



**MSDS FOR SARA REPORTS**

**Ethanol**  
**CAS # 64-17-5**

<b>Health</b>	<b>0</b>
<b>Flammability</b>	<b>3</b>
<b>Reactivity</b>	<b>0</b>
<b>Special</b>	

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 \* CHEMINFO \*  
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 \* Canadian Centre for Occupational Health and Safety \*  
 \* Issue : 2000-4 (November, 2000) \*

\*\*\* SECTION 1. CHEMICAL IDENTIFICATION \*\*\*

CHEMINFO RECORD NUMBER : 423  
 CCOHS CHEMICAL NAME : Ethanol  
 SYNONYMS :  
 \* Absolute alcohol  
 \* Alcohol  
 \* Anhydrous ethanol  
 \* Ethanol denatured  
 \* Ethyl alcohol  
 \* Ethyl hydrate  
 \* Ethyl hydroxide  
 \* Fermentation alcohol  
 \* Grain alcohol  
 \* 1-Hydroxyethane  
 \* Methyl carbinol  
 \* Alcool Etylique  
 CAS REGISTRY NUMBER : 64-17-5  
 UN/NA NUMBER(S) : 1170  
 RTECS NUMBER(S) : KQ6300000  
 EU EINECS/ELINCS NUMBER : 200-578-6  
 CHEMICAL FAMILY : Primary aliphatic alcohol / primary alkanol /  
 primary alkyl alcohol  
 MOLECULAR FORMULA : C2-H6-O  
 STRUCTURAL FORMULA : CH3-CH2-OH

STATUS :

The CHEMINFO record for this chemical is complete. The full format ("TOTAL") provides a detailed evaluation of health, fire and reactivity hazards, as well as recommendations on topics such as handling and storage, personal protective equipment, accidental release and first aid.

\*\*\* SECTION 2. DESCRIPTION \*\*\*

APPEARANCE AND ODOUR :

Colourless, clear, volatile liquid with a sweet, ethereal odour like wine

or whiskey (62-64). Denatured ethanol may have an unpleasant odour. Hygroscopic (absorbs moisture from the air) (65,66)

ODOUR THRESHOLD :

Reported values vary widely; 49-716 ppm (geometric mean: 180 ppm) (detection); 100 ppm (recognition) (63)

WARNING PROPERTIES :

GOOD - TLV is 5 to 10 times the odour threshold.

COMPOSITION/PURITY :

Ethanol is available commercially in the anhydrous form (absolute alcohol or 100% ethanol) and as various proofs or percentages of ethanol-water, the most common being 190 proof or 95%. If ethanol is used for purposes other than as a beverage, it is denatured by addition of substances, such as methanol, 2- propanol, ethyl acetate, methyl isobutyl ketone, heptane or kerosene, to make the product undesirable for human consumption. See reference 65 for a more complete list of denaturants. Completely denatured alcohol (CDA) and specially denatured alcohols (SDA) are available.(62,67) The physical properties given in this CHEMINFO record are for the pure, anhydrous alcohol and/or 95% alcohol. Physical properties can vary depending on whether ethanol is anhydrous, mixed with water, the percentage composition, and whether it is denatured and the type of denaturant used.

USES AND OCCURRENCES :

Ethanol is a component of alcoholic beverages, such as beer, wine and spirits. It is used as a solvent, mainly in the manufacture of toiletries and cosmetics, surface coatings, inks, detergents and household cleaners, external pharmaceuticals, insecticides and disinfectants, and in food and drug processing; as a raw material to produce various chemical, such as acetic acid, ethyl acetate, ethyl acrylate, and other ethyl esters, ethylamine, glycol ethers, ethylene and butadiene; in the manufacture of drugs and medicinal chemicals, plastics, lacquers, dyes, polishes, plasticizers, perfumes, cosmetics and explosives; and as a motor fuel.(62,64,67) Can also be used as an antiseptic.(65)

\*\*\* SECTION 3. HAZARDS IDENTIFICATION \*\*\*

\*\* EMERGENCY OVERVIEW \*\*

Colourless, clear, volatile liquid with a sweet, ethereal odour like wine or whiskey. Hygroscopic. FLAMMABLE LIQUID AND VAPOUR. Vapour is slightly heavier than air and may spread long distances. Distant ignition and flashback are possible. Mild central nervous system depressant following ingestion or very high vapour concentrations. May cause headache, nausea, dizziness, drowsiness, incoordination and confusion. Causes eye irritation. POSSIBLE MUTAGEN - May cause genetic damage, based on animal data. Aspiration hazard. Swallowing or vomiting of the liquid may result in aspiration into the lungs.

