

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1 Product identifier**

Trade name: **PART B – Hardwax Oil**
Product vorm: Blend
UFI-code: 9FAH-CVKV-9204-HS6Y

1.2. Relevant identified uses of the substance or mixture and uses advised against

Recommended use: Hardener for coating materials or adhesives for industrial and trade applications.

1.3. Details of the supplier of the safety data sheet

SOBELTEC nv
Klein Frankrijkstraat 43 - 9600 Ronse - Belgium T +32 55 230 600
info@ariomat.com
Bevoegde persoon die verantwoordelijk is voor het veiligheidsinformatieblad: info@ariomat.com

1.4. Emergency telephone number

National Poison Information Service (NPIS).
UK NPIS 0344 892 0111 (24 hour service)
National Poison Information Center of Ireland (NPIC)
Beaumont Hospital - PO Box 1297 - Beaumont Road - Dublin 9
Healthcare Professionals: +353 (01) 809 2566 (24 hour service)

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture EC**

regulation criteria 1272/2008 (CLP):



Warning, Acute Tox. 4, Harmful if inhaled.



Warning, Skin Sens. 1, May cause an allergic skin reaction.



Warning, STOT SE 3, May cause respiratory irritation.

Adverse physicochemical, human health and environmental effects:
No other hazards

2.2. Label elements**Labelling (1272/2008/CE):**

Hazard pictograms:



Warning

Hazard statements:

H332 Harmful if inhaled.
H317 May cause an allergic skin reaction.
H335 May cause respiratory irritation.

Precautionary statements:

P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P280 Wear protective gloves. Wear eye or face protection.

P312 Call a POISON CENTER/doctor if you feel unwell.

P333+P313 If skin irritation or rash occurs: Get medical advice/attention.

P362+P364 Take off contaminated clothing and wash it before reuse.

P501 Dispose of contents/container in accordance with applicable regulations.

Special Provisions:

EUH204 Contains isocyanates. May produce an allergic reaction.

EUH208 Contains hexamethylene-di-isocyanate. May produce an allergic reaction.

Contains

Hexamethylene diisocyanate oligomers, isocyanurate

Special provisions according to Annex XVII of REACH and subsequent amendments: None

2.3. Other hazards











No PBT, vPvB or endocrine disruptor substances present in concentration $\geq 0.1\%$ No other hazards

SECTION 3: Composition/information on ingredients

3.1. Substances

NA

3.2. Mixtures

| Qty | Name | Ident. Number | Classification |
|-----------|--|--|---|
| ~100 % | Hexamethylene diisocyanate oligomers, isocyanurate | CAS: 28182-81-2 EC: 931-274-8 REACH No.: 01-21194857 96-17 |  3.1/4/Inhal Acute Tox. 4 H332  3.4.2/1-1A-1B Skin Sens. 1,1A,1B H317  3.8/3 STOT SE 3 H335 |
| <1000 ppm | hexamethylene-di-isocyanate | Index 615-011-00-1 number: CAS: 822-06-0 EC: 212-485-8 REACH No.: 01-21194575 71-37 |  3.1/1/Inhal Acute Tox. 1 H330  3.2/2 Skin Irrit. 2 H315  3.3/2 Eye Irrit. 2 H319  3.8/3 STOT SE 3 H335  3.1/4/Oral Acute Tox. 4 H302  3.4.1/1 Resp. Sens. 1 H334  3.4.2/1 Skin Sens. 1 H317 Specific Concentration Limits: C $\geq 0,5\%$: Resp. Sens. 1 H334 C $\geq 0,5\%$: Skin Sens. 1 H317 |

SECTION 4: First aid measures

4.1. Description of first aid measures

In case of skin contact:

Remove contaminated clothing immediately and dispose off safely.

Areas of the body that have - or are only even suspected of having - come into contact with the product must be rinsed immediately with plenty of running water and possibly with soap.

Wash thoroughly the body (shower or bath).

In case of eyes contact:

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

In case of Ingestion:

Do NOT induce vomiting.

In case of Inhalation:

If breathing is irregular or stopped, administer artificial respiration.

In case of inhalation, consult a doctor immediately and show him packing or label. In

case of unwellness, seek medical advice immediately.

4.2. Most important symptoms and effects, both acute and delayed None.

4.3. Indication of any immediate medical attention and special treatment needed

In case of accident or unwellness, seek medical advice immediately (show directions for use or safety data sheet if possible).

Treatment: None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:

Fire extinguishing powder, foam or CO₂. Use foam and water jets only in case of extensive fire outbreak.

Extinguishing media which must not be used for safety reasons: high volume water jet.

5.2. Special hazards arising from the substance or mixture Burning

produces heavy smoke.

Do not inhale combustion gases in case of a fire.

5.3. Advice for firefighters

Use suitable breathing apparatus.

Collect contaminated fire extinguishing water separately. This must not be discharged into drains.

Move undamaged containers from immediate hazard area if it can be done safely.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures Wear

personal protection equipment.

Wear breathing apparatus if exposed to vapours/dusts/aerosols. Provide adequate ventilation.

Use appropriate respiratory protection.

See protective measures under point 7 and 8.

6.2. Environmental precautions

Do not allow to escape into waterways, wastewater or soil.

Retain contaminated washing water and dispose it in compliance with the local and national regulations currently in force.

In case of gas escape or of entry into waterways, soil or drains, inform the responsible authorities.

6.3. Methods and material for containment and cleaning up

Cover the spilling with wet, absorbent material (e.g. sawdust, chemical binder based on calcium silicate hydrate, sand) and remove mechanically.

After approx. one hour transfer to waste container and do not seal (evolution of CO₂!). Keep damp in a safe ventilated area for several days.

6.4. Reference to other sections See
also section 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Avoid contact with skin and eyes, inhalation of vapours and mists.
Use localized ventilation system.
Don't use empty container before they have been cleaned.
Before making transfer operations, assure that there aren't any incompatible material residuals in the containers.
See also section 8 for recommended protective equipment.
Advice on general occupational hygiene:
Contaminated clothing should be changed before entering eating areas. See
also section 8 for recommended protective equipment.

7.2. Conditions for safe storage, including any incompatibilities Keep

away from food, drink and feed.
Adequately ventilated premises.

7.3. Specific end use(s) None

in particular.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters hexamethylene-di-isocyanate

- CAS: 822-06-0
EU - TWA: 0.034 mg/m³, 0.005 ppm - Notes: ITALY
OEL - TWA: 0.035 mg/m³, 0.005 ppm - STEL: 0.07 mg/m³, 0.01 ppm - Notes: DENMARK
OEL - TWA: 0.075 mg/m³, 0.01 ppm - STEL: 0.15 mg/m³, 0.02 ppm - Notes: FRANCE
OEL - TWA: 0.035 mg/m³, 0.005 ppm - STEL: 0.035 mg/m³, 0.005 ppm - Notes: GERMANY
OEL - TWA: 0.035 mg/m³ - STEL: 0.035 mg/m³ - Notes: HUNGARY
OEL - TWA: 0.04 mg/m³ - STEL: 0.08 mg/m³ - Notes: POLAND
OEL - TWA: 0.035 mg/m³, 0.005 ppm - Notes: SPAIN
OEL - TWA: 0.02 mg/m³, 0.002 ppm - STEL: 0.03 mg/m³, 0.005 ppm - Notes: SWEDEN
ACGIH - TWA(8h): 0.005 ppm - Notes: URT irr, resp sens

DNEL Exposure Limit Values

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2

Worker Industry: 0.5 mg/m³ - Exposure: Human Inhalation - Frequency: Long Term, local effects

Worker Industry: 1 mg/m³ - Exposure: Human Inhalation - Frequency: Short Term, local effects

hexamethylene-di-isocyanate - CAS: 822-06-0

Worker Industry: 0.07 mg/m³ - Exposure: Human Inhalation - Frequency: Short Term, systemic effects - Endpoint: Respiratory tract irritation

Worker Industry: 0.07 mg/m³ - Exposure: Human Inhalation - Frequency: Short Term, local effects - Endpoint: Respiratory tract irritation

Worker Industry: 0.035 mg/m³ - Exposure: Human Inhalation - Frequency: Long Term, systemic effects - Endpoint: Respiratory tract irritation

Worker Industry: 0.035 mg/m³ - Exposure: Human Inhalation - Frequency: Long Term, local effects - Endpoint: Respiratory tract irritation

PNEC Exposure Limit Values

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2

Target: Marine water - Value: 0.0127 mg/l

Target: Freshwater - Value: 0.127 mg/l

Target: Marine water sediments - Value: 26670 mg/kg

Target: Freshwater sediments - Value: 266700 mg/kg

Target: Intermittent release - Value: 1.27 mg/l

Target: Microorganisms in sewage treatments - Value: 38.3 mg/l

Target: Soil - Value: 53182 mg/kg hexamethylene-di-isocyanate

- CAS: 822-06-0

Target: Marine water - Value: 0.00774 mg/l

Target: Freshwater - Value: 0.0774 mg/l

Target: Marine water sediments - Value: 0.001334 mg/kg

Target: Freshwater sediments - Value: 0.01334 mg/kg

Target: Intermittent release - Value: 0.774 mg/l

Target: Microorganisms in sewage treatments - Value: 8.42 mg/l

Target: Soil - Value: 0.0026 mg/kg

8.2. Exposure controls

Eye protection:

Use safety goggles or close fitting safety goggles, don't use eye lens (Standard EN 166).

Skin protection:

Wear suitable protective clothing (Standard EN 1149).

Hand protection:

Use protective gloves that provides comprehensive protection, e.g. P.V.C., neoprene or rubber (Standard EN 374).

Respiratory protection:

Use adequate protective respiratory equipment, e.g. A2-P2 (Standard EN 405).

