

2,3-Dimethylbutane

sc-238285

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

2,3-Dimethylbutane

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

2145 Delaware Ave
Santa Cruz, CA 95060

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: **CHEMWATCH: From within the US and Canada:**
877-715-9305

Emergency Tel: **From outside the US and Canada: +800 2436 2255**
(1-800-CHEMCALL) or call +613 9573 3112

PRODUCT USE

■ Solvent.

SYNONYMS

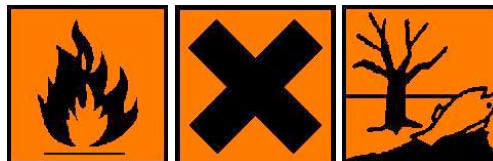
C6-H14, "butane, 2, 3-dimethyl-", hexane

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability:	3		
Toxicity:	2		
Body Contact:	2		
Reactivity:	1		
Chronic:	0		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Irritating to skin.

HARMFUL - May cause lung damage if swallowed.

Highly flammable.

Vapors may cause dizziness or suffocation.

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733).

■ Accidental ingestion of the material may be damaging to the health of the individual.

■ Isoparaffinic hydrocarbons cause temporary lethargy, weakness, inco-ordination and diarrhea.

EYE

■ Although the liquid is not thought to be an irritant, direct contact with the eye may produce transient discomfort characterized by tearing or conjunctival redness (as with windburn).

■ Instillation of isoparaffins into rabbit eyes produces only slight irritation.

SKIN

■ This material can cause inflammation of the skin on contact in some persons.

■ The material may accentuate any pre-existing dermatitis condition.

■ Repeated exposure may cause skin cracking, flaking or drying following normal handling and use.

■ Dermal, isoparaffins have produced slight to moderate irritation in animals and humans under occluded patch conditions where evaporation cannot freely occur. However, they are not irritating in non-occluded tests, which are a more realistic simulation of human exposure. They have not been found to be sensitizers in guinea pig or human patch testing. However, occasional rare idiosyncratic sensitisation reactions in humans have been reported.

■ Open cuts, abraded or irritated skin should not be exposed to this material.

■ Material on the skin evaporates rapidly and may cause tingling, chilling and even temporary numbness.

■ The liquid may be miscible with fats or oils and may degrease the skin, producing a skin reaction described as non-allergic contact dermatitis. The material is unlikely to produce an irritant dermatitis as described in EC Directives.

■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

■ Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.

■ Inhalation of vapors or aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.

■ There is some evidence to suggest that the material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.

■ Inhalation of high concentrations of gas/vapor causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination.

■ Central nervous system (CNS) depression may include general discomfort, symptoms of giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

■ Nerve damage can be caused by some non-ring hydrocarbons. Symptoms are temporary, and include weakness, tremors, increased saliva, some convulsions, excessive tears with discoloration and inco-ordination lasting up to 24 hours.

■ Material is highly volatile and may quickly form a concentrated atmosphere in confined or unventilated areas. Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.

CHRONIC HEALTH EFFECTS

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
2,3-dimethylbutane	79-29-8	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

-
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.
- Avoid giving milk or oils.
- Avoid giving alcohol.
- If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

EYE

- If this product comes in contact with the eyes:
 - Wash out immediately with fresh running water.
 - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
 - If pain persists or recurs seek medical attention.
 - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin contact occurs:
 - Immediately remove all contaminated clothing, including footwear
 - Flush skin and hair with running water (and soap if available).
 - Seek medical attention in event of irritation.

INHALED

-
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor.

NOTES TO PHYSICIAN

■ Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.

For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:

- Primary threat to life, from pure petroleum distillate ingestion and/or inhalation, is respiratory failure.
- Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO₂ 50 mm Hg) should be intubated.
- Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
- A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
- Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines. Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
- Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

[Ellenhorn and Barceloux: Medical Toxicology].

Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHg):	195.016 @ 21.1
Upper Explosive Limit (%):	7.7
Specific Gravity (water=1):	0.662
Lower Explosive Limit (%):	1.2

EXTINGUISHING MEDIA

-
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog - Large fires only.

