

RECEIVED
OPPT/CBIC
2003 SEP -4 AM 9:44

I U C L I D

Data Set

Robust Summaries

Existing Chemical Memo : ID: 110-18-9
CAS No. : Crompton US HPV: TMEDA
: 110-18-9
EINECS Name : N,N,N',N'-tetramethylethylenediamine
EC No. : 203-744-6
Molecular Formula : C6H16N2

Printing date : 26.06.2003
Revision date :
Date of last update : 26.06.2003

Number of pages : 23

Chapter (profile) : Chapter: 1.1, 2.1, 2.2, 2.4, 2.5, 2.6.1, 3.1.1, 3.1.2, 3.3.1, 3.5, 4.1, 4.2, 4.3,
5.1.1, 5.2.1, 5.2.2, 5.4, 5.5, 5.8.2, 9

Reliability (profile) : Reliability: without reliability, 1, 2, 3, 4
Flags (profile) : Flags: without flag, confidential, non confidential, WGK (DE), TA-Luft (DE),
Material Safety Dataset, Risk Assessment, Directive 67/548/EEC, SIDS

2. Physico-Chemical Data

Id 110-18-9
Date 18.03.2003

2.1 MELTING POINT

Value : = -55 °C
Sublimation :
Method : other: no data
Year : 1999
GLP :
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Reliability : (2) valid with restrictions
Peer reviewed publication
13.01.2003 (2)

2.2 BOILING POINT

Value : = 121 °C at
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Reliability : (2) valid with restrictions
Peer reviewed publication
10.01.2003 (2)

2.4 VAPOUR PRESSURE

Value : = 20 hPa at 25 °C
Decomposition :
Method : other (calculated): MPBPWIN v 1.40
Year : 2002
GLP :
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Reliability : (2) valid with restrictions
10.01.2003 (8)

2.5 PARTITION COEFFICIENT

Partition coefficient : octanol-water
Log pow : = .3 at °C
pH value :
Method : other (measured): no data
Year : 1995
GLP :
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Reliability : (2) valid with restrictions
Peer reviewed publication
10.01.2003 (1)

Partition coefficient : octanol-water
Log pow : = -.26 at °C
pH value :
Method : other (calculated): KOWWIN v 1.66
Year : 2002
GLP :

2. Physico-Chemical Data

Id 110-18-9

Date 18.03.2003

Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9

Reliability : (2) valid with restrictions
10.01.2003

(8)

2.6.1 SOLUBILITY IN DIFFERENT MEDIA

Solubility in : Water
Value : = 877700 mg/l at 25 °C

pH value :
concentration : at °C

Temperature effects :

Examine different pol. :

pKa : at 25 °C

Description :

Stable :

Deg. product :

Method : other: Estimation using WSKOW v 1.40

Year : 2002

GLP :

Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9

Remark : Literature value for melting point (-55 °C) used as physical property input.

Reliability : (2) valid with restrictions
13.01.2003

(8)

3. Environmental Fate and Pathways

Id 110-18-9
Date 18.03.2003

3.1.1 PHOTODEGRADATION

Type : air
 Light source :
 Light spectrum : nm
 Relative intensity : based on intensity of sunlight
DIRECT PHOTOLYSIS
 Halflife t1/2 : .8 hour(s)
 Degradation : % after
 Quantum yield :
 Deg. product :
 Method : other (calculated): AOPWIN v 1.90
 Year : 2002
 GLP :
 Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9

Remark : Concentration of hydroxyl radicals in air = 1.5E6 OH/cm3
 12-hour day

Reliability : (2) valid with restrictions
 18.03.2003

(8)

3.3.1 TRANSPORT BETWEEN ENVIRONMENTAL COMPARTMENTS

Type : fugacity model level III
 Media :
 Air : % (Fugacity Model Level I)
 Water : % (Fugacity Model Level I)
 Soil : % (Fugacity Model Level I)
 Biota : % (Fugacity Model Level II/III)
 Soil : % (Fugacity Model Level II/III)
 Method : other: calculation using Epiwin Level III Fugacity Model
 Year : 2002

Test condition : Henry's Law Constant: 5.6E-8 atm-m³/mole (Henrywin program)
 Vapor pressure: 15 mmHg (Mppwin program)
 Log Kow: 0.3 (experimental value)
 Soil Koc: 0.818 (calc by model)
 Melting point: -55 °C

Test substance : 1000 kg/hr emissions to air, water and soil compartments.
 Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9

	Mass Amount (percent)	Half-life (hr)	Emissions (kg/hr)
Air	0.142	1.62	1000
Water	56.3	900	1000
Soil	43.4	900	1000
Sediment	0.106	3.6E+3	0

	Fugacity (atm)	Reaction (kg/hr)	Advection (kg/hr)	Reaction (percent)	Advection (percent)
Air	4.59E-12	934	21.8	31.1	0.728
Water	2.08E-12	666	865	22.2	28.8
Soil	5.58E-11	513	0	17.1	0

3. Environmental Fate and Pathways

Id 110-18-9
Date 18.03.2003

Sediment 1.92E-12 0.313 0.0325 0.0104 0.00108

Persistence time: 512 hr
Reaction time: 727 hr
Advection time: 1.73E3 hr
Percent reacted: 70.4
Percent advected: 29.6

Half-lives (hr), (based upon Biowin (ultimate) and Aopwin):

Air: 1.62
Water: 900
Soil: 900
Sediment: 3600
Biowin estimate: 2.433 (weeks-months)

Advection times (hr):

Air: 100
Water: 1000
Sediment: 5E+4

Reliability : (1) valid without restriction
Reliable model

15.01.2003

(8)

3.5 BIODEGRADATION

Deg. product :
Method : other: Calculation using BIOWIN v4.00
Year : 2003
GLP :
Test substance :

Result : Probability of Rapid Biodegradation (BIOWIN v4.00):
Linear Model : 0.2817
Non-Linear Model : 0.0436
Expert Survey Biodegradation Results:
Ultimate Survey Model: 2.4328 (weeks-months)
Primary Survey Model : 3.1041 (weeks)
Readily Biodegradable Probability (MITI Model):
Linear Model : 0.2972
Non-Linear Model : 0.1720

Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9

Reliability : (2) valid with restrictions
18.03.2003

(8)