\*\* POTENTIAL HEALTH EFFECTS \*\*

EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE :

INHALATION :

Ethanol provides good warning of exposure. Aerosols and vapours are irritating to the nose and throat well above the odour threshold (approximately 100-180 ppm) and established occupational exposure limits (1000 ppm) and well below exposures expected to cause the effects typically associated with alcohol ingestion.

A 30-minute exposure to 1800 to 2000 ppm ethanol aerosol caused coughing, dry throat and temporary bronchial constriction.(58) In other studies, brief exposure to very high levels (5300-10600 ppm (cited as 10-20 mg/L)) produced temporary irritation of the nose and coughing. At 16000 ppm (cited as 30 mg/L), continuous irritation of nose, with coughing was observed and 21300 ppm (cited as 40 mg/L) was considered to be intolerable for even a short period of time.(16)

Symptoms of alcohol intoxication which develop following the ingestion of alcoholic beverages containing ethanol have been well described in the literature (see "Ingestion" below). Similar effects are not expected to occur following inhalation of ethanol, unless ethanol is heated or misted. Individuals with repeated exposure to ethanol can develop tolerance to its effects. In this case, higher exposure may be required to produce effects which were previously observed at lower exposures.

One historical study has described symptoms such as headaches and slight

numbness (approximately 1380 ppm for 30 minutes); sensations of warmth/cold (from 3340 ppm for 100 minutes); difficulty breathing, drowsiness and fatigue (from 8840 ppm for 60 minutes) in volunteers.(2,3) The validity of this study has been questioned, since subsequent studies have shown that it is unlikely that these effects would have been observed at the low concentrations cited.(3,16)

SKIN CONTACT :

Ethanol is either not irritating or only mildly irritating to the skin, based on human and animal information. No irritation was produced in 16 volunteers following application of 0.5 mL of 95% ethanol, using a modified Draize test.(42) Mild irritation has been observed in animal tests. Absorption of ethanol through the skin is minimal.(3) Harmful effects would not be expected by this route of exposure.

EYE CONTACT :

Depending upon concentration, direct contact with the liquid is expected to produce moderate to severe irritation, based on animal information. Exposure to high vapour concentrations can produce mild irritation. High vapour concentrations (7000-10000 ppm) have caused stinging and watering of the eyes which increased in intensity with passing time and persisted throughout the exposure. There was no subsequent eye damage noted. Exposure to 2500 ppm had no effect on the eyes.(5,16)

INGESTION :

Due to the relatively low oral toxicity of ethanol, it is unlikely that toxic effects would result from accidental occupational ingestion. Evidence from animal studies and human consumption of alcoholic beverages demonstrates that ingestion of large amounts causes depression of the central nervous system (CNS) with symptoms such as lack of coordination, impaired vision, reduced reaction time, slurred speech, impaired judgement, nausea/vomiting and unconsciousness progressing to death from respiratory or circulatory failure.(2,49) For an average adult, the fatal ingested dose is approximately 1 L (approximately 2 pints) of 40-55% ethanol (the percentage found in whiskey, gin, rum, vodka, or brandy) consumed within a few minutes.(49)

Based on animal evidence and its physical properties, ethanol can be aspirated into the lungs during ingestion or vomiting. Aspiration can cause potentially fatal injury to the lungs.

EFFECTS OF LONG-TERM (CHRONIC) EXPOSURE :

Occupational exposures which principally occur by inhalation and skin contact do not result in as high absorption of ethanol as that which occurs from drinking alcoholic beverages.(2,3) Ethanol vapours and mists produce irritation, thus limiting long-term inhalation exposure. Ethanol is not readily absorbed through the skin.

SKIN IRRITATION: Long-term or repeated contact may result in dermatitis (dry, red, cracked skin). Repeated application of 10% ethanol, under cover, to 8 volunteers for 21 days produced redness and hardening of the skin during the final 7 days of exposure.(42)

SKIN SENSITIZATION: Ethanol is not a clear occupational skin sensitizer. Approximately 20 cases of ethanol allergic skin reactions confirmed by positive patch tests have been identified. In most cases, exposure to ethanol was not occupational.(9,10,12,13,51-54,59,60) In some cases, a previous history of allergies was also identified.(53,54,59) One limited study suggests that contact sensitivity to ethanol may be related to an ethnic sensitivity, similar to the Oriental ethnic sensitivity to skin flushing following ingestion of alcoholic beverages.(55) Another report suggests that some of the cases may actually be a non-allergic wheal reaction (non-allergic contact urticaria).(12)

In the three occupational exposure cases located, patch testing with ethanol proved positive. Prior history of allergies was not discussed for any of the cases.(9,10,61) Therefore, no firm conclusions can be drawn from these reports.

