

ISOPA PRODUCT STEWARDSHIP PROGRAMMES

"One Step Ahead – 2nd Generation" TDI/MDI Users



Version 2019

One Step Ahead



SAFETY is not a one time effort

- Commitment from the ISOPA Member Companies
- Continuous improvement required
- Working with hazardous chemicals requires right attitude towards health & safety from management and workers.
- Good Environmental, Health and Safety attitude helps to secure future business success

One Step Ahead



one step ahead **Safety in Action**

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One Step Ahead



Behavior based Performance



TDI / MDI in General

One Step Ahead – TDI/MDI Users

ONG Step ahead Safety in Action

Content

- Essential data
- Good practice
- When things go wrong . . .

→ Informing session

Appearance of TDI



| | Liquid | | Reacted | |
|-----|--|--|----------------|--|
| TDI | Clear to pale yellow Sharp, pungent | | White Foamy | |

TDI classification



CLP / GHS



Signal word: Danger

Hazard statements

- H315 Causes skin irritation
- H317 May cause an allergic skin reaction
- H319 Causes serious eye irritation
- H330 Fatal if inhaled
- H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled
- H335 May cause respiratory irritation
- H351 Suspected of causing cancer
- H412 Harmful to aquatic life with long lasting effects

Follow precautionary statements and product labelling in supplier's SDS.

Signal Word: Very toxic T+

Risk-phrases

DSD

| R26 | Very toxic by inhalation |
|-----------|--|
| R36/37/38 | Irritating to eyes, respiratory system and skin |
| R40 | Limited evidence of a carcinogenic effect |
| R42/43 | May cause sensitization by inhalation and skin contact |
| R52/53 | Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment |

Follow safety phrases and product labelling in supplier's SDS.

TDI Physical Properties



 TDI has a substantial vapour pressure already at 20 °C resulting in a high concentration in air above the liquid



- The exposure limit of 0.035 mg/m³ is below the odor limit
- ➡ WHEN YOU SMELL TDI YOU ARE ABOVE THE EXPOSURE LIMIT ⁹

| тс | OI Physical I | Properties | | ONE Step ahead Safety in Action |
|-----------------|--------------------------------|---------------------------|---|--|
| • | TDI has a sig above the liq | gnifican a high co uid | ncentratic | on in air |
| | Satu 30000 _م | Always | Temp. in °C | TDI in mg/m ³ |
| TDI in mg/m^3 | | | 20 | 98 |
| | 20000 - | protect yourself | 40 | 548 |
| | | from broathing | 60 | 2390 |
| | 10000 - | Inom breatning | 80 | 8509 |
| | | | 100 | 25597 |
| | 0 20 | | <i>J. Chem. Eng.</i> (Data for 2,4-T | <i>Data, 1975, 20, 1, 13-15.</i> DI isomer) |

WHEN YOU SMELL TDI YOU ARE ABOVE THE OCCUPATIONAL EXPOSURE LIMIT

Appearance of MDI



| Solid or Liquid | | Reacted | | |
|----------------------------------|--|-----------------|--|--|
| Clear to brown Slightly musty | | Brown Crusty | | |

MDI classification

CLP / GHS



Signal word: Danger

Hazard statements

- H332 Harmful if inhaled.
- H315 Causes skin irritation.
- H319 Causes serious eye irritation.
- H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
- H317 May cause an allergic skin reaction.
- H335 May cause respiratory irritation.
- H351 Suspected of causing cancer.
- H373 May cause damage to organs through prolonged or repeated exposure.

Follow precautionary statements and product labelling in supplier's SDS.

Signal Word: Danger

Risk-phrases

DSD

| R20 | Harmful by inhalation. |
|-----------|---|
| R36/37/38 | Irritating to eyes, respiratory system and skin. |
| R40 | Limited evidence of a carcinogenic effect. |
| R42/43 | May cause sensitization by inhalation and skin contact. |
| R48/20 | Harmful: danger of serious damage to health by prolonged exposure through inhalation. |

Follow safety phrases and product labelling in supplier's SDS.



MDI Physical Properties



- Like most substances MDI evaporates and will be present in air
- The higher the temperature of the MDI the greater the potential concentration in the air



Vapour Pressure Concentration of MDI in air

WHEN YOU SMELL MDI YOU ARE ABOVE THE OCCUPATIONAL EXPOSURE LIMIT



TDI/MDI Chemical Properties



TDI/MDI will react with many compounds – especially water, polyol, amines, ammonium hydroxide, alkalines

Higher temperatures mean faster reactions

(beware of temperatures > 40 °C)

In your region these temperatures are normal on a day to day basis!