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

| Properties | Value | Method: | Notes: |
|---|-------------------------------------|---------|--------|
| Physical state: | Liquid | -- | -- |
| Colour: | N.A. | -- | -- |
| Odour: | | -- | -- |
| Melting point/freezing point: | N.A. | -- | -- |
| Boiling point or initial boiling point and boiling range: | >220 °C | -- | -- |
| Flammability: | N.A. | -- | -- |
| Lower and upper explosion limit: | N.A. | -- | -- |
| Flash point: | 228 °C | -- | -- |
| Auto-ignition temperature: | N.A. | -- | -- |
| Decomposition temperature: | N.A. | -- | -- |
| pH: | N.A. | -- | -- |
| Kinematic viscosity: | > 20,5 mm ² /sec (40 °C) | -- | -- |

| | | | |
|--|---------------------------------------|----|----|
| Solubility in water: | Insoluble, REACTS WITH WATER | -- | -- |
| Solubility in oil: | N.A. | -- | -- |
| Partition coefficient n-octanol/water (log value): | N.A. | -- | -- |
| Vapour pressure: | N.A. | -- | -- |
| Density and/or relative density: | 1.16 g/cm ³ | -- | -- |
| Relative vapour density: | N.A. | -- | -- |

Particle characteristics:

| | | | |
|----------------|------|----|----|
| Particle size: | N.A. | -- | -- |
|----------------|------|----|----|

Boiling point, Flash point and Upper/lower flammability or explosive limits, Evaporation rate, Vapour pressure, Auto-ignition temperature: if not differently specified, it is to be referred to the solvent.

The indicated values do not necessarily correspond to the product specification. Please refer to the technical information sheet for specification data.

9.2. Other information

| Properties | Value | Method: | Notes: |
|------------|------------|---------|--------|
| Viscosity: | 1200 mPa.s | -- | -- |

SECTION 10: Stability and reactivity

10.1. Reactivity

Stable under normal conditions of storage and manipulation.

10.2. Chemical stability

Stable under normal conditions of storage and manipulation.

10.3. Possibility of hazardous reactions

Exothermic reaction with amines and alcohols; reacts with water forming CO₂: in closed containers, risk of bursting owing to increase of pressure.

It may generate flammable gases on contact with elementary metals (alkalis and alkaline earth, alloys in powder or vapours) and powerful reducing agents.

It may generate toxic gases on contact with oxidising mineral acids, and powerful oxidising agents.

10.4. Conditions to avoid

Stable under normal conditions.

10.5. Incompatible materials

This information is not available.

10.6. Hazardous decomposition products

No hazardous decomposition products when stored and handled correctly.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Toxicological information of the product: N.A.

Toxicological information of the main substances found in the product:

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2 a)

acute toxicity:

Test: LD50 - Route: Oral - Species: Rat, female > 2500 mg/kg - Source: OECD 423

Test: LD50 - Route: Skin - Species: Rat > 2000 mg/kg - Source: OECD 402

Test: LC50 - Route: Inhalation Mist 1.5 mg/l - Duration: 4h - Source: OECD 403 b)

skin corrosion/irritation:

Test: Skin Irritant - Route: Skin - Species: Rabbit Positive - Source: OECD 404 c)

serious eye damage/irritation:

Test: Eye Irritant - Route: Eyes - Species: Rabbit Negative - Source: OECD 405 d)

respiratory or skin sensitisation:

Test: Skin Sensitization - Route: Skin - Species: Guinea pig Positive - Source: OECD 406

Test: Respiratory Sensitization - Route: Inhalation - Species: Guinea pig Negative - Source: OECD 403

Toxicological kinetics, metabolism and distribution information:

Test: NOAEL - Route: Inhalation (aerosol) - Species: Rat 3.3 mg/m³ - Source: OECD 413

hexamethylene-di-isocyanate - CAS: 822-06-0 a) acute toxicity:

Test: LD50 - Route: Oral - Species: Rat 746 mg/kg

Test: LD50 - Route: Skin - Species: Rabbit 599 mg/kg - Duration: 24h

Test: LC50 - Route: Inhalation - Species: Rat 0.124 mg/l - Duration: 4h b)

skin corrosion/irritation:

Test: Skin Corrosive - Route: Skin - Species: Rabbit Positive - Duration: 4h - Source: OECD 404

c) serious eye damage/irritation:

Test: Eye Corrosive - Route: Eyes - Species: Rabbit Positive - Duration: 30 seconds - Source: OECD 405

d) respiratory or skin sensitisation:

Test: Skin Sensitization - Route: Skin - Species: Guinea pig Positive - Source: OECD 406

Test: Respiratory Sensitization - Route: Inhalation - Species: Guinea pig Positive - Source: OECD 406

i) STOT-repeated exposure:

Test: NOAEC - Route: Inhalation Vapour - Species: Rat Positive 0.035 mg/m³ - Duration: 2 years - Source: OECD 453 - Notes: Target: respiratory tract Toxicological kinetics, metabolism and distribution information:

Test: NOAEL - Route: Inhalation Vapour - Species: Rat 0.2 mg/m³ - Duration: 2 years - Source: OECD 453

Test: LOAEL - Route: Inhalation Vapour - Species: Rat 1 mg/m³ - Duration: 2 years - Source: OECD 453

If not differently specified, the information required in Regulation (EU)2020/878 listed below must be considered as N.A.:

- a) acute toxicity;
- b) skin corrosion/irritation;
- c) serious eye damage/irritation;
- d) respiratory or skin sensitisation;
- e) germ cell mutagenicity;
- f) carcinogenicity;
- g) reproductive toxicity;
- h) STOT-single exposure;
- i) STOT-repeated exposure;
- j) aspiration hazard.

11.2. Information on other hazards Endocrine disrupting properties:

No endocrine disruptor substances present in concentration $\geq 0.1\%$

SECTION 12: Ecological information

12.1. Toxicity

Adopt sound working practices, so that the product is not released into the environment.

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2 a) Aquatic

acute toxicity:

Endpoint: LC50 - Species: Fish ≥ 100 mg/l - Duration h: 96 - Notes: EU Method C.1

Endpoint: LC50 - Species: Daphnia 127 mg/l - Duration h: 48 - Notes: EU Method C.2

Endpoint: EC50 - Species: Algae > 1000 mg/l - Duration h: 72 - Notes: Method OECD 201 c)

Bacteria toxicity:

Endpoint: EC50 - Species: Activated sludge 3828 mg/l - Duration h: 3 - Notes: Method OECD

209 hexamethylene-di-isocyanate -

CAS: 822-06-0 a) Aquatic acute toxicity:

Endpoint: LC50 - Species: Fish 22 mg/l - Duration h: 96 - Notes: Method EU C.1

Endpoint: EC50 - Species: Daphnia ≥ 89.1 mg/l - Duration h: 48 - Notes: Method EU C.2

Endpoint: EC50 - Species: Algae > 77.4 mg/l - Duration h: 72 - Notes: Method EU C.3 b)

Aquatic chronic toxicity:

Endpoint: LOEC - Species: Algae 12.6 mg/l - Duration h: 72 - Notes: Method EU C.3

Endpoint: NOEC - Species: Algae 11.7 mg/l - Duration h: 72 - Notes: Method EU C.3 c)

Bacteria toxicity:

Endpoint: EC50 - Species: Activated sludge 842 mg/l - Duration h: 3 - Notes: EG-RL

88/302/EEC

12.2. Persistence and degradability

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2

Biodegradability: Non-readily biodegradable - Test: Oxygen consumption - Duration: 28 days -

%: 1 - Notes: Method OECD 301D hexamethylene-di-isocyanate

- CAS: 822-06-0

Biodegradability: Non-readily biodegradable - Test: Biochemical oxygen demand - Duration:

28 days - %: 42

12.3. Bioaccumulative potential

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2

Test: BCF - Bioconcentration factor 367.7 hexamethylene-di-isocyanate

- CAS: 822-06-0

Bioaccumulation: Not bioaccumulative - Test: BCF - Bioconcentration factor 57.63 Test:

LogKow 3.2

12.4. Mobility in soil

Hexamethylene diisocyanate oligomers, isocyanurate - CAS: 28182-81-2

Test: LogKoc 7.3-7.8

hexamethylene-di-isocyanate - CAS: 822-06-

0 Test: LogKoc 3.77

12.5. Results of PBT and vPvB assessment vPvB

Substances: None - PBT Substances: None

12.6. Endocrine disrupting properties

No endocrine disruptor substances present in concentration $\geq 0.1\%$

12.7. Other adverse effects

Information not available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Recover if possible. In so doing, comply with the local and national regulations currently in force.

SECTION 14: Transport information

14.1. UN number or ID number

Not classified as dangerous in the meaning of transport regulations.

14.2. UN proper shipping name N.A.

14.3. Transport hazard class(es) N.A.

14.4. Packing group N.A.

14.5. Environmental hazards N.A.

14.6. Special precautions for user N.A.

14.7. Maritime transport in bulk according to IMO instruments

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Dir. 98/24/EC (Risks related to chemical agents at work)

Dir. 2000/39/EC (Occupational exposure limit values)

Regulation (EC) n. 1907/2006 (REACH)

Regulation (EC) n. 1272/2008 (CLP)

Regulation (EC) n. 790/2009 (ATP 1 CLP)

Regulation (EU) n. 2020/878

Regulation (EU) n. 286/2011 (ATP 2 CLP)

Regulation (EU) n. 618/2012 (ATP 3 CLP)

Regulation (EU) n. 487/2013 (ATP 4 CLP)

Regulation (EU) n. 944/2013 (ATP 5 CLP)

Regulation (EU) n. 605/2014 (ATP 6 CLP)

Regulation (EU) n. 2015/1221 (ATP 7 CLP)

Regulation (EU) n. 2016/918 (ATP 8 CLP)

Regulation (EU) n. 2016/1179 (ATP 9 CLP)

Regulation (EU) n. 2017/776 (ATP 10 CLP)

Regulation (EU) n. 2018/669 (ATP 11 CLP)

Regulation (EU) n. 2018/1480 (ATP 13 CLP)

Regulation (EU) n. 2019/521 (ATP 12 CLP)

Restrictions related to the product or the substances contained according to Annex XVII Regulation (EC) 1907/2006 (REACH) and subsequent modifications:

Restrictions related to the product:

Restriction 3

Restrictions related to the substances contained: No restriction.

