl_4

IDENTIFICATION

UN No. 1846

Common Synonyms	Observable Characteristics	Manufacturers
CARBON TET TETRACHLOROMETHANE PERCHLOROMETHANE BENZINOFORM NECATORINA	Clear, colourless, liquid. Strong, ethereal odour somewhat resembling chloroform.	Cornwall Chemicals Ltd., Cornwall, Ontario. Dow Chemical Canada Inc., Sarnia, Ontario.

Transportation and Storage Information

Shipping State: Liquid. **Classification:** Poison. **Inert Atmosphere:** No requirement. **Venting:** Pressure-vacuum. **Pump Type:** Standard types.	**Label(s):** White label - POISON; Class 6.1, Group II. **Storage Temperature:** Ambient. **Hose Type:** Cross-linked polyethylene, Viton, Buna-N flexisteel, Teflon, stainless.	**Grades or Purity:** Commercial, technical. **Containers and Materials:** Cans, drums, tank cars, tank trucks; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid. **Solubility** (Water): 0.12 g/100 mL (25°C); 0.08 g/100 mL (20°C). **Molecular Weight:** 153.8 **Vapour Pressure:** 56 mm Hg (10°C); 90 mm Hg (20°C); 137 mm Hg (30°C). **Boiling Point:** 76.7°C.	**Floatability** (Water): Sinks. **Odour:** Strong ethereal odour (like chloroform). (21 to 200 ppm, odour threshold). **Flash Point:** Not flammable. **Vapour Density:** 5.5 **Specific Gravity:** 1.59 (25°C).	**Colour:** Colourless. **Explosive Limits:** Not flammable. **Melting Point:** -23.0°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - readily absorbed by skin. Symptoms for inhalation, ingestion and skin absorption are: abdominal pains, nausea, vomiting, confusion, weakness, unconsciousness.
Toxicology: Highly toxic by inhalation, ingestion or skin absorption.
TLV®- (skin) 5 ppm; 30 mg/m^3 LC_{50} - Inhalation: mouse = 9 526 ppm/8 h LD_{50} - Oral: rat = 2.8 g/kg
Short-term Inhalation Limits - 20 ppm; 125 mg/m^3 (15 min).
Delayed Toxicity - Delayed effects may include severe damage to liver and kidneys, but may not become evident until 1 to 10 days after exposure. CCl_4 is a suspected carcinogen.

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving carbon tetrachloride.
Behaviour in Fire: Decomposes at high temperatures (in fire) to give phosgene, chlorine and hydrogen chloride.
Ignition Temperature: Not combustible. **Burning Rate:** Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with allyl alcohol, aluminum and its alloys, barium, bromine trifluoride, calcium hypochlorite, diborane, dimethylformamide and fluorine, lithium, magnesium, liquid oxygen, potassium, sodium and strong alkalis.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways..Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: Possibility of concentration in food chain.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Avoid contact and inhalation. Stop or reduce discharge, if this can be done without risk. Contain spill by diking to prevent entry into water intakes or courses. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus; totally encapsulated chemical protection suit.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving carbon tetrachloride. Decomposes at high temperatures evolving phosgene, hydrogen chloride and chlorine gases.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Ingestion: give plenty of water to conscious victim to drink. Keep warm and quiet. Contact: irrigate eyes and flush skin with plenty of water. Remove contaminated clothing at same time. If medical assistance is not immediately available. transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so. 2. Contact manufacturer or supplier for advice. 3. If possible, contain discharge by damming or water diversion. 4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.	1. Stop or reduce discharge if safe to do so. 2. Contact manufacturer or supplier for advice. 3. If possible, contain discharge by damming or water diversion. 4. Remove material with pumps or vacuum equipment and place in appropriate containers. 5. Recover undamaged containers. 6. Absorb residual liquid on natural or synthetic sorbents. 7. Remove contaminated soil for disposal. 8. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CHLORDANE $C_{10}H_6Cl_8$

IDENTIFICATION

UN No. 2761
Danger Group According to Percentage of Active Substance
Group III solid 55 to 100%
liquid 10 to 100%

Common Synonyms	Observable Characteristics	Manufacturers
1,2,4,5,6,7,8,8-OCTACHLOR-2,3,3a,4,7,7a-HEXAHYDRO-4,7, METHANOINDANE	White to grey powder, granules or grey to brown liquids. Solid, odourless. Liquids, chlorine-like odour.	Chipman, Incorporated, Stoney Creek, Ontario. Interprovincial Co-ops Ltd., Saskatoon, Saskatchewan. Velsicol Corp., Mississauga, Ontario. Chevron Chemical, Burlington, Ontario.

(Chlordane is a pesticide commonly used to control ground insects such as ants and grubs.)

Transportation and Storage Information

Shipping State: Solid or liquid (formulation).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open; SN (flame arrester).
Pump Type: No information.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Various, as described below.
Containers and Materials: Glass bottles, cans, drums; aluminum clad or enamel-lined.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid (technical).
Solubility (Water): Technical-insoluble, EC and WP are dispersable.
Molecular Weight: 409.8
Vapour Pressure: 0.0001 mm Hg (20°C) (technical).
Boiling Point: 175°C (technical).

Floatability (Water): All except SN sink.
Odour: Odourless.
Flash Point: SN 56-90°C (c.c.).
Vapour Density: No information.
Specific Gravity: 1.59 to 1.63 (25°C) (technical).

Colour: Solid-white to grey. Liquid-grey to brown.
Explosive Limits: Only SN may be flammable.
Melting Point: No information.

HAZARD DATA

Human Health

Symptoms: Inhalation, Ingestion or Skin Contact: blurred vision, confusion, abdominal pain, nausea, vomiting, diarrhea, hyperexcitability, tremors, convulsions, followed by CNS depression which may terminate in respiratory failure.
Toxicology: Highly toxic by ingestion. Moderately toxic by skin contact.
TLV® (skin) 0.5 mg/m^3
Short-term Inhalation Limits - (skin) 2.0 mg/m^3
LC_{50} - Inhalation: cat = 100 mg/m^3/4 h
Delayed Toxicity - Suspected carcinogen.
LD_{50} - Oral: rabbit = 0.10 g/kg
LD_{50} - Oral: human = 0.04 g/kg

Fire

Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical.
Behaviour in Fire: Releases toxic fumes.
Ignition Temperature: No information.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 0.0082 to 0.097 mg/L/96 h/rainbow trout/LC_{50}/freshwater; 0.058 mg/L/24 h/bluegill/LC_{50}/freshwater; 0.062 to 0.214 mg/L/96 h/fathead minnow/LC_{50}/freshwater.
Land-Air: LD_{50} - Oral: chicken = 0.22 g/kg; LD_{50} - Oral: mallard = 800-850 mg/L (5 day); LD_{50} - Oral: pheasant = 400-500 mg/L (5 day).
Food Chain Concentration Potential: Possible; chlordane is known to be present in the environment.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces - Respiratory Protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion

Use carbon dioxide, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats

3. If possible contain discharge by booming.
4. If floating, skim and remove.

Sinks or mixes

3. If possible contain discharge by damming or water diversions.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Absorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Available Formulations

Technical Grade: Purity: 60 to 75%
Properties: sinks in water.

Formulations:

Type:	Purity:	Properties:
Du - dust	- typically 5%, remainder inerts	- low combustibility
EC - emulsifiable concentrate	- typically 75%	- dispersible in water
GR - granular	- typically 5 to 25%, remainder inerts	- sinks in water, low combustibility
SN - solution	- typically 2% in deoderized kerosene	- flammable to combustible, floats on water
WP - wettable powder	- typically 40%	- dispersable in water

CHLORINE Cl_2

IDENTIFICATION

UN No. 1017

Common Synonyms	Observable Characteristics	Manufacturers
None.	Greenish-yellow gas or clear, amber-coloured liquid under pressure. Pungent, bleach-like, irritating odour.	C.I.L. Inc., Cornwall, Ont., Dalhousie, N.B., Becancour, Que. Dow Chemical Canada Inc., Sarnia, Ont., Fort Saskatchewan, Alta. Canadian Occidental Petroleum Ltd., Vancouver, B.C., Nanaimo, B.C. F.M.C., Squamish, B.C.

Transportation and Storage Information

Shipping State: Liquid (compressed gas).
Classification: Poisonous gas.
Inert Atmosphere: No requirement.
Venting: Safety relief.
Pump Type: Normally transferred by its own pressure.

Label(s): White label - POISONOUS GAS; Class 2.3.
Storage Temperature: Ambient.
Hose Type: Rigid piping (steel, special grade); special flexible steel or stainless steel, copper tubing.

Grades or Purity: Commercial, technical, pure (99.9%).
Containers and Materials: Cylinders, tank cars, tank trucks, ton containers; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility (Water): 1.46 g/100 mL (0°C); 0.57 g/100 mL (30°C).
Molecular Weight: 70.9
Vapour Pressure: 2 749 mm Hg (0°C); 6 780 mm Hg (31°C).
Boiling Point: -34.1°C.

Floatability (Water): Liquid sinks and boils.
Odour: Characteristic, pungent, irritating (0.3 to 3.5 ppm, odour threshold).
Flash Point: Not flammable.
Vapour Density: (Gas) 2.5 g/L (20°C, 1 atm)
Specific Gravity: 1.57 (-40°C) (liquid).

Colour: Greenish-yellow.
Explosive Limits: Not flammable.
Melting Point: -101°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation of mucous membranes, watering of eyes, nasal discharge, sneezing, coughing, difficulty breathing, headache, nausea, muscular weakness and pulmonary edema. Ingestion: pain and burning sensation, thirst, abdominal cramps, nausea and vomiting, difficulty breathing, shock, convulsions and coma.
Contact: skin - burning sensation, inflammation and blisters; eyes - burning, watering, loss of sight.
Toxicology: High toxicity by inhalation.

TLV®- (inhalation) 1 ppm; 3 mg/m^3.
Short-term Inhalation Limits - 3 ppm; 9 mg/m^3 (15 min).

LC_{50} - Inhalation: rat = 293 ppm/1 h
LC_{50} - Inhalation: mouse = 137 ppm/1 h
Delayed Toxicity - None known.

LD_{50} - No information.

Fire

Fire Extinguishing Agents: Not combustible in air; use water with caution in fires involving chlorine as chlorine in water at some concentrations is very corrosive. Use water to keep fire-exposed containers cool.
Behaviour in Fire: Most combustible materials burn in chlorine as they do in oxygen. May combine with H_2O or steam to produce toxic and corrosive HCl fumes.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; slightly soluble. May react to produce toxic and corrosive HCl fumes.
With Common Materials: Can react with: turpentine, ether, ammonia gas, hydrocarbons, hydrogen and powdered metals, polypropylene, rubber, sulfamic acid, acetaldehyde, acetylene, alcohols, alkyl phosphenes, aluminum, benzene, boron, brass, calcium, carbon, carbon disulfide, copper, ethane, ethylene, glycerol, iron, magnesium, manganese, several mercuric compounds, phosphorus, PCBs, silicone, sodium and zinc.
Stability: Stable, within the limits of the foregoing.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in very low concentrations. Fish toxicity: 0.08 ppm/168 h/trout/TLm/freshwater; 0.7 to 0.15 ppm/96 h/fathead minnow/LC_{50}/freshwater; 0.5 mg/L/72 h/Daphnia magna/LC_{50}/freshwater; Aquatic toxicity rating = <1 ppm/96 h/TLm/freshwater; BOD: None.
Land-Air: Lethal to plant life.

EMERGENCY MEASURES

Special Hazards

CORROSIVE, POISON. HIGH CHEMICAL REACTIVITY. Vapour cloud collects in low lying areas.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE; POISON". Call Fire Department. Evacuate from downwind. Avoid contact and inhalation. Stop or control leak if safe to do so. Contact manufacturer for advice. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated suit. Gloves - rubber. Boots rubber (pants worn outside boots).

Fire and Explosion

Not combustible. In fires involving chlorine, use water with caution, but water should not be applied directly to a chlorine leak. Use water to cool fire-exposed containers.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: eyes (for liquid or gas) - irrigate with large amount of water for at least 30 min; skin - wash with plenty of water and soap for at least 15 minutes, and remove contaminated clothing; if both inhalation and contact have occurred, first aid for inhalation should be given first. Ingestion: rinse mouth of conscious victim liberally with water and give water to drink. Keep warm and quiet. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

2. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Recover undamaged containers.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CHLOROBENZENE C_6H_5Cl

IDENTIFICATION

UN No. 1134

Common Synonyms	Observable Characteristics	Manufacturers	
MONOCHLOROBENZENE PHENYL CHLORIDE BENZENE CHLORIDE MCB CHLOROBENZOL	Clear, colourless liquid. Almond-like odour.	No Canadian manufacturers. Canadian supplier: Dow Chemical Canada Inc., Sarnia, Ontario.	Originating from: Dow Chemical, Midland, Michigan, USA

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: Centrifugal or positive displacement; carbon or stainless steel.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.2, Group II.
Storage Temperature: Ambient.
Hose Type: Cross-linked polyethylene, Viton, Teflon, braided, flexible stainless steel or bronze.

Grades or Purity: Technical, 99.5%.
Containers and Materials: Drums, tank cars, tank trucks; carbon steel, stainless steel. Not aluminum.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 0.05 g/100 mL (20°C); 0.0488 g/100 mL (30°C).
Molecular Weight: 112.6
Vapour Pressure: 8.8 mm Hg (20°C); 11.8 mm Hg (25°C); 15 mm Hg (30°C).
Boiling Point: 132°C.

Floatability (Water): Sinks.
Odour: Almond-like (0.21 to 0.22 ppm, odour threshold).
Flash Point: 29°C (c.c.).
Vapour Density: 3.9
Specific Gravity: 1.1 (20°C).

Colour: Colourless.
Explosive Limits: 1.3 to 7.1%.
Melting Point: -45°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - irritation, mild burns, may be absorbed; eyes - irritation, watering, inflammation. Inhalation: irritation of eyes, nose and throat, coughing, dizziness, headache, extreme drowsiness, loss of consciousness, coma. Ingestion: irritation of lips and mouth, nausea, vomiting, diarrhea, drowsiness, loss of consciousness, narcosis and shock.
Toxicology: Moderately toxic by inhalation, ingestion and contact.