During reaction heat & gases (CO_2) will be formed \rightarrow Risk of burns/dangerous pressures

Where do you find these conditions ?

Where do you find these conditions?



- Proper drum cleaning with decontaminant
- Polyol / diisocyanate stored together
- Spillage into a drain
- Opening drums
- Off-loading of wrong chemical into a bulk storage tank
- TDI/MDI in face / eyes or mouth (soft tissue)
- Disposal of TDI/MDI in wet drums
- In the foam curing, crushing and storage area







TDI/MDI module within OSA program



- Both TDI and MDI are used in the AF/ME regions
- The One Step Ahead program has separate modules for TDI and MDI
- Next slides in the presentation are extracted from the TDI module, as TDI has the highest toxicity and therefore the most stringent safety measures

Effect of TDI/MDI on your health

Short term / one-off exposure above safe level

- Irritates mouth, throat, lungs
- Tight chest, coughing
- Difficulty in breathing
- Eyes watering
- Itching, red skin (immediately or delayed)
- May be hot or burn

Symptoms can occur up to 24 hours after exposure

Seek medical assistance *Immediately with SDS* !



Effect of TDI/MDI on your health



Long term/repeated over-exposure from breathing or skin contact leads to risk of sensitization

Symptoms such as occasional breathing difficulties similar to asthma, hay fever, sneezing

When sensitized, potentially severe asthma in the case of even low TDI/MDI exposure

Sensitization could prevent working with diisocyanates for life; early and prompt removal from exposure can typically result in cessation of allergic responses

Sensitization is non-reversible and is a reaction of the immune system. Not to be confused with irritation

Typical examples of unsafe behaviour





Typical examples of safe behaviour





Emptying a drum using a pump



Getting qualified medical attention



Cleaning up a spill

Don't forget to wear Personal Protective Equipment (PPE) each time when handling chemicals!



How would you describe the health effects of TDI?

- a) TDI is a clear to pale yellow liquid with a pungent odor. As long as I do not smell TDI, I am safe
- b) The occupational exposure level (OEL) of TDI is below the odor level. Therefore when you smell TDI you are very much above the safe level
- c) TDI poses a strong sensitizing potential to both skin and respiratory tract. Sensitization of the respiratory tract may result in significant decreases in lung function of workers, an asthma-like reaction characterized by wheezing, dyspnea, and bronchial constriction

Answer

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How can workers protect from sensitization to TDI/MDI?

- a) By avoiding to touch fresh foam without gloves and by avoiding to breathe in TDI/MDI vapor
- b) By avoiding to breathe in TDI/MDI vapor
- c) Fresh foam does not contribute to sensitization as the diisocyanates have already reacted. Hence fresh foam can be handled without gloves
- d) You cannot avoid sensitization of coworkers

Answer



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What is the labelling information of TDI?

- a) Fatal if inhaled
- b) May cause respiratory irritation; Causes skin irritation and serious eye irritation
- c) May cause allergy or asthma symptoms of breathing difficulties if inhaled; may cause an allergic skin reaction
- d) Suspected of causing cancer
- e) Harmful to aquatic life with long lasting effects



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Which effects may be caused by a short term or a oneoff exposure with TDI- or MDI-vapor above safe level?

- a) Tight chest, coughing
- b) Difficulty in breathing
- c) Symptoms may occur up to 24 hours after exposure
- d) A bad smell



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Which general statements related to a TDI or MDI exposure are correct?

- a) High exposure to TDI or MDI is one possible cause of sensitization
- b) Early treatment is important
- c) Symptoms may occur later
- d) Immediately seek medical help





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TDI / MDI Safe Handling

Safe handling of TDI/MDI



- Is the workplace clean and do you have good personal hygiene?
- Does anyone eat, drink or smoke in the workplace?
- Is there good workplace ventilation?
- Is there continuous use of the correct PPE including during plant maintenance?
- Do you have emergency equipment?
 Do you know where to find emergency equipment?
- Are TDI/MDI levels measured in the workplace?
- Do you have and practice emergency procedures?
- Are regular medical health checks performed?

Good personal hygiene



 Wash hands with soap & water after finishing work and before eating, drinking or smoking

Do not use solvents for washing hands

Use disposable or clean towels

Do not re-use contaminated clothing or gloves



How to safely remove disposable gloves



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Remove carefully to protect your skin from contamination

Clean and safe workplace

- Keep work area clean and tidy
- Respiratory equipment should be readily available (and well maintained)
- Know the locations of safety showers and eyebaths / eye wash bottles. They should be easily accessible
- Do not eat, drink or smoke in the workplace
- Segregate your PPE and work clothes
 Do not take the PPE or work clothes home or in areas where food is
 consumed.