FIRE FIGHTING

-
- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- If safe, switch off electrical equipment until vapor fire hazard removed.
- Use water delivered as a fine spray to control the fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protective location.
- If safe to do so, remove containers from path of fire.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

-
- Liquid and vapor are highly flammable.
- Severe fire hazard when exposed to heat, flame and/or oxidizers.
- Vapor may travel a considerable distance to source of ignition.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).

Combustion products include: carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

Contains low boiling substance: Closed containers may rupture due to pressure buildup under fire conditions.

May emit clouds of acrid smoke.

FIRE INCOMPATIBILITY

- Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PERSONAL PROTECTION

Glasses:

Chemical goggles.

Gloves:

Respirator:

Type AX Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

-
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

MAJOR SPILLS

- Chemical Class: aliphatic hydrocarbons

For release onto land: recommended sorbents listed in order of priority.

SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
LAND SPILL - SMALL				
cross-linked polymer - particulate	1	shovel	shovel	R, W, SS
cross-linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
wood fiber - pillow	2	throw	pitchfork	R, P, DGC, RT
treated wood fibre- pillow	2	throw	pitchfork	DGC, RT
sorbent clay - particulate	3	shovel	shovel	R, I, P
foamed glass - pillow	3	throw	pitchfork	R, P, DGC, RT
LAND SPILL - MEDIUM				
cross-linked polymer - particulate	1	blower	skiploader	R,W, SS
cross-linked polymer - pillow	2	throw	skiploader	R, DGC, RT
sorbent clay - particulate	3	blower	skiploader	R, I, P
polypropylene - particulate	3	blower	skiploader	W, SS, DGC
expanded mineral - particulate	4	blower	skiploader	R, I, W, P, DGC
polypropylene - mat	4	throw	skiploader	DGC, RT

Legend

DGC: Not effective where ground cover is dense

R: Not reusable

I: Not incinerable

P: Effectiveness reduced when rainy

RT: Not effective where terrain is rugged

SS: Not for use within environmentally sensitive sites

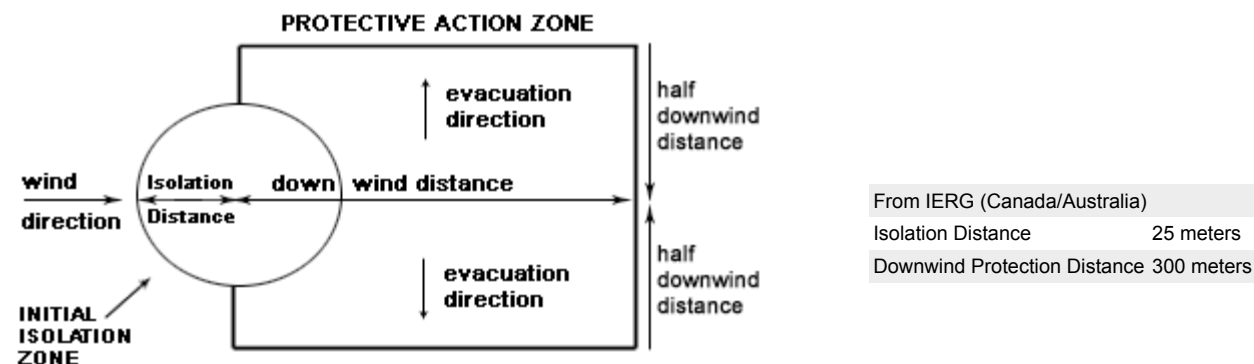
W: Effectiveness reduced when windy

Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;

R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988.

- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Consider evacuation (or protect in place).
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapor.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



From US Emergency Response Guide 2000 Guide 128

FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.

5 Guide 128 is taken from the US DOT emergency response guide book.

6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects

or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

■

- Containers, even those that have been emptied, may contain explosive vapors.
- Do NOT cut, drill, grind, weld or perform similar operations on or near containers.

Contains low boiling substance:

Storage in sealed containers may result in pressure buildup causing violent rupture of containers not rated appropriately.

