FOREWORD INTRODUCTION

HEXAMETHYLENEDIAMINE

CAS N°: 124-09-4

Substance

End Point	:	**IDENTIFIERS, PHYSICAL AND CHEMICAL PROPERTIES**
Chemical Name	:	**1,6-Hexanediamine**
Common Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
RTECS Number	:	**MO1180000**

Synonyms

1,6-Diaminohexane
.alpha.-.omega.-Hexanediamine
Hexylenediamine
1,6-Hexylenediamine
HMD
HMDA

Properties & Definitions

Molecular Formula	:	**C6H16N2**
Molecular Weight	:	**116.24**
Melting Point	:	**41C**
Boiling Point	:	**205C**
Flash Point	:	**0.9 - 7.6 volume %**
Vapour Pressure	:	**0.05 kPa (0.4 mmHg) at 25C CAL**
Octanol/Water Partition Coefficient	:	**log Pow = 0.02**
Water Solubility	:	**800 g/L at 15.6C**
Additives	:	**None**
Impurities	:	**None. Purity of industrial product: 100%**
General Comments	:	Flammability (solids/gases): 85C. Ignition temperature: 305C.

Overall Evaluation

SIDS INITIAL ASSESSMENT

CURRENTLY OF LOW PRIORITY FOR FURTHER WORK

Hexamethylendiamine (HMDA) is an isolated chemical intermediate which is used for the manufacture of polyamides. Information regarding uses, production levels, exposure, and emissions was available only from the DuPont Company in Canada and in the United States.

Tasks involving the exposure to HMDA are of short duration; therefore, occupational exposure is expected to be limited. Air monitoring at plant sites has detected =< 0.07 ppm HMDA; personal monitoring values range from 0.01 to 3.7 ppm. It is also expected that consumer exposure is negligible since HMDA is generally incorporated into other products before reaching the consumer; however, consumer exposure will need to be reassessed when additional exposure data is received from other countries.

Under environmental conditions, HMDA will exist in an ionic state (+2). Based on the low Koc, this material is considered to be highly mobile in soil, and the high water solubility of HMDA would suggest that this compound would largely partition into the water compartment. This material biodegrades in activated sludge systems, and it is expected that biodegradation in soil is also possible. Information regarding the photolysis or hydrolysis of HMDA was not available. The low octanol/water coefficient indicates that HMDA is unlikely to bio-concentrate in aquatic organisms; therefore, potential for secondary poisoning is low.

Experimentally, HMDA has exhibited low to slight acute toxicity towards freshwater fish species and moderate acute toxicity to the microcrustaceon Daphnia magna and towards the algal species Selenastrum capricornutum. HMDA has been shown to inhibit nitrification in Nitrosomonas species. Since HMDA has the capability to ionize in water, this material did not fit the requirements for application of QSAR-derived estimates of chronic toxicity. Therefore, the MTC (0.148 mg/L) was determined by applying an assessment factor of 100 to the lowest experimentally-derived acute EC50 value.

This material exhibited low to slight acute toxicity by the oral and inhalation routes and was moderately toxic by

the dermal route. It is corrosive and irritating to skin and eye; it did not induce skin sensitization. Upon repeated administration to rats or mice in drinking water or in the diet, the NOAEL was approximately 500 mg/kg/day following 15 days or 13 weeks of administration. When rats or mice were exposed by inhalation to HMDA dihydrochloride, the lowest NOAEL for nasal irritation and histological alterations following 12 and 90 days of exposure was 31 mg/m3 (10 mg/m3 or ca. 2.1 ppm HMDA) and 5 mg/m3 (1.6 mg/m3 or ca. 0.3 ppm HMDA), respectively. Experimental evidence indicates that HMDA is not genotoxic. No adverse reproductive effects were observed in a one-generation reproduction study (NOAEL>160 mg/m3 HMDA dihydrochloride) when rats and mice were exposed by inhalation. Developmental studies indicate that fetal toxicity was present only at concentrations which were maternally toxic, and no malformations were detected.

EXPOSURE

EMISSIONS

Canada - For DuPont, air from the process is vented into a condensate system.
It is estimated that 500 - 600 lbs/day are trapped in this manner. The condensate is passed through a trickling filter system where ca. 300 lbs/day is degraded. The remaining condensate is then transferred directly to a municipal environmental treatment plant adjacent to the DuPont Canada processing site where the remaining HMDA is degraded by an activated sludge system.

ENVIRONMENTAL EXPOSURE

BIODEGRADABILITY

Most reports indicate that HMDA biodegrades in test medium inoculated with activated sludge.

ENVIRONMENTAL FATE MODELING

The fugacity model described by MacKay is not applicable to HMDA since this compound occurs in an ionic state (+2) under environmental conditions. However, the extremely high water solubility of HMDA (909 g/L) would suggest that this compound would largely partition into the water environment.

CONSUMER EXPOSURE

No specific information was provided. DuPont does not know of any uses of HMDA in which this material is not incorporated into other products (e.g., polymers) before reaching the consumer. Therefore, no consumer is expected.

OCCUPATIONAL EXPOSURE

Monitoring Data:

Canada - DuPont personal monitoring = 0.01 - 3.7 ppm;
air = 0.02 - 0.07 ppm

All personal samples taken during a short time period as the task involving the use of HMDA were of limited duration.

(0.07 ppm = ca. 0.05 mg/kg/day in humans assuming 100% absorption by a 70 kg man breathing 10 m3 / 8 hours and 1 ppm = 4.8 mg/m3)

United States- personal exposures (12-hour shift) during routine operations = < 0.1 ppm (limit of detection)

(0.1 ppm = ca. 0.07 mg/kg/day in humans)

EXPOSURE STANDARDS

1 ppm vapor or 5 mg/m3 total particulates (8- and 12-hour TWA)
(DuPont internal guideline and AIHA WEEL)

(1 ppm = ca. 0.7 mg/kg/day in humans)

0.5 ppm vapor (2.3 mg/m3) (1993 ACGIH TLV)

TOXICITY

Ecotoxicity:
Hexamethylenediamine is classified as a Class II chemical according to OECD Guidance for Initial Assessment of Aquatic Effects.

CALCULATION OF MAXIMUM TOLERABLE CONCENTRATION (MTC):

HMDA exhibited moderate acute toxicity towards the algal species, Selenastrum capricornutum (96 h EC50 = 14.8 mg/L), and the microcrustacean, Daphnia magna (48 h EC50 = 23.4 mg/L). The three freshwater fish species tested showed low to slight acute toxicity with differences in sensitivity of 25-fold between the bluegill sunfish (48 h LC50 = 73.5 mg/L) and fathead minnow (96 h LC50 = 1825 mg/L). Since it has the capability to ionize in water, HMDA is not classified as a Class I chemical and does not exhibit baseline toxicity. Therefore, the use of QSARs to estimate acute or chronic aquatic toxicity is not appropriate. In addition, no chronic aquatic data from structurally comparable aliphatic amines could be found in available databases.

Applying an assessment factor of 100 to the lowest experimentally derived acute LC50 or EC50 values for algal, daphnid, and fish species, the MTC = 14.8 mg/L/100 or 0.148 mg/L.

HUMAN TOXICITY

This material exhibited low to slight acute toxicity by the oral (LD50 = 380 - 1127 mg/kg body weight) and inhalation (LD50 > 950 mg/kg body weight) routes and was moderately toxic by the dermal route (LD50 = 1110 mg/kg body weight). It is corrosive and irritating to skin and eyes; it did not induce skin sensitization. Upon repeated administration to rats or mice in drinking water or in the diet, the NOAEL was approximately 500 mg/kg/day following 15 days or 13 weeks of administration. When rats or mice were exposed by inhalation to HMDA dihydrochloride, the lowest NOAEL for nasal irritation and histological alterations following 12 and 90 days of exposure was 31 mg/m3 (10 mg/m3 or ca. 2.1 ppm HMDA) and 5 mg/m3 (1.6 mg/m3 or ca. 0.3 ppm HMDA), respectively. Experimental evidence indicates that HMDA is not genotoxic. No adverse reproductive effects were observed in a one generation reproduction study (NOAEL > 160 mg/m3 HMDA dihydrochloride) when rats and mice were exposed by inhalation. Developmental studies indicate that fetal toxicity was present only at concentrations which were maternally toxic, and no malformations were detected.

CONCLUSIONS AND RECOMMENDATIONS

Given that HMDA is an isolated intermediate, has low potential for exposure, is demonstrated to be low to moderately toxic to human health and to aquatic organisms, and biodegrades rapidly, this material is considered to be currently of low priority for further work in the SIDS context.

Production-Trade

Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Geographic Area : **CAN**

Production

Quantity	*Year*
38500-44000 t/y - P	**1991**

General Comments : The given data is based on DuPont volumes.

References

!SIDSP*
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Production-Trade

Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Geographic Area : **USA**

Production

Quantity	*Year*
227000-454000 t/y - P	**1993**

General Comments : The given data is based on DuPont volumes.

References

!SIDSP*
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Uses

Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Geographic Area : **CAN**

Use

Quantity	*Year*	*Comments*
		HMDA is an isolated chemical intermediate for the manufacture of polyamides.

References

Secondary References : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Uses

Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Geographic Area : **USA**

Use

Quantity	*Year*	*Comments*
99 %		Approximately 99% of the HMDA produced is used as an intermediate for the manufacture of polyamides. The uses of the HMDA either used by DuPont or sold by DuPont are as follows:
83 %		To fiber
10 %		To engineering plastics
6 %		To polyurethane coatings and adhesives
1 %		To specialty nylons including monofilaments and inks
0.2 %		To specialty chemicals including biocides, petroleum additives and phenol purification.
0.1 %		To other uses including resale

References

Secondary References : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Uses

Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Geographic Area : **NOR**

Use

Quantity	Year	Comments
		Used in the manufacture of other chemical products. Component of binders for paint, glue, etc. and in printing inks.

References

Secondary References : **!SIDSP***

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**Pathway into the Environment and Environmental Fate.**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Method and Conditions

Test method description	:	Environmental model: fugacity model, MacKay (1991)

Quantity Transported

General Comments	:	The fugacity model described by MacKay (1991) is not applicable to HMDA since this compound occurs in an ionic state (+2) under environmental conditions. The extremely high water solubility of HMDA (906 g/m3) would suggest that this compound would largely partition into the water environment.

References

Primary Reference	:	**MMFAM*** MacKay, D. Multimedia Models : the Fugacity Approach, (1991)
Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**Pathway into the Environment and Environmental Fate.**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Pathway and Transport

Pathway	:	**INDST**
Pathway description	:	Air from the process

Quantity Transported

Medium	*to Medium*	*Quantity*	*Time*	*Year*	*to Year*
AIR		**227-273 kg/d**			

Air from the process is vented into a condensate system. It is estimated that 500 - 600 lbs/day are trapped in this manner.

General Comments	:	The condensate is passed through a trickling filter system where ca. 300 lbs/day is degraded. The remaining condensate is then transferred directly to a municipal enviromental treatment plant adjacent to the DuPont Canada processing site where the remaining HMDA is degraded by an activated sludge system.