TLV®- (inhalation) 75 ppm; 350 mg/m^3.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - Long-term exposure, suspected liver and kidney damage.

LD_{50} - Oral: rat = 2.9 g/kg

Fire

Fire Extinguishing Agents: Carbon dioxide, dry chemical or foam. Water spray may be used to control large fires. Layer of water may be used to blanket the fire.
Behaviour in Fire: Flashback may occur along vapour trail. Combustion products may be toxic.
Ignition Temperature: 593 to 638°C.
Burning Rate: 4.6 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Can react vigorously with oxidizing compounds. Reacts with dimethyl sulfoxide and silver perchlorate. Degrades aluminum, rubber and plastic. Hazardous polymerization will not occur.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 20 ppm/96 h/bluegill/TLm/freshwater; Aquatic toxicity rating = 1 to 100 ppm/96 h/TLm/freshwater; 29 to 30 mg/L/48 h/fathead minnow/TLm/freshwater; BOD: 0.3 lb./lb., 5 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call Fire Department. Eliminate all ignition sources. Avoid contact and inhalation. Stay upwind and use water spray to control vapours. Stop or reduce discharge, if safe to do so. Contact manufacturer. Dike or dam spill to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Acid suit - (jacket and pants) rubber or plastic, or coveralls. Boots - high, rubber (pants worn outside boots). Gloves - rubber or plastic.

Fire and Explosion

Use dry chemical, foam or carbon dioxide. Water spray may be used to control small fires. Layer of water may be used to blanket the fire. Flashback may occur along vapour trail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if breathing has stopped; give oxygen if breathing is laboured. Contact: remove contaminated clothing; wash eyes and affected skin with plenty of warm water for at least 15 minutes. Ingestion: give warm water to conscious victim to drink. Keep warm and quiet. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CHLOROFORM $CHCl_3$

IDENTIFICATION

UN No. 1888

Common Synonyms	Observable Characteristics	Manufacturers	
TRICHLOROMETHANE METHENYL TRICHLORIDE	Clear, colourless, liquid. Characteristic ethereal odour.	Canadian Supplier:	Originating from:
		Allied Chemical, Mississauga, Ont.	Allied Chemical, USA
		Dow Chemical Canada, Inc., Sarnia, Ont.	Dow Chemical, USA
		Du Pont Canada, Montreal, Que.	West Germany
		Mallinckrodt Canada, Pte Claire, Que.	Mallinckrodt, USA

Transportation and Storage Information

Shipping State: Liquid.
Classification: Poison.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: Gear or centrifugal; steel or stainless steel.

Label(s): White label - POISON; Class 6.1, Group II.
Storage Temperature: Ambient.
Hose Type: Flexible stainless steel, Teflon, Viton.

Grades or Purity: Technical.
Containers and Materials: Drums, tank trucks, tank cars; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 1.0 g/100 mL (15°C); 0.8 g/100 mL (20°C); 0.93 g/100 mL (25°C).
Molecular Weight: 119.4
Vapour Pressure: 160 mm Hg (20°C); 245 mm Hg (30°C).
Boiling Point: 61.2°C.

Floatability (Water): Sinks.
Odour: Characteristic ethereal (205 to 307 ppm, odour threshold).
Flash Point: Not flammable.
Vapour Density: 4.1
Specific Gravity: 1.49 (20°C).

Colour: Colourless.
Explosive Limits: Not flammable.
Melting Point: -63.5°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: of high concentrations may result in narcosis, shock and coma. Contact: irritating to skin and mucous membranes. Ingestion: followed by severe burning in mouth and throat, pain in chest and abdomen and vomiting, loss of consciousness.
Toxicology: Moderate by inhalation and ingestion.
TLV®- (inhalation) 10 ppm; 50 mg/m^3.
Short-term Inhalation Limits - 50 ppm; 225 mg/m^3 (15 min).

LC_{50} - Inhalation: mouse = 28 g/m^3
TC_{10} - Inhalation: human = 5 000 mg/m^3/7 min.
Delayed Toxicity - Suspected carcinogen.
Causes liver and kidney damage.

LD_{50} - Oral: rat = 0.8 g/kg
LD_{Lo} - Oral: human = 0.14 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving chloroform.
Behaviour in Fire: Decomposes at high temperatures (as in fires) to give phosgene and hydrochloric gases.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with acetone and a base, aluminum, lithium, magnesium, nitrogen tetroxide, potassium, (potassium hydroxide and methanol) and sodium. Dissolves rubber and plastics.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: critical concentration = 10 mg/L; Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: 0.08%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Avoid contact and inhalation. Stop or reduce discharge, if this can be done without risk. Contain spill by diking to prevent entry into water intakes or courses. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves - rubber or vinyl. Boots - rubber (pants worn outside boots). Outerwear - coveralls, aprons, suit - impervious material.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving chloroform. Chloroform decomposes at high temperatures (as in fires) to evolve phosgene and hydrogen chloride.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Ingestion: keep warm and quiet. Treat as severe emergency. Contact: remove contaminated clothing and irrigate eyes and flush skin with plenty of water for at least 15 min. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CHLOROSULFONIC ACID $ClSO_3H$ or $(ClSO_2OH)$

IDENTIFICATION

UN No. 1754

Common Synonyms	Observable Characteristics	Manufacturers	
SULFURIC CHLOROHYDRIN CHLORSULFONIC ACID CHLORSULFURIC ACID.	Colourless to pale yellow liquid. Sharp, acrid, choking odour. Fumes when exposed to air.	No Canadian manufacturers. Canadian Supplier: Du Pont Canada, Montreal, Que., Toronto, Ont. and branches across Canada.	Originating from: E.I. Du Pont de Nemours and Co. Inc., Wilmington, Del., USA

Transportation and Storage Information

Shipping State: Liquid.
Classification: Corrosive liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: Centrifugal, gear; steel, stainless steel.

Label(s): Black and white label - CORROSIVE; Class 8, Group I.
Storage Temperature: Ambient.
Hose Type: Teflon, flexible steel, stainless steel.

Grades or Purity: Technical (commercial).
Containers and Materials: Carboys, drums, tank cars, tank trucks.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): Reacts to form H_2SO_4 and HCl.
Molecular Weight: 116.5
Vapour Pressure: 0.8 mm Hg (30°C); 1 mm Hg (32°C).
Boiling Point: 151 to 158°C.

Floatability (Water): Reacts violently, decomposes into sulfuric and hydrochloric acids.
Odour: Sharp, acrid, penetrating. (1 to 5 ppm, odour threshold).
Flash Point: Not flammable.
Vapour Density: 4.0
Specific Gravity: 1.77 (20°C).

Colour: Colourless to pale yellow.
Explosive Limits: Not flammable.
Melting Point: -80°C.

HAZARD DATA

Human Health

Symptoms: Causes severe burns. Contact: skin - concentrated solutions are rapidly destructive to body tissues; eyes - rapidly causes severe damage, which may be followed by total loss of sight. Inhalation: vapour or mist will cause damage to the upper respiratory tract and even to lung tissue, and loss of consciousness. Ingestion: destructive to mouth, throat and stomach, pain and burning sensation.
Toxicology: Highly toxic by ingestion, inhalation and contact.
TLV®- (inhalation) No information. LC_{50} - No information. LD_{50} - No information.
Short-term Inhalation Limits - No information. Delayed Toxicity - No information.

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving chlorosulfonic acid. Water may be used to cool fire-exposed containers. Do not let water contact chlorosulfonic acid.
Behaviour in Fire: Not combustible. Can cause ignition by contact with combustible material.
Ignition Temperature: Not combustible. **Burning Rate:** Not combustible.

Reactivity

With Water: Reacts violently to produce sulfuric and hydrochloric acids.
With Common Materials: Reacts violently with acetic acid, acetic anhydride, acetonitrile, acrolein, acrylic acid, acrylonitrile, allyl alcohol, allyl chloride, ammonium hydroxide, aniline, butyraldehyde, creosote, cresol, cumene, diisobutylene, epichlorohydrin, ethylacetate, ethylacrylate, ethylenediamine, ethyleneglycol, hydrochloric acid, hydrofluoric acid, hydrogen peroxide, metal powders, methylethyl ketone, nitric acid, phosphorus, propylene oxide, pyridine, sodium hydroxide, sulfuric acid, styrene, vinyl acetate and organic matter.
Stability: Stable, within the limits of the foregoing.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 282 ppm/96 h/mosquito fish/TLm/freshwater; 100 to 300 ppm/48 h/shrimp/LC_{50}/saltwater; Aquatic toxicity rating = 10 to 100 ppm/96 h/TLm/freshwater; BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

CORROSIVE. VIOLENT REACTION IN CONTACT WITH WATER. REACTS WITH MANY MATERIALS.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Call Fire Department. Call manufacturer or supplier for assistance. Stop or reduce discharge, if this can be done without risk. Use water spray to control vapour. Do not allow water to contact material. Contain spill by diking to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - use self-contained breathing apparatus. Acid suit - complete, rubber with hood or totally encapsulated suit. Boots - rubber, pants worn outside boots. Gloves - gauntlet, rubber.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving chlorosulfonic acid. Water may be used to cool fire-exposed containers. Do not let water contact chlorosulfonic acid.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: flush eyes and skin with plenty of water for at least 15 minutes, while removing contaminated clothing. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method), if laboured give oxygen. Ingestion: give conscious victim large amounts of water to drink. Do not induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers. Caution must be taken to make sure water does not contact material during recovery procedures.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CHROMIC ANHYDRIDE CrO_3

IDENTIFICATION

UN No. 1463 Solid
1755 Solution

Common Synonyms	Observable Characteristics	Manufacturers		
CHROMIC ACID CHROMIC ACID, SOLID CHROMIUM TRIOXIDE CHROMIUM OXIDE CHROMIUM VI OXIDE	Dark red, crystals or powder. Odourless.	No Canadian manufacturer. Selected US manufacturer: Essex Chemical Company, Clifton, NJ, USA	Canadian supplier: Canada Chrome and Chemicals Ltd., Toronto, Ont. Van Waters and Rogers, Vancouver, B.C.	Originating from: British Crome, UK Diamond Shamrock, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: Corrosive; Oxidizer.
Inert Atmosphere: No requirement.
Venting: No requirement.

Label(s): Yellow label - OXIDIZER; Class 5.1, Group II. Black and white label - CORROSIVE; Class 8, Group II.
Storage Temperature: Ambient.

Grades or Purity: Technical flake, 99.75% CrO_3.
Containers and Materials: Drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 61.7 g/100 mL (0°C); 67.5 g/100 mL (100°C).
Molecular Weight: 100
Vapour Pressure: No information.
Boiling Point: Decomposes at 250°C.

Floatability (Water): Sinks and dissolves.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 2.70 (20°C).

Colour: Dark red.
Explosive Limits: Not flammable.
Melting Point: 196°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - irritation, inflammation and tissue destruction; eyes - irritation, inflammation, risk of serious lesions. Ingestion: burning sensation in mouth and throat, stomach cramps, nausea and vomiting, diarrhea, shock, coma. Inhalation: irritation of nose and eyes, difficulty breathing and sneezing.
Toxicology: Very toxic by inhalation; moderately toxic by ingestion and contact.
TLV® (Inhalation) 0.05 mg/m^3 (as Cr VI).
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - Suspected carcinogen.
LD_{50} - No information.
LD_{Lo} - Subcutaneous: dog = 0.3 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Use water on fires involving chromic anhydride.
Behaviour in Fire: Chromic acid is a very powerful oxidizer and can ignite organic materials. In fire, containers may rupture.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Chromic acid is a powerful oxidizing agent and may ignite organic materials. Reacts violently with acetic acid, acetic anhydride, acetone, aluminum, ammonia, anthracene, benzene, camphor, diethyl ether, alcohol, glycerol, hydrocarbons, hydrogen sulfide, methanol, naphthalene, phosphorus, potassium, pyridine, sodium, sulfur and turpentine.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 52 ppm/96 h/goldfish/died/freshwater; 0.01 ppm/48 h/Daphnia magna/TLm/freshwater;
BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

OXIDIZER, POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "OXIDIZER, POISON". Avoid contact and inhalation. Stop or reduce discharge, if this can be done without risk. Dike spill to prevent runoff. Notify supplier and environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces Respiratory protection - self-contained breathing apparatus. Otherwise goggles - (mono), tight fitting. Gloves - rubber, plastic coated. Dust respirators - with suitable filters for protection against dusts and mists. Protective clothing - coveralls, aprons, suits. Rubber safety shoes.

Fire and Explosion

Not combustible. Use water on fires involving chromic anhydride. Chromic anhydride is a very powerful oxidizing agent and may ignite organic materials. In fire, containers may rupture.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - irrigate with plenty of water; skin - flush affected areas with large volumes of water; at the same time, remove contaminated clothing. Ingestion: if victim is conscious, rinse mouth with water and give water to drink. Inhalation: if breathing has stopped give artificial respiration (not mouth-to-mouth method); if breathing is laboured, give oxygen. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

COBALT Co
IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
COBALT METAL (nonradioactive).	Silvery, bluish-white shining metal. Black powder. Odourless.	Shell Canada Ltd., Toronto, Ontario.

