

SAFETY DATA SHEET



D.E.H.® 29 Epoxy Hardener

Version	Revision Date:	SDS Number:	Date of last issue: 12-07-2020
7.1	11-10-2021	101234322	Date of first issue: 11-10-2021

BLUE CUBE OPERATIONS LLC encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

SECTION 1. IDENTIFICATION

Product name : D.E.H.® 29 Epoxy Hardener
Product code : 000000001000000990

Manufacturer or supplier's details

Company name of supplier : BLUE CUBE OPERATIONS LLC

Address : 190 CARONDELET PLAZA, SUITE 1530
CLAYTON MO 63105-3467

Telephone : (844) 238-3445
E-mail address : INFO@OLIN.COM
24-Hour Emergency Contact : +1 800 424 9300

Local Emergency Contact : 1-800-424-9300
Identified uses : Used in applications such as:
Adhesives.
Casting.
Tooling.
Marine and protective coatings.
Composites.
Potting and encapsulation.
Civil engineering.

SECTION 2. HAZARDS IDENTIFICATION

GHS classification in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute toxicity (Oral) : Category 4
Acute toxicity (Dermal) : Category 4
Skin corrosion : Category 1B
Serious eye damage : Category 1
Skin sensitization : Category 1

GHS label elements

Hazard pictograms :



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Signal Word : Danger

Hazard Statements : Harmful if swallowed or in contact with skin.
Causes severe skin burns and eye damage.
May cause an allergic skin reaction.

Precautionary Statements : **Prevention:**
P261 Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P272 Contaminated work clothing must not be allowed out of the workplace.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:

P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.

P301 + P330 + P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.

P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.

P305 + P351 + P338 + P310 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.

P333 + P313 If skin irritation or rash occurs: Get medical advice/ attention.

P363 Wash contaminated clothing before reuse.

Storage:

P405 Store locked up.

Disposal:

P501 Dispose of contents/ container to an approved waste disposal plant.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Components

Chemical name	CAS-No.	Concentration (% w/w)
Higher ethyleneamines	68131-73-7	>= 60 - < 90
Pentaethylenhexamine mixture	4067-16-7	>= 20 - < 55
Tetraethylenepentamine mixture	112-57-2	>= 5 - < 25
Triethylenetetramine mixture	112-24-3	>= 0.1 - < 1

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Actual concentration is withheld as a trade secret

SECTION 4. FIRST AID MEASURES

- | | |
|---|---|
| If inhaled | : Move person to fresh air; if effects occur, consult a physician. |
| In case of skin contact | : Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing. Seek medical attention if symptoms occur or irritation persists. Wash clothing before reuse.
Discard items which cannot be decontaminated, including leather articles such as shoes, belts and watchbands.
Suitable emergency safety shower facility should be immediately available. |
| In case of eye contact | : Immediately flush eyes with water; remove contact lenses, if present, after the first 5 minutes, then continue flushing eyes for at least 15 minutes. Obtain medical attention without delay, preferably from an ophthalmologist.
Suitable emergency eye wash facility should be immediately available. |
| If swallowed | : Do not induce vomiting. Give one cup (8 ounces or 240 ml) of water or milk if available and transport to a medical facility. Do not give anything by mouth unless the person is fully conscious. |
| Most important symptoms and effects, both acute and delayed | : Aside from the information found under Description of first aid measures(above)any additional important symptoms and effects are described in Section 11: Toxicology Information. |
| Protection of first-aiders | : First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection).
If potential for exposure exists refer to Section 8 for specific personal protective equipment. |
| Notes to physician | : If burn is present, treat as any thermal burn, after decontamination.
Due to irritant properties, swallowing may result in burns/ulceration of mouth, stomach and lower gastrointestinal tract with subsequent stricture. Aspiration of vomitus may cause lung injury. Suggest endotracheal/esophageal control if lavage is done.
No specific antidote.
Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient. |

