Guidance for Working with MDI and Polymeric MDI: Things You Should Know

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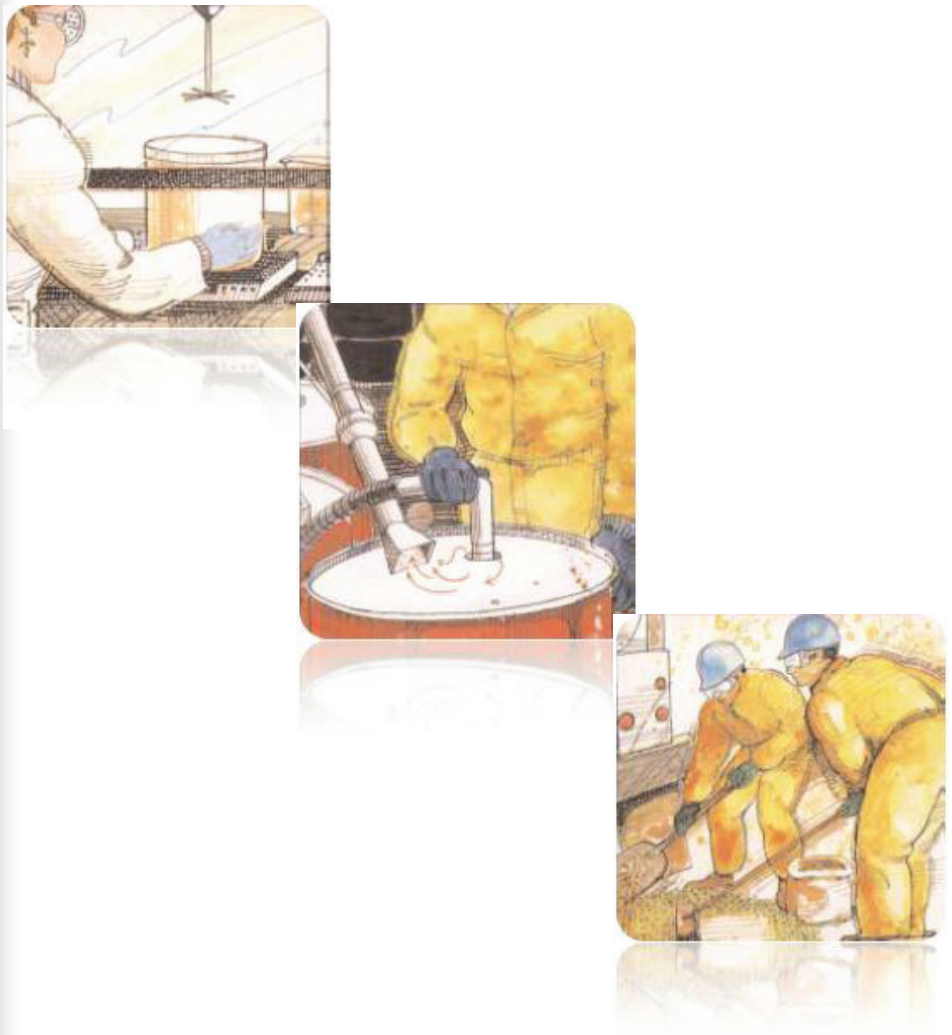
Purpose

The Center for the Polyurethanes Industry (CPI), prepared this guidance to provide information about important health and safety considerations when working with MDI or polymeric MDI. It supplements the comprehensive information contained in your supplier's Safety Data Sheets (SDSs), which are as the primary source of information for specific MDI or polymeric MDI distribution and handling issues. Throughout this document, the term MDI is used to adress both MDI and polymeric MDI.



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Identifying MDI

Diphenylmethane diisocyanate, commonly referred to as MDI, is a white to yellowish solid at room temperature with no odor. Polymeric MDI, which is more commonly used, is a mixture of MDI and larger molecular weight oligomers of MDI, and is a brownish liquid at room temperature and may have a slight odor. Some typical values for other physical properties are:

	Pure MDI	**Polymeric MDI**
Physical State	Solid at ambient conditions	Liquid
Molecular Weight	250	varies
Boiling Point	> 300 °C	> 300 °C
Freezing/Melting Point	40 °C	5 °C
Specific Gravity	1.33 @ 68°F (20°C)	1.24 @ 68°F (20°C)
Density	9.8 lbs/gal (50°C)	--
Vapor Pressure	$4.65x10^{-6}$ mm Hg at 68°F (20°C)	$2.33x10^{-6}$ mm Hg at 68°F (20°C)
Viscosity	4.7 to 5.0 mPas @ 122°F (50°C)	100 to 250 mPas @ 77°F (25°C)
Solubility in Water	not soluble; reacts with the evolution of CO2	not soluble; reacts with the evolution of CO2
Flash Point	412°F (211°C)	406°F (208°C)

Source: MDI and TDI: Safety, Health and the Environment. A Source Book and Practical Guide. Dennis C. Allport, David S. Gilbert, Susan M. Outterside, 2003.

Recognizing Potential Health Hazards

Overexposure to MDI vapor, liquid or aerosol can be harmful to your health. There are four possible routes of exposure:

- breathing it in
- getting it in your eyes
- getting it on your skin
- swallowing it

Here are the potential effects of overexposure and some first-aid considerations:

Inhalation: If MDI is sprayed as a mist or heated, or handled where there is poor ventilation, there is a greater chance of overexposure. Even if you cannot smell MDI, you may be in danger of overexposure, because most people cannot smell MDI until concentrations are above applicable exposure limits. Exposure limits are set by regulatory

organizations like the Occupational Safety and Health Administration (OSHA) and other professional organizations such as the American Conference of Governmental Industrial Hygienists (ACGIH). Exposure limits typically define the maximum air concentration to which you can be exposed without the need for respiratory protection.

