

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
- Anti-corrosive coating (e.g. bridge structures, telecommunication towers, transformers, wind turbines)
- Artificial limbs
- Cable and wire insulation
- Elastomer
- Flooring (e.g. low porosity industrial flooring)
- Flotation material
- Foundry core
- Ink
- Insulation (e.g. buildings, domestic appliance)
- Laquer
- Laminated fabric
- Orthopedic casting and immobilization product
- Pesticide
- Packaging material
- Paint hardener
- Plastic
- Polyurethane foam
- Sealant
- Spray paint
- Synthetic rubber
- Synthetic textile/fibre
- Varnish
- Weather resistant material

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)
- Toluene diisocyanate (TDI)
 - Classified by the International Agency for Research on Cancer (IARC) as a Group 2B carcinogen

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SECTORS

Agriculture, industrial manufacturing, service

JOB

Agriculture

Crop worker, farm worker, gardener, greenhouse worker, grounds keeper, landscaper, nursery worker

Industrial Manufacturing

Assembler/fabricator (e.g. aircraft, automotive, electronic), food/beverage production worker, foundry worker, glazier, jeweler/precious stone worker, metal worker/machinist (e.g. cutters, die caster, driller, grinder, solderer, welder, plater), packaging worker, paint/lacquer formulator, pesticide formulator, pharmaceutical production worker, plastic product worker, tobacco processing worker, textile worker, upholsterer, wire and cables, woodworker (e.g. furniture manufacturer)

Service

Aesthetician, artist, automobile mechanic, carpet cleaner, caterer, cleaner/custodian, cosmetologist, drycleaner, embalmer, floor polisher, garage worker, hairdresser, nail salon technician, painter, plumber, tire vulcanizer

HOW COMMON ARE THE HEALTH EFFECTS?

Isocyanate exposure is the most common cause of occupational asthma (prevalence ranges from 5-15%).

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

32% of spray-painters exposed to HDI reported hand dermatitis.

Automotive manufacturing workers accounted for 73% of TDI-induced asthma cases, 52% of MDI, and 71% of HDI.

KEY PREVENTION STRATEGIES

Elimination

- Use heat ovens to harden paint (e.g. on vehicles) in place of an isocyanate-based product

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)

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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

SOURCES

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