SECTION 5. FIRE-FIGHTING MEASURES

- | | |
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| Suitable extinguishing media | : Water fog or fine spray.
Dry chemical fire extinguishers.
Carbon dioxide fire extinguishers. |
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- Foam.
Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.
- Unsuitable extinguishing media : Do not use direct water stream.
May spread fire.
- Specific hazards during fire fighting : Container may rupture from gas generation in a fire situation.
Violent steam generation or eruption may occur upon application of direct water stream to hot liquids.
- Hazardous combustion products : During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating.
Combustion products may include and are not limited to:
Nitrogen oxides.
Carbon monoxide.
Carbon dioxide.
- Further information : Keep people away. Isolate fire and deny unnecessary entry.
Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed.
Fight fire from protected location or safe distance. Consider the use of unmanned hose holders or monitor nozzles.
Immediately withdraw all personnel from the area in case of rising sound from venting safety device or discoloration of the container.
Burning liquids may be extinguished by dilution with water.
Do not use direct water stream. May spread fire.
Move container from fire area if this is possible without hazard.
Burning liquids may be moved by flushing with water to protect personnel and minimize property damage.
Contain fire water run-off if possible. Fire water run-off, if not contained, may cause environmental damage.
Review the 'Accidental Release Measures' and the 'Ecological Information' sections of this (M)SDS.
- Special protective equipment for fire-fighters : Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves).
Avoid contact with this material during fire fighting operations.
If contact is likely, change to full chemical resistant fire fighting clothing with self-contained breathing apparatus. If this is not available, wear full chemical resistant clothing with self-contained breathing apparatus and fight fire from a remote location.
For protective equipment in post-fire or non-fire clean-up situations, refer to the relevant sections.

SECTION 6. ACCIDENTAL RELEASE MEASURES

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- | | | |
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| Personal precautions, protective equipment and emergency procedures | : | Evacuate area.
Only trained and properly protected personnel must be involved in clean-up operations.
Keep personnel out of low areas.
Keep upwind of spill.
Ventilate area of leak or spill.
Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection. Refer to section 7, Handling, for additional precautionary measures. |
| Environmental precautions | : | Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information. |
| Methods and materials for containment and cleaning up | : | Contain spilled material if possible.
Small spills:
Absorb with materials such as:
Clay.
Dirt.
Milsorb®.
Sand.
Do NOT use absorbent materials such as:
Cellulose.
Sawdust.
Wash the spill site with water.
Remove with shovel.
Collect in suitable and properly labeled containers.
Large spills:
Dike area to contain spill.
Knock down and dilute vapors with water fog or spray.
Collect with vacuum equipment.
Ground and bond all containers and handling equipment.
Wash the spill site with large quantities of water.
See Section 13, Disposal Considerations, for additional information. |

SECTION 7. HANDLING AND STORAGE

- | | | |
|-----------------------------|---|---|
| Advice on safe handling | : | Do not get in eyes, on skin, or on clothing.
Avoid prolonged or repeated contact with skin.
Do not swallow.
Avoid breathing vapor.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Spills of these organic materials on hot fibrous insulations may lead to lowering of the autoignition temperatures possibly resulting in spontaneous combustion.
See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION. |
| Conditions for safe storage | : | Store in a dry place.
Avoid moisture.
Store in the following material(s): |

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Stainless steel.
Carbon steel.
Avoid contact with metals such as:
Brass.
Bronze.
Copper.
Copper alloys.
Additional storage and handling information on this product may be obtained by calling your sales or customer service contact.

Recommended storage temperature : 50 - 81 °F / 10 - 27 °C

Storage period : 24 Months

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Tetraethylenepentamine mixture	112-57-2	TWA	5 mg/m ³	US WEEL
Triethylenetetramine mixture	112-24-3	TWA	1 ppm	US WEEL

Engineering measures : Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations.
Local exhaust ventilation may be necessary for some operations.

Personal protective equipment

Respiratory protection : Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. For most conditions, no respiratory protection should be needed; however, if handling at elevated temperatures without sufficient ventilation, use an approved air-purifying respirator.

Filter type : The following should be effective types of air-purifying respirators: Organic vapor cartridge.

Hand protection

Remarks : Use gloves chemically resistant to this material. Examples of preferred glove barrier materials include: Polyethylene. Ethyl vinyl alcohol laminate ('EVAL'). Examples of acceptable glove

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barrier materials include: Butyl rubber. Natural rubber ('la-tex'). Neoprene. Nitrile/butadiene rubber ('nitrile' or 'NBR'). Polyvinyl alcohol ('PVA'). Polyvinyl chloride ('PVC' or 'vinyl'). Viton. NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Eye protection : Use chemical goggles.

Skin and body protection : Use protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Liquid.

Color : Brown to black

Odor : Amine.

Odor Threshold : No test data available

pH : 13
Method: Literature

Melting point/range : Not applicable

Freezing point : -26 °F / -32 °C
Method: Literature

Boiling point/boiling range : > 212 °F / > 100 °C
Method: Decomposes

Flash point : 244 °F / 118 °C
Method: Pensky-Martens Closed Cup ASTM D 93, closed cup

Evaporation rate : No data available

Flammability (liquids) : Not expected to be a static-accumulating flammable liquid.

