



Government of **Western Australia**
Department of **Commerce**

Guidance note

Controlling isocyanate hazards at work

2008

**commission
for occupational
safety and health**

Foreword

This guidance note is issued by the Commission for Occupational Safety and Health (the Commission) under the provisions of the *Occupational Safety and Health Act 1984* (the OSH Act).

The introduction of the OSH Act enabled the establishment of the tripartite Commission, which comprises representatives of employers, unions and government, as well as experts. It has the function of developing the occupational safety and health legislation and supporting guidance material, and making recommendations to the Minister responsible for the OSH Act for their implementation. To fulfil its functions, the Commission is empowered to establish advisory committees, hold public inquiries, and publish and disseminate information.

The Commission's objective is to promote comprehensive and practical preventive strategies that improve the working environment of Western Australians. This guidance note has been developed through a tripartite consultative process and the views of employers and unions, along with those of government and experts, have been considered.

Scope and application of this guidance note

This guidance note applies to all workplaces in Western Australia covered by the OSH Act. It provides guidance for employers and workers on the management of isocyanates in the workplace, and some of the legislative requirements in the OSH Act and Occupational Safety and Health Regulations 1996 (the OSH Regulations).

It is not possible to deal with every situation that may be found at workplaces. The practical guidance in this document should be considered in conjunction with the general duties in the OSH Act, as well as specific requirements in it and the OSH Regulations.

Legislative framework for occupational safety and health

Occupational Safety and Health Act 1984

The OSH Act provides for the promotion, co-ordination, administration and enforcement of occupational safety and health in Western Australia. It applies to all industries with the exception of mining and petroleum.

With the objective of preventing occupational injuries and diseases, the OSH Act places certain duties on employers, workers, self-employed people, manufacturers, designers, importers and suppliers.

The broad duties established by the OSH Act are supported by regulations, together with non-statutory codes of practice and guidance notes.

Occupational Safety and Health Regulations 1996

The OSH Regulations spell out specific requirements of the legislation. They may prescribe minimum standards and have a general application, or define specific requirements related to a particular hazard or type of work. They may also allow licensing or granting of approvals and certificates etc.

Regulations and codes of practice

A code of practice provides practical guidance on how to comply with a general duty under the OSH Act or a safe work practice.

If there is a code of practice about a risk, either:

- do what the code of practice says; or
- adopt and follow another way that gives the same level of protection against the risk.

A code of practice does not have the same legal force as a regulation and is not sufficient reason, of itself, for prosecution under the Act.

Guidance notes and guidelines

A guidance note or guideline is an explanatory document providing detailed information on the requirements of legislation, regulations, standards, codes of practice or matters relating to occupational safety and health, as approved by the Commission.

Disclaimer

Information in this publication is provided to assist people in meeting occupational safety and health obligations. While information is correct at the time of publication, readers should check and verify any legislation referenced in this publication to ensure it is current at the time of use.

Changes in law after this document is published may impact on the accuracy of information. The Commission provides this information as a service to the community. It is made available in good faith and is derived from sources believed to be reliable and accurate at the time of publication.

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1. Introduction

Isocyanates are a group of chemicals used in the manufacture of polyurethane plastics, synthetic rubbers, foams, paints, varnishes and adhesives.

People exposed to isocyanates can develop a range of short term health problems, such as headache, sore eyes, sore throat, difficulty in breathing and skin irritation.

Isocyanate exposure can also lead to long term asthma and dermatitis if a person become sensitised.

Sensitisation is a condition in which breathing or skin conditions can return with increasing severity with any further exposure to the original sensitising agent or similar substances even at very low exposures.

2. Who is at risk?

As all Western Australia's isocyanate supplies come from interstate or overseas, the people at risk of isocyanate exposure in this state are those involved in:

- manufacture of polyurethane foams, synthetic rubbers and plastics;
- spraying of two-part polyurethane paints, when unreacted droplets may be inhaled;
- spraying of resins containing isocyanates, usually to create a foam coating;
- heating of isocyanates prior to mixing with resins;
- tasks where polyurethane is heated to a point where isocyanates are released, as in "hot wire" cutting of foam or when pipes lagged with polyurethane foam are welded;
- storage of newly made polyurethane products, while they are still curing and emitting isocyanate fumes;
- mixing or spraying of isocyanates in poorly ventilated workplaces; and
- transport, transfer and storage of both containers and bulk supplies of isocyanates, particularly if leakages or spillages occur.

3. How can isocyanates harm you?

All isocyanates are hazardous substances and require care in handling. The greatest risks are from inhaling vapours, fine droplets (aerosols) and dusts containing isocyanates, as they irritate the linings of the nose, throat, lungs and eyes.

People exposed to isocyanates at work are at greater risk of developing respiratory problems, such as asthma, if they breathe in isocyanate vapours or droplets of resin spray.

There is also a risk of skin conditions if there is regular skin contact with isocyanates.

