

MIOSHA Fact Sheet



Isocyanate Exposure in Construction

Isocyanates are compounds that contain the isocyanate group (-NCO). When mixed with alcohol (hydroxyl) groups, they react to form polyurethane polymers. Construction materials that contain such polymers include spray-on insulation, sound proofing materials, polyurethane paint systems, caulks/sealants, waterproofing agents, adhesives and concrete patching/repair materials. Isocyanate-containing materials typically consist of two parts that are mixed, resulting in a reaction that forms the desired product. However, it is important to realize that not all isocyanate-containing materials consist of two parts, for example aerosol insulating foams used to seal and insulate small openings and seams around electrical wall outlets and window frame openings. Also, many caulking agents react upon exposure to air to form a polyurethane product.

Employee exposure to isocyanates can result in both immediate and long-term serious health effects including difficulty breathing, chest tightness, and irritation of skin and mucous membranes. Isocyanates are irritating to the eyes, nose, throat and skin, and are known to sensitize the respiratory system. Excessive, short-term exposures can result in increased respiratory secretions, edema (i.e., swelling), and painful respiration, all of which if severe enough can result in decreased pulmonary function. Chronic, long-term exposure can also result in decreased lung function, eventually leading to the sensitization of the respiratory system and the development of occupational asthma. Once sensitized, even low-level exposure can result in a severe, life-threatening immune system response. Additionally, isocyanates include compounds classified as potential human carcinogens.

Employer Responsibilities:

The Construction Standard [Part 601, Air Contaminants for Construction](#) (Part 601) regulates employee exposure to isocyanates in the construction industry. The ceiling limit (C), or the level of exposure that should never be exceeded, is 0.2 mg/m³ for methylene bisphenyl isocyanate (MDI), and 0.14 mg/m³ for toluene-2,4-diisocyanate (TDI). The eight-hour maximum allowable concentration (MAC) exposure limit for methyl isocyanate (MIC) is 0.05 mg/m³ and it carries a skin notation. This means the employer must ensure precautions are also taken to prevent skin absorption.

To achieve compliance with the exposure limits, the employer is required to implement administrative and/or engineering controls whenever feasible. If administrative or engineering controls are not feasible to reduce or eliminate exposure, then personal protective equipment or other protective measures must be implemented to maintain employee exposures within the limits. It should be recognized that exposure to many monomeric and polymeric isocyanate compounds are not currently regulated by a specific exposure limit in MIOsha Part 601. In these situations, the employer is expected to comply with the recommended exposure limits from the manufacturer, the National Institute for Occupational Safety and Health (NIOSH) or the American Conference of Governmental Industrial Hygienists (ACGIH). These alternative exposure limits should be listed on the product's Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS).

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How to Avoid Hazards:

The simplest method is to eliminate the hazard through the substitution of materials that do not contain isocyanates whenever possible. However, because of the unique and desirable chemical properties that isocyanates possess, this may not be a viable choice. In such cases the employer must develop and implement an effective health and safety program that addresses the safe handling and use of these materials. An effective health and safety program should address the following:

- **Exposure Assessment** - Exposure air monitoring should be conducted to determine potential employee exposures during representative work operations.
- **Engineering/Work Practice Controls** - Such controls can include the use of local and general exhaust ventilation systems, and the implementation of restricted access work areas/zones. Other work practice controls include ensuring that all containers are tightly closed when not in use as well ensuring that materials are stored, mixed, and applied in accordance with the manufacturer's instructions. The employer should also consider exposure during cleaning of contaminated equipment.
- **Respiratory Protection** - Depending on the level of exposure, employers can and may select half face, negative pressure, air-purifying respirators equipped with cartridges appropriate to the hazard provided that a cartridge change-out schedule is established. However, because isocyanate odor thresholds are higher than the MIOSHA exposure limits, the use of supplied-air respiratory protection is strongly encouraged whenever detectable airborne levels are present in the workplace. Whenever respiratory protection is required in the workplace, an employer must develop and implement a respiratory protection program in accordance with the General Industry and Construction Standard [Part 451, Respiratory Protection](#).
- **Personal Protective Equipment** – Employees must be provided with impermeable protective work clothing/gloves to minimize skin contact with isocyanates. Eye protection should always be worn as well. The employer may refer to the manufacturer's MSDS or SDS for specific recommendations.
- **Training** – Each employer in the state of Michigan who has employees who are working with, or who are potentially exposed to hazardous chemicals during the course of their work, is required to train employees in accordance with the General Industry Standard [Part 430, Hazard Communication](#).
- **Medical Surveillance** - Though not required by a specific MIOSHA construction regulation, employers are strongly encouraged to develop a medical surveillance program that includes pre-placement and annual physical examinations, with emphasis placed on the respiratory system and patient history. All personnel who are potentially exposed to isocyanates during the course of their work should be included in such a program.

Compliance Assistance:

If you would like additional assistance, please contact the Construction Safety and Health Division at 517-284-7680 or the Consultation Education and Training Division at 517-284-7720. Construction Safety and Health Standards and other information can be viewed on the MIOSHA website at www.michigan.gov/miosha. For additional information regarding the hazards of isocyanates and the measures that can be taken to protect employees from exposure, you can visit the following web sites:

- [OSHA, Safety and Health Topics, Isocyanates](#)
- [MIOSHA, CET-5045, The Isocyanates](#)
- [NIOSH, Health & Safety Topic, Isocyanates](#)
- [NIOSH Alert, Preventing Asthma and Death from Diisocyanate Exposure](#)