TRIETHANOLAMINE

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
TRIETHANOLAMINE

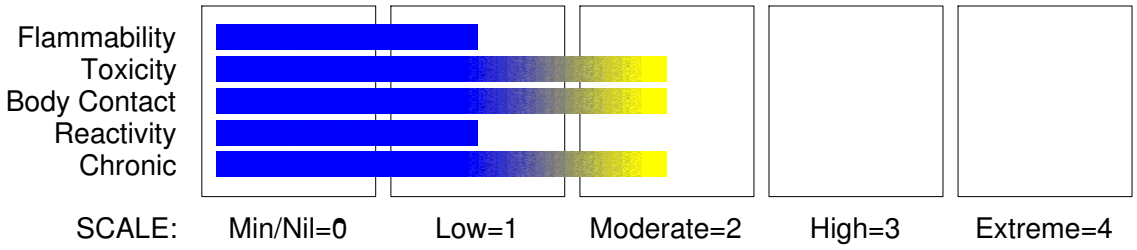
OTHER NAMES

C6-H15-N-O3, C6-H15-N-O3, triethylolamine, trihydroxytriethylamine, tri(hydroxyethyl)amine, tris(2-hydroxyethyl)amine, "ethanol, 2, 2, 2-nitrilotris", "2, 2, 2-nitrilotrisethanol", "ethanol, 2, 2', 2''-nitrilotri", "2, 2', 2''-nitrilotriethanol", "nitrilo-2, 2', 2''-triethanol", TEA, alkanolamine, "amino alcohol"

PRODUCT USE
Intermediate for manufacture of fatty acid soaps used in drycleaning, cosmetics, household detergents and emulsions. Wool scouring, textile antifume agent and water repellent, dispersion agent, corrosion inhibitor, softening agent.
Also used as an emulsifier, humectant and plasticizer, chelating agent, rubber accelerator, pharmaceutical alkalizing agent.

SUPPLIER
Company: S D FINE- CHEM LIMITED
Address:
315- 317, T.V. INDUSTRIAL ESTATE,
248, WORLI,
MUMBAI- 400030.INDIA.
technical@sdfine.com
Telephone: 91- 22- 24959898
Telephone: 91- 22- 24959899
Fax: 91- 22- 24937232

HAZARD RATINGS



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Section 2 - HAZARDS IDENTIFICATION

GHS Classification

Acute Toxicity (Dermal) Category 4
Acute Toxicity (Inhalation) Category 4
Acute Toxicity (Oral) Category 4
Eye Irritation Category 2A
Respiratory Irritation Category 3
Skin Corrosion/Irritation Category 2
Skin Sensitizer Category 1

EMERGENCY OVERVIEW

HAZARD

WARNING
Determined by using GHS criteria:
H335 H302 H312 H332 H315 H319 H317
May cause respiratory irritation
Harmful if swallowed
Harmful in contact with skin
Harmful if inhaled
Causes skin irritation
Causes serious eye irritation
May cause allergic skin reaction

PRECAUTIONARY STATEMENTS

Prevention

Use only outdoors or in a well ventilated area.
Avoid breathing dust/fume/gas/mist/vapours/spray.
Wear protective gloves/clothing
Wash thoroughly after handling.
Contaminated clothing should not be allowed out of the workplace.
Do not eat, drink or smoke when using this product.
Wash hands thoroughly after handling.

Response

Wash contaminated clothing before reuse.
If eye irritation persists, get medical advice/attention.
If skin irritation or rash occurs, seek medical advice/attention.
Wear eye/face protection.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If skin irritation occurs, seek medical advice/attention.
Call a POISON CENTER or doctor/physician if you feel unwell.
Remove/Take off immediately all contaminated clothing
Specific treatment: refer to Label or MSDS.
IF ON SKIN: Gently wash with plenty of soap and water.

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IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing.
Wash/Decontaminate removed clothing before reuse.

Storage
Store locked up.

Disposal
Dispose of contents and container in accordance with relevant legislation.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
triethanolamine	102-71-6	>85
with		
diethanolamine	111-42-2	<10
ethanolamine	141-43-5	<10

Section 4 - FIRST AID MEASURES

SWALLOWED

· IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
· For advice, contact a Poisons Information Centre or a doctor.
· Urgent hospital treatment is likely to be needed.
· In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
· If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
· If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.
· Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
· INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
NOTE: Wear a protective glove when inducing vomiting by mechanical means.

