MATERIAL SAFETY DATA SHEET

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Section 1 - Product and Company Information

Product Name	CARMUSTINE
Product Number	C0400
Brand	SIGMA
Company	Sigma-Aldrich Canada, Ltd
Street Address	2149 Winston Park Drive
City, State, Zip, Country	Oakville ON L6H 6J8 CA
Technical Phone:	9058299500
Emergency Phone:	800-424-9300
Fax:	9058299292

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
CARMUSTINE	154-93-8	No

Formula: C5H9Cl2N3O2

Synonyms: BCNU * BiCnu * N,N'-Bis(2-chloroethyl)-N-nitrosourea * Bis(2-chloroethyl)nitrosourea * 1,3-Bis(beta-chloroethyl)-1-nitrosourea * 1,3-Bis-(2-chloroethyl)-1-nitrosourea * Bischloroethylnitrosourea * Carmubris * Carmustin * Carmustine * FDA 0345 * NCI-C04773 * Nitrumon * NSC-409962 * SK 27702 * SRI 1720 * Urea, N,N'-bis(2-chloroethyl)-N-nitroso- (9CI)

RTECS Number: YS2625000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Highly Toxic (USA) Very Toxic (EU).
May cause cancer. May cause heritable genetic damage. May impair fertility. May cause harm to the unborn child. Very toxic if swallowed.
Target organ(s): Lungs. Bone marrow. Calif. Prop. 65 carcinogen & reproductive hazard.

HMIS RATING
HEALTH: 3*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING
HEALTH: 3
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

Section 5 - Fire Fighting Measures

FLASH POINT
N/A

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe dust. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed. Store in a cool dry place.
Store at -20°C

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Mechanical exhaust required. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Other: Wear appropriate government approved respirator, chemical-resistant gloves, safety goggles, other protective clothing.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Solid Form: Oily liquid toamorphous solid

Property	Value	At Temperature or Pressure
Molecular Weight	214.1 AMU	
pH	N/A	
BP/BP Range	N/A	
MP/MP Range	N/A	
Freezing Point	N/A	
Vapor Pressure	N/A	
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	N/A	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	N/A	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	N/A	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Acids.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Nitrogen oxides, Hydrogen chloride gas.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: May cause eye irritation.
Inhalation: May be harmful if inhaled. Material may be

irritating to mucous membranes and upper respiratory tract.
Ingestion: May be fatal if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Bone marrow. Lungs. Liver. Kidneys. Eyes.

SIGNS AND SYMPTOMS OF EXPOSURE
May cause liver function alteration, ataxia, dysarthria, central nervous system depression, vomiting, nausea, flushing of skin, conjuctiva, renal damage, pulmonary damage.

CONDITIONS AGGRAVATED BY EXPOSURE
Immunosuppressant causes delayed and cumulative bone-marrow depression.

TOXICITY DATA

Intravenous
Child
78 MG/KG
LDLO
Remarks: Gastrointestinal:Nausea or vomiting. Lungs, Thorax, or Respiration:Other changes. Blood:Changes in bone marrow not included above.

Parenteral
Woman
1566 MG/KG
LDLO
Remarks: Lungs, Thorax, or Respiration:Cyanosis. Lungs, Thorax, or Respiration:Fibrosis (interstitial). Lungs, Thorax, or Respiration:Dyspnea.

Oral
Rat
20 mg/kg
LD50

Intraperitoneal
Rat
17420 UG/KG
LD50

Subcutaneous
Rat
83200 UG/KG
LD50
Remarks: Nutritional and Gross Metabolic:Weight loss or decreased weight gain. Gastrointestinal:Hypermotility, diarrhea. Behavioral:Ataxia.

Intravenous
Rat
13800 UG/KG
LD50
Remarks: Lungs, Thorax, or Respiration:Chronic pulmonary edema. Gastrointestinal:Ulceration or bleeding from stomach. Blood:Changes in bone marrow not included above.

Intramuscular
Rat
79600 UG/KG

LD50
Remarks: Nutritional and Gross Metabolic:Weight loss or decreased weight gain. Gastrointestinal:Hypermotility, diarrhea. Behavioral:Ataxia.

Oral
Mouse
19 mg/kg
LD50
Remarks: Kidney, Ureter, Bladder:Urine volume increased. Liver:Jaundice, other or unclassified. Gastrointestinal:Hypermotility, diarrhea.

Intraperitoneal
Mouse
21260 UG/KG
LD50

Subcutaneous
Mouse
24 MG/KG
LD50
Remarks: Kidney, Ureter, Bladder:Urine volume increased. Gastrointestinal:Hypermotility, diarrhea. Liver:Jaundice, other or unclassified.

Intravenous
Mouse
45 MG/KG
LD50

Intramuscular
Mouse
86300 UG/KG
LD50
Remarks: Nutritional and Gross Metabolic:Weight loss or decreased weight gain. Gastrointestinal:Hypermotility, diarrhea. Behavioral:Ataxia.