Upper explosion limit / Upper flammability limit : Not applicable

Lower explosion limit / Lower flammability limit : Not applicable

Vapor pressure : < 0.01 mmHg (68 °F / 20 °C)

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	Method: Literature
Relative vapor density	: 8 Method: Literature
Relative density	: 1.014 (68 °F / 20 °C) Method: Literature
Solubility(ies) Water solubility	: completely soluble (68 °F / 20 °C) Method: Literature
Partition coefficient: n-octanol/water	: log Pow: -3.67 Method: Estimated.
Autoignition temperature	: Not determined
Decomposition temperature	: No test data available
Viscosity Viscosity, dynamic	: 200 - 300 mPa,s (77 °F / 25 °C) Method: ASTM D 445
Viscosity, kinematic	: 70 - 120 cSt (104 °F / 40 °C) Method: Literature
Explosive properties	: No data available
Oxidizing properties	: No data available
Molecular weight	: No test data available

Note: These are the Reference Points for these Physical Properties listed above, unless otherwise noted in their respective Physical Property value information: Boiling Point at 760 mmHg; Evaporation Rate Butyl Acetate = 1; Relative Vapor Density Air = 1; and Relative Density Water = 1.

NOTE: The physical data presented above are typical values and should not be construed as a specification.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	: No data available
Chemical stability	: Stable under recommended storage conditions. See Storage, Section 7.
Possibility of hazardous reactions	: Polymerization will not occur.
Conditions to avoid	: Exposure to elevated temperatures can cause product to decompose. Generation of gas during decomposition can cause pressure in closed systems. Reaction with carbon dioxide may form an amine carbamate. Smoke may be generated depending on vapor pressure of

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- mixture.
Product absorbs carbon dioxide from the air.
- Incompatible materials : Avoid contact with oxidizing materials.
Avoid contact with:
Acids.
Acrylates.
Alcohols.
Aldehydes.
Halogenated hydrocarbons.
Ketones.
Nitrites.
Avoid contact with metals such as:
Brass.
Bronze.
Copper.
Copper alloys.
- Hazardous decomposition products : Decomposition products depend upon temperature, air supply and the presence of other materials.
Decomposition products can include and are not limited to:
Aromatic compounds.
Ammonia.
Ethylenediamine.
Volatile amines.
Hydrocarbons.
Phenolics.

SECTION 11. TOXICOLOGICAL INFORMATION**Acute toxicity****Product:**

- Acute oral toxicity : Remarks: Low toxicity if swallowed.
Swallowing may result in irritation or burns of the mouth, throat, and gastrointestinal tract.
- LD50 (Rat): 1,716.2 mg/kg
Remarks: Based on information for a similar material:
- Acute inhalation toxicity : Remarks: At room temperature, exposure to vapor is minimal due to low volatility. Vapor from heated material may cause respiratory irritation and other effects.
- Remarks: As product:
The LC50 has not been determined.
- Acute dermal toxicity : Remarks: Prolonged or widespread skin contact may result in absorption of potentially harmful amounts.
- Remarks: As product:
The dermal LD50 has not been determined.
- LD50 (Rabbit): > 1,000 mg/kg

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Method: Estimated.

Remarks: Based on information for component(s):

Components:**Higher ethyleneamines:**

Acute oral toxicity : LD50 (Rat, male and female): 1,716.2 mg/kg
Remarks: Based on information for a similar material:

Acute inhalation toxicity : Remarks: The LC50 has not been determined.

Acute dermal toxicity : LD50 (Rabbit, male and female): 1,465.4 mg/kg
Remarks: Based on information for a similar material:

Pentaethylenhexamine mixture:

Acute oral toxicity : LD50 (Rat): 1,600 mg/kg

LD50 (Rat, male): 1,861.9 mg/kg

LD50 (Rat, female): 1,591.4 mg/kg

LD50 (Rat, male and female): 1,716.2 mg/kg

Acute inhalation toxicity : Remarks: At room temperature, exposure to vapor is minimal due to low volatility. Vapor from heated material may cause respiratory irritation and other effects.

Remarks: As product:
The LC50 has not been determined.

Acute dermal toxicity : LD50 (Rabbit): > 1,000 - < 2,000 mg/kg
Remarks: For similar material(s):

Tetraethylenepentamine mixture:

Acute oral toxicity : LD50 (Rat): > 3,250 mg/kg

Acute inhalation toxicity : Remarks: At room temperature, exposure to vapor is minimal due to low volatility.
Excessive exposure may cause irritation to upper respiratory tract (nose and throat).

