

Isocyanates

Helping to reduce your exposure to Isocyanates during metal production and fabrication.

What are Isocyanates?

Isocyanates are a wide and diverse range of highly reactive chemicals that are commonly used to react with compounds containing alcohol (hydroxyl) functional groups to create polyurethane polymers. A chemical containing two such isocyanate groups is called a diisocyanate. Diisocyanates are commonly used in polyurethane paints, coatings, and insulating foams, and in resins systems used as binders in sand casting processes.

How can Isocyanates affect me?

Workplace exposures to isocyanates have been associated with a range of potential health effects – some can result from short-term acute exposures, others from long-term, repetitive, chronic exposures. Exposures can include isocyanate vapors, mist, and dusts.

Did you know?

Potentially all workers exposed to isocyanates are at risk of becoming sensitized to isocyanates, not just those with existing history of asthma, allergies, or other respiratory conditions. Sensitization can occur after a large single exposure or after repeated low level exposure. Once sensitized, even very low subsequent isocyanate exposures, or other triggers (such as cigarette smoke or cold air), can result in immediate or even delayed asthma attack symptoms.

Potential acute health effects from metal production or fabrication

- Irritation of the eyes, nose, and throat
- Skin irritation and dermatitis
- Wheezing, chest tightness, breathlessness, and coughing
- Chemical conjunctivitis

Potential chronic health effects from metal production or fabrication

- Respiratory sensitization
- Occupational asthma
- Skin sensitization
- Liver and kidney dysfunction

Additional Information

Toluene diisocyanate is classified as a Group 2B – Possibly carcinogenic to humans by the International Agency for Research on Cancer (IARC), and as an A3-Confirmed animal carcinogen with unknown relevance to humans by the American Conference of Governmental Industrial Hygienists (ACGIH).

When do workplace exposures occur?

Inhalation

The main source of worker exposure is from the inhalation of isocyanates, particularly when spray applying polyurethane paints, coatings, foams, and glues. Another significant source of exposure includes the associated maintenance and cleaning of polyurethane spray equipment, and production and use of sand castings in foundry operations.

The fine aerosol mists and vapors generated by spraying can be readily inhaled and isocyanates and other components they contain can be readily absorbed in your lungs. Application of isocyanate containing products by dipping, brush or roller, in a well ventilated area, generally results in lower levels of inhalation risk to workers.

Dermal

Dermal exposures can occur through direct skin contact with isocyanate containing materials and deposition of aerosols upon exposed skin and eyes during spraying and foaming operations.

Industries/Applications Where Workplace Exposures May Occur

Examples of metal production and fabrication applications, as well as other industries and processes in which individuals may be exposed to isocyanates:

Metal production, metal fabrication and related applications

- Metal foundries and sand-casting operations
- Painting/coating of metal parts and equipment
- Injecting or spraying foam insulation and adhesives

Other applications

- Manufacture of isocyanates and isocyanate containing materials
- Spray application of truck bed liners
- Application of polyurethane architectural coatings
- Furniture manufacturing

What can I do to help protect my workers?

Use appropriate controls.

Employers need to conduct a risk assessment, including a determination of exposure levels compared to exposure limits to understand what control measures may be needed. If required, controls from the hierarchy of controls should be implemented and their effectiveness measured.

There are many ways of minimizing personal exposures, but one of the most important ways is to spray paints and coatings in properly designed spray paint booths or rooms, with proper working procedures and well designed and functioning ventilation. Spray application causes both visible and invisible aerosol mists and vapors that can remain in the air for many minutes or even hours after spraying has been finished. So, it is important to ensure that the spray booth runs at a slight negative pressure, and that workers who may enter the booth are aware of the booth clearance time (time taken for the ventilation to clear spray mist).

Get the equipment that you need.

In addition to implementing other control measures, Personal Protective Equipment (PPE) such as Respiratory Protective Equipment (RPE) is commonly used to reduce exposures and risks to workers.

Respiratory Protective Equipment (RPE) – Air-Purifying Respirators

3M has a range of RPE that can help reduce your exposure to dusts, mists, metal fume, as well as other gases and vapors commonly encountered in metal production and fabrication. These include disposable particulate respirators, reusable half- and full-facepiece respirators, all the way to heavy-duty battery powered air-purifying respirators (PAPR) combined with a range of robust facepieces, headtops, and helmets.

An effective respiratory program to use air-purifying respirators with appropriate filters to reduce exposure per AS/NZS 1715 to isocyanates. These may take the form of a half facepiece respirator and goggles or a full-face respirator with particulate filters in combination with organic vapor cartridges, or a PAPR with combination particulate filter and organic vapor cartridge.

An air purifying respirator would only be suitable when rolling or applying by brush isocyanate containing paint. If spraying, it must be a Supplied Air respirator as explained below.

Respiratory Protective Equipment (RPE) – Supplied Air Respirators

3M also has a wide range of supplied air respirators, suitable for use in some of the most demanding work environments.

In Australia and New Zealand a supplied-air respirator is mandated by Safe Work Australia and WorkSafe New Zealand when spraying isocyanate containing paint due to the increased exposure risk over the application of these materials by brush or roller. Loose-fitting hoods are commonly used, providing a continuous supply of clean breathable air into the hood that additionally helps protect the face and eyes.

Other PPE

3M can also provide a wide range of other safety solutions including:

- Head, eye, and face protection
- Disposable and reusable ear plugs and ear muffs
- Protective Communication solutions
- Disposable protective coveralls
- Fall protection
- Confined space solutions



[Find your respirator](#)

Use our interactive disposable respirator selector to help you find a respirator that meets your protection needs.



[Find your respirator](#)

Use our respirator selection guide to help you find a respirator that meets your protection needs.



[Find your respirator](#)

Use our interactive powered and supplied air respirator selector to help you find a respirator that meets your protection needs.

[View all 3M PPE Solutions](#)

Training

A key component of an effective PPE program is training for both workers and those responsible for health and safety in the workplace.

For example, workers wearing PPE should be trained in and understand:

- How PPE works, what it does, and its limitations
- Inspection, maintenance, and cleaning of the PPE as well as identifying defective PPE and knowing proper disposal
- Proper fitting and use of the PPE
- The nature of all hazardous substances present and the potential effects upon their health

Stay informed.

When selecting the appropriate protective equipment, local, state, provincial, or national regulations, laws, and guidelines need to be followed.

One of the tasks of the occupational safety and health specialist is to monitor constantly changing legal regulations, occupational exposure limits, etc.

Technical Help

At any time, you can get in touch with one of our PPE professionals for personalized help on the selection and use of 3M products. They can help you through the process of selecting suitable products based on your risk assessment, as well as helping you understand how to fit, use, and maintain your PPE – helping you to stay protected. In Australia contact Customer Service at 1300 363 565. In New Zealand contact Customer Service at 0800 252 627.

References and Resources

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<https://www.safeworkaustralia.gov.au/doc/guide-handling-isocyanates>

<https://www.worksafe.govt.nz/topic-and-industry/hazardous-substances/guidance/substances/safe-use-of-isocyanates/>

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