

Hexamethylenetetramine

sc-211588

Material Safety Data Sheet



The Power is Question

Hazard Alert Code Key:

EXTREME

HIGH

MODERATE

LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME

Hexamethylenetetramine

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800

EMERGENCY:

ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS

C6-H12-N4, HMTA, hexamethyleneamine, "1, 3, 5, 7-tetraazatricyclo[3.3.1.1]-decane", "1, 3, 5, 7-tetraaza-adamantane", Aminoform, Ammoform, Cystamin, Cystogen, Formin, Formamine, Ammonioformaldehyde, Metramine, Hexaform, Uritone, Hexilmethyleneamine, Urotropine, Resotropin, Urotropin, "Methenamine GR"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

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

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



CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

May cause SENSITISATION by inhalation and skin contact.
Highly flammable.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- Accidental ingestion of the material may be damaging to the health of the individual.
- Large doses of ammonia or injected ammonium salts may produce diarrhea and may be sufficiently absorbed to produce increased production of urine and systemic poisoning. Symptoms include weakening of facial muscle, tremor, anxiety, reduced muscle and limb control.

EYE

- Although the material is not thought to be an irritant, direct contact with the eye may cause transient discomfort characterized by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.

<p>.

SKIN

- Skin contact is not thought to have harmful health effects, however the material may still produce health damage following entry through wounds, lesions or abrasions.
- There is some evidence to suggest that this material can cause inflammation of the skin on contact in some persons.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- 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.
- Mild irritation is produced on moist skin when vapour concentrations of ammonia exceed 10000 ppm. High vapour concentrations (>30000 ppm) or direct contact with solutions produces severe pain, a stinging sensation, burns and vesiculation and possible brown stains. Extensive burning may be fatal. Vapour exposure may, rarely, produce urticaria.

INHALED

- The material is not thought to produce either adverse health effects or irritation of the respiratory tract following inhalation (as classified using animal models). Nevertheless, adverse effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
- The highly irritant properties of ammonia vapor result as the gas dissolves in mucous fluids and forms irritant, even corrosive solutions.

CHRONIC HEALTH EFFECTS

- Inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population.

Skin contact with the material is more likely to cause a sensitization reaction in some persons compared to the general population.

Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung.

<p>.

Prolonged or repeated minor exposure to ammonia gas/vapour may cause long-term irritation to the eyes, nose and upper respiratory tract. Repeated exposure or prolonged contact may produce dermatitis, and conjunctivitis.

Other effects may include ulcerative changes to the mouth and bronchial and gastrointestinal disturbances. Adaptation to usually irritating concentrations may result in tolerance. In animals, repeated exposures to sub-lethal levels produces adverse effects on the respiratory tract, liver, kidneys and spleen. Exposure at 675 ppm for several weeks produced eye irritation in dogs and rabbits; corneal opacity, covering between a quarter to one half of the total surface area, was evident in rabbits.

When administered by inhalation, formaldehyde induced squamous cell carcinomas of the nasal cavity in rats of both sexes. Although excess occurrence of a number of cancers has been reported in humans, the evidence for a possible involvement of formaldehyde is strongest for nasal and nasopharyngeal cancer. The occurrence of these cancers showed an exposure-response gradient in more than one study, but the numbers of exposed cases were often small and some studies did not show excesses. In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx and nasal passages.

Several investigations have concluded that specific respiratory sensitisation occurs based on positive bronchial provocation tests amongst formaldehyde-exposed workers. These studies have been criticised for methodological reasons. One large study however revealed that 5% of persons exposed to formaldehyde and had asthma-like symptoms met the study criteria for formaldehyde-induced asthma; this included a positive response on a bronchial provocation test with 2.5 mg/m³ formaldehyde. Although differential individual sensitivity has been established, the mechanism for this increased sensitivity is unknown.

There is limited evidence that formaldehyde has any adverse effect on reproduction or development in humans. An investigation of reproductive function in female workers exposed to formaldehyde in the garment industry, revealed an increased incidence of menstrual disorders, inflammatory disease of the reproductive tract, sterility, anaemia, and low birth weights amongst off-spring.

Respiratory sensitization may result in allergic/asthma like responses; from coughing and minor breathing difficulties to bronchitis with wheezing, gasping.

HMTA is a known skin sensitizer and some individuals develop skin irritation from contact with the solid, vapour or solution.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
hexamine	100-97-0	> 98
NOTE: Slowly decomposes in water to produce		
formaldehyde	50-00-0	
ammonia	1336-21-6	

Section 4 - FIRST AID MEASURES

SWALLOWED

· If swallowed do NOT induce vomiting. · If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

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.

