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**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME  
(NICNAS)**

**FULL PUBLIC REPORT**

**Unithane Polymer**

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**Director  
Chemicals Notification and Assessment**

**FULL PUBLIC REPORT****Unithane Polymer****1. APPLICANT AND NOTIFICATION DETAILS**

## APPLICANT(S)

Parchem Construction Products Pty Ltd (ABN: 80 069 961 968)  
7 Lucca Road  
Wyong NSW 2259

and

Orica Australia Pty Ltd (ABN: 99 004 117 828)  
1330 Ferntree Gully Road  
Scoresby VIC 3179

## NOTIFICATION CATEGORY

Limited: Polymer with NAMW  $\geq 1000$  (greater than 1 tonne per year).

## EXEMPT INFORMATION (SECTION 75 OF THE ACT)

Data items and details claimed exempt from publication:

Identity of chemical;

Composition;

Introduction volume;

Specific use; and

Specific process description.

## VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)

Variation to the schedule of data requirements is claimed as follows:

Molecular weight

## PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)

None known

## NOTIFICATION IN OTHER COUNTRIES

None known

**2. IDENTITY OF CHEMICAL**

## MARKETING NAME(S)

Unithane Polymer

Polymer in Toby Unithane

Polymer in Toby Unithane C&T gloss

Polymer in Toby Unithane clear gloss

**3. COMPOSITION**

## DEGREE OF PURITY

High

## HAZARDOUS IMPURITIES/RESIDUAL MONOMERS

*Chemical Name* 1,3-diisocyanatomethylbenzene (TDI)  
*CAS No.* 26471-62-5 *Weight %* < 0.4  
*Hazardous Properties* Harmful by inhalation and may cause sensitisation by inhalation.

## DEGRADATION PRODUCTS

Hazardous decomposition products are carbon oxides, nitrogen oxides, and trace quantities of cyanide and ketones. Burning produces irritating or poisonous gases.

The product will not decompose explosively.

## LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES

The notified polymer is moisture sensitive and will cure into a solid matrix. Any residual monomer will be trapped within the solid polymer matrix.

**4. INTRODUCTION AND USE INFORMATION**

## MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

The notified polymer will be manufactured into a finished product. It will be supplied to tradesmen and retail market for application to cork, timber and parquetry. The finished product will contain <50% notified polymer.

## MAXIMUM INTRODUCTION VOLUME OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

<i>Year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
<i>Tonnes</i>	30-60	30-60	30-60	30-60	30-60

## USE

The notified polymer is supplied in a single component solvent-based, moisture cured clear gloss polyurethane coating designed as tough, durable and abrasion resistant finish for the protection and enhancement of cork, timber and parquetry.

**5. PROCESS AND RELEASE INFORMATION****5.1. Distribution, transport and storage**

## PORT OF ENTRY

Not applicable. The notified polymer will be manufactured in Australia as a finished product.

## IDENTITY OF MANUFACTURER/RECIPIENTS

Parchem Construction Products Pty Ltd (ABN: 80 069 961 968)  
7 Lucca Road  
Wyong NSW 2259

and

Orica Australia Pty Ltd (ABN: 99 004 117 828)  
1330 Ferntree Gully Road  
Scoresby VIC 3179

## TRANSPORTATION AND PACKAGING

The notified polymer is manufactured as a finished product. The finished product is packed into 10 and 20 L DG-compliant metal pails for distribution to customers. Bulk orders will be transported in pallets. The products will be transported by road or rail as UN 1263 Paint Class 3 PG III. Transport should be in accordance with ADG Code, the IMDG Code or the IATA Code.

## 5.2. Operation description

The manufacture of the polymer involves blending and curing of the notified polymer, container filling, transport, storage. These processes are described in section 5.3 below.