References

Secondary Reference : **!SIDSP***

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**CONCENTRATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**FIELD**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*	*Lifestage*	*Sex*
	AIR	**OCC**		

Test Method and Conditions

Test method description	:	Monitoring study (DuPont personal monitoring)

Test Results

Matrix	*Concentrations*	*Spec.*	*Date*
AIR	**0.02-0.07 ppm**		

Levels of HMDA found in area air monitoring

References

Secondary Reference	:	**!SIDSP***

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**CONCENTRATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*	*Lifestage*	*Sex*
	AIR	**OCC**		

Species/strain/system	:	Monitoring study DuPont site

Test Method and Conditions

Test method description	:	DuPont internal guideline and AIHA WEEL

Test Results

Matrix	Concentrations	Spec.	Date
	1 ppm 1 ppm vapour (8 and 12 hours)		
	5 mg/m3 Total particulate, 8 and 12 hours		
	2 ppm 8-hour TWA		
	5 mg/m3 8-hour TWA		
	0.5 ppm 0.5 ppm vapour (2.3 mg/m3)		

General Comments : Exposure standards: 2 ppm - 8-hour TWA (AIHA WEEL) and 5mg/m3, 8-hour TWA; 1 ppm 8 and 12-hour TWA (vapour) (DuPont internal guideline), 5 mg/m3 8 and 12-hour TWA (total dust); 0.5 ppm vapour (2.3 mg/m3) (1993 ACGIH TLV).

References

Secondary Reference :

!SIDSP*
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**HUMAN INTAKE AND EXPOSURE**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Results

General Comments : Consumer exposure: no specific information was provided. DuPont does not know of any uses of HMDA in which this material is not incorporated into other products (e.g., polymers) before reaching the consumer. Therefore, no consumer exposure is expected.

References

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**HUMAN INTAKE AND EXPOSURE**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*
	AIR	**OCC**	**IHL**	**ADULT**	

Test Method and Conditions

Test method description : Monitoring study (DuPont personal monitoring)

Test Results

Intake	*Spec.*	*Date*
0.05 mg/kg/	**d**	

(0.07 ppm) in humans assuming 100% absorption by a 70 kg man

0.01-3.7 ppm
Levels of HMDA found in personal monitoring at DuPont Canada sites. All the personal samples were of a short time period (10 - 30 minutes) as the tasks were of the limited duration.

General Comments : (0.07 ppm = ca. 0.05 mg/kg/day in humans assuming 100% absorption by a 70 kg man breathing 10 m3/8 hours and 1 ppm = 4.8 mg/m3).

References

Secondary Reference :

!SIDSP*

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**BIODEGRADATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*
	AQ	**SLUDG**

Species/strain/system : Activated sludge

Test Method and Conditions

Test method description : OECD Confirmatory Test (1972); GLP: no

(An)aerobic : **AEROB**

Exposure

Dose / Concentration : **40 mg/L**

Exposure comments : Test performed in parallel in 6 laboratories. Applied amount = 40 mg/L based on TOC.

Test Results

Quantity	*Time*	*Comments on result*
90 %	**31 d**	Degradation after 31 days
40 %	**31 d**	In one laboratory, only 40% elimination was observed.
80-100 %	**31 d**	In five laboratories results ranged from 80 - 100% COD elimination.

References

Primary Reference : **TSDTAZ**
Zahn, R. and Huber, W. Tenside Detergents, 12, 226-270, (1975)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**BIODEGRADATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*
	AQ	**SLUDG**

Species/strain/system : BASF activated sludge

Test Method and Conditions

Test method description : Zahn-Wellens test, OECD Guideline 302 B updated 7/85, ISO DP 9888, EEC Guideline 88/302/EEC, Part C, in EEC Official Gazette L133, dated 30 May 1988; GLP: yes

(An)aerobic : **AEROB**

Exposure

Dose / Concentration : **399 mg/L**

Exposure comments : Applied amount = 399 mg/L based on DOC.

Test Results

Quantity	*Time*	*Comments on result*
11 %	**3 h**	Degradation after 3 hours
98 %	**8 d**	Degradation after 8 days
>80 %	**5 d**	DOC elimination level (it climbs sharply), after 5 days

General Comments : Most reports indicate HMDA biodegrades in test medium inoculated with activated sludge.

References

Primary Reference : **KUHIT***
Test Procedure, 2(113), 257, (1989)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**BIODEGRADATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**
Species/strain/system	:	Medium unspecified

Test Method and Conditions

Test method description	:	BSBx determination, DEV H5 DIN 38409, Part 51, German unified procedure for evaluating water, waste water and sludge.

Test Results

Quantity	*Time*	*Comments on result*
100 %	**5 d**	Degradation after 5 days

References

Primary Reference	:	**KUHIT*** Test Procedure, 2(113), 257, (1989)
Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**BIODEGRADATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*
	AQ	**SLUDG**

Species/strain/system	:	Activated sludge, unadapted

Test Method and Conditions

Test method description	:	Zahn-Wellens test, OECD Guideline 302 B updated 7/85, ISO DP9888, EEC Guideline 88/302/EEC, Part C, in EEC Official Gazette L133, dated 30 May 1988; GLP: yes

Exposure

Dose / Concentration : **1000 mg/L**
Exposure comments : Adaptation time = 3 days; applied amount = 1000 mg/L based on CSB.

Test Results

Quantity	*Time*	*Comments on result*
>90 %	**6 d**	Degradation after 6 days

References

Primary Reference : **AEWAF***
Zahn, R. and Wellens, H. Zeitschrift fuer Wasser und Abwasser Forshung, 13(1), 1-7, (1980)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **BIODEGRADATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**
Geographic Area : **CAN**

Test Subject

Organism	*Medium*	*Specification*
	AQ	**SLUDG**

Species/strain/system : Activated sludge

Test Method and Conditions

Test method description : Test conducted in laboratory activation unit

(An)aerobic : **AEROB**

Exposure

Dose / Concentration : **100 mg/L**
Exposure comments : Applied amount = 100 mg/L based on test material.

Test Results

Quantity	*Time*	*Comments on result*
80 %		Degradation

References

Primary Reference : **#URBSF***
BASF AG. BASF Unpublished Report, (1974)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **BIODEGRADATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**
Geographic Area : **CAN**

Species/strain/system : Medium unspecified

Test Method and Conditions

Test method description : Modified OECD Confirmatory Test (TOC), 1972

(An)aerobic : **AEROB**

Test Results

Quantity	*Time*	*Comments on result*
>60 %		Degradation

General Comments : HMDA can be well eliminated by biodegradation.

References

Primary Reference : **BASFB***
BASF AG. Safety Bulletin

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**PHOTODEGRADATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Results

General Comments	:	No information was available; however, photolysis is expected to be negligible based on the chemical nature of HMDA.

References

Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**HYDROLYSIS**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Results

General Comments	:	No information was available; however, hydrolysis is expected to be negligible based on the chemical nature of HMDA.

References

Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**SORPTION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Results

General Comments	:	The measured log Pow for HMDA = 0.02 therefore, log Koc = 1.387. This low log10 Koc value indicates that HMDA is highly mobile in soil.

References

Primary Reference	:	**CLOGP*** CLOGP Program, Medicinal Chemistry Project, 3.4.1, (1986)
Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**EVAPORATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Geographic Area	:	**CAN**

Test Results

General Comments	:	No information was available; however, the low vapor pressure and high water solubility suggests that little volatilization from water or soil would occur.

References

Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**BIOCONCENTRATION**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**

Test Results

General Comments	:	Based on the low Kow (0.094), HMDA is not expected to bioconcentrate in aquatic organisms; therefore, the potential for secondary poisoning is low.

References

Secondary Reference	:	**!SIDSP***

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**METABOLISM**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**VTR**				

Species/strain/system : Rat liver homogenates

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure comments : Incubation in the presence of a continuation of diamine oxidase and aldehyde oxidase.

Test Results

Organ	*Quantity*	*Time*	*Comments on result*
LIVER			Metabolites: caprolactam and 6-aminohexanoic acid In rat liver homogenates catalyzed with a combination of diamine oxidase and aldehyde oxidase, HMDA was metabolized to caprolactam and 6-aminohexanoic acid. Neither enzyme alone carried out the reaction.
LIVER			Incubation in the presence of diamine oxidase yielded 3,4,5, 6-tetrahydro-2H-azepine as the only product detected, which was converted to caprolactam and 6-aminohexanoic acid the presence of partially purified liver aldehyde oxidase.

References

Primary Reference : **XENOBH**
Xenobiotica, the Fate of Foreign Compounds in Biological Systems, 19(1), 33-42, (1989)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **EXCRETION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
			ORL				

Species/strain/system : Species and strain not specified

Test Substance

Labelled Compound : **Radiolabeled hexamethylenediamine**

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Dose / Concentration : **7-9 mg/kg BW**
Exposure comments : A single oral dose of 7 - 9 mg/kg of radiolabeled hexamethylenediamine was administered.

Test Results

General Comments : After single oral dose of 7 - 9 mg/kg of radiolabeled hexamethylenediamine, 85-95% of the radioactivity was recovered in the urine and feces within 3 days.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1984)

Study

End Point : **EXCRETION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**		**M**		

Test Substance

Labelled Compound : **14C-labelled hexamethylenediamine**

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Dose / Concentration : **0.4 mg/kg BW**
Exposure comments : 0.4 mg/kg of 14C-labeled hexamethylenediamine was administered by gavage to male rats.

Test Results

Organ	*Quantity*		*Time*	*Comments on result*
AIR	20 %	TOT	72 h	Approximately 20% of the dose was recovered as carbon dioxide over 72-hour period.
URINE	47 %	TOT	72 h	% of the dose excreted with urine
FECES	27 %	TOT	72 h	% of the dose excreted with feces

General Comments : Less than 1.5% of the radioactivity was retained by the rats 72 hours after treatment; the intestines contained the greatest concentrations after one hour.

References

Primary Reference : **TOLED5**
David, R. M. and Heck, H. d'A. Toxicology Letters, 17(1-2), 49-55, (1983)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Species/strain/system : Rabbit
Dose / Concentration : **1110 mg/kg BW**

Test Method and Conditions

Test method description : GLP: no data

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
RBT			**SKN**			**LD50**	Dermal LD50 in rabbit was reported as 1110 mg/kg.

