

CODING FORMS FOR SRC INDEXING

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Submitting Organization		MONSANTO CHEM CO	
Contractor			
Document Title		INITIAL SUBMISSION: MATERIAL SAFETY DATA SHEET ON BHMT CONCENTRATE (BIS-HEXAMETHYLENETRIAMINE, 53.7%), WITH COVER DATED 7/21/87	
Chemical Category		BHMT CONCENTRATE (BIS-HEXAMETHYLENETRIAMINE,	



74I-0791-001049

Monsanto



Monsanto Chemical Company
600 N. Lindbergh Boulevard
St. Louis, Missouri 63167
Phone: (314) 694-1000

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July 21, 1987

Ms. Roberta Wedge
Dynamac Corporation
6th Floor
11140 Rockville Pike
Rockville, MD 20852

Contains No CBI

Dear Ms. Wedge:

In response to your recent inquiry concerning BHMT (Bis-hexamethylenetri-amine) Concentrate, I am enclosing our current material safety data sheet (MSDS) for this product.

You also inquired about the uses of BHMT. From what we can determine, it is used in an additive for road paving materials, in wet strength (paper) resins, as an additive in oil well operations and in water treatment additives. There may be other applications of which we are not aware.

I hope that this information will be helpful to you. If you have any further questions, please call me at (314) 694-2575.

Sincerely,

Verne L. Rhodes
Manager, Product Safety

MONSANTO PRODUCT NAME

BHMT CONCENTRATE
(BIS-HEXAMETHYLENTRIAMINE)

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167
EMERGENCY ONE NO.
(CALL COLLECT)
314-694-1000

PRODUCT IDENTIFICATION

BHMT Concentrate has a typical composition range of:

Hexamethylenediamine (HMD)	3.3%
Aminocapronitrile (ACN)	0.7%
Adiponitrile (ADN)	0.1%
Bis-hexamethylenetriamine (BHMT)	53.7%
Water	10.5%
GC Unknowns	31.7%

Chemical Name: 1,6-Hexanediamine, N-(6-aminohexyl)

Synonym: BHMT

Chemical Formula: $C_{12}H_{29}N_3$

Chemical Family: Amine

CAS No.: 68411-90-5

DOT Proper Shipping Name: Corrosive Liquid, Poisonous, N.O.S.
(Bis-hexamethylenetriamine)

DOT Hazard Class/I.D. No.: Corrosive Material, Class B Poison/UN2922

DOT Label: Corrosive and Poison

U.S. Surface Freight Classification: Chemicals, N.O.I.B.N.

Reportable Quantity (RQ) Under

DOT (49 CFR) and CERCLA Regulations: Not Applicable

This product contains, as components, the substances listed below which are identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Bis-hexamethylenetriamine, CAS No. 143-23-7
- Hexamethylenediamine, CAS No. 124-09-4

WARNING STATEMENTS

DANGER!
MAY BE FATAL IF ABSORBED THROUGH SKIN
CAUSES BURNS TO EYES AND SKIN
HARMFUL IF SWALLOWED

PRECAUTIONARY MEASURES

Do not get in eyes, on skin, on clothing.
Avoid breathing vapor.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labelled safeguards until container is cleaned, reconditioned or destroyed.

EMERGENCY AND FIRST AID PROCEDURES

POISON: CALL A PHYSICIAN.

FIRST AID: IF IN EYES OR ON SKIN, immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse. Destroy contaminated shoes.

IF SWALLOWED, DO NOT induce vomiting. Give large quantities of water. Call a physician immediately. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

NOTE TO PHYSICIAN: IF SWALLOWED, give gastric lavage.

IN CASE OF: SPILL or LEAK, keep people away. Keep upwind. Shut off leak if without risk. If necessary to enter spill area, wear self-contained breathing apparatus and full protective clothing including boots. Dike to confine liquid. Absorb spilled material with sweeping compound or sand. Sweep up or shovel into dry, clean containers. Keep out of sewers, watersheds and waterways (see "Spill, Leak & Disposal Information" section).

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles and have eye baths immediately available where there is potential for eye contact.

Skin Protection: Wear appropriate protective gloves and protective clothing that provide a barrier to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical splash goggles, a face shield and a protective apron that provides a barrier when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

OCCUPATIONAL CONTROL PROCEDURES (continued)

Respiratory Protection: Avoid breathing dust, vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure is excessive. Consult respirator manufacturer to determine appropriate type equipment for a given application. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR 1910.134.

Ventilation: Provide ventilation to minimize exposure. Use local mechanical exhaust ventilation at sources of air contamination such as open process equipment. Consult NFPA Standard 91 for design of exhaust systems.