4. Ecotoxicity

Id 110-18-9
Date 18.03.2003

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type :
Species :
Exposure period : 96 hour(s)
Unit : mg/l
LC50 : 392
Method : other: Calculation using ECOSAR v0.99g
Year : 2002
GLP :
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9

Test condition : Log Kow: 0.30
Mpt: -55 °C
Ecosar Class: Aliphatic amines
Reliability : (2) valid with restrictions
Estimation using ECOSAR v0.99g
15.01.2003 (8)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

Type :
Species : Daphnia sp. (Crustacea)
Exposure period : 48 hour(s)
Unit : mg/l
EC50 : 23
Method : other: Calculation using Ecosar v0.99g
Year : 2002
GLP :
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9

Test condition : Log Kow: 0.30
Mpt: -55 °C
Ecosar Class: Aliphatic amines
Reliability : (2) valid with restrictions
Estimation using ECOSAR v0.99g
15.01.2003 (8)

4.3 TOXICITY TO AQUATIC PLANTS E.G. ALGAE

Species : other algae
Endpoint :
Exposure period : 96 hour(s)
Unit : mg/l
EC50 : 24
Method : other: Calculation using Ecosar v0.99g
Year : 2002
GLP :
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9

Test condition : Log Kow: 0.30
Mpt: -55 °C
Ecosar Class: Aliphatic amines

4. Ecotoxicity

Id 110-18-9
Date 18.03.2003

Reliability

: (2) valid with restrictions
Estimation using ECOSAR v0.99g

15.01.2003

(8)

5.1.1 ACUTE ORAL TOXICITY

Type : LD50
Value : = 406 - 891 mg/kg bw
Species : rat
Strain : Sprague-Dawley
Sex : male/female
Number of animals : 32
Vehicle : water
Doses : 125, 250, 500, 1000 and 2000 mg/kg b.w.
Method : EPA OTS 798.1175
Year : 1994
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9
 Trade name: NIAX(R) Catalyst C-279
 Source: Union Carbide Chemicals
 Lot No.: 45-VCB-31
 Purity: 98.9%

Method : Body weight range: Males 218-259 g, Females 200-215 g
 Doses per time period: Single dose administered by gavage
 Dose administered: Five females per group received single doses of 125, 250, 500 or 1000 mg/kg b.w. Three males per group received doses of 125, 500, 1000 or 2000 mg/kg b.w.
 Post dose observation period: 14 days
 Statistical methods: LD50 for female rats was calculated using the moving average method (Thompson, W.R. (1947). Use of moving averages and interpolation to estimate medium-effective dose. Bacteriologic Rev., 11, 115-145). An estimate of the slope was made by the formula developed by Weil (Weil, C.S. (1983). Economical LD50 and slope determination. Drug and Chemical Toxicology, 6(6), 595-603).

Result : LC50 (males) = 891 mg/kg bw (95% confidence limits = 469-1690 mg/kg bw)
 LC50 (females) = 406 mg/kg bw (95% confidence limits = 252-655 mg/kg bw)

Number of deaths: The three male rats dosed at 2000 mg/kg bw all died on the day of dosing, as did two males dosed at 1000 mg/kg bw. The five female rats dosed at 1000 mg/kg bw died on the day of dosing, as did two females dosed at 500 mg/kg bw. A further female in this group died after one day. One female in the 250 mg/kg bw group died after 2 days.

Clinical signs: Signs of toxicity included sluggishness, salivation (in 1), lacrimation (in 2), tremors (sometimes intermittent), myoclonic jerking (mostly in animals that died), myoclonic jerking and tremors with animals in an upright position (30 second to 3 minute duration and sometimes repeated), tonic convulsions, clonic convulsions (in 2 that died), straub tail (in 1), aggressive behavior when handled (in 2), hyperactivity, kyphosis (in 2), 2 with an abnormal gait (elevated hind quarter/limb region), an unsteady gait (in 1), abnormal breathing (labored, audible or slow), gasping (with vocalization in some females), piloerection, red tearing, prostration, cyanosis (in 1), an unkempt appearance (in 1), diarrhea, a yellow to brown stain on the perianal or perineal fur (of 2), urine stains on periurogenital fur (of 1), a red crust on the perinasal and/or periorcular fur, a large amount of blood in the urine of 2 (positive by HEMASTIX® Reagent Strips) and emaciation (in 1).

Bodyweights: Most animals exhibited a consistent weight gain during the

5. Toxicity

Id 110-18-9

Date 18.03.2003

14 d observation period.

Necropsy: Necropsy of rats that died revealed red lungs (some mottled), dark maroon livers, red to brown liquid in the stomachs, discolored stomachs (glandular portion gray, red, maroon, brown and/or purple), a black discoloration on the stomach of 1 (possible necrosis), discolored intestines (red, yellow and/or gray), intestines with brown areas in 1 (possible necrosis), upper portion of intestines with tan areas (in 2), hemorrhaged intestines, red to brown liquid in the intestines, 1 dark maroon cecum, 1 cecum distended with red to brown liquid and 1 dark maroon spleen. Necropsy of survivors revealed no gross lesions except for gas-filled intestines in 1 female dosed with 250 mg/kg of test substance.

Brain lesions were observed in most animals and included neuronal degeneration, gliosis, hemorrhages, hydropic degeneration of the choroid plexus, edema, encephalitis (in 1) and encephalomalacia (in 1). The neuronal degeneration and gliosis observed in the region of the cerebral cortex and the hippocampus are lesions typical of those induced by an excitatory neurotoxin and were apparent in dose levels beginning with 250 mg/kg for females and 500 mg/kg for males. The most significant effects, according to the pathologist, were noted more frequently in survivors. The marked changes observed in the choroid plexuses of several animals that died indicated that the test substance may have entered through this region. Other nervous system changes included axonal degeneration of the tibial nerve in 1 female (at 500 mg/kg) and hemorrhages of the spinal cord in 3 males (at 2000 mg/kg). There were no lesions apparent in the skeletal muscle of any animal.

Reliability : (1) valid without restriction
Study conducted to standard test method under GLP.