References

Primary Reference : **TXAPA9**
Vernot, E. H. et al. Toxicology and Applied Pharmacology, 42(2), 417-423, (1977)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Dose / Concentration : **950 mg/m3 AIR**

Test Substance

Description of the test substance : Particulate hexamethylenediamine

Test Method and Conditions

Test method description : GLP: no data

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
RAT			**IHL**			**LC50**	Inhalation LC50 in rat was refered as >950 mg/m3.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Dose / Concentration : **380 mg/kg BW**

Test Method and Conditions

Test method description : GLP: no data

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
MOUSE			**ORL**			**LD50**	Oral LD50 for mice was reported as 380 mg/kg body weight

References

Primary Reference : **#STANO***
Standard Oil Co. Unpublished data

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Dose / Concentration : **980 mg/kg BW**

Test Method and Conditions

Test method description : GLP: yes

Test Results

Organism	Medium	Spec.	Route	Lifestage	Sex	Effect	Effect Comments
RAT			**ORL**			**LD50**	Oral LD50 for rats was established as 980 mg/kg body weight

References

Primary Reference : **JJATDK**
Johannsen, F. R. and Levinskas, G. J. Journal of Applied Toxicology, 7(4), 259-263, (1987)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Dose / Concentration : **792-1127 mg/kg BW**

Test Method and Conditions

Test method description : GLP: yes

Test Results

Organism	Medium	Spec.	Route	Lifestage	Sex	Effect	Effect Comments
RAT			**ORL**			**LD50**	Oral LD50 for rats was reported as 792 mg/kg (fasted) and 1127 mg/kg (non-fasted).

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-111-81, (1981)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Dose / Concentration : **750-800 mg/kg BW**

Test Method and Conditions

Test method description : GLP: no data

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
RAT			**ORL**		**M** **F**	**LD50**	Oral LD50 for male and female rats was reported as 800 mg/kg and 750 mg/kg body weight.

General Comments : Similar test and results reported by Back, K. C. et al. in Toxicological Testing of Selected Hazardous Materials for Transportation Purposes (1976).

References

Primary Reference : **TXAPA9**
Vernot, E. H. et al. Toxicology and Applied Pharmacology, 42(2), 417-423, (1977)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Dose / Concentration : **500 mg/kg BW**

Test Method and Conditions

Test method description : GLP: no data

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
RAT			**ORL**			**LD50**	Oral LD50 for rats was reported as >500 mg/kg body weight.

References

Primary Reference : **JPETAB**
Dieke, S. H. et al. Journal of Pharmacology & Experimental Therapeutics, 90, 260-270, (1947)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**IHL**				

Test Method and Conditions

Test method description : GLP: no data

Exposure

Dose / Concentration : **750 mg/m3 AIR**

Test Results

Acute Lethal Concentration (ALC) in mouse was refered as 750 mg/m3.

References

Primary Reference : **NTPAP***
National Toxicology Program Fiscal Year 19-- Annual Plan(7), 5-9, (1982)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**				

Test Method and Conditions

Test method description : GLP: yes

Exposure

Dose / Concentration : **1500 mg/kg BW**

Test Results

Acute Lethal Dose (ALD) for rats was reported as 1500 mg/kg body weight (modified fixed dose).

References

Primary Reference : **JJATDK**
Kennedy, Jr. G. L. et al. Journal of Applied Toxicology, 6(3), 145-148, (1996)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**				

Test Method and Conditions

Test method description : GLP: no data

Exposure

Dose / Concentration : **1000 mg/kg BW**

Test Results

Acute Lethal Dose (ALD) for rats was refered as 1000 mg/kg body weight (modified fixed dose).

General Comments : Similar test and results reported in DuPont-Unpublished Report, volume HL-8-48 (1948).

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-51-62, (1962)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
GPIG			**IHL**			**10**	

Species/strain/system : Guinea pig

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **3-4 d**
Dose / Concentration : **237 mg/m3 AIR**
Exposure comments : Ten guinea pigs were exposed to 50 ppm for two hours/day.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH		**3-4 d**		

All of the animals were dead after three to four days of exposure.

-	**CONDI**				
-	**BEHAV**				
CNS	**FUNCT**				

Signs of toxicity included general weakness, decreased appetite, reduced alertness and reaction of stimuli and dyspnea. Dyspnea was noted in all exposed animals and the severity of dyspnea increased with the number of exposures.

RESPI	**FUNCT**				
	NEF				

No pathological changes were observed.

References

Primary Reference : **#STANO***
Standard Oil Co. Unpublished data

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
GPIG			**ORL**			**6**	

Species/strain/system : Guinea pig

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **20-95 d**
Dose / Concentration : **20 mg/kg BW**
Exposure comments : Six animals were fed 20 mg/kg/day for 20-95 days.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH				

Five of six animals died within 70 days and the sixth died after 95 days.

BW	**DECR**
RBC	**DECR**
WBC	**DECR**

Loss in weight and anemia associated with leucopenia were observed.

KIDNY	**STRUC**
LIVER	**STRUC**

Degenerative changes in the kidneys and liver were observed.

References

Primary Reference : **MELAAD**
Ceresa, C. and de Blasus, M. Medicina del Lavoro, 41, 78-85, (1950)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
HUMAN						**27**	

Species/strain/system : Nylon workers

Exposure

Exposure Type : **OCC**
Exposure comments : Nylon workers handling adiponitrile and hexamethylenediamine.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
RBC	**DECR**				
WBC	**DECR**				
WBC	**INCR**				

A tendency towards hyperchromic anemia of the hemolytic type , slight leucopenia, and sometimes lymphomonocytosis was observed among 27 nylon workers, especially those handling adiponitrile and hexamethylenediamine.

References

Primary Reference : **MELAAD**
Ceresa, C. Medicina del Lavoro

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
HUMAN			**IHL**			**27**	

Species/strain/system : Factory workers

Exposure

Exposure Type : **OCC**
Dose / Concentration : **33.2-132.8 mg/m3 AIR**
Exposure comments : Exposure of workers to 7 to 28 ppm hexamethylenediamine. Normal plant levels ranged from 0.4 to 1.2 ppm.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
EYE	**IRRIT**				
RESPI	**IRRIT**				

Irritation of the conjunctiva and upper respiratory tract was observed.

NEF

Blood tests gave normal results.

LIVER	**INFL**				**1/20**
SKIN	**ALLER**				

One worker out of 20 developed hepatitis followed by eczema due to hypersensitivity to hexamethylenediamine.

NEF

No anemia was observed.

References

Primary Reference : **MELAAD**
Gallo, G. and Ghiringhelli, L. Medicina del Lavoro, 49, 683-689, (1958)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
MOUSE			**IHL**		**M**	**10/group**	**10**
					F	**10/group**	**10**

Species/strain/system : B6C3F1 Mice

Test Substance

Description of the test substance : Hexamethylenediamine dihydrochloride

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type	:	**SHORT**
Exposure Period	:	**13 wk**
Frequency	:	**6 h/d** **5 d/wk**
Dose / Concentration	:	**1.6-160 mg/m3 AIR**
Exposure comments	:	Groups of mice were exposed for 13 weeks to 1.6, 5, 16, 50, or 160 mg/m3 hexamethylenediamine dihydrochloride (corresponding to 0.5, 1.6, 5, 15, and 51 mg/m3 hexamethylenediamine).

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
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	NEF				

No mice died during the study. Body weights were similar in the treated and the control groups. No compound-related clinical signs of toxicity were seen with the possible exception of rough hair coat, particularly in the males.

	NEF

No compound-related gross pathological lesions were found.

RESPI	**STRUC**
NOSE	**STRUC**

Compound-related microscopic lesions included epithelial atrophy of the respiratory tissue and olfactory nerve degeneration in the nose and nasal cavity. The lesions were seen in females at concentrations of 16 mg/m3 and greater in males at 50 mg/m3 and greater.

RESPI	**STRUC**

Atrophy and ulceration of the laryngeal epithelium were seen in males exposed to 160 mg/m3.

	NEF

No dose-relataed changes in organ weights were seen.

	NEF

No effects were observed on sperm morphology and vaginal cytology.

	LOAEL
	NOAEL

LOAEL = 50 mg/m3 in males and 16 mg/m3 in females. NOAEL = 16 mg/m3 in males and 5 mg/m3 in females. (5 mg/m3 HMDA dihydrochloride = 1.6 mg/m3 HMDA = ca. 0.64 mg/kg body weight/day).

References

Primary Reference : **#NTPSE***

Hejtmancik, M. et al. National Toxicology Program. Technical Report Series, (1988)

Secondary Reference : **!SIDSP***

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**IHL**		**M**	**5/group**	**5**
					F	**5/group**	**5**

Species/strain/system : B6CF1 Mice

Test Substance

Description of the test substance : Hexamethylenediamine dihydrochloride

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **12 d**
Frequency : **6 h/d**
Dose / Concentration : **31-2540 mg/m3 AIR**
Exposure comments : Groups of mice were exposed for 12 days over a 16-day period to 31, 94, 282, 847, or 2540 mg/m3 of hexamethylenediamine dihydrochloride, which corresponded to 10, 30, 90, 267, and 800 mg/m3 of hexamehylenediamine.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH				

Mortality and morbidity occured in mice of both sexes exposed to 2540 mg/m3.

RESPI	**FUNCT**
	BEHAV

Signs of toxicity included dyspnea, rough hair coat, abnormal posture and hypoactivity.

BW	**DECR**

A pronouced depression in mean body weight was evident by day 8 of exposure.

LYMPH	**STRUC**
NOSE	**STRUC**
RESPI	**STRUC**

Changes evident microscopically consisted of lesions in the lymphatic tissue, nasal cavity, trachea, larynx, pancreas, testes and ovaries.

PANCR STRUC
GONAD STRUC

NOSE STRUC
SKIN INFL
STRUC

Effects in the lower concentration groups were limited to ulceration of the mucosa acute inflammation, and atrophy of the neural or respiratory epithelium in the nose and nasal cavity.

LOAEL

LOAEL = 282 mg/m3 in males, 847 mg/m3 in females (based on ulceration, inflammation and atrophy of the neural on respiratory epithelium in the nose and nasal cavity).

NOAEL

NOAEL = 94 mg/m3 in males and 282 mg/m3 in females.

References

Primary Reference : **#NTPSE***
Craig, D. K. et al. National Toxicology Program. Technical Report Series, (1986)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**ORL**		**M**	**5/GROUP**	
					F	**5/GROUP**	

Species/strain/system : B6C3F1 mice

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type : **SHORT**
Exposure Period : **15 d**
Dose / Concentration : **0.2-3.0 mg/mL AQ/DRINK**
Exposure comments : Groups of mice were given drinking water containing 0.2-3.0 mg/mL of test substance for 15 days. (Actual doses: 36, 66, 139, 267 and 564 mg/kg body weight/day for males and 48, 116, 208, 391, 632 mg/kg body weight/day for females).

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	NEF				

No deaths occured during the study.

LIVER	**SIZE**				
BRAIN	**SIZE**				
	NEF				

With the exception of decreased liver-to-brain weight ratios in the female mice in the 0.8 and 3.0 mg/mL groups, no significant effects were observed during the study.

NEF

There were no gross or microscopic lesions in the liver or other organs.

NOAEL

NOAEL = 564 mg/kg body weight/day in males (highest dose evaluated); 632 mg/kg body weight/day in females (highest dose evaluated).

References

Primary Reference : **#NTPSE***
Hejtmancik, M. et al. National Toxicology Program. Technical Report Series, (1985)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**IHL**		**M**	**15/group**	**15**
					F	**15/group**	**15**

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type : **SHORT**
Exposure Period : **7-13 wk**
Frequency : **6 h/d**
5 d/wk
Dose / Concentration : **12.8-215 mg/m3 AIR**
Exposure comments : Groups of rats were exposed for 13 weeks to 12.8 or 51 mg/m3 hexamethylenediamine. A third group exposed to 215 mg/m3 was terminated during the seventh week of the study due to exposure-related deaths.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	DEATH				

Exposure-related deaths in rats exposed to 215 mg/m3.