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: No requirement.
Label(s): Not regulated.
Storage Temperature: Ambient.
Grades or Purity: 95 to 99.9%.
Containers and Materials: Kegs, drums.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Insoluble.
Molecular Weight: 58.9
Vapour Pressure: No information.
Boiling Point: 2 900 to 3 500°C.
Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 8.9 (20°C).
Colour: Silver-grey or black.
Explosive Limits: Not flammable.
Melting Point: 1 493°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: shortness of breath, irritation of respiratory tract; asthma-like symptoms. Ingestion: pain, vomiting, diarrhea, convulsions. Contact: skin-dermatitis, irritation; eyes - conjunctivitis.
Toxicology: Highly toxic by inhalation and ingestion.
TLV® (inhalation) 0.05 mg/m^3 (as metal dust and fume).
Short-term Inhalation Limits - 0.1 mg/m^3 (15 min) (as metal dust and fume).
LC_{50} - No information.
Delayed Toxicity - Some evidence of damage to heart, thyroid and pancreas.
LD_{50} - No information.
LD_{Lo} - Oral: rat = 1.5 g/kg

Fire

Fire Extinguishing Agents: Solid metal is not combustible. Powder is combustible; use specially formulated dry-type agents to extinguish fires involving cobalt (dry sand, dry dolomite, dry graphite or sodium chloride).
Behaviour in Fire: Powdered cobalt may be pyrophoric in air.
Ignition Temperature: 370°C (dust); 760°C (cloud). **Burning Rate:** No information.

Reactivity

With Water: No reaction.
With Common Materials: Powdered cobalt reacts violently with acetylene, air and ammonium nitrate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 50.0 mg/L/tns/Daphnia magna/LC_{100}/freshwater; 1.0 mg/L/rainbow trout/not harmful/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POWDERED COBALT IS PYROPHORIC.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Avoid contact or inhalation of dust or fumes. Notify manufacturer or supplier. Notify environmental authorities.

Protective Clothing and Equipment

In fires, or enclosed spaces, Respiratory protection - self-contained breathing apparatus; otherwise, Gloves - rubber. Safety goggles or glasses. Coveralls.

Fire and Explosion

Solid metal is not combustible. Powder is combustible and pyrophoric. Use specially formulated dry-type agents to extinguish fires involving cobalt. (dry sand, dry dolomite, dry graphite or sodium chloride).

First Aid

Move victim out of spill area to fresh air. Call for medical assistance. but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Ingestion: give milk or water to conscious victim to drink, induce vomiting. Contact: skin - remove contaminated clothing and wash affected areas thoroughly with plenty of water; eyes - irrigate with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

COPPER Cu

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
COPPER METAL	Reddish, metallic solid or powder. Odourless.	Canada Metal Co. Ltd., Toronto, Ontario. Gaspé Copper Mines Ltd., Murdochville, Que.

Transportation and Storage Information

Shipping State: Solid. **Classification:** Not regulated. **Inert Atmosphere:** No requirement. **Venting:** No requirement.	**Label(s):** Not regulated. **Storage Temperature:** Ambient.	**Grades or Purity:** 99.9%+. **Containers and Materials:** Kegs, drum, bulk by rail or truck; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid. **Solubility** (Water): 0.00002g/100 mL (30°C). **Molecular Weight:** 63.6 **Vapour Pressure:** No information. **Boiling Point:** 2 560 to 2 600°C.	**Floatability** (Water): Sinks. **Odour:** Odourless. **Flash Point:** Not flammable. **Vapour Density:** No information. **Specific Gravity:** 8.9 (20°C).	**Colour:** Reddish. **Explosive Limits:** Dust can explode. **Melting Point:** 1 083°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: dust irritates the nose and upper respiratory tract. Ingestion: causes metallic taste, nausea, gastrointestinal problems.
Toxicology: Highly toxic by inhalation (dust and fumes); moderately toxic by ingestion.

TLV®- (inhalation) 0.2 mg/m^3 (copper fume); 1 mg/m^3 (dust, mist). Short-term Inhalation Limits - 2.0 mg/m^3 (15 min) (dusts and mists).	LC_{50} - No information. Delayed Toxicity - Possible kidney damage, jaundice, perforation of nasal septum.	LD_{50} - Intraperitoneal: mouse = 0.0035 g/kg

Fire

Fire Extinguishing Agents: Solid is not combustible. Powder is combustible. Use specially formulated dry-type agents to extinguish fires involving copper (dry sand, dry dolomite, dry graphite or sodium chloride).
Behaviour in Fire: Solid is not combustible. Powder is combustible and can explode.

Ignition Temperature: No information.	**Burning Rate:** No information.

Reactivity

Water: No reaction.
With Common Materials: Reacts violently with acetylene, ammonium nitrate, bromates, chlorates, iodates, chlorine, ethylene oxide, fluorine, hydrogen peroxide and hydrogen sulfide.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Saltwater aquatic guideline: 0.7 µg/L/24 h/average; concentration should not exceed 8 µg/L at any time; human drinking water criterion = 1 µg/L; BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Powdered copper is flammable. Dust is explosive.

Immediate Responses

Keep non-involved people away from spill site. In the case of powdered copper, call Fire Department. Stop or reduce discharge if safe to do so. Contact manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires, or enclosed spaces, Respiratory protection - self-contained breathing apparatus; otherwise, Gloves - rubber. Safety goggles or glasses. Coveralls.

Fire and Explosion

Powdered copper may ignite when heated.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Ingestion: give milk or water to conscious victim to drink. Induce vomiting. Contact: skin - remove contaminated clothing and wash affected areas throughly with plenty of water; eyes - irrigate with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

COPPER CHLORIDE $CuCl_2$

IDENTIFICATION

UN No. 2802

Common Synonyms	Observable Characteristics	Manufacturers
CUPRIC CHLORIDE $CuCl_2$ COPPER (II) CHLORIDE (dihydrate) $CuCl_2.2H_2O$	Anhydrous: Brownish-yellow powder. Odourless. Dihydrate: Green crystals. Odourless.	No Canadian Manufacturers: US Manufacturers: Diamond Shamrock Corp. Cleveland, Ohio. Mallinckrodt Inc. St. Louis, Missouri.

Transportation and Storage Information

Shipping State: Solid.
Classification: Corrosive.
Inert Atmosphere: No requirement.
Venting: No requirement.

Label(s): Black and white label - CORROSIVE; Class 8; Group III.
Storage Temperature: Ambient.

Grades or Purity: Technical.
Containers and Materials: Fibre drums, barrels.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 70.6 g/100 mL (0°C), 107.9 g/100 mL (100°C) (anhydrous); 110.4 g/100 mL (0°C), 192.4 g/100 mL (100°C) (dihydrate).
Molecular Weight: 134.4 (anhydrous); 170.5 (dihydrate).
Vapour Pressure: No information.
Boiling Point: Anhydrous decomposes to CuCl at 993°C. Dihydrate loses $2H_2O$ at 100°C.

Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 3.39 (anhydrous); 2.54 (dihydrate) (20°C).

Colour: Brownish-yellow or green.
Explosive Limits: Not flammable.
Melting Point: 620°C (anhydrous); dihydrate loses $2H_2O$ at 100°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: coughing, sneezing, irritation of nose and throat. Ingestion: burning sensation, stomach cramps, nausea, vomiting, diarrhea, convulsions, coma. Contact: skin - itching and inflammation; eyes - stinging and inflammation.
Toxicology: Highly toxic by ingestion and inhalation.
TLV®- 1 mg/m^3 (as Cu dusts and mists), 0.2 mg/m^3 (copper fume). Short-term inhalation Limits - 2 mg/m^3 (15 min)as Cu dust and mists).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 0.14 g/kg
LD_{50} - Oral: mouse = 0.19 g/kg
LD_{50} - Oral: guinea pig = 0.03 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving copper chloride.
Behaviour in Fire: No information.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Can react violently with potassium and sodium.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: critical concentration = 3.3 mg/L; 0.044 ppm/3 weeks/Daphnia magna/LC_{50}/freshwater; 0.009 ppm (as Cu)/tns/goldfish/rapid death/freshwater; BOD: none.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Dike spill area, particularly if there is any danger of water runoff. Avoid inhalation of dust and fumes. Lightly wet down dry spillage, particularly if there is any dust drift by wind. Notify supplier or manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces Respiratory protection - self-contained breathing apparatus. Other protective equipment as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used on fires involving copper chloride.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: conscious victim should be given water to drink. Keep warm and quiet. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so.	1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.	2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.	3. Dike to prevent runoff from rainwater or water application.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.	4. Remove material by manual or mechanical means.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.	5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

COPPER NAPHTHENATE

IDENTIFICATION

Common Synonyms

CUPRENOL
WITTOX-C
COPPER UVERSOL
NAPHTHENIC ACID, COPPER SALT
Copper naphthenate is derived from naphthenic acid which is a mixture of cyclic aliphatic acids.

Observable Characteristics

Dark green liquid (solution) or green-blue solid. Solution smells of the solvent, typically gasoline, mineral oil distillates.

Manufacturers

Dussek Bros. (Canada) Ltd., Belleville, Ontario.
Nuodex Canada Limited, Toronto, Ontario.

Transportation and Storage Information

Shipping State: Liquid (solution).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum or open (flame arrester).
Pump Type: No information.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: 6, 8 or 11.5% copper.
Containers and Materials: Drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Insoluble.
Molecular Weight: Variable.
Vapour Pressure: No information.
Boiling Point: 154 to 202°C.

Floatability (Water): Sinks or floats depending on specific gravity.
Odour: Solution, smells of the solvent.
Flash Point: 38°C (c.c. typical).
Vapour Density: No information.
Specific Gravity: 0.93 to 1.06 (20°C).

Colour: Green-blue (solid) or dark green liquid
Explosive Limits: 0.8 to 5.0% (mineral spirits).
Melting Point: No information.

HAZARD DATA

Human Health

Symptoms: Inhalation: concentrated vapour of solvent may cause headache, and in severe cases, uncoordination. Ingestion: burning pain in mouth and throat, causes gastrointestinal irritation, vomiting, convulsions and collapse. Contact: may cause skin or eye irritation.
Toxicology: Highly toxic by ingestion or inhalation.
TLV®- (inhalation) - 0.2 mg/m^3 (copper fume); 1 mg/m^3 (copper dust, mist).
Short-term Inhalation Limits - 2.0 mg/m^3 (15 min) (copper dust and mist).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - No information.
LD_{Lo} - Oral: mouse = 0.11 g/kg

Fire

Fire Extinguishing Agents: Use foam, carbon dioxide and dry chemical. Water may be used to cool fire-exposed containers.
Behaviour in Fire: No information.
Ignition Temperature: 282°C (mineral spirits).
Burning Rate: 4 mm/min (mineral spirits).

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Aquatic toxicity rating = 2.0 ppm/72 h/blue-green algae/100% kill/freshwater; BOD: 8%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Call Fire Department. Avoid contact and inhalation. Stop or reduce discharge, if safe to do so. Dike to prevent runoff. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces Respiratory protection - self-contained breathing apparatus. Otherwise, goggles, respirator, rubber gloves, coveralls.

Fire and Explosion

Use foam, carbon dioxide or dry chemical to extinguish fires. Water may be used to cool fire-exposed containers.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: remove contaminated clothing and wash eyes and affected skin thoroughly with plenty of water. Ingestion: give water or milk to conscious victim to drink. Allow vomiting to occur. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

Floating

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Sinking

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

COPPER SULFATE $CuSO_4 \cdot 5H_2O$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
BLUESTONE CUPRIC SULFATE BLUE VITRIOL ROMAN VITRIOL COPPER 2 SULFATE PENTAHYDRATE COPPER SULFATE PENTAHYDRATE	Whitish-blue to greenish-blue powder or crystals. Odourless.	Canadian Copper Refiners Ltd., Montreal, Que. Cominco Limited, Kimberley, B.C. Canadian Metafina, Vancouver, B.C.

Transportation and Storage Information

Shipping State: Solid.
Classification: Not regulated.
Inert Atmosphere: No requirement.
Venting: Open.
Label(s): None. Class 9.2, Group 1.
Storage Temperature: Ambient.
Grades or Purity: Technical.
Containers and Materials: Multiwall paper and poly bags, drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 31.6 g/100 mL (0°C); 203.3 g/100 mL (100°C).
Molecular Weight: 249.7
Vapour Pressure: No information.
Boiling Point: Loses $4H_2O$ at 110°C; loses $5H_2O$ at 150°C.
Floatability (Water): Sinks and mixes.
Odour: Odourless.
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: 2.28 (20°C).
Colour: Whitish-blue to greenish-blue.
Explosive Limits: Not flammable.
Melting Point: Loses $4H_2O$ at 110°C; loses $5H_2O$ at 150°C.

HAZARD DATA

Human Health

Symptoms: Contact: irritation of eyes and skin, as well as congestion of nasal mucous membranes. Ingestion: vomiting, gastric pain, hemorrhagic gastritis, diarrhea, convulsions and collapse. Inhalation: sore throat, coughing, shortness of breath.
Toxicology: Moderately toxic by ingestion and inhalation.
TLV® (inhalation) 0.2 mg/m^3 (as fume Cu); 1 mg/m^3 (dust, mist Cu).
Short-term inhalation Limits - 2 mg/m^3 for 15 min (as Cu, dust and mist).
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - Oral: rat= 0.3 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving copper sulfate.
Behaviour in Fire: Not combustible. When heated above 400°C can release toxic SO_x fumes. Closed containers may rupture when heated above 110°C due to loss of water vapour and expansion.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: No reaction, soluble.
With Common Materials: Can react with hydroxylamine and magnesium.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 0.15 mg/L/48 h/rainbow trout/TLm/freshwater; 3.8 ppm/24 h/rainbow trout/TLm/freshwater; 1.0 mg/L/24 h/Daphnia magna/LC_{100}/freshwater; BOD: None.
Land-Air: LD_{Lo} - wild bird = 0.3 g/kg
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Avoid contact and inhalation. Stop or reduce discharge if safe to do so. Contain spill by diking. Notify manufacturer or supplier. Notify environmental authorities.

Protective Clothing and Equipment

In fires and confined spaces - Respiratory protection - self-contained breathing apparatus. Otherwise, Gloves - rubber or plastic. Goggles - (mono), tight fitting. Rubber boots (pants worn outside boots).

Fire and Explosion

Not combustible. Most fire extinguishing agents may be use on fires involving copper sulfate.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: remove contaminated clothing, wash eyes and affected skin with plenty of water. Keep warm and quiet. Ingestion: give milk or water to conscious victim to drink. Induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CRESOL $CH_3C_6H_4OH$

IDENTIFICATION

UN No. 2076

Common Synonyms

HYDROXYMETHYLBENZENE
CRESYLIC ACID
HYDROXYTOLUENE
METHYL PHENOL
ORTHO-CRESOL; o-CRESOL,2-CRESOL) Cresol (cresylic acid)
META-CRESOL; m-CRESOL,3-CRESOL) is usually a mixture
PARA-CRESOL; p-CRESOL,4-CRESOL) of these forms.