CHRONIC EXPOSURE - CARCINOGEN
Result: This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Rat
Route of Application: Intraperitoneal
Dose: 15 MG/KG
Exposure Time: 7W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors. Lungs, Thorax, or Respiration:Tumors.

Species: Rat
Route of Application: Intravenous
Dose: 16 MG/KG
Exposure Time: 60W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Lungs, Thorax, or Respiration:Tumors.

Species: Mouse

Route of Application: Skin
Dose: 276 MG/KG
Exposure Time: 23W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Other: Hair. Skin and Appendages: Other: Tumors.

Species: Mouse
Route of Application: Intraperitoneal
Dose: 98 MG/KG
Exposure Time: 26W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Lungs, Thorax, or Respiration:Tumors. Gastrointestinal:Tumors.

Species: Rat
Route of Application: Intravenous
Dose: 26 MG/KG
Exposure Time: 60W
Frequency: I
Result: Gastrointestinal:Tumors. Tumorigenic:Equivocal tumorigenic agent by RTECS criteria.

Species: Rat
Route of Application: Intravenous
Dose: 45 MG/KG
Exposure Time: 60W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Lungs, Thorax, or Respiration:Tumors.

Species: Rat
Route of Application: Intravenous
Dose: 51 MG/KG
Exposure Time: 24W
Frequency: I
Result: Lungs, Thorax, or Respiration:Tumors. Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors.

IARC CARCINOGEN LIST

Rating: Group 2A

NTP CARCINOGEN LIST

Rating: Clear evidence.
Species: Mouse
Route: Intraperitoneal

CHRONIC EXPOSURE - TERATOGEN
Result: May cause congenital malformation in the fetus.

Species: Rat
Dose: 8 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-9D PREG)
Result: Specific Developmental Abnormalities: Urogenital system. Specific Developmental Abnormalities: Cardiovascular (circulatory) system. Specific Developmental Abnormalities:

Musculoskeletal system.

Species: Rat
Dose: 8 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-9D PREG)
Result: Specific Developmental Abnormalities: Body wall. Specific Developmental Abnormalities: Eye, ear. Specific Developmental Abnormalities: Central nervous system.

Species: Rat
Dose: 4 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (6-9D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Species: Rabbit
Dose: 6500 UG/KG
Route of Application: Intravenous
Exposure Time: (6-18D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

CHRONIC EXPOSURE - MUTAGEN

Species: Human
Dose: 100 UMOL/L
Cell Type: Embryo
Mutation test: DNA damage

Species: Human
Dose: 100 UMOL/L
Cell Type: lung
Mutation test: DNA damage

Species: Human
Dose: 25 UMOL/L
Cell Type: HeLa cell
Mutation test: DNA

Species: Human
Dose: 50 UMOL/L
Cell Type: Other cell types
Mutation test: DNA damage

Species: Human
Dose: 60 MG/L
Cell Type: Other cell types
Mutation test: DNA damage

Species: Human
Dose: 10 MG/L
Cell Type: HeLa cell
Mutation test: Other mutation test systems

Species: Human
Dose: 1 UMOL/L
Cell Type: leukocyte
Mutation test: DNA inhibition

Species: Human

Dose: 100 UMOL/L
Cell Type: HeLa cell
Mutation test: DNA inhibition

Species: Human
Dose: 50 UMOL/L
Cell Type: lymphocyte
Mutation test: DNA inhibition

Species: Human
Dose: 5 UMOL/L
Cell Type: lymphocyte
Mutation test: Sister chromatid exchange

Species: Human
Dose: 4 UMOL/L
Cell Type: Other cell types
Mutation test: Sister chromatid exchange

Species: Rat
Route: Intraperitoneal
Dose: 100 UMOL/KG
Mutation test: DNA damage

Species: Rat
Dose: 50 UMOL/L
Cell Type: Other cell types
Mutation test: DNA damage

Species: Rat
Dose: 80 MG/KG
Cell Type: S. typhimurium
Mutation test: Body fluid assay

Species: Rat
Dose: 5 MG/L
Cell Type: Other cell types
Mutation test: Cytogenetic analysis

Species: Rat
Dose: 1 UMOL/L
Cell Type: Other cell types
Mutation test: Sister chromatid exchange

Species: Mouse
Route: Intraperitoneal
Dose: 1450 UG/KG
Mutation test: Micronucleus test

Species: Mouse
Dose: 200 UG/L (+S9)
Cell Type: lymphocyte
Mutation test: Mutation in microorganisms

Species: Mouse
Route: Intraperitoneal
Dose: 150 UMOL/KG
Mutation test: DNA damage

Species: Mouse
Dose: 20 MG/L
Cell Type: leukocyte

Mutation test: DNA damage

Species: Mouse
Route: Intraperitoneal
Dose: 30 MG/KG
Mutation test: DNA inhibition

Species: Mouse
Dose: 1 MG/L
Cell Type: leukocyte
Mutation test: DNA inhibition

Species: Mouse
Dose: 20 UMOL/L
Cell Type: Bone marrow
Mutation test: DNA inhibition

