

CAUSATIVE AGENT: ISOCYANATES

LUNG IRRITANT, LUNG SENSITIZER, SKIN IRRITANT, SKIN ALLERGEN

DEFINITION

Chemically reactive compound containing the isocyanate group “-NCO”; primary routes of exposure are inhalation and skin absorption; exposure may lead to lung irritation or sensitization (i.e. allergy) as well as skin irritation or allergy.

HEALTH EFFECTS

- Occupational asthma: asthma (i.e. airway obstruction) or the exacerbation of pre-existing asthma resulting from an exposure in the workplace
- Allergic contact dermatitis: an allergic reaction of the skin triggered by exposure to a chemical allergen
- Irritant contact dermatitis: a skin rash triggered by over-exposure to water, solvents, friction, or contact with irritating substances (e.g. soaps, detergents)
- Upper respiratory tract irritation
- Cancer resulting from exposure to carcinogenic compounds
- Other health effects (e.g. dizziness, headaches)

EXAMPLES

- Adhesive (i.e. carton boxes)
- Anti-corrosive coating (e.g. bridge structures, telecommunication towers, transformers, wind turbines)
- Elastomer
- Ink
- Packaging material
- Paint
- Pesticides
- Polyurethane foam (i.e. rock consolidation, sealing)
- Sealant (e.g. mine ventilation sealant)
- Sizing agents (i.e. alkyl isocyanates)
- Synthetic rubber
- Thin spray-on liners (i.e. polyurethanes and polyresins)
- Tires

KEY COMPOUNDS

Review cleaning products' Safety Data Sheets to identify the presence of these compounds. Follow the appropriate precautionary measures.

- Hexamethylene diisocyanate (HDI)
- Isophorone diisocyanate (IPDI)
- Methylene biscyclohexylisocyanate (HMDI)
- Methylene diisocyanate (MDI)
- Methyl isocyanate (MIC)
- Naphthalene diisocyanate (NDI)
- Octadecyl isocyanate
- Toluene diisocyanate (TDI)
 - Classified by the International Agency for Research on Cancer (IARC) as a Group 2B carcinogen

CAUSATIVE AGENT: ISOCYANATES

SECTORS

Forestry, mining, pulp and paper

JOB

Forestry

Mechanic, mill worker (i.e. particleboard, plywood, veneer), pesticide handler

Mining

Labourer, mechanic, miner (i.e. surface or underground), service crew

Pulp and Paper

Maintenance technician, mill operator (e.g. paper sizing), printing press operator

OTHER CONSIDERATIONS

- Isocyanates are classified as designated substances in Ontario (i.e. medical surveillance must be provided to workers with occupational isocyanate exposure, with the exclusion of workers in the construction sector)
- Some isocyanates have legal airborne exposure limits (i.e. TDI, HDI, HMDI, IPDI, MDI, MIC)
 - Currently Ontario only regulates monomer isocyanates
 - However, many newer isocyanates are polymeric
- Sensitization from dermal isocyanate exposure can trigger an asthma-like response upon inhalation
- Isocyanates lead to extreme sensitivity (hypersensitivity) reactions that can occur at very low concentrations
- Workers who do not work directly with isocyanates but are exposed by touching surfaces or tools can develop isocyanate-induced asthma

HOW COMMON ARE THE HEALTH EFFECTS?

Approximately 24,000 Canadians are occupationally exposed to TDI; Ontario workers have the greatest exposure (approx. 12,000 exposed).

TDI leads to sensitization in about 5% of exposed workers.

KEY PREVENTION STRATEGIES

Substitution

- Substitute monomeric isocyanates with pre-polymeric isocyanates (they become less airborne)
- Choose less hazardous application processes (i.e. roller application vs. spray gun)

Engineering Controls

- Block off access to other workers who are not adequately protected
- Improve dilution ventilation using fans (i.e. local and general)
- Use tools to prevent direct contact with isocyanates or products containing isocyanates

Administrative Controls

- Provide training on proper handling, avoidance of spills, and good housekeeping practices
- Follow manufacturers' directions for curing
- Restrict access where Isocyanates are used (i.e. the area should not be re-occupied by workers or nearby trades for a minimum of 24 hours)

Personal Protective Equipment

- A full-facepiece supplied air respirator is required for working with Isocyanates (ensure workers are periodically fit-tested)
- Avoid gloves made from natural rubber latex (consult manufacturer; if necessary, use low-protein and powder-free styles)

CAUSATIVE AGENT: ISOCYANATES

SOURCES

CAREX Canada, 2017. Profiles & Estimates.

Bernstein, D.I., 2003. Occupational asthma caused by exposure to low-molecular-weight chemicals. *Immunology and Allergy Clinics of North America* 23, 221-234.

International Labour Organization, 2018. International Hazard Datasheets on Occupations (HDO).

N.C. Department of Labor, 2013. A Guide to Occupational Exposure to Isocyanates.

Reh, B.D., 2004. A Summary of Health Hazard Evaluations: Issues Related to Occupational Exposure to Isocyanates, 1989 to 2002 (No. 2004-116). National Institute for Occupational Safety and Health.

Safe Work Australia, 2015. Guide to Handling Isocyanates.

Vandenplas, O., Cartier, A., Lesage, J., Cloutier, Y., Perrault, G., Grammer, L.C. et al., 1992. Occupational asthma caused by a prepolymer but not the monomer of toluene diisocyanate (TDI). *Journal of Allergy and Clinical Immunology* 89, 1183-1188.

Work Safe Alberta, 2010. Isocyanates at the Work Site (No. CH005 — Chemical Hazards). Workplace Health and Safety Bulletin.