Where applicable, refer to the following regulatory provisions:

Directive 2012/18/EU (Seveso III)

Regulation (EC) nr.648/2004 (detergents).

Dir. 2004/42/EC (VOC directive)

WGK Classification (Water hazard class - Verwaltungsvorschrift wassergefährdende Stoffe)

Provisions related to directive EU 2012/18 (Seveso III):

Seveso III category according to Annex 1, part 1

None

15.2. Chemical safety assessment

A Chemical Safety Assessment has been carried out for the mixture.

Substances for which a Chemical Safety Assessment has been carried out: Hexamethylene diisocyanate oligomers, isocyanurate

SECTION 16: Other information

Text of phrases referred to under heading 3:

H332 Harmful if inhaled.

H317 May cause an allergic skin reaction.

H335 May cause respiratory irritation.

H330 Fatal if inhaled.

H315 Causes skin irritation.

H319 Causes serious eye irritation.

H302 Harmful if swallowed.

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.

| Hazard class and hazard category | Code | Description |
|----------------------------------|---------------|--|
| Acute Tox. 1 | 3.1/1/Inhal | Acute toxicity (inhalation), Category 1 |
| Acute Tox. 4 | 3.1/4/Inhal | Acute toxicity (inhalation), Category 4 |
| Acute Tox. 4 | 3.1/4/Oral | Acute toxicity (oral), Category 4 |
| Skin Irrit. 2 | 3.2/2 | Skin irritation, Category 2 |
| Eye Irrit. 2 | 3.3/2 | Eye irritation, Category 2 |
| Resp. Sens. 1 | 3.4.1/1 | Respiratory Sensitisation, Category 1 |
| Skin Sens. 1 | 3.4.2/1 | Skin Sensitisation, Category 1 |
| Skin Sens. 1,1A,1B | 3.4.2/1-1A-1B | Skin Sensitisation, Category 1,1A,1B |
| STOT SE 3 | 3.8/3 | Specific target organ toxicity - single exposure, Category 3 |

This safety data sheet has been completely updated in compliance to Regulation 2020/878. Classification and procedure used to derive the classification for mixtures according to Regulation (EC) 1272/2008 [CLP]:

| Classification according to Regulation (EC) Nr. 1272/2008 | Classification procedure |
|---|--------------------------|
| Acute Tox. 4, H332 | Calculation method |
| Skin Sens. 1, H317 | Calculation method |
| STOT SE 3, H335 | Calculation method |

This document was prepared by a competent person who has received appropriate training.

Main bibliographic sources:

NIOSH - Registry of toxic effects of chemical substances (1983)

I.N.R.S. - Fiche Toxicologique

The information contained herein is based on our state of knowledge at the above-specified date. It refers solely to the product indicated and constitutes no guarantee of particular quality. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process.

It is the duty of the user to ensure that this information is appropriate and complete with respect to the specific use intended.

This MSDS cancels and replaces any preceding release.

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.

ATE: Acute Toxicity Estimate

ATEmix: Acute toxicity Estimate (Mixtures)

| | |
|-------------|---|
| CAS: | Chemical Abstracts Service (division of the American Chemical Society). |
| CLP: | Classification, Labeling, Packaging. |
| DNEL: | Derived No Effect Level. |
| EINECS: | European Inventory of Existing Commercial Chemical Substances. |
| GefStoffVO: | Ordinance on Hazardous Substances, Germany. |
| GHS: | Globally Harmonized System of Classification and Labeling of Chemicals. |
| IATA: | International Air Transport Association. |
| IATA-DGR: | Dangerous Goods Regulation by the "International Air Transport Association" (IATA). |
| ICAO: | International Civil Aviation Organization. |
| ICAO-TI: | Technical Instructions by the "International Civil Aviation Organization" (ICAO). |
| IMDG: | International Maritime Code for Dangerous Goods. |
| INCI: | International Nomenclature of Cosmetic Ingredients. |
| KSt: | Explosion coefficient. |
| LC50: | Lethal concentration, for 50 percent of test population. |
| LD50: | Lethal dose, for 50 percent of test population. |
| PNEC: | Predicted No Effect Concentration. |
| RID: | Regulation Concerning the International Transport of Dangerous Goods by Rail. |
| STEL: | Short Term Exposure limit. |
| STOT: | Specific Target Organ Toxicity. |
| TLV: | Threshold Limiting Value. |
| TWA: | Time-weighted average |
| WGK: | German Water Hazard Class. |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Version:2

Revision date: 07/02/2019

| Exposure scenario | Sector(s) of Use: | Process Category(ies): | Environmental Release Category(ies): |
|--|------------------------------|---|--------------------------------------|
| 1. Formulation (industrial and professional) | SU 3, SU10 | PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC15 | ERC2 |
| 2. Industrial end use | SU 3, SU12, SU13, SU19 | PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC14, PROC15 | ERC5, ERC6a, ERC6c, |
| 3. Professional end use | SU10, SU12, SU13, SU19, SU22 | PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC10, PROC11, PROC13, PROC14, PROC15 | ERC2, ERC8c, ERC8f |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|--|------------|
| Section 1 - Exposure Scenario Title | |
| ES1. Formulation (industrial and professional) | |
| Description of activities/processes treated in the exposure scenario | |
| Main User Group: SU3 - Industrial uses: Uses of substances as such or in preparations at industrial sites SU 10 Formulation [mixing] of preparations and/or re-packaging (excluding alloys) | |
| Process category: PROC 1 Use in closed process, no likelihood of exposure PROC 2 Use in closed, continuous process with occasional controlled exposure (e.g. sampling) PROC 3 Use in closed batch process (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC 8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at nondedicated facilities PROC 8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 15 Use as a laboratory reagent | |
| Environmental release category: ERC2 - Formulation of preparations | |
| Section 2 - Operating Conditions and Risk management measures | |
| 2.1 - Operating Conditions related to human exposure | |
| Duration of exposure | 8 h/day |
| Frequency of exposure | 220 d/year |
| Physical form | Liquid |
| Concentration of substance in preparation or article: max 100% | |
| 2.2 - Risk management measures related to human health | |
| Organisational and Technical measures: Local exhaust ventilation is required. In long-term processes where contact to substance cannot be excluded (e.g. filling operations), containment (e.g. housing) is recommended. Procedural and/or control technologies are used to minimise emissions and the resulting exposure during purification or cleaning and maintenance procedures. Control staff entry to work area. Persons who suffer from skin complaints or other hypersensitivity reactions of skin should not work with the product. Ensure all equipment well maintained. Regular cleaning of equipment and work area. | |
| Risk management measures: In short-term process where contact to substance cannot be excluded (e.g. sampling operations), an air-fed mask or a combination of activated carbon filter and particulate filter is required. For processes where the opportunity for exposure arises, the use of gloves and protective clothing is stipulated. Suitable materials for safety gloves; EN 3743: Laminate glove - PE/EVOH/PE; Breakthrough time >= 480 min. Wear eye/face protection e.g. goggles and face shield. Keep away from foodstuffs, drinks and tobacco. Keep working clothes separately. Change contaminated or soaked clothing immediately. | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|--|--|
| 2.3 - Operating Conditions related to environment | |
| Emission days per site | max. 300 |
| Annual amount used per site | >1000 t |
| Abatement measures waste water | No waste water is occurring during formulation. |
| 2.4 - Risk management measures related to environment | |
| Organisational measures: | |
| Procedural and/or control technologies are used to minimise emissions and the resulting exposure during purification or cleaning and maintenance procedures | |
| Abatement measures: | |
| Waste water: | No waste water is generated |
| Waste air: | All waste gases from production and dis/charging steps are transferred to a combustion unit or to an activated carbon filter |
| Soil: | Sealing of all relevant soil surfaces in the facility |
| Waste management measures, necessary for risk management at different stages of the life cycle of substances (including mixtures or articles at the end of its life cycle): | |
| Type of waste: Solvent used for cleaning procedures. | |
| Disposal technique: The waste from production is disposed by incineration in a waste combustor. | |
| Fraction released to environment: No emission to the environment during waste treatment during waste treatment. | |
| Section 3 - Estimation of exposure information | |
| 3.1 - Estimation of exposure | |
| Workers (oral) | No significant oral exposure |
| Workers (dermal) | Estimated by the means of the ECETOC TRA model |
| PROC 1 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |
| PROC 2 (>4 h) | 0,14 mg/kg (body weight) using personal protection equipment |
| PROC 3 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |
| PROC 4 (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 5 (>4 h) | 1,37 mg/kg (body weight) using personal protection equipment |
| PROC 8a (>4 h) | 1,37 mg/kg (body weight) using personal protection equipment |
| PROC 8b (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 9 (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 15 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |
| Workers (inhalation) | Estimated by the means of the ECETOC TRA model |
| PROC 1 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 2 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 3 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 4 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 5 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 8a (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 8b (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 9 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 15 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|--|--------------------|
| Environment | |
| Water | 0 mg/l |
| Soil | 0 mg/kg wet weight |
| STP | 0 mg/l |
| Human via environment | 0 mg/kg bw/day |
| 3.2 - Workers exposure | |
| <p>Oral exposure to HDI TRIMER is unlikely to occur because it is prohibited to eat, drink or smoke in the production area. Resting rooms are separated from the manufacturing area and industrial hygiene standards are applied. Personnel who work with HDI TRIMER should have a pre-placement medical examination and periodic examinations thereafter, including a pulmonary function test. Anyone with a medical history of chronic respiratory disease, asthmatic or bronchial attacks, indications of allergic responses, recurrent eczema or sensitization conditions of the skin should not handle or work with HDI TRIMER. Anyone who develops chronic respiratory distress when working with Polyisocyanates should be removed from exposure and examined by a physician.</p> | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Further exposure must be avoided if a sensitivity to HDI TRIMER has developed (ALIPA, 2008). As the formulation HDI TRIMER takes place in closed processes, dermal and inhalation exposure may solely arise at sampling and filling steps. Such exposure is reduced through appropriate risk management measurements like the use of closed units, the presence of ventilation and exhaustion as well as equipped work places and personal protection equipment. A generic tier 1 estimation of the workers exposure occurring at the manufacture of HDI TRIMER was performed using the ECETOC TRA model (v. 2009). Underlying substance properties as well as model settings are presented in the following table.