(Rat): Exposure time: 8 h

Test atmosphere: vapor

Symptoms: No deaths occurred following exposure to a saturated atmosphere.

Assessment: The substance or mixture has no acute inhalation toxicity

Remarks: The LC50 has not been determined.

Acute dermal toxicity : LD50 (Rabbit): 1,260 mg/kg

Triethylenetetramine mixture:

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Acute oral toxicity : LD50 (Rat, male and female): 1,716 mg/kg

Acute inhalation toxicity : Remarks: The LC50 has not been determined.

Acute dermal toxicity : LD50 (Rabbit): 1,465 mg/kg

Skin corrosion/irritation**Product:**

Result : Corrosive after 3 minutes to 1 hour of exposure

Remarks : Brief contact may cause skin burns. Symptoms may include pain, severe local redness and tissue damage.

Components:**Higher ethyleneamines:**

Result : Causes burns.

Remarks : Brief contact may cause skin burns. Symptoms may include pain, severe local redness and tissue damage.

Pentaethylenhexamine mixture:

Result : Causes burns.

Remarks : Brief contact may cause severe skin burns. Symptoms may include pain, severe local redness and tissue damage.

Tetraethylenepentamine mixture:

Result : Causes burns.

Remarks : Brief contact may cause skin burns. Symptoms may include pain, severe local redness and tissue damage.

Remarks : Classified as corrosive to the skin according to DOT guidelines.

Triethylenetetramine mixture:

Result : Causes burns.

Remarks : Brief contact may cause severe skin burns. Symptoms may include pain, severe local redness and tissue damage.

Remarks : Classified as corrosive to the skin according to DOT guidelines.

Serious eye damage/eye irritation**Product:**

Remarks : May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur.

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Components:**Higher ethyleneamines:**

Result	: Corrosive
Remarks	: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur.

Pentaethylenehexamine mixture:

Result	: Corrosive
Remarks	: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur. May cause pain.

Tetraethylenepentamine mixture:

Result	: Corrosive
Remarks	: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur.

Triethylenetetramine mixture:

Result	: Corrosive
Remarks	: May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur.

Respiratory or skin sensitization**Product:**

Remarks	: Skin contact may cause an allergic skin reaction. Has demonstrated the potential for contact allergy in mice.
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Remarks	: For respiratory sensitization: No relevant data found.
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Components:**Higher ethyleneamines:**

Assessment	: The product is a skin sensitizer, sub-category 1B.
Remarks	: Skin contact may cause an allergic skin reaction. Has demonstrated the potential for contact allergy in mice.

Remarks	: For respiratory sensitization: No relevant data found.
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Pentaethylenehexamine mixture:

Assessment	: The product is a skin sensitizer, sub-category 1B.
Remarks	: Skin contact may cause an allergic skin reaction. Has caused allergic skin reactions when tested in guinea pigs.

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Remarks : For respiratory sensitization:
No relevant data found.

Tetraethylenepentamine mixture:

Assessment : The product is a skin sensitizer, sub-category 1B.
Remarks : Has demonstrated the potential for contact allergy in mice.
Has caused allergic skin reactions when tested in guinea pigs.
Individuals having an allergic skin reaction to this product may have an allergic skin reaction to similar material(s).
The similar material(s) is/are:
Ethylenediamine (EDA).
Diethylenetriamine.
Piperazine.
Aminoethylpiperazine (AEP).

Remarks : For respiratory sensitization:
No relevant data found.

Triethylenetetramine mixture:

Assessment : May cause sensitization by skin contact.
Remarks : Has caused allergic skin reactions in humans.
Has demonstrated the potential for contact allergy in mice.
Has caused allergic skin reactions when tested in guinea pigs.
Individuals having an allergic skin reaction to this product may have an allergic skin reaction to similar material(s).
The similar material(s) is/are:
Ethylenediamine (EDA).
Diethylenetriamine.
Piperazine.
Aminoethylethanolamine (AEEA).

Remarks : For respiratory sensitization:
No relevant data found.

Germ cell mutagenicity**Product:**

Genotoxicity in vitro : Remarks: In vitro genetic toxicity studies were negative in some cases and positive in other cases.
For similar material(s):
Triethylenetetramine (TETA).
Animal genetic toxicity studies were negative.

