1. PRODUCT IDENTIFICATION

TRADE NAME  Fusel Oil
CHEMICAL FAMILY  Mixture of primary Aliphatic Alcohols
CHEMICAL NAME  3-Methyl-1-Butanol (Major component), and 2-Methyl-1-Butanol.
SYNONYMS  Isoamyl Alcohol and Active Amyl Alcohol
CHEMICAL ABSTRACTS No.  123-51-3 (3-Methyl-1-Butanol) 137-32-6 (2-Methyl-1-Butanol )
NIOSH No.  EL5425000 and EL5250000
HAZCHEM CODE  3(Y)
UN No.  1201

2. COMPOSITION

HAZARDOUS COMPONENTS  3-Methyl-1-Butanol (44-65 %), 2-Methyl-1-Butanol (10-15 %),
(Isobutanol (4-6%), 1 Butanol (0,5-1.0%), 1-Propanol (trace), Ethanol (7-9%),
and water (12-15%).

EEC CLASSIFICATION  Not available
R PHRASES  (R10, R20) Flammable; harmful by inhalation.
S PHRASES  (S16) Keep away from sources of ignition - no smoking.

3. HAZARD IDENTIFICATION

MAIN HAZARDS

Flash Point  ±42°C (closed cup)
Flammable  Vapour/air mixtures are explosive.
USA TLV (TWA)  100 ppm (361 mg/m³) for 3-Methyl-1-Butanol

CHEMICAL HAZARDS

The hazards of Fusel Oil are principally concerned with its flammability.
BIOLOGICAL HAZARDS

Harmful if inhaled, absorbed through the skin or swallowed. Mild central nervous system depressant. High vapour concentrations may cause headache, nausea, dizziness, drowsiness and incoordination. Causes eye irritation. Aspiration hazard. Swallowing or vomiting may result in aspiration into the lungs.

HEALTH EFFECTS - EYES

Vapours or liquid Fusel Oil may cause severe corneal irritation.

HEALTH EFFECTS - SKIN

Liquid may cause mild irritation to the skin. Tests on animals indicates that isoamyl alcohol may be absorbed through the skin and cause central nervous system effects. Repeated or prolonged exposure can cause redness, drying and cracking of the skin (dermatitis).

HEALTH EFFECTS - INGESTION

Ingestion of Fusel Oil can cause central nervous effects such as nausea, vomiting, stomach and chest pain, headache weakness, dizziness, and at higher doses, collapse, coma and death.

HEALTH EFFECTS - INHALATION

Concentrations of 150 ppm can cause irritation to the nose and throat. High concentrations of Fusel Oil vapours can cause severe irritation to the nose, throat, and respiratory tract, cough and difficult breathing as well as central nervous system depression effects such as nausea, vomiting, headache, dizziness, and eventually unconsciousness.

CARCINOGENICITY

No information available.

MUTAGENICITY

No information available

REPRODUCTIVE HAZARDS

No information available

TOXICOLOGICALLY SYNERGISTIC MATERIALS

No information available

POTENTIAL FOR ACCUMULATION

Does not accumulate in the body. Absorbed isoamyl alcohol is largely broken down or excreted through the urine. A small amount is eliminated unchanged in the expired air and urine.
4. FIRST AID MEASURES

PRODUCT IN EYE
Flush immediately with water or neutral saline solution for at least 15 minutes, while holding the eyelids open. Remove contact lenses if worn. Obtain medical attention immediately.

PRODUCT ON SKIN
Remove contaminated clothing and wash the affected area with soap and water. Obtain medical assistance if irritation persists after washing. Completely decontaminate clothing before reuse.

PRODUCT INGESTED
Never give anything by mouth if victim is rapidly losing consciousness, is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. If breathing has stopped, trained personnel should begin artificial respiration (AR) or, if the heart has stopped, cardiopulmonary resuscitation (CPR) immediately.
Avoid mouth-to-mouth contact by using mouth guards or shields.
Obtain medical advice immediately

PRODUCT INHALED
Remove the victim to fresh air. If breathing is weak, irregular or has stopped, apply artificial respiration. Oxygen may be beneficial. Obtain urgent medical assistance.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
Use dry chemical powder extinguishers, especially near electrical equipment. Carbon dioxide, alcohol-resistant foams, or water spray may also be used. Water spray may be useful to keep containers cool near a fire.