Observable Characteristics

Colourless to yellow or pink to yellow-brown liquid (sometimes solid). Tarry or phenol-like odour.

Manufacturers

Canadian supplier:
Domtar Chemicals Group,
Tar and Chemicals Division,
Toronto, Ont.

Transportation and Storage Information

Shipping State: Liquid or solid.
Classification: Poison.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: Centrifugal; steel, stainless steel.

Label(s): White label - Poison; Class 6.1, Group II.
Storage Temperature: Ambient.
Hose Type: Polyethylene, butyl, Viton.
Containers and Materials: Drums, tank cars, tank trucks; steel, stainless steel.

Grades or Purity: USP liquid (mixed isomers). Phenol-cresol mixtures: Ortho-cresol; 80 to 98% (with phenol). Meta-cresol; 60 to 98% (with other cresols and xylenol). Meta-para-cresol, containing cresol and xylenols. Para-cresol 92 to 98% containing meta-cresol.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid (sometimes a solid).
Solubility (Water): (o) 3.1 g/100 mL (40°C), 5.6 g/100 mL (100°C); (m) 2.4 g/100 mL (20°C), 5.8 g/100 mL (100°C); (p) 2.4 g/100 mL (40°C), 5.3 g/100 mL (100°C).
Molecular Weight: 108.1 (pure o, m, or p).

Floatability (Water): Sinks.
Odour: Tarry or phenol-like (0.001 to 27 ppm, odour threshold); (o) 0.26 ppm, (m) 0.27 ppm, (p) 0.2 ppm.
Flash Point: (o) 81°C; (m or p) 86°C(c.c.).
Vapour Density: (o,m,p) 3.7
Vapour Pressure: (o) 0.24 mm Hg (25°C), 5 mm Hg (64°C); (m) 0.04 mm Hg (20°C), 0.12 mm Hg (30°C), 5 mm Hg (76°C); (p) 0.04 mm Hg (20°C), 1 mm Hg (53°C).

Colour: Colourless to yellow or pink to yellow-brown.
Explosive Limits: 1.4% (LEL, o); 1.1% (LEL, m, p).
Melting Point: (o) 31°C; (m) 12°C; (p) 34.8°C.
Specific Gravity: 1.04 (20°C)(o,m,p).
Boiling Point: (o) 191°C; (m) 202°C; (p) 202°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - readily absorbed producing burns and symptoms similar to inhalation. Inhalation: results in muscular weakness, headache, dizziness, dimness of vision, ringing in ears, irregular and rapid respiration, weak pulse, mental confusion, muscular twitching, loss of consciousness. Ingestion: in addition to the above there can also be nausea, with or without vomiting, and severe abdominal pains.
Toxicology: Highly toxic by ingestion. Moderately toxic by contact and inhalation. Readily absorbed through skin.
TLV®- (skin) 5 ppm; 22 mg/m^3.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - Possible damage to liver and kidney.

LD_{50} - Oral: rat = 1.45 g/kg (cresol mixture).
LD_{50} - Oral: rat = 0.12 g/kg (ortho).
LD_{50} - Oral: rat = 0.24 g/kg (meta).
LD_{50} - Oral: rat = 0.21 g/kg (para).

Fire

Fire Extinguishing Agents: Use water spray, dry chemical, foam or carbon dioxide. Use water spray to disperse vapours and keep fire-exposed containers cool.
Behaviour in Fire: Emits highly toxic fumes in fires.
Ignition Temperature: 599°C (o-cresol); 558°C (m- or p-cresol)

Burning Rate: No information.

Reactivity

With Water: No reaction; slightly soluble.
With Common Materials: Can react vigorously with oxidizing materials. Reacts with chlorosulfonic acid, nitric acid and oleum.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 24 ppm/96 h/bluegill/TLm/freshwater; Aquatic toxicity rating = 1 to 10 ppm/96 h/TLm/freshwater; (ortho) 22.2 to 20.8 mg/L/48 h/bluegill/TLm/freshwater; (meta) 24 mg/L/48 h/mosquito fish/TLm/freshwater; BOD: o-cresol: 164%, 5 days; m-cresol:170%, 5 days; p-cresol: 144%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Call Fire Department. Avoid contact and inhalation. Contact manufacturer or supplier for advice. Stop or reduce discharge, if safe to do so. Dike to contain toxic runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated suit. Gloves - rubber. Boots - high, rubber - pants worn outside boots.

Fire and Explosion

Use water spray, dry chemical, foam or carbon dioxide. Use water spray to disperse vapours and keep fire-exposed containers cool.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: skin - remove contaminated clothing, flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim to drink. Do not induce vomiting. Inhalation: oxygen is recommended for respiratory distress. Treat as an emergency. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. If material is a solid, remove by manual or mechanical means.
6. Recover undamaged containers.
7. Absorb residual liquid on natural or synthetic sorbents.
8. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

CRYOLITE $AlF_3 \cdot 3NaF$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
GREENLAND SPAR ICETONE KRYOLITH SODIUM ALUMINUM FLUORIDE ALUMINUM SODIUM FLUORIDE SODIUM FLUOALUMINATE	Colourless to white, sometimes reddish or brown to black, solid. Odourless.	Aluminum Company of Canada Ltd., Montreal, Quebec. Alcan Smelters and Chemicals Ltd., Jonquière, Quebec.

Transportation and Storage Information

Shipping State: Solid. **Classification:** None. **Inert Atmosphere:** No requirement. **Venting:** Open.	**Label(s):** Not regulated. **Storage Temperature:** Ambient.	**Grades or Purity:** Commercial, technical. **Containers and Materials:** Drums, bulk by rail or truck; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid. **Solubility** (Water): 3 g/100 mL (0°C); 4 g/100 mL (25°C); 9 g/100 mL (90°C). **Molecular Weight:** 210 **Vapour Pressure:** No information. **Boiling Point:** No information.	**Floatability** (Water): Sinks. **Odour:** Odourless. **Flash Point:** Not flammable. **Vapour Density:** No information. **Specific Gravity:** 2.95	**Colour:** Colourless to white, sometimes reddish or brown to black. **Explosive Limits:** Not flammable. **Melting Point:** 1 000°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - irritation and dermatitis. Inhalation (dust): coughing, chills, tightness in chest, cyanosis. Ingestion: salivation, nausea, vomiting, diarrhea, abdominal pain, convulsions.
Toxicology: Highly toxic by ingestion and skin absorption.

TLV® (inhalation) 2.5 mg/m³ (as Fluoride, F). Short-term Inhalation Limits - No information.	LC_{50} - No information. Delayed Toxicity - may result in long-term bone damage especially for repeated exposure.	LD_{50} - Oral: rat = 0.2 g/kg LD_{50} - Intraperitoneal: rat = 0.059 g/kg

Fire

Fire Extinguishing Agents: Not combustible. Most fire extinguishing agents may be used on fires involving cryolite.
Behaviour in Fire: No information.

Ignition Temperature: Not combustible.	**Burning Rate:** Not combustible.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 5 ppm/Daphnia magna/static bioassay; BOD: None.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge, if this can be done without risk. Contain spill by diking, particularly if there is any water runoff. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - dust respirator with suitable filter for dust protection. Goggles - (mono) type, tight fitting. Gloves - rubber, neoprene or PVC coated. Outer clothing, as required.

Fire and Explosion

Not combustible. Most fire extinguishing agents may be used in fires involving cryolite.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Ingestion: give plenty water or milk to conscious victim to drink. Keep warm and quiet. Contact: skin and eyes - remove contaminated clothing and flush affected areas with plenty of water. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CUMENE $C_6H_5CH(CH_3)_2$

IDENTIFICATION

UN No. 1918

Common Synonyms	Observable Characteristics	Manufacturers
CUMOL ISOPROPYLBENZENE 2-PHENYLPROPANE	Clear, colourless liquid. Sharp aromatic odour.	Gulf Oil Canada Limited, Montreal, Quebec.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Open (flame arrester).
Pump Type: Centrifugal, gear, explosion-proof, grounded.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.2, Group II.
Storage Temperature: Ambient.
Hose Type: Viton, polypropylene, Teflon.

Grades or Purity: Technical.
Containers and Materials: Drums, tank cars, tank trucks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 0.005 g/100 mL (20°C).
Molecular Weight: 120.2
Vapour Pressure: 3.2 mm Hg (20°C); 10 mm Hg (38°C).
Boiling Point: 152.0 to 152.7°C.

Floatability (Water): Floats.
Odour: Sharp aromatic, (0.008 to 0.047 ppm, odour threshold).
Flash Point: 36 to 44°C (c.c.).
Vapour Density: 4.1
Specific Gravity: 0.86 (20°C).

Colour: Colourless.
Explosive Limits: 0.9 to 6.5%.
Melting Point: -96.1°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation of respiratory tract, sore throat, coughing, shortness of breath, nausea. Ingestion: abdominal pain and vomiting. Contact: skin - redness and irritation. Also absorbed by skin to produce symptoms similar to inhalation.
Toxicology: Moderately toxic by inhalation, ingestion and contact.
TLV® - (skin) 50 ppm; 245 mg/m^3.
Short-term Inhalation Limits - (skin) 75 ppm; 365 mg/m^3 (15 min).
LC_{50} - Inhalation: rat = 8 000 ppm/4 h
Delayed Toxicity - No information.
LD_{50} - Oral: rat = 1.4 g/kg

Fire

Fire Extinguishing Agents: Use water spray, dry chemical, foam or carbon dioxide. Use water to keep fire-exposed containers cool. Water spray may be ineffective in fighting fire.
Behaviour in Fire: Flashback may occur along vapour trail.
Ignition Temperature: 425°C.
Burning Rate: 5 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing materials. Reacts violently with nitric acid, oleum, chlorosulfonic acid.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: >110 ppm/24 h/brine shrimp/TLm/saltwater; BOD: 40%, 5 days (freshwater).
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Eliminate all sources of ignition. Call manufacturer or supplier for guidance. Contain spill by diking to prevent runoff. Stop or reduce discharge, if safe to do so. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus, and totally encapsulated suit. Gloves - butyl or PVA. Boots - high, rubber.

Fire and Explosion

Use water spray, dry chemical, foam or carbon dioxide, to extinguish. Use water to keep fire-exposed containers cool. Flashback may occur along vapour trail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if necessary. Contact: eyes - flush with plenty of water; skin - remove contaminated clothing and flush affected areas with water. Ingestion: Do not induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

CUMENE HYDROPEROXIDE $C_6H_5C(CH_3)_2OOH$

IDENTIFICATION

UN No. 2116

Common Synonyms	Observable Characteristics	Manufacturers
α,α-DIMETHYLBENZYL HYDROPEROXIDE CUMYL HYDROPEROXIDE ISOPROPYLBENZENE HYDROPEROXIDE	Colourless to pale yellow liquid.	Gulf Oil Canada Limited, Montreal, Quebec.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Organic peroxide.
Inert Atmosphere: No requirement.
Venting: Open (flame arrester).
Pump Type: Standard types.

Label(s): Yellow label - ORGANIC PEROXIDE; Class 5.2, Group I.
Storage Temperature: Ambient.
Hose Type: Standard types.

Grades or Purity: 77 to 85%; 90% cut with cumene.
Containers and Materials: Drums, tank cars, tank trucks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 1.5 g/100 mL (20°C).
Molecular Weight: 152.2
Vapour Pressure: 25 mm Hg at 100°C.
Boiling Point: 153°C (decomposes).

Floatability (Water): Floats or sinks depending on specific gravity.
Odour: No information.
Flash Point: 79°C (c.c.); 88°C (o.c.).
Vapour Density: 5.3
Specific Gravity: (70%) 1.00; (90%) 1.05 (20°C).

Colour: Colourless to pale yellow.
Explosive Limits: 0.9 to 6.5% (as cumene).
Melting Point: -10°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: sore throat, coughing, shortness of breath, laboured breathing. Contact: skin and eyes - redness and pain, burning sensation. Ingestion: abdominal pain, vomiting, diarrhea.
Toxicology: Highly toxic by inhalation, skin absorption and ingestion.
TLV® - No information.
Short-term Inhalation Limits - No information.
LC_{50} - Inhalation: rat = 220 ppm/4 h
Delayed Toxicity - No information.
LD_{50} - Oral: rat = 0.4 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, foam, carbon dioxide or water spray.
Behaviour in fire: At concentrations of 91% and above, decomposes violently at about 150°C. At temperatures greater than 153°C also decomposes with some violence.
Ignition Temperature: Decomposes above 153°C.
Burning Rate: Decomposes.

Reactivity

With Water: No reaction.
With Common Materials: Strong oxidizing agent, may react with organic materials.
Stability: Stable; however, compositions 91% and above decompose.

Environment

Water: Prevent entry into water intakes and waterways; BOD: No information.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

ORGANIC PEROXIDE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "ORGANIC PEROXIDE". CALL FIRE DEPARTMENT. Eliminate all sources of ignition. Call manufacturer. Dike to prevent runoff. Stop or reduce discharge, if this can be done without risk. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self contained breathing apparatus. Gloves. Boots. Clothing - acid suit, coveralls (neoprene, natural rubber, butyl) (pants worn outside boots).