## 5.3. Occupational exposure

### *Number and Category of Workers*

<i>Category of Worker</i>	<i>Number</i>	<i>Exposure Duration</i>	<i>Exposure Frequency</i>
<b>Manufacturing site</b>			
Manufacturing	6-8	4-8 hours/week	10-15 days/year
Transport and Storage	2	1-2 hours/week	50 days/year
<b>Customer site</b>			
Incoming goods receiving workers	2	1-2 hours/week	50 days/year
Production operators	10	35 hours/week	240 days/year
<b>Applicator Site</b>			
Application workers	100	8 hours/day	200 days/year

### *Exposure Details*

#### **Manufacturing site**

The polymerization and dilution processes are carried out in a dedicated 10 tonne stainless steel sealed reaction vessel. The majority of processes involved are carried out in enclosed and highly automated equipment.

During manufacture of the coating containing the notified polymer, storage personnel will assemble raw materials near the reaction vessel as required. The TDI is stored in a specialized sealed room and is pumped directly from that room by an operator via a dedicated automated and metered system into the reaction vessel. Another operator will add raw materials and monitor the reaction. Prior to packaging, quality control personnel will collect sample and check the quality of the coating. The finished coating will be filled directly from the reaction vessel into 10 or 20 litre plastic drums ready for sale.

#### **End use**

The product will be applied by trained and experienced timber floor tradesman. These tradesmen will open container, pour a small quantity into a tray, dip the roller into the product and apply it to the floor with the roller. The coating product will be applied in well-ventilated areas. Windows and doors will be opened during application.

## 5.4. Release

### **RELEASE OF CHEMICAL AT SITE**

The release of the notified polymer during manufacture and dilution to the end use product is expected to be minimal as the process is automated. Any spills during manufacture and storage will be contained by plant bunding and collected by adsorbing onto an inert material. This material will then be sent to landfill by a licensed waste contractor. These losses are expected to be less than 0.5% (max 300 kg) of the manufactured polymer. Waste generated through the washing of equipment will be collected in a holding tank and also disposed of to landfill by a licensed waste contractor. Washing residues is expected to account for less than 1% (600 kg) of the manufactured polymer.

### **RELEASE OF CHEMICAL FROM USE**

Residues from the empty timber floor coating products are expected to account for around 1% (max 600 kg) of the manufactured polymer. Empty containers with residual products are left open and the moisture in the air will trigger the curing process. The resultant solid mass will be disposed of to landfill.

The roller and empty tray used in the coating application will be rinsed with a suitable solvent. The wastes will be reused for other future cleaning until the solution becomes too viscous, at which time it will be collected by the flooring product distributor for disposal by a licensed waste contractor to landfill or by incineration. The notifier has not estimated a waste generated during the cleaning of application equipment. The waste generated through washing of application equipment will be greatest when only

a small area is coated. Assuming as a worst case the area being treated is around 20 m<sup>2</sup>, according to the label this would require around 2 L of the product. Allowing for approximately 50mL remaining absorbed to the roller and another 50 mL remains adhering to the tray, approximately 5% of the product could be lost through washing of the application equipment. Hence, as a worst case up to 3000 kg of the notified polymer may be disposed of as a result of cleaning application equipment. As the area to which the product is applied increases the relative amount of waste generated through cleaning application equipment will decrease.

### 5.5. Disposal

The majority of the waste polymer generated will either be disposed of to landfill or incinerated either as residues in containers or as waste from cleaning application equipment. Some may deposit on the ground. Wastes generated during manufacture and use of the notified polymer is not expected to exceed 4500 kg per annum.

The polymer floor finish will dry to form an inert coating on the surface of the floors. It will remain on the floors until it is gradually worn down by human traffic, being slowly dispersed on shoes etc. At the end of its useful life it will be removed by the professional floor sanders and presumably replaced by another coat of a similar product. The coating containing the notified polymer will be broken up into solid particulate matter in the sanding/removal process and most likely disposed to landfill.