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.

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· 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, without delay.

NOTES TO PHYSICIAN

Treat symptomatically.
For poisons (where specific treatment regime is absent):

BASIC TREATMENT

· Establish a patent airway with suction where necessary.
· Watch for signs of respiratory insufficiency and assist ventilation as necessary.
· Administer oxygen by non-rebreather mask at 10 to 15 L/min.
· Monitor and treat, where necessary, for pulmonary oedema .
· Monitor and treat, where necessary, for shock.
· Anticipate seizures .
· DO NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.

ADVANCED TREATMENT

· Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
· Positive-pressure ventilation using a bag-valve mask might be of use.
· Monitor and treat, where necessary, for arrhythmias.
· Start an IV D5W TKO. If signs of hypovolaemia are present use lactated Ringers solution. Fluid overload might create complications.
· Drug therapy should be considered for pulmonary oedema.
· Hypotension with signs of hypovolaemia requires the cautious administration of fluids. Fluid overload might create complications.
· Treat seizures with diazepam.
· Proparacaine hydrochloride should be used to assist eye irrigation.
BRONSTEIN, A.C. and CURRANCE, P.L.
EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.

Section 5 - FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

· Water spray or fog.
· Foam.
· Dry chemical powder.
· BCF (where regulations permit).
· Carbon dioxide.

FIRE FIGHTING

· Alert Fire Brigade and tell them location and nature of hazard.
· Wear full body protective clothing with breathing apparatus.
· Prevent, by any means available, spillage from entering drains or water course.
· Use water delivered as a fine spray to control 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 protected location.
· If safe to do so, remove containers from path of fire.

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FIRE/EXPLOSION HAZARD
- Combustible.
- Slight fire hazard when exposed to heat or flame.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).
- May emit acrid smoke.
- Mists containing combustible materials may be explosive.

Combustion products include: carbon dioxide (CO2), nitrogen oxides (NOx), other pyrolysis products typical of burning organic material.
May emit poisonous fumes.
May emit corrosive fumes.

FIRE INCOMPATIBILITY
Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Personal Protective Equipment
Gas tight chemical resistant suit.

Section 6 - ACCIDENTAL RELEASE MEASURES

EMERGENCY PROCEDURES

MINOR SPILLS
Slippery when spilt.
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labelled container for waste disposal.

MAJOR SPILLS
Slippery when spilt.
Moderate hazard.
- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

EMERGENCY RESPONSE PLANNING GUIDELINES (ERPG)
The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour WITHOUT experiencing or developing

life-threatening health effects is:
triethanolamine 500 mg/m^3

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irreversible or other serious effects or symptoms which could impair an individual's ability to take protective action is:
triethanolamine 20 mg/m³

other than mild, transient adverse effects without perceiving a clearly defined odour is:
triethanolamine 5 mg/m³

The threshold concentration below which most people will experience no appreciable risk of health effects:
triethanolamine 5 mg/m³

American Industrial Hygiene Association (AIHA)

Ingredients considered according to the following cutoffs

Very Toxic (T+)	>= 0.1%	Toxic (T)	>= 3.0%
R50	>= 0.25%	Corrosive (C)	>= 5.0%
R51	>= 2.5%		
else	>= 10%		

where percentage is percentage of ingredient found in the mixture

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

DO NOT allow clothing wet with material to stay in contact with skin.
DO NOT USE brass or copper containers / stirrers.
Alkanolamines and iron may produced unstable complexes. Monoethanolamine (MEA) and iron form a trisethanolamino-iron complex. This material may spontaneously decompose at temperatures between 130 and 160 degrees C. and is suspected of causing a fire in a nearly empty storage tank containing a "heel" of MEA in contact with carbon steel coils.
If steam coil heating is used, low pressure steam in stainless steel coils should be considered. Drum heating should also be reviewed and, where possible, temperatures should be maintained below 130 degrees C.

- 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 or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- 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.