Components:**Pentaethylenehexamine mixture:**

Genotoxicity in vitro : Remarks: In vitro genetic toxicity studies were negative in some cases and positive in other cases.
Animal genetic toxicity studies were negative.

Tetraethylenepentamine mixture:

Genotoxicity in vitro : Remarks: In vitro genetic toxicity studies were positive.

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Animal genetic toxicity studies were negative.

Triethylenetetramine mixture:

Genotoxicity in vitro : Remarks: In vitro genetic toxicity studies were negative in some cases and positive in other cases.
Animal genetic toxicity studies were negative.

Carcinogenicity**Product:**

Remarks : Did not cause cancer in laboratory animals.

Components:**Higher ethyleneamines:**

Remarks : Did not cause cancer in laboratory animals.

Pentaethylenehexamine mixture:

Remarks : Did not cause cancer in laboratory animals.

Tetraethylenepentamine mixture:

Remarks : Did not cause cancer in laboratory animals.

Triethylenetetramine mixture:

Remarks : Did not cause cancer in laboratory animals.

IARC No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

NTP No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity**Product:**

Effects on fertility : Remarks: No relevant data found.

Effects on fetal development : Remarks: Laboratory animals that were fed exaggerated doses of Triethylenetetraamine(TETA) showed adverse fetal effects that were believed to be associated with an observed copper deficiency.
Exposures having no effect on the mother should have no effect on the fetus.

Components:**Higher ethyleneamines:**

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Effects on fertility : Remarks: No relevant data found.

Effects on fetal development : Remarks: Did not cause birth defects or other effects in the fetus even at doses which caused toxic effects in the mother.

Pentaethylenehexamine mixture:

Effects on fertility : Remarks: No relevant data found.

Effects on fetal development : Remarks: Based on information for component(s): Laboratory animals that were fed exaggerated doses of Triethylenetetraamine(TETA) showed adverse fetal effects that were believed to be associated with an observed copper deficiency.
Exposures having no effect on the mother should have no effect on the fetus.

Tetraethylenepentamine mixture:

Effects on fertility : Remarks: No relevant data found.

Effects on fetal development : Remarks: For the component(s) tested: Laboratory animals that were fed exaggerated doses of Triethylenetetraamine(TETA) showed adverse fetal effects that were believed to be associated with an observed copper deficiency.
Exposures having no effect on the mother should have no effect on the fetus.

Triethylenetetramine mixture:

Effects on fertility : Remarks: No relevant data found.

Effects on fetal development : Remarks: Laboratory animals that were fed exaggerated doses of Triethylenetetraamine(TETA) showed adverse fetal effects that were believed to be associated with an observed copper deficiency.
Exposures having no effect on the mother should have no effect on the fetus.

STOT-single exposure**Product:**

Assessment : Material is corrosive. Material is not classified as a respiratory irritant; however, upper respiratory tract irritation or corrosivity may be expected.

Components:**Higher ethyleneamines:**

Assessment : Material is corrosive. Material is not classified as a respiratory irritant; however, upper respiratory tract irritation or corrosivity may be expected.

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Pentaethylenehexamine mixture:

Assessment : Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Tetraethylenepentamine mixture:

Assessment : Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Triethylenetetramine mixture:

Assessment : Material is corrosive. Material is not classified as a respiratory irritant; however, upper respiratory tract irritation or corrosivity may be expected.

STOT-repeated exposure**Components:****Pentaethylenehexamine mixture:**

Assessment : The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Repeated dose toxicity**Product:**

Remarks : Repeated skin application to laboratory animals did not produce systemic toxicity.
Contains component(s) which have been reported to cause effects on the following organs in animals:
lung

Components:**Higher ethyleneamines:**

Remarks : In animals, effects have been reported on the following organs:
Lung.

Pentaethylenehexamine mixture:

Remarks : For the component(s) tested:
Repeated skin application to laboratory animals did not produce systemic toxicity.

Tetraethylenepentamine mixture:

Remarks : Repeated skin application to laboratory animals did not produce systemic toxicity.

Triethylenetetramine mixture:

Remarks : In animals, effects have been reported on the following organs:
Lung.

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Aspiration toxicity**Product:**

Based on physical properties, not likely to be an aspiration hazard.

Components:**Higher ethyleneamines:**

Based on available information, aspiration hazard could not be determined.

Pentaethylenehexamine mixture:

Based on physical properties, not likely to be an aspiration hazard.

Tetraethylenepentamine mixture:

Aspiration into the lungs may occur during ingestion or vomiting, causing tissue damage or lung injury.