30.01.2003

(7)

Type : LD50
Value : = 268 mg/kg bw
Species : rat
Strain : Sprague-Dawley
Sex : male/female
Number of animals : 18
Vehicle :
Doses : 125, 250 and 500 mg/kg b.w.
Method : other: UCBRRC Method
Year : 1994
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Trade name: NIAX(R) Catalyst C-279
Source: Union Carbide Chemicals
Lot No.: 45-VCB-31
Purity: 98.9%

Method : Body weight range: Males 286-295 g, Females 209-259 g
Doses per time period: Single dose administered by gavage
Dose administered: Five females per group were dosed by stomach intubation at single doses of 125, 250 or 500 mg/kg b.w. Three males were dosed at 250 mg/kg b.w.
Post dose observation period: 14 days
Statistical methods: LD50 for female rats was calculated using the moving

5. Toxicity

Id 110-18-9

Date 18.03.2003

Result : average method (Thompson, W.R. (1947). Use of moving averages and interpolation to estimate medium-effective dose. Bacteriologic Rev., 11, 115-145). An estimate of the slope was made by the formula developed by Weil (Weil, C.S. (1983). Economical LD50 and slope determination. Drug and Chemical Toxicology, 6(6), 595-603).
: LC50 (females) = 268 mg/kg bw (95% confidence limits = 181-396 mg/kg bw)
LC50 (males) > 250 mg/kg bw

Number of deaths: Five female rats dosed with 500 mg/kg b.w. died on the day of dosing. Two female rats dosed at 250 mg/kg b.w. died on the first day post-dosing. No male rats died

Clinical signs: Signs of toxicity observed in both male and female rats included sluggishness, fasciculation, intermittent tremors (head region) and red tearing. In addition, female rats exhibited the following: tremors, marked myoclonic jerking and tremors (sometimes repeated and/or with animals in an upright position), clonic and/or tonic convulsions followed by death (in 2), an aggressive behaviour (in 1), salivation, lacrimation, piloerection, abnormal breathing, prostration, a urine stain on the perigenital fur (of 1) and a red crust on the perinasal and/or periocular fur.

Bodyweights: Most animals exhibited a consistent weight gain during the 14 d observation period; 1 female exhibited a 1 g weight loss at 14 d.

Necropsy: Necropsy of animals that died revealed dark to bright red lungs (mottled in 1), dark red to maroon livers (mottled in 1), hemorrhages or red streaks in the stomachs (glandular portion), an ulcerated stomach (in 1), red areas on the intestines and blackening of the outer edges of spleen or liver (in 2).

The brain, spinal cord, sciatic nerve and hind limb skeletal muscle from 2 to 5 rats from each dose group were saved and examined microscopically. Microscopic lesions apparent in the brain included hydropic degeneration of the choroid plexus, edema (in 2) and hemorrhage (in 2) which were all observed in females dosed with 500 mg/kg. There were no lesions evident in the saved skeletal muscle, spinal cord or sciatic nerve tissues of any animal.

Reliability : (1) valid without restriction
Test method similar to guideline methods, conducted under GLP.

30.01.2003 (6)

5.1.2 ACUTE INHALATION TOXICITY

Type : LC50
Value : > 1180 ppm
Species : rat
Strain : other: CD(R)BR
Sex : male/female
Number of animals : 10
Vehicle :
Doses : 1180 ppm
Exposure time : 4 hour(s)
Method : EPA OTS 798.1150
Year : 1996
GLP : yes

5. Toxicity

Id 110-18-9

Date 18.03.2003

- Test substance** : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Source: OSi Specialities, Inc.
Purity: 99.5%
Lot No.: 56-VCB-90-A
- Method** : Body weight range: 239-252 g
Doses per time period: Single dose, whole body, 4 hour exposure.
Vapor generation: Heated glass vaporization column packed with glass beads.
Post dose observation period: 14 days
- Result** : Number of deaths: No animals died during exposure or the 14 day observation period.
- Clinical signs: During exposure, gasping was apparent for all animals except one, and lacrimation from one or both eyes and bilateral ptosis were present for nine and ten animals, respectively.
- At one-hour post-exposure, the majority of the animals has rales and corneal opacities, while laboured respiration were noted for all. Rales persisted through day 14 for all animals. Corneal opacities (bilateral) were present in all animals over the course of the 14 day observations period.
- Bodyweights: Body weight gain was depressed for the first three days of the observation period. By 14 days post-exposure, body weights/gains had returned to normal for most animals.
- Necropsy: Gross necropsy on day 14 revealed that all animals except one had corneal ulcerations. Both eyes on one male contained hypopyon.
- Conclusion** : The LC50 was found to be > 1180 ppm under the conditions of this study.
The NOAEL was found to be < 1180 ppm.
- Reliability** : (1) valid without restriction
Study conducted to standard test method under GLP.
- 17.01.2003 (9)
- Type** : other: LT50
Value :
Species : rat
Strain : Sprague-Dawley
Sex : male/female
Number of animals : 30
Vehicle :
Doses :
Exposure time :
Method : other: UCBRRC Method
Year : 1994
GLP : yes
- Test substance** : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Trade name: NIAX(R) Catalyst C-279
Source: Union Carbide Chemicals
Lot No.: 45-VCB-31
Purity: 98.9%
- Method** : Body weight range: Males 286-295 g, Females 209-259 g
Doses per time period: Single exposure for either 40 minutes, 1 h 20 minutes, or 2 h 41 minutes.
Dose administered: Saturated vapor
Animals/dose: 5 male/5 female
Post dose observation period: 14 days

5. Toxicity

Id 110-18-9

Date 18.03.2003

Vapor generation: Air passed through a gas washing bottle containing the substance.

Statistical methods: LT50 was calculated using the moving average method (Thompson, W.R. (1947). Use of moving averages and interpolation to estimate medium-effective dose. Bacteriologic Rev., 11, 115-145).

Result : LT50 (male) 1.25 hours
LT50 (female) 1.44 hours

Number of deaths: All animals exposed for 2 h 41 minutes died during exposure. In the 1 h 20 minutes group, 2 females died after 1 day, 2 males died after 2 days, and 1 male died after 4 days.

Clinical signs: Signs of toxicity observed during exposure included blepharospasm, tremors, mouth breathing, lacrimation and wet fur (around the mouth, nose and/or eyes). Following exposure and/or during the 14-day observation period, abnormal breathing (mouth, audible and slow), decreased motor activity, corneal opacity and/or corneal ulceration, an unkempt appearance and fur encrustation (around nose and eyes) were apparent. The apparent corneal opacity and/or ulceration which was noted in all survivors persisted through 14 days.

