File No: PLC/270

November 2001

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME**

**FULL PUBLIC REPORT**

# 1,3-Benzenedicarboxylic acid, polymer with dimethyl 1,4-benzenedicarboxylate, 2,2-dimethyl-1,3-propanediol, 2-ethyl-2-(hydroxymethyl)-1,3-propanediol and hexanedioic acid

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act* 1989 (the Act) and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the National Occupational Health and Safety Commission which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment and the assessment of public health is conducted by the Department of Health and Aged Care.

For the purposes of subsection 78(1) of the Act, copies of this full public report may be inspected by the public at the Library, National Occupational Health and Safety Commission, Plaza level, Alan Woods Building, 25 Constitution Avenue, Canberra ACT 2600 between 9am to 5pm Monday to Friday.

Copies of this full public report may also be requested, free of charge, by contacting the Administration Coordinator on the fax number below.

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Director
Chemicals Notification and Assessment

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## 1. APPLICANT

Degussa Australia Pty Ltd of 17 Raglan St South Melbourne Victoria 3205 (ACN 80 005 415 752) has submitted a notification statement in support of their application for an assessment certificate for the synthetic polymer of low concern (PLC) 1,3-Benzenedicarboxylic acid, polymer with dimethyl 1,4-benzenedicarboxylate, 2,2-dimethyl-1,3-propanediol, 2-ethyl-2-(hydroxymethyl)-1,3-propanediol and hexanedioic acid.

The notifier has not applied for any information relating to '1,3-Benzenedicarboxylic acid, polymer with dimethyl 1,4-benzenedicarboxylate, 2,2-dimethyl-1,3-propanediol, 2-ethyl-2-(hydroxymethyl)-1,3-propanediol and hexanedioic acid' to be exempt from publication in the Full Public Report.

## 2. IDENTITY OF POLYMER

**Chemical name:** 1,3-Benzenedicarboxylic acid, polymer with dimethyl 1,4-benzenedicarboxylate, 2,2-dimethyl-1,3-propanediol, 2-ethyl-2-(hydroxymethyl)-1,3-propanediol and hexanedioic acid.

**CAS number:** 65421-56-9

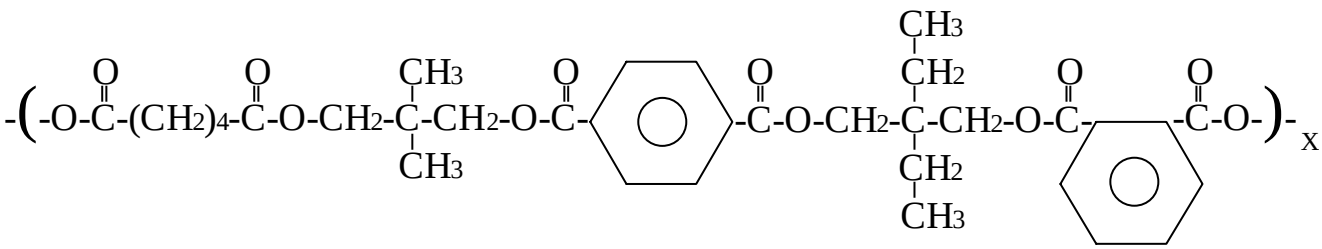
**Other names:** Adipic acid-dimethyl terephthalate-isophthalic acid-neopentyl glycol-trimethylpropane copolymer.

Polymer of dicarboxylic acids and polyols.