In one sensitization study, 6/93 volunteers developed delayed allergic skin reactions.(11) In another study, sensitization was not produced in any of 94 subjects tested.(8) These results indicate that ethanol may be a weak skin sensitizer.

HUMAN POPULATION STUDIES: No conclusions about the potential long-term health effects of ethanol can be drawn from a mortality study of ethanol production workers. Workers were exposed to strong sulfuric acid at the same time and it appears that this chemical is more likely to have caused

the health effects observed.(15)

LONG-TERM INGESTION: Long-term ingestion of alcoholic beverages containing ethanol has been clearly associated with significant health problems, including cirrhosis of the liver and diseases of the gastrointestinal, cardiovascular, respiratory, and nervous systems. Mental problems include a wide range of neurological changes, depression and other mental disorders.(17,48,49) There are no cases or studies reported of similar long-term health effects resulting from occupational exposure to ethanol.

CARCINOGENICITY :

The International Agency for Research on Cancer (IARC) has not evaluated the carcinogenicity of occupational exposure to ethanol. IARC has classified alcoholic beverages as Group 1 carcinogens based on tumours of the oral cavity, pharynx, larynx, esophagus and liver. Oral exposure to alcoholic beverages containing ethanol is not relevant to occupational exposures. IARC has concluded that there is inadequate evidence for carcinogenicity of ethanol in animals.(17)

The American Conference of Governmental Industrial Hygienists (ACGIH) has designated ethanol as an A4 (not classifiable as a human carcinogen). The US National Toxicology program has listed consumption of alcoholic beverages as a known human carcinogen.

TERATOGENICITY AND EMBRYOTOXICITY :

There are no reports of adverse effects on pregnancy following occupational exposures. It is well documented that exposure to ethanol through the ingestion of alcoholic beverages during pregnancy can cause significant harmful effects in unborn children. Certain physical malformations, stillbirths, low birth weight, and neurological, behavioural and intelligence deficits have been observed in the children of mothers who have consumed alcohol during pregnancy. The most severe group of effects is commonly referred to as Fetal Alcohol Syndrome (FAS). The lower limit of alcohol ingestion necessary to cause FAS has not been determined, but is associated with the consumption of large amounts of alcohol or chronic alcoholism in the mother. Reduced birth weight is a less severe effect and the lower limit of alcohol ingestion associated with this effect appears to be approximately two drinks per day on average.(46) Effects have not generally been seen with alcoholic beverage intake of about one drink per day.(17)

Animal evidence also clearly demonstrates that ingestion of ethanol can cause embryotoxicity, teratogenicity and fetotoxicity in the presence of maternal toxicity. No effects were observed in one study with very high inhalation exposures, despite the observation of significant harmful effects in the mothers.

REPRODUCTIVE TOXICITY :

There are no reports of adverse effects on pregnancy following occupational exposures. Reproductive effects have been observed in people who have consumed large amounts of alcoholic beverages which contain ethanol. Human population studies have shown testicular atrophy and sperm effects in alcoholic men, but these effects are generally accompanied by the cirrhosis of the liver. Some studies have shown early menopause in alcoholic women.(45) It is not possible to draw firm conclusions about the potential reproductive toxicity of ethanol from these studies because of design limitations. For example, often only a very small number of people were studied and alcoholics are commonly exposed to other harmful chemicals (for example, through smoking or second-hand smoking). Furthermore, these effects cannot be related to people who are occupationally exposed to ethanol because the nature and degree of exposure is significantly different.

Effects on reproductive organs, including decreased testicular weight, decreased numbers of motile sperm, decreased ovarian function and irregular fertility cycles, have been observed in animals given very large oral doses of ethanol. However, no confirmed effects on fertility or reproductive capability have been observed.