Fire and Explosion

Use dry chemical, foam, carbon dioxide, water spray to extinguish. Decomposes with some violence at temperatures greater than 153°C.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: eyes - irrigate thoroughly with water for at least 15 minutes; skin - flush thoroughly with water and soap for at least 15 minutes. Ingestion: give plenty of water to conscious victim to drink. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

Floats
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Sinks
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

CYANIDES

IDENTIFICATION

UN No. 1587 Copper cyanide $CU(CN)_2$
1680 Potassium cyanide KCN
1713 Zinc cyanide $Zn(CN)_2$

Common Synonyms	Observable Characteristics	Manufacturers	
COPPER CYANIDE - CUPRICIN - CUPRIC CYANIDE - CUPROUS CYANIDE (see also sodium cyanide)	KCN - white crystals. $Zn(CN)_2$ - colourless to white powder. $CU(CN)_2$ - white to yellow-green powder. All have distinct hydrocyanic acid odour (almond-like).	No Canadian manufacturers Canadian suppliers: Canadian Industries Ltd., Toronto, Ontario. Du Pont Canada Ltd., Montreal, Que.; Toronto, Ont.	Originating from: E.I. Du Pont de Nemours Inc., Wilmington, Delaware; Niagara Falls, NY.

Transportation and Storage Information

Shipping State: Solid.
Classification: Poisonous solid.
Inert Atmosphere: No requirement.
Venting: Sealed containers.

Label(s): White lavel - POISON; Class 6.1, Group I, II or III.
Storage Temperature: Ambient.

Grades or Purity: Technical: Potassium cyanide: 97% KCN; Copper cyanide: 99% $CU(CN)_2$; Zinc cyanide: 95.3% $Zn(CN)_2$.
Containers and Materials: Cans, drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): (Cu) insoluble; (K) 50 g/100 mL (25°C); 100 g/100 mL (100°C); (Zn) 0.005 g /100 mL (20°C).
Molecular Weight: (Cu) 115.6; (K) 65.1; (Zn) 117.4.
Vapour Pressure: No information.
Boiling Point: Cu (decomposes in air); K (no information); Zn (decomposes 800°C).

Floatability (Water): KCN sinks and mixes. Zn and Cu cyanides sink.
Odour: Distinct HCN odour (almond-like).
Flash Point: Not flammable.
Vapour Density: No information.
Specific Gravity: (Cu) 2.92 (20°C); (K) 1.52 (16°C); (Zn) 1.85 (20°C0.

Colour: White to yello-green crystals or powders.
Explosive Limits: Not flammable.
Melting Point: Cu (decomposes in air); K, 634.5°C; Zn (decomposes 800°C).

HAZARD DATA

Human Health

Symptoms: Inhalation, Ingestion and Contact (skin): dizziness, rapid respiration, vomiting, flushing, headache, drowsiness, rapid pulse and unconsciousness.
Toxicology: Highly toxic by inhalation, ingestion and skin contact.

TLV*- (skin) 5 mg/m^3 (as CN^-).
short-term inhalation Limits - No information.

LC_{50} - No information
Delayed Toxicity - No information.

LD_{Lo} - Intraperitoneal: rat 0.05 g/kg (Cu)
LD_{50} - Oral: rat = 0.01 g/kg (K)
LD_{Lo} - Intrapertional: rat = 0.1 g/kg (Zn)

Fire

Fire Extinguishing Agents: Not combustible. In fires involving cyanides, most fire extinguishing agents may be used, except water.
Behaviour in Fire: Not combustible.
Ignition Temperature: Not combustible.
Burning Rate: Not combustible.

Reactivity

With Water: In contact with water or moist air, low concentration of HCN gas is released.
With Common Materials: Contact with acids or weak alkalis liberates poisonous and flammable HCN gas. Reacts violently with chlorates, fluorine, magnesium, nitrates, nitric acid and nitrites.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in very low concentrations. Fish toxicity: 0.16 ppm/48 h/bluegill/TLm/freshwater; BOD: 0%, 7 days (theoretical) (K).
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Avoid contact and inhalation. Contact supplier or manufacturer for guidance. Stop or reduce discharge, if this can be done without risk. Dike to prevent runoff from rainwater or water application. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated suit. Gloves - cotton for dry product, rubber for solutions. Boots, coveralls - as required.

Fire and Explosion

Not combustible. In fires involvng cyanides, most fire extinguishing agents may be used, except water.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Contact: immediately flush skin and eyes with plenty of water, while removing contaminated clothes. Keep warm and quiet. Inhalation: give artificial respiration or oxygen if breathing has stopped or is laboured (do not use mouth-to-mouth technique). Ingestion: if victim is conscious, induce vomiting and repeat until vomitus is clear. Give oxygen. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

CYCLOHEXANE $(CH_2)_6$

IDENTIFICATION

UN No. 1145

Common Synonyms	Observable Characteristics	Manufacturers
HEXAMETHYLENE HEXAHYDROBENZENE HEXANAPHTHENE	Clear, colourless liquid. Aromatic odour.	Gulf Oil Canada Limited, Montreal, Quebec.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Open (flame arrester) or pressure-vacuum.
Pump Type: Centrifugal, gear, explosion-proof motors.

Label(s): Red label - FLAMMABLE; Class 3.1, Group II.
Storage Temperature: Ambient.
Hose Type: Reinforced antistatic rubber, neoprene.

Grades or Purity: Commercial 85 to 98%; technical.
Containers and Materials: Cans, drums, tank cars, tank trucks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 0.0055 g/100 mL (20°C); 0.0045 g/100 mL (15°C).
Molecular Weight: 84.2
Vapour Pressure: 77 mm Hg (20°C); 120 mm Hg (30°C).
Boiling Point: 80.7°C.

Floatability (Water): Floats.
Odour: Aromatic (0.04 to 0.41 ppm, odour threshold).
Flash Point: -20°C (c.c.).
Vapour Density: 2.9
Specific Gravity: (liquid) 0.78 (20°C).

Colour: Colourless.
Explosive Limits: 1.3 to 8.4%
Melting Point: 6.3 to 6.6°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: headache, nausea, vomiting, dizziness, unconsciousness, convulsions. Ingestion: dizziness, fatigue, unconsciousness, coma. Contact: skin - dryness and irritation; eyes - stinging, watering and inflammation.
Toxicology: Moderately toxic by inhalation and ingestion.
TLV® (inhalation) 300 ppm; 1 050 mg/m^3.
Short-term Inhalation Limits - 375 ppm; 1 300 mg/m^3 (15 min).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 29.8 g/kg
LD_{50} - Oral: mouse = 1.3 g/kg

Fire

Fire Extinguishing Agents: Use foam, dry chemical or carbon dioxide. Water may be ineffective. Cool fire-exposed containers with water.
Behaviour in Fire: No information.
Ignition Temperature: 245°C.

Burning Rate: 6.9 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Can react with strong oxidizing agents. Reacts violently with nitrogen dioxide.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Fish toxicity: 15 500 ppm/24 h/mosquito fish/TLm/freshwater; 32 to 43 mg/L/48 h/fathead minnow/TLm/freshwater; 34 to 43 mg/L/48 h/bluegill/TLm/freshwater; BOD: 238%, 25 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". CALL FIRE DEPARTMENT. Eliminate all sources of ignition. Use only spark-proof tools. Call manufacturer or supplier for guidance. Dike to prevent runoff. Stop or reduce discharge, if this can be done without risk. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves - butyl, neoprene, or PVC. Outer protective clothing - as required. Acid suit, coveralls, etc. Boots - high, rubber (pants worn outside boots).

Fire and Explosion

Use foam, dry chemical or carbon dioxide to extinguish. Water may be ineffective. Cool fire-exposed containers with water spray.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: administer artificial respiration, if necessary. Contact: eyes - irrigate with plenty of water; skin - flush with plenty of water, while removing contaminated clothing. Ingestion: Do not induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal or cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

2,4-D $C_8H_6Cl_2O_3$ (acid)

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
(2,4-DICHLOROPHENOXY) ACETIC ACID 2,4-D AMINE 2,4-D ESTER	White to brown or grey solids (flakes), brown liquids. Characteristic.	Ciba-Geigy Canada Ltd., Cambridge, Ontario. Chipman Inc., Stoney Creek, Ontario. Allied Chemical Services, Calgary, Alberta. Interprovincial Co-ops Ltd., Saskatoon, Saskatchewan. Dow Chemical Canada Inc., Sarnia, Ontario. (from Midland, MI).
(A commonly used herbicide for the control of broadleaf weeds.)		

Transportation and Storage Information

Shipping State: Solid or liquid (formulation).
Classification: Miscellaneous Dangerous Goods, Class 9.1, 9.2.
Inert Atmosphere: No requirement.
Venting: Open.

Pump Type: No information.
Label(s): Not required.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Various, as described below.
Containers and Materials: Glass bottles; jugs, pails, cans, drums; steel. Not aluminum.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid (technical acid), liquid (technical ester or amine or solutions).
Solubility (Water): 0.09 g/100 mL (25°C) technical acid; technical butoxyethanol ester - insoluble; 300 g/100 mL (20°C) technical amine; 333 g/100 mL isoctyl ester.
Molecular Weight: 221.0 (acid)
Vapour Pressure: 0.4 mm Hg (160°C) technical acid.

Floatability (Water): Sinks; EC will disperse, amine is soluble.
Odour: Characteristic (3 ppm, odour threshold).
Flash Point: Variable.
Vapour Density: No information.
Specific Gravity: 1.57 (30°C) technical acid.
Boiling Point: 160°C (0.4 mm Hg) technical acid; 870°C technical amine, decomposes; 156-162°C (1.5 mm Hg) butoxyethanol ester.

Colour: White to brown or grey.
Explosive Limits: PP products can form explosive mixtures in air.
Melting Point: 135 to 138°C (technical acid); 85 to 87°C (technical amine).

HAZARD DATA

Human Health

Symptoms: Ingestion: irritation of gastrointestinal tract, flushing of skin, nausea, vomiting, CNS depression, muscular twitching, muscular weakness. Inhalation: respiratory tract irritation, asthma. Contact: skin - irritation and allergic reaction.
Toxicology: Highly toxic by ingestion. Moderately toxic by inhalation and skin contact.

TLV®- No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
TC_{Lo} - Inhalation: Human = 1 mg/m^3 (butylester)
Delayed Toxicity - Suspected carcinogen.

LD_{50} - Oral: human = 0.05 g/kg (acid)
LD_{50} - Oral: rat = 0.375 g/kg (acid)
LD_{50} - Oral: rat = 0.666 g/kg (sodium salt)

Fire

Fire Extinguishing Agents: Use foam, carbon dioxide or dry chemical.
Behaviour in Fire: Releases toxic fumes.
Ignition Temperature: No information.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water. Toxicity rating = 1 to 10 ppm/96 h/TLm/freshwater; Fish toxicities: 5.6 mg/L/48 h/LC_{50}/Daphnia magna/freshwater (ester); 2.2 mg/L/48 h/LC_{50}/rainbow trout/freshwater (acid); 1.1 mg/L/48 h/bluegill/LC_{50}/freshwater (ester); 5.0 mg/L/48 h/killifish/LC_{50}/saltwater.
Land-Air: LD_{50} - Oral: Chicken = 0.54 g/kg (acid); LD_{50} >5000 ppm/duck/5 days (ester), mule deer = 0.5 g/kg (acid), pheasant = 0.47 g/kg (acid).
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards
POISON.

Immediate Responses
Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment
In fires or confined spaces - Respiratory protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion
Use carbon dioxide, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid
Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim to drink and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available, transport victim to hospital, doctor, or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats
3. If possible contain discharge by booming.
4. If floating, skim and remove.

Sinks or mixes
3. If possible contain discharge by damming or water diversions.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Adsorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal
1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Formulations (typical ingredients)	acid	diethylamine salt	mixed butyl esters	isooctyl esters	butoxyethyl ester	propylene glycol butyl ester	diethanolamine salt	other amine salts	sodium salt
EC			30 to 80%	3 to 60%	40 to 70%	20%	-		
- emulsifiable concentrate									
- dispersible in water									
CE	5%	0.1 to 0.5%	-	-	20%	-	-	5%	-
- granular									
- low combustibility									
PP	-	0.2%	-	-	-	-	0.3%	-	-
- prescribed product									
- flammable									
PE	3 to 5%	-	-	-	-	-	-	-	-
- pellet									
- low combustibility									
SH	60%	10 to 60%	-		-		1 to 30%	2 to 20%	-
- solution									
- combustibility varies from low to high									
SO	33%	-	-	-	-	-	-	-	-
- solid									
- combustible									
TA	-	-	-	-	-	-	-	-	33%
- tablet									
- low combustibility									

Other possible ingredients found in formulations: atrazine, bromacil, dicamba, mercury, MCPA, trifluralin, borax, propylene.

DICAMBA $HOOC(C_2)_2C_6H_2Cl(OCH_3)$

IDENTIFICATION

UN No. 2769
Danger Group According to Percentage of Active Substance
Group III liquid 50 to 100%

Common Synonyms	Observable Characteristics	Manufacturers
3,6-DICHLORO-O-ANISIC ACID 3,6-DICHLORO-2-METHOXYBENZOIC ACID **Common Trade Names** BANVEL DYCLEER (A herbicide for broadleaf plants.)	White, grey to brown solid or brownish liquid. Odourless.	Ciba-Geigy, Cambridge, Ont. Chipman Chemicals, Hamilton, Ont. Velsicol Chemical Corporation, Mississauga, Ont.

Transportation and Storage Information

Shipping State: Solid or liquid (formulation).
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: No information.

Label(s): Not regulated.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Various, as described below.
Containers and Materials: Glass bottles; cans, drums; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.45 g/100 mL (Solid), SN 72 g/100 mL; EC is dispersible in water.
Molecular Weight: 221.1
Vapour Pressure: 0.000034 mm Hg (25°C).
Boiling Point: No information.

Floatability (Water): Sinks; SN soluble, EC dispersible in water.
Odour: Odourless.
Flash Point: Only PP flammable.
Vapour Density: 7.64
Specific Gravity: 1.57 (20°C) technical.

Colour: White, grey to brown.
Explosive Limits: Only PP products are flammable.
Melting Point: 114 to 116°C (technical).

HAZARD DATA

Human Health

Symptoms: Inhalation: dizziness, weakness, headache, nausea, vomiting and difficulty breathing. Contact: eyes - extremely irritating. Ingestion: symptoms similar to inhalation.
Toxicology: Moderately toxic by ingestion.
TLV® No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 1.04 g/kg
LD_{50} - Oral: Guinea pig = 3.00 g/kg

Fire

Fire Extinguishing Agents: Use carbon dioxide, foam or dry chemical.
Behaviour in Fire: Releases toxic fumes in fires.
Ignition Temperature: No information.

Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Stable.

Environment

Water: Prevent entry into water intakes or waterways. Fish toxicity: 40 mg/L/48 h/bluegill/TLm/freshwater; 35 mg/L/48 h/rainbow trout/LC_{50}/freshwater.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces - Respiratory Protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion

Use carbon dioxide, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration (not mouth-to-mouth method); if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give water to conscious victim and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats

3. If possible contain discharge by booming.
4. If floating, skim and remove.

Sinks or mixes

3. If possible contain discharge by damming or water diversions.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Absorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Available Formulations

Technical Grade: Purity: typically 98%
Properties: combustible solid, slightly soluble in water

Formulations:

Type:	Purity:	Properties:
EC - emulsifiable concentrate	- typically 1%	- dispersible in water
GR - granular	- typically 1%, remainder inerts	
PE - pellet	- typically 1%, remainder inerts	
SN - solution	- typically 15% in water	- not combustible, miscible with water (dimethylammonium salt)
PP - pressurized product	- typically 0.1%	- flammable

Other Possible Ingredients Found in Formulations: MCPA; 2,4-D; Mecoprop; bromacil.

DICAMBA $HOOC(C_2)_2C_6H_2Cl(OCH_3)$

1,2-DICHLOROBENZENE $C_6H_4Cl_2$

IDENTIFICATION

UN No. 1591

Common Synonyms	Observable Characteristics	Manufacturers
ORTHO-DICHLOROBENZENE o-DICHLOROBENZENE DCB DOWTHERM-E	Colourless liquid. Pleasant, aromatic odour.	Record Chemical Co. Inc., Montreal, Quebec.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Poison.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: Standard types. Steel or stainless steel.

Label(s): White label - POISON;
Class 6.1; Group III.
Storage Temperature: Ambient.
Hose Type: Polyethylene, Viton, stainless steel, Teflon.

Grades or Purity: Technical, 99.5%;
technical, 85% ortho, 15% para-;
technical 80% ortho, 17% para-;
2% meta-. Pure >99.5% ortho., <0.5% para.
Containers and Materials: Drums, tank cars, tank trucks; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 0.010 g/100 mL (20°C);
0.015 g/100 mL (25°C).
Molecular Weight: 147.0
Vapour Pressure: 1 mm Hg (20°C);
1.9 mm Hg (30°C).
Boiling Point: 180.5°C.

Floatability (Water): Sinks.
Odour: Pleasant, aromatic,
(4.0 to 50.0 ppm, odour threshold).
Flash Point: 66°C (c.c.).
Vapour Density: 5.1
Specific Gravity: 1.31 (20°C).

Colour: Colourless.
Explosive Limits: 2.2 to 9.2%.
Melting Point: -16.7 to -18°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: coughing, faintness, trembling, coma. Contact: skin and eyes - redness and burning sensation. Ingestion: abdominal pain, vomiting, shock.
Toxicology: Moderately toxic by inhalation and ingestion.
TLV® (inhalation) 50 ppm, 300 mg/m^3.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
LC_{Lo} - Inhalation: rat = 821 ppm/7 h
Delayed Toxicity - Possible long-term effects of liver and kidney damage.

LD_{50} - Oral: rat = 0.5 g/kg

Fire

Fire Extinguishing Agents: Use water spray, foam, dry chemical, or carbon dioxide. Use water to keep fire-exposed containers cool.
Behaviour in Fire: Toxic gases (HCl and other chlorine-containing compounds) may be given off at elevated temperatures.
Ignition Temperature: 648°C.
Burning Rate: 1.3 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: May react with oxidizing materials. Can react violently with finely divided aluminum.
Stability: Stable.

Environment

Water: Prevent entry to water intakes and waterways. Fish toxicity: 13 ppm/tns/marine plankton/no growth/saltwater; harmful to Chlorella sp. (alga) at 18 mg/L; BOD: less than 0.1%, 1/3 day (theoretical).
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Call Fire Department. Avoid contact and inhalation. Notify manufacturer. Stop or reduce discharge, if this can be done without risk. Dike spill to contain runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus. Gloves and apron or coveralls, plastic coated. Boots - high, rubber (pants worn outside boots).

Fire and Explosion

Use water spray, foam, dry chemical or carbon dioxide to extinguish. Water may be used to keep fire-exposed containers cool. Toxic gases (HCl and other chlorine-containing compounds) may be given off at elevated temperatures.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: remove contaminated clothing and wash eyes and skin with plenty of warm water. Ingestion: Give water to conscious victim to drink and induce vomiting. Inhalation: apply artificial respiration if breathing has stopped (not mouth-to-mouth method); oxygen if breathing is laboured. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Absorb residual liquids on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

DIMETHYL ETHER CH_3OCH_3

IDENTIFICATION

UN No. 1033

Common Synonyms	Observable Characteristics	Manufacturers	
METHYL ETHER METHYL OXIDE WOOD ETHER WOOD NAPHTHA	Colourless gas. Pleasant, ethereal odour.	No Canadian manufacturer. Canadian supplier: Union Carbide Canada Limited, Pointe aux Trembles, Quebec.	Originating from: Union Carbide Corporation, Chemicals and Plastics, New York, NY.

Transportation and Storage Information

Shipping State: Liquid (compressed gas).
Classification: Flammable gas.
Inert Atmosphere: No requirement
Venting: Safety-relief.
Pump Type: No information.

Label(s): Red label - FLAMMABLE GAS; Class 2.1.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: Technical, 99.5%.
Containers and Materials: Cylinders; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Gas.
Solubility (Water): 7 g/100 mL (18°C).
Molecular Weight: 46.1
Vapour Pressure: 1 915 mm Hg (0°C); 3 745 mm Hg (20°C); 5 692 mm Hg (34°C).
Boiling Point: -24.8°C.

Floatability (Water): Floats.
Odour: Ethereal.
Flash Point: -41.1°C (c.c.).
Vapour Density: 1.6
Specific Gravity: 0.67 (20°C).

Colour: Colourless.
Explosive Limits: 3.4 to 27.0%.
Melting Point: -141.5°C.

HAZARD DATA

Human Health

Symptoms: Inhalation or Ingestion: headache, dizziness and rapid loss of consciousness, respiratory paralysis, anaesthesia. Contact: skin or eyes - liquid may cause frostbite.
Toxicology: Moderately toxic by ingestion or inhalation.
TLV® - (inhalation) No information.
Short-term Inhalation Limits - No information.
LC_{50} - Inhalation: mouse = 386 ppm/15 min.
Delayed Toxicity - No information.
LD_{50} - No information.

Fire

Fire Extinguishing Agents: Stop flow of gas before attempting to put out fire. Most fire extinguishing agents may be used on fires involving dimethyl ether. Water spray may be used to cool fire-exposed containers and protect people effecting shutoff.
Behaviour in Fire: Flashback may occur along vapour trail.
Ignition Temperature: 350°C.
Burning Rate: 6.6 mm/min.

Reactivity

With Water: No reaction.
With Common Materials: Reacts violently with aluminum and lithium aluminum hydrides. "Burns" in a chlorine atmosphere.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Information on aquatic toxicities not available.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warnings: "FLAMMABLE". Call Fire Department. Eliminate all sources of ignition. Use only spark-proof tools. Avoid contact and inhalation. Notify manufacturer or supplier for advice. Stop or reduce discharge if this can be done without risk. Contain Spill area by diking to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - use self-contained breathing apparatus. Gloves - rubber. Boots - rubber (pants worn outside boots). Outerwear - as required: acid "slicker" suit, coveralls.

Fire and Explosion

Stop flow of gas before attempting to put out fire. Most fire extinguishing agents may be used on fires involving dimethyl ether. Water may be used to cool fire-exposed containers and protect men effecting shutoff. Flashback may occur along vapour trail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: eyes - irrigate with water for at least 15 minutes; skin - flush with plenty of water; at same time, remove contaminated clothing. Treat as for frostbite. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Recover undamaged containers.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

DIMETHYL TEREPHTHALATE $C_6H_4(COOCH_3)_2$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers	
DMT, DMP TEREPHTHALIC ACID, DIMETHYL ESTER 1,4-BENZENEDICARBOXYLIC ACID, DIMETHYL ESTER DIMETHYL-1,4-BENZENEDICARBOXYLATE DIMETHYLPHTHALATE	Colourless crystals. Odourless.	No Canadian manufacturers. Canadian suppliers: Eastman Chemicals, Millhaven Fibres, Millhaven, Ont.	Originating from: Eastman, USA Hercules, USA

Transportation and Storage Information

Shipping State(s): Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): None. Not regulated.
Storage Temperature: Ambient.

Grades or Purity: Technical 99.9%.
Containers and Materials: Bottles, drums; glass or steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): 0.33 g/100 mL (80°C).
Molecular Weight: 194.2
Vapour Pressure: 16 mm Hg (100°C); 140 mm Hg (150°C).
Boiling Point: >300°C (sublimes).

Floatability (Water): Sinks.
Odour: Odourless.
Flash Point: 146°C (c.c.).
Vapour Density: 6.7
Specific Gravity: 1.04 at 20°C.

Colour: Colourless.
Explosive Limits: 0.9% at 180°C (LEL) (dust).
Melting Point: 140°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes and skin - irritation and redness. Inhalation: irritation of nasal passages, sore throat, coughing. Ingestion: abdominal pain, nausea and vomiting.
Toxicology: Moderate toxicity by ingestion and contact. Low toxicity by inhalation.
TLV® - 5 mg/m^3.
Short-term Inhalation Limits - 10 mg/m^3 (15 min).

LC_{50} - No information.
Delayed Toxicity - Suspected carcinogen.

LD_{50} - Oral: rat = 4.39 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical or carbon dioxide. Water or foam may cause frothing.
Behaviour in Fire: No information.
Ignition Temperature: (dust) 490°C.

Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: May react with strong oxidizers (nitrates, alkalis, acids).
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Toxicity to aquatic life unknown.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Dike to prevent runoff from rainwater or water application. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces, Respiratory protection - self-contained breathing apparatus; otherwise, protective clothing as required.

Fire and Explosion

Use carbon dioxide or dry chemical to extinguish. Water or foam may cause frothing.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes and skin - remove contaminated clothing and flush affected areas with plenty of water. Inhalation: give artificial respiration if necessary. Ingestion: give plenty of water to conscious victim to drink. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so.	1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.	2. Contact manufacturer or supplier for advice.
3. If possible, contain spill by damming or water diversion.	3. Contain spill by diking with earth or other barrier.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.	4. Remove material by manual or mechanical means.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.	5. Recover undamaged containers.
	6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

DINOSEB $(C_4H_9)C_6H_2(NO_2)_2OH$

IDENTIFICATION

UN No. 2779
Danger Group According to Percentage of Active Substance
Group II >40 to 100%
Group III solid 5 to 40%
liquid 5 to 40%

Common Synonyms	Observable Characteristics	Manufacturers
2-SEC-BUTYL-4,6-DINITROPHENOL **Common Trade Names** DYTOP SINOX DINOCAP PREMERGE (A herbicide used for pre-emergent and post-emergent weed control.)	Technical, orange to brown solid or brownish liquid; pungent odour.	Dow Chemical Canada, Inc., Sarnia, Ontario (from Midland, MI). FMC of Canada, Hamilton, Ontario. Niagara Chemical, Burlington, Ontario.

Transportation and Storage Information

Shipping State: Solid or liquid (formulation).
Classification: Poison, substituted nitrophenol pesticide, MAS.
Inert Atmosphere: No requirement.
Venting: Open.

Label(s): White label - POISON; Class 6.1.
Storage Temperature: Ambient.
Hose Type: Seamless stainless steel, Teflon, Viton, neoprene, cross-linked polyethylene.
Pump Type: Centrifugal or positive displacement, stainless steel.

Grades or Purity: Various as described below.
Containers and Materials: Glass bottles, cans, drums, tank trucks, tank cars, intermodel tanks; steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid (technical).
Solubility (Water): 0.0052 g/100 mL (20°C); EC is dispersible in water.
Molecular Weight: 240.2
Vapour Pressure: 1 mm Hg (151°C) technical.
Boiling Point: >300°C technical.

Floatability (Water): Sinks, SN floats.
Odour: Pungent.
Flash Point: 177°C technical; 15 to 30°C SN.
Vapour Density: No information.
Specific Gravity: 1.26 (45°C) technical.

Colour: Orange to brown.
Explosive Limits: SN may be explosive.
Melting Point: 32 to 44°C (technical).

HAZARD DATA

Human Health

Symptoms: Inhalation, Ingestion or Contact (skin): high fever, thirst, nausea, vomiting, excessive perspiration and difficulty breathing. Symptoms may later progress to cyanosis, muscular tremors and coma.
Toxicology: Very highly toxic by ingestion. Moderately toxic by skin contact.
TLV® - No information.
Short-term Inhalation Limits - No information.

LC_{50} - No information.
Delayed Toxicity - Possible kidney/liver damage.

LD_{50} - Oral: rat = 0.025 g/kg
LD_{50} - Skin: rat = 0.080 g/kg

Fire

Fire Extinguishing Agents: Use foam, carbon dioxide or dry chemical.
Behaviour in Fire: Releases toxic fumes. Exothermic decomposition can occur resulting in an explosion
Ignition Temperature: No information.
Burning Rate: No information.

Reactivity

With Water: No reaction.
With Common Materials: No information.
Stability: Normally stable, may undergo exothermic decomposition on heating.

Environment

Water: Prevent entry into water intakes and waterways. Very toxic to aquatic life. Fish toxicity = 0.038 to 0.051/mg/L/96 h/lake trout/LC_{50}/freshwater; 0.056 to 0.081 mg/L/96 h/cutthroat trout/LC_{50}/freshwater.
Land-Air: LD_{50} - Oral: chicken = 0.04 g/kg; wild bird = 0.007 g/kg.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer or supplier. Dike to contain material or water runoff. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces - Respiratory protection - self-contained breathing apparatus and totally encapsulated suit. Otherwise, approved pesticide respirator and impervious outer clothing.