RESPI	**IRRIT**
EYE	**IRRIT**

Signs of respiratory and conjunctival irritation were noted in the rats exposed to 51 and 215 mg/m3.

BW	**RETAR**

Body weight gain was significantly reduced in male and female rats in the 215 mg/m3 group.

BLOOD	**STIMU**

After five weeks of exposure, slight hemopoietic stimulation of peripheral blood parameters was observed in rats exposed to 215 mg/m3.

RESPI	**STRUC**
NOSE	**STRUC**
LUNG	**STRUC**

Treatment-related microscopic lesions were limited to rats in the 215 mg/m3 group and were confined to the trachea, nasal passages and lungs.

LOAEL
-
NOAEL

LOAEL = 51 mg/m3 (based on local irritation effects without corresponding pathological changes). NOAEL = 12.8 mg/m3 (12.8 mg/m3 HMDA = ca. 2.5mg/kg body weight/day).

References

Primary Reference : **FAATDF**
Johannsen et al. Fundamental and Applied Toxicology, 9, 504-511, (1987)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**IHL**		**M**	**10/group**	**10**
					F	**10/group**	**10**

Species/strain/system : Fisher 344 rats

Test Substance

Description of the test substance : Hexamethylenediamine dihydrochloride

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type : **SHORT**
Exposure Period : **13 wk**
Frequency : **6 h/d**
5 d/wk
Dose / Concentration : **1.6-160 mg/m3 AIR**
Exposure comments : Groups of rats were exposed for 13 weeks to 1.6, 5, 16, 50 or 160 mg/m3 hexamethylenediamine dihydrochloride (corresponding to 0.5, 1.6, 5, 15, and 51 mg/m3 hexamethylenediamine).

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
BW	**DECR**				
	-				
	NEF				

All of the exposed males exhibited body weights slightly below those of the control rats; the decreases were not dose -related but the largest decrease was in the high-dose group (10.6%). No dose-related body weight effects were observed in females.

NEF

No rats died during the study.

RESPI FUNCT
NOSE EXOC

Clinical observations consisted of rales and nasal discharge that occurred relatively late in the study.

NEF

No compound-related gross lesions were observed at necropsy.

LUNG SIZE
GONAD SIZE
HEART SIZE

Organ weight changes were noted in the lungs, epididymis, heart, thymus, kidney and testes.

TYMUS SIZE
KIDNY SIZE

NOSE STRUC
RESPI STRUC

Histopathological examination revealed changes in the nasal cavity and larynx. The nasal lesions were considered moderate in the 160 mg/m3 group and mild in the 50 mg/m3 group for the larynx of the females.

Sperm morphology and vaginal cytology examination did not reveal any compound-related abnormalities.

General Comments : LOAEL = 50 mg/m3; NOAEL = 16 mg/m3 in both sexes (16 mg/m3 HMDA dihydrochloride = 5 mg/m3 HMDA = ca. 1 mg/kg body weight /day).

References

Primary Reference : **#NTPSE***
Hejtmancik, M. et al. National Toxicology Program. Technical Report Series, (1988)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**IHL**				

Test Substance

Description of the test substance : Hexamethylenediamine dust

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **4 wk**
Frequency : **6 h/d**
5 d/wk
Dose / Concentration : **49-262 mg/m3 AIR**
Exposure comments : Groups of rats were exposed to 49 or 262 mg/m3 hexamethylenediamine dust for four weeks.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
NOSE	**IRRIT**				
NOSE	**INFL**				
RESPI	**FUNCT**				

Sneezing, rhinitis, and rattled breathing were observed in the 262 mg/m3 exposure group.

HAIR	**COLOR**				
-	**COR**				
BW	**RETAR**				

Discolored fur, ear and tail lesions (indicative of burns), and decreased weight gain were also observed in the 262 mg/m3 exposure group.

CNS	**BEHAV**				
	CHNG				

In the 49 mg/m3 group, ruffled fur, ptosis, and hypoactivity were noted.

	NEF				

No evidence of target organ toxicity was seen in the 49 mg/m3 group.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**IHL**		**M**	**5/GROUP**	**5**
					F	**5/GROUP**	**5**

Species/strain/system : Fisher 344 rats

Test Substance

Description of the test substance : Hexamethylenediamine dihydrochloride

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type	:	**SHORT**
Exposure Period	:	**12 d**
Frequency	:	**6 h/d**
Dose / Concentration	:	**31-2540 mg/m3 AIR**
Exposure comments	:	Groups of rats were exposed six hours/day for 12 days over a 16-day period to 31, 94, 282, 847, or 2540 mg/m3 hexamethylenediamine dihydrochloride, which correspond to 10, 30, 90, 267 and 800 mg/m3 hexamethylenediamine.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH				

Male and female rats exposed to 2540 mg/m3 either died or were killed due to a moribund condition prior to the scheduled sacrifice.

RESPI	**FUNCT**				
NOSE	**EXOC**				
	BEHAV				

Rats exposed to 2540 mg/m3 exhibited clinical signs of toxicity such as dyspnea, rales, nasal discharge, hypoactivity.

GIT	**FUNCT**				
EYE	**EXOC**				
BW	**DECR**				

Diarrhea and ocular discharge were also observed in the 2540 mg/m3 group; body weights on day 8 were decreased 5.2% in males and 18.5% in females.

LYMPH	**STRUC**				
RESPI	**STRUC**				
PANCR	**STRUC**				

Microscopic changes were observed in lymphatic tissue, the nasal and laryngeal mucosa, the pancreas and the ovary.

RESPI	**INFL**				
RESPI	**STRUC**				

In the 847 mg/m3 concentration group, microscopic observations were limited to acute inflammation and ulceration of the larynx and nasal cavity and the incidence was similar to that observed in the high-dose group.

BW	**RETAR**				

Body weight gain was depressed by 8.3% and 19.2% in male and female rats, respectively in the 847 mg/m3 concentration group.

-	**NEF**				
RESPI	**INFL**				
RESPI	**STRUC**				

No microscopic changes were observed in females exposed to 282 mg/m3 or lower, while minimal to slight laryngeal inflammation and ulceration was observed in a few males at the lower dose levels.

LOAEL	
-	
NOAEL	

LOAEL = 94 mg/m3 in males and 282 mg/m3 in females (based on larynx and nasal ulceration). NOAEL = 31 mg/m3 in males; 94 mg/m3 in females.

General Comments	:	(31 mg/m3 HMDA dihydrochloride = 10 mg/m3 HMDA = 1.8 mg/kg body weight/day HMDA assuming 100% absorption by a 250 g rat breathing 0.045 m3/6h).

References

Primary Reference : **#NTPSE***
Craig, D. K. et al. National Toxicology Program. Technical Report Series, (1986)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**IHL**			**10**	

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure comments : Five rats were exposed to vapors developed at 45C and at approximately 4 L/minute. The rats were given seven, 4 hours exposures in 9 days. In a second series of experiment, 5 rats were exposed to the gases similarly liberated with an air flow of 6.5 liters/minute.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
RESPI	**IRRIT**		**3 mi**		
RESPI	**FUNCT**				

In the initial experiment, the rats showed severe irritation of the mucous membranes within three minutes and the respiration became jerky.

NEF

None of the animals died. Upon gross pathological examination, the lungs and trachea as well as the other organs were found to be normal.

ABDOM **INFL** **1/5**

One rat had an abdominal abscess.

RESPI **FUNCT**
SKIN **COLOR**

In the second experiment, the respiration became jerky, and the animals became cyanotic soon after the beginning of the exposure.

NOSE CIRC 1/5
DEATH

One rat that developed hemorrhages around the nose died during the fourth exposure.

LUNG CIRC
LIVER CIRC
SPLN SIZE

Small subpleural hemorrhages in the lung were revealed during necropsy of the dead rat. The liver was small and congested, the spleen was small and the other viscera were normal.

SPLN COLOR
RESPI COLOR
KIDNY COLOR

The outstanding histopathological finding was brown pigmentation in the spleen, the peripancreatic lymph nodes, and the tubular epithelium of the kidney.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**IHL**				

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **11-15 d**
Frequency : **6 h/d**
Dose / Concentration : **998-9984 mg/m3 AIR**
Exposure comments : Groups of rats were repeatedly exposed for six hours/day to 210, 1050, or 2100 ppm hexamethylenediamine.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	DEATH				**3/8**

Three of eight rats exposed to 2100 ppm died after two exposures.

NOSE	**IRRIT**
RESPI	**FUNCT**
CNS	**BEHAV**

Surviving rats exhibited nasal irritation, respiratory difficulty and lethargy.

LUNG	**CIRC**
LUNG	**INFL**
KIDNY	**STRUC**

Necropsy revealed lungs congestion, peribronchiolar inflammation, areas of hemorrhage and enema in the lungs and vacuolation of kidney tubules.

	DEATH	**1/10**

One of 10 rats exposed 11 times to 1050 ppm died.

LUNG	**IRRIT**
BW	**RETAR**
CNS	**BEHAV**

Signs of toxicity included lung and nasal irritation, reduced weight gain, and lethargy.

URINE	**NEF**
BLOOD	**NEF**

Urine and blood tests were normal.

LUNG	**CIRC**
LUNG	**INFL**

Necropsy revealed petechial hemorrhage in the lungs and lung inflammation.

NEF

No signs of toxicity including histopathology were seen in the rats exposed 15 times to 210 ppm.

General Comments : 210 ppm was the concentration at which no toxic effects were observed.

References

Primary Reference : **BJIMAG**
Gage, J. C. British Journal of Industrial Medicine, 27(1), 1-18, (1970)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**SKN**			**12**	

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Dose / Concentration : **1-2 %**
Exposure comments : A 1% paste in vaseline was applied to the intact shaved skin of six rats, five days/week for a total of 16 treatments. Six additional rats received treatment with a 2% paste for a total of seven treatments.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
SKIN	**CIRC**	**RV**			
SKIN	**CHNG**				

The first several applications of the 1% paste produced erythema and scaling of the skin, but the effects gradually subsided and new hair nearly covered the area by the final treatment.

LIVER	**STRUC**				

Mild degenerative changes in the liver were noted in three rats.

KIDNY	**TUBUL**				

Mild to moderate regressive lesions were seen in the renal tubules of two rats.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**		**M**	**15/GROUP**	**15**
					F	**15/GROUP**	**15**

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type : **SHORT**
Exposure Period : **13 wk**
Dose / Concentration : **50-500 mg/kg BW**
Exposure comments : Rats were fed diets containing 50, 150 or 500 mg/kg/day for 13 weeks.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	NEF				

No adverse clinical observations or treatment-related deaths occured during the study.

-	**NEF**
-	**-**
BW	**DECR**

There were no significant effects on food consumption or weight gain, although an apparent dose-related decrease in overall weight gain occurred in the 150 and 500 mg/kg groups over the testing period.

