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

### JOBS
**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)
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SOURCES


