Preventing asthma and sensitization associated with isocyanates

Isocyanates are highly reactive chemicals used in many products, including:

- Automotive and aerospace paints
- Spray polyurethane foams
- Truck bed liners
- Glues and adhesives
- Injection molding
- Lacquers and coatings

Products containing isocyanates have various brand or trade names and different chemical formulations. The most commonly used isocyanates include:

- Methylene diphenyl diisocyanate (MDI)
- Toluene diisocyanate (TDI)
- Hexamethylene diisocyanate (HDI)

Other isocyanates you may encounter include isophorone diisocyanate (IPDI) and naphthalene diisocyanate (NDI).

How to identify isocyanates in products

To determine whether a product contains isocyanates:

- Read the label and review the Safety Data Sheet (SDS).
- Look for hazard statements indicating the product may cause:
  - Skin and eye irritation
  - Allergic skin reactions
  - Asthma symptoms or breathing difficulties if inhaled
  - Respiratory irritation
- Identify two-component products that require mixing. (One component is often labeled as an activator, hardener, or catalyst.)

Hazardous ingredients

Isocyanates exist in many chemical formulations. Some of the most common ones found in the hazardous ingredients section of SDSs include:

TDI (Toluene Diisocyanate)

- 2,4-TDI (CAS: 584-84-9)
- 2,6-TDI (CAS: 91-08-7)
- TDI homopolymer (CAS: 9017-01-0)

MDI (Methylene Diphenyl Diisocyanate)

- 4,4’-MDI (CAS: 101-68-8)
- 2,4’-MDI (CAS: 5873-54-1)
- 2,2’-MDI (CAS: 2536-05-2)
- Polymeric MDI (CAS: 9016-87-9)

HDI (Hexamethylene Diisocyanate)

- Hexamethylene-1,6-diisocyanate (CAS: 822-06-0)
- HDI Oligomer (CAS: 28182-81-2)
- 1,6-Hexamethylene diisocyanate (CAS: 35147-46-7)

IPDI (Isophorone Diisocyanate)

- Isophorone diisocyanate (CAS: 4098-71-9)

Health hazards of isocyanates

Isocyanates can cause severe health effects, particularly sensitization of the skin and respiratory system.

Symptoms of exposure

Acute symptoms include:

- Eye or skin irritation
- Skin rash or blistering
- Runny nose, sore throat, or cough
- Wheezing, shortness of breath, and chest tightness

Respiratory sensitization and asthma

Repeated exposure can lead to isocyanate asthma, a potentially life-threatening allergic reaction. Once sensitized, even very low exposures can trigger severe reactions, including death. Sensitization is permanent.

Carcinogenicity

- TDI is classified as a Group 2B (possible human carcinogen) by the International Agency for Research on Cancer (IARC).
- Other isocyanates have not been classified as carcinogens.

Assessing the risks

To evaluate personal exposure to isocyanates:

- Conduct air and surface sampling and compare results to occupational exposure limits.
- Air sampling should use an active pump with specific media (varies by isocyanate type).
- Surface sampling can be done using colorimetric SwypeTM indicating pads to detect contamination.

Occupational exposure limits (OELs)

The Oregon Occupational Safety and Health Division (Oregon OSHA) has permissible exposure limits (PELs) for most isocyanates. These limits can be found in Oregon's Air Contaminants Table Z-2 (bit.ly/46Nyqzd)

How to prevent isocyanate exposure

Substitution

- Use an isocyanate-free product instead of a two-component system.
- Use preformed foam insulation instead of spray foam.

Engineering controls

- Isolate operations from other work areas.
- Use a spray booth or local exhaust ventilation system.
- Apply products using a brush or roller instead of spraying.
- If spraying, use high-volume, low-pressure (HVLP) spray guns.

Administrative controls

- Restrict access to authorized personnel.
- Limit workers' exposure time near isocyanates.
- Conduct medical monitoring for workers exposed to isocyanates, including:
- Pre-placement medical exam and annual evaluations.
- Medical removal if sensitization occurs.

Personal protective equipment (PPE)

- Wear chemical-resistant suits covering all exposed skin.
- Use gloves made from butyl rubber, natural rubber, nitrile rubber, or polyvinyl alcohol.

- Wear goggles or full-face respiratory protection.
- Use a respirator with an organic vapor cartridge and a P100 filter.

Personal hygiene

- Wash skin immediately with soap and water after removing PPE or if exposed to isocyanates.
- Decontaminate work surfaces and tools daily if they contact isocyanate products.

Train workers

- Recognize hazards and proper procedures when using isocyanates.
- Understand health effects and early symptoms of exposure.
- Properly use ventilation systems and PPE.

Resources

1. **CDC NIOSH** - Engineering Controls Database: Preventing Asthma and Death from MDI Exposure During Spray-on Truck Bed Liner Applications bit.ly/4myeox0

2. **OSHA** - Isocyanate page osha.gov/isocyanates