Species: Mouse
Dose: 40 UMOL/L
Cell Type: Bone marrow
Mutation test: Other mutation test systems

Species: Mouse
Dose: 1 MG/L
Cell Type: leukocyte
Mutation test: Other mutation test systems

Species: Mouse
Route: Intraperitoneal
Dose: 9050 UG/KG
Mutation test: Cytogenetic analysis

Species: Mouse
Route: Intravenous
Dose: 4400 UG/KG
Mutation test: Sister chromatid exchange

Species: Mouse
Route: Unreported
Dose: 8800 UG/KG
Mutation test: Sister chromatid exchange

Species: Mouse
Dose: 1500 UG/KG
Cell Type: lymphocyte
Mutation test: Sister chromatid exchange

Species: Mouse
Dose: 100 GM/L
Cell Type: lymphocyte
Mutation test: Sister chromatid exchange

Species: Mouse
Dose: 200 UG/L
Cell Type: lymphocyte
Mutation test: Mutation in mammalian somatic cells.

Species: Hamster
Dose: 3 MG/L
Cell Type: lung
Mutation test: Mutation in mammalian somatic cells.

Species: Mouse
Dose: 25 MG/KG
Cell Type: S. typhimurium
Mutation test: Host-mediated assay

Species: Mouse
Dose: 4 MG/KG
Cell Type: leukocyte
Mutation test: Host-mediated assay

Species: Mouse
Route: Intraperitoneal
Dose: 33 MG/KG
Mutation test: sperm

Species: Hamster
Dose: 10 UMOL/L
Cell Type: lung
Mutation test: Micronucleus test

Species: Hamster
Dose: 8500 NMOL/L
Cell Type: lung
Mutation test: DNA damage

Species: Hamster
Route: Intraperitoneal
Dose: 15 MG/KG
Mutation test: DNA inhibition

Species: Hamster
Dose: 3200 UG/L
Cell Type: lung
Mutation test: Cytogenetic analysis

Species: Hamster
Dose: 12 UMOL/L
Cell Type: lung
Mutation test: Sister chromatid exchange

Species: Hamster
Dose: 10 UMOL/L
Cell Type: lung
Mutation test: Mutation in mammalian somatic cells.

Species: Hamster
Dose: 4 MG/L
Cell Type: ovary
Mutation test: Mutation in mammalian somatic cells.

Species: Mammal
Dose: 10 MMOL/L
Cell Type: lymphocyte
Mutation test: DNA damage

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD
Result: May cause reproductive disorders.

Species: Rat
Dose: 9 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (9W MALE)

Result: Effects on Fertility: Litter size (e.g.; # fetuses per litter; measured before birth). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).

Species: Mouse
Dose: 11 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (1D MALE)
Result: Paternal Effects: Spermatogenesis (including genetic material, sperm morphology,motility, and count).

Species: Mouse
Dose: 40 MG/KG
Route of Application: Intraperitoneal
Exposure Time: (12D PREG)
Result: Effects on Newborn: Growth statistics (e.g., reduced weight gain). Effects on Newborn: Viability index (e.g., # alive at day 4 per # born alive). Effects on Newborn: Live birth index (# fetuses per litter; measured after birth).

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Toxic solids, organic, n.o.s.
UN#: 2811
Class: 6.1
Packing Group: Packing Group II
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Toxic solid, organic, n.o.s.
IATA UN Number: 2811
Hazard Class: 6.1
Packing Group: II

Section 15 - Regulatory Information

EU ADDITIONAL CLASSIFICATION
Symbol of Danger: T+
Indication of Danger: Very toxic.
R: 45-46-60-61-28
Risk Statements: May cause cancer. May cause heritable genetic damage. May impair fertility. May cause harm to the unborn child. Very toxic if swallowed.
S: 53-22-36/37/39-45
Safety Statements: Avoid exposure - obtain special instructions before use. Do not breathe dust. Wear suitable protective clothing, gloves, and eye/face protection. In case of accident

or if you feel unwell, seek medical advice immediately (show the label where possible).

US CLASSIFICATION AND LABEL TEXT

Indication of Danger: Highly Toxic (USA) Very Toxic (EU).
Risk Statements: May cause cancer. May cause heritable genetic damage. May impair fertility. May cause harm to the unborn child. Very toxic if swallowed.
Safety Statements: Avoid exposure - obtain special instructions before use. Do not breathe dust. Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
US Statements: Target organ(s): Lungs. Bone marrow. Calif. Prop. 65 carcinogen & reproductive hazard.

UNITED STATES REGULATORY INFORMATION

SARA LISTED: No

UNITED STATES - STATE REGULATORY INFORMATION

CALIFORNIA PROP - 65

California Prop - 65: This product is or contains chemical(s) known to the state of California to cause developmental toxicity. This product is or contains chemical(s) known to the state of California to cause cancer.

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: No
NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.