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

What does the distribution tell us?

Dialog is essential to change behavior. Do not ignore possible incidents

1

Behavior related

risks

10

Serious accident; accident with lasting consequences

Minor accident. Accidents that are not described as serious

30

Accidents with material damage (all kinds)

600

Incidents with no visible injuries or damage
One Step Ahead

Behavior based Performance
TDI / MDI in General
One Step Ahead – TDI/MDI Users

Content

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

→ Informing session
## Appearance of TDI

<table>
<thead>
<tr>
<th></th>
<th>Liquid</th>
<th>Reacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDI</td>
<td>Clear to pale yellow Sharp, pungent</td>
<td>White</td>
</tr>
<tr>
<td></td>
<td><img src="image1" alt="Liquid TDI" /></td>
<td>Foamy</td>
</tr>
<tr>
<td></td>
<td><img src="image2" alt="Reacted TDI" /></td>
<td></td>
</tr>
</tbody>
</table>

![Image](image3)
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.

**DSD**

Signal Word: Very toxic T+

**Risk-phrases**

- 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 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**
TDI Physical Properties

- TDI has a significant vapour pressure giving a high concentration in air above the liquid.

Always protect yourself from breathing TDI!

WHEN YOU SMELL TDI YOU ARE ABOVE THE OCCUPATIONAL EXPOSURE LIMIT

<table>
<thead>
<tr>
<th>Temp. in °C</th>
<th>TDI in mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>98</td>
</tr>
<tr>
<td>40</td>
<td>548</td>
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<tr>
<td>60</td>
<td>2390</td>
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<tr>
<td>80</td>
<td>8509</td>
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<td>100</td>
<td>25597</td>
</tr>
</tbody>
</table>

(Data for 2,4-TDI isomer)

# Appearance of MDI

<table>
<thead>
<tr>
<th>Solid or Liquid</th>
<th>Reacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear to brown</td>
<td>Brown Crusty</td>
</tr>
<tr>
<td>Slightly musty</td>
<td></td>
</tr>
</tbody>
</table>

- 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.

DSD

Signal Word: Danger

**Risk-phares**
- 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.
MDI Physical Properties

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

Always protect yourself from breathing MDI!

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 (CO₂) will be formed
→ 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

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.
Question

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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Question

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
Question

What is the labelling information of TDI?

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Question

Which effects may be caused by a short term or a one-off 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
Answer

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Question

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
Answer

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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

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

- Wear protective liquid- tight gloves
- Wear overall & boots
- In emergencies wear overall and/or heavy duty apron
- Wear eye protection

- Butyl rubber
- Neoprene
- Nitrile

More detailed information on PPE will be discussed later in the program
Dealing with a spillage of TDI/MDI

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:

- Liquid / yellow soap: 0,2 – 2%
- Sodium carbonate: 5 – 10%
- Water: fill to 100%
Do you have and do you know where to find the emergency equipment?

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

Know where your first aid equipment is
Know what to do
Know 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

And don’t panic!
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 shower
- Emergency Eye wash shower
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 - Exposure to TDI/MDI

• **Speed is essential**

• **Practice how to carry out First Aid Procedures**

• **Seek medical advice**
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

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
Question

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

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
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Question

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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Question

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!
Answer

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