**Marketing names:** Dynapol H 700

**Molecular formula:** $(C_{10}H_{10}O_4.C_8H_6O_4.C_6H_{14}O_3.C_6H_{10}O_4.C_5H_{12}O_2)x$

**Structural formula:**



**Reactive functional groups:** Carboxylic groups (low concern)
Aliphatic hydroxyl groups (low concern)

**Functional group equivalent weight (FGEW):** Not applicable

**Molecular weight (MW):**

| Number-average MW | Weight-average MW | % MW < 1000 | % MW < 500 | Method |
|---|---|---|---|---|
| 2400 | 8500 | 10 | 3.2 | GPC |

**Structural identification method**: Infrared spectroscopy.

**Peaks at** 3550, 2975, 1725, 1575,1475, 1375, 1125, 11001075, 1025, 990, 675, 575 and 525 $cm^{-1}$.

## 3. POLYMER COMPOSITION AND PURITY

**Polymer constituents**

| Constituent | Synonym | CAS no. | % weight | % residual |
|---|---|---|---|---|
| 1,4-Benzenedicarboxylic acid, dimethyl ester | Terephthalic acid, dimethyl ester | 120-61-6 | 23 | 0.01 |
| 1,3-Benzenedicarboxylic acid | Isoterephthalic acid | 121-91-5 | 20 | 0.05 |
| Hexanedioic acid | Adipic acid | 124-04-9 | 15 | 0.08 |
| 2,2-Dimethyl-1,3-propanediol | Neopentyl glycol | 126-30-7 | 34 | 0.86 |
| 2-Ethyl-2-(hydroxymethyl)-1,3-propanediol | 1,1,1-Trimethylolpropane | 77-99-6 | 8 | 0.08 |

**Purity (%):** 99%

**Hazardous impurities (other than residual monomers and reactants):** None

**Non-hazardous impurities at 1% by weight or more:** None

**Additives/adjuvants:** None

## 4. PLC JUSTIFICATION

The notified polymer meets the PLC criteria.

## 5. PHYSICAL AND CHEMICAL PROPERTIES

| Property | Result | Comments |
|---|---|---|
| **Appearance** | Light to whitish, viscous liquid | |
| **Melting point** | 76°C | |
| **Density** | 1.18 g/mL | |
| **Water solubility** | Insoluble. | See comments below. |
| **Particle size** | Not provided. | Imported as a liquid. |
| **Flammability** | Not flammable. | |
| **Autoignition temperature** | Not provided. | |
| **Explosive properties** | Not explosive. | |
| **Stability/reactivity** | Stable. | |
| **Hydrolysis as function of pH** | Not determined | Hydrolysis is not expected. See comments below. |
| **Partition coefficient** | Not determined | See comments below. |
| **Adsorption/desorption** | Not determined | See comments below. |
| **Dissociation constant** | Not determined | See comments below. |

### 5.1 Comments on physical and chemical properties

The notified polymer is a saturated, low molecular weight (NAMW 2400), branched, hydroxylated polyester resin containing only hydroxyl functional groups.

The notifier has not provided data for the water solubility of the notified polymer citing the fact that monomeric esters are known to be sparingly soluble in water, and with their solubility decreasing with the chain length of the aliphatic group. As such, polyesters are even less soluble than monomeric esters and hence the new polymer is not expected to be soluble in water.

Hydrolysis of monomeric esters is slow under normal environmental conditions. At elevated temperatures, and in the presence of acid or base catalysts, saponification of esters takes place. Polyesters are expected to behave in the same way as monomeric esters, but would require even more extreme conditions for hydrolysis to occur. Hence, in the absence of a catalyst, and under ambient temperatures and in pH conditions found in the environment, no hydrolysis of the notified polymer is anticipated.

The partition coefficient was not determined. Given its low water solubility, the polymer is expected to partition into the octanol phase.

No adsorption data were provided in the notification dossier. The polymer is not expected to be mobile in soils due to its likely low water solubility.

The dissociation constant was not determined. The polymer is not ionic and is therefore not expected to dissociate, although it may contain a small amount of free carboxylic acid functionalities expected to have typical acidity.

## 6. USE, VOLUME AND FORMULATION

**Use:**
The notified polymer is used as an original equipment manufacturing base coat and repair metallic base coat for two coat metallic automotive refinish coatings.