Bodyweights: Most animals lost weight by 7 days but recovered within 14 days. 5 animals had no weight loss during the 14-day observation period.

Necropsy: Necropsy of animals that died revealed dark red lungs (in 2), dark purple kidneys and liver (possible autolysis) in 2 and corneal opacity. Corneal ulceration and opacity were evident in survivors at necropsy. At necropsy, a veterinarian examined the eyes of exposed rats and also reported corneal vascularization, conjunctivitis, hypopyon and desmetocele with single instances of hemorrhage, keratitis and necrosis.

Reliability : (2) valid with restrictions
Non-standard study, conducted under GLP

17.01.2003 (6)

Type : other: LT50

Value :

Species : rat

Strain : Sprague-Dawley

Sex : male/female

Number of animals : 20

Vehicle :

Doses :

Exposure time :

Method : other: UCBRRC Method

Year : 1994

GLP : yes

Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Trade name: NIAX(R) Catalyst C-279
Source: Union Carbide Chemicals
Lot No.: 45-VCB-31
Purity: 98.9%

Method : Body weight range: Males 237-286 g, Females 200-223 g
Doses per time period: Single exposure for either 20 or 40 minutes.
Dose administered: Saturated vapor
Animals/dose: 5 male/5 female
Post dose observation period: 14 days
Vapor generation: Static - 105 g substance placed in sealed test chamber

5. Toxicity

Id 110-18-9

Date 18.03.2003

Result : LT50 (male) 25.9 minutes
LT50 (female) 30.8 minutes

Number of deaths: All males and 4/5 females in the 40 minute exposure group died either during exposure or within 4 hours 45 minutes following exposure. One male died in the 20 minute exposure group.

Clinical signs: The signs of toxicity observed included tremors, mouth breathing, salivation, wet fur (facial area), an unkempt appearance, abnormal breathing (mouth, audible and slow), decreased motor activity, encrustation of the perinasal and periocular fur and apparent corneal opacity and ulceration. Except for the persistent corneal effects, all survivors recovered within 12 to 13 days.

Bodyweights: Most surviving animals showed a weight gain over the 14 day period.

Necropsy: At necropsy, ocular effects including corneal opacity and corneal vascularization were evident mostly in survivors. Other ocular effects in survivors included panophthalmitis, lens or corneal ulceration, hemorrhages and/or the presence of fibrin in the anterior ocular chamber, swollen globes and keratitis. No gross lesions were observed in other tissues.

Reliability : (2) valid with restrictions
Non-standard study, conducted under GLP

20.01.2003

(7)

Type : LC50
Value : = 1318 ppm
Species : rat
Strain : Wistar
Sex : male/female
Number of animals : 30
Vehicle :
Doses : 938, 1869 and 3058 ppm
Exposure time : 4 hour(s)
Method : other: UCBRRRC method
Year : 1985
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Source: Union Carbide Corporation
Purity: no data
Lot No.: no data

Method : Body weight range: 259-290 g
Doses per time period: Single dose, whole body, 4 hour exposure.
Vapor generation: Dynamic - test material metered into a heated evaporator and vapor carried into test chamber using an air stream.
Post dose observation period: 14 days

Result : LC50 (males) 1389 ppm (95% confidence limits 846-2281 ppm)
LC50 (females) 1235 ppm (95% confidence limits 758-2012 ppm)
LC50 (combined) 1318 ppm (95% confidence limits 949-1829 ppm)

Number of deaths: In the 3058 ppm group, 5 males and 3 females died during exposure. The remaining 2 females died during day 1 following exposure. In the 1869 ppm group, 5 females died during exposure. Three males died on day 1 and one male on day 8 following exposure. In the 938 ppm group, one female died on day 9 and one male on day 10 following exposure.

Clinical signs: Clinical signs of toxicity were observed in all exposure

5. Toxicity

Id 110-18-9

Date 18.03.2003

groups and included lacrimation, excessive salivation, urogenital wetness, ocular, oral and nasal encrustation, eye opacity, respiratory difficulties, hypactivity, coordination loss, head tremours, negative toe and tail pinch reflex, negative righting reflex and distended stomachs.

Bodyweights: Loss of body weight was observed in all surviving rats 7 day postexposure. During the second postexposure week, further loss of body weight was observed for one male and two female rats in the 938 ppm exposure group.

Necropsy: Discoloured and mottled lungs, livers, kidneys, and spleens were observed in all rats which died in exposure to 3058 ppm. Similar findings were observed in some of the rats exposed to 1869 and 938 ppm.

Reliability : (4) not assignable
Test method similar to guideline methods, conducted under GLP. No information on substance purity.

17.01.2003

(4)

5.1.3 ACUTE DERMAL TOXICITY

Type : LD50
Value : = 1230 mg/kg bw
Species : rabbit
Strain : New Zealand white
Sex : male/female
Number of animals : 18
Vehicle :
Doses : 0.5, 1.0 and 2.0 g/kg b.w.
Method : EPA OTS 798.1100
Year : 1994
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Trade name: NIAX(R) Catalyst C-279
Source: Union Carbide Chemicals
Lot No.: 45-VCB-31
Purity: 98.9%

Method : Age/Bodyweight: Male - 2.5-3.5 kg, female 2.3-3.4 kg
Doses per time period: Single dose applied for 24 hours (occlusive).
Dose concentration: Undiluted
Animals/dose: Five females per group were exposed to doses of 0.5, 1.0 and 2.0 g/kg b.w. Three males were exposed to 1.0 g/kg b.w.
Post dose observation period: 14 days

Result : LD50 (females) = 1230 mg/kg bw

Number of deaths: All females dosed with 2.0 g/kg b.w. died the day after dosing. No mortalities occurred amongst females dosed at 0.5 g/kg b.w. One male dosed with 1.0 g/kg b.w. also died.

Clinical signs: Skin reactions included erythema, edema, necrosis, fissuring (on 1), ulceration, ecchymoses (on 2) and scabs. Signs of toxicity included sluggishness, rapid breathing, lacrimation (in 1), vocalization when handled (in 1), wetness of the perioral fur (of 2) and diarrhea (in 1). Affected survivors recovered at 3 to 5 days.