MUTAGENICITY :

There are no reports of mutagenic effects in people with occupational exposures. Mutagenic effects, such as increased frequencies of chromosomal aberrations, sister chromatid exchanges and aneuploidies have been observed in the white blood cells of alcoholics. It is not possible to relate these effects directly to ethanol because of other potential causes, such as smoking and exposure to other potentially harmful chemicals at the same time. Ethanol has caused mutagenic effects in live animals. In most studies of cultured human cells, ethanol has not produce mutagenic effects

(chromosomal aberrations or sister chromatid exchanges), but positive results have also been observed. Positive and negative results have been obtained in cultured mammalian cells. Ethanol is weakly or non-mutagenic in bacteria. (17,30-32)

**TOXICOLOGICALLY SYNERGISTIC MATERIALS :**

Most information about the interactions of ethanol with other chemicals results from studies involving alcohol consumption and exposure to chemicals. Occupational exposure to ethanol would be much lower and any interactive effects would be substantially reduced or absent. Ethanol increases liver metabolism and thus increases the metabolism of some organic compounds. It may also compete for metabolic sites thus interfering with the metabolism of other compounds. (2,7)

Ethanol has been associated with an increase in the toxicity of many chemicals including other alcohols, ketones (e.g. acetone and methyl ethyl ketone), benzene, toluene, halogenated hydrocarbons (e.g. carbon tetrachloride, trichloroethylene, chloroform, and methylene chloride), aromatic amines and nitrosamines. (2,4,7,14) In particular, it enhances the activity of many chemicals which are harmful to the liver (hepatotoxic agents). (2) There is also a synergistic effect between ethanol and certain metals (e.g. cobalt, manganese and mercury) or compounds containing these metals. (7)

Some chemicals (e.g. thiuram disulfides or "antabuse" , dimethylformamide and cyanamide) can decrease or slow the metabolism of ethanol thereby increasing the toxic effects of ethanol. (7)

**POTENTIAL FOR ACCUMULATION :**

Ethanol does not accumulate. It is readily absorbed by the oral or inhalation routes of exposure, but skin uptake is low. Human absorption of vapours has been reported to be 33-62%, and independent of air concentration and ventilation rate. Most ethanol is metabolized before it is eliminated. It is metabolized primarily by the liver to acetaldehyde, which in turn is converted to acetic acid or acetate, which is oxidized to carbon dioxide, which is exhaled. Only small amounts are eliminated unchanged in exhaled air, urine or perspiration. The rate of metabolism varies between individuals and, in the case of animals, between species. (2,3,17)

**\*\*\* SECTION 4. FIRST AID MEASURES \*\*\***

**INHALATION :**

If symptoms develop, remove source of contamination or have victim move to fresh air. If symptoms persist, obtain medical advice.

**SKIN CONTACT :**

No health effects expected. If contact occurs, flush with lukewarm, gently flowing water for 5 minutes or until the chemical is removed.

**EYE CONTACT :**

Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 20 minutes, or until the chemical is removed, while holding the eyelid(s) open. Take care not to rinse contaminated water into the unaffected eye or onto the face. Obtain medical attention immediately.

**INGESTION :**

NEVER give anything by mouth if the victim is rapidly losing consciousness, is unconscious or is convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 oz.) of water to dilute material in the stomach. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Obtain medical attention immediately.

**FIRST AID COMMENTS :**

All first aid procedures should be periodically reviewed by a doctor familiar with the material and its conditions of use in the workplace.

NOTE: Denatured alcohol often contains other potentially toxic ingredients. The first aid procedures recommended should be appropriate for the product as a whole, not just the ethanol component.

**\*\*\* SECTION 5. FIRE FIGHTING MEASURES \*\*\***

**FLASH POINT :**

13 deg C (55.4 deg F) (closed cup) (100%) (67,68); 17 deg C (62.6 deg F) (closed cup) (95-96%) (68)

**LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) :**

3.3% (68); 4.3% (62) (100%)

**UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) :**

19% (62,68) (100%)  
AUTOIGNITION (IGNITION) TEMPERATURE :  
363 deg C (685 deg F) (100%) (68); 423-425 deg C (793.4-797 deg F) (100%)  
(62,67)  
EXPLOSION DATA - SENSITIVITY TO MECHANICAL IMPACT :  
Not sensitive. Stable material.  
EXPLOSION DATA - SENSITIVITY TO STATIC CHARGE :  
Will not accumulate static charge. The electrical conductivity of ethanol  
(1.345 pS/m X 10(5) at 25 deg C) is high.(69,70) Mixtures of ethanol  
vapour and air at concentrations in the flammable range may be ignited by a  
static charge of sufficient energy.  
COMBUSTION AND THERMAL DECOMPOSITION PRODUCTS :  
Carbon monoxide, carbon dioxide and other toxic, irritating chemicals.(66)  
FIRE HAZARD COMMENTS :  
Flammable liquid. Can release vapours that form explosive mixtures with  
air at, or above, 13 deg C. Vapour is slightly heavier than air and can  
travel a considerable distance to a source of ignition and flash back to a  
leak or open container. Can accumulate in confined spaces, resulting in a  
toxicity and flammability hazard. Closed containers may rupture violently  
when exposed to fire or excessive heat for a sufficient period of time.  
EXTINGUISHING MEDIA :  
Carbon dioxide, dry chemical powder, alcohol foam or polymer foam. Water  
may be ineffective because it will not cool ethanol below its flash point.  
Fire fighting foams are the extinguishing agent of choice for most  
flammable liquid fires. However, alcohols are water-soluble and will break  
down the common foams.(66,68)  
FIRE FIGHTING INSTRUCTIONS :  
Evacuate area and fight fire from a safe distance or protected location.  
Approach fire from upwind to avoid toxic decomposition products.  
Stop leak before attempting to stop the fire. If the leak cannot be  
stopped, and if there is no risk to the surrounding area, let the fire burn  
itself out. If the flames are extinguished without stopping the leak,  
vapours could form explosive mixtures with air and reignite. Water can  
extinguish the fire if used under favourable conditions and when hose  
streams are applied by experienced firefighters trained in fighting all  
types of flammable liquid fires. If possible, isolate materials not yet  
involved in the fire, and move containers from fire area if this can be  
done without risk, and protect personnel. Otherwise, fire-exposed  
containers or tanks should be cooled by application of hose streams and  
this should begin as soon as possible and should concentrate on any  
unwetted portions of the container. If this is not possible, use unmanned  
monitor nozzles and immediately evacuate the area. If a leak or spill has  
not ignited, use water spray in large quantities to disperse the vapours  
and to protect personnel attempting to stop a leak. Water spray can be used  
to dilute spills to nonflammable mixtures and flush spills away from  
ignition sources. Solid streams of water may be ineffective and spread  
material. For a massive fire in a large area, use unmanned hose holder or  
monitor nozzles; if this is not possible withdraw from fire area and allow  
fire to burn. Stay away from ends of tanks, but be aware that flying  
material from ruptured tanks may travel in any direction. Withdraw  
immediately in case of rising sound from venting safety device or any  
discolouration of tank due to fire.  
As in any fire, firefighters may enter the area if positive pressure  
self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) and  
full Bunker Gear is worn.

\*\* NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX \*\*

NFPA - HEALTH : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.  
NFPA - FLAMMABILITY : 3 - Can be ignited under almost all normal temperature conditions.  
NFPA - REACTIVITY : 0 - Normally stable  
NFPA - COMMENTS :

The hazard identification ratings and definitions presented here are based on the 1985 edition of NFPA Code 704. NFPA is currently updating these hazard ratings based on the 1990 edition of NFPA Code 704.

\*\*\* SECTION 6. ACCIDENTAL RELEASE MEASURES \*\*\*

PRECAUTIONS :

Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. Ventilate area.

Extinguish or remove all ignition sources.

CLEAN-UP :

Prevent material from entering sewers, waterways or confined spaces. Keep materials which can burn away from spilled material. Stop or reduce leak if safe to do so.

Contain spill with earth, sand, or absorbent material which does not react with spilled material. Remove liquid by explosion-proof pumps or vacuum equipment. Place in suitable, covered, labelled containers. Flush area with water. Contaminated absorbent material may pose the same hazards as the spilled product.

Large spills: Contact fire and emergency services and supplier for advice.

\*\*\* SECTION 7. HANDLING AND STORAGE \*\*\*

HANDLING :

This material is a FLAMMABLE, TOXIC (eye irritant, possible mutagen) LIQUID. Before handling, it is very important that engineering controls are operating and that personal hygiene measures are being followed.

People working with this chemical should be properly trained regarding its hazards and its safe use.

Eliminate all ignition sources (e.g. sparks, open flames, hot surfaces).

Keep away from heat. Post "NO SMOKING" signs. It is very important to keep areas where this material is used clear of other materials which can burn (e.g., cardboard, sawdust).

Use in smallest possible amounts in a well ventilated area separate from the storage area. Avoid generating vapours or mists. Prevent the release of vapours and mists into the workplace air.