**Manufacture/Import volume:**
The notified polymer will be imported at

Year 1: 250-500 kg
Years 2-5: 500-1000 kg

**Formulation details:**
The notified polymer will be imported in 200 L steel drums as a component of the product Dynapol H 700-22 (50% notified polymer in 1:1 xylene/butylacetate).

Dynapol H 700-22 will be used as a component in the formulation of automotive refinish coatings at PPG Industries Australia Pty Ltd at McNaughton Rd Clayton Victoria. At the paint manufacture site Dynapol H 700-22 and other ingredients will be blended in a fully enclosed high speed paint mixing vessel fitted with exhaust ventilation. Dynapol H 700-22 will be added to the paint mixing vessel through a loading hatch using a drum lifting/tipping device. Local ducted fume extraction is located adjacent to the loading hatch. The automotive refinish coatings are automatically filled into 1 L tinplate paint cans in an enclosed cabinet under exhaust ventilation. The finished paints will contain 10% notified polymer.

The automotive refinish coatings will be diluted and applied by spray gun to automotive panels as the basecoat in a well ventilated, down draft spray booth with an effective fume extraction system. After application of the topcoat, the painted car panels will be heat cured.

## 7. OCCUPATIONAL EXPOSURE

| Exposure route | Exposure details | Controls indicated by notifier |
|---|---|---|
| ***Laboratory Development (1 site)*** | | |
| *Manufacture and testing of paint (3 workers, 8 hrs/day, 20 days/year)* | | |

| | | |
|---|---|---|
| Dermal and ocular | Possible exposure to drips, spills and splashes during batch adjustment and when taking and testing samples. | Coveralls, goggles and impervious gloves worn. |

***Paint Formulation (1 site)***

*Paint make up (3 workers, 8 hrs/day, 30 days/year)*

| | | |
|---|---|---|
| Dermal, inhalation and ocular | Possible dermal and ocular exposure to drips, spills and splashes during charging of mixer and blending. Possible inhalation exposure to aerosols during charging. | The paint is manufactured in fully enclosed high speed paint mixers fitted with an exhaust ventilation system. Coveralls, goggles and impervious gloves worn. Local ducted fume extraction is located adjacent to the loading hatch. |

*QC testing (3 workers, 8 hrs/day, 30 days/year)*

| | | |
|---|---|---|
| Dermal and ocular | Possible exposure to drips, spills and splashes during batch adjustment and when taking and testing samples. | Coveralls, goggles and impervious gloves worn. |

*Filling into drums (3 workers, 8 hrs/day, 30 days/year)*

| | | |
|---|---|---|
| Dermal | Possible exposure to drips and spills when connecting filling lines. | The paint is automatically filled into cans in an enclosed cabinet under exhaust ventilation. Coveralls, goggles and impervious gloves worn. |

***Paint application (3000 sites)***

*Thinning and application of paint and cleaning of spray equipment (6000 workers, 4 hrs/day, 220 days/year)*

| | | |
|---|---|---|
| Dermal and inhalation | Possible exposure to drips and spills during preparatory stages of the paint for spraying and cleaning of equipment. Formation of aerosols and therefore inhalation exposure is likely during spray application. | Paint will be diluted and applied in a well ventilated, down draft spray booth with an effective fume extraction system. Anti-static flame retardant overalls, anti-static footwear, impervious gloves, eye protection worn and air fed breathing mask worn. |

***Transport and storage***

*Transport and storage personnel (943 workers, 1 hr/day, 4-200 days/year), handle and transport the polymer (50% notified polymer) and paint (10% notified polymer) solutions.*

| | | |
|---|---|---|
| Dermal | Exposure to the polymer and paint solutions is unlikely except in cases of accidental spillage. | None indicated. |

## 8. PUBLIC EXPOSURE

Neither the imported polymer solution nor the paint will be sold to the public. The public will come into contact with the notified polymer after it becomes part of an inert, fully cured paint film on the exterior of the car body which is not bioavailable. Thus, public exposure to the notified polymer through the cured paint film will be low.