| Substance properties | | Model setting | |
|-------------------------|---------------|--|--|
| Molecular weight | Ca. 500 g/mol | Type of setting | Industrial |
| Vapour pressure | < 0,0001 Pa | State | Liquid |
| Water solubility | n.a. | Duration of activity | > 4 h/day |
| Dustiness | n.a. | Use of ventilation | Indoor, without ventilation (dermal exposition); Indoor, with ventilation (inhalation exposition) |
| | | Use of respiratory protection equipment | No |
| | | Substance used in preparation | n.a. |

Dermal exposure of workers to HDI TRIMER is solely possible during (dis)charging as well as sampling steps. According to the Technical Report (ECETOC, 2004) no dermal exposure is expected when operating in closed (PROC 1), closed continuous (PROC 2) or closed batch processes (PROC 3). Though the outcome of the ECETOC TRA for all PROC's is reported here.

| Operation | Dermal exposure estimate (mg/kg bw/day) Without PPE | Dermal exposure estimate (mg/kg bw/day) With PPE |
|--------------|---|--|
| PROC 1 >4 h | 0,34 | 0,03 |
| PROC 2 >4 h | 1,37 | 0,14 |
| PROC 3 >4 h | 0,34 | 0,03 |
| PROC 4 >4 h | 6,86 | 0,69 |
| PROC 5 >4 h | 13,7 | 1,37 |
| PROC 8a >4 h | 13,7 | 1,37 |
| PROC 8b >4 h | 6,86 | 0,69 |
| PROC 9 >4 h | 6,86 | 0,69 |
| PROC 15 >4 h | 0,34 | 0,03 |

For processes where the possibility for exposure arises, the use of personal protection equipment (PPE), e.g. gloves is recommended to control the risk. Use of suitable gloves reduces exposure by 90% (EU TGD, Part I, 2003). For PROC 5 and 8a, elevated exposure is estimated. Regarding the sensitilising effect of HDI TRIMER, exposure time should be reduced or other effective RMMs (e.g. housing) should be considered.

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Inhalation exposure is minimized via the application of mainly closed processes as well as the presence of local exhaust ventilation during all sampling and (dis)charging operations. The following table comprises the calculated exposure of workers during the manufacture of HDI TRIMER. However, the current version of ECETOC TRA (July,

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

2009) has some weaknesses for the exposure estimation of liquids. The tool does not give any response to changes when using LEV, PPE or different exposure times. Therefore, the effect of LEV (90%) was calculated manually.

| Operation | Dermal exposure estimate without PPE | | Dermal exposure estimate with PPE | |
|--------------|--------------------------------------|-----------------|-----------------------------------|-----------------|
| | mg/m ³ | mg/kg pc/giorno | mg/m ³ | mg/kg pc/giorno |
| PROC 1 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 2 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 3 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 4 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 5 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 8a >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 8b >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 9 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |
| PROC 15 >4 h | 2,1 | 0,32 | 0,21 | 0,04 |

In order to validate the refined ECETOC TRA estimations, results were compared with those from the “Advanced Reach Tool” (<http://www.advancedreachtool.com/>) (Version 1). This tool has been developed for higher tier exposure assessments. It is capable to estimate exposure from handling liquids. As an example, filling operations according to PROC 8b/9 were calculated with the tool.

| Model settings | Input |
|--|--|
| Primary product | Liquid |
| Process temperature | 15-25°C |
| Vapour pressure | 0,0001 Pa |
| Liquid weight fraction | 1 |
| Viscosity | Like water |
| Is the primary emission source located in the breathing zone of the worker (<1 m)? | Yes |
| Activity class | Falling liquids |
| Activity subclass | Falling liquids with splash loading |
| Use rate of transfer | 10-1000 l/min |
| Level of containment | handling that reduces contact between product and adjacent air |
| General control measures | local exhaust ventilation |
| Type of hood | fixed capturing hood |
| Fully enclosed | No |
| Are demonstrable and effective housekeeping practices in place? | Yes |
| Site description | indoors, room size 1000m ³ |
| Air changes per hour | 3 |
| Are secondary sources present in the workroom? | No |

Exposure Scenario
Hexamethylene diisocyanate oligomers, isocyanurate

| Exposure period | Full shift |
|--|------------|
| <p>The outcome of the “Advanced Reach Tool” was 0.037 mg/m3 (75-percentile) and 0.074 mg/m3 (90-percentile). These results show that results from ECETOC TRA modified with the factor of 0.1 according to LEV are in the same range or even more conservative.</p> | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

The following table comprises the total exposure of a worker occurring during the manufacture of the substance accounting for the dermal as well as inhalation exposure for each single process. All relevant RMMs have been considered.

| Operation | Total exposure (mg/kg bw/day) |
|-----------|----------------------------------|
| PROC1 | 0,07 |
| PROC2 | 0,17 |
| PROC3 | 0,07 |
| PROC4 | 0,73 |
| PROC5 | 0,86 |
| PROC8a | 0,86 |
| PROC8b | 0,73 |
| PROC9 | 0,73 |
| PROC15 | 0,07 |

3.3 - Consumer exposure

Not applicable as the manufacture of the substance is characterized and consumer are not affected.

3.4 - Indirect exposure of human via the environment (oral)

No release of HDI TRIMER by waste water, waste air or waste from manufacture occurs. Therefore humans are not exposed via the environment.

3.5 - Environmental exposure

Environmental releases: Release of HDI TRIMER is strictly controlled by means of effective risk management measures. Exposure of the environment is not expected. Waste gases are cleaned by incineration or by an activated carbon filter. Organic solvent used for cleaning procedures are disposed off via a waste combustion unit. During waste treatment, exposure of the environment is therefore not expected.

Exposure concentration in sewage treatment plants (STP): No waste water is generated related to manufacture of HDI TRIMER. Therefore a sewage treatment plant (STP) is not affected. **PEC_{STP} = 0 mg/l.**

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Exposure concentration in aquatic pelagic compartment: Summary of the Predicted Exposure Concentration (PEC) of HDI TRIMER in aquatic pelagic compartment taken into account for risk characterisation:

| Compartments | PEC local (aquatic) mg/l | PEC local + regional (aquatic) mg/l | Justification |
|-------------------------------|--------------------------|-------------------------------------|---|
| Freshwater | 0 | 0 | No waste water is generated related to formulation of HDI TRIMER. Therefore, direct emissions to freshwater are not expected. Indirect emission of the substance via atmospheric deposition is also not possible due to the risk management measures during manufacture (cleaning of waste air) and during waste disposal (incineration). |
| Marine water | 0 | 0 | See freshwater |
| Intermittent release of water | 0 | 0 | See freshwater |

Predicted Exposure Concentrations (PEC) in sediments: In the risk characterization was considered the total of expected exposure concentrations (PEC) of the HDI TRIMER freshwater sediments:

| Compartments | PEC local (sediments) mg/kg dw | PEC local + regional (sediments) mg/kg dw | Justification |
|------------------------|--------------------------------|---|--|
| Freshwater sediments | 0 | 0 | No waste water is generated related to formulation of HDI TRIMER. Therefore, direct emissions to freshwater sediment are not expected. Indirect emission of the substance via atmospheric deposition is also not possible due to the risk management measures during manufacture (cleaning of waste air) and during waste disposal (incineration). |
| Marine water sediments | 0 | 0 | See fresh water sediments |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Exposure concentrations in soil and groundwater: The exposure of the terrestrial compartment can occur through the application of sewage sludge and the deposition from the atmosphere. Since no emission to waste water occurs, the entry via sewage sludge can be excluded. Deposition from air is unlikely to occur as an emission to the atmospheric compartment during manufacture can be excluded. Waste gases are transferred to an incineration plant or to similar cleaning processes, where HDI TRIMER is completely removed. Furthermore, all relevant surfaces within the production plant are sealed to prevent contamination of soil. Summary of the Predicted Exposure Concentration (PEC) for HDI TRIMER in soil taken into account for risk characterisation.

| Compartments | PEC local (soil/groundwater) | PEC local + regional (soil/groundwater) | Justification |
|--|---------------------------------|--|--|
| Agricultural Soil averaged (mg/kg ww) | 0 | 0 | No penetration via the application of sewage. Sludge and atmospheric deposition. |
| Prateria media (mg/kg peso/peso) | 0 | 0 | See agricultural soil |
| Falde freatiche (mg/l) | 0 | 0 | See agricultural soil |

Atmospheric compartment: Waste air is transferred to an incineration plant or to similar waste treatment procedures assuming an efficiency of 100 % with respect to the removal of HDI TRIMER. Consequently, an emission to the atmospheric compartment can be excluded. Summary of the Predicted Exposure Concentration (PEC) for HDI TRIMER in air taken into account for risk characterisation.

| | PEC local (air) | PEC local+regional (air) | Justification |
|--|-----------------|--------------------------|---|
| During emission ($\mu\text{g}/\text{m}^3$) | 0 | 0 | Complete removal from waste gases due to purification, e.g. via incineration. |
| Annual average ($\mu\text{g}/\text{m}^3$) | 0 | 0 | See emission |
| Annual deposition ($\mu\text{g}/\text{m}^2/\text{day}$) | 0 | 0 | See emission |

Exposure concentration relevant for the food chain (Secondary poisoning): During formulation, HDI TRIMER is not released into the environment. Therefore, secondary poisoning via the environment is not considered to be a risk.