Triethylenetetramine mixture:

Based on physical properties, not likely to be an aspiration hazard.

SECTION 12. ECOLOGICAL INFORMATION**Ecotoxicity****Product:**

Toxicity to fish	:	Remarks: Material is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested). LC50 (Pimephales promelas (fathead minnow)): 100 mg/l Exposure time: 96 h Test Type: static test Method: OECD Test Guideline 203 or Equivalent
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 2.2 mg/l Exposure time: 48 h Test Type: static test
Toxicity to algae/aquatic plants	:	ErC50 (Pseudokirchneriella subcapitata (green algae)): 0.5 mg/l End point: Growth rate inhibition Exposure time: 72 h Test Type: static test Method: OECD Test Guideline 201 or Equivalent

Components:**Higher ethyleneamines:**

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-
- Toxicity to fish : Remarks: Based on analogy.
Material is highly toxic to aquatic organisms on an acute basis (LC50/EC50 between 0.1 and 1 mg/L in the most sensitive species tested).

LC50 (Poecilia reticulata (guppy)): 100 mg/l
Exposure time: 96 h
Test Type: semi-static test
Method: Directive 67/548/EEC, Annex V, C.1.
- Toxicity to daphnia and other aquatic invertebrates : EC50 (water flea Daphnia magna): 2.2 mg/l
Exposure time: 48 h
Method: Directive 67/548/EEC, Annex V, C.2.
- Toxicity to algae/aquatic plants : EC50 (Pseudokirchneriella subcapitata (green algae)): 0.5 mg/l
End point: Growth rate inhibition
Exposure time: 72 h
Test Type: Static
Method: OECD Test Guideline 201 or Equivalent

EC50 (Pseudokirchneriella subcapitata (green algae)): 0.23 mg/l
End point: Biomass
Exposure time: 72 h
Test Type: Static
Method: OECD Test Guideline 201 or Equivalent
- M-Factor (Acute aquatic toxicity) : 1
- M-Factor (Chronic aquatic toxicity) : 1

Pentaethylenehexamine mixture:

- Toxicity to fish : Remarks: Material is moderately toxic to aquatic organisms on an acute basis (LC50/EC50 between 1 and 10 mg/L in the most sensitive species tested).

LC50 (Pimephales promelas (fathead minnow)): 133 mg/l
Exposure time: 96 h
Test Type: static test

LC50 (Poecilia reticulata (guppy)): 180 mg/l
Exposure time: 96 h
Test Type: semi-static test
- Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): 17.5 mg/l
Exposure time: 48 h
Test Type: Static
- Toxicity to algae/aquatic plants : EbC50 (Pseudokirchneriella subcapitata (green algae)): 0.7 mg/l
End point: Biomass

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ErC50 (Pseudokirchneriella subcapitata (green algae)): 1.7 mg/l
End point: Growth rate inhibition
Exposure time: 72 h
Test Type: Static
Method: OECD Test Guideline 201

Tetraethylenepentamine mixture:

Toxicity to fish : Remarks: Material is moderately toxic to aquatic organisms on an acute basis (LC50/EC50 between 1 and 10 mg/L in the most sensitive species tested).
May increase pH of aquatic systems to > pH 10 which may be toxic to aquatic organisms.

LC50 (Poecilia reticulata (guppy)): 420 mg/l
Exposure time: 96 h
Test Type: semi-static test
Method: OECD Test Guideline 203 or Equivalent

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): 24.1 mg/l
Exposure time: 48 h
Test Type: static test
Method: OECD Test Guideline 202 or Equivalent

Toxicity to algae/aquatic plants : ErC50 (Pseudokirchneriella subcapitata (green algae)): 6.8 mg/l
End point: Growth rate inhibition
Exposure time: 72 h
Test Type: static test
Method: OECD Test Guideline 201 or Equivalent

Toxicity to microorganisms : EC50 (activated sludge): 1,600 mg/l
Exposure time: 1 h
Test Type: static test

Triethylenetetramine mixture:

Toxicity to fish : Remarks: Material is slightly toxic to aquatic organisms on an acute basis (LC50/EC50 between 10 and 100 mg/L in the most sensitive species tested).
May increase pH of aquatic systems to > pH 10 which may be toxic to aquatic organisms.