SUITABLE CONTAINER

- Metal can or drum
- Packaging as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

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STORAGE INCOMPATIBILITY

Avoid reaction with.
Avoid strong acids, bases.
Avoid contact with copper, aluminium and their alloys.
Avoid reaction with oxidising agents.
Avoid reaction with aldehydes, ketones, acrylates, organic anhydrides, organic halides.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.
- No smoking, naked lights or ignition sources.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

+	X	+	X	0	+

+: May be stored together
O: May be stored together with specific preventions
X: Must not be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records

- triethanolamine: CAS:102- 71- 6
- diethanolamine: CAS:111- 42- 2
- ethanolamine: CAS:141- 43- 5

EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
ethanolamine		30

ODOUR SAFETY FACTOR (OSF)

OSF=0.77 (triethanolamine)
Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.
Odour Safety Factor (OSF) is determined to fall into either Class C, D or E.
The Odour Safety Factor (OSF) is defined as:
OSF= Exposure Standard (TWA) ppm/ Odour Threshold Value (OTV) ppm
Classification into classes follows:

Class	OSF	Description
A	550	Over 90% of exposed individuals are aware by smell that the Exposure Standard (TLV- TWA for example) is being reached, even

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		when distracted by working activities
B	26- 550	As " A" for 50- 90% of persons being distracted
C	1- 26	As " A" for less than 50% of persons being distracted
D	0.18- 1	10- 50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached
E	<0.18	As " D" for less than 10% of persons aware of being tested

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MATERIAL DATA

Exposure at or below the TLV-TWA is thought to minimise the potential for skin and eye irritation, and acute effects (including liver, kidney and nerve damage) and chronic effects (including cancer and allergic contact dermatitis).

INGREDIENT DATA

DIETHANOLAMINE:

Odour Threshold: 2.6 ppm
The TLV-TWA is thought to be protective against the significant risk of eye damage and skin irritation.

ETHANOLAMINE:

Odour threshold: 3-4 ppm.
Continuous exposure at 5 ppm produced only slight systemic effects. Intermittent exposure produces a lesser degree of toxicity in laboratory animals. This decreased toxicity is related to the rate of elimination; the longer retained, the greater the toxicity,. The TLV-TWA is thought to be protective against the risk of irritation and neuropathic effects.

PERSONAL PROTECTION

EYE

· Safety glasses with side shields.
· Chemical goggles.
· Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

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HANDS/FEET

Suitability and durability of glove type is dependent on usage. Factors such as:
· frequency and duration of contact,
· chemical resistance of glove material,
· glove thickness and
· dexterity,
are important in the selection of gloves.
Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.
NOTE: The material may produce skin sensitisation in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.

OTHER

· Overalls.
· P.V.C. apron.
· Barrier cream.
· Skin cleansing cream.
· Eye wash unit.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.
For further information consult your
Occupational Health and Safety Advisor.

ENGINEERING CONTROLS

Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.
An approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area. 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, vapours, 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.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5- 10 m/s (500- 2000 f/min.)

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range

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1: Room air currents minimal or favourable to capture
2: Contaminants of low toxicity or of nuisance value only.
3: Intermittent, low production.
4: Large hood or large air mass in motion

1: Disturbing room air currents
2: Contaminants of high toxicity
3: High production, heavy use
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

APPEARANCE

Clear, colourless, viscous, hygroscopic liquid with slight ammoniacal odour.
Strong base. (Calculated pH 11.25, measured 10.5).
Soluble in water, alcohol, chloroform; slightly soluble in benzene, ether.
Viscosity 601 cPs @ 25 deg C.
Conversion factors: 1ppm = 6.09 mg/m3: 1mg/m3 = 0.164 ppm @ 25 deg C.

PHYSICAL PROPERTIES

Liquid.
Mixes with water.

Molecular Weight: 149.22
Melting Range (°C): 15.8- 21.2
Solubility in water (g/L): Miscible
pH (1% solution): 10.5 @ 1.0%
Volatile Component (%vol): Nil @ 38 C.
Relative Vapour Density (air=1): 5
Lower Explosive Limit (%): Not available
Autoignition Temp (°C): 360
State: Liquid

Boiling Range (°C): 310- 360
Specific Gravity (water=1): 1.13 @ 20 C.
pH (as supplied): Not available
Vapour Pressure (kPa): < 0.001 @ 20 C
Evaporation Rate: 0.01 BuAc=1
Flash Point (°C): 179 (OC)
Upper Explosive Limit (%): Not available
Decomposition Temp (°C): 335
Viscosity: Not Available

log Kow (Sangster 1997): - 1
log Kow: -1.32- -1.75
log Kow (Prager 1995): - 1.43
log Kow: -1.43
log Kow (Sangster 1997): - 1.31
log Kow: -1.31

Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

CONDITIONS CONTRIBUTING TO INSTABILITY

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

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Section 11 - TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
Limited evidence exists that the substance may cause irreversible but non-lethal mutagenic effects following a single exposure.