### 5.6. Public exposure

The notified polymer or products containing it are intended for commercial use only. The coating products will be applied by professional applicators and will not be available to the public. Members of the general public may come into contact with wooden floors coated with paints containing the notified polymer. However, exposure will be negligible because the notified polymer is likely to be bound within the cured paint film.

Public exposure during manufacture and transport of products containing the notified polymer is considered low except in unlikely events of manufacturing and transport accidents.

## 6. PHYSICAL AND CHEMICAL PROPERTIES

The following physico-chemical properties are for the polymer unless otherwise stated.

<b>Appearance at 20°C and 101.3 kPa</b>	Clear yellowish liquid
<b>Boiling Point</b>	Decomposes before boiling; 140-185 °C (based on solvents)
Remarks	Test report not provided.
<b>Density</b>	>1000 kg/m <sup>3</sup> at 25°C (pre polymer); 980 kg/m <sup>3</sup> (finished product)
Remarks	Test report not provided.
<b>Vapour Pressure</b>	0.93 kPa (based on solvents)
Remarks	Test report not provided.
<b>Water Solubility</b>	Insoluble
Remarks	Test report not provided. The isocyanate groups in the polymer will rapidly hydrolyse to amine groups in the presence of water. The resulting amine groups are predicted to react further with isocyanate groups to form a largely hydrophobic cross-linked polymer without significant water solubility.
<b>Hydrolysis as a Function of pH</b>	Not determined

Remarks	The isocyanate groups in the polymer is expected to rapidly hydrolyse to amine groups in the presence of water.
<b>Partition Coefficient (n-octanol/water)</b>	Not Determined
Remarks	Calculation based on model structures for the prepolymer (isocyanate free structure) indicates that the partition coefficient is high ( $\log K_{ow} > 4$ ). The addition of the isocyanate containing moieties will increase the molecular weight and would be expected to also increase the partition coefficient. Hence, based on the high molecular weight and anticipated low water solubility the notified polymer is expected to have a high partition coefficient. Any hydrolysis of the isocyanate groups is predicted to increase the value of the partition coefficient through the resulting cross-linking of the polymer.
<b>Adsorption/Desorption</b>	Not determined
Remarks	Based on the expected high partition coefficient, the notified polymer is expected to bind strongly to organic matter in soil.
<b>Dissociation Constant</b>	Not determined
Remarks	The notified polymer does not contain any groups which can undergo dissociation.
<b>Particle Size</b>	Not applicable.
Remarks	The notified polymer is liquid.
<b>Flash Point</b>	>177 °C (prepolymer)
Remarks	Test report not provided.
<b>Flammability Limits</b>	0.9% to 7% (based on solvents)
Remarks	Test report not provided.
<b>Autoignition Temperature</b>	Not determined
Remarks	Not expected to undergo autoignition.
<b>Explosive Properties</b>	Not determined
Remarks	Not expected to be explosive.
<b>Reactivity</b>	
Remarks	The notified polymer will react with strong oxidising agents or organic peroxides.

## 7. TOXICOLOGICAL INVESTIGATIONS

No toxicity data were submitted.

## **8. ENVIRONMENT**

### **8.1. Environmental fate**

No environmental fate data were submitted

### **8.2. Ecotoxicological investigations**

No ecotoxicity data were submitted

## **9. RISK ASSESSMENT**

### **9.1. Environment**

#### **9.1.1. Environment – exposure assessment**

Waste from polymer manufacture and formulation (<900 kg per annum) will end up being disposed of to landfill as an inert solid by a licensed waste contractor. In landfill the polymer will be bound within a cross-linked polymer matrix and is expected to remain immobile.

Washings from the cleaning of application equipment (up to 3000 kg per annum) is expected to be either disposed of to landfill as a cured solid or possibly incinerated. Waste remaining in the empty coating containers will also be disposed of in landfill.