## 9. ENVIRONMENTAL EXPOSURE

### 9.1. Release

The notified polymer-solvent solution will be used to formulate paints that will be applied to car bodies in a controlled factory environment, otherwise it will be used as a metallic base coat. The manufacture of paint involves blending of the polymer-solvent solution with other components in fully enclosed mixing vessels from which it is automatically dispensed into paint cans.

Release of the notified polymer to the environment could occur in the form of waste generation at the manufacturing site during blending of the paint product, or at customer sites during application of the paint to car bodies. Only minimal release of the polymer is expected to occur during the manufacturing processes mainly through incidental spills. No atmospheric release is anticipated because the substance is not volatile, although, the paint contains some solvents, which evaporate in the ventilation systems. The evaporated solvent is vented via a stack to the atmosphere.

The notifier anticipates about 20 kg of waste polymer may be generated each year as a result of spills during manufacturing. All incidental spills are contained by bunding and collected for disposal. The manufacturer, PPG, has developed a process whereby waste resins and paints are dissolved and the residues converted to an inert solid which can be disposed of either in landfill or by incineration.

At customer sites, waste polymer may be generated in three main ways: by overspray during the application process, cleaning of the spray guns and mixing equipment, and residues in empty containers. Most of the waste is generated by overspray during the application process.

Transfer efficiency of paint during spray painting is approximately 30%, with the remaining 70% being released as overspray. Control measures used to capture overspray include filters installed in spray booths and masking materials such paper. An overspray rate of 70% equates to a maximum of about 700 kg of notified polymer being generated for disposal.

The amount of waste generated from cleaning of spray guns and mixing equipment and from residues in containers will be small compared to overspray. No estimates are provided for wastes generated through equipment cleaning, however, the notifier estimates that paint residues in containers will account for about 2% of the container contents or up to 20 kg per annum. If the paint blend contains 10% of the new polymer, then residues would account for only about 2 kg of waste polymer. The paint containing the polymer will dry to form a solid that will be disposed of in landfill. Wastes generated through overspray and equipment washing will be collected and disposed of through licensed waste disposal contractors.

No release of the polymer is expected at end use. The new polymer will be incorporated into the coating formulation used to paint the exterior of car bodies. Once the paint is dried it will become inert.

### 9.2. Fate

Usage patterns indicate that approximately 30% of the notified polymer will be incorporated into the coating formulation and reside on car bodies where it will be inert. The polymer, being incorporated into the automotive surface coating, will share the fate of the vehicle bodies, potentially being recycled as scrap. The paint coating would not be readily degradable, however, paint film left exposed to sunlight for long periods will slowly deteriorate under the action of UV light, but this will be negligible over the life of the motor vehicle.

The remaining 70% of the notified polymer will be wastes generated during paint manufacture, formulation and spray paint application. Waste generated during manufacturing is recovered as an insoluble solid from the wastewater used for cleaning and is disposed to landfill. The containers and their residue will also be disposed in this manner. Wastes generated from overspray onto paper are likely to be incinerated, while wastes collected on filters are likely to be landfilled or incinerated. Incineration would destroy the polymer releasing combustion products comprising mainly oxides of carbon and water.

In landfill, the notified polymer is expected to only slowly degrade. Leaching of the polymer from landfill sites is not expected given the low water solubility of the substance. Hydrolysis, although theoretically possible because of the presence of ester groups in the polymer, is unlikely in the environmental pH range (pH 4 to 9).

The polymer is not expected to cross biological membranes, due to the low solubility and high molecular weight, and as such should not bioaccumulate (Connell, 1989).

## 10. EVALUATION OF HEALTH EFFECTS DATA

No toxicological data were submitted.

One of the constituent monomers in the polymer is a hazardous substance – hexanedioic acid (R36). It is present in the notified polymer at a concentration well below its cut-off level (20%).

The MSDS for the product Dynapol H 700-22 (which contains the notified polymer at 50% w/w) indicates it is harmful by inhalation and in contact with skin and can result in skin irritation. The toxic effects indicated are due to the presence of solvents and not the notified polymer.