SKIN

■ If skin contact occurs: · Immediately remove all contaminated clothing, including footwear · Flush skin and hair with running water (and soap if available).

INHALED

· If dust is inhaled, remove from contaminated area. · Encourage patient to blow nose to ensure clear passage of breathing. · If irritation or discomfort persists seek medical attention.

NOTES TO PHYSICIAN

■ For acute or short-term repeated exposures to formaldehyde:

INGESTION:

· Patients present early with severe corrosion of the gastro-intestinal tract and systemic effects.

· Inflammation and ulceration may progress to strictures.

for irritant gas exposures:

· the presence of the agent when it is inhaled is evanescent (of short duration) and therefore, cannot be washed away or otherwise removed

· arterial blood gases are of primary importance to aid in determination of the extent of damage. Never discharge a patient significantly exposed to an irritant gas without obtaining an arterial blood sample.

· supportive measures include suctioning (intubation may be required), volume cycle ventilator support (positive and expiratory pressure (PEEP), steroids and antibiotics, after a culture is taken

· If the eyes are involved, an ophthalmologic consultation is recommended

Occupational Medicine: Third Edition; Zenz, Dickerson, Horvath 1994 Pub: Mosby.

For acute or short term repeated exposures to ammonia and its solutions:

· Mild to moderate inhalation exposures produce headache, cough, bronchospasm, nausea, vomiting, pharyngeal and retrosternal pain and conjunctivitis. Severe inhalation produces laryngospasm, signs of upper airway obstruction (stridor, hoarseness, difficulty in speaking) and, in excessively, high doses, pulmonary edema.

· Warm humidified air may soothe bronchial irritation.

May decompose in acid environment of stomach.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not applicable.
Upper Explosive Limit (%):	Not available.
Specific Gravity (water=1):	1.33 @ 20 C
Lower Explosive Limit (%):	Not available.

EXTINGUISHING MEDIA

■ For SMALL FIRES:

Dry chemical, CO₂, water spray or foam.

For LARGE FIRES:

Water-spray, fog or foam.

FIRE FIGHTING

· Alert Emergency Responders and tell them location and nature of hazard.

· Wear breathing apparatus plus protective gloves.

When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 1000 metres in all directions.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

· Flammable solid which burns and propagates flame easily, even when partly wetted with water.

· Any source of ignition, i.e. friction, heat, sparks or flame, may cause fire or explosion.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO₂), formaldehyde, nitrogen oxides (NO_x), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY

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

PERSONAL PROTECTION

Glasses:

Chemical goggles.

Gloves:

Respirator:

Type BKAX-P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Remove all ignition sources.
- DO NOT touch or walk through spilled material.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of overexposure occurs.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers.
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

- Glass container.

For low viscosity materials and solids: Drums and jerricans must be of the non-removable head type. Where a can is to be used as an inner package, the can must have a screwed enclosure.

<p>.

STORAGE REQUIREMENTS

- FOR MINOR QUANTITIES:

- Store in an indoor fireproof cabinet or in a room of noncombustible construction
- Provide adequate portable fire-extinguishers in or near the storage area.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	Notes
Canada - Ontario Occupational Exposure Limits	hexamine (Hexamethylenetetramine (HMT))			0.35	2			
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	formaldehyde (FORMALDEHYDE)	0.04						
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	formaldehyde (FORMALDEHYDE)	0.03						
US ATSDR Minimal Risk Levels for Hazardous Substances	formaldehyde (FORMALDEHYDE)	0.008						

(MRLs)