Bodyweights: Many survivors exhibited a weight loss by 7 days, with some recovery by 14 days.

Necropsy: Necropsy of the rabbits that died revealed dark red lungs, lungs

5. Toxicity

Id 110-18-9

Date 18.03.2003

with dark red patches, 1 pale (tan) liver, enlarged thymuses, mottled dark red thymuses. A moderate to large amount of blood was noted in the urine of 3 rabbits that died (positive by KEMASTIX(R) Reagent Strips). There were no gross lesions evident in survivors at necropsy.

Reliability : (1) valid without restriction
Study conducted to standard test method under GLP.

20.01.2003 (7)

5.2.1 SKIN IRRITATION

Species : rabbit
Concentration : undiluted
Exposure : Occlusive
Exposure time :
Number of animals : 8
Vehicle :
PDII :
Result :
Classification :
Method : EPA OTS 798.4470
Year : 1994
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
CAS #: 110-18-9
Trade name: NIAX(R) Catalyst C-279
Source: Union Carbide Chemicals
Lot No.: 45-VCB-31
Purity: 98.9%

Method : Weight of animals: < 3.5 kg
Dose: 0.5 mL.
No. of animals: Two rabbits (male) exposed for 4 hours, 2 rabbits (1 M, 1F) exposed for 1 hour, 6 rabbits (3M, 3F) exposed for 3 minutes.

Result : 4 hour contact: Moderate erythema and edema on 2 of 2 rabbits, full thickness necrosis on 2, ecchymoses on 2, scabs on 2, alopecia on 2. Necrosis, scabs and alopecia at 14 days.

1 hour contact: Moderate erythema and edema on 2 of 2 rabbits, full-thickness necrosis on 2, ulceration on 2, ecchymoses on 2, scans on 2, alopecia on 2. Necrosis, scabs and alopecia at 14 days.

3 minute contact: Moderate erythema on 6 of 6 rabbits, minor edema on 6, full thickness necrosis on 6, ulceration on 2, ecchymoses on 3, fissuring on 1, desquamation on 6, scabs on 6, alopecia on 6. Necrosis, desquamation, scabs and alopecia at 14 days.

Reliability : (1) valid without restriction
Study conducted to standard test method under GLP.

20.01.2003 (7)

5.2.2 EYE IRRITATION

Species : rabbit
Concentration : undiluted
Dose : .01 ml
Exposure time :
Comment : not rinsed
Number of animals : 4
Vehicle : none

5. Toxicity

Id 110-18-9
Date 18.03.2003

Result :
Classification :
Method : EPA OTS 798.4500
Year : 1994
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9
 Trade name: NIAX(R) Catalyst C-279
 Source: Union Carbide Chemicals
 Lot No.: 45-VCB-31
 Purity: 98.9%

Method : Two animals per sex were administered a low volume eye dose (0.01 ml) which was placed directl onto the cornea. The undosed eye of each animal served as the control.

Result : A summary of the eye irritation results is shown in Table 1.

A volume of 0.01 mL of test substance instilled into rabbit eyes produced moderate to severe corneal injury in 4 of 4 rabbits. Iritis and severe conjunctival irritation were also produced in all 4 rabbit eyes. Within 1 hour, 1 rabbit developed necrosis of the nictitating membrane and conjunctivae. All 4 rabbits had hemorrhage of the nictitating membranes by 24 hours. A pus-like ocular discharge was evident in the dosed eye of each animal within 1 to 48 hours. At 7 days, corneal vascularization was observed in 1 rabbit. Another rabbit developed corneal vascularization by 17 days. Two rabbits had a normal ocular appearance within 14 days. Another dosed eye healed by 17 days. Moderate corneal opacity and corneal vascularization persisted in 1 rabbit through 21 days.

The installation of the substance into rabbit eyes produced severe, persistent irritation.

Table 1: Summary of primary eye irritation results for NIAX® Catalyst C-279

Observation	Observation times									
		1 hr	24 hr	48 hr	72 hr	7 d	10 d	14 d	17 d	21 d
Cornea										
Opacity:	Range	0-1	1	1-2	2	0-2	0-2	0-2	0-2	0-2
	Mean	0.8	1.0	1.8	2.0	1.0	0.8	0.5	0.5	0.5
Area:	Range	0-4	2-4	1-3	1-2	0-2	0-2	0-1	0-1	0-1
	Mean	2.5	3.0	1.5	1.2	1.0	0.8	0.2	0.2	0.2
Iris										
Inflam:	Range	1	1	1	1	0-1	0-1	0-1	0-1	0
	Mean	1.0	1.0	1.0	1.0	0.2	0.2	0.2	0.2	0.0
Conjunctivae										
Redness:	Range	2-3	3	3	3	1-3	1-3	0-3	0-3	0
	Mean	2.2	3.0	3.0	3.0	1.8	1.8	1.0	1.0	0.0
Chemosis:	Range	2	1-2	1-3	1-2	0-1	0-1	0-1	0-1	0
	Mean	2.0	1.5	2.0	1.8	0.2	0.2	0.5	0.2	0.0
Discharge:	Range	2	1-3	1-3	2-3	1	0-2	0-2	0-2	0
	Mean	2.0	2.2	2.5	2.5	1.0	0.8	0.8	0.5	0.0

Reliability : (1) valid without restriction
Study conducted to standard test method under GLP.

20.01.2003

(7)

5.4 REPEATED DOSE TOXICITY

Type :
Species : rat
Sex : male/female
Strain : Fischer 344
Route of admin. : inhalation: vapour
Exposure period : 6 hours
Frequency of treatm. : 5 days per week for 9 days
Post exposure period : none
Doses : 0, 50, 250, 750 ppm
Control group : yes, concurrent no treatment
NOAEL : < 50 ppm
LOAEL : = 50 ppm
Method : other: UCBRRC Method
Year : 1985
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9
 Source: Aldrich Chemical Company
 Purity: 99%
 Lot No.: JL0615CL

Method : Age at study initiation: Approximately 7 weeks

No. of animals/sex/dose: 10 males/10 females

Clinical observations performed and frequency: All animals were observed prior to, during, and following each exposure for signs of toxic effects. All animals were weighed prior to the first, second, fifth, sixth and seventh exposures and also prior to sacrifice. Hematologic evaluations were performed on blood samples collected on the day of sacrifice.