The MSDS for the paint product (which contains the notified polymer at 10%) indicates it is harmful by inhalation, in contact with skin and if swallowed, and can result in eye and skin irritation. Again the effects indicated are due to the presence of solvents and other additives and not the notified polymer.

## 11. EVALUATION OF ENVIRONMENTAL EFFECTS DATA

No ecotoxicological data were provided in the notification dossier.

## 12. ENVIRONMENTAL RISK ASSSESSMENT

The overall environmental hazard posed by the notified polymer is expected to be low. No release of the notified polymer to the aquatic environment is expected to occur under normal usage. However, wastes will be generated for disposal at the manufacturing, blending and application stages.

Only a small amount of waste will be generated during blending and manufacturing mainly through incidental spills, equipment cleaning, and container residues. More waste is expected to be generated during application of the paint to car bodies due to the poor transfer efficiency of paint during spray painting. About 70% of paint containing the new polymer could be released as overspray. It is expected that spray painting will occur in closed workshops where the over-sprayed paint will be captured by filters and other masking materials for disposal. Approximately 30% of paint containing the new polymer will be incorporated into the coating formulation and deposited on motor vehicles, where once dried, will become inert.

Polymer incorporated onto car bodies will share the fate of the vehicles, which are likely to be recycled as scrap at the end of their useful life. Most of the generated waste is expected to be disposed in approved landfill sites where it will slowly degrade. Leaching of the polymer from landfill sites is unlikely given its low water solubility. Hydrolysis, although theoretically possible because of the presence of ester groups in the polymer, is unlikely in the normal environmental pH range.

Some wastes may be disposed of by incineration. Incineration of polymer wastes would destroy the polymer releasing combustion products comprising mainly oxides of carbon and water.

The notified polymer is unlikely to cross biological membranes, due to the low solubility and high molecular weight, and as such should not bioaccumulate.

## 13. HEALTH AND SAFETY RISK ASSESSMENT

### 13.1. Hazard assessment

No toxicological information has been provided for the notified polymer. Based on its high molecular weight, low reactivity and low content of residual monomers, it is unlikely to be a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b). The polymer solution Dynapol H 700-22 is a hazardous substance due to the content of the solvents xylene and n-butyl acetate. It is classed as a Class 3 dangerous good (flammable liquid) because of the solvent content.

The MSDS for the polymer solution Dynapol H 700-22 lists a number of potential health effects, namely eye, mucous membrane and respiratory irritation, headaches, dizziness,

vomiting and central nervous system depression. Skin irritation or contact dematitis may also occur on repeated exposure. Skin defatting may also occur. The symptoms relate mainly to the solvents, xylene and n-butyl acetate, rather than the notified polymer.

The polymer itself is not reactive and non-volatile, and because of the high molecular weight is not expected to cross biological membranes. The notifier states that there have been no reported incidences of adverse effects on the occupational health of workers using the notified polymer overseas.

**13.2. Occupational health and safety**

The notified polymer will be imported into Australia and blended into paint that is used only in automotive finish coatings. Exposure to the imported solution Dynapol H 700-22, which contains 50 % notified polymer, may occur during paint manufacture. Workers involved in paint formulation and end use may be exposed to paint solutions containing 10 % notified polymer.

Dermal and ocular exposure of paint formulation workers to drips, spills and splashes of the product Dynapol H 700-22 may occur when charging the mixing vessel. Inhalation exposure to Dynapol H 700-22 aerosols and vapours may also occur when charging the mixing vessel. Ocular and dermal exposure should be limited by the use of coveralls, goggles and impervious gloves. The use of local ducted fume extraction located adjacent to the loading hatch should limit inhalation exposure.