EYE
Evidence exists, or practical experience predicts, that the material may cause severe eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals. Eye contact may cause significant inflammation with pain. Corneal injury may occur; permanent impairment of vision may result unless treatment is prompt and adequate. Repeated or prolonged exposure to irritants may cause inflammation characterised by a temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.

SKIN
Skin contact with the material may be harmful; systemic effects may result following absorption.
The material produces mild skin irritation; evidence exists, or practical experience predicts, that the material either

· produces mild inflammation of the skin in a substantial number of individuals following direct contact, and/or
· produces significant, but mild, inflammation when applied to the healthy intact skin of animals (for up to four hours), such inflammation being present twenty-four hours or more after the end of the exposure period.

Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.
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 aerosols (mists, fumes), generated by the material during the course of normal handling, may be harmful.
Evidence shows, or practical experience predicts, that the material produces irritation of the respiratory system, in a substantial number of individuals, following inhalation.
In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly

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derived from the vascular system.

CHRONIC HEALTH EFFECTS

On the basis, primarily, of animal experiments, concern has been expressed by at least one classification body that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.
Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
There exists limited evidence that shows that skin contact with the material is capable either of inducing a sensitisation reaction in a significant number of individuals, and/or of producing positive response in experimental animals.
Exposure to the material may result in a possible risk of irreversible effects. The material may produce mutagenic effects in man. This concern is raised, generally, on the basis of
appropriate studies with similar materials using mammalian somatic cells in vivo. Such findings are often supported by positive results from in vitro mutagenicity studies.
Prolonged or chronic exposure to alkanolamines may result in liver, kidney or nervous system injury. Repeated inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease.
Results of repeated exposure tests with diethanolamine (DEA) in laboratory animals include anaemia (rats) and effects on the kidneys (rats and mice) and liver (mice). DEA produces nervous system injury in dogs and rats. Heart and salivary gland lesions have also been seen in mice treated cutaneously with DEA and in mice receiving DEA in drinking water. Rats given high doses of DEA developed anaemia and testicular lesions.
Exaggerated doses of DEA produced heart and nervous system effects in other animals. Changes in other organs were judged to be secondary due to the poor health of animals subjected to extremely high doses of DEA. Rats, rabbits and guinea pigs exposed to high vapour concentrations of volatile monoethanolamine (MEA) (up to 1250 ppm) for periods of up to 5 weeks developed pulmonary, hepatic and renal lesions. Dogs, rats and guinea pigs exposed to 100 ppm MEA for 30 days, became apathetic and developed poor appetites. Animal tests also indicate that inhalation exposure to MEA may result in nervous system injury.
All species exposed to airborne MEA experienced dermal effects, varying from ulceration to hair loss probably resulting from contact with the cage.
An increased incidence of skeletal variations, suggestive of a slight developmental delay was seen in the foetuses of rats given 1500 mg/kg/day DEA cutaneously; this also produced significant maternal toxicity. No foetal malformations, however, were seen in rats nor in rabbits receiving identical treatment. The foetus of rats given high doses of MEA by gavage, showed an increased rate of embryofoetal death, growth retardation, and some malformations including hydronephrosis and hydroureter. The high doses required to produce these effects bring into question the relevance of this finding to humans. There is some evidence that embryofoetotoxicity and teratogenicity does not occur in rats when MEA is administered by dermal application to the mother.
The National Toxicology Program (NTP) concluded that there is clear evidence of liver tumours and some evidence of kidney tumours in mice exposed dermally to DEA over their lifetime. Chronic skin painting studies in mice of both sexes produced liver tumours and an increased incidence of kidney tumours in male mice. The significance of these findings to humans is unclear as DEA is neither genotoxic, mutagenic nor clastogenic, and did not induce tumours in rats or transgenic mice similarly treated. Alkanolamines (especially those containing a secondary amine moiety) may react with nitrites or other nitrosating agents to form carcinogenic N-nitrosamines. Alkanolamines are metabolised by biosynthetic routes to ethanolamine and choline and incorporated into phospholipids. They are excreted predominantly unchanged with a half-life of approximately one week. In the absence of sodium nitrite, no conversion to carcinogenic N-nitrosamines was observed.
Diethanolamine competitively inhibits the cellular uptake of choline, in vitro, and hepatic changes in choline homeostasis, consistent with choline deficiency, are observed in vivo.
Many amines are potent skin and respiratory sensitisers and certain individuals especially those described as "atopic" (i.e. those predisposed to asthma and other