The majority of the notified polymer will end up being applied to timber as a floor coating. The polymer coating will react with the moisture in the air to form an inert cross-linked coating on the surface of the timber. It will remain on the timber until it is gradually worn down by human traffic, being slowly dispersed on shoes etc. At the end of its useful life it will either be removed by sanding (and presumably replaced by another coat of a similar product) or disposed of to landfill bound to the timber to which it has been applied. If removed by sanding, the coating containing the notified polymer will be broken up into solid particulate matter and most likely disposed to landfill or simply fall to the ground.

#### **9.1.2. Environment – effects assessment**

No ecotoxicity data were provided for the notified polymer. Non-ionic polymers with a number average molecular weight in excess of 1000 are of low concern for ecotoxicity due to their low water solubility (Boethling and Nabholz 1997). The notified polymer contains isocyanate groups which could hydrolyse in water to potentially cationic functionalities. Both the isocyanate and their potentially cationic hydrolysis products may exhibit toxicity towards aquatic organisms.

#### **9.1.3. Environment – risk characterisation**

Waste polymer from manufacture, formulation into coatings or residues in containers (either polymer transport drums or paint tins) will be disposed of to landfill as an inert solid where it is expected to be immobile.

The majority of waste polymer generated during application (through spills and washing) will either be disposed of in landfill or incinerated. Incineration of the polymer would destroy the material with the production of water vapour, and oxides of carbon and nitrogen.

The lack of exposure of the polymer to the aquatic compartment indicates that the polymer is unlikely to have an adverse effect on aquatic organisms. The possible toxicity of the free isocyanate groups or their potentially cationic hydrolysis products is of low concern due to the expected limited environmental exposure resulting from the proposed use in solvent-based timber finishes.

The majority of the notified polymer will be applied to timber surfaces and either share the fate of the timber at the end of its useful life (most likely to landfill) or be removed by sanding. If removed by sanding the coating containing the notified polymer will be broken up into solid

particulate matter and most likely disposed to landfill.



## 9.2. Human health

### 9.2.1. Occupational health and safety – exposure assessment

#### Polymer and coating manufacture

The polymer and coating manufacture was described as highly automated and enclosed. Therefore, worker exposure is limited to intermittent skin, eye and inhalation exposure when manual intervention is required during the manufacturing processes. Dermal exposure to small amounts of the finished coating can occur during quality control testing and packaging operations, if the packaging machine malfunctions. As the polymer will be manufactured with excess TDI (0.4%), precautions are taken to prevent worker exposure to TDI. TDI is stored in a specialised sealed room and transfer operations are via dedicated pipes.

The minimum personal protective equipment (PPE) worn by workers involved in handling the notified polymer and products containing it include overalls or long pants with long sleeve shirt, safety glasses and hearing protection. In addition to the above PPE, plant operators will wear solvent resistant thick rubber gloves (to the elbow). Full face breathing apparatus (long line to compressed air supply) is worn when adding raw materials to the reaction vessel (the majority or the raw materials are pumped into the reaction vessel). Laboratory technicians will wear long pants, lab coat, latex gloves, safety glasses and hearing protection.

Mechanical extraction is in place above the reaction vessel at the raw material addition port and also at the point where the finished product is filled into 10 and 20 litre Dangerous Goods compliant containers.

#### End use

Dermal and inhalation exposures, and to a lesser extent ocular exposure from splashes, when opening coating containers, pouring the coating into a tray and applying coating into the floor with a roller. Coating is carried out in well-ventilated areas, where windows and doors are left open to aerate the treated floors during application and some time after application. Workers will wear overalls, gloves (rubber, PVA or neoprene), goggles and respirator fitted with organic vapour filter canister.

#### Transport and storage

Transport and storage workers will handle sealed containers of raw materials for use in the manufacture of the notified polymer and sealed finished coating incorporating the notified polymer. Hence, worker exposure is unlikely except in the event of accident.

Overall, the automated and enclosed operations involved in polymer and coating manufacture, and the use of engineering controls and PPE would ensure that occupational exposure to the notified polymer and TDI is low. Exposure to the notified polymer and TDI is further reduced during coating application, given that the concentration of the notified polymer will be reduced in the coating products.