PROTECTIVE CLOTHING
Self contained breathing apparatus and full protective clothing should be worn, especially eye protection (goggles or face shield) and neoprene, or nitrile gloves.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS
Restrict access to area until completion of the cleanup. Ensure that the cleanup is conducted by trained personnel only.
Protective clothing should be worn to prevent excessive skin contact. Fusel Oil should be handled wearing an approved respirator or self contained breathing apparatus, Neoprene, butyl or natural rubber gauntlets or gloves,
safety goggles and other protective clothing. An apron or rubber boots should be worn if there is a risk of splashing.

ENVIRONMENTAL PRECAUTIONS

Keep material out of sewers, storm drains, surface waters, and soil
Toxic to aquatic life at low concentrations.

CLEAN-UP METHODS

Small Spills

Eliminate all sources of ignition, ventilate the area and wear a laboratory coat or overalls, gloves, approved self- contained breathing apparatus and safety boots. Small quantities may be absorbed on paper and evaporated in a fume cupboard (do not pour into drains as explosive concentrations may develop).
Soak up spill with absorbent material which does not react with spilled chemical. Place material 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.
Do not touch spilled material. Prevent material from entering sewers or confined spaces. 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 with flame-proof pumps or vacuum equipment. Place in suitable, covered, labelled containers for removal and disposal at a controlled site.
Dispose of contaminated product and materials used in cleaning up spills or leaks in a manner approved for this material. Consult appropriate state and regulatory agencies to ascertain proper disposal procedures. Ideally, Fusel Oil should be disposed of in a chemical incinerator with appropriate precautions.
Flush spill area with a large volume of water and allow to drain to a waste treatment system

7. HANDLING AND STORAGE

SUITABLE MATERIALS

Store in iron or stainless steel solvent storage tanks.

HANDLING/STORAGE PRECAUTIONS

Storage Conditions

Store in a cool, dry, well-ventilated area, out of direct sunlight. Store away from heat and ignition sources. Store away from incompatible materials such as oxidizing materials. Use grounded, non-sparking ventilation systems and electrical equipment that does not provide a source of ignition. Store in suitable, labelled containers. Keep containers tightly closed when not in use and when empty. Protect from damage. Use suitable, approved storage cabinets, tanks, rooms and buildings. If storing small quantities under refrigeration, use an approved, explosion- proof refrigerator. Limit quantity of material in storage. Restrict access to storage area. Post warning signs when appropriate. Keep storage area separate from populated work areas. Inspect periodically for deficiencies such as damage or leaks. Have appropriate fire extinguishers available in and near the storage area. Comply with all applicable regulations for the storage and handling of flammable materials.

Handling
Wear protective clothing as detailed above. Use approved flammable liquid storage containers in the work area. Ground drums and bond transfer containers. (Grounding clips must contact bare metal.) Keep material away from sparks, flames and other ignition sources. Post "NO SMOKING" signs in area of use. Avoid generating mist amounts in designated. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Label containers. Keep containers closed when not in use. Empty containers may contain residues which are hazardous.

8. EXPOSURE CONTROLS/PERSO NAL PROTECTION

OCCUPATIONAL EXPOSURE STANDARDS

<table>
<thead>
<tr>
<th>Agency</th>
<th>Standard</th>
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</thead>
<tbody>
<tr>
<td>HSE</td>
<td>100 ppm (360 mg/m³) for 3-Methyl-1-Butanol</td>
</tr>
<tr>
<td>MAK</td>
<td>Not available</td>
</tr>
<tr>
<td>ACGIH</td>
<td>TLV(TWA) 100 ppm (361 mg/m³) for 3-Methyl-1-Butanol</td>
</tr>
</tbody>
</table>

ENGINEERING CONTROL MEASURES

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. Administrative controls and personal protective equipment may also be required. Local exhaust ventilation is normally required when handling this chemical. Use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Supply sufficient replacement air to make up for air removed by exhaust system.

PERSONAL PROTECTION - RESPIRATORY

Full respiratory protection should be readily available in case of spillage.

PERSONAL PROTECTION - HAND

Wear neoprene or nitrile gloves.

PERSONAL PROTECTION - EYE

Safety goggles or approved safety glasses. Contact lenses should not be worn.

PERSONAL PROTECTION - SKIN

Wear overall, safety shoes/boots.