Paint formulation workers may be exposed to the vapours of the paint solution (containing 10% notified polymer) during paint mixing prior to application. Inhalation exposure will be limited by the use of fully enclosed mixers fitted with an exhaust ventilation system. Laboratory development workers and QC technicians may receive dermal and ocular exposure to drips, spills and splashes of the paint solution when taking and testing paint samples and during batch adjustment. The use of gloves, safety goggles and overalls should serve to limit dermal and ocular exposure.

Drum filling personnel may receive dermal contact to paint solutions during connecting and disconnecting pump lines during drum filling. As the drum filling process is automated and workers wear gloves, safety goggles and overalls, exposure is expected to be incidental.

Coating application operators may experience dermal exposure to spills and drips of the paint (10 % notified polymer) when connecting pump lines between the drums and the spray equipment, when thinning the paint solution and when cleaning the spray equipment. The use of gloves and safety glasses or goggles should limit dermal exposure. The spraying procedure is expected to produce a dense aerosol. The use of the paint containing the notified polymer should be in accordance with the NOHSC *National Guidance Material for Spray Painting* (NOHSC, 1999c). The use of a well ventilated, down draft spray booth with an effective fume extraction system as well as anti-static flame retardant overalls, anti-static footwear, impervious gloves, eye protection and air fed breathing apparatus should adequately serve to limit any dermal or inhalation exposure from aerosols.

The notified polymer becomes biologically unavailable for absorption once it is incorporated in the paint during curing. The health risk for workers handling products coated with paint containing the notified polymer is considered to be negligible.

There is little potential for significant occupational exposure to the notified polymer in the transport and storage of the polymer or paint solutions other than in the event of an accidental spill.

Engineering controls and personal protective equipment necessary for reduction of exposure to hazardous solvents should be more than adequate to reduce exposure to the notified polymer.

Given the risk reduction measures indicated and that the notified polymer is unlikely to be a hazardous substance, the notified polymer is of low concern to human health and safety in the workplace.

### 13.3. Public health

In view of its high molecular weight, low toxicity and the use pattern, the notified polymer is likely to pose a minimal hazard to public health.

## 14. MSDS AND LABEL ASSESSMENT

### 14.1. MSDS

The MSDS of the notified polymer and the product Dynapol H 700-22, which contains the notified polymer at 50%, provided by the notifier were in accordance with the NOHSC *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 1994a). They are published here as part of the assessment report. The accuracy of the information on the MSDS remains the responsibility of the applicant.

### 14.2. Label

The label for the product Dynapol H 700-22, which contains the notified polymer at 50%, 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.

## 15. RECOMMENDATIONS

No special precautions are required for the notified polymer, however, due to the presence of hazardous solvents in the polymer solution, the following recommendations are made.

*Control Measures*

Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the product Dynapol H 700-22:
  - Ensure ventilation is adequate.

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the product Dynapol H 700-22:
  - Overalls
  - Safety shoes
  - Goggles
  - Gloves
  - Respirator where engineering controls inadequate

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

- A copy of the MSDS should be easily accessible to employees.

- If products and mixtures containing the notified polymer 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.

Emergency procedures

- Spills/release of the product Dynapol H 700-22 should be taken up with absorbent material.
- In the event of a spillage, all possible sources of ignition should be shut down.
- Action should be taken to prevent a spill entering drains or waterways.

Transport and Packaging

- The product Dynapol H 700-22 is a flammable liquid and should be transported as a dangerous good.

**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(1) of the Act; if
  - the notified polymer is introduced in a chemical form that does not meet the PLC criteria.

or

(2) 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.

## 16. REFERENCES

Connell D. W. (1990) General characteristics of organic compounds which exhibit bioaccumulation. In Connell D. W., (Ed) Bioaccumulation of Xenobiotic Compounds. CRC Press, Boca Raton, USA.

National Occupational Health and Safety Commission (1994a) National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]. Australian Government Publishing Service, Canberra.

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

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.

National Occupational Health and Safety Commission (1999a) List of Designated Hazardous Substances [NOHSC:10005(1999)]. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1999b) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1994)]. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1999c) National Guidance Material for Spray Painting. Australian Government Publishing Service, Canberra.