NEF

There was no significant effect on clinical chemistry or hematological parameters after either 42 or 48 days.

SIZE
-
NEF

Sporadic, statistically significant differences in several absolute or relative organ weights were observed between treated and control groups. The changes were not dose- related and there were no histopathological changes observed in any organ.

NOAEL

NOAEL = 500 mg/kg body weight/day in both sexes (highest dose evaluated).

References

Primary Reference : **JJATDK**
Johannsen, F. R. and Sevinskas, G. J. Journal of Applied Toxicology, 7(4), 259-263, (1987)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**ORL**		**M**	**5/GROUP**	
					F	**5/GROUP**	

Species/strain/system : Fisher rats

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type : **SHORT**
Exposure Period : **15 d**
Dose / Concentration : **0.75-6.7 mg/mL AQ DRINK**
Exposure comments : Groups of rats were given drinking water containing 0.75-6.0 mg/mL (males) and 0.83-6.7 mg/mL (females) for 15 days. (Target doses = 100, 200, 400, 600, 800 mg/kg body weight/day) actual doses = 96, 189, 357, 449, 545 for males and 126, 263, 422, 517, 634 for females).

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	NEF				

No deaths or abnormal clinical observations were associated with treatment.

	BEHAV		
	NEF		

Water consumption was depressed in several groups; however, body weights were unaffected by treatment.

TYMUS	**SIZE**	**M**	

Thymus weights in the high-dose males (6.0 mg/mL) were depressed relative to control groups.

LIVER	**SIZE**	**F**	

Liver weights in the 1.7, 5.0 and 6.7 mg/mL females were depressed relative to the control groups.

	NEF		

There were no gross or microscopic changes in thymus and liver or other organs.

	LOAEL		

LOAEL > 545 mg/kg body weight/day in males (highest dose evaluated) and 634 mg/kg body weight/day in females (based on decreased liver weight).

	NOAEL		

NOAEL = 545 mg/kg body weight/day in males and 517 mg/kg body weight/day in females.

References

Primary Reference : **#NTPSE***
Hejtmancik, M. et al. National Toxicology Program. Technical Report Series, (1985)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**			**6**	

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **2 wk**
Frequency : **5 d/wk**
Dose / Concentration : **300 mg/kg BW**

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH		**10 d**		**1/6**

One rat died after the tenth day.

BW **RETAR**

The remainder rats failed to gain weight.

General Comments : The effects seemed to be associated with the caustic property of the material.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-8-48

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MAMMALIAN TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**				

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Dose / Concentration : **400 mg/kg BW**
Exposure comments : One mL of a 10% solution of test substance (ca. 400 mg/kg/day) was administered by gavage.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH				

The rats died after two to four doses.

GIT	**STRUC**
STM	**STRUC**

Pathological evaluation revealed considerable necrotic and ulcerative processes in the epithelium of the mucosa of the mouth and stomach.

References

Primary Reference : **YJBMAU**
Von Oettingen, W. F. Yale Journal of Biology and Medicine, 15, 167, (1942)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **CARCINOGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**SKN**				

Test Substance

Vehicle - Solvent : Benzene

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **4 mo**
Frequency : **3 x/wk**
Exposure comments : A 1% solution in benzene was painted on the back 3 times/week for four months.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	NEF				

No evidence of carcinogenicity.

References

Primary Reference : **CNREA8**
Oppenheimer, G. S. et al. Cancer Research, 15, 333-340, (1955)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MUTAGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
BACT			**VTR**				

Species/strain/system : Salmonella typhimurium TA1950, TS24, TA1537, TA1538, TA1952, G46 and GW19

Test Method and Conditions

Test method description : Bacterial test for gene mutation

Exposure

Exposure comments : Tested for co-mutagenic activity with nitrite.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	NEF				

Negative result

References

Primary Reference : **ENMUDM**
Murphy-Corb, M. et al. Environmental Mutagenesis, 5(1), 101-109, (1983)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MUTAGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
BACT			**VTR**				

Species/strain/system : Salmonella typhimurium TA1535, TA1537 and TA1538

Test Method and Conditions

Test method description : Bacterial test (Gene mutation), Ames test; GLP: no data

Exposure

Dose / Concentration : **100 ug/ PLATE**
Exposure comments : Test was performed with and without S-9 activation.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	NEF				

Negative results with and without metabolic activation.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-378-75

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MUTAGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
BACT			**VTR**				

Species/strain/system : Salmonella typhimurium TA100, TA1535, TA1537, and TA98

Test Method and Conditions

Test method description : Bacterial test (Gene mutation), Ames test; GLP: no data

Exposure

Dose / Concentration : **10 ug/ PLATE**
Exposure comments : Tests were performed with and without metabolic activation (S9).

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	NEF				

Negative results with and without metabolic activation.

References

Primary Reference : **#ENMUDM**
Mortelmans, K. et al. Environmental Mutagenesis, 8 Suppl.7, 1-119, (1986)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MUTAGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**VTR**				

Species/strain/system : BALB/3T3 Clone A31 mouse cells

Test Method and Conditions

Test method description : Morphological transformation; GLP: no data

Exposure

Exposure comments : Test was performed with and without metabolic activation.

Test Results

Genotoxic effect without metabolic activation

NEF
Negative genotoxic effect with metabolic activation

CELL
Lowest concentration producing cell toxicity was 100 ug/mL

General Comments : OECD/SIDS classification: positive result.

References

Primary Reference : **#URBSF***
BASF AG. BASF Unpublished Report, (1980)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MUTAGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**		**M**		
					F		

Test Method and Conditions

Test method description : Cytogenetic assay (Chromosomal aberration). Cytognenetic analysis of bone marrow; GLP: yes

Exposure

Exposure Type : **ACUTE**
Dose / Concentration : **75-750 mg/kg BW**
Exposure comments : Doses of 0, 75, 250 and 750 mg/kg were administered by oral gavage to groups of rats. Six males and six female animals were sacrificed at 6, 24 and 48 hours after dosing.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	NEF				

Negative result. Chromosome aberrations were not significantly increased in the treated groups compared to control.

Lowest dose producing toxicity was 250 mg/kg.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report, (1984)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **MUTAGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**VTR**				

Species/strain/system : Primary rat hepatocytes

Test Method and Conditions

Test method description : Unscheduled DNA synthesis; GLP: no data

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	NEF				

Negative result in unscheduled DNA synthesis test

	CELL				

Lowest concentration producing cell toxicity was 1000 nL/mL.

References

Primary Reference : **#URBSF***
BASF AG. BASF Unpublished Report, 81/229

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **SENSITIZATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
GPIG							

Species/strain/system : Guinea pig

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure comments : 2% aqueous solution was used.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	NEF				

No irritation or sensitization

General Comments : OECD/SIDS comment: non-sensitizer in guinea pigs.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-8-48

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **SENSITIZATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
GPIG							

Species/strain/system : Guinea pig

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure comments : No data concerning exposure.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
SKIN	**NEF**				
SKIN	**IRRIT**				

Irritation was produced but no sensitization.

General Comments : OECD/SIDS comment: nonsensitizer in guinea pigs.

References

Primary Reference : **AEXPBL**
Zeller, H. Archiv fuer Experimentelle Pathologie und Pharmakologie, 232, 239-240, (1957)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **SENSITIZATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
HUMAN						**310**	

Test Substance

Vehicle - Solvent : Water

Exposure

Exposure Type : **OCC**
Exposure comments : A study of 310 workers involved in the production of condensers. Workers were potentially exposed to TiO2, cellulose, nitrate, styrene, hexamethylenediamine, capon lacquer, and epoxide tar.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
LUNG	**ALLER**				

Atopic forms of bronchial asthma

NOSE	**ALLER**				

Allergic rhinitis

SKIN	**ALLER**				

Allergic dermatitis

References

Primary Reference : **ZKMAAX**
Engibaryan, L. A. and Frangulyan, R. A. Zhurnal Eksperimental'noi i Klinisches Koi Meditsiny
(Journal of Experimental and Clinical Medicine), 23(6), 569-599, (1983)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **SENSITIZATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
HUMAN			**SKN**			**4**	

Exposure

Exposure Type : **OCC**
Exposure comments : Nylon factory workers exposed to hexamethylenediamine.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
SKIN	**ALLER**				**4**

Dermatitis caused by hexamethylenediamine occurred in four workers in a nylon factory. The condition reappeared rapidly if the same work was resumed.

References

Primary Reference : **AMPMAR**
Duverneuil, G. and Buisson, G. Archives des Maladies Professionnelles de Medecine du Travail et de Securite Sociale, 13, 389-390, (1952)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
GPIG			**SKN**			**10**	

Species/strain/system : Guinea pig

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Dose / Concentration : **0.05 mL**
Exposure comments : 0.05 mL of test substance was applied to intact shaved skin of guinea pigs.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
SKIN	**COR**				

Severe necrosis within one hour

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-164-69, (1969)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**SKN**				

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure comments : No data concerning exposure

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
SKIN	**IRRIT**				

Irritation was produced at a concentration as low as 1% in vaseline.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-26-47, (1947)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RBT			**OCU**				

Species/strain/system : Rabbit

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure comments : 25% aqueous solution of hexamethylenediamine was used.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
EYE	**COR**	**PM**			

Irreversible damage. Classified as corrosive to the eye.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RBT			**OCU**				

Species/strain/system : Rabbit

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Exposure comments : 85% hexamethylenediamine was used.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
EYE	**IRRIT**	**RV**			

Severe initial reaction with extensive lacrimation. Six hours later, the irritation had progressed to severe conjunctivitis. The treated eyes had returned to normal within 5 to 10 days after treatment.

References

Primary Reference : **STANO***
Standard Oil Co. Unpublished data

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RBT			**SKN**				

Species/strain/system : Rabbit

Test Method and Conditions

Test method description : DOT corrosivity test; GLP: no data

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
SKIN	**COR**				

Corrosive

General Comments : The test substance was classified as corrosive.

References

Primary Reference : **#IBTUR***
Industrial Biotest Unpublished Report, (1972)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RBT			**SKN**				

Species/strain/system : Rabbit

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Exposure Period : **24 h**
Exposure comments : Aqueous solution of 6 and 10% hexamethylenediamine were applied to the intact clipped skin of rabbits for 24 hours.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
SKIN	**COR**				

Severe skin damage

	NEF				

No skin irritation was observed when the skin was washed within one minute of application.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-218-72, (1972)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RBT			**SKN**				

Species/strain/system : Rabbit

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Exposure Period : **24 h**
Exposure comments : Rabbits were treated for 24 hours with an aqueous solution of 25% hexamethylenediamine.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
SKIN	**COR**	**PM**			

Irreversible damage was observed.

General Comments : Hexamethylenediamine was classified as corrosive to the skin.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **IRRITATION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RBT			**SKN**			**3**	

Species/strain/system : Rabbit

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **ACUTE**
Exposure Period : **15 mi**
Exposure comments : Three rabbits were treated with 85% hexamethylenediamine for 15 minutes.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
SKIN	**IRRIT**	**RV**	**1 mi**		**2**

Painful reactions were observed within a minute after application. Immediately after removal of the patch, the treated area was extremely erythemic with numerous small vesicles or blisters. Eventual healing and regrowth of hair occurred in two rabbits.