Some of the health effects of isocyanate exposure include:

- eye irritation, watering and discomfort;
- irritation of the respiratory tract;
- dryness of the throat;
- tightness of the chest;
- difficulty in breathing;
- headaches;
- asthma attacks;
- reddening, swelling and blistering of exposed skin if not washed off; and
- dermatitis.

4. Which WA workplaces have the highest risk?

As a general guide, processes that involve spraying isocyanates or the use of volatile isocyanates, such as *toluene diisocyanate* (TDI), pose the greatest risk. Three types of workplaces stand out as having the highest risk of isocyanate exposure in Western Australia. They are:

- workplaces where isocyanates are mixed with a resin and then sprayed to produce an insulating foam – droplets containing isocyanates are the main hazard because they can be inhaled and absorbed by the body;
- workplaces where TDI is mixed with resins in the manufacture of foam – isocyanate vapours released during mixing and curing are the main hazard; and
- workplaces where two-part polyurethane paints are sprayed, most typically in the painting of motor vehicles.

5. What are the different isocyanates?

The two most commercially important isocyanates are:

- *toluene diisocyanate* (TDI); and
- *diphenylmethane diisocyanate* (MDI).

Other forms of isocyanates also available and include *hexamethylene diisocyanate* (HDI), *naphthalene diisocyanate* (NDI) and *isophorone diisocyanate* (IPDI).

TDI evaporates most easily and is therefore the most harmful of these isocyanates. However, all isocyanates can pose a health risk during the spraying of paint or foam, when droplets containing unreacted isocyanates can be inhaled.

6. What are other isocyanate hazards?

Dusts from solid forms of isocyanates are a hazard and should not be inhaled.

Burning or breaking down polyurethane materials by heating may lead to the production of free isocyanates and a number of toxic gases such as carbon monoxide and hydrogen cyanide.

Isocyanates react slowly with water to produce carbon dioxide. While this is not in itself a hazardous reaction, dangerous pressures can develop inside closed containers if an isocyanate becomes contaminated with water.

As isocyanates can only be smelled at concentrations considered to be harmful, it is dangerous to rely on odour to detect the presence of an isocyanate.

7. What information and training is required?

Information and training should be provided to workers in a manner that is readily understood with special consideration given to language and literacy issues.

In relation to information and training at the workplace:

- workers must be informed of all identified hazards in the workplace;
- workers must be given information, instruction, training and supervision on safe working procedures, including fitting, use and storage of personal protective clothing and equipment;
- workers should know how to identify hazards and to report them to a supervisor;
- training on hazardous substances must include potential health effects of the substances used, control measures, correct use of protective clothing and equipment and the need for and details of health surveillance;
- workers from non-English speaking backgrounds may have special needs. They should be provided with information in their first language and increased supervision if necessary;
- workers must be trained in spill clean up, if required to do so, and in emergency evacuation procedures; and
- training should be ongoing, with regular revision of safe procedures.

See the [Guidance note: Provision of information on hazardous substances at workplaces Material Safety Data Sheets \(MSDS.\)](#)

8. What are Material Safety Data Sheets (MSDS)?

An MSDS provides information needed for the safe use of hazardous substances at the workplace. They contain information about the identity of the substance, its health effects and precautions for use and safe handling.

MSDSs are produced by the manufacturer and provided by the supplier. Employers are responsible for obtaining MSDSs and providing them to workers.

9. How can isocyanate hazards be controlled?

The OSH Regulations require employers, main contractors, self-employed people and people having control of the workplace or control of its access to identify hazards, assess the risks and control the risks.

The OSH Regulations outline a three step process:

1. **identify hazards** – this involves recognising things or processes that may cause injury or harm to the health of a person, such as hazards from isocyanates;
2. **assess the risks** – this involves assessing the risk of injury or harm to a person resulting from each hazard identifies in the above step; and
3. **control risks** – this involves implementing control measures to eliminate or reduce the risk of a person being injured or harmed.

Identification of hazards

Identify hazards by:

- checking labels and MSDSs;
- regular inspection of workplace, plant and equipment;
- communication between workers and management about hazards;
- regular review of tasks and procedures; and
- checking incident and injury records for recurring situations.

Risk assessment

Assess risks by:

- using information from MSDSs, labels, operating manuals and Australian and Australian/New Zealand standards.
- checking work processes to ensure that controls are in accordance with the manufacturer's MSDS;
- conducting atmospheric monitoring to measure exposure levels; and
- conducting health surveillance to detect any adverse effects at an early stage.

Controlling risks

Control risks by:

- eliminating or removing the hazard – do not use the chemical if it is not required;
- substituting or replacing the substance with a safer one;
- isolating it from workers – for example, with an enclosed system or physical barriers or relocating employees;
- introducing engineering controls – for example, through the use of a local exhaust ventilation (LEV);
- introducing administrative controls – for example, limiting workers' time near the chemical and training; and
- using personal protective clothing and equipment such as full face respiratory protection, safety goggles or gloves.