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Summary of the Predicted Exposure Concentration for HDI TRIMER in food for secondary poisoning taken into account for risk characterisation.

| | PEC local (oral) | PEC local + regional (oral) | Justification |
|---------------------------------------|---------------------|--------------------------------|---------------------------------|
| PEC oral, predator (mg/kg w/w) | 0 | 0 | No release into the environment |
| PEC oral, top predator (mg/kg w/w) | 0 | 0 | No release into the environment |
| Concentration in earthworm (mg/kg ww) | 0 | 0 | No release into the environment |

Section 4 - Guidance to Downstream User

ECETOC TRA, or, EUSES v2.1, Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures, If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required

Section 1 - Exposure Scenario Title

ES2. Industrial end use

Description of activities/processes treated in the exposure scenario

Main User Group:

SU3 - Industrial uses: Uses of substances as such or in preparations at industrial sites

SU 12 - Manufacture of plastics products, including compounding and conversion

SU 13 - Manufacture of other non-metallic mineral products, e.g. plasters, cement

SU 19 - Building and construction work

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|---|------------|
| Process category: PROC 1 Use in closed process, no likelihood of exposure PROC 2 Use in closed, continuous process with occasional controlled exposure (e.g. sampling) PROC 3 Use in closed batch process (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC 7 Industrial spraying. PROC 8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at nondedicated facilities PROC 8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10 Roller application or brushing PROC 13 Treatment of articles by dipping and pouring. PROC 14 Production of preparations or articles by tableting, compression, extrusion, pelletisation PROC 15 Use as a laboratory reagent | |
| Environmental release category: ERC 5 Industrial use resulting in inclusion into or onto a matrix ERC 6a Industrial use resulting in manufacture of another substance (use of intermediates) ERC 6c Industrial use of monomers for manufacture of thermoplastics. ERC 6d Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers | |
| Section 2 - Operating Conditions and Risk management measures | |
| 2.1 - Operating Conditions related to human exposure | |
| Duration of exposure | 8 h/day |
| Frequency of exposure | 220 d/year |
| Physical form | Liquid |
| Concentration of substance in preparation or article: in general 50% | |
| 2.2 - Risk management measures related to human health | |
| Organisational and Technical measures: Local exhaust ventilation is required. In long-term processes where contact to substance cannot be excluded (e.g. filling operations), containment (e.g. housing) is recommended. Procedural and/or control technologies are used to minimise emissions and the resulting exposure during purification or cleaning and maintenance procedures. Control staff entry to work area. Persons who suffer from skin complaints or other hypersensitivity reactions of skin should not work with the product. Ensure all equipment well maintained. Regular cleaning of equipment and work area. | |
| Risk management measures: In short-term process where contact to substance cannot be excluded (e.g. sampling operations), an air-fed mask or a combination of activated carbon filter and particulate filter is required. For processes where the opportunity for exposure arises, the use of gloves and protective clothing is stipulated. Suitable materials for safety gloves; EN 374- | |
| 3: Laminate glove - PE/EVOH/PE; Breakthrough time >= 480 min. Wear eye/face protection e.g. goggles and face shield. Keep away from foodstuffs, drinks and tobacco. Keep working clothes separately. Change contaminated or soaked clothing immediately. | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|---|--|
| 2.3 - Operating Conditions related to environment | |
| Emission days per site | max. 300 |
| Annual amount used per site | >1000 t |
| Abatement measures waste water | No waste water is occurring during production. |
| 2.4 - Risk management measures related to environment | |
| Organisational measures: Procedural and/or control technologies are used to minimise emissions and the resulting exposure during purification or cleaning and maintenance procedures | |
| Abatement measures: Waste water: No waste water is generated Waste air: All waste gases from production and dis/charging steps are transferred to a combustion unit or to an activated carbon filter Soil: Sealing of all relevant soil surfaces in the facility | |
| Waste management measures, necessary for risk management at different stages of the life cycle of substances (including mixtures or articles at the end of its life cycle): Type of waste: Solvent used for cleaning procedures. Disposal technique: The waste from production is disposed by incineration in a waste combustor. Fraction released to environment: No emission to the environment during waste treatment during waste treatment. | |
| Section 3 - Estimation of exposure information | |
| 3.1 - Estimation of exposure | |
| Workers (oral) | No significant oral exposure |
| Workers (dermal) | Estimated by the means of the ECETOC TRA model |
| PROC 1 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |
| PROC 2 (>4 h) | 0,14 mg/kg (body weight) using personal protection equipment |
| PROC 3 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |
| PROC 4 (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 5 (>4 h) | 1,37 mg/kg (body weight) using personal protection equipment |
| PROC 7 (>4 h) | 4,20 mg/kg (body weight) using personal protection equipment |
| PROC 8a (>4 h) | 1,37 mg/kg (body weight) using personal protection equipment |
| PROC 8b (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 9 (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 10 (>4 h) | 1,62 mg/kg (body weight) using personal protection equipment |
| PROC 13 (>4 h) | 2,70 mg/kg (body weight) using personal protection equipment |
| PROC 14 (>4 h) | 0,34 mg/kg (body weight) using personal protection equipment |
| PROC 15 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|-------------------------------|---|
| Workers (inhalation) | Estimated by the means of the ECETOC TRA model |
| PROC 1 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 2 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 3 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 4 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 5 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 7 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 8a (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| 8b (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 9 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 10 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| 13 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 14 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 15 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| Environment | |
| Water | 0 mg/l |
| Soil | 0 mg/kg wet weight |
| STP | 0 mg/l |
| Human via environment | 0 mg/kg bw/day |
| 3.2 - Workers exposure | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Oral exposure to HDI TRIMER is unlikely to occur because it is prohibited to eat, drink or smoke in the production area. Resting rooms are separated from the manufacturing area and industrial hygiene standards are applied. Personnel who work with HDI TRIMER should have a pre-placement medical examination and periodic examinations thereafter, including a pulmonary function test. Anyone with a medical history of chronic respiratory disease, asthmatic or bronchial attacks, indications of allergic responses, recurrent eczema or sensitization conditions of the skin should not handle or work with HDI TRIMER. Anyone who develops chronic respiratory distress when working with Polyisocyanates should be removed from exposure and examined by a physician. Further exposure must be avoided if a sensitivity to HDI TRIMER has developed (ALIPA, 2008). As the formulation HDI TRIMER takes place in closed processes, dermal and inhalation exposure may solely arise at sampling and filling steps. Such exposure is reduced through appropriate risk management measurements like the use of closed units, the presence of ventilation and exhaustion as well as equipped work places and personal protection equipment. A generic tier 1 estimation of the workers exposure occurring at the manufacture of HDI TRIMER was performed using the ECETOC TRA model (v. 2009). Underlying substance properties as well as model settings are presented in the following table.

| Substance properties | | Model setting | |
|----------------------|---------------|---|--|
| Molecular weight | Ca. 500 g/mol | Type of setting | Industrial |
| Vapour pressure | < 0,0001 Pa | State | Liquid |
| Water solubility | n.a. | Duration of activity | > 4 h/day |
| Dustiness | n.a. | Use of ventilation | Indoor, without ventilation (dermal exposition); Indoor, with ventilation (inhalation exposition) |
| | | Use of respiratory protection equipment | No |
| | | Substance used in preparation | n.a. |

Dermal exposure of workers to HDI TRIMER is solely possible during (dis)charging as well as sampling steps. According to the Technical Report (ECETOC, 2004) no dermal exposure is expected when operating in closed (PROC 1), closed continuous (PROC 2) or closed batch processes (PROC 3). Though the outcome of the ECETOC TRA for all PROC's is reported here.

| Operation | Dermal exposure estimate (mg/kg bw/day) Without PPE | Dermal exposure estimate (mg/kg bw/day) With PPE |
|-------------|---|--|
| PROC 1 >4 h | 0,34 | 0,03 |
| PROC 2 >4 h | 1,37 | 0,14 |

| | | |
|--------------|------|------|
| PROC 3 >4 h | 0,34 | 0,03 |
| PROC 4 >4 h | 6,86 | 0,69 |
| PROC 5 >4 h | 13,7 | 1,37 |
| PROC 7 >4 h | 42,9 | 4,3 |
| PROC 8a >4 h | 13,7 | 1,37 |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | | |
|--------------|------|------|
| PROC 8b >4 h | 6,86 | 0,69 |
| PROC 9 >4 h | 6,86 | 0,69 |
| PROC 10 >4 h | 27,7 | 2,7 |
| PROC 13 >4 h | 13,7 | 1,37 |
| PROC 14 >4 h | 3,43 | 0,34 |
| PROC 15 >4 h | 0,34 | 0,03 |

For processes where the opportunity for exposure arises, the use of personal protection equipment (PPE) is recommended to control the risk. Use of PPE's reduces exposure by 90% (EU TGD, Part 5, 7 and 10, additional RMMs are required in cases where opportunity for contact with the substance exists. In these cases, either technical measures or personal protection equipment should be used. When the worker is in near distance to the spray. The spray direction is typically horizontal or downwards. Downward ventilation (about 0.3 m/sec) is used from top to down and overspray is collected in a filter. The one-way overall, gloves and a full-face respirator mask with external air supply (ALIPA 2010).

Inhalation exposure is minimised via the application of mainly closed processes as well as the use of exhaust ventilation during all sampling and (dis)charging operations. The following table comprises the estimated exposure of workers during the industrial end use of HDI TRIMER. However, the current version of the tool (July, 2009) has some weaknesses for the exposure estimation of liquids. The tool does not give changes when using LEV, PPE or different exposure times. Therefore the effect of LEV (90% reduction) is entered manually.

| Operation | Inhalative exposure estimate | |
|--------------|------------------------------|-----------------|
| | mg/m ³ | mg/kg pc/giorno |
| PROC 1 >4 h | 2,1 | 0,32 |
| PROC 2 >4 h | 2,1 | 0,32 |
| PROC 3 >4 h | 2,1 | 0,32 |
| PROC 4 >4 h | 2,1 | 0,32 |
| PROC 5 >4 h | 2,1 | 0,32 |
| PROC 7 >4 h | 2,1 | 0,32 |
| PROC 8a >4 h | 2,1 | 0,32 |
| PROC 8b >4 h | 2,1 | 0,32 |
| PROC 9 >4 h | 2,1 | 0,32 |
| PROC 10 >4 h | 2,1 | 0,32 |
| PROC 13 >4 h | 2,1 | 0,32 |
| PROC 14 >4 h | 2,1 | 0,32 |
| PROC 15 >4 h | 2,1 | 0,32 |

In order to validate the refined ECETOC TRA estimations, results were compared with those from the "Reach Tool" (<http://www.advancedreachtool.com/>) (Version 1). This tool has been developed for exposure assessments. It is capable to estimate exposure from handling liquids. Two examples have been calculated: Spraying according to PROC7 and filling operations according to PROC 8b/9 were calculated in the following table, input parameters are described.