Organs examined at necropsy: Liver, lungs, kidneys, brains, spleen, gonads, thymus, nasal turbinates, larynx, trachea, gross lesions, eyes.

Statistical methods: Results of quantitative continuous variables were intercompared among the concentration groups and one control group by use of analysis of variance (ANOVA)(Sokal & Rohlf, 1969), Bartlett's homogeneity of variance (Sokal & Rohlf, 1969) and Duncan's multiple range tests (Snedecor and Cochran, 1967). The latter was used to delineate which exposure groups differed from the control when F from the analysis of variance was significant. If Bartlett's test indicated heterogenous variances, all groups were compared by an ANOVA for unequal variances (Brown and Forsythe, 1974) followed if necessary by t-tests. Statistical procedures for hematologic variables were similar. Corrected Bonferroni probabilities were used for t-test comparisons. The fiducial limit of 0.05 (two-tailed) was used as the critical level of significance for all comparisons.

Brown, M.B. & Forsythe, A.B., The small sample behavior of some statistics which test the equality of several means, *Technometrics*, 16, 1974

Snedecor, G.W. & Cochran, W.G., *Statistical Methods*, Iowa State University Press, Ames, IO, 1967

Sokal, R.R. & Rohlf, F.J., *Biometry*, W.H. Freeman & Co., San Francisco,

Result

1969.

: Actual dose received: 51.1±1.6 ppm, 246.0±7.3 ppm , 743.0±50.4 ppm

Body weight: Body weight loss was observed in the 250 ppm-exposed survivors and a decrease in body weight gain occurred throughout the study in the 50 ppm male rats.

Clinical signs: During exposure, rats of the 750 ppm group had closed or partially closed eyes. This finding was also observed in rats exposed to 250 ppm, but was limited to the first day of exposure.

Clinical signs found in the 750 ppm animals were abdominal, mouth and audible breathing; perinasal, periocular and perioral wetness and encrustation; lacrimation; and eye opacity. Hyperactivity was noted particularly in the 750 ppm exposed female rats.

Exposure-related clinical observations in animals of the 250 ppm group were primarily breathing difficulties, eye opacity, and wetness or encrustation of the nose, mouth, and eyes. Two males of the 50 ppm group had abdominal breathing. Corneal opacities were observed in all 50 ppm male and female rats. These signs in the rats of the 50 ppm group were first noticed following the fourth exposure to the substance. Except for eye opacity in one male, rats of the control group had no clinical abnormalities.

Ophthalmic findings: Due to death, the 750 ppm exposed rats were not examined. Treatment-related lesions were observed in both sexes of the 250 and 50 ppm groups. Corneal opacity was the most frequent finding. Eye ulcers were observed in 30% of the 250 ppm exposed rats. Although 30% of the control male animals had corneal edema, the incidence of this finding in the 50 and 250 ppm groups was between 90 and 100 % for male and female rats.

Hematologic findings: No biologically significant alterations were observed in the 50 and 250 ppm groups. Due to mortality, no data were obtained from the 750 ppm group.

Histopathology: Treatment related lesions were observed in the eyes, nasal mucosa, larynx and thymus. Specifically, rats exposed to 750 ppm had keratitis and corneal necrosis, nasal mucosal ulceration, epithelial cell necrosis of the larynx and congestion of the lungs and liver. Rats of the 250 ppm group had keratitis and corneal ulceration of the eyes, nasal mucosal ulceration, upper respiratory tract squamous cell metaplasia which extended through the larynx and thymic atrophy. Lesions found in the 50 ppm exposed rats were keratitis and squamous cell metaplasia of the nasal mucosa.

Mortality and time to death: All animals in the 750 ppm group died within the first three days of the study.

Organ weight changes: No data are available for the 750 ppm exposed rats due to mortality.

For the 250 ppm exposed rats, decreases in absolute weights of brain, liver, kidneys, lungs and testes were observed. The relative weights of these same organs were increased, which suggests that the alterations in absolute organ weights were simply a reflection of decreased body weights.

For the 50 ppm exposed rats, no alterations were found in the organ weights of the female rats. Male rats had a mild increase in relative brain and testes weights. Unlike the female rats, the male rats had a decrease in

body weight gain throughout the study.

Necropsy findings: The only gross lesions of biological significance in both the sacrificed rats and those that died during the study were lesions involving the eyes seen in some rats at all exposure concentrations and nasal encrustation observed in two of the intermediate dose males and several of the high dose male and female rats. In addition, thymic atrophy was observed in several male and female rats from the intermediate exposure concentration that were sacrificed at study termination, and a few rats from this dosage group were devoid of body fat at the time of necropsy. A majority of the high exposure concentration male and female rats found dead during the study had color change in the lungs at necropsy. Three rats in this group were found to have hemorrhage around the brain. Only four rats were found to have color changes in the lungs at the time of sacrifice, three 250 ppm and one 50 ppm rat.

The four organs/tissues in which lesions of biological significance were found in both the sacrificed rats and those found dead during the study were the eyes, nasal tissues, larynx and thymus. The eye lesions involved principally the cornea and occasionally the anterior chamber and were manifested primarily as keratitis and corneal necrosis, with some lesions involving the iris. Eye lesions were observed in all test groups, with increasing severity in the higher dosage groups.

Nasal lesions were confined primarily to the anterior-most section and consisted of degeneration of respiratory and olfactory epithelium, which in the intermediate and high exposure concentration resulted in mucosal ulceration in many of the male and female rats. Mild to moderate squamous metaplasia of the respiratory epithelium was seen in some low dose males and in most males and females from the intermediate exposure concentration. In the 750 ppm exposure concentration male and female rats there was also vacuolar degeneration and necrosis of the epithelium of the hard palate seen occasionally as well as vacuolar degeneration of the skin around the nares.

The larynx in both male and female rats had lesions consisting of generally minimal to mild squamous metaplasia in the sacrificed intermediate dose group and vacuolar degeneration and necrosis of the epithelium in the high dose rats. Degeneration and necrosis extended down into the upper trachea in some of the high dose rats, but were absent in the intermediate dose animals.

In the rats sacrificed at the end of the study, thymic atrophy was observed in the intermediate exposure concentration male and female rats, but was not present in the low dose animals.