Canada - Ontario Occupational Exposure Limits	formaldehyde (Formaldehyde)	1	1.5	2	3	
US NIOSH Recommended Exposure Limits (RELs)	formaldehyde (Formaldehyde)	0.016			0.1	See Appendix A; Ca; (Ceiling ([15-minute]))
US ACGIH Threshold Limit Values (TLV)	formaldehyde (Formaldehyde)				0.3	TLV Basis: upper respiratory tract & eye irritation
US NIOSH Recommended Exposure Limits (RELs)	formaldehyde (Formalin (as formaldehyde))	0.016			0.1	See Appendix A; Ca; (Ceiling ([15-minute]))
Canada - British Columbia Occupational Exposure Limits	formaldehyde (Formaldehyde)	0.3			1	A2, 1; S
Canada - Alberta Occupational Exposure Limits	formaldehyde (Formaldehyde)	0.75	0.9		1	1.3
US - Idaho - Acceptable Maximum Peak Concentrations	formaldehyde (Formaldehyde (Z37.16-1967))	3			5	
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	formaldehyde (Rosin core solder pyrolysis products, as formaldehyde)		0.1			
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	formaldehyde (Formaldehyde; see 1910.1048)	3			5	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	formaldehyde (Formaldehyde; see 1910.1048)			See Table Z-2 for		
US - California Permissible Exposure Limits for Chemical Contaminants	formaldehyde (Rosin core solder, pyrolysis products, as formaldehyde)		0.1			
US - California Permissible Exposure Limits for Chemical Contaminants	formaldehyde (Formaldehyde, see Section 5217)	0.75		2		
US - Alaska Limits for Air Contaminants	formaldehyde (Rosin core solder pyrolysis products, as formaldehyde)		0.1			
US - Michigan Exposure Limits for Air Contaminants	formaldehyde (Formaldehyde; see R325.51451 et seq.F)	0.75	0.9	2	2.5	
US - Oregon Permissible Exposure Limits (Z-1)	formaldehyde (Rosin core solder pyrolysis products (as Formaldehyde))		0.1			*

US - Oregon Permissible Exposure Limits (Z-1)	formaldehyde (Formaldehyde)	0.75					TWA (See 1910.1048)
US - Hawaii Air Contaminant Limits	formaldehyde (Formaldehyde)	0.75					See 12-202-37
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	formaldehyde (Rosin core solder pyrolysis products (as formaldehyde))	-	0.1	-	0.3		
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	formaldehyde (Formaldehyde)	2	3	-	-		
US - Washington Permissible exposure limits of air contaminants	formaldehyde (Formaldehyde (see chapter 296-856 WAC))	0.75		2			
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	formaldehyde (Formaldehyde)					0.3	SEN, T20
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	formaldehyde (Formaldehyde)					2	3
US - Wyoming Toxic and Hazardous Substances Table Z-2 Acceptable ceiling concentration, Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift	formaldehyde (Formaldehyde; see 1910.1048)	0.75		2			
US OSHA Permissible Exposure Levels (PELs) - Table Z1	formaldehyde (Formaldehyde; see 1910.1048)	0.75		2			
US OSHA Permissible Exposure Levels (PELs) - Table Z2	formaldehyde (Formaldehyde; see 1910.1048)			2			
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	formaldehyde (Formaldehyde; see 1910.1048)	0.75		2			
Canada - Northwest Territories Occupational Exposure Limits	formaldehyde (Formaldehyde)					2	2.4

(English)						
Canada - Northwest Territories Occupational Exposure Limits (English)	formaldehyde (Rosin core solder pyrolysis products (as formaldehyde))		0.1		0.3	
Canada - Prince Edward Island Occupational Exposure Limits	formaldehyde (Formaldehyde)				0.3	TLV Basis: upper respiratory tract & eye irritation
Canada - Nova Scotia Occupational Exposure Limits	formaldehyde (Formaldehyde)				0.3	TLV Basis: upper respiratory tract & eye irritation
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	ammonia (Ammonia)	25	18	40	30	
US - Minnesota Permissible Exposure Limits (PELs)	ammonia (Ammonia)			35	27	
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	ammonia (AMMONIA)	1.7				
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	ammonia (AMMONIA)	0.1				
Canada - Ontario Occupational Exposure Limits	ammonia (Ammonia)	25	17	35	24	
US NIOSH Recommended Exposure Limits (RELs)	ammonia (Ammonia)	25	18	35	27	
Canada - Alberta Occupational Exposure Limits	ammonia (Ammonia)	25	17	35	24	
Canada - British Columbia Occupational Exposure Limits	ammonia (Ammonia)	25		35		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	ammonia (Ammonia)			35	27	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	ammonia (Ammonia)	50	35			
US - Vermont Permissible Exposure Limits Table Z-1-A Final	ammonia (Ammonia)			35	27	