SKIN	**COR**				**1**

Necrosis was noted in the other rabbit, which may have been due to the animal scratching the treated area. The area eventually healed with slight scarring.

References

Primary Reference : **#STANO***
Standard Oil Co. Unpublished data

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**IMMUNOTOXICITY**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**				

Test Method and Conditions

Test method description	:	Immunologic parameters were evaluated at various times; GLP: no data

Exposure

Exposure Type	:	**LONG**
Exposure Period	:	**12 mo**
Dose / Concentration	:	**0.1-10 mg/mL AQ DRINK**
Exposure comments	:	Concentrations of 0.1, 1, or 10 mg/mL were administered via the drinking water for 12 months.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
ABO	**INHIB**				
SPLN	**DECR**				

The highest concentration inhibited production of antiviral complement-binding antibodies and reduced lymphoid spleen tissue. Follide involution and replacement by connective tissue was evident histologically.

References

Primary Reference	:	**JHEMA2** Shubik, V. M. et al. Journal of Hygiene, Epidemiology, Microbiology and Immunology, 22, 408-414, (1978)
Secondary Reference	:	**!SIDSP*** OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **REPRODUCTION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**IHL**		**M**	**20**	
					F	**40**	

Species/strain/system : B6C3F1 mice

Test Substance

Description of the test substance : Hexamethylenediamine dihydrochloride

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **13 wk**
Frequency : **6 h/d**
Dose / Concentration : **16-160 mg/m3 AIR**
Exposure comments : Groups of mice were exposed to hexamethylenediamine dihydrochloride at 16, 50, or 160 mg/m3 (corresponding to 5, 15 and 51 mg/m3 HMDA), for 13 weeks and mated to produce F1 offspring.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
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NEF

No parental body weight effects or compound-related clinical signs were observed.

NEF

All mating, gestation, and lactation parameters were similar to the control group.

NEF

No adverse effects were noted in offspring.

NOEL

NOEL for P generation: 160 mg/m3. NOEL for F1 generation: 160 mg/m3 (160 mg/m3 HMDA dihydrochloride = 51 mg/m3 HMDA = 20.4 mg/kg body weight in the mouse).

References

Primary Reference : **#NTPSE***
Hejtmancik, M. et al. National Toxicology Program. Technical Report Series, (1988)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **REPRODUCTION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**IHL**		**M**	**20**	
					F	**40**	

Species/strain/system : Fisher 344 rats

Test Substance

Description of the test substance : Hexamethylenediamine dihydrochloride

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **13 wk**
Frequency : **6 h/d**
Dose / Concentration : **16-160 mg/m3 AIR**
Exposure comments : Groups of rats were exposed to hexamethylenediamine dihydrochloride at 16, 50, or 160 mg/m3 (corresponding to 5, 15 and 51 mg/m3 HMDA), for 13 weeks and mated to produce F1 offspring.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
	NEF			**M**	

No effects occurred in male body weight.

BW	**DECR**			**F**	

Female body weights were lower on gestation day 0.

	NEF				

No effects on male or female fertility or gestation length.

	NEF				

No effects were noted in pup weight, litter size, pup survival or incidence of morphological malformations.

	NOEL				

NOEL for P generation: 160 mg/m3; NOEL for F1 generation: 160 mg/m3. (160 mg/m3 HMDA dihydrochloride = 51 mg/m3 HMDA = 9.2 mg/kg body weight/day in the rat).

References

Primary Reference : **#NTPSE***
Hejtmancik, M. et al. National Toxicology Program. Technical Report Series, (1988)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **REPRODUCTION**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**ORL**		**M**		
					F		

Test Method and Conditions

Test method description : Study design satisfies EPA/OECD/JMAFF Guidelines, GLP: yes

Exposure

Exposure Type : **LONG**
Exposure Period : **2 GN**
Dose / Concentration : **50-500 mg/kg BW/d**
Exposure comments : Rats were exposed via the diet to hexamethylenediamine at 0, 50, 150 or 500 mg/kg/day for two generations.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
BW	**DECR**				

Significant decreases occurred in the body weights of P and F1 males in the 500 mg/kg/day group. Female weights were decreased in the 500 mg/kg/day group during gestation.

FETUS **SIZE**

The F1 litter size in the 500 mg/kg/day group was significantly decreased on day 0 of lactation; the value was similar in the 500 mg/kg/day group in the F2 generation, but it was not significant.

OFSPR **SIZE**

At birth, pup weights were similar to the control group, but were significantly lower in the 500 mg/kg/day by day 21 of lactation in both the F1 and F2 generations.

NOEL
NOEL
NOEL

NOEL for P generation: 150 mg/kg body weight/day; NOEL for F1 generation: 150 mg/kg body weight/day. NOEL for F2 generation: 150 mg/kg body weight/day.

References

Primary Reference : **FAATDF**
Short, R. D. et al. Fundamental and Applied Toxicology, 16, 490-494, (1991)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **TERATOGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE			**IPR**		**F**		

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
Exposure Period : **10-14 TDP**
Frequency : **4 x/d**
Dose / Concentration : **103 mg/kg**
Exposure comments : Pregnant mice were exposed by IPR injection of 103 mg/kg, four times/day, on days 10-14 of gestation.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
FETUS	**-**				
FETUS	**SIZE**				

Retarded fetal skeletal development and retarded weight gain were the only effects mentioned.

References

Primary Reference : **#MONSC***
Monsanto Company Unpublished Report

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **TERATOGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
MOUSE					**F**		

Test Method and Conditions

Test method description : Fetal ornithine decarboxylase activity was evaluated two hours post-treatment. Fetal weights were collected and skeletal and visceral examinations were conducted on gestation day 18 fetuses, GLP: no data.

Exposure

Exposure Type : **SHORT**
Exposure Period : **10-14 TDP**
Dose / Concentration : **103 mg/kg BW**
Exposure comments : Mice were treated with 0.89 mM/kg of HMDA on days 10-14 of gestation.

Test Results

Organ	Effect	Rev.	OnSet	Sex	Affected in Exposed - Controls
FETUS	**BIOCH**				
-	**-**				
FETUS	**SIZE**				

Ornithine decarboxylase activity was decreased on days 10- 12. Fetal weight was decreased as measured on day 18 of gestation.

NEF

No skeletal or visceral effects were seen.

References

Primary Reference : **TJADAB**
Manen, C. A. et al. Teratology, Journal of Abnormal Development, 28(2), 237-242, (1983)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **TERATOGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	Medium	Specification	Route	Lifestage	Sex	Number exposed	Number controls
RAT			**ORL**		**F**	**22/GROUP**	

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type	:	**SHORT**
Exposure Period	:	**6-15 TDP**
Dose / Concentration	:	**112-300 mg/kg BW**
Exposure comments	:	Groups of pregnant rats were dosed by gavage with 112, 184, or 300 mg/kg of HMDA on days 6-15 of gestation.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH				

In the 300 mg/kg group, one dam died and one was sacrificed in moribund condition; both were considered to be compound- related.

BW	**DECR**

Decreased weight gain during dosing and decreased overall weight gain on gestation day 21 was observed in the 300 mg /kg group.

	NEF

No effects were seen on the number of implantation sites, mean litter size, or incidence of resorptions.

-	**NEF**
FETUS	**SIZE**

No effects were seen on the sex ratio or fetal length; however fetal weight was decreased in the 300 mg/kg group.

	NEF

No compound-related malformations were seen.

FETUS

An increased incidence of spotty livers occurred in the 300 mg/kg fetuses. An increased incidence of poorly or unossified cervical centra or sacral/caudal vertebra was observed in the 184 and 300 mg/kg groups.

NOEL

NOEL for Maternal Toxicity: 184 mg/kg/day. NOAEL for Fetal Toxicity: 184 mg/kg/day.

NOEL

NOEL for Fetal Malformations: 300 mg/kg/day (no major or minor malformations, however, increased incidence of anatomical variations and ossification delays at 184 and 300 mg/kg/day).

References

Primary Reference : **JJATDK**
Johannsen, F. R. and Levinskas, G. J. Journal of Applied Toxicology, 7(4), 259-263, (1987)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **TERATOGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**		**F**	**4-6/GROUP**	

Test Method and Conditions

Test method description : GLP: yes

Exposure

Exposure Type : **SHORT**
Exposure Period : **6-15 TDP**
Dose / Concentration : **112.5-900 mg/kg BW**
Exposure comments : Groups of four to six pregnant rats were dosed by gavage with 112.5, 225, 450, or 900 mg/kg on days 6-15 of gestation.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	DEATH				

All of the dams in the 450 and 900 mg/kg groups died within 6 days of treatment; gross examination revealed internal hemorrhaging. No death occurred in the 112.5 or 225 mg/kg groups.

Reduced body weight gain at 225 mg/kg/day in dams was observed.

NEF

No adverse effects on pregnancy and litter data was observed in surviving dams.

NEF

No malformations were detected.

NOEL

NOEL for Maternal Toxicity: 112.5 mg/kg/day

NOEL

NOEL for Fetal Toxicity: 225 mg/kg/day

References

Primary Reference : **JJATDK**
Johannsen, F. R. and Levinskas, G. J. Journal of Applied Toxicology, 7(4), 259-263, (1987)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **TERATOGENICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
RAT			**ORL**		**F**		

Test Method and Conditions

Test method description : GLP: no data

Exposure

Exposure Type : **SHORT**
0-14 TDP
Dose / Concentration : **10-200 mg/kg BW**
Exposure comments : Pregnant rats were administered 10, 100, or 200 mg/kg by gavage on days 0-14 of gestation.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*

NEF
No effect on litter size resorptions, or corpora lutea.

NEF
No fetal malformations detected.

NOEL
NOEL for Maternal Toxicity: 100 mg/kg/day (based on decreased body weight at 200 mg/kg). NOEL for Fetal Toxicity: 200 mg/kg/day.

References

Primary Reference : **TOLED5**
David, R. M. and d'A. Heck, H. Toxicology Letters, 17(1-2), 49-55, (1983)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **AQUATIC ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Species/strain/system : Guppy (Poecilia reticulata)

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
FISH	**AQ**	**FRESH**				**LC50**	LC50 for 48 hours = 100-500 mg/L.

General Comments : The given concentration is calculated.

References

Primary Reference : **BASFB***
BASF AG. Safety Bulletin

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **AQUATIC ACUTE TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Species/strain/system : Bluegill sunfish (Lepomis macrochirus)

Test Method and Conditions

Test method description : Static

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
FISH	**AQ**	**FRESH**				**LC50**	LC50 for 48 hours = 73.5 mg/L.

General Comments : This chemical is slightly toxic to bluegills. The given concentration is calculated.