In the high exposure concentration rats, all of which died during the study, pulmonary congestion, which coincides with the color change observed at gross necropsy, was evident in most of the rats in addition to those lesions already described above.

Conclusion : It is concluded that with respect to the lesions observed in the eyes and the anterior nasal tissues there was an observable effect level in the lowest target concentration (50 ppm) of test material used in this study.

Reliability : (1) valid without restriction
Well-reported study conducted to GLP

21.01.2003

(3)

5.5 GENETIC TOXICITY 'IN VITRO'

Type : Ames test

5. Toxicity

Id 110-18-9

Date 18.03.2003

System of testing : *S. typhimurium* strains TA98, TA100, TA 1535, TA1537 and TA1538
Test concentration : 0.10, 0.30, 1.0, 3.0 and 10.0 mg/plate (Expt 1 & 2)
Cycotoxic concentr. : > 10 mg/plate
Metabolic activation : with and without
Result : negative
Method : other: UCBRRC Method similar to OECD 471
Year : 1994
GLP : yes
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9
 Source: OSi Specialities, Inc.
 Purity: 98.9%
 Lot No.: 45-VCB-31

Method : Metabolic activation: Aroclor 1254-induced rat liver S9

Number of replicates: 3

Positive controls:

2-aminoanthracene (+S9, TA98, TA100, TA1535, TA1537, TA1538)

4-nitro-o-phenylenediamine (-S9, TA98, TA1538)

sodium azide (-S9, TA100, TA1535)

9-aminoacridine (-S9, TA1537)

Solvent: water

Due to bacterial contamination the TA100 plates in Expt 1 were not evaluated, therefore a third experiment was conducted using TA100.

Result : No mutagenic activity was observed in any of the 5 strains tested.

Table 1. Revertant colony counts obtained per plate using *S. typhimurium* strains TA98, TA100, TA1535, TA1537 and TA1538 (results of first assay)

Dose (mg)	Metabolic activation	Average revertants per plate ± standard deviation				
		TA98	TA100	TA 1535	TA 1537	TA 1538
Water	-	20 ± 1.5	All plates had microbial contaminants and were not evaluated	10 ± 2.5	6 ± 3.0	7 ± 2.3
4-NPD	-	550 ± 19.1		-	-	798 ± 12.9
NaN ₃	-			1080 ± 20.4	-	-
9-AA	-			-	392 ± 115	-
0.10	-	24 ± 4.2		13 ± 1.5	6 ± 2.1	10 ± 0.0
0.30	-	16 ± 3.2		8 ± 0.6	5 ± 2.1	11 ± 2.1
1.0	-	16 ± 1.7		10 ± 1.2	7 ± 2.1	8 ± 1.7
3.0	-	22 ± 6.4		9 ± 2.1	6 ± 0.6	6 ± 4.6
10.0	-	16 ± 6.7		13 ± 3.1	8 ± 4.9	6 ± 3.5
Water	+	19 ± 6.2		10 ± 5.6	5 ± 3.0	17 ± 4.6
2-AA	+	1142 ± 110		117 ± 18.4	166 ± 14.7	1106 ± 52.4
0.10	+	23 ± 2.5		8 ± 4.7	7 ± 2.3	22 ± 3.5
0.30	+	16 ± 14.0		13 ± 2.1	6 ± 3.2	13 ± 2.9
1.0	+	23 ± 3.5		14 ± 1.5	7 ± 4.0	16 ± 5.0
3.0	+	21 ± 2.9		7 ± 0.6	5 ± 2.0	15 ± 3.5
10.0	+	19 ± 4.0		9 ± 3.6	7 ± 3.8	15 ± 5.6

4-NPD - 4-Nitro-o-phenylenediamine

NaN₃ - Sodium azide

9-AA - 9-aminoacridine

2-AA - 2-aminoanthracene

5. Toxicity

Id 110-18-9

Date 18.03.2003

Table 2. Revertant colony counts obtained per plate using *S. typhimurium* strains TA98, TA100, TA1535, TA1537 and TA1538 (results of second assay)

Dose (mg)	Metabolic activation	Average revertants per plate \pm standard deviation				
		TA98	TA100	TA1535	TA1537	TA1538
Water	-	18 \pm 4.4	96 \pm 13.1	12 \pm 1.7	7 \pm 3.2	9 \pm 2.1
4-NPD	-	576 \pm 31.6	-	-	-	842 \pm 15.9
NaN ₃	-	-	1108 \pm 61.1	1073 \pm 30.6	-	-
9-AA	-	-	-	-	233 \pm 91.4	-
0.10	-	21 \pm 4.4	81 \pm 5.0	9 \pm 5.7	4 \pm 0.6	12 \pm 2.1
0.30	-	20 \pm 2.0	91 \pm 6.5	10 \pm 4.4	4 \pm 2.1	13 \pm 1.5
1.0	-	19 \pm 5.9	81 \pm 12.9	9 \pm 4.7	7 \pm 4.0	9 \pm 0.0
3.0	-	21 \pm 3.0	83 \pm 5.7	11 \pm 1.7	4 \pm 2.1	10 \pm 4.2
10.0	-	19 \pm 0.0	77 \pm 9.0	8 \pm 1.5	5 \pm 0.0	8 \pm 2.9
Water	+	28 \pm 6.2	113 \pm 11.4	10 \pm 4.9	9 \pm 6.0	27 \pm 4.6
2-AA	+	980 \pm 91.0	1406 \pm 258	98 \pm 5.6	150 \pm 35.0	1323 \pm 65.6
0.10	+	21 \pm 4.0	89 \pm 13.1	8 \pm 1.5	6 \pm 3.6	20 \pm 5.5
0.30	+	24 \pm 6.7	105 \pm 8.0	9 \pm 1.0	7 \pm 1.2	20 \pm 5.1
1.0	+	26 \pm 8.7	91 \pm 12.4	10 \pm 0.0	6 \pm 1.2	18 \pm 3.2
3.0	+	24 \pm 4.4	101 \pm 10.5	9 \pm 3.1	5 \pm 2.6	16 \pm 1.2
10.0	+	20 \pm 4.0	104 \pm 7.5	12 \pm 2.3	5 \pm 2.3	12 ^T \pm 5.7

T - Toxic; absence of background lawn or mean number of colonies less than half solvent control value.