Rule Limits for Air Contaminants					
US - Idaho - Limits for Air Contaminants	ammonia (Ammonia)	50	35		
US - California Permissible Exposure Limits for Chemical Contaminants	ammonia (Ammonia)	25	18	35	27
US - Michigan Exposure Limits for Air Contaminants	ammonia (Ammonia)			35	27
US - Oregon Permissible Exposure Limits (Z-1)	ammonia (Ammonia)	25	18		*
Canada - Northwest Territories Occupational Exposure Limits (English)	ammonia (Ammonia)	25	17	35	24
US - Alaska Limits for Air Contaminants	ammonia (Ammonia)			35	27
US - Washington Permissible exposure limits of air contaminants	ammonia (Ammonia)	25		35	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	ammonia (Ammonia)	25		35	
US - Hawaii Air Contaminant Limits	ammonia (Ammonia)	25	18	35	27
US OSHA Permissible Exposure Levels (PELs) - Table Z1	ammonia (Ammonia)	50	35		
US ACGIH Threshold Limit Values (TLV)	ammonia (Ammonia)	25		35	TLV Basis: eye damage; upper respiratory tract irritation
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	ammonia (Ammonia)	25	17	35	24
Canada - Nova Scotia Occupational Exposure Limits	ammonia (Ammonia)	25		35	TLV Basis: eye damage; upper respiratory tract irritation
Canada - Prince Edward Island Occupational Exposure Limits	ammonia (Ammonia)	25		35	TLV Basis: eye damage; upper respiratory tract irritation
US - Wyoming Toxic and Hazardous	ammonia (Ammonia)	50	35		

Substances Table
Z1 Limits for Air
Contaminants
ENDOELTABLE

PERSONAL PROTECTION



RESPIRATOR

Type BKAX-P Filter of sufficient capacity
Consult your EHS staff for recommendations

EYE

- Safety glasses with side shields.
- Chemical goggles.

HANDS/FEET

■ NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.

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

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

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

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.

- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.

- Contaminated gloves should be replaced.

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

Wear physical protective gloves, eg. leather.

OTHER

- Overalls.
- Eyewash unit.
- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets), non sparking safety footwear.

ENGINEERING CONTROLS

■ For large scale or continuous use:

- Spark-free, earthed ventilation system, venting directly to the outside and separate from usual ventilation systems
- Provide dust collectors with explosion vents.

CARE: Explosive vapour air mixtures may be present on opening vessels which have contained liquid ammonia. Fatalities have occurred.

- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.

- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.

Mixes with water.

State	Divided solid	Molecular Weight	140.19
Melting Range (°F)	545- 563 (Decomp)	Viscosity	Not Applicable
Boiling Range (°F)	505.4 (Sublimes.)	Solubility in water (g/L)	Miscible
Flash Point (°F)	482	pH (1% solution)	8.4 (0.2M aq)
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	734	Vapour Pressure (mmHG)	Not applicable.
Upper Explosive Limit (%)	Not available.	Specific Gravity (water=1)	1.33 @ 20 C

Lower Explosive Limit (%)	Not available.	Relative Vapor Density (air=1)	4.9
Volatile Component (%vol)	Not applicable.	Evaporation Rate	Not applicable

APPEARANCE

White powder or colourless crystals. Mild ammonia odour. Soluble in water, alcohol, acetone and chloroform. Aqueous solutions slowly dissociate releasing formaldehyde and ammonia.

log Kow -2.13- -2.34 log Kow 0-0.35

Material	Value
----------	-------

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.

STORAGE INCOMPATIBILITY

■ Formaldehyde:

- is a strong reducing agent
- may polymerize in air unless properly inhibited (usually with methanol up to 15%) and stored at controlled temperatures
- will polymerize with active organic material such as phenol
- reacts violently with strong oxidisers, hydrogen peroxide, potassium permanganate, acrylonitrile, caustics (sodium hydroxide, yielding formic acid and flammable hydrogen), magnesium carbonate, nitromethane, nitrogen oxides (especially at elevated temperatures), peroxyformic acid
- is incompatible with strong acids (hydrochloric acid forms carcinogenic bis(chloromethyl)ether*), amines, ammonia, aniline, bisulfides, gelatin, iodine, magnesite, phenol, some monomers, tannins, salts of copper, iron, silver.
- acid catalysis can produce impurities: methylal, methyl formate

Aqueous solutions of formaldehyde:

- slowly oxidise in air to produce formic acid
- attack carbon steel

Concentrated solutions containing formaldehyde are:

- unstable, both oxidising slowly to form formic acid and polymerising; in dilute aqueous solutions formaldehyde appears as monomeric hydrate (methylene glycol) - the more concentrated the solution the more polyoxymethylene glycol occurs as oligomers and polymers (methanol and amine-containing compounds inhibit polymer formation)
- readily subject to polymerisation, at room temperature, in the presence of air and moisture, to form paraformaldehyde (8-100 units of formaldehyde), a solid mixture of linear polyoxymethylene glycols containing 90-99% formaldehyde; a cyclic trimer, trioxane (CH₂O₃), may also form

Flammable and/or toxic gases are generated by the combination of aldehydes with azo, diazo compounds, dithiocarbamates, nitrides, and strong reducing agents

*The empirical equation may be used to determine the concentration of bis(chloromethyl)ether (BCME) formed by reaction with HCl:

$$\log(\text{BCME})_{\text{ppb}} = -2.25 + 0.67 \log(\text{HCHO})_{\text{ppm}} + 0.77 \log(\text{HCl})_{\text{ppm}}$$

Assume values for formaldehyde, in air, of 1 ppm and for HCl of 5 ppm, resulting BCME concentration, in air, would be 0.02 ppb.

Avoid reaction with oxidizing agents.

For ammonia:

- Ammonia forms explosive mixtures with oxygen, chlorine, bromine, fluorine, iodine, mercury, platinum and silver.
- Fire and/or explosion may follow contact with acetaldehyde, acrolein, aldehydes, alkylene oxides, amides, antimony, boron, boron halides, bromine chloride, chloric acid, chlorine monoxide, o-chloronitrobenzene, 1-chloro-2,4-nitrobenzene, chlorosilane, chloromelamine, chromium trioxide, chromyl chloride, epichlorohydrin, hexachloromelamine, hypochlorites (do NOT mix ammonia with liquid household bleach), isocyanates, nitrogen tetroxide, nitrogen trichloride, nitryl chloride, organic anhydrides, phosphorous trioxide, potassium ferricyanide, potassium mercuric cyanide, silver chloride, stibine, tellurium halides, tellurium hydropentachloride, tetramethylammonium amide, trimethylammonium amide, trioxxygen difluoride, vinyl acetate.
- Shock-, temperature-, and pressure sensitive compounds are formed with antimony, chlorine, germanium compounds, halogens, heavy metals, hydrocarbons, mercury oxide, silver compounds (azides, chlorides, nitrates, oxides).
- Vapours or solutions of ammonia are corrosive to copper, copper alloys, galvanised metal and aluminium. Mixtures of ammonia and air lying within the explosive limits can occur above aqueous solutions of varying strengths.
- Avoid contact with sodium hydroxide, iron and cadmium.
- Several incidents involving sudden "boiling" (occasionally violent) of a concentrated solution (d, 0.880, 35 wt %) have occurred when screw-capped winchesters are opened. These are attributable to supersaturation of the solution with gas caused by increases in temperature subsequent to preparation and bottling. The effect is particularly marked with winchesters filled in winter and opened in summer.
- Ammonia polymerises violently with ethylene oxide.
- Ammonia attacks some coatings, plastics and rubber.
- Attacks copper, bronze, brass, aluminium, steel and their alloys.

Hexamine (hexamethylenetetramine):

- is hygroscopic and heat sensitive
- is weakly basic in aqueous solution
- reacts violently with strong oxidisers, sodium peroxide, nitric acid, 1-bromopentaborane(9) (may explode above 194 deg C), cellulose nitrate of high surface area, iodine (deflagrates at 138 deg C), iodoform (may explode above 175 deg C)
- may form heat-sensitive explosive materials with digold ketenide
- is incompatible with acids, acid halides, acrylates, alcohols, substituted allyls, aldehydes, alkylene oxides, anhydrides including maleic anhydride, cresols, caprolactam solution, epichlorohydrin, epoxides including butyl glycidyl ether, isocyanates, glycols, halogenated organics, ketones, peroxides, phenols, vinyl acetate
- may increase explosive sensitivity of nitromethane
- may generate flammable hydrogen gas on contact with strong reducing agents including hydrides, nitrides and sulfides

- attacks copper and copper alloys
- when heated above 200 deg C decomposes producing toxic and corrosive gases including hydrogen cyanide, ammonia and formaldehyde.

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

Section 11 - TOXICOLOGICAL INFORMATION

HEXAMINE

TOXICITY AND IRRITATION

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

TOXICITY	IRRITATION
Intravenous (rat) LD50: 9200 mg/kg	Nil Reported
Subcutaneous (mouse) LD50: 215 mg/kg	

■ Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's edema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type.

<p>

Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms.