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allergic responses) may show allergic reactions when chronically exposed to alkanolamines.
In a study with coconut diethanolamide, the National Toxicology Program (Technical Report Series 479), showed clear evidence of carcinogenic activity in male B6C3F1 mice based on increased incidences of hepatic and renal tubule neoplasms and in female B6C3F1 mice based on increased incidences of hepatic neoplasms. There was equivocal evidence of carcinogenic activity in female F344/N rats based on a marginal increase in the incidence of renal tube neoplasms. These increases were associated with the concentration of free diethanolamine present as a contaminant in the diethanolamine condensate. Exposure to rats to coconut oil diethanolamine condensate by dermal application in ethanol for 2 years resulted in epidermal hyperplasia, sebaceous gland hyperplasia, hyperkeratosis and parakeratosis in males and females and ulcer in females at the site of application. There were increases in the incidences of chronic inflammation, epithelial hyperplasia, and epithelial ulcer in the forestomach of female rats. The severity of nephropathy in dosed female rats were increased. Exposure of mice to coconut oil diethanolamine condensate by dermal application for 2 years resulted in increased incidences of eosinophilic foci of the liver in males. Increased incidences of epidermal hyperplasia, sebaceous gland hyperplasia, and hyperkeratosis in males and females, ulcer in males, and parakeratosis and inflammation in females at the site of application and of follicular cell hyperplasia in the thyroid gland of males and females, were chemical related.
Reversible liver and kidney damage has been demonstrated in animals from chronic exposure.
Although the product is not, in itself, carcinogenic, reaction under strong acid conditions, with nitrites and nitrous acids results in the formation of a potent carcinogen, N-nitrosodiethanolamine.
This situation might be encountered in certain metal-treatment operations, for example.
A cohort study, in which cancer morbidity and mortality were investigated in workers exposed to cutting fluids with nitrates and amines (amongst them triethanolamine), had negative results. The effects on workers industrially exposed to metal-working coolants containing sodium nitrite and triethanolamine solutions were investigated in a Russian study.
Observed vascular effecs were attributed to sodium nitrite; no effects were attributed to triethanolamine.
Screening studies in mice suggest that the material does not effect foetal development.

TOXICITY AND IRRITATION

unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 8000 mg/kg	Skin (human): 15 mg/3d (int)- Mild
Oral (rat) LD50: 4920 ul/kg	Skin (rabbit): 560 mg/24 hr- Mild
Dermal (rat) LD50: >16000 mg/kg minor iritis,	
Dermal (rabbit) LD50: 16 ml/kg * minor conjunctival irritation	
Intraperitoneal (rat) LD50: 1510 mg/kg with significant discharge;	
Oral (mouse) LD50: 5846 mg/kg no corneal injury *	
Intraperitoneal (mouse) LD50: 1450 mg/kg	Skin (rabbit): 4 h occluded
Oral (rabbit) LD50: 2200 mg/kg no irritation *	
Dermal (rabbit) LD50: >20000 mg/kg	
Oral (g.pig) LD50: 2200 mg/kg	

The material may produce severe irritation to the eye causing pronounced inflammation.
Repeated or prolonged exposure to irritants may produce conjunctivitis.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the

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epidermis.
Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
The substance is classified by IARC as Group 3:
NOT classifiable as to its carcinogenicity to humans.
Evidence of carcinogenicity may be inadequate or limited in animal testing.
NOTE: Substance has been shown to be mutagenic in at least one assay, or belongs to a family of chemicals producing damage or change to cellular DNA.
Limited evidence of a carcinogenic effect*.