- Check for bulging containers.
- Vent periodically
- Always release caps or seals slowly to ensure slow dissipation of vapors
- DO NOT allow clothing wet with material to stay in contact with skin
- Electrostatic discharge may be generated during pumping - this may result in fire.
- Ensure electrical continuity by bonding and grounding (earthing) all equipment.
- Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (≤ 1 m/sec until fill pipe submerged to twice its diameter, then ≤ 7 m/sec).
- Avoid splash filling.
- Do NOT use compressed air for filling discharging or handling operations.
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, naked lights, heat or ignition sources.
- When handling, DO NOT eat, drink or smoke.
- Vapor may ignite on pumping or pouring due to static electricity.
- DO NOT use plastic buckets.
- Earth and secure metal containers when dispensing or pouring product.
- Use spark-free tools when handling.
- Avoid contact with incompatible materials.
- Keep containers securely sealed.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

RECOMMENDED STORAGE METHODS

■ Packing as supplied by manufacturer. Plastic containers may only be used if approved for flammable liquid. Check that containers are clearly labeled and free from leaks.

- For low viscosity materials (i): Drums and jerricans must be of the non-removable head type. (ii): Where a can is to be used as an inner package, the can must have a screwed enclosure.
- For materials with a viscosity of at least 2680 cSt. (23 deg. C)
- For manufactured product having a viscosity of at least 250 cSt. (23 deg. C)
- Manufactured product that requires stirring before use and having a viscosity of at least 20 cSt (23 deg. C) - (i): Removable head packaging; (ii): Cans with friction closures and (iii): low pressure tubes and cartridges may be used.
- Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages
- In addition, where inner packagings are glass and contain liquids of packing group I there must be sufficient inert absorbent to absorb any spillage, unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic.

STORAGE REQUIREMENTS

■

- Store in original containers in approved flame-proof area.
- No smoking, naked lights, heat or ignition sources.
- DO NOT store in pits, depressions, basements or areas where vapors may be trapped.
- Keep containers securely sealed.
- Store away from incompatible materials in a cool, dry well ventilated area.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



X: Must not be stored together

O: May be stored together with specific preventions

+: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US ACGIH Threshold Limit Values (TLV)	2,3-dimethylbutane (2,3-Dimethylbutane)	500		1000					TLV Basis: central nervous system impairment; upper respiratory tract & eye irritation
Canada - Prince Edward Island Occupational Exposure Limits	2,3-dimethylbutane (2,3-Dimethylbutane)	500		1000					TLV Basis: central nervous system impairment; upper respiratory tract & eye irritation
Canada - Nova Scotia Occupational Exposure Limits	2,3-dimethylbutane (2,3-Dimethylbutane)	500		1000					TLV Basis: central nervous system impairment; upper respiratory tract & eye irritation
Canada - Alberta Occupational Exposure Limits	2,3-dimethylbutane (Dimethylbutane (Hexane, all isomers, except n-Hexane))	500	1760	1000	3500				
Canada - Alberta Occupational Exposure Limits	2,3-dimethylbutane (Hexane (all isomers except n-hexane))	500	1760	1000	3500				
Canada - Ontario Occupational Exposure Limits	2,3-dimethylbutane (Hexane, other isomers of)	500	1,760	1,000	3,520				
Canada - British Columbia Occupational Exposure Limits	2,3-dimethylbutane (Hexane, other isomers)	200							
US NIOSH Recommended Exposure Limits (RELs)	2,3-dimethylbutane (Hexane isomers (excluding n-Hexane))	100	350			510	1800		(Ceiling ([15-minute]))
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	2,3-dimethylbutane (Hexane (other isomers))	500		1000					
US - Washington Permissible exposure limits of air contaminants	2,3-dimethylbutane (Hexane - other isomers)	500		1,000					
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	2,3-dimethylbutane (Hexane (other isomers))	500	1760	1000	3500				
US - Hawaii Air Contaminant Limits	2,3-dimethylbutane (Hexane isomers)	500	1,800						(CAS (Varies with compound))
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	2,3-dimethylbutane (Hexane isomers)	500	1800	1000	3600				