<p>

Attention should be paid to atopic diathesis, characterized by increased susceptibility to nasal inflammation, asthma and eczema.

Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure.

Formaldehyde generators (releasers) are often used as preservatives. Formaldehyde may be generated following hydrolysis.

Formaldehyde generators are a diverse group of chemicals that can be recognised by a small, easily detachable formaldehyde moiety.

According to Annex VI of the Cosmetic Directive 76/768/EC, the maximum authorised concentration of free formaldehyde is 0.2%. In addition, the provisions of Annex VI state that,

All finished products containing formaldehyde or substances in this Annex and which release formaldehyde must be labelled with the warning "contains formaldehyde" where the concentration of formaldehyde in the finished product exceeds 0.05%.

Formaldehyde-releasing preservatives have the ability to release formaldehyde in very small amounts over time. The use of formaldehyde-releasing preservatives ensures that the actual level of free formaldehyde in the products is always very low but at the same time sufficient to ensure absence of microbial growth. The formaldehyde reacts most rapidly with organic and inorganic anions, amino and sulfide groups and electron-rich groups to disrupt metabolic processes, eventually causing death of the organism.

There is concern that when formaldehyde-releasing preservatives are present in a formulation that also includes amines, such as triethanolamine (TEA), diethanolamine (DEA), or monoethanolamine (MEA), nitrosamines can be formed; nitrosamines are carcinogenic substances that can potentially penetrate skin.

CARCINOGEN

FORMALDEHYDE	US Environmental Defense Scorecard Recognized Carcinogens	Reference(s)	P65
FORMALDEHYDE	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	P65
Formaldehyde	US Air Toxics Hot Spots TSD for Describing Available Cancer Potency Factors	IARC Class	2A

Section 12 - ECOLOGICAL INFORMATION

This material and its container must be disposed of as hazardous waste.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
hexamine	HIGH		LOW	HIGH
formaldehyde	LOW	LOW	LOW	HIGH
ammonia	LOW		LOW	HIGH

GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles

Name / EHS TRN A1a A1b A1 A2 B1 B2 C1 C2 C3 D1 D2 D3 E1 E2 E3 Cas No / RTECS No _____
 _____ Hexamethy 849 382 0 NI 0 R 0 NI 0 0 (1) 0 1 S D 2 lene tetramine (40% solution) / CAS:100- 97- 0 / MN4725000

Legend: EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships)
 NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation,
 B1=Acute aquatic toxicity LC/EC150 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg),
 C2=Acute mammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion,
 D2=Eye irritation & corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference
 with coastal amenities, For column A2: R=Readily biodegradable, NR=Not readily biodegradable. For column D3: C=Carcinogen,
 M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lung injury, N=Neurotoxic,
 I=Immunotoxic. For column E1: NT=Not tainting (tested), T=Tainting test positive. For column E2: Fp=Persistent floater, F=Floater, S=Sinking
 substances. The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard. (GESAMP/EHS Composite List

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information

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

B. Component Waste Numbers

When formaldehyde is present as a solid waste as a discarded commercial chemical product, off-specification species, as a container residue, or a spill residue, use EPA waste number U122 (waste code T).

Disposal Instructions

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

! Puncture containers to prevent re-use and bury at an authorized landfill.

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

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

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

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

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

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols: None Hazard class or Division: 4.1

Identification Numbers: UN1328 PG: III

Label Codes: 4.1 Special provisions: A1, IB8, IP3, T1, TP33

Packaging: Exceptions: 151 Packaging: Non- bulk: 213

Packaging: Exceptions: 151 Quantity limitations: 25 kg

Passenger aircraft/rail:

Quantity Limitations: Cargo 100 kg Vessel stowage: Location: A aircraft only:

Vessel stowage: Other: None

Hazardous materials descriptions and proper shipping names:

Hexamethylenetetramine

Air Transport IATA:

ICAO/IATA Class: 4.1 ICAO/IATA Subrisk: None

UN/ID Number: 1328 Packing Group: III

Special provisions: None

Cargo Only

Packing Instructions: 420 Maximum Qty/Pack: 100 kg

Passenger and Cargo Passenger and Cargo

Packing Instructions: 419 Maximum Qty/Pack: 25 kg

Passenger and Cargo Limited Quantity Passenger and Cargo Limited Quantity

Packing Instructions: Y419 Maximum Qty/Pack: 10 kg

Shipping Name: HEXAMETHYLENETETRAMINE

Maritime Transport IMDG:

IMDG Class: 4.1 IMDG Subrisk: None

UN Number: 1328 Packing Group: III

EMS Number: F-A , S-G Special provisions: None

Limited Quantities: 5 kg

Shipping Name: HEXAMETHYLENETETRAMINE

Section 15 - REGULATORY INFORMATION



REGULATIONS

ND

Ingredient CAS % de minimus concentration

formaldehyde 50-00-0 0.1

ammonia 1336-21-6 1.0

ND

Ingredient CAS RQ

formaldehyde 50-00-0 100 lb (45.4 kg)

ammonia 1336-21-6 1000 lb (454 kg)

hexamine (CAS: 100-97-0) is found on the following regulatory lists;

"Canada - Ontario Occupational Exposure Limits", "Canada Domestic Substances List (DSL)", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 18: List of products to which the Code does not apply", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - New Jersey Right to Know Hazardous Substances", "US Cosmetic Ingredient Review (CIR) Cosmetic ingredients found safe, with qualifications", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes", "US EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "US NFPA 499 Combustible Dusts", "US Toxic Substances Control Act (TSCA) - Inventory"

Regulations for ingredients

formaldehyde (CAS: 50-00-0,8005-38-7,8006-07-3,8013-13-6,112068-71-0) is found on the following regulatory lists;

"Canada - Alberta Ambient Air Quality Objectives", "Canada - Alberta Occupational Exposure Limits", "Canada - British Columbia Occupational Exposure Limits", "Canada - Northwest Territories Occupational Exposure Limits (English)", "Canada - Nova Scotia Occupational Exposure Limits", "Canada - Ontario Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits", "Canada - Prince Edward Island Occupational Exposure Limits - Carcinogens", "Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)", "Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Saskatchewan Occupational Health and Safety Regulations - Designated Chemical Substances", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada ARET (Accelerated Reduction / Elimination of Toxics) Substance List", "Canada Domestic Substances List (DSL)", "Canada Environmental Protection Act (CEPA) 1999 - Schedule 1 Toxic Substances List", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada National Pollutant Release Inventory (NPRI)", "Canada Priority Substances List (PSL1, PSL 2)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "GESAMP/EHS Composite List - GESAMP Hazard Profiles", "IMO IBC Code Chapter 17: Summary of minimum requirements", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs", "International Chemical Secretariat (ChemSec) REACH SIN* List (*Substitute It Now!) 1.0", "International Council of Chemical Associations (ICCA) - High Production Volume List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - Alaska Limits for Air Contaminants", "US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for which emissions must be quantified", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - California OEHHA/ARB - Acute Reference Exposure Levels and Target Organs (RELs)", "US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)", "US - California Permissible Exposure Limits for Chemical Contaminants", "US - California Proposition 65 - Carcinogens", "US - California Proposition 65 - No Significant Risk Levels (NSRLs) for Carcinogens", "US - California Toxic Air Contaminant List Category II", "US - Connecticut Hazardous Air Pollutants", "US - Hawaii Air Contaminant Limits", "US - Idaho - Acceptable Maximum Peak Concentrations", "US - Idaho - Limits for Air Contaminants", "US - Maine Chemicals of High Concern List", "US - Massachusetts Oil & Hazardous Material List", "US - Michigan Exposure Limits for Air Contaminants", "US - Minnesota Hazardous Substance List", "US - Minnesota Permissible Exposure Limits (PELs)", "US - New Jersey Right to Know Hazardous Substances", "US - Oregon Hazardous Materials", "US - Oregon Permissible Exposure Limits (Z-1)", "US - Oregon Permissible Exposure Limits (Z-2)", "US - Pennsylvania - Hazardous Substance List", "US - Rhode Island Hazardous Substance List", "US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants", "US - Vermont Hazardous Constituents", "US - Vermont Hazardous wastes which are Discarded Commercial Chemical Products or Off-Specification Batches of Commercial Chemical Products or Spill Residues of Either", "US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants", "US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants", "US - Washington Class A toxic air pollutants: Known and Probable Carcinogens", "US - Washington Dangerous waste constituents list", "US - Washington Discarded Chemical Products List - ""U"" Chemical Products", "US - Washington Permissible exposure limits of air contaminants", "US - Wyoming List of Highly Hazardous Chemicals, Toxics and Reactives", "US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants", "US - Wyoming Toxic and Hazardous Substances Table Z-2 Acceptable ceiling concentration, Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift", "US ACGIH Threshold Limit Values (TLV)", "US ACGIH Threshold Limit Values (TLV) - Carcinogens", "US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)", "US CAA (Clean Air Act) - HON Rule - Organic HAPs (Hazardous Air Pollutants)", "US CERCLA Priority List of Hazardous Substances", "US Clean Air Act - Hazardous Air Pollutants", "US Cosmetic Ingredient Review (CIR) Cosmetic ingredients found safe, with qualifications", "US CWA (Clean Water Act) - List of Hazardous Substances", "US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances", "US Department of Homeland Security Chemical Facility Anti-Terrorism Standards - Chemicals of Interest", "US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US EPA Acute Exposure Guideline Levels (AEGs) - Interim", "US EPA Carcinogens Listing", "US EPA High Production Volume Program Chemical List", "US EPA Master Testing List - Index I Chemicals Listed", "US EPCRA Section 313 Chemical List", "US FDA Indirect Food Additives: Adhesives and Components of Coatings - Substances for Use as Components of Coatings - Acrylate ester copolymer coating", "US FDA Indirect Food