LC50 (Pimephales promelas (fathead minnow)): 330 mg/l
Exposure time: 96 h
Test Type: static test
Method: OECD Test Guideline 203 or Equivalent

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): 31.1 mg/l
Exposure time: 48 h
Test Type: static test
Method: OECD Test Guideline 202 or Equivalent

Toxicity to algae/aquatic : EC50 (Pseudokirchneriella subcapitata (green algae)): 20 mg/l

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plants

End point: Growth rate inhibition
Exposure time: 72 h
Test Type: semi-static test
Method: OECD Test Guideline 201 or Equivalent

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEC (Daphnia magna (Water flea)): 1.9 mg/l
End point: number of offspring
Exposure time: 21 d
Test Type: semi-static test
Method: OECD Test Guideline 211 or Equivalent

Toxicity to microorganisms : EC50 (Bacteria): 680 mg/l
Exposure time: 16 h

Persistence and degradability**Product:**

Biodegradability : Result: Not biodegradable.
Remarks: Based on stringent OECD test guidelines, this material cannot be considered as readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions.

Biodegradation: 9.5 %
Exposure time: 28 d
Method: OECD Test Guideline 301B or Equivalent
Remarks: 10-day Window: Fail

Biochemical Oxygen Demand (BOD) : 1 %
Incubation time: 5 d

: 1 %
Incubation time: 10 d

: 1 %
Incubation time: 20 d

Chemical Oxygen Demand (COD) : 1.93 mg/mg

Components:**Pentaethylenehexamine mixture:**

Biodegradability : Result: Not biodegradable.
Remarks: Material is not readily biodegradable according to OECD/EEC guidelines.

Biodegradation: 0 %
Exposure time: 162 d
Method: OECD Test Guideline 301D
Remarks: 10-day Window: Fail

Biochemical Oxygen Demand (BOD) : 2.000 %
Incubation time: 5 d

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4.000 %
Incubation time: 10 d

8.000 %
Incubation time: 20 d

Tetraethylenepentamine mixture:

Biodegradability : Result: Not biodegradable.
Remarks: Material is not readily biodegradable according to OECD/EEC guidelines.

Biodegradation: 0 %
Exposure time: 28 d
Method: OECD Test Guideline 301A or Equivalent
Remarks: 10-day Window: Fail

Biodegradation: 17 %
Exposure time: 84 d
Method: OECD Test Guideline 302A or Equivalent
Remarks: 10-day Window: Not applicable

Biochemical Oxygen Demand (BOD) : 0 - 12 %
Incubation time: 20 d

Chemical Oxygen Demand (COD) : 1.54 - 1.88 mg/mg

ThOD : 3.39 mg/mg

Photodegradation : Rate constant: 3.16E-10 cm³/s
Method: Estimated.

Triethylenetetramine mixture:

Biodegradability : Remarks: Biodegradation under aerobic static laboratory conditions is moderate (BOD₂₀ or BOD₂₈/ThOD between 10 and 40%).

Result: Not biodegradable.
Biodegradation: 0 %
Exposure time: 20 d
Method: OECD Test Guideline 301D or Equivalent
Remarks: 10-day Window: Fail

Biochemical Oxygen Demand (BOD) : 5.000 %
Incubation time: 5 d

2.5 - 11 %
Incubation time: 20 d

Chemical Oxygen Demand (COD) : 1.94 mg/mg

ThOD : 3.40 mg/mg

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Bioaccumulative potential**Components:****Higher ethyleneamines:**

Partition coefficient: n-octanol/water : log Pow: -2.65
Remarks: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Pentaethylenhexamine mixture:

Partition coefficient: n-octanol/water : log Pow: -3.67
Method: Estimated.

Tetraethylenepentamine mixture:

Partition coefficient: n-octanol/water : log Pow: -3.16
Method: Estimated.
Remarks: No bioconcentration is expected because of the relatively high water solubility.

Triethylenetetramine mixture:

Partition coefficient: n-octanol/water : log Pow: -2.65
Method: Estimated.
Remarks: Bioconcentration potential is low (BCF < 100 or Log Pow < 3).

Mobility in soil**Product:**

Distribution among environmental compartments : Remarks: No relevant data found.

Components:**Pentaethylenhexamine mixture:**

Distribution among environmental compartments : Remarks: Potential for mobility in soil is slight (Koc between 2000 and 5000).
Koc: 3887
Method: Estimated.

Tetraethylenepentamine mixture:

Distribution among environmental compartments : Koc: 3.6 - 1098
Method: Estimated.
Remarks: Potential for mobility in soil is very high (Koc between 0 and 50).
Given its very low Henry's constant, volatilization from natural bodies of water or moist soil is not expected to be an important fate process.