US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	2,3-dimethylbutane (Hexane isomers)	500	1800	1000	3600
US - California Permissible Exposure Limits for Chemical Contaminants	2,3-dimethylbutane (Hexane, other isomers)	500	1800	1000	3600
US - Alaska Limits for Air Contaminants	2,3-dimethylbutane (Hexane isomers)	500	1800	1000	3600
US - Michigan Exposure Limits for Air Contaminants	2,3-dimethylbutane (Hexane isomers)	500	1800	1000	3600
US - Minnesota Permissible Exposure Limits (PELs)	2,3-dimethylbutane (Hexane isomers)	500	1800	1000	3600

MATERIAL DATA

2,3-DIMETHYLBUTANE:

■ for: hexane, isomers (excluding n-hexane)

The TLV-TWA is thought to be protective against nausea, headache, upper respiratory tract irritation and CNS depression. The STEL is added to prevent objective depression of the CNS. The lower value ascribed to n-hexane is due to the neurotoxicity of its metabolites, principally 5-hydroxy-2-hexanone and 2,5-hexanedione. It is considered unlikely that other hexanes follow the same metabolic route. It should be noted however that the n-hexane TLV-TWA also applies to commercial hexane having a concentration of greater than 5% n-hexane.

for 2,2-dimethylbutane:
The TLV-TWA is thought to be protective against nausea, headache, upper respiratory tract irritation and CNS depression. The STEL is added to prevent objective depression of the CNS. The lower value ascribed to n-hexane is due to the neurotoxicity of its metabolites, principally 5-hydroxy-2-hexanone and 2,5-hexanedione. It is considered unlikely that other hexanes follow the same metabolic route. It should be noted however that the n-hexane TLV-TWA (50 ppm, 176 mg/m³) also applies to commercial hexane having a concentration of greater than 5% n-hexane.

MAK Category II Peak Limitation: For substances with systemic effects and with a half-life in humans of less than two hours. Allows excursions of 2 times the MAK value, for 30 minutes (on average), four times per shift.
MAK Group IIc: Substances with MAK Values but no pregnancy risk group classification. These are substances which have been investigated but for which no information regarding possible damage to the fetus/embryo was found. Mention calls attention to the absence of adequate data.

MAK values, and categories and groups are those recommended within the Federal Republic of Germany.

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PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

-
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

HANDS/FEET

■ Wear chemical protective gloves, eg. PVC.

Wear safety footwear or safety gumboots, eg. Rubber.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER

■

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

RESPIRATOR

■ Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-face Respirator	Full-Face Respirator
1000	10	AX-1	-
1000	50	-	AX-1
5000	50	Airline*	-
5000	100	-	AX-2
10000	100	-	AX-3
	100+		Airline* *

* - Continuous Flow ** - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

ENGINEERING CONTROLS

■ CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.

For flammable liquids and flammable gases, local exhaust ventilation or a process enclosure ventilation system may be required. Ventilation equipment should be explosion-resistant. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.

Type of Contaminant:	Air Speed:
solvent, vapors, degreasing etc., evaporating from tank (in still air).	0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers, welding, spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)	0.5-1 m/s (100-200 f/min.)
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable to capture	1: Disturbing room air currents
2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 1-2 m/s (200-400 f/min.) for extraction of solvents generated in a tank 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Liquid.

Does not mix with water.

Floats on water.

State	Liquid	Molecular Weight	86.18
Melting Range (°F)	-200.2	Viscosity	Not Available
Boiling Range (°F)	136.4	Solubility in water (g/L)	Immiscible

Flash Point (°F)	-27.994	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapor Pressure (mmHg)	195.016 @ 21.1
Upper Explosive Limit (%)	7.7	Specific Gravity (water=1)	0.662
Lower Explosive Limit (%)	1.2	Relative Vapor Density (air=1)	3
Volatile Component (%vol)	100	Evaporation Rate	Fast
Gas group	IIA		

2,3-DIMETHYLBUTANE

■ log Kow (Sangster 1997): 3.42

APPEARANCE

Colourless liquid with mild petroleum odour; does not mix with water.

log Kow 3.17-3.94

Material	Value
■ log Kow (Sangster 1997)	3.42

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

-
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

- Avoid reaction with oxidizing agents.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

2,3-DIMETHYLBUTANE

TOXICITY AND IRRITATION

- No significant acute toxicological data identified in literature search.