10. What storage controls are necessary?

The general principles for storage controls of substances include:

- storing hazardous substances in a cool, lockable and enclosed area with adequate ventilation;
- storing incompatible substances separately, for example storing isocyanates away from acids, alkalis or amines, and avoiding risks of mixing and cross contamination;
- ensuring all labels remain intact on containers and packaging;
- limiting access to chemical storage areas to authorised people only;
- ensuring flammable, explosive or toxic substances are stored away from possible sources of electric spark, heat or flame;
- checking all containers against leakage or seepage and keeping lids and caps tightly sealed;
- ensuring forklift and other mobile plant operators are formally trained in safe procedures for chemical containers;
- having appropriate fire fighting and emergency equipment; and
- monitoring atmospheric contamination and temperature levels in storage areas.

Isocyanates and other chemicals classed as dangerous goods must be stored in accordance with the Dangerous Goods (Storage and Handling of Non-explosives) Regulations 2007. These are available at: www.slp.wa.gov.au

11. What are the specific requirements for isocyanates?

Manufacturing processes where isocyanates are used should be designed so that isocyanates are not released into the workplace atmosphere. Skin contact also needs to be minimised. Other ways of minimising exposure are listed below.	
Buildings in which isocyanate materials are stored, handled or processed must have sufficient ventilation to ensure that the relevant occupational exposure standard (OES) is not exceeded. While natural ventilation may be sufficient when isocyanates of low volatility are used, mechanical ventilation will be necessary when using TDI.	
Mechanical ventilation is required when isocyanates are heated. Local exhaust ventilation (LEV) will also be necessary where isocyanates are released from individual processes or items of plant.	
Where isocyanates are sprayed, LEV systems will be required and must be designed to remove the spray mist or aerosols. This requires careful design and regular maintenance.	
Where practicable, totally enclosed systems should be used whenever TDI or other isocyanates heated over 60 are used.	
Respiratory protection must be carefully selected based on information available through the risk assessment process. As a guide, positive pressure air supplied respirators will be required where materials containing isocyanates are sprayed. The concentration of isocyanate present in the air will determine the level of protection required in other circumstances. The respiratory protection selected must be capable of reducing exposure below the occupational exposure standard.	
Systems for handling isocyanates must be designed to prevent the entry of moisture.	
Where foam is manufactured from TDI, the freshly produced 'buns' must be stored in a well-ventilated area because significant amounts of TDI are given off during the curing process. Sufficient space between the 'buns' must also be provided to allow heat to dissipate.	
Adequate fire fighting equipment must be provided. There is an increased risk of fire where TDI based foam is manufactured because of the heat generated during the reaction.	
Sufficient supplies of absorbent material, such as sand or sawdust, and decontaminant should be stored on site to deal with any spills or leaks. Liquid decontaminants containing water, ammonia and detergent are commercially available.	
Empty containers of isocyanates need to be thoroughly decontaminated before being returned to the supplier, sold or disposed of.	

12. What first aid facilities should be available?

First aid facilities should be appropriate for the hazards in the workplace and should comply with the Commission's *Codes of practice: First aid facilities and services, Workplace amenities and facilities and personal protective clothing and equipment*.

Specific first aid requirements for the type of isocyanate used can be found in the manufacturer's MSDS. This will provide guidance on measures to be taken when exposure has occurred through inhalation, skin contact, splashes to the eyes and/or ingestion. Workers may require some assistance in interpreting the information.

13. What is the law?

The OSH Act says that, as far as is practicable, employers must provide and maintain a work environment in which employees are not exposed to hazards. This includes providing a safe system of work, training, information and supervision, as well as personal protective clothing and equipment where appropriate.

The OSH Act says employees must take reasonable care of their own safety and health and avoid adversely affecting the safety and health of others. They must comply, as far as possible, with safety instructions, use personal protective clothing and equipment provided and report hazards or injuries.

The OSH Regulations contain specific requirements for workplaces that use hazardous substances. These cover things such as:

- labelling of containers;
- Material Safety Data Sheets (MSDS);
- induction and safety training;
- record keeping;
- risk assessment and control; and
- health surveillance.

As mentioned under Section 9 of this guidance note, the OSH Regulations also require employers, main contractors, self-employed people and people having control of the workplace or control of its access to identify hazards, assess the risks and control the risks.

Employers, main contractors and self employed people must ensure that no person at the workplace is exposed to concentrations of isocyanates above the occupational exposure standard (OES).

Regulations 5.73 to 5.78 specifically apply to workplaces using isocyanates and cover issues such as handling, decanting, ventilation requirements and decontamination. The most stringent controls apply to TDI. Employers should seek further information on these regulations and have the information available for workers.

If the health of a person is at risk as a result of exposure to isocyanates at work, the employer must ensure that health surveillance is carried out in accordance with the OSH regulations. Regulation 5.1 defines 'health surveillance' and regulation 5.23 requires an employer, main contractor or self employed person to provide health surveillance to a worker in relation to hazardous substances.

14. Further information

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