References

Primary Reference : **CLNSAG**
Scheier, A. Contributions from the Department of Limnology Academy of Natural Sciences of Philadelphia, (1965)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**AQUATIC ACUTE TOXICITY**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Species/strain/system	:	Bluegill sunfish (Lepomis macrochirus)

Test Method and Conditions

Test method description	:	Static aerated. Dilution water: reconstituted, deionized water; five concentrations plus two controls (acetone and water), two to four replicates per concentration, five fish per replicate (age unspecified).
Temperature	:	**19-20 C**

Test Results

Organism	*Medium*	*Spec.*	*Route*	*Lifestage*	*Sex*	*Effect*	*Effect Comments*
FISH	**AQ**	**FRESH**				**LC50**	LC50 for 48 hours and 96 hours > 56 mg/L.

General Comments : This chemical is slightly toxic to bluegills. The given concentration is calculated. An NOEC value also reported > 56 mg /L.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-40-69, (1969)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**AQUATIC ACUTE TOXICITY**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Species/strain/system	:	Fathead minnow (Pimephales promelas), 9-months

Test Method and Conditions

Test method description	:	Static unaerated. Dilution water: well water. pH of test solutions adjusted to provide acceptable range for survival; EDTA hardness =79 mg/L CaCO3; 9 concs. plus control, 2 replicates per conc; ten 9-month old fish per replicate; GLP: yes
Temperature	:	**22 C**
pH	:	**8-8.5**
Dissolved Oxygen	:	**>60% MG/L**
Hardness of Water	:	**79 MG/L**

Test Results

Organism	Medium	Spec.	Route	Lifestage	Sex	Effect	Effect Comments
FISH	**AQ**	**FRESH**		**ADULT**		**LC50**	LC50 for 96 hours = 1825 mg/L.

General Comments : The give concentration is calculated. The acute toxicity of hexamethylenediamine to fathead minnows was low.

References

Primary Reference : **#UREID***

Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-439-85, (1985)

Secondary Reference : **!SIDSP***

OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **AQUATIC TOXICITY**
Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**
Geographic Area : **CAN**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
ALGAE	**AQ**	**FRESH**					

Species/strain/system : Algae (Selenastrum capricornutum)

Test Method and Conditions

Test method description : Based on OECD Method 201 (1984); static; GLP: yes. End point: growth inhibition. The dissolved oxygen was at 60% and pH = 8.5.
Temperature : **24.5-25.0 C**
pH : **7.5**

Exposure

Exposure comments : Six concentrations plus a control, were evaluated with sterile enriched media.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	EC50 INHIB				

EC50 for 96 hours = 14.8 mg/L

	LOEC INHIB				

LOEC for 96 hours = 15 mg/L

	NOEC INHIB				

NOEC (no observed effect concentration) for 96 hours = 10 mg/L.

General Comments : HMDA exhibited moderate toxicity to S. capricornutum. The given concentrations are calculated.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-167-93, (1993)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**AQUATIC TOXICITY**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
BACT							

Species/strain/system : Bacteria (Nitrosomonas, sp.)

Test Method and Conditions

Test method description : End point: the degree of inhibition of ammonia oxidation (nitrification) was determined; GLP: no

Exposure

Exposure Period	:	**2 h**
Dose / Concentration	:	**10-100 mg/L**
Exposure comments	:	Cultures were exposed over a 2-hour period to concentrations of 10, 50 or 100 mg/L.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	IC50 INHIB				

(EC50 for inhibition) estimated concentration producing 50% inhibition over a 2-hour period = 85 mg/L.

General Comments : The test concentrations are calculated.

References

Primary Reference : **JWPFA5**
Hockenbury, M. R. and Grady, C. P. Journal of the Water Pollution Control Federation, 768-777, (1977)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point	:	**AQUATIC TOXICITY**
Chemical Name	:	**Hexamethylenediamine**
CAS Number	:	**124-09-4**
Study type	:	**LAB**
Geographic Area	:	**CAN**

Test Subject

Organism	*Medium*	*Specification*	*Route*	*Lifestage*	*Sex*	*Number exposed*	*Number controls*
CRUS	**AQ**	**FRESH**		**JUV**		**10/CONC**	

Species/strain/system : Water flea (Daphnia magna)

Test Method and Conditions

Test method description	:	Static. Dilution water: filtered fish tank. EDTA hardness = 83 mg/L CaCO3. End point: immobility; GLP: yes
Temperature	:	**20 C**
pH	:	**8.5**
Dissolved Oxygen	:	**>=60% MG/L**
Hardness of Water	:	**83 MG/L**

Exposure

Exposure comments : Nine concentrations plus control, two replicates per concentration, ten <24-hour neonate daphnids per replicate.

Test Results

Organ	*Effect*	*Rev.*	*OnSet*	*Sex*	*Affected in Exposed - Controls*
	EC50 BEHAV				

EC50 immobility for 48 hours = 23.4 mg/L.

General Comments : HMDA exhibited moderate toxicity to D. magna.

References

Primary Reference : **#UREID***
Du Pont. E. I. Du Pont de Nemours & Company Inc. Unpublished Report, HL-303-85, (1985)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Study

End Point : **TERRESTRIAL ACUTE TOXICITY**

Chemical Name : **Hexamethylenediamine**
CAS Number : **124-09-4**
Study type : **LAB**
Geographic Area : **CAN**

Species/strain/system : Redwinged blackbird (Agelaius phoenicus)
Exposure Type : **ACUTE**

Test Results

Organism	Medium	Spec.	Route	Lifestage	Sex	Effect	Effect Comments
BIRD			**ORL**			**LD50**	Approximate lethal dose >101 mg/kg.

References

Primary Reference : **AECTCV**
Schafer, E. W. Archives of Environmental Contamination and Toxicology, 12(3), 355-382, (1983)

Secondary Reference : **!SIDSP***
OECD/SIDS. Screening Information Data Set (SIDS) of OECD High Production Volume Chemicals Programme, (1994)

Substance

[redacted]

Chemical Name : **1,6-HEXANEDIAMINE**
HEXAMETHYLENE DIAMINE
HEXAMETHYLENEDIAMINE SOLIDE (FR)

Reported Name : **HEXAMETHYLENEDIAMINE**

Area	*Type*	*Subject*	*Spec.*	*Description*	*Level / Summary Information :*
CAN	**REG**	**TRNSP LABEL PACK**	**-**	**CLASS RQR**	SOLID. PIN (PRODUCT IDENTIFICATION NO.): UN2280. CLASS (8): CORROSIVE. PACKING GROUP III, (I=GREAT DANGER, III=MINOR DANGER). MAXIMUM AMOUNT PER PACKAGE THAT MAY BE TRANSPORTED ON A PASSENGER AIRCRAFT OR VEHICLE: 25 KG. MAXIMUM AMOUNT PER PACKAGE THAT MAY BE TRANSPORTED ON A CARGO AIRCRAFT: 100 KG. PRESCRIBED BY THE TRANSPORTATION OF DANGEROUS GOODS REGULATIONS, UNDER THE TRANSPORTATION OF DANGEROUS GOODS ACT (ADMINISTERED BY THE DEPARTMENT OF TRANSPORT). THE ACT AND REGULATIONS ARE INTENDED TO PROMOTE SAFETY IN THE TRANSPORTATION OF DANGEROUS GOODS IN CANADA, AS WELL AS PROVIDE ONE COMPREHENSIVE SET OF RULES APPLICABLE TO ALL MODES OF TRANSPORT ACCROSS CANADA. THESE ARE BASED ON UNITED NATIONS RECOMMENDATIONS. THE ACT AND REGULATIONS SHOULD BE CONSULTED FOR DETAILS. RECORDS ARE ENTERED UNDER THE PROPER SHIPPING NAME FOUND IN THE REGULATIONS; THIS MAY INCLUDE VERY GENERAL GROUPS OF CHEMICAL SUBSTANCES. ***Title :*** ***Reference :*** ***Effective Date :*** 06DEC1990 ***Last Amendment :*** **CAGAAK, 124, 26, 5523, 1990** **Canada Gazette Part II** ***Entry / Update :*** OCT1991

Substance

[redacted]

Chemical Name : **1,6-HEXANEDIAMINE**
HEXAMETHYLENE DIAMINE
HEXAMETHYLENEDIAMINE, SOLUTION DE (FR)

Reported Name : **HEXAMETHYLENEDIAMINE**

Area	*Type*	*Subject*	*Spec.*	*Description*	*Level / Summary Information :*
CAN	**REG**	**TRNSP LABEL PACK**	**-**	**CLASS RQR**	SOLUTION. PIN (PRODUCT IDENTIFICATION NO.): UN1783. CLASS (8): CORROSIVE; CLASS (6.1): POISONOUS. PACKING GROUP II, (I=GREAT DANGER, III=MINOR DANGER). MAXIMUM AMOUNT PER PACKAGE THAT MAY BE TRANSPORTED ON A PASSENGER AIRCRAFT OR VEHICLE: 1 L. MAXIMUM AMOUNT PER PACKAGE THAT MAY BE TRANSPORTED ON A CARGO AIRCRAFT: 30 L. PRESCRIBED BY THE TRANSPORTATION OF DANGEROUS GOODS REGULATIONS, UNDER THE TRANSPORTATION OF DANGEROUS GOODS ACT (ADMINISTERED BY THE DEPARTMENT OF TRANSPORT). THE ACT AND REGULATIONS ARE INTENDED TO PROMOTE SAFETY IN THE TRANSPORTATION OF DANGEROUS GOODS IN CANADA, AS WELL AS PROVIDE ONE COMPREHENSIVE SET OF RULES APPLICABLE TO ALL MODES OF TRANSPORT ACCROSS CANADA. THESE ARE BASED ON UNITED NATIONS RECOMMENDATIONS. THE ACT AND REGULATIONS SHOULD BE CONSULTED FOR DETAILS. RECORDS ARE ENTERED UNDER THE PROPER SHIPPING NAME FOUND IN THE REGULATIONS; THIS MAY INCLUDE VERY GENERAL GROUPS OF CHEMICAL SUBSTANCES. ***Title :*** ***Reference :*** ***Effective Date :*** 06DEC1990 ***Last Amendment :*** **CAGAAK, 124, 26, 5523, 1990** **Canada Gazette Part II** ***Entry / Update :*** OCT1991

Substance

[redacted]

Chemical Name : **1,6-HEXANEDIAMINE**
HEXAMETHYLENEDIAMINE (FR)

Reported Name : **HEXAMETHYLENEDIAMINE**

CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
CAN	REG	USE STORE LABEL	OCC	RQR	INGREDIENT DISCLOSURE LIST CONCENTRATION 1% WEIGHT/WEIGHT. THE WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) IS A NATIONAL SYSTEM TO PROVIDE INFORMATION ON HAZARDOUS MATERIALS USED IN THE WORKPLACE. WHMIS IS IMPLEMENTED BY THE HAZARDOUS PRODUCTS ACT AND THE CONTROLLED PRODUCTS REGULATIONS (ADMINISTERED BY THE DEPARTMENT OF CONSUMER AND CORPORATE AFFAIRS). THE REGULATIONS IMPOSE STANDARDS ON EMPLOYERS FOR THE USE, STORAGE AND HANDLING OF CONTROLLED PRODUCTS AND ADDRESS LABELLING AND IDENTIFICATION, EMPLOYEE INSTRUCTION AND TRAINING, AS WELL AS THE UPKEEP OF A MATERIALS SAFETY DATA SHEET (MSDS). THE PRESENCE IN A CONTROLLED PRODUCT OF AN INGREDIENT IN A CONCENTRATION EQUAL TO OR GREATER THAN SPECIFIED IN THE INGREDIENT DISCLOSURE LIST MUST BE DISCLOSED IN THE SAFETY DATA SHEET. ***Title :*** ***Reference :*** ***Effective Date :*** 31DEC1987 ***Last Amendment :*** **CAGAAK, 122, 2, 551, 1988** ***Entry / Update :*** APR1991 **Canada Gazette Part II**