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

2,3-DIMETHYLBUTANE:

Marine Pollutant:	Yes
■ log Kow (Sangster 1997):	3.42

- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
- Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

- For n-hexane:

log Kow: 3.17-3.94

BOD 5 if unstated: 2.21

COD: 0.04

ThOD: 3.52

Environmental fate:

Transport and Partitioning: The physical properties of n-hexane that affect its transport and partitioning in the environment are: water solubility of 9.5 mg/L; log[Kow] (octanol/water partition coefficient), estimated as 3.29; Henry's law constant, 1.69 atm-m³ mol; vapor pressure, 150 mm Hg at 25 C; and log[Koc] in the range of 2.90 to 3.61. As with many alkanes, experimental methods for the estimation of the Koc parameter are lacking, so that estimates must be made based on theoretical considerations.

The dominant transport process from water is volatilization. Based on mathematical models the half-life for n-hexane in bodies of water with any degree of turbulent mixing (e.g., rivers) would be less than 3 hours. For standing bodies of water (e.g. small ponds), a half-life no longer than one week (6.8 days) is estimated Based on the log octanol/water partition coefficient (i.e. log[Koc]) and the estimated log sorption coefficient (i.e. log[Koc]) n-hexane is not expected to become concentrated in biota. A calculated bioconcentration factor (BCF) of 453 for a fathead minnow further suggests a low potential for n-hexane to bioconcentrate or bioaccumulate in trophic food chains.

In soil, the dominant transport mechanism for n-hexane present near the surface probably is volatilisation (based on its Henry's law constant, water solubility, vapor pressure, and Koc). While its estimated Koc values suggest a moderate ability to sorb to soil particles, n-hexane has a

density (0.6603 g/mL at 20 C) well below that of water and a very low water solubility of 9.5 mg/L. n-Hexane would, therefore, be viewed as a light nonaqueous phase liquid (LNAPL), which would suggest a low potential for leaching into the lower soil depths since the n-hexane would tend to float on the top of the saturated zone of the water table. n-Hexane would generally stay near the soil surface and, if not appreciably sorbed into the soil matrix, would be expected eventually to volatilise to the atmosphere. Exceptions would involve locations with shallow groundwater tables where there were large spills of hexane products. In such cases, the n-hexane could spread out to contaminant a large volume of soil materials.

Air: n-Hexane does not absorb ultraviolet (UV) light at 290 nm and is thus not expected to undergo direct photolysis reactions. The dominant tropospheric removal mechanism for n-hexane is generally regarded to be decomposition by hydroxyl radicals. Calculations assuming typical hydroxyl radical concentrations suggest a half-life of approximately 2.9 days. While n-hexane can react with nitrogen oxides to produce ozone precursors under controlled laboratory conditions, the smog-producing potential of n-hexane is very low compared to that of other alkanes or chlorinated VOCs. Hydroxyl ion reactions in the upper troposphere, therefore, are probably the primary mechanisms for n-hexane degradation in the atmosphere. As with most alkanes, n-hexane is resistant to hydrolysis.

Water: Although few data are available dealing explicitly with the biodegradation of n-hexane in water, neither hydrolysis nor biodegradation in surface waters appears to be rapid compared with volatilization. In surface waters, as in the atmosphere, alkanes such as n-hexane would be resistant to hydrolysis. Biodegradation is probably the most significant degradation mechanism in groundwater. The ability of *Pseudomonas mendocina* bacteria to metabolise n-hexane in laboratory microcosms simulating groundwater conditions has been documented. Mixed bacterial cultures as well as pure cultures are documented as capable of metabolizing n-hexane under aerobic conditions. In general, linear alkanes (such as n-hexane) are viewed as the most readily biodegradable fractions in petroleum, particularly when oxygen is present in solution. Once introduced into groundwater, n-hexane may be fairly persistent since its degradation by chemical hydrolysis is slow and opportunities for biodegradation may be limited under anoxic conditions or where nutrients such as nitrogen or phosphorus are in limited supply.