Airborne Exposure Limits:

Product: BHMT concentrate

OSHA PEL/8-hour Time-weighted average: None established
ACGIH TLV/8-hour Time-weighted average: None established

Component: Bis-hexamethylenetriamine (53.7% by weight of product)

OSHA PEL/8-hour Time-weighted average: None established
ACGIH TLV/8-hour Time-weighted average: None established

Component: Hexamethylenediamine (3.3% by weight of product)

OSHA PEL/8-hour Time-weighted average: None established
ACGIH TLV/8-hour Time-weighted average: None established

Monsanto has adopted, for its own internal use, an exposure limit of 3 ppm 8-hour time-weighted average and 5 ppm short-term exposure limit for hexamethylenediamine.

FIRE PROTECTION INFORMATION

Solid or viscous solution

Flash Point: 380°F

Method: Open Cup

Melting Point: 93°F

Extinguishing Media: Water spray, foam, dry chemical, carbon dioxide or any Class B extinguishing agent.

Special Firefighting Procedures: Fire fighters and others who may be exposed to products of combustion (see "Hazardous Decomposition Products" below) should wear full protective clothing including self-contained breathing apparatus. Fire fighting equipment should be thoroughly decontaminated after use.

Unusual Fire and Explosion Hazards: None known.

REACTIVITY DATA

Materials to Avoid: Oxidizing agents, acids, isocyanates, aldehydes, ketones, anhydrides, phenols, nitrates and halogenated compounds.

Hazardous Decomposition Products: Ammonia, low boiling amines and carbon monoxide.

Hazardous Polymerization: Not likely to occur.

HEALTH EFFECTS SUMMARY

The following information presents both human experience and the results of scientific experiments used by qualified experts to assess the effects of BHMT concentrate on the health of industrially exposed individuals and to support the Precautionary Measures and Occupational Control Procedures recommended in this document. To avoid misunderstanding, the data provided in this section should be interpreted by individuals trained in evaluation of this type of information.

Human Experience

Dermal contact and inhalation are expected to be the primary routes of occupational exposure to BHMT concentrate. BHMT concentrate can cause severe burns to the eyes and skin. BHMT concentrate is considered to be highly toxic following dermal absorption and moderately toxic following oral ingestion.

Toxicological Data

Data from Monsanto studies indicate the following:

Oral LD₅₀ (Rat): 450 mg/kg, Moderately Toxic
Dermal LD₅₀ (Rabbit): <200 mg/kg, Highly Toxic
Eye Irritation (Rabbit): (FHSA) Corrosive
Skin Irritation (Rabbit): (FHSA) Corrosive

BHMT was evaluated in a 4-week oral toxicity study in which 6 groups of 10 male and 10 female rats were administered the test material by oral gavage at concentrations of 0, 20, 40, 80, 160 and 320 mg/kg/day. Mortality was observed at the 160 and 320 mg/kg/day dose levels. Slight reductions in body weights were observed in rats receiving BHMT at dose levels of 80 mg/kg/day and above, also food consumption was significantly reduced at dose levels of 40 mg/kg/day and above. No adverse treatment-related gross or histopathological changes were reported.

No embryotoxic, fetotoxic or teratogenic effects were observed when BHMT was administered by oral gavage to groups of 25 mated female rats at dose levels of 0, 50, 100 or 250 mg/kg/day on gestation days 6 through 15.

BHMT was evaluated for mutagenic or genotoxic potential in the following systems: microbial assays with five S. typhimurium strains; in vitro Chinese hamster ovary (CHO) cell point mutation assay; in vivo rat bone marrow cell clastogenesis assay; and an unscheduled DNA synthesis assay. No evidence of mutagenicity was observed in any of these assays.

HEALTH EFFECTS SUMMARY (continued)

Components

BHMT concentrate may contain up to 3.3% hexamethylenediamine as an impurity. Toxicity information is available for hexamethylenediamine:

Oral LD₅₀ (Rat): 980 mg/kg, Slightly Toxic

Dermal LD₅₀ (Rabbit): Estimated to be between 2,000 and 3,160 mg/kg,
Slightly Toxic

Eye Irritation (Rabbit): (FHSA) Corrosive

Skin Irritation (Rabbit): (FHSA) Corrosive

Dust Inhalation (Rat): 10 of 10 rats survived exposure to 0.95 mg/l of
hexamethylenediamine for 4 hours.

No mutagenic effect was observed when hexamethylenediamine was tested in a microbial mutagenicity assay using five Salmonella strains and one yeast strain with and without mammalian microsomal activation.