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEARANCE</td>
<td>Colourless liquid</td>
</tr>
<tr>
<td>ODOUR</td>
<td>Mild choking alcohol odour.</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable</td>
</tr>
<tr>
<td>BOILING POINT/RANGE</td>
<td>123-133°C</td>
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<tr>
<td>MELTING POINT/RANGE</td>
<td>Not available</td>
</tr>
<tr>
<td>FLASH POINT</td>
<td>±42°C (open cup)</td>
</tr>
<tr>
<td>FLAMMABILITY</td>
<td>1 - 10% v/v</td>
</tr>
<tr>
<td>AUTOFLAMMABILITY</td>
<td>350°C</td>
</tr>
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</table>
EXPLOSIVE PROPERTIES
None

OXIDISING PROPERTIES
None

VAPOUR PRESSURE
5 mm Hg at 25°C

DENSITY
837 kg/m³ at 25°C

SOLUBILITY - WATER
Slightly in water

SOLUBILITY - SOLVENT
Miscible with most organic solvents

VAPOUR DENSITY
Not available

STABILITY AND REACTIVITY

STABLE
Stable, does not react with water.

CONDITIONS TO AVOID
Heat, flames and all sources of ignition or static.

INCOMPATIBLE MATERIALS
Oxidising agents e.g. nitrates, perchlorates, peroxides.

HAZARDOUS DECOMPOSITION PRODUCTS
None reported.
Incomplete combustion will liberate carbon monoxide and carbon dioxide.

POLYMERIZATION
Does not occur.

TOXICOLOGICAL INFORMATION

ACUTE TOXICITY
See Section 3 (Biological Hazards)

SKIN AND EYE CONTACT
See Section 3.
SUB-CHRONIC TOXICITY
See Section 3.

CARCINOGENICITY
See Section 3.

MUTAGENICITY
See Section 3.

REPRODUCTIVE HAZARDS
See Section 3.

12. ECOLOGICAL INFORMATION

AQUATIC TOXICITY - FISH
No data available
AQUATIC TOXICITY - DAPHNIA
No data available
AQUATIC TOXICITY - ALGAE
No data available
BIO DEGRADABILITY
No data available
BIO-ACCUMULATION
No data available
MOBILITY
No data available
GERMAN WGK
No data available

13. DISPOSAL CONSIDERATIONS

DISPOSAL METHODS
Only under conditions approved by local authorities. See also Section 6.

DISPOSAL OF PACKAGING
Empty containers may contain residues which are flammable and hazardous and are subject to controlled disposal. Always obey hazard warnings.

14. TRANSPORT INFORMATION

UN No. 1201
SUBSTANCE IDENTITY No.
ADR/RID CLASS Not available
ADR/RID ITEM No. Not available
ADR/RID HAZARD IDENTITY No. Not available
IMDG - SHIPPING NAME Amyl Alcohol
IMDG - CLASS 3.2
IMDG - PACKAGING GROUP II
IMDG - MARINE POLLUTANT No
IMDG - EMS No. 3-06
MATERIAL SAFETY DATA SHEET

FUSEL OIL

MIXTURE OF ISOMERS OF AMYL ALCOHOL

MAJOR COMPONENT 3-METHYL-1-BUTANOL

CH₃(CH₂)₂CH₂CH₂OH

PAGE 8 OF 9

MAJOR COMPONENT 3-METHYL-1-BUTANOL

CH₃(CH₂)₂CH₂CH₂OH

305

Amyl Alcohol

3

Flammable liquid

Not available

Not available

Not available

Not available

15. REGULATORY INFORMATION

EEC HAZARD CLASSIFICATION

Not available

RISK PHRASES

R10, R20

SAFETY PHRASES

S16

NATIONAL LEGISLATION


16. OTHER INFORMATION

CAS No.

123-51-3 (3-Methyl-1-Butanol)

EINECS No.

204-633-5

EEC ANNEX 1 No.

Not available

MITI No.

Not available

FDA LIST No.

Not available

LISTING - TOSCA

Not available

LISTING - ACOIN

Not available

LISTING - CANADIAN DSL/NDSL

Not available

NOTIFICATION - EEC

Not available

NOTIFICATION - USA

Not available

APPENDIX

MSDS PREPARATION DATE

1996-04-24

MSDS SERIAL No.

F013/MS1

COMPILED BY

D D LIEBENBERG

SOURCES OF INFORMATION

1. Canadian Centre for Occupational Health and Safety. Record No’s 54, 655 and 363.
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