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| Model settings | Input |
|--|---------------------------------------|
| Primary product | Liquid |
| Process temperature | 15-25°C |
| Vapour pressure | 0,0001 Pa |
| Liquid weight fraction | 0.1 – 0.5 (10-50 %) |
| Viscosity | Like water |
| Is the primary emission source located in the breathing zone of the worker (<1 m)? | Yes |
| Activity class | Surface spraying of liquids |
| Situation | moderate (0.3 – 3 l/min.) |
| Spray direction | Horizontal or downwards |
| Spray technique | Spraying with high compressed air |
| Process fully enclosed? | no |
| Effective housekeeping? | yes |
| Site description | Indoors, room size 100 m ³ |
| Primary localised controls | Fixed capturing hood (90 % reduction) |
| Secondary localised controls | no |
| Segregation | 3 |
| Air changes per hour | No |
| Are secondary sources present in the workroom? | Full shift |

The outcome of the “Advanced Reach Tool” was 0.095 mg/m³ (75-percentile) and 0.18 mg/m³ (90-percentile). These results show that results from ECETOC TRA modified with the factor of 0.1 according to LEV are in the same range or even more conservative.

| Model settings | Input |
|--|--|
| Primary product | Liquid |
| Process temperature | 15-25°C |
| Vapour pressure | 0,0001 Pa |
| Liquid weight fraction | 1 |
| Viscosity | Like water |
| Is the primary emission source located in the breathing zone of the worker (<1 m)? | Yes |
| Activity class | Falling liquids |
| Activity subclass | Falling liquids with splash loading |
| Use rate of transfer | 10-1000 l/min |
| Level of containment | handling that reduces contact between product and adjacent air |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|---|---------------------------------------|
| General control measures | local exhaust ventilation |
| Type of hood | fixed capturing hood |
| Fully enclosed | No |
| Are demonstrable effective housekeeping and practices in place? | Yes |
| Site description | indoors, room size 1000m ³ |
| Air changes per hour | 3 |
| Are secondary sources present in the workroom? | No |

| | |
|---|--------------------------------------|
| Exposure period | Full shift |
| <p>The outcome of the “Advanced Reach Tool” was 0.037 mg/m³ (75-percentile) and 0.074 mg/m³ (90-percentile). These results show that results from ECETOC TRA modified with the factor of 0.1 according to LEV are in the same range or even more conservative. The following table comprises the total exposure of the worker occurring during the industrial end use as an accounting for the dermal as well as inhalation exposure for each single process.</p> | |
| Operation | Total exposure (mg/kg bw/day) |
| PROC1>4h | 0,07 |
| PROC2>4h | 0,18 |
| PROC3>4h | 0,07 |
| PROC4>4h | 0,73 |
| PROC5>4h | 1,41 |
| PROC7>4h | 4,3 |
| PROC8a>4h | 1,41 |
| PROC8b>4h | 0,73 |
| PROC9>4h | 0,73 |
| PROC10>4h | 2,7 |
| PROC13>4h | 1,41 |
| PROC14>4h | 0,38 |
| PROC15>4h | 0,07 |
| 3.3 - Consumer exposure | |
| Not applicable as the industrial end use in industrial setting of the substance is characterized and consumers are not affected | |
| 3.4 - Indirect exposure of human via the environment (oral) | |
| No release of HDI TRIMER by waste water, waste air or waste from manufacture occurs. Therefore humans are not exposed via the environment. | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| 3.5 - Environmental exposure | | | |
|---|--------------------------|-------------------------------------|---|
| Environmental releases: Release of HDI TRIMER is controlled by means of effective risk management measures. Exposure of the environment is not expected. Waste gases are cleaned by incineration or by an activated carbon filter. Organic solvent used for cleaning procedures are disposed off via a waste combustion unit. During waste treatment, exposure of the environment is therefore not expected. | | | |
| Exposure concentration in sewage treatment plants (STP): Waste water related to industrial end use of HDI TRIMER is generally not directed to a sewage treatment plant (STP). Therefore a STP is not affected. There are 2 types of waste water collection: <ol style="list-style-type: none"> Collection of the "overspray" in water. The isocyanate groups in HDI TRIMER react with water yielding polymeric ureas or, if polyols are present, forming Polyurethanes. The sludge is precipitating which in most cases is incinerated or, in a few cases, disposed off in landfills. Collection of the "overspray" with dry filters and disposing off by incineration or landfill (see 1.). PEC_{STP} = 0 mg/l. | | | |
| Exposure concentration in aquatic pelagic compartment: Summary of the Predicted Exposure Concentration (PEC) of HDI TRIMER in aquatic pelagic compartment taken into account for risk characterisation: | | | |
| Compartments | PEC local (aquatic) mg/l | PEC local + regional (aquatic) mg/l | Justification |
| Freshwater | 0 | 0 | Waste water related to industrial end use of HDI TRIMER is generally not directed to a sewage treatment plant (STP). Therefore a STP is not affected. There are 2 types of waste water collection: <ol style="list-style-type: none"> Collection of the "overspray" in water. The isocyanate groups in HDI TRIMER react with water yielding polymeric ureas or, if polyols are present, forming Polyurethanes. The sludge is precipitating which in most cases is incinerated or, in a few cases, disposed off in landfills. Collection of the "overspray" with dry filters and disposing off by incineration or landfill (see 1.). |
| Marine water | 0 | 0 | See freshwater |
| Intermittent release of water | 0 | 0 | See freshwater |
| | | | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Predicted Exposure Concentrations (PEC) in sediments: In the risk characterization was considered the total of expected exposure concentrations (PEC) of the HDI TRIMER freshwater sediments:

| Compartments | PEC local (sediments) mg/kg dw | PEC local + regional (sediments) mg/kg dw | Justification |
|---------------------------|--------------------------------------|--|--|
| Freshwater sediments | 0 | 0 | Waste water related to industrial end use of HDI TRIMER is generally not directed to a sewage treatment plant (STP). Therefore a STP is not affected. There are 2 types of waste water collection: 1. Collection of the "overspray" in water. The isocyanate groups in HDI TRIMER react with water yielding polymeric ureas or, if polyols are present, forming Polyurethanes. The sludge is precipitating which in most cases is incinerated or, in a few cases, disposed off in landfills. 2. Collection of the "overspray" with dry filters and disposing off by incineration or landfill (see 1.). |
| Marine water sediments | 0 | 0 | See fresh water sediments |

Exposure concentrations in soil and groundwater: The exposure of the terrestrial compartment can occur through the application of sewage sludge and the deposition from the atmosphere. Since no emission to waste water occurs, the entry via sewage sludge can be excluded. Deposition from air is unlikely to occur as an emission to the atmospheric compartment during manufacture can be excluded. Waste gases are transferred to an incineration plant or to similar cleaning processes, where HDI TRIMER is completely removed. Furthermore, all relevant surfaces within the production plant are sealed to prevent contamination of soil. Summary of the Predicted Exposure Concentration (PEC) for HDI TRIMER in soil taken into account for risk characterisation.

| Compartments | PEC local (soil/groundwater) | PEC local + regional (soil/groundwater) | Justification |
|---|---------------------------------|--|--|
| Agricultural Soil averaged (mg/kg ww) | 0 | 0 | No penetration via the application of sewage. Sludge and atmospheric deposition. |
| Prateria media (mg/kg peso/peso) | 0 | 0 | See agricultural soil |
| Falde freatiche (mg/l) | 0 | 0 | See agricultural soil |
| | | | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Atmospheric compartment: Waste air is transferred to an incineration plant or to similar waste treatment procedures assuming an efficiency of 100 % with respect to the removal of HDI TRIMER. Consequently, an emission to the atmospheric compartment can be excluded. Summary of the Predicted Exposure Concentration (PEC) for HDI TRIMER in air taken into account for risk characterisation.

| | PEC local (air) | PEC local+regional (air) | Justification |
|--|-----------------|--------------------------|---|
| During emission ($\mu\text{g}/\text{m}^3$) | 0 | 0 | Complete removal from waste gases due to purification, e.g. via incineration. |
| Annual average ($\mu\text{g}/\text{m}^3$) | 0 | 0 | See emission |
| Annual deposition ($\mu\text{g}/\text{m}^2/\text{day}$) | 0 | 0 | See emission |

Exposure concentration relevant for the food chain (Secondary poisoning): During formulation, HDI TRIMER is not released into the environment. Therefore, secondary poisoning via the environment is not considered to be a risk. Summary of the Predicted Exposure Concentration for HDI TRIMER in food for secondary poisoning taken into account for risk characterisation.

| | PEC local (oral) | PEC local + regional (oral) | Justification |
|---------------------------------------|------------------|-----------------------------|---------------------------------|
| PEC oral, predator (mg/kg w/w) | 0 | 0 | No release into the environment |
| PEC oral, top predator (mg/kg w/w) | 0 | 0 | No release into the environment |
| Concentration in earthworm (mg/kg ww) | 0 | 0 | No release into the environment |

Section 4 - Guidance to Downstream User

ECETOC TRA, or, EUSES v2.1, Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required.