Oral (rat) LD50: 5560 mg/kg (calc.)	Eye (rabbit): 5.62 mg - SEVERE
Oral (rat) LD50: 4.92 ml/kg (female) *	Eye (rabbit): 10 mg - mild
Oral (rat) LD50: 8.57 ml/kg (male) *	Eye (rabbit): 0.1 ml - (occluded, male or female)
Kill rate 1/5 *	

Lachrymation, diarrhoea, convulsions, urinary tract changes, changes in bladder weight, changes in testicular weight, changes in thymus weight, changes in liver weight, dermatitis after systemic exposure, kidney, ureter, bladder tumours recorded.
Equivocal tumourigen by RTECS criteria.
* Union Carbide

DIETHANOLAMINE:
unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 710 mg/kg	Skin (rabbit): 50 mg (open)- Mild
Dermal (rabbit) LD50: 12200 mg/kg	Skin (rabbit): 500 mg/24 hr- Mild
	Eye (rabbit): 5500 mg - SEVERE
	Eye (rabbit):0.75 mg/24 hr SEVERE

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of the epidermis.

ETHANOLAMINE:
unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (rat) LD50: 2050 mg/kg	Skin (rabbit):505 mg open- Moderate
Oral (rat) LD50: 1510 mg/kg *	Eye (rabbit): 0.76 mg - SEVERE
Dermal (rabbit) LD50: 1000 mg/kg	

The material may produce severe irritation to the eye causing pronounced inflammation.
Repeated or prolonged exposure to irritants may produce conjunctivitis.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterised by skin redness (erythema) and swelling the epidermis. Histologically there may be intercellular oedema of the spongy layer (spongiosis) and intracellular oedema of

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the epidermis.
Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
* Bayer

Section 12 - ECOLOGICAL INFORMATION

Fish LC50 (96hr.) (mg/l):	3500 (24hr
Daphnia magna EC50 (48hr.) (mg/l):	2.5
Algae IC50 (72hr.) (mg/l):	1.8- 47
log Kow (Sangster 1997):	- 1
log Pow (Verschueren 1983):	0.75428571
BOD20:	6.20%
ThOD:	2.04

DO NOT discharge into sewer or waterways.
log Kow: -1.32- -1.75
Koc: 3
Half-life (hr) air: 4
Henry's atm m^3 /mol: 3.38E-19
BOD 5 if unstated: nil-0.17
COD: 1.5
ThOD: 2.04; 1.61 p/p
ThOD (measured) 1.52 mg/mg (Union Carbide)
ThOD (calculated) 1.61 mg/mg (Union Carbide)
BCF: <1
Biodegradability:
96% DOC reduction (OECD Method 301E)
BOD
Day 5: 8%
Day 10: 9%
Day 20: 66%
Passes Sturm, AFNOR tests for biodegradability.
Reaches more than 70% mineralisation in OECD test for inherent biodegradability (Zahn-Wellens test)
Theoretical oxygen demand ThOD) is calculated at 1.61 p/p. Degradation is expected in the atmospheric environment within minutes to hours.
Material is practically non-toxic to aquatic organisms on an acute basis (LC50 >100 mg/l in most sensitive species)
Fish LC50 (96 h): fathead minnow (Pimephales promelas) 1800-11800 mg/l
fathead minnow 5600 mg/l (Union Carbide)
bluegill (Leuciscus idus) 7930 mg/l
goldfish (Carrassius auratus) 5000 mg/l
Daphnia magna LC50 (24 h): 1390 - 2038 mg/l
Daphnia magna LC50 (48 h): 947 mg/l (Union Carbide)

continued...

Algae LC50 (48 h): 750 mg/l
Brine shrimp LC50: (Artemia salina) 5600 mg/l
Maximum aceeptable toxicant concentration (MATC): 22 mg/l
Algal growth inhibition (Scenedesmus subspicatus) EC50: 470-750 mg/l
Inhibition of bacteria in effluent: 50% inhibition: >10000 mg/l
Inhibitory concentration (IC50) is OECD "Activated Sludge, Respiration Inhibition Test" (Guideline 209) is >1000 mg/l. Material has shown a potential to biodegrade. Attains >99% degradation in activated sludge in 24 hours. Attains >99% degradation in soil is 1-14 days.
Bioconcentration potential is low (BCF less than 100 or log Kow less than 3). Log octanol/ water partition coefficient (log Kow) is estimated using the Pomona-Medchem structural fragment to be -1.746. Potential for the mobility in soil is very high (Koc betweeen 0 and 50).
Henry's Law Constant (H) is estimated to be 3.38E-19 atm.m³/mol (25 C)
Log soil organic carbon partition coefficient (log Koc) is estimated to be 0.48.
When released into soil the material is expected to degrade without significant evaporation. A half-life of between 1 to 10 days is expected.
When released into water, the material is expected to degrade with a half-life of about 1 to 10 days. Beacuse the material has a log octanol-water coefficient of less than 3 it is not expected to bioaccumulate. Release to air is expected to produce photolytic degradation resulting in hydroxyl radicals. The material is expected to be removed from the atmosphere by dry and wet deposition (half-life between 1 and 10 days).
Refer to data for ingredients, which follows:

DIETHANOLAMINE:

Hazardous Air Pollutant:	Yes
log Kow (Prager 1995):	- 1.43
Half- life Soil - High (hours):	168
Half- life Soil - Low (hours):	14.4
Half- life Air - High (hours):	7.2
Half- life Air - Low (hours):	0.72
Half- life Surface water - High (hours):	168
Half- life Surface water - Low (hours):	14.4
Half- life Ground water - High (hours):	336
Half- life Ground water - Low (hours):	28.8
Aqueous biodegradation - Aerobic - High (hours):	168
Aqueous biodegradation - Aerobic - Low (hours):	14.4
Aqueous biodegradation - Anaerobic - High (hours):	672
Aqueous biodegradation - Anaerobic - Low (hours):	57.6
Aqueous biodegradation - Removal secondary treatment - High (hours):	94%
Photooxidation half- life air - High (hours):	7.2
Photooxidation half- life air - Low (hours):	0.72

DO NOT discharge into sewer or waterways.
log Kow: -1.43
Koc: 4
Half-life (hr) air: 4
Henry's atm m³ /mol: 5.35E-14
BOD 5: 0.03-0.1,0.9%
BOD 28: 57 mg/gm
COD: 1590 mg/gm
TPC 470 mg/gm
ThOD: 2.13
BCF: <1
At very low concentrations (about 10 ppm) diethanolamine can be degraded in biological wastewater treatment plants.

continued...

Ecotoxicology:
Fish LC50 (96 h): Fathead minnow 100 mg/l
(48 h): Bluegill sunfish 1850 mg/l
Daphnia magna LC50 (48 h): 109 mg/l
Toxicity invertebrate: LC50(96) insct0.5-39ug/L
Bioacculmulation: moderate - sig

ETHANOLAMINE:

Fish LC50 (96hr.) (mg/l):	170
Algae IC50 (72hr.) (mg/l):	0.75- 1.6
log Kow (Sangster 1997):	- 1.31
log Pow (Verschueren 1983):	- 1.31
BOD5:	0.93
COD:	1.27
ThOD:	2.49

Prevent, by any means available, spillage from entering drains or water courses.
DO NOT discharge into sewer or waterways.
log Kow: -1.31
Koc: 5
Half-life (hr) air: 11
Henry's atm m^3 /mol: 4.00E-08
BOD 5 if unstated: 0.8-1.1,0%
COD: 1.27-1.28
ThOD: 2.49
BCF: <1
Toxicity Fish: LC50(96)13480mg/L
Toxicity invertebrate: cell mult. inhib.65-6500mg/L
Bioacculmulation: not sig
Nitrif. inhib.: 50% inhib at 4100mg/L
Anaerobic effects: sig degrad
Degradation Biological: sig
processes Abiotic: RxnOH*,no hydrol
Biodegradability:
BOD5: 800 mg/g
>70%: BOD of the ThOD (OECD 301F)
>90%: DOC reduction (OECD 301A)
Ecotoxicity:
Fish LC50 (96 h): Oncorrhynchus 150 mg/l
Daphnia LC50 (24 h): 120-140 mg/l
Algae NOEC (192 h): 0.75-0.97 mg/l
Environmental Fate:
Movement and Partitioning:
Bioconcentration potential is low (BCF less than 100 or log Kow less than 3). The potential for mobility in the soil is high (Koc between 0 and 50).
Log soil organic carbon partition coefficient (log Koc) is estimated to be 0.70.
Degradation and Persistence:
The material is biodegradable, passing the OECD tests for ready biodegradability.
Biodegradation reached in CO2 evolution test after 28 days: 97%*
(modified Sturm Test, OECD 301B)
Biodegradation reached in modified OECD Screening Test after 28 days: 94%*
(OECD 301E)
Biodegradation reached in manometric Respirometer Test after 28 days:>70%*
(OECD 301F)
Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD >40%)

continued...