Additives: Adhesives and Components of Coatings - Substances for Use Only as Components of Adhesives - Adhesives", "US Food Additive Database", "US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act", "US National Toxicology Program (NTP) 11th Report Part B. Reasonably Anticipated to be a Human Carcinogen", "US NFPA 45 Fire Protection for Laboratories Using Chemicals - Flammability Characteristics of Common Compressed and Liquefied Gases", "US NIOSH Recommended Exposure Limits (RELs)", "US OSHA Carcinogens Listing", "US OSHA List of Highly Hazardous Chemicals, Toxics and Reactives", "US OSHA Permissible Exposure Levels (PELs) - Table Z1", "US OSHA Permissible Exposure Levels (PELs) - Table Z2", "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide", "US RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261", "US RCRA (Resource Conservation & Recovery Act) - List of Hazardous Wastes", "US SARA Section 302 Extremely Hazardous Substances", "US Spacecraft Maximum Allowable Concentrations (SMACs) for Airborne Contaminants", "US - Texas Air Monitoring Comparison Values for Evaluating VOCs", "US Toxic Substances Control Act (TSCA) - Inventory", "USA: Chemical Facility Anti-Terrorism Standards - List Appendix A - 6CFR 27", "WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water"

ammonia (CAS: 1336-21-6) is found on the following regulatory lists;

"Canada - Saskatchewan Industrial Hazardous Substances", "Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances", "Canada Domestic Substances List (DSL)", "Canada Environmental Protection Act (CEPA) 1999 - Schedule 1 Toxic Substances List", "Canada Environmental Quality Guidelines (EQGs) Water: Aquatic life", "Canada Ingredient Disclosure List (SOR/88-64)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "CODEX General Standard for Food Additives (GSFA) - Additives Permitted for Use in Food in General, Unless Otherwise Specified, in Accordance with GMP", "IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk", "International Council of Chemical Associations (ICCA) - High Production Volume List", "International Fragrance Association (IFRA) Survey: Transparency List", "OECD Representative List of High Production Volume (HPV) Chemicals", "US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List", "US - Massachusetts Oil & Hazardous Material List", "US - New Jersey Right to Know Hazardous Substances", "US - Pennsylvania - Hazardous Substance List", "US CWA (Clean Water Act) - List of Hazardous Substances", "US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances", "US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides", "US Department of Transportation (DOT), Hazardous Material Table", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US EPA High Production Volume Chemicals Additional List", "US Food Additive Database", "US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act", "US NFPA 45 Fire Protection for Laboratories Using Chemicals - Flammability Characteristics of Common Compressed and Liquefied Gases", "US Postal Service (USPS) Hazardous Materials Table: Postal Service Mailability Guide", "US Toxic Substances Control Act (TSCA) - Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Ingestion may produce health damage*.
 - Cumulative effects may result following exposure*.
 - May produce skin discomfort*.
- * (limited evidence).

Ingredients with multiple CAS Nos

Ingredient Name CAS formaldehyde 50-00-0, 8005-38-7, 8006-07-3, 8013-13-6, 112068-71-0

Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.

- Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

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

This document is copyright. Apart from any fair dealing for the purposes of private study, research, review or criticism, as permitted under the Copyright Act, no part may be reproduced by any process without written permission from CHEMWATCH. TEL (+61 3) 9572 4700.

Issue Date: Jan-24-2010

Print Date: Oct-20-2010