Section 1 - Exposure Scenario Title

ES3. Professional end use

Description of activities/processes treated in the exposure scenario

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|--|------------|
| Main User Group: SU 10 Formulation [mixing] of preparations and/or re-packaging (excluding alloys) SU 12 - Manufacture of plastics products, including compounding and conversion SU 13 - Manufacture of other non-metallic mineral products, e.g. plasters, cement SU 19 - Building and construction work SU 22 Professional uses: Public domain (administration, education, entertainment, services, craftsmen). | |
| Process category: PROC 3 Use in closed batch process (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC 8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at nondedicated facilities PROC 8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 10 Roller application or brushing PROC 11 Non industrial spraying PROC 13 Treatment of articles by dipping and pouring. PROC 14 Production of preparations or articles by tableting, compression, extrusion, pelletisation PROC 15 Use as a laboratory reagent | |
| Environmental release category: ERC 2 Formulation of preparations ERC 8c Wide dispersive indoor use resulting in inclusion into or onto a matrix. ERC 8f Wide dispersive outdoor use resulting in inclusion into or onto a matrix | |
| Section 2 - Operating Conditions and Risk management measures | |
| 2.1 - Operating Conditions related to human exposure | |
| Duration of exposure | 8 h/day |
| Frequency of exposure | 220 d/year |
| Physical form | Liquid |
| Concentration of substance in preparation or article: in general 50% | |
| 2.2 - Risk management measures related to human health | |
| Organisational and Technical measures: Local exhaust ventilation is required. In long-term processes where contact to substance cannot be excluded (e.g. filling operations), containment (e.g. housing) is recommended. Procedural and/or control technologies are used to minimise emissions and the resulting exposure during purification or cleaning and maintenance procedures. Control staff entry to work area. Persons who suffer from skin complaints or other hypersensitivity reactions of skin should not work with the product. Ensure all equipment well maintained. Regular cleaning of equipment and work area. | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Risk management measures:

In short-term process where contact to substance cannot be excluded (e.g. sampling operations), an air-fed mask or a combination of activated carbon filter and particulate filter is required. For processes where the opportunity for exposure arises, the use of gloves and protective clothing is stipulated. Suitable materials for safety gloves; EN 3743: Laminate glove - PE/EVOH/PE; Breakthrough time ≥ 480 min. Wear eye/face protection e.g. goggles and face shield. Keep away from foodstuffs, drinks and tobacco. Keep working clothes separately. Change contaminated or soaked clothing immediately.

2.3 - Operating Conditions related to environment

Emission days per site max. 300

Annual amount used per site >1000 t

Abatement measures waste water No waste water is occurring during production.

2.4 - Risk management measures related to environment

Organisational measures:

Procedural and/or control technologies are used to minimise emissions and the resulting exposure during purification or cleaning and maintenance procedures

Abatement measures:

Waste water: No waste water is generated

Waste air: All waste gases from production and dis/charging steps are transferred to a combustion unit or to an activated carbon filter

Soil: Sealing of all relevant soil surfaces in the facility

Waste management measures, necessary for risk management at different stages of the life cycle of substances (including mixtures or articles at the end of its life cycle):

Type of waste: Solvent used for cleaning procedures.

Disposal technique: The waste from production is disposed by incineration in a waste combustor.

Fraction released to environment: No emission to the environment during waste treatment during waste treatment.

Section 3 - Estimation of exposure information

3.1 - Estimation of exposure

Workers (oral) No significant oral exposure

Workers (dermal) Estimated by the means of the ECETOC TRA model

| | |
|----------------|---|
| PROC 3 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |
| PROC 4 (>4 h) | 0.69 mg/kg (body weight) using personal protection equipment |
| PROC 5 (>4 h) | 1,37 mg/kg (body weight) using personal protection equipment |
| PROC 8a (>4 h) | 1,37 mg/kg (body weight) using personal protection equipment |
| 8b (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 9 (>4 h) | 0,69 mg/kg (body weight) using personal protection equipment |
| PROC 10 (>4 h) | 1,62 mg/kg (body weight) using personal protection equipment |
| PROC 11 (>4 h) | 10,70 mg/kg (body weight) using personal protection equipment |
| PROC 13 (>4 h) | 2,70 mg/kg (body weight) using personal protection equipment |
| PROC 14 (>4 h) | 0,34 mg/kg (body weight) using personal protection equipment |
| PROC 15 (>4 h) | 0,03 mg/kg (body weight) using personal protection equipment |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|-------------------------------|--|
| Workers (inhalation) | Estimated by the means of the ECETOC TRA model |
| PROC 3 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 4 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 5 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 8a (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation PROC |
| 8b (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 9 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 10 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 11 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 13 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation PROC |
| 14 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| PROC 15 (>4 h) | 0,21 mg/m ³ , with Local exhaust ventilation |
| Environment | |
| Water | 0 mg/l |
| Soil | 0 mg/kg wet weight |
| STP | 0 mg/l |
| Human via environment | 0 mg/kg bw/day |
| 3.2 - Workers exposure | |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Oral exposure to HDI TRIMER is unlikely to occur because it is prohibited to eat, drink or smoke in the production area. Resting rooms are separated from the manufacturing area and industrial hygiene standards are applied. Personnel who work with HDI TRIMER should have a pre-placement medical examination and periodic examinations thereafter, including a pulmonary function test. Anyone with a medical history of chronic respiratory disease, asthmatic or bronchial attacks, indications of allergic responses, recurrent eczema or sensitization conditions of the skin should not handle or work with HDI TRIMER. Anyone who develops chronic respiratory distress when working with Polyisocyanates should be removed from exposure and examined by a physician. Further exposure must be avoided if a sensitivity to HDI TRIMER has developed (ALIPA, 2008). As the synthesis HDI TRIMER takes place in closed processes, dermal and inhalation exposure may solely arise at sampling and filling steps. Such exposure is reduced through appropriate risk management measurements like the use of closed units, the presence of ventilation and exhaustion as well as equipped work places and personal protection equipment. A generic tier 1 estimation of the workers exposure occurring at the manufacture of HDI TRIMER was performed using the ECETOC TRA model (v. 2009). Underlying substance properties as well as model settings are presented in the following table.

| Substance properties | | Model setting | |
|-------------------------|---------------|--|--|
| Molecular weight | Ca. 500 g/mol | Type of setting | Industrial |
| Vapour pressure | < 0,0001 Pa | State | Liquid |
| Water solubility | n.a. | Duration of activity | > 4 h/day |
| Dustiness | n.a. | Use of ventilation | Indoor, without ventilation (dermal exposition); Indoor, with ventilation (inhalation exposition) |
| | | Use of respiratory protection equipment | No |
| | | Substance used in preparation | n.a. |

Dermal exposure of workers to HDI TRIMER is solely possible during (dis)charging as well as sampling steps. According to the Technical Report (ECETOC, 2004) no dermal exposure is expected when operating in closed (PROC 1), closed continuous (PROC 2) or closed batch processes (PROC 3). Though the outcome of the ECETOC TRA for all PROC's is reported here.

| Operation | Dermal exposure estimate (mg/kg bw/day) | Dermal exposure estimate (mg/kg bw/day) |
|--------------|--|--|
| | Without PPE | With PPE |
| PROC 3 >4 h | 0,34 | 0,03 |
| PROC 4 >4 h | 6,86 | 0,69 |
| PROC 5 >4 h | 13,7 | 1,37 |
| PROC 8a >4 h | 13,7 | 1,37 |
| PROC 8b >4 h | 6,86 | 0,69 |
| PROC 9 >4 h | 6,86 | 0,69 |
| PROC 10 >4 h | 27,7 | 2,7 |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | | |
|--------------|-----|------|
| PROC 11 >4 h | 107 | 10,7 |
|--------------|-----|------|

| | | |
|--------------|------|------|
| PROC 13 >4 h | 13,7 | 1,37 |
| PROC 14 >4 h | 3,43 | 0,34 |
| PROC 15 >4 h | 0,34 | 0,03 |

For processes where the opportunity for exposure arises, the use of personal protection equipment (PPE) such as gloves is recommended to control the risk. Use of PPE's reduces exposure by 90% (EU TGD, Part I, 5, 7 and 10, additional RMMs are required in cases where opportunity for contact with the substance arises. In these cases, either technical measures or personal protection equipment should be used. When the worker is in near distance to the spray. The spray direction is typically horizontal or downwards. If local exhaust ventilation (about 0.3 m/sec) is used from top to down and overspray is collected in a filter. The overall, gloves and a full-face respirator mask with external air supply (ALIPA 2010). Inhalation exposure is minimised via the application of mainly closed processes as well as the use of local exhaust ventilation during all sampling and (dis)charging operations. The following table comprises the exposure of workers during the industrial end use of HDI TRIMER. However, the current version of the tool (July, 2009) has some weaknesses for the exposure estimation of liquids. The tool does not give changes when using LEV, PPE or different exposure times. Therefore the effect of LEV (90% reduction) is entered manually.

| Operation | Inhalative exposure estimate | |
|--------------|------------------------------|-----------------|
| | mg/m ³ | mg/kg pc/giorno |
| PROC 3 >4 h | 0,21 | 0,04 |
| PROC 4 >4 h | 0,21 | 0,04 |
| PROC 5 >4 h | 0,21 | 0,04 |
| PROC 8a >4 h | 0,21 | 0,04 |
| PROC 8b >4 h | 0,21 | 0,04 |
| PROC 9 >4 h | 0,21 | 0,04 |
| PROC 10 >4 h | 0,21 | 0,04 |
| PROC 10 >4 h | 0,21 | 0,04 |
| PROC 13 >4 h | 0,21 | 0,04 |
| PROC 14 >4 h | 0,21 | 0,04 |
| PROC 15 >4 h | 0,21 | 0,04 |

In order to validate the refined ECETOC TRA estimations, results were compared with the "Reach Tool" (<http://www.advancedreachtool.com/>) (Version 1). This tool has been developed for exposure assessments. It is capable to estimate exposure from handling liquids. Two examples have been calculated: Spraying according to PROC11 and filling operations according to PROC 8b/9 were calculated. The following table, input parameters are described.

| Model settings | Input |
|---------------------|---------|
| Primary product | Liquid |
| Process temperature | 15-25°C |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|--|-----------------------------|
| Vapour pressure | 0,0001 Pa |
| Liquid weight fraction | 0.1 – 0.5 (10-50 %) |
| Viscosity | Like water |
| Is the primary emission source located in the breathing zone of the worker (<1 m)? | Yes |
| Activity class | Surface spraying of liquids |
| Situation | moderate (0.3 – 3 l/min.) |

| | |
|--|---------------------------------------|
| Spray direction | Horizontal or downwards |
| Spray technique | Spraying with high compressed air |
| Process fully enclosed? | no |
| Effective housekeeping? | yes |
| Site description | Indoors, room size 100 m ³ |
| Primary localised controls | Fixed capturing hood (90 % reduction) |
| Secondary localised controls | no |
| Segregation | 3 |
| Air changes per hour | No |
| Are secondary sources present in the workroom? | Full shift |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