Sediment and Soil: The most important biodegradation processes involve the conversion of the n-hexane to primary alcohols, aldehydes and, ultimately, into fatty acids. Similar processes are encountered with other light hydrocarbons such as heptane. In general, unless the n-hexane is buried at some depth within a soil or sediment, volatilisation is generally assumed to occur at a much more rapid rate than chemical or biochemical degradation processes. Once introduced into deeper sediments, n-hexane may be fairly persistent.

Ecotoxicity:

Fish LC50 (96 h): *Oncorhynchus mykiss* 4.14 mg/l; *Pimephales promelas* 2.5 mg/l (flow through); *Lepomis macrochirus* 4.12 mg/l

Daphnia EC50 (48 h): 3.87 mg/l.

■ DO NOT discharge into sewer or waterways.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
2,3-dimethylbutane	HIGH		LOW	MED

GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles

Name / Cas No / RTECS No	EHS	TRN	A1a	A1b	A1	A2	B1	B2	C1	C2	C3	D1	D2	D3	E1	E2	E3
E2~ / CAS:79- 29- 8 / MN9275000	—	—	850	268	3	NI	3	R	4	NI	0	0	0	2	2	NA	E 2

Legend: EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships)
 NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation,
 B1=Acute aquatic toxicity LC/ECIC50 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg),
 C2=Acute mammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion,
 D2=Eye irritation & corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference
 with coastal amenities, For column A2: R=Readily biodegradable, NR=Not readily biodegradable. For column D3: C=Carcinogen,
 M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lung injury, N=Neurotoxic,
 I=Immunotoxic. For column E1: NT=Not tainting (tested), T=Tainting test positive. For column E2: Fp=Persistent floater, F=Floater, S=Sinking
 substances. The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard. (GESAMP/EHS Composite List
 of Hazard Profiles - Hazard evaluation of substances transported by ships)

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

Ignitability characteristic: use EPA hazardous waste number D001 (waste code I)

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	None	Hazard class or Division:	3
Identification Numbers:	UN2457	PG:	II
Label Codes:	3	Special provisions:	IB2, T7, TP1
Packaging: Exceptions:	150	Packaging: Non-bulk:	202
Packaging: Exceptions:	150	Quantity limitations: Passenger aircraft/rail:	5 L
Quantity Limitations: Cargo aircraft only:	60 L	Vessel stowage: Location:	E
Vessel stowage: Other:	None		

Hazardous materials descriptions and proper shipping names:

2,3-Dimethylbutane

Air Transport IATA:

ICAO/IATA Class:	3	ICAO/IATA Subrisk:	None
UN/ID Number:	2457	Packing Group:	II
Special provisions:	None		

Shipping Name: 2,3-DIMETHYLBUTANE

Maritime Transport IMDG:

IMDG Class:	3	IMDG Subrisk:	None
UN Number:	2457	Packing Group:	II
EMS Number:	F-E , S-D	Special provisions:	None
Limited Quantities:	1 L	Marine Pollutant:	Yes

Shipping Name: 2,3-DIMETHYLBUTANE

Section 15 - REGULATORY INFORMATION



REGULATIONS

2,3-dimethylbutane (CAS: 79-29-8) is found on the following regulatory lists;

"Canada - Nova Scotia Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (French)", "US - Massachusetts Oil & Hazardous Material List", "US - New Jersey Right to Know Hazardous Substances", "US - Pennsylvania - Hazardous Substance List", "US ACGIH Threshold Limit Values (TLV)", "US Toxic Substances Control Act (TSCA) - Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Inhalation and/or ingestion may produce health damage*.
 - May produce discomfort of the respiratory system*.
 - Repeated exposure potentially causes skin dryness and cracking*.
- * (limited evidence).

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■ Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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