Fire and Explosion

Use carbon dioxide, foam or dry chemical to extinguish. Releases toxic fumes in fires.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eye - irrigate with plenty of water. Ingestion: give water to conscious victim to drink and induce vomiting; in the case of petroleum distillates, do not induce vomiting for fear of aspiration and chemical pneumonia. If medical assistance is not immediately available, transport victim to hospital, doctor, or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.

Floats
3. If possible contain discharge by booming.
4. If floating, skim and remove.

Sinks or mixes
3. If possible contain discharge by damming or water diversions.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.

5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. If liquid, remove material with pumps or vacuum equipment and place in appropriate containers.
5. If solid, remove material by manual or mechanical means.
6. Recover undamaged containers.
7. Adsorb residual liquid on natural or synthetic sorbents.
8. Remove contaminated soil for disposal.
9. Notify environmental authorities to discuss cleanup and disposal of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

Available Formulations

Technical Grade: Purity: 95 to 98%
Properties: Combustible.

Formulations:

Type:	Purity:	Properties:
EC - emulsifiable concentrate	- typically 30 or 60%	- dispersible in water
SN - solution	- typically 35% in petroleum distillates	- flammable, floats on water.

DIPHENYL AMINE $(C_6H_5)_2NH$

IDENTIFICATION

Common Synonyms	Observable Characteristics	Manufacturers
ANILINOBENZENE N-PHENYLANILINE DPA, DFA	Colourless to greyish crystals. Floral odour.	No Canadian manufacturers. Canadian suppliers: Bayer (Canada) Inc., Pointe Claire, Quebec. Cyanamid Canada Inc., Toronto, Ontario.

Transportation and Storage Information		
Shipping State(s): Solid. **Classification:** Not regulated. **Inert Atmosphere:** No requirement. **Venting:** Open.	**Label(s):** None. **Storage Temperature:** Ambient.	**Grades or Purity:** Technical. **Containers and Materials:** Polyethylene-lined paper bags, fibre, tank cars, tank trucks.

Physical and Chemical Characteristics		
Physical State (20°C, 1 atm): Solid. **Solubility** (Water): Insoluble. **Molecular Weight:** 169.2 **Vapour Pressure:** 1 mm Hg (108.3°C). **Boiling Point:** 302°C.	**Floatability** (Water): Sinks. **Odour:** Floral. **Flash Point:** 153°C (c.c.). **Vapour Density:** 5.8 **Specific Gravity:** 1.16 (20°C).	**Colour:** Colourless to greyish. **Explosive Limits:** No information. **Melting Point:** 52.8°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes - irritation and watering. Inhalation: irritation of nose, headache, coughing, nausea. Ingestion: slight irritation of stomach, nausea and vomiting, diarrhea and general fatigue.
Toxicology: Moderately toxic by ingestion.

TLV® 10 mg/m^3. Short-term Inhalation Limits - 20 mg/m^3 (15 min).	LC_{50} - No information. Delayed Toxicity - Suspected teratogen.	LD_{50} - Oral: guinea pig = 0.3 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical or carbon dioxide. Water or foam may cause frothing.
Behaviour in Fire: When heated to decomposition, emits highly toxic fumes.
Ignition Temperature: 634°C. **Burning Rate:** No information.

Reactivity

With Water: No reaction.
With Common Materials: Can react with oxidizing agents. Reacts violently with melamines.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Toxicity to aquatic life unknown.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Dike to prevent runoff from rainwater or water application. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

In fires or confined spaces, Respiratory protection - self-contained breathing apparatus; otherwise, protective clothing as required.

Fire and Explosion

Use dry chemical or carbon dioxide to extinguish. Water or foam may cause frothing.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: give artificial respiration if necessary. Contact: eyes and skin - remove contaminated clothing and flush affected areas with plenty of water. Ingestion: give plenty of water to conscious victim to drink. If medical assistance is not immediately available, transport victim to doctor, hospital or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain spill by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material by manual or mechanical means.
5. Recover undammaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

DIPHENYLMETHANE-4,4'-DIISOCYANATE $(P\text{-}OCNC_6H_4)_2CH_2$

IDENTIFICATION

UN No. 2489

Common Synonyms	Observable Characteristics	Manufacturers
MDI DIPHENYLMETHANE DIISOCYANATE METHYLENE-DIPARAPHENYLENE ISOCYANATE METHYLENE-BIS (PHENYL ISOCYANATE)	White to light yellow. Crystals or solid.	No Canadian manufacturers. Canadian suppliers: Originating from: Bayer Canada, Mississauga, Ont. Du Pont Canada, Montreal. E.I. Du Pont de Nemours, USA

Transportation and Storage Information

Shipping State: Solid.
Classification: None.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Label(s): Not regulated.
Storage Temperature: Ambient.
Grades or Purity: Technical; 91 to 99%.
Containers and Materials: Drums.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Solid.
Solubility (Water): Reacts slowly.
Molecular Weight: 250.3
Vapour Pressure: 0.00001 mm Hg (25°C).
Boiling Point: 314°C.
Floatability (Water): Sinks and reacts slowly.
Odour: No information.
Flash Point: 196°C (c.c.); 202°C (o.c.).
Vapour Density: 8.6 to 8.7
Specific Gravity: 1.2 (20°C).
Colour: White to light yellow.
Explosive Limits: No information.
Melting Point: 37 to 41°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: sore throat, coughing, laboured breathing. Ingestion: severe irritation, vomiting and abdominal spasm. Contact: skin and eyes - redness, swelling, irritation.
Toxicology: Highly toxic by inhalation and ingestion.
TLV - 0.02 ppm; 0.2 mg/m^3.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - No information.
LD_{50} - No information.

Fire

Fire Extinguishing Agents: Use carbon dioxide and dry powders. No water or water-containing agents should be used.
Behaviour in Fire: Upon heating or combustion, decomposes yielding toxic gases such as hydrogen cyanide (HCN), carbon monoxide (CO) and NO_x.
Ignition Temperature: Decomposes.
Burning Rate: No information.

Reactivity

With Water: Slowly reacts forming carbon dioxide and other products.
With Common Materials: Reacts violently with acids, bases, alcohols and amines.
Stability: Stable (within the limits of the foregoing).

Environment

Water: Prevent entry into water intakes and waterways. Toxic to aquatic life.
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

Toxic in low concentrations.

Immediate Responses

Keep non-involved people away from spill site. Stop or reduce discharge if safe to do so. Notify manufacturer. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated suit.

Fire and Explosion

Use carbon dioxide and dry powders to extinguish. No water or water-containing agents should be used. Upon heating yields toxic gases such as HCN, CO and NO_x.

First Aid

Move victim out of spill site to fresh air. Call for medical assistance, but start first aid at once. Contact: eyes - irrigate with plenty of water; skin - remove contaminated clothing and flush affected areas with plenty of water. Inhalation: give artificial respiration, if breathing has stopped; oxygen, if breathing is laboured. Ingestion: give plenty of water to conscious victim to drink. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water	Land-Air
1. Stop or reduce discharge if safe to do so.	1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.	2. Contact manufacturer or supplier for advice.
3. If possible, contain spill by damming or water diversion.	3. Contain spill by diking with earth or other barrier.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.	4. Remove material by manual or mechanical means.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.	5. Recover undamaged containers.
	6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

EPICHLOROHYDRIN $O{\cdot}CH_2{\cdot}CH{\cdot}CH_2Cl$

IDENTIFICATION

UN No. 2023

Common Synonyms	Observable Characteristics	Manufacturers
ECH CHLOROPROPYLENE OXIDE CHLOROMETHYLOXIRANE 1-CHLORO-2,3-EPOXYPROPANE 3-CHLORO-1,2-PROPYLENE OXIDE EPI EPICHLORHYDRIN	Colourless liquid. Ethereal odour.	No Canadian manufacturers. Canadian suppliers: Dow Chemical Canada Inc., Sarnia, Ontario Shell Canada Limited, Toronto, Ontario Originating from: Dow Chemical, Freeport, TX

Transportation and Storage Information

Shipping State: Liquid.
Classification: Poison.
Inert Atmosphere: Recommended for storage.
Venting: Pressure-vacuum.
Pump Type: Standard types (grounded). Not copper or copper alloys.

Label(s): White label - POISON; Class 6.1, Group II.
Storage Temperature: Ambient
Hose Type: Tite flex, Teflon; stainless steel. Allchem (cross-linked polyethylene). Not copper or copper alloys.

Grades or Purity: 99%.
Containers and Materials: Drums, tank cars, tank trucks; steel or stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 6 g/100 mL (20°C).
Molecular Weight: 92.5
Vapour Pressure: 12 mm Hg (20°C); 22 mm Hg (30°C).
Boiling Point: 115 to 118°C.

Floatability (Water): Reacts mildly; sinks and mixes slightly.
Odour: Ethereal (0.08 to 100 ppm, odour threshold).
Flash Point: 32-39°C (o.c.); 31-38°C (c.c.).
Vapour Density: 3.3
Specific Gravity: 1.18 (20°C).

Colour: Colourless.
Explosive Limits: 3.8 to 21%.
Melting Point: -25°C.

HAZARD DATA

Human Health

Symptoms: Contact: eyes - irritation, watering, burning; skin - readily absorbed; itching, irritation, inflammation, blisters and burning. Ingestion: irritation, pain in swallowing, stomach and abdominal pain, nausea and vomiting, diarrhea. Inhalation: irritation of mucous membranes, headache, nausea, cyanosis, dizziness, fatigue and diarrhea.
Toxicology: Highly toxic by ingestion. Moderately toxic by skin absorption.
TLV* - (skin) 2 ppm; 10 mg/m^3.
Short-term Inhalation Limits - 5 ppm; 20 mg/m^3 (skin) (15 min).

LC_{50} - No information.
Delayed Toxicity - Suspected carcinogen.

LD_{50} - Oral: rat = 0.09 g/kg

Fire

Fire Extinguishing Agents: Use water spray, alcohol foam, carbon dioxide or dry chemical. Use water to cool fire-exposed containers and disperse vapours.
Behaviour in Fire: In fires, emits highly toxic fumes of phosgene gas and hydrogen chloride. Flashback may occur along vapour trail.
Ignition Temperature: 411°C.

Reactivity

With Water: Mild reaction; slightly soluble.
With Common Materials: Reacts violently with nitric acid, chlorosulfonic acid, ethylenediamine, ethyleneimine, oleum and sulfuric acid. May react with oxidizers, acids and bases.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life in low concentrations. Fish toxicity: 10 ppm/48 h/Daphia magna/ lethal concentration; aquatic toxicity rating = 10 to 100 mg/L/96 h/TLm/freshwater; 23 mg/L/24 h/goldfish/LD_{50}/freshwater; BOD: 3 to 16%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

POISON.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "POISON". Call Fire Department. Avoid contact and inhalation. Evacuate from downwind. Contact manufacturer for guidance. Stop or reduce discharge if this can be done without risk. Dike to prevent runoff. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated protective clothing. Destroy contaminated leather clothing after use.

Fire and Explosion

Use water spray, alcohol foam, carbon dioxide or dry chemical to extinguish. Water spray may be used to cool fire-exposed containers and disperse vapours. When heated to decomposition, emits highly toxic fumes of phosgene gas and hydrogen chloride. Flashback may occur along vapour tail.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: immediately irrigate eyes and flush with plenty of warm water for at least 15 minutes. Remove contaminated clothing while washing. Ingestion: give water to conscious victim to drink and induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Adsorb residual liquid on natural or synthetic sorbents.
6. Remove contaminated soil for disposal.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ETHANOLAMINE $HOCH_2CH_2NH_2$

IDENTIFICATION

UN No. 2491

Common Synonyms	Observable Characteristics	Manufacturers	
MEA MONOETHANOLAMINE 2-AMINOETHANOL β-AMINOETHYL ALCOHOL ETHYLOLAMINE COLAMINE GLYCINOL	Colourless liquid. Mild ammoniacal odour. May be a solid under some atmospheric conditions.	Union Carbide, Montreal, Que. Dow Chemical Canada Inc., Fort Saskatchewan, Alta. Canadian supplier: Dow Chemical Canada Inc., Sarnia, Ont. Union Carbide, Toronto, Ont.	Originating from: Dow Chemical, USA Union Carbide, USA

Transportation and Storage Information

Shipping State: Liquid.
Classification: Corrosive.
Inert Atmosphere: No requirement.
Venting: Open.
Pump Type: Centrifugal or positive displacement, stainless steel.

Label(s): Black and white label - CORROSIVE; Class 8, Group III.
Storage Temperature: Ambient.
Hose Type: Stainless steel, Teflon.

Grades or Purity: Commercial, 99+%.
Containers and Materials: Cans, drums, tank cars; steel and stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility: (Water): Miscible in all proportions.
Molecular Weight: 61.1
Vapour Pressure: 0.4 mm Hg (20°C); 6 mm Hg (60°C).
Boiling Point: 170 to 172°C.

Floatability (Water): Sinks in fresh water; floats in salt water.
Odour: Ammoniacal (3 to 4 ppm, odour threshold).
Flash Point: 85°C (c.c.).
Vapour Density: 2.1
Specific Gravity: 1.02 (20°C).

Colour: Colourless.
Explosive Limits: No information.
Melting Point: 10 to 11°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - irritation; eyes - irritation, possible corneal injury. Ingesiton: irritation, nausea and vomiting. Inhalation: irritation and coughing.
Toxicology: Moderately toxic by contact, inhalation and ingestion.
TLV* - (inhalation) 3 ppm; 8 mg/m^3.
Short-term Inhalation Limits - 6 ppm; 15 mg/m^3 (15 min).

LC_{50} - No information.
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 2.1 g/kg

Fire

Fire Extinguishing Agents: Use water spray, dry chemical, alcohol foam or carbon dioxide. Water and regular foam may cause excessive frothing. Water spray may be used to cool fire-exposed containers and disperse vapours.
Behaviour in Fire: No information.
Ignition Temperature: 410°C.