Good workplace ventilation

- A good ventilation is key for a safe work environment
- For sufficient ventilation an extraction system is needed
- Further openings (doors, windows) in the building can support an efficient ventilation of the workplace





Good workplace* ventilation

- Check that extraction system is switched on
- Place hood as near as possible above the source
- Repeatedly check flow-direction
- A fume hood is most appropriate for laboratory areas
- Foam production on a conveyor requires sufficient extraction also in the tunnel and at the cut off area.
- Air curtains improve the extraction efficiency





* includes warehouse

Continuous use of the correct PPE





More detailed information on PPE will be discussed later in the program ³⁶

Dealing with a spillage of TDI/MDI

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VIDEO CLIP

Dealing with a spillage of TDI/MDI

- Evacuate area
- Inform neighbours and authorities according to the emergency plan
- Put on PPE including self-contained breathing apparatus
- Prevent TDI/MDI entering drains
- Cover the spill with sand or special absorbent to prevent escape of TDI/MDI vapor
- Apply liquid decontaminant on the covered spill and mix with shovel
- Put contaminated sand in steel drums (max 2/3 full), leave open to prevent pressure build up and monitor emissions
- Use decontaminant solution to clean and neutralize the surface
- Drum can only be closed when temperature is low and falling
- Treat as TDI/MDI waste
- Measure TDI/MDI levels in the atmosphere

Decontamination Recipe

For the decontamination of diisocyanates, the following products are required :

POSSIBLE DECONTAMINANT RECIPE

Liquid / yellow soap: 0,2 - 2%

Sodium carbonate: 5 - 10%

Water: fill to 100%

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Safety in Action

Do you have and do you know where to find the emergency equipment?

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- Decontaminant solution
- Shovels
- Brushes and waste container
- Absorbent material such as sand

First Aid equipment

Know where your first aid equipment isKnow what to doKnow who to tell





Shower

Soap

Clean running water is best

Eyebath or eye wash bottle

Telephone number of medical doctor - Refer to Safety Data Sheet (SDS) emergency telephone numbers / procedures

Emergency procedures

VIDEO CLIP:

Know First Aid for TDI



Emergency procedures

Know First Aid for TDI/MDI







- Force open the eyelids
- Flush with lots of water for at least 15 minutes
- If in doubt, keep flushing
- See eye specialist as soon as possible
- Immediately wash with soap & water
- Immediately remove contaminated clothing
- Go outside into fresh air
- Doctor has to be consulted and a SDS has to be handed out for more product and emergency information

Examples of First Aid Equipment





Emergency procedures - Exposure to TDI/MDI



- A single high exposure to TDI/MDI is one possible cause of sensitization
- Early treatment is important
- Remember that symptoms may occur later up to 24H after exposure
- Help is available for the doctor from ISOPA member companies



Emergency procedures

Fire involving TDI/MDI

Follow your normal factory emergency procedure

- Sound Alarm
- EVACUATE immediately
- Use trained specialists to fight fire
- Ensure protection from TDI/MDI emissions
- Remember TDI/MDI fires are not self extinguishing







Follow your factory emergency procedure



Handling of fresh TDI/MDI-based foam

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Hazards:

- Exposure to TDI/MDI, additives and release agent
- Heat generated during reaction
- Dust from sawing

Wear PPE (see previous slides)Good ventilation is important

Setting up an Emergency Plan for Spillages, Accidents and fires



- Set up scenarios of possible emergency cases including fires, accidents and spillages
- Define procedures for different scenarios
- Implement periodic employee trainings
- Implement periodic audit of PPE, safety and emergency equipment



What is important for a clean and safe workplace?

- a) To know the location of emergency equipment (safety shower; eyebaths; etc.)
- b) When eating in the workplace, keep the food in the refrigerator at the workplace, so it cannot be contaminated
- c) Do not smoke, eat or drink at the workplace at all
- d) Segregate working clothes and PPE from the places, where you eat or have a rest

Answer



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Fresh foam should be handled with gloves? What has to be taken into consideration related to the gloves?

- a) The timing. Gloves may vary in break-through time. Therefore gloves should be replaced regularly according to the specific requirements.
- b) The type of gloves. Not every glove is suitable for handling of e.g. fresh foam or for handing diisocyanates. Therefore check, which gloves may be used for handling of fresh PU foam or working with diisocyanates.
- c) Foam type. Some foam types can be touched immediately after production

Answer



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A worker accidently has been splashed with TDI/MDI. Which measures should be initiated?

- a) Remove the person from the area with the spillage, bring him to fresh air
- b) Immediately remove contaminated clothing
- c) Immediately wash with soap & water
- d) Seek medical assistance. Provide the SDS!





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