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Triethylenetetramine mixture:

Distribution among environmental compartments : Koc: 4.1 - 310
Method: Estimated.
Remarks: Potential for mobility in soil is very high (Koc between 0 and 50).

Other adverse effects**Components:****Pentaethylenehexamine mixture:**

Results of PBT and vPvB assessment : This mixture has not been assessed for persistence, bioaccumulation and toxicity (PBT).

Tetraethylenepentamine mixture:

Results of PBT and vPvB assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB).

Triethylenetetramine mixture:

Results of PBT and vPvB assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT). This substance is not considered to be very persistent and very bioaccumulating (vPvB).

SECTION 13. DISPOSAL CONSIDERATIONS**Disposal methods**

Waste from residues : AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL.
THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information.
All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations.
Regulations may vary in different locations.
Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.
DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER.
FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device.

SECTION 14. TRANSPORT INFORMATION**International Regulations**

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UNRTDG

UN number	: UN 2735
Proper shipping name	: (Polyethylenepolyamines, Pentaethylenehexamine)
Class	: 8
Packing group	: III
Labels	: 8

IATA-DGR

UN/ID No.	: UN 2735
Proper shipping name	: Amines, liquid, corrosive, n.o.s. (Polyethylenepolyamines, Pentaethylenehexamine)
Class	: 8
Packing group	: III
Labels	: Corrosive
Packing instruction (cargo aircraft)	: 856
Packing instruction (passenger aircraft)	: 852

IMDG-Code

UN number	: UN 2735
Proper shipping name	: AMINES, LIQUID, CORROSIVE, N.O.S. (Polyethylenepolyamines, Pentaethylenehexamine)
Class	: 8
Packing group	: III
Labels	: 8
EmS Code	: F-A, S-B
Marine pollutant	: yes
Remarks	: Stowage category AAlkalis

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

Domestic regulation**49 CFR**

UN/ID/NA number	: UN 2735
Proper shipping name	: Amines, liquid, corrosive, n.o.s. (Polyethylenepolyamines, Pentaethylenehexamine)
Class	: 8
Packing group	: III
Labels	: CORROSIVE
ERG Code	: 153
Marine pollutant	: no

Special precautions for user

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

SECTION 15. REGULATORY INFORMATION**SARA 302 Extremely Hazardous Substances Threshold Planning Quantity**

This material does not contain any components with a section 302 EHS TPQ.

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SARA 311/312 Hazards : Acute toxicity (any route of exposure)
Skin corrosion or irritation
Serious eye damage or eye irritation
Respiratory or skin sensitization

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Pennsylvania Right To Know

Tetraethylenepentamine mixture	112-57-2
Triethylenetetramine mixture	112-24-3

California Prop. 65

This product contains no listed substances known to the State of California to cause cancer, birth defects or other reproductive harm, at levels which would require a warning under the statute.

International Regulations

Montreal Protocol : Not applicable

Rotterdam Convention (Prior Informed Consent) : Not applicable

Stockholm Convention (Persistent Organic Pollutants) : Not applicable

The ingredients of this product are reported in the following inventories:

CH INV	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
DSL	: All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.
AICS	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
NZIoC	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
ENCS	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
ISHL	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
KECI	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
PICCS	: All intentional components are listed on the inventory, are exempt, or are supplier certified.
IECSC	: All intentional components are listed on the inventory, are exempt, or are supplier certified.

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TCSI : All intentional components are listed on the inventory, are exempt, or are supplier certified.

TSCA : All substances listed as active on the TSCA Inventory or are not required to be listed.

TSCA list

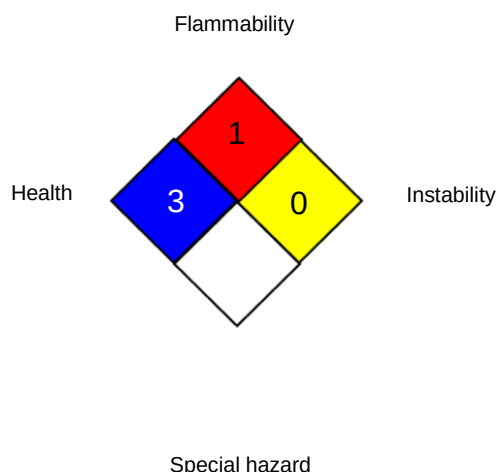
No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16. OTHER INFORMATION

Further information

NFPA 704:



Full text of other abbreviations

US WEEL : USA. Workplace Environmental Exposure Levels (WEEL)
US WEEL / TWA : 8-hr TWA

AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organiza-

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tion; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

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