4-NPD - 4-Nitro-o-phenylenediamine

NaN₃ - Sodium azide

9-AA - 9-aminoacridine

2-AA - 2-aminoanthracene

Table 3. Revertant colony counts obtained per plate using *S. typhimurium* strain TA100 (results of third assay)

Dose (mg)	Metabolic activation	Average revertants per plate \pm standard deviation
Water	-	127 \pm 10.0
NaN ₃	-	1242 \pm 22.5
0.10	-	129 \pm 4.5
0.30	-	112 \pm 13.5
1.0	-	118 \pm 34.5
3.0	-	100 \pm 9.0
10.0	-	110 \pm 22.0
Water	+	100 \pm 9.5
2-AA	+	1626 \pm 310.5
0.10	+	104 \pm 4.4
0.30	+	101 \pm 11.2
1.0	+	97 \pm 17.0
3.0	+	110 \pm 5.0
10.0	+	96 \pm 7.5

NaN₃ - Sodium azide

2-AA - 2-aminoanthracene

Reliability

: (1) valid without restriction

Test method similar to guideline methods, conducted under GLP.

22.01.2003

(5)

5. Toxicity

Id 110-18-9

Date 18.03.2003

Type : Ames test
System of testing : S. typhimurium TA 98, TA 100, TA 1535 and TA 1537
Test concentration : 0, 100, 333, 1000, 3333 and 10,000 ug/plate
Cycotoxic concentr. :
Metabolic activation : with and without
Result : negative
Method : other: similar to OECD 471
Year : 1987
GLP : no data
Test substance : Chemical name: N,N,N',N'-tetramethylethylenediamine
 CAS #: 110-18-9
 Source: Sigma
 Purity: 99%
Method : Metabolic activation: Aroclor 1254-induced rat or hamster S9

 Number of replicates: 3
 Positive controls:
 2-aminoanthracene (+S9, TA98, TA100, TA1535, TA1537)
 4-nitro-o-phenylenediamine (-S9, TA98)
 sodium azide (-S9, TA100, TA1535)
 9-aminoacridine (-S9, TA1537)

 Solvent: water
Result : Mutagenic responses of Salmonella tester strains are shown in Table 1.

 No mutagenic activity was observed in any of the 4 strains tested, with and without S9 activation.

Table 1. TMEDA - revertant colony counts (mean and standard error of mean for three plates) obtained using *S. typhimurium* strains TA98, TA100, TA1535 and TA1537

Dose µg/plate	TA100						TA1535					
	NA		10% HLI		10% RLI		NA		10% HLI		10% RLI	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
0	98	2.5	117	15.0	115	12.7	15	3.8	7	1.0	8	3.4
100	98	6.6	116	6.7	107	9.9	17	2.3	7	2.8	12	2.6
333	78	5.0	115	8.0	115	3.8	16	1.3	10	2.5	9	3.2
1000	89	5.6	107	7.4	109	12.1	17	4.9	7	0.9	7	3.0
3333	78	5.5	127	11.9	106	8.4	15	1.7	15	1.7	12	0.0
10,000	78	1.8	81	12.3	107	9.1	12	3.7	17	0.7	6	1.5
+ve	360	13.1	1207	26.5	449	22.1	340	16.8	460	10.7	200	17.9
	TA1537						TA98					
	NA		10% HLI		10% RLI		NA		10% HLI		10% RLI	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
0	6	0.9	8	0.3	5	1.5	16	1.7	25	3.2	24	1.5
100	4	0.9	5	1.0	10	1.9	11	2.7	31	1.5	20	1.5
333	7	2.4	3	0.7	4	0.9	19	3.6	27	4.2	22	2.7
1000	7	0.3	7	2.6	5	3.3	11	2.3	28	3.8	25	2.6
3333	6	3.0	6	0.6	4	1.5	13	2.3	27	4.0	17	5.7
10,000	5	1.5	5	1.5	5	0.9	13	3.7	-	-	22	4.4
+ve	298	37.1	341	29.2	129	8.2	637	31.3	579	25.8	131	23.5

NA - not activated

10%HLI - Aroclor 1254-induced hamster liver S-9

10%RLI - Aroclor 1254-induced rat liver S-9

Reliability : (2) valid with restrictions
 Well-reported literature review of study (peer reviewed)

22.01.2003

(10)

9. References

Id 110-18-9

Date 18.03.2003

- (1) Hansch, C., Leo, A. and Hoekman, D. 1995. Exploring QSAR - Hydrophobic, Electronic and Steric Constants. Washington, DC: American Chemical Society.
- (2) Lide, D.R. (ed.), CRC Handbook of Chemistry and Physics, 79th ed., Boca Raton, FL, CRC Press Inc., p 3-153, 1998-1999
- (3) Union Carbide Bushy Run Research Center. 1985. N,N,N',N'-tetramethylenediamine. Nine-day vapor inhalation study on rats. Project Report No. 48-13.
- (4) Union Carbide Bushy Run Research Center. 1985. Tetramethylethylenediamine acute vapor inhalation study with rats. Project Report No. 47-194.
- (5) Union Carbide Bushy Run Research Center. 1994. NIAX(R) Catalyst C-279: Mutagenic potential in the Salmonella/Microsome (Ames) assay. Laboratory project ID: 93U1287.
- (6) Union Carbide Bushy Run Research Center. 1994. NIAX(R) Catalyst C-279: Acute peroral toxicity testing in the rat using the undiluted test substance and acute inhalation toxicity testing in the rat (dynamic conditions). Laboratory Project No. 93U1300.
- (7) Union Carbide Bushy Run Research Center. 1994. NIAX(R) Catalyst C-279: Acute toxicity and irritancy testing using the rat (peroral and inhalation toxicity) and the rabbit (cutaneous and ocular tests). Laboratory Project ID: 93U1289.
- (8) US EPA, EPIWIN v3.10, EPI Suite Software, 2000
- (9) WIL Research Laboratories. 1996. Acute inhalation toxicity study of refined TMEDA in albino rats. WIL Report No. WIL-242084
- (10) Zeiger, E., Anderson, B., Haworth, S., Lawlor, T., Mortelmans, K. and Speck, W. 1987. Salmonella Mutagenicity Tests: III. Results from the testing of 255 chemicals. Environmental Mutagenesis Volume 9, Supplement 9:1-110.