The outcome of the “Advanced Reach Tool” was 0.095 mg/m³ (75-percentile) and 0.18 mg/m³ (90-percentile). These results show that results from ECETOC TRA modified with the factor of 0.1 according to LEV are in the same range or even more conservative.

| Model settings | Input |
|--|--|
| Primary product | Liquid |
| Process temperature | 15-25°C |
| Vapour pressure | 0,0001 Pa |
| Liquid weight fraction | 1 |
| Viscosity | Like water |
| Is the primary emission source located in the breathing zone of the worker (<1 m)? | Yes |
| Activity class | Falling liquids |
| Activity subclass | Falling liquids with splash loading |
| Use rate of transfer | 10-1000 l/min |
| Level of containment | handling that reduces contact between product and adjacent air |
| General control measures | local exhaust ventilation |
| Type of hood | fixed capturing hood |
| Fully enclosed | No |
| Are demonstrable and effective housekeeping practices in place? | Yes |
| Site description | indoors, room size 1000m ³ |
| Air changes per hour | 3 |
| Are secondary sources present in the workroom? | No |
| Exposure period | Full shift |

The outcome of the “Advanced Reach Tool” was 0.037 mg/m³ (75-percentile) and 0.074 mg/m³ (90-percentile). These results show that results from ECETOC TRA modified with the factor of 0.1 according to LEV are in the same range or even more conservative. The following table comprises the total exposure of the worker occurring during the professional end use as an accounting for the dermal as well as inhalation exposure for each single process.

| Operation | Total exposure (mg/kg bw/day) |
|-----------|-------------------------------|
| PROC3>4h | 0,07 |
| PROC4>4h | 0,73 |

| | |
|-----------|------|
| PROC5>4h | 1,41 |
| PROC8a>4h | 1,41 |
| PROC8b>4h | 0,73 |
| PROC9>4h | 0,73 |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | |
|-----------|------|
| PROC10>4h | 2,7 |
| PROC11>4h | 10,7 |
| PROC13>4h | 1,41 |
| PROC14>4h | 0,38 |
| PROC15>4h | 0,07 |
| | |

3.3 - Consumer exposure

Not applicable as the industrial end use in industrial setting of the substance is characterized and consumers are not affected

3.4 - Indirect exposure of human via the environment (oral)

No release of HDI TRIMER by waste water, waste air or waste from manufacture occurs. Therefore humans are not exposed via the environment.

3.5 - Environmental exposure

Environmental releases:

Release of HDI TRIMER is controlled by means of effective risk management measures. Exposure of the environment is not expected. Waste gases are cleaned by incineration or by an activated carbon filter. Organic solvent used for cleaning procedures are disposed off via a waste combustion unit. During waste treatment, exposure of the environment is therefore not expected.

Exposure concentration in sewage treatment plants (STP):

Waste water related to industrial end use of HDI TRIMER is generally not directed to a sewage treatment plant (STP). Therefore a STP is not affected. There are 2 types of waste water collection:

1.

Collection of the “overspray” in water. The isocyanate groups in HDI TRIMER react with water yielding polymeric ureas or, if polyols are present, forming Polyurethanes. The sludge is precipitating which in most cases is incinerated or, in a few cases, disposed off in landfills.

2.

Collection of the “overspray” with dry filters and disposing off by incineration or landfill (see 1.). **PEC_{STP} = 0 mg/l.**

Exposure concentration in aquatic pelagic compartment:

Summary of the Predicted Exposure Concentration (PEC) of HDI TRIMER in aquatic pelagic compartment taken into account for risk characterisation:

| Compartments | PEC local (aquatic) mg/l | PEC local + regional (aquatic) mg/l | Justification |
|--------------|--------------------------------|---|---------------|
|--------------|--------------------------------|---|---------------|

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

| | | | |
|------------|---|---|--|
| Freshwater | 0 | 0 | <p>Waste water related to industrial end use of HDI TRIMER is generally not directed to a sewage treatment plant (STP). Therefore a STP is not affected. There are 2 types of waste water collection:</p> <ol style="list-style-type: none"> 1. Collection of the “overspray” in water. The isocyanate groups in HDI TRIMER react with water yielding polymeric ureas or, if polyols are present, forming Polyurethanes. The sludge is precipitating which in most cases is incinerated or, in a few cases, disposed off in landfills. 2. Collection of the “overspray” with dry filters and disposing off by incineration or landfill (see 1.). |
|------------|---|---|--|

| | | | |
|-------------------------------|---|---|----------------|
| Marine water | 0 | 0 | See freshwater |
| Intermittent release of water | 0 | 0 | See freshwater |

Predicted Exposure Concentrations (PEC) in sediments: In the risk characterization was considered the total of expected exposure concentrations (PEC) of the HDI TRIMER freshwater sediments:

| Compartments | PEC local (sediments) mg/kg dw | PEC local + regional (sediments) mg/kg dw | Justification |
|------------------------|--------------------------------|---|--|
| Freshwater sediments | 0 | 0 | <p>Waste water related to industrial end use of HDI TRIMER is generally not directed to a sewage treatment plant (STP). Therefore a STP is not affected. There are 2 types of waste water collection:</p> <ol style="list-style-type: none"> 1. Collection of the “overspray” in water. The isocyanate groups in HDI TRIMER react with water yielding polymeric ureas or, if polyols are present, forming Polyurethanes. The sludge is precipitating which in most cases is incinerated or, in a few cases, disposed off in landfills. 2. Collection of the “overspray” with dry filters and disposing off by incineration or landfill (see 1.). |
| Marine water sediments | 0 | 0 | See fresh water sediments |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Exposure concentrations in soil and groundwater: The exposure of the terrestrial compartment can occur through the application of sewage sludge and the deposition from the atmosphere. Since no emission to waste water occurs, the entry via sewage sludge can be excluded. Deposition from air is unlikely to occur as an emission to the atmospheric compartment during manufacture can be excluded. Waste gases are transferred to an incineration plant or to similar cleaning processes, where HDI TRIMER is completely removed. Furthermore, all relevant surfaces within the production plant are sealed to prevent contamination of soil. Summary of the Predicted Exposure Concentration (PEC) for HDI TRIMER in soil taken into account for risk characterisation.

| Compartments | PEC local (soil/groundwater) | PEC local + regional (soil/groundwater) | Justification |
|--|---------------------------------|--|--|
| Agricultural Soil averaged (mg/kg ww) | 0 | 0 | No penetration via the application of sewage. Sludge and atmospheric deposition. |
| Prateria media (mg/kg peso/peso) | 0 | 0 | See agricultural soil |
| Falde freatiche (mg/l) | 0 | 0 | See agricultural soil |

Atmospheric compartment: Waste air is transferred to an incineration plant or to similar waste treatment procedures assuming an efficiency of 100 % with respect to the removal of HDI TRIMER. Consequently, an emission

to the atmospheric compartment can be excluded. Summary of the Predicted Exposure Concentration (PEC) for HDI TRIMER in air taken into account for risk characterisation.

| | PEC local (air) | PEC local+regional (air) | Justification |
|--|-----------------|--------------------------|---|
| During emission ($\mu\text{g}/\text{m}^3$) | 0 | 0 | Complete removal from waste gases due to purification, e.g. via incineration. |
| Annual average ($\mu\text{g}/\text{m}^3$) | 0 | 0 | See emission |
| Annual deposition ($\mu\text{g}/\text{m}^2/\text{day}$) | 0 | 0 | See emission |

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

Exposure concentration relevant for the food chain (Secondary poisoning): During formulation, HDI TRIMER is not released into the environment. Therefore, secondary poisoning via the environment is not considered to be a risk. Summary of the Predicted Exposure Concentration for HDI TRIMER in food for secondary poisoning taken into account for risk characterisation.

| | PEC local (oral) | PEC local + regional (oral) | Justification |
|---------------------------------------|---------------------|--------------------------------|---------------------------------|
| PEC oral, predator (mg/kg w/w) | 0 | 0 | No release into the environment |
| PEC oral, top predator (mg/kg w/w) | 0 | 0 | No release into the environment |
| Concentration in earthworm (mg/kg ww) | 0 | 0 | No release into the environment |

Section 4 - Guidance to Downstream User

ECETOC TRA, or, EUSES v2.1, Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures, If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required

Abbreviations and acronyms

B bioaccumulation
 BCF Bioconcentration factor
 ECETOC European Centre for Ecotoxicology and Toxicology of Chemicals
 ES Exposure Scenario
 ERC Environmental release category
 LEV Local exhaust ventilation
 PC Chemical product category
 PEC Predicted Environmental Concentration
 PNEC Predicted No-Effect Concentration
 PPE Personal Protective Equipment
 PROC Process category
 RCR Risk Characterisation Ratio
 RMM Risk Reduction Measure
 SCOEL Scientific Committee on Occupational Exposure Limit
 STP Sewage Treatment Plant
 SU Sector of use
 TRA Targeted Risk Assessment
 TWA value Time Weighted Average value vB
 Very Bioaccumulative
 WWTP Waste Water Treatment Plant

Exposure Scenario

Hexamethylene diisocyanate oligomers, isocyanurate

This exposure scenario was drawn to integration of the safety data sheet. The information contained in this annex are based on the data currently available to us in connection with the product. The above data were collected according to our best knowledge, however only for informative purposes.

The Security tab is used to help the user of the product in the decision of the applicability and suitability of the product in relation to the use and in the fulfilment of the obligations associated with the use of hazardous substances, it exempts from knowledge and application of the provisions relating to such activity, nor by the application of appropriate protection measures.

Since we cannot affect the handling, storage, use and disposal of the product and we have no information, no liability is accepted for the handling, storage, use and disposal of the product.

When the product is used as part of another product, the present ES will no longer apply'

Manufactured by:

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