Do not use with incompatible materials such as strong oxidizing agents.

Never return contaminated material to its original container. See Incompatibilities - Materials to Avoid section for more information.

Do not dispense in storage area unless dispensing area is segregated by fire-resistant construction. To avoid splashing, carefully dispense into sturdy containers made of compatible materials. Never transfer liquids by pressurizing the original shipping containers with air or inert gas. Only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids. Ground all drums, transfer vessels, hoses and piping. Ground clips must contact bare metal. When dispensing in other than a closed system, ensure dispensing container is bonded to receiving transfer equipment and container.

Label containers. Keep containers closed when not in use. Avoid damaging containers. Empty containers may contain hazardous residues.

Never perform any welding, cutting, soldering, drilling or other hot work on an empty vessel, container or piping until all liquid and vapours have been cleared. To prevent sparking, generously wet hard surfaces before they are chipped, ground, etc, in potentially hazardous areas.

Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas of use. Keep aisles and exits free of obstruction. For large scale operations, consider the installation of leak and fire detection equipment along with a suitable, automatic fire suppression system.

Have suitable emergency equipment for fires, spills and leaks readily available.

Follow handling precautions on Material Safety Data Sheet. Have suitable emergency equipment for fires, spills and leaks readily available.

Practice good housekeeping. Maintain handling equipment. Comply with applicable regulations.

STORAGE :

Store in a cool, well-ventilated area out of direct sunlight and away from heat and ignition sources.

Keep storage area clear of burnable materials (e.g. old rags, cardboard). Lighted cigarettes, matches, or any other ignition sources should not be allowed around indoor or outdoor storage areas.

Store within temperature range recommended by chemical manufacturer/supplier. Alarms that warn of temperatures higher than recommended may be necessary.

Store away from oxidizers and corrosives and other incompatible materials such as ammonia and potassium tert-butoxide. See Incompatibilities -

Materials to Avoid section for more information.

Store flammable materials according to occupational health and safety regulations and fire and building codes which will describe the kind of storage area and the type of storage containers for a specified amount of the material.

Storage facilities should be made of fire resistant materials. Use a grounded, non-sparking ventilation system, approved explosion-proof equipment and intrinsically safe electrical systems.

Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Keep storage area separate from work areas. Ground floor storage facilities are usually recommended. Store away from work process and production areas, elevators, building and room exits or main aisles leading to exits. Post warning signs. Inspect periodically for damage or leaks. Have appropriate fire extinguishers and spill clean-up equipment in or near storage area. Inspect all incoming containers to make sure they are properly labelled and not damaged. Keep quantity stored as small as possible. Store in suitable, labelled containers (usually the shipping container). Keep containers closed. Bond and ground metal containers in storage area. Install pressure and vacuum relief venting in all drums of flammable liquids. Make sure storage area is well ventilated. No stacking of containers. Protect from damage.

Keep empty containers in separate storage area. Empty containers may contain hazardous residues. Keep closed.

Contain spills or leaks by storing in trays made from compatible materials. Keep absorbents for leaks and spills readily available. Provide raised sills or ramps at doorways or create a trench which drains to a safe location.

Follow any special instructions for storage on Material Safety Data Sheet (e.g. maximum storage quantities).

Avoid bulk storage indoors. Store in an isolated fireproof building, if possible.

Equip storage tank vents with a flame arrestor. Storage tanks should be above ground, over an area sealed on the bottom and diked to hold entire contents.

\*\*\* SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION \*\*\*

NOTE : Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

SAMPLING AND ANALYSIS :

Use appropriate instrumentation and sampling strategy (location, timing, duration, frequency, and number of samples). Interpretation of the sampling results is related to these variables and the analytical method. Sampling should be carried out by trained personnel.

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NIOSH METHOD 1400 - NIOSH manual of analytical methods. 4th edition. Volume 1. Partially evaluated method. Collection on coconut shell charcoal sorbent tube. Desorption with carbon disulfide (CS<sub>2</sub>) and 2-butanol. Analysis by gas chromatography using flame ionization detector (FID). Estimated detection limit: 0.01 mg.

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COLORIMETRIC DETECTOR TUBES: Commercially available for ethanol.

ENGINEERING CONTROLS :

Engineering methods to control hazardous conditions are preferred. Methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions, and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

When there is large scale use of this material, local exhaust ventilation with or without process enclosure may be necessary. Use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Supply sufficient replacement

air