BOD20 (Biochemical Oxygen Demand after 20 days): 1.5 p/p
ThOD (Theoretical Oxygen Demand)): 2.36 p/p (calc).
IC50 (Inhibitory Concentration): >1000 mg/l
(OECD Activated Sludge Respiration Inhibition Test (OECD 209)
Ecotoxicology:
The material is practically non-toxic to aquatic organisms on an acute basis (LC50/ EC50 >100 mg/l in most sensitive species).
Daphnia LC50 (-) 114 mg/l *
Fish LC50 (-): Oncorhyncus mykiss 150 mg/l, gold fish 170 mg/l, bluegill 300-1000 mg/l, fathead minnow 635 mg/l, mosquito fish 337.5, golden orfe 224-525 mg/l
* (Dow Chemical)
BOD5: 60%; BOD19: 75%; BOD20: 100% **
Toxicity to microorganisms:
IC50 700 mg/l
Daphnia LC50 (48 h): 33 mg/l; 93 mg/l **
Fish KC50 (96 h): fathead minnow 125 mg/l, 206 mg/l **
ThOD: 1.54 mg/mg (measured); 1.31 mg/mg (calculated) **
Octanol/ Water coefficient Kow (measured): -1.31 **
Monoethanolamine is toxic to aquatic life at relatively low concentrations in water.
Editors note: there is clear contradiction between the conclusion reached by Dow Chemical and other manufacturers relating to aquatic toxicity.
Under present EC Directives the material is not toxic to aquatic life.
** (Dow Chemical)

Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Authority for disposal.
- Bury or incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorised landfill.
- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.

Otherwise:

- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

Section 14 - TRANSPORTATION INFORMATION

HAZCHEM: None

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS:UN, IATA, IMDG

Section 15 - REGULATORY INFORMATION

REGULATIONS

continued...

Section 15 - REGULATORY INFORMATION

triethanolamine (CAS: 102-71-6) is found on the following regulatory lists;
Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (English)
IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk
International Agency for Research on Cancer (IARC) Carcinogens
OECD Representative List of High Production Volume (HPV) Chemicals
The Australia Group Export Control List: Chemical Weapons Precursors

Section 16 - OTHER INFORMATION

Denmark Advisory list for selfclassification of dangerous substances

Substance	CAS	Suggested codes
triethanolamine	102- 71- 6	R43

MSDS SECTION CHANGES

The following table displays the version number of and date on which each section was last changed.

Section Name	Version	Date	Section Name	Version	Date	Section Name	Version	Date
Advice to Doctor	5	5- Oct- 2006	Storage (storage incompatibility)	5	5- Oct- 2006	Acute Health (inhaled)	5	5- Oct- 2006
First Aid (eye)	5	5- Oct- 2006	Storage (suitable container)	5	5- Oct- 2006	Acute Health (skin)	5	5- Oct- 2006
First Aid (inhaled)	5	5- Oct- 2006	Engineering Control	5	5- Oct- 2006	Acute Health (swallowed)	5	5- Oct- 2006
First Aid (swallowed)	5	5- Oct- 2006	Personal Protection (eye)	5	5- Oct- 2006	Chronic Health	5	5- Oct- 2006
Fire Fighter (extinguishing media)	5	5- Oct- 2006	Personal Protection (hands/feet)	5	5- Oct- 2006	Toxicity and Irritation (Irritation)	4	22- Jan- 2006
Fire Fighter (fire fighting)	5	5- Oct- 2006	Personal Protection (other)	5	5- Oct- 2006	Toxicity and Irritation (Other)	5	5- Oct- 2006
Fire Fighter (fire incompatibility)	5	5- Oct- 2006	Appearance	5	5- Oct- 2006	Environmental	5	5- Oct- 2006
Fire Fighter (fire/explosion hazard)	5	5- Oct- 2006	Physical Properties	5	5- Oct- 2006	Disposal	5	5- Oct- 2006
Spills (major)	5	5- Oct- 2006	Acute Health (eye)	5	5- Oct- 2006	Transport	5	5- Oct- 2006
Handling Procedure	5	5- Oct- 2006						

The above information is believed to be accurate and represent the best information currently available to us, but does not represent any warranty expressed or implied of the properties of the product. User should make their own investigation to determine the suitability of the information for their particular purpose.

Issue Date: 5-Oct-2017