Burning Rate: No information.

Reactivity

With Water: No reaction; soluble.
With Common Materials: Reacts violently with acetic acid, acetic anhydride, acrolein, acrylic acid, acrylonitrile, chlorosulfonic acid, epichlorohydrin, hydrochloric acid, hydrofluoric acid, nitric acid, oelum, sulfuric acid, vinyl acetate. May react with halocarbons, epoxides, oxidizing materials, brass, bronze, zinc and cooper.
Stability: Stable within limits of foregoing.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating = 100 to 1 000 ppm/96 h/TLm/freshwater; Fish toxicity: >5 000 mg/L/24 h/goldfish/LC_{50}/freshwater; 7 100 ppm/48 h/shrimp/LC_{50}/saltwater; BOD: 78 to 93%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

CORROSIVE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "CORROSIVE". Call Fire Department. Notify manufacturer for advice. Shut off leak, if safe to do so. Dike to prevent runoff from rainwater or water application. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated protective clothing.

Fire and Explosion

Use water spray, dry chemical, alcohol foam or carbon dioxide to extinguish. Water spray may be used to cool fire-exposed containers and disperse vapours.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: flush skin and eyes with plenty of water for at least 30 minutes; remove contaminated clothing. Ingestion: give water to conscious victim to drink; induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

Sinks
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by damming or water diversion.
4. Dredge or vacuum pump to remove contaminants, liquids and contaminated bottom sediments.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Floats
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

Liquid
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Adsorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Solid
1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Dike to prevent runoff from rainwater or water application.
4. Remove material by manual or mechanical means.
5. Recover undamaged containers.
6. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.

ETHYL ACETATE $CH_3COOC_2H_5$

IDENTIFICATION

UN No. 1173

Common Synonyms	Observable Characteristics	Manufacturers	
VINEGAR NAPHTHA ACETIC ETHER ACETIC ESTER ACETIC ACID ETHYL ESTER ETHYL ETHANOATE	Colourless liquid. Fragrant, fruity odour.	Canadian manufacturer. Caledon Laboratories Ltd. Georgetown, Ont. Canadian suppliers: Bate Chemical, Toronto, Ont. Celanese Canada, Edmonton, Alta. Stanchem, Montreal, Quebec. Eastman Chemical, Toronto, Ont.	Originating from: Union Carbide, USA Celanese, USA Eastman, USA

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Open (flame arrester) or pressure-vacuum.
Pump Type: Gear, centrifugal, flammable liquid types.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.2, Group II.
Storage Temperature: Ambient.
Hose Type: Polyethylene, polypropylene, butyl, Hypalon.

Grades or Purity: Commercial 85 to 88%.
Containers and Materials: Drums, tank cars, tank trucks; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 7.9 to 8.6 g/100 mL (20°C); 7.4 g/100 mL (35°C).
Molecular Weight: 88.1
Vapour Pressure: 73 mm Hg (20°C); 115 mm Hg (30°C).
Boiling Point: 77°C.

Floatability (Water): Floats and mixes slightly.
Odour: Fragrant, fruity (6 to 70 ppm, odour threshold).
Flash Point: 10°C (o.c.); -4.4°C (c.c.)
Vapour Density: 3.04
Specific Gravity: 0.90 (20°C).

Colour: Colourless.
Explosive Limits: 2.0 to 11.5%.
Melting Point: -82 to -84°C.

HAZARD DATA

Human Health

Symptoms: Contact: skin - irritation and dermatitis; eyes - irritation. Ingestion: irritation, headache and nausea. Inhalation: sore throat, coughing, dizziness, drowsiness.
Toxicology: Moderately toxic by ingestion and inhalation.
TLV® - (inhalation) 400 ppm; 1 400 mg/m^3.
Short-term Inhalation Limits - No information.
LC_{50} - Inhalation: rat = 1 600 ppm/8 h
Delayed Toxicity - May cause liver or kidney damage.
LD_{50} - Oral: rat = 11 g/kg

Fire

Fire Extinguishing Agents: Use carbon dioxide, dry chemical or alcohol-type foam. Water may be ineffective, but may be used to cool fire-exposed containers.
Behaviour in Fire: Flashback may occur along vapour trail.
Ignition Temperature: 426°C.
Burning Rate: 3.7 mm/min

Reactivity

With Water: No reaction; slightly soluble.
With Common Materials: Can react vigorously with oxidizing materials. Reacts violently with chlorosulfonic acid, oleum and potassium-t-butoxide.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Aquatic toxicity rating = 100 to 1 000 ppm/96 h/TLm/freshwater; BOD: 15 to 36%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call Fire Department. Eliminate all ignition sources. Contact manufacturer or supplier for advice. Dike to prevent runoff from rainwater or water application. Stop or reduce discharge if this can be done without risk. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus in fires or enclosed spaces. Otherwise, Eye protection - goggles or face shield. Gloves - rubber or plastic. Outer clothing - suitable for situation, coveralls, etc. Boots - rubber.

Fire and Explosion

Use carbon dioxide, dry chemical or alcohol-type foam to extinguish. Flashback may occur along vapour trail. Water may be used to cool fire-exposed containers.

First Aid

Move victim out of spill area to fresh air. Call for medical assistance. but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if breathing is laboured, give oxygen. Contact: eyes - irrigate with water for at least 15 minutes; skin - remove contaminated clothing; wash affected areas thoroughly with water. Ingestion: give milk or water to conscious victim to drink and induce vomiting. If medical assistance is not immediately available, transport victim to hospital, doctor or clinic.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Adsorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ETHYL ACRYLATE $CH_2{:}CHCOOC_2H_5$

IDENTIFICATION

UN No. 1917

Common Synonyms	Observable Characteristics	Manufacturers	
ACRYLIC ACID, ETHYL ESTER ETHYL 2-PROPENOATE 2-PROPENOIC ETHYL ESTER	Colourless liquid. Sharp acrid odour.	No Canadian manufacturers. Canadian supplier: Celanese Canada, Montreal, Quebec.	Originating from: Celanese Chemical Co., New York, NY.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Pressure-vacuum.
Pump Type: No information.

Label(s): Red and white label - FLAMMABLE LIQUID; Class 3.2, Group II.
Storage Temperature: Ambient.
Hose Type: No information.

Grades or Purity: 98.5 to 99.5%.
Containers and Materials: Drums, tank cars, tank trucks; steel, stainless steel.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): 2 g/100 mL (20°C).
Molecular Weight: 100.1
Vapour Pressure: 29 mm Hg (20°C); 49 mm Hg (30°C).
Boiling Point: 99.1 to 99.6°C.

Floatability (Water): Floats and mixes slightly.
Odour: Sharp acid (0.1 to 0.47 ppb, odour threshold).
Flash Point: 10°C (o.c.).
Vapour Density: 3.5
Specific Gravity: 0.92 (20°C) (liquid).

Colour: Colourless.
Explosive Limits: 1.4 to 14%.
Melting Point: -71 to -75°C.

HAZARD DATA

Human Health

Symptoms: Inhalation: irritation of mucous membranes, thoracic congestion, coughing, cyanosis. Ingestion: irritation, pain in swallowing, nausea and vomiting, diarrhea. Contact: skin - readily absorbed, itching, irritation, inflammation and blistering; eyes - irritation and burning.
Toxicology: Moderately toxic by inhalation, ingestion and skin absorption.
TLV® - (skin) 5 ppm; 20 mg/m^3.
Short-term Inhalation Limits - 25 ppm; 100 mg/m^3 (15 min).

LC_{50} - No information.
LC_{Lo} - Inhalation: rat = 1 000 ppm/4 h
Delayed Toxicity - No information.

LD_{50} - Oral: rat = 1.02 g/kg

Fire

Fire Extinguishing Agents: Use dry chemical, alcohol foam or carbon dioxide. Water may be ineffective but may be used to cool fire-exposed containers and knock down vapours.
Behaviour in Fire: At high temperatures, polymerization may take place stopping vents and causing rupture of containers. Flashback may occur along vapour trail.
Ignition Temperature: 372°C.
Burning Rate: 4.3 mm/min.

Reactivity

With Water: No reaction; slightly soluble.
With Common Materials: Reacts vigorously with oxidizing materials. Reacts violently with chlorosulfonic acid.
Stability: May polymerize under certain conditions.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity = 12 ppm/24 h/brine shrimp/TLm/saltwater; Aquatic toxicity rating = 100 to 1 000 ppm/96 h/TLm/freshwater; BOD: 11 to 66% (5 days).
Land-Air: No information.
Food Chain Concentration Potential: No information.

EMERGENCY MEASURES

Special Hazards

FLAMMABLE. May polymerize.

Immediate Responses

Keep non-involved people away from spill site. Issue warning: "FLAMMABLE". Call Fire Department. Eliminate all sources of ignition. Call manufacturer for advice. Dike to prevent runoff from rainwater or water application. Notify environmental authorities.

Protective Clothing and Equipment

Respiratory protection - self-contained breathing apparatus and totally encapsulated protective clothing.

Fire and Explosion

Use dry chemical, alcohol foam or carbon dioxide to extinguish. Water may be ineffective, but may be used to cool fire-exposed containers and knock down vapours. At high temperatures, polymerization may take place stopping vents and causing rupture of containers. Flashback may occur along vapour trail.

First Aid

Move victim from spill site to fresh air. Call for medical assistance, but start first aid at once. Inhalation: if breathing has stopped, give artificial respiration; if laboured, give oxygen. Contact: skin - remove contaminated clothing and flush affected areas with plenty of water; eyes - irrigate with plenty of water. Ingestion: give conscious victim plenty of water to drink and induce vomiting. If medical assistance is not immediately available, transport victim to doctor, clinic or hospital.

ENVIRONMENTAL PROTECTION MEASURES

Response

Water

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. If possible, contain discharge by booming.
4. If floating, skim and remove.
5. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Land-Air

1. Stop or reduce discharge if safe to do so.
2. Contact manufacturer or supplier for advice.
3. Contain spill by diking with earth or other barrier.
4. Remove material with pumps or vacuum equipment and place in appropriate containers.
5. Recover undamaged containers.
6. Adsorb residual liquid on natural or synthetic sorbents.
7. Notify environmental authorities to discuss disposal and cleanup of contaminated materials.

Disposal

1. Contact manufacturer or supplier for advice on disposal.
2. Contact environmental authorities for advice on disposal.
3. Incinerate (approval of environmental authorities required).

ETHYL ALCOHOL C_2H_5OH

IDENTIFICATION

Common Synonyms		Observable Characteristics	Manufacturers
ALCOHOL ETHANOL GRAIN ALCOHOL DENATURED ALCOHOL ETHYL HYDRATE ABSOLUTE ETHANOL	SPIRITS ALCOHOL, DEHYDRATED	Clear, colourless liquid. Typical alcohol odour.	Ontario Paper Co. Ltd., Thorold, Ontario. Commercial Alcohols, Montreal, Que. Mohawk Oil, Minnedosa, Manitoba. Consolidated Alcohols Ltd., Toronto, Ontario.

Transportation and Storage Information

Shipping State: Liquid.
Classification: Flammable liquid.
Inert Atmosphere: No requirement.
Venting: Open with flame arrester or pressure vacuum.
Pump Type: Centrifugal, gear, etc.; steel, stainless steel.

Label(s): Red label - FLAMMABLE LIQUID; Class 3.2, Groups I, II or III.
Storage Temperature: Ambient.
Hose Type: Polyethylene, polypropylene, butyl, Hypalon, natural rubber, Viton.

Grades or Purity: Anhydrous (100%); (95%) specially denatured; completely denatured.
Containers and Materials: Cans, drums, tank cars, tank trucks; steel, stainless steel, aluminum.

Physical and Chemical Characteristics

Physical State (20°C, 1 atm): Liquid.
Solubility (Water): Miscible in all proportions.
Molecular Weight: 46.1
Vapour Pressure: 43.9 mm Hg (20°C); 50 mm Hg (25°C); 75 mm Hg (30°C).
Boiling Point: 78.4°C.

Floatability (Water): Mixes.
Odour: Alcohol (1 to 10 ppm, odour threshold).
Flash Point: 13°C (c.c.) (pure); 17°C (c.c.) (95%+ water); 24°C (c.c.) (50%+ water).
Vapour Density: 1.6
Specific Gravity: 0.79 (20°C).

Colour: Colourless.
Explosive Limits: 3.3% to 19%.
Melting Point: -110 to -118°C.

HAZARD DATA

Human Health

Symptoms: Ingestion: visual impairment, muscular incoordination and slowing of reaction time, slurring of speech, nausea and vomiting. Bizarre symptoms (other than typical intoxication) can result from the denaturants often present in industrial ethyl alcohol. Contact: skin - drying and dermatitis; eyes - irritation and watering. Inhalation: irritation of nose and eyes.
Toxicology: Low toxicity through ingestion, inhalation and contact.
TLV® (inhalation) 1 000 ppm; 1 900 mg/m^3.
Short-term Inhalation Limits - No information.
LC_{50} - No information.
Delayed Toxicity - None.
LD_{50} - Oral: rat = 14 g/kg
TD_{Lo} - Oral: man = 0.05 g/kg

Fire

Fire Extinguishing Agents: Use carbon dioxide, dry chemical, or alcohol foam. Water may be ineffective.
Behaviour in Fire: Flash back may occur along vapour trail.
Ignition Temperature: 363°C.
Burning Rate: 3.9 mm/min.

Reactivity

With Water: No reaction, soluble.
With Common Materials: Can react vigorously with oxidizing materials. Reacts violently with acetyl chloride, chromates, hydrogen peroxide, nitric acid, perchlorates, (permanganates and sulfuric acid), and silver nitrate.
Stability: Stable.

Environment

Water: Prevent entry into water intakes and waterways. Harmful to aquatic life. Fish toxicity: 13 000 mg/L/95 h/rainbow trout/LC_{50}/freshwater; 9 000 mg/L/24 h/creek chub/LC_{100}/freshwater; BOD: 93 to 167%, 5 days.
Land-Air: No information.
Food Chain Concentration Potential: None.