MDI can irritate your nose and lungs. You may feel tightness in your chest and have difficulty breathing. Overexposure may cause you to become sensitized or "allergic" to MDI which may cause you to have asthma-like attacks if you breathe MDI vapors again. If this happens, any further exposure must be avoided. Effects may occur immediately upon exposure, and/or be delayed for several hours after exposure ends.

If you suspect someone has become overexposed, remove the person to an area with fresh air, and try to keep them calm and warm — but not hot. Seek immediate medical attention. If they are having difficulty breathing, a qualified person may provide oxygen. If they stop breathing, a qualified person may give artificial resuscitation. Call a doctor at once.

Eye Contact: Getting MDI in your eyes can be painful and could cause tearing and irritation. Wear chemical goggles or safety glasses with side shields whenever you might be exposed to liquid or vapor MDI or MDI mist. If you get MDI in your eyes, wash them immediately with a continuous flow of low pressure water, preferably from an eyewash fountain, for at least 15 minutes. See a doctor at once.

Skin Contact: Getting MDI on your skin may play a role in the development of skin sensitization. In addition, animal tests have indicated that respiratory sensitization may occur from skin contact with MDI. Repeatedly getting MDI on your skin may also cause discoloration, redness, swelling, or itching. It is best to conduct your work to avoid skin contact, but if you get MDI on your skin, wash thoroughly with soap and flowing water (warm water if available), do not use solvents.

If your skin is irritated, seek medical attention. Properly dispose of any clothing contaminated with MDI, as well as contaminated items such as shoes, belts, and watchbands.

Ingestion: Swallowing MDI can cause irritation in your mouth, throat and stomach. If you swallow MDI, rinse the mouth with water; do not try to induce vomiting. See a physician immediately.

Protecting Yourself from MDI Overexposure

Overexposure to airborne MDI can occur in inadequately ventilated environments when MDI is sprayed, aerosolized, or heated. In addition, overexposure can occur when there is direct skin contact with liquid MDI.

Where there is a risk of exposure to airborne MDI above applicable exposure limits, consider using (at a minimum):

- An approved respirator, either air-supplied or air-purifying. Consult your company safety professional or the product SDS for guidance. The type of respiratory protection will depend upon the maximum exposure concentration.
- Elevated airborne concentrations may be irritating to the eyes; therefore eye protection may also be needed if not already provided by the respirator.

Where there is a risk of skin and eye contact with liquid MDI consider using at a minimum:

- MDI resistant gloves (see CPI document MDI User Guidelines for Protective Clothing Selection, AX-178).
- Chemical safety goggles.
- If there is potential for more extensive exposure, consider using the following:
    - MDI-resistant long-sleeve coveralls or full body suit.
    - MDI-resistant fitted boots.
    - Head protection, such as a close-fitting hood.

In spray applications, use respiratory protection, eye protection, and complete skin protection are necessary. Visit spraypolyurethane.org for additional health and safety information on spray polyurethane foam.

Understanding Potential Reactivity Hazards

MDI is a reactive chemical. Reactions with buildup of heat or pressure can result from improper mixing with:

- Acids, inorganic bases (such as sodium hydroxide or potassium hydroxide), ammonia, and amines;
- Magnesium, aluminum and their alloys
- Other metal salts, especially halides (such as tin, iron, aluminum and zinc chlorides)
- All strong oxidizing agents (such as bleach or chlorine)
- Polyols
- Water (typically a relatively slow reaction)

Caution: Resealing MDI containers contaminated with any of the above materials can cause a buildup of pressure in the container and cause it to explode. All forms of MDI can

also self-react in a fire or at very high temperatures, releasing carbon dioxide and causing the buildup of pressure in sealed containers sufficient to cause explosion.

Handling, Unloading and Storing MDI Considerations

To minimize hazards when handling, unloading, or storing MDI consider the following:

- Wear protective clothing
- Follow employers' established procedures for normal operations, maintenance, loading/ unloading sampling, special operations, and emergencies
- Use appropriate checklists provided by the employer for specific procedures
- Inspect equipment to ensure operating integrity following maintenance procedures
- Maintain good housekeeping
- Participate in relevant training programs

Handling drums consider the following:

- Wear protective clothing
- Follow all safety precautions for handling MDI until empty drums are decontaminated
- Handle and store drums in a well-ventilated area with containment
- Check drum shipments for leakage
- Do not use pressure to empty drums
- Do not store MDI in open-head drums
- Use plugs/caps on terminal valves or fittings and bleed valves
- Keep drum overpacks available
- Keep drums segregated from containers of material that are incompatible with MDI
- Provide secondary containment
- Do not cut empty MDI drums with a torch
- Do not use empty MDI drums from a worksite for personal use such as a barbecue pit, flower box, trash barrel, etc. Empty drums should be handled by a qualified drum reconditioner. Contact the Reusable Industrial Packaging Association (RIPA – www.reusablepackaging.org) to locate a drum reconditioner near you.

Responding to Emergencies

Fires, spills, bulging drums, and other emergencies involving MDI require immediate responses. If you are not a trained, designated emergency responder, leave the area immediately and notify the appropriate emergency response personnel.
If you need assistance with a spill or other emergency involving MDI, call CHEMTREC at 1-800-424-9300. CHEMTREC operators are available 24 hours a day, seven days a week.

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