### 9.2.2. Public health – exposure assessment

The notified polymer and the products containing it will not be available to the public. Although members of the public will make dermal contact with treated timber floors, public exposure will be low, because at this stage the notified polymer will form part of an inert, hardened paint film, and will not be available for separate exposure. Public exposure via inhalation is not also envisaged in homes with treated timber flooring, since the timber is allowed to cure and dry before the place is occupied.

### 9.2.3. Human health – effects assessment

No toxicological data have been provided for the notified polymer. Since the notified polymer has high molecular weight, absorption across biological membranes and resultant systemic toxicity would be restricted. However, the polymer contains reactive isocyanate functional groups (TDI), which can cause local irritation and allergic reactions (NOHSC, 1990). TDI is on the NOHSC *List of Designated Hazardous Substances* and described as having limited evidence of a carcinogenic effect (Carcinogen Category 3), very toxic by inhalation, irritating to eyes, respiratory system and skin and may cause sensitisation by inhalation and skin contact (NOHSC,

2003a). The notified polymer contains <0.4% excess TDI as a residual monomer, therefore the notified polymer would be classified as a hazardous substance (Harmful) and warrants the risk phrases: R20 – Harmful by inhalation and R42 – May cause sensitisation by inhalation (NOHSC, 2003a).

#### 9.2.4. Occupational health and safety – risk characterisation

##### **Polymer and coating manufacture**

The most likely points at which exposure may occur is when manual intervention is required if the automated equipment used in manufacture and in packaging malfunctions, when collecting sample for quality testing, and during spill and cleaning of equipments. Dermal and inhalation exposure, and to a lesser extent ocular exposure to the polymer and the coating containing it can occur when carrying the above activities. The presence of TDI presents a risk of health effects via inhalation, irritation to skin and eyes and respiratory system, and respiratory sensitisation. It is the employers' responsibility to maintain atmospheric levels of TDI below the NOHSC exposure standard of 0.02 mg/m<sup>3</sup> (TWA) and 0.07 mg/m<sup>3</sup> STEL (as -NCO) (NOHSC, 1995). The risk of occupational asthma from repetitive exposure to isocyanates is also well known. Given the sensitising properties of isocyanates, precautions to prevent exposure must be taken by all personnel, but especially those who either have had prior contact with isocyanates or suffer from any form of compromised respiratory function (NOHSC, 1990). Health surveillance for isocyanates should also be conducted (NOHSC, 1994a). However, the control measures in place and the use of personal protective equipment will ensure sufficient protection to worker exposure against TDI, the notified polymer and the products containing it.

##### **End-use**

Worker exposure during coating application is expected to be further reduced as the notified polymer is used in a dilute form. The use of protective equipment and recommended safety practices during coating application (use in well ventilated areas), would limit exposure to the coating containing the notified polymer.

The notified polymer may also be present in coating formulations containing hazardous ingredients. If these formulations are classified as hazardous to health in accordance with the NOHSC Approved Criteria for Classifying Hazardous Substances, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Given the automated operations involved during polymer and coating manufacture, the engineering controls and the protective equipment used during manufacture and coating application, the health risk to workers during polymer and coating manufacture is expected to be low.

#### 9.2.5. Public health – risk characterisation

The notified polymer will be used as a coating ingredient for timber floors. Coating products containing the notified polymer will only be available to professional painters. Members of the public may make dermal contact with coated timber as flooring for houses. However, the risk of public health from the notified polymer will be negligible because, the polymer is likely to be bound within a cured film, from which it is unlikely to be bioavailable.

## 10. CONCLUSIONS – ASSESSMENT LEVEL OF CONCERN FOR THE ENVIRONMENT AND HUMANS

### 10.1. Hazard classification

Because of the presence of excess TDI as an adjuvant necessary for the stability of the polymer, the product/mixture containing the notified polymer would be classified as hazardous under the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004). The classification and labelling details are:

R20 – Harmful by inhalation

R42 – May cause sensitisation by inhalation

## 10.2. Environmental risk assessment

The chemical is not considered to pose a risk to the environment based on its reported use pattern.