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
GBR	REG	TRNSP LABEL	-	CLASS RQR	LABELLING OF ROAD TANKERS: CORROSIVE SUBSTANC E. EMERGENCY ACTION CODE: 2R (APPLIES TO SOLU TIONS) ***Title :*** HAZARDOUS SUBSTANCES (LABELLING OF ROAD TANKE RS) REGULATIONS 1978 ***Reference :*** **GBRSI*, 1702, 1978** ***Effective Date :*** 28MCH1979 **Statutory Instruments** ***Last Amendment :*** ***Entry / Update :*** JAN1983

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
GBR	REG	TRNSP AQ AQ	MARIN MARIN EMI	RQR RSTR RSTR	CATEGORY C SUBSTANCE: DISCHARGE INTO THE SEA IS PROHIBITED; DISCHARGE OF TANK WASHINGS AND RESIDUAL MIXTURES IS SUBJECT TO RESTRICTIONS . (APPLIES TO HEXAMETHYLENEDIAMINE SOLUTION). ***Title :*** THE MERCHANT SHIPPING (CONTROL OF POLLUTION B Y NOXIOUS LIQUID SUBSTANCES IN BULK) REGULATI ONS 1987, SCHEDULE 1 ***Reference :*** **GBRSI*, 551, 15, 1987** ***Effective Date :*** 06APR1987 **Statutory Instruments** ***Last Amendment :*** **GBRSI*, 2604, 2, 1990** ***Entry / Update :*** 1992 **Statutory Instruments**

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
IND	**REG**	**MANUF**	**-**	**RQR**	These rules define the responsabilities of oc cupiers of any industrial activity in which t his toxic and hazardous substance may be invo lved. These responsabilities encompass: (a) a ssessment of major hazards (causes, occurrenc e, frequency); (b) measures to prevent accide nts and limit eventual impairment to human he alth and pollution of the environment; (c) pr ovision of relevant factual knowledge and ski lls to workers in order to ensure health and environmental safety when handling equipments and the foregoing chemical; (d) notification of the competent authorities in case of majo r accidents; (e) notification of sites to the competent authorities 3 months before commen cing; (f)preparation of an on-site emergency plan as to how major accidents should be cope d with; (g) provision of competent authoritie s with information and means to respond quick ly and efficiently to any off-site emergency; (h) provision of information to persons outs ide the site, liable to be affected by a majo r accident; (i) labelling of containers as to clearly identify contents, manufacturers, ph ysical, chemical and toxicological data; (j) preparation of a safety data sheet including any significant information regarding hazard of this substance and submission of safety re ports to the competent authorities; (k) for t he import of a hazardous chemical to India, i mporters must supply the competent authoritie s with specified information regarding the sh ipment.
		SAFTY		**RQR**	
		STORE		**RQR**	
		IMPRT		**RQR**	

Title : THE MANUFACTURE, STORAGE AND IMPORT OF HAZARD OUS CHEMICALS RULES. 1989

Reference : **GAZIN*, 787, 1989** ***Effective Date :*** 27NOV1989
THE GAZETTE OF INDIA
Last Amendment : ***Entry / Update :*** SEP1992

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
RUS	**REG**	**AIR**	**AMBI**	**MAC**	0.001MG/M3 1X/D, 0.001MG/M3 AV/D.

Title :

Reference : ***Effective Date :*** AUG1984

Last Amendment : **PDKAV*, 3086-84, 1984** ***Entry / Update :*** SEP1985
PREDELNO DOPUSTIMYE KONTSENTRATSII (PDK) ZAGRYAZNYAYUSHCHIKH VESHCHESTV V ATMOSFERNOM VOZDUKHE NASELENNYKH MEST (MAXIMUM ALLOWABLE CONCENTRATIONS (MAC) OF CONTAMINANTS IN THEAMBIENT AIR OF RESIDENTIAL AREAS)

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
RUS	REG	AIR	OCC	MAC CLASS	CLV: 0.1MG/M3 (VAPOUR) HAZARD CLASS: I

Title :

Reference : ***Effective Date :*** 01JAN1989

Last Amendment : **GOSTS*, 12.1.005, 1988** ***Entry / Update :*** MAY1990

GOSUDARSTVENNYI STANDART SSSR (STATE STANDARD OF USSR)

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
RUS	REG	AQ	SURF	MAC CLASS	0.01MG/L HAZARD CLASS: II

Title :

Reference : ***Effective Date :*** 1JAN1989

Last Amendment : **SPNPV*, 4630-88, 1988** ***Entry / Update :*** JUL1990

SANITARNYE PRAVILA I NORMY OKHRANY POVERKHNOSTNYKH VOD OT ZAGRIAZNENIA (HEALTH REGULATION AND STANDARDS OF SURFACE WATER PROTECTION FROM CONTAMINATION)

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
USA	REG	TRNSP PACK LABEL	-	PRMT CNTRL RQR	SOLID: MAY BE TRANSPORTED IN PASSENGER AIRCRA FT AND PASSENGER RAILCAR NOT TO EXCEED 25 POU NDS/PACKAGE. MAY BE TRANSPORTED IN CARGO AIRC RAFT NOT TO EXCEED 100 POUNDS/PACKAGE. MAY BE TRANSPORTED IN CARGO AND PASSENGER VESSELS O N AND BELOW DECK. ALL SHIP MENTS MUST BE LABE LED CORROSIVE. SOLUTION: MAY BE TRANSPORTED I N PASSENGER AIRCRAFT AND PASSENGER RAILCAR NO T TO EXCEED 1 QUART/PACKAGE. MAY BE TRANSPORT ED IN CARGO AIRCRAFT NOT TO EXCEED 10 GALLONS /PACKAGE. MAY BE TRANSPORTED IN CARGO AND PAS SENGER V ESSELS ON AND BELOW DECK. ALL SHIPME NTS MUST BE LABELED CORROSIVE.; Summary - THI S REGULATION LISTS AND CLASSIFIES THOSE MATER IALS WHICH THE DEPARTMENT OF TRANSPORTATION H AS DESIGNATED AS HAZARDOUS MATERIALS FOR SHIP PING PAPERS, PACKAGE MARKING, LABELING, AND T RANSPORT VEHICLE PLACARDING APPLICABLE TO THE SHIPMENT AND TRANSPORT OF THOSE HAZARDOUS MA TERIALS.

Title : HAZARDOUS MATERIALS REGULATIONS, PART 172--HA ZARDOUS MATERIALS TABLES AND HAZARDOUS MATERI ALS COMMUNICATIONS REGULATIONS

Reference : **CFRUS*, 49, 172, 101, 1984** ***Effective Date :*** OCT1991

Code of Federal Regulations

Last Amendment : **CFRUS*, 49, 172, 101, 1990** ***Entry / Update :*** NOV1991

Code of Federal Regulations

Substance

[redacted]

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	*Type*	*Subject*	*Spec.*	*Description*	*Level / Summary Information :*
IMO	**REC**	**TRNSP LABEL PACK**	**MARIN**	**CLASS**	HAZARD CLASS: 8 = CORROSIVE. PACKING GROUP: I II = MINOR DANGER (I = GREAT DANGER-III=MINOR DANGER). (APPLIES TO SOLID HEXAMETHYLENEDIAM INE). UN NO. 2280

Title :

Reference : ***Effective Date :***

Last Amendment : **!, IMCOC*, 10004, 1990** ***Entry / Update :*** JAN1991

International Maritime Dangerous Goods Code

Substance

[redacted]

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	*Type*	*Subject*	*Spec.*	*Description*	*Level / Summary Information :*
IMO	**REC**	**TRNSP LABEL PACK**	**MARIN**	**CLASS**	HAZARD CLASS: 8 = CORROSIVE. PACKING GROUP: I I = MEDIUM DANGER (I=GREAT DANGER - III=MINOR DANGER). (APPLIES TO HEXAMETHYLENEDIAMINE SO LUTION. UN NO. 1783

Title :

Reference : ***Effective Date :***

Last Amendment : **!, IMCOC*, 10004, 1990** ***Entry / Update :*** JAN1991

International Maritime Dangerous Goods Code

Substance

[redacted]

Chemical Name :
Reported Name : **Hexamethylenediamine**
CAS Number : **124-09-4**

Area	*Type*	*Subject*	*Spec.*	*Description*	*Level / Summary Information :*
IMO	**REC**	**AQ**	**EMI**	**RSTR**	Category C substance (substance which is slightly toxic to aquatic life): discharge into the sea of this substance, of ballast water, tank washings or other residues or mixtures containing such a substance shall be prohibited except where specified conditions are satisfied. Technological requirements prescribe equipments and designs that must be present on the tankers as well as port facilities for receiving residues or mixtures containing the regulated substance. Technical assistance for training of scientific and technical personnel shall be promoted where requested by the Parties of the Convention. (Applies to hexamethylenediamine solution)
		AQ	**MARIN**	**RSTR**	

Title : International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

Reference : ***Effective Date :***

Last Amendment : **IMODC*,** ***Entry / Update :*** SEP1994

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
UN	**REC**	**TRNSP LABEL PACK**	**-**	**CLASS**	HAZARD CLASS: 8 = CORROSIVE. PACKING GROUP: I II = MINOR DANGER (I = GREAT DANGER-III=MINOR DANGER). (APPLIES TO SOLID HEXAMETHYLENEDIAM INE). UN NO. 2280

Title :

Reference : ***Effective Date :***

Last Amendment : **!, UNTDG*, 15, 1989** ***Entry / Update :*** AUG1990

UN Transport of Dangerous Goods, Recommendation prepared by theCommittee of Experts on the Transport of Dangerous Goods

Substance

Chemical Name :
Reported Name : **hexamethylenediamine**
CAS Number : **124-09-4**

Area	Type	Subject	Spec.	Description	Level / Summary Information :
UN	**REC**	**TRNSP LABEL PACK**	**-**	**CLASS**	HAZARD CLASS: 8 = CORROSIVE. PACKING GROUP: I I = MEDIUM DANGER (I=GREAT DANGER - III=MINOR DANGER). (APPLIES TO HEXAMETHYLENEDIAMINE SO LUTION. UN NO. 1783

Title :

Reference : ***Effective Date :***

Last Amendment : **!, UNTDG*, 15, 1989** ***Entry / Update :*** AUG1990

UN Transport of Dangerous Goods, Recommendation prepared by theCommittee of Experts on the Transport of Dangerous Goods