Hexamethylenediamine administered by gavage at doses of 75, 250 and 750 mg/day did not produce clastogenic changes such as chromosomal aberrations in the bone marrow cells of rats. Under the conditions of this test, hexamethylenediamine was considered nonmutagenic.

No adverse effects were observed when hexamethylenediamine was fed to rats at dietary levels of 0, 50, 150 or 500 mg/kg/day for 90 days.

In a subacute aerosol inhalation study, rats were exposed to hexamethylenediamine at 12.8, 51.0 and 215 mg/m³ for 6 hours per day, 5 days per week for 7 weeks. The study was terminated at the 7th week due to the high mortality rate at 215 mg/m³. Respiratory irritation was observed in both the high and mid dose groups. Microscopic changes in the lung were observed in the high exposure group only. The no effect level was 12.8 mg/m³.

Rats were exposed to dust concentrations of hexamethylenediamine at 49 mg/m³ or 262 mg/m³, 6 hours per day, 5 days per week for 4 weeks. Ruffed fur, ptosis and hypoactivity but no evidence of target organ toxicity, were observed at 49 mg/m³. Sneezing, rhinitis and rattled breathing were evidenced at 262 mg/m³. Discolored fur, ear and tail lesions indicative of burns and depressed body weight gain were also observed at this treatment level.

Rats were orally dosed with 0, 112, 184 and 300 mg/kg hexamethylenediamine on days 7 through 16 of gestation. At the 300 mg/kg dose, maternal toxic effects were demonstrated by reduced body weight, decreased food consumption and death of 10% of the treated animals. Fetal toxicity was demonstrated by retarded fetal weight gain at 300 mg/kg/day and retarded skeletal development at both 300 and 184 mg/kg/day. No evidence of a teratogenic response was observed at any dosage. Retarded fetal skeletal development and retarded fetal weight gain were also observed in another study in which 0.89 mM/kg hexamethylenediamine in 0.9% saline was administered intraperitoneally to mice 4 times a day on days 10 through 14 of gestation.

HEALTH EFFECTS SUMMARY (continued)

A two generation reproduction study was conducted using rats administered hexamethylenediamine in the diet at concentrations equivalent to 50, 150, or 500 mg of the test compound per kg of body weight per day for two consecutive generations. Reduced food consumption was found in the high dose males and females of both the F₀ and F₁ generations. Reduced body weight gains were found in the high dose females of the F₀ generation during the gestation period and in the F₁ generation high dose females during both the pregestational and gestational periods. Reduced body weights were also found in both generations of high dose males. Reductions in the litter size at birth and decreased pup weights during the lactation period occurred in the high dose groups of both generations. There were no adverse effects on reproduction or on the viability of offspring in this study at any dose level. The no-effect level for this study was considered to be 150 mg/kg/day.

Single oral administration of C¹⁴ - hexamethylenediamine to rats indicated that the product and its metabolites were quantitatively excreted within 72 hours following administration. The major route of elimination was in the urine.

PHYSICAL DATA

Appearance: Black Solid or viscous solution
Melting Point: 34°C
Boiling Point @ 100 mm Hg: 250°C
Solubility in Water: 50 gms/100 ml
Specific Gravity: 0.88
Viscosity @ 27°C for BHMT containing 10% H₂O: 25 cps

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

SPILL, LEAK & DISPOSAL INFORMATION

Waste Disposal: Because of its corrosivity, this product can be classified as a hazardous waste as designated by the Environmental Protection Agency (EPA) under authority of the Resource Conservation and Recovery Act (RCRA). The waste would have EPA Hazardous Waste number D002 as designated in 40 CFR 261.22. All applicable local, state and federal laws and regulations should be followed when disposing of this material. This material should not be dumped, spilled, rinsed or washed into sewers or public waterways. Waste liquid should be disposed of in an approved hazardous waste incinerator. Contaminated soils and solid material should be disposed of in an approved hazardous waste landfill.

SPILL, LEAK & DISPOSAL INFORMATION (continued)

Spill or Leakage Procedures: Keep unnecessary people away. Stay upwind. Shut off leak if without risk. If necessary to enter spill area, wear self-contained breathing apparatus and full protective clothing including boots. Contain spill. Small spills can be collected on sand or other non-combustible absorbant material, then flush area with water. Sweep or shovel small dry spill into dry containers and cover. Remove containers, then flush area with water. Collect large spills by pumping into drums, salvage tank or a vacuum truck. Residual soils may be contaminated, remove for disposal. Guard against watershed, waterway and water supply contamination. If not possible notify health and pollution control authorities.

DATE 7/87

SUPERSEDES 6/86

MSDS NUMBER 068411905

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

Manager, Product Safety
Monsanto Chemical Company
An operating unit of Monsanto Company
314-694-1000

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