## 10.3. Human health risk assessment

### 10.3.1. Occupational health and safety

There is Low Concern to occupational health and safety under the conditions of the occupational settings described.

### 10.3.2. Public health

There is No Significant Concern to public health when used as coating for timber flooring.

## 11. MATERIAL SAFETY DATA SHEET

### 11.1. Material Safety Data Sheet

The MSDS of the [products containing the notified chemical](#) provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 2003b). It is published here as a matter of public record. The accuracy of the information on the MSDS remains the responsibility of the applicant.

### 11.2. Label

The label for the [product containing the notified chemical](#) provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace Substances* (NOHSC, 1994b). The accuracy of the information on the label remains the responsibility of the applicant.

## 12. RECOMMENDATIONS

### REGULATORY CONTROLS

#### Hazard Classification and Labelling

- Use the following risk phrases for products/mixtures containing the notified chemical:
  - $\geq 0.1\%$  conc  $< 1\%$ : R20 - Harmful by inhalation and R42 - May cause sensitisation by inhalation

### CONTROL MEASURES

#### Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified polymer as introduced:
  - Fully enclosed and automated polymer and coating manufacture
  - Exhaust ventilation during mixing, packaging and coating application
- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer as introduced:
  - During cleaning of equipment, avoid spills and splashing
  - Coating application should be conducted in well ventilated areas
- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer as introduced:
  - Chemical resistant gloves
  - Protective clothing which protects the body, arms and legs
  - Goggles or face shield
  - Full face breathing apparatus during polymer and coating manufacture
  - Respirator fitted with organic vapour filter canister during coating application
  - Health surveillance for isocyanates in accordance with the NOHSC National Model

### Regulations for Control of Workplace Hazardous Substances.

Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- Atmospheric monitoring should be conducted to measure workplace concentrations during manufacture of the notified polymer and coating products.
- A copy of the MSDS should be easily accessible to employees.
- If products and mixtures containing the notified chemical are classified as hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

### Environment

- The following control measures should be implemented by end users to minimise environmental exposure during use of the notified polymer:
  - Do not allow material or contaminated packaging to enter drains, sewers or water courses.

### Disposal

- Wastes generated during industrial application should be disposed of through a licensed waste contractor.

### Emergency procedures

- Spills/release of the notified chemical should be handled by absorbing onto an inert material, scooping up and placing in marked containers for disposal.

### 12.1. Secondary notification

The Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

- (1) Under Section 64(2) of the Act:
  - if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.

No additional secondary notification conditions are stipulated.

## 13. BIBLIOGRAPHY

Boethling RS and Nabholz JV (1997) "Environmental Assessment of Polymers under the U.S. Toxic Substances Control Act", Chapter 10 (pp 187-234) of *Ecological Assessment of Polymers*, J. D. Hamilton and R. Sutcliffe (Ed's), Van Nostrand Reinhold.

National Occupational Health and Safety Commission (1990) *Worksafe Australia Guide - Isocyanates*. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1994a) *National Model Regulations for Control of Workplace Hazardous Substances* [NOHSC:1005(1994)]. Australian Government Publishing Service, Canberra.

NOHSC (1994b) *National Code of Practice for the Labelling of Workplace Substances* [NOHSC:2012(1994)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

National Occupational Health and Safety Commission (1995) Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment, [NOHSC:1003(1995)]. In: Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards. Australian Government Publishing Service, Canberra.

NOHSC (2003a) List of Designated Hazardous Substances [NOHSC:10005(2003)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

NOHSC (2003b) National Code of Practice for the Preparation of Material Safety Data Sheets, 2nd edn [NOHSC:2011(2003)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

NOHSC (2004) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)]. National Occupational Health and Safety Commission, Canberra, AusInfo.