File No: LTD/1510

May 2011

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Polymer in DISPERBYK-2008

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth) (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 Department of Health and Ageing, and conducts the risk assessment for public health and occupational health and safety. The assessment of environmental risk is conducted by the Department of Sustainability, Environment, Water, Population and Communities.

For the purposes of subsection 78(1) of the Act, this Full Public Report may be inspected at our NICNAS office by appointment only at Level 7, 260 Elizabeth Street, Surry Hills NSW 2010.

This Full Public Report is also available for viewing and downloading from the NICNAS website or available on request, free of charge, by contacting NICNAS. For requests and enquiries please contact the NICNAS Administration Coordinator at:

Street Address:	Level 7, 260 Elizabeth Street, SURRY HILLS NSW 2010, AUSTRALIA.
Postal Address:	GPO Box 58, SYDNEY NSW 2001, AUSTRALIA.
TEL:	+ 61 2 8577 8800
FAX	+ 61 2 8577 8888
Website:	www.nicnas.gov.au

Director
NICNAS

TABLE OF CONTENTS

FULL PUBLIC REPORT

Polymer in DISPERBYK-2008

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Akzo Nobel Pty Ltd (ABN 59 000 119 424)
51 McIntyre Road
SUNSHINE NORTH, VIC 3020

Nuplex Industries (Aust) Pty Ltd (ABN 25 000 045 572)
49-61 Stephen Road
BOTANY, NSW 2019

NOTIFICATION CATEGORY
Limited: Synthetic polymer with Mn ≥ 1000 Da.

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication: chemical name, other names, molecular and structural formulae, molecular weight, analytical data, polymer constituents, residual monomers, impurities, use details and import volume.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows: melting point, boiling point, density, vapour pressure, water solubility, hydrolysis as a function of pH, partition coefficient, adsorption/desorption, dissociation constant, flammability limits and autoignition temperature.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
United States of America (2008)

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
DISPERBYK-2008 (Product containing the notified polymer)

CAS NUMBER
Not assigned

MOLECULAR WEIGHT
> 1000 Da

ANALYTICAL DATA
Reference IR and GPC spectra were provided.

3. COMPOSITION

DEGREE OF PURITY > 60%

NON HAZARDOUS IMPURITIES/RESIDUAL MONOMERS (> 1% by weight) None

ADDITIVES/ADJUVANTS None

LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES
None under normal conditions of use.

DEGRADATION PRODUCTS

No degradation, decomposition or depolymerisation of the notified polymer is expected to occur under normal conditions of use.

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20°C AND 101.3 kPa: Yellow-brown amber liquid (product).

Property	Value	Data Source/Justification
Melting Point/Freezing Point	< 20°C	The polymer is a liquid at room temperature.
Boiling Point	Not determined	The notifier gave an estimate of > 200°C based on the molecular weight
Density	1030 kg/m^3 (imported solution, 60% notified polymer)	MSDS
Vapour Pressure	< 1.3 × 10^{-9} kPa	Estimated based on the NAMW > 1,000 Da (US EPA, 2007)
Water Solubility	Not determined	Expected to have low water solubility based on its predominantly hydrophobic structure.
Hydrolysis as a Function of pH	Not determined	The notified polymer has functional groups that are susceptible to hydrolysis. However, hydrolysis is expected to be slow at environmental pH (4-9)
Partition Coefficient (n-octanol/water)	Not determined	The notified polymer may partition from water into octanol based on its hydrophobicity. However, the high molecular weight of the notified polymer indicates that it will not cross biological membranes.
Adsorption/Desorption	Not determined	Based on its ionic nature and presumed low solubility in water, the notified polymer is expected to adsorb strongly to soil and sediment and have low mobility in the environment
Dissociation Constant	Not determined	The notified polymer will be ionised in the environmental pH range (4-9) based on the presence of a basic functional group in the polymer structure
Flash Point	> 105°C (imported solution, 60% notified polymer)	MSDS (DIN EN 2719, ISO 2719)
Autoignition Temperature	> 105°C (imported solution, 60% notified polymer)	Calculated value, from MSDS
Explosive Properties	Not expected to be explosive	The structural formula contains no explosophores.

DISCUSSION OF PROPERTIES

Reactivity

Stable under normal conditions of use.

Dangerous Goods classification

Based on the submitted physical-chemical data in the above table the notified polymer is not classified according to the Australian Dangerous Goods Code (NTC, 2007). However the data above do not address all Dangerous Goods endpoints. Therefore consideration of all endpoints should be undertaken before a final decision on the Dangerous Goods classification is made by the introducer of the polymer.

5. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified polymer will not be manufactured in Australia. The notified polymer will be imported into Australia as a component in a wetting and dispersing additive (60% in polypropylene glycol solution) in sealed steel 25 kg or 200 kg drums for reformulation into industrial coatings and inks. A portion of the notified polymer will also be imported as a component of ink preparations.

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

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	0 – 5	5 – 10	5 – 10	10 – 15	10 – 15

PORT OF ENTRY
Melbourne

IDENTITY OF MANUFACTURER/RECIPIENTS
Akzo Nobel Pty Ltd
Nuplex Industries (Aust) Pty Ltd

TRANSPORTATION AND PACKAGING
When used in industrial surface coatings the notified polymer will be imported in sealed 25 kg or 200 kg drums and transported by road or rail. The notified polymer may also be imported as a component of ink preparations at less than 5% concentration in 1, 3 and 5 L plastic bottles. After reformulation industrial coatings containing the notified polymer will be stored and transported in 1 L, 4 L, 10 L and 20 L steel cans and pails.

USE
The notified polymer will be used as a wetting and dispersing additive (< 10% concentration) in high solid and solvent-free coating industrial coatings and as a component (< 5% concentration) of industrial printing inks.

OPERATION DESCRIPTION

Reformulation of coatings

At the coating manufacturing site, the notified polymer will be manually weighed from the storage drums into a stainless steel blending tank and mixed with pigments, solvent and sometimes resin to form the mill base. The mill base (< 20 % notified polymer) will then be pumped into a large mixing vessel to which the remaining additives and resin will be added to form the finished product. Samples will be removed at this stage for quality control testing by laboratory technicians. The finished product (< 10 % notified polymer) will be fed into containers by gravity from the bottom of the mixing vessel through a filter and filling lines. Occasionally the coatings may be manufactured in batch mixers where addition of the notified polymer is semi-automated. This process will involve workers opening the pails or drums, weighing the required amount of notified polymer and manually charging the blending vessels. All coating reformulation processes will occur under exhaust ventilation. Equipment will be cleaned by rinsing with water and the washings will be treated prior to release to sewer treatment plants, resulting in the collection and disposal of the notified polymer to landfill.

Reformulation of printing ink

Approximately 10% of the imported volume of the notified polymer will be used as a component of ink preparations of which up to 50% may be locally formulated. At the ink manufacturing sites, the notified polymer will be manually weighed and transferred from the storage drums into a stainless steel blending tank and mixed with pigments and varnish (a resin and solvent). Manufacturers may pre-disperse the notified polymer with pigment and solvent for addition to the resin mixture (less than 10% notified polymer). The process generally occurs in a closed automated system with dedicated transfer lines. Occasionally, ink manufacture may occur in batch mixers where addition of the polymer is semi-automated. The reformulated inks containing the notified polymer will be sampled for laboratory analysis and all processes will occur under local exhaust ventilation. The finished ink products (< 5% notified polymer) will be fed into containers by gravity from the bottom of the mixing vessel through a filter and filling lines. Manufacturing and application equipment will be cleaned by rinsing with water and the washings will be treated prior to release to sewer treatment plants, resulting in the collection and disposal of the notified polymer to landfill.

End use

The commercial/industrial coatings (< 10 % notified polymer) will be applied by roller or spray. The used containers will be cleaned by filling with an appropriate solvent and the contents pumped to storage pits prior to disposal by a licensed waste management company.

The ink formulations containing notified polymer (< 5%) will be transferred directly from the containers to printing machines via automated lines. The printing machines will be fully automated with local fume extraction. An operator will connect and disconnect the ink containers and will also handle the printed substrate, once the ink is fully dried and cured. Any residual ink is usually manually washed from the equipment daily using the recycled solvent with the washings are collected by solvent recyclers.

6. HUMAN HEALTH IMPLICATIONS

6.1 Exposure assessment

6.1.1 Occupational exposure

NUMBER AND CATEGORY OF WORKERS

Coating formulation and application

Category of Worker	*Number*	*Exposure Duration (hours/day)*	*Exposure Frequency (days/year)*
Transport	6-8	2-3	10-15
Coating formulation	4	8	50
Laboratory	2	1	20
Application	100	6	260

Printing formulation and application

Category of Worker	*Number*	*Exposure Duration (hours/day)*	*Exposure Frequency (days/year)*
Storage and transport personnel	20	4	50
Ink Manufacture/Formulation	4	8	50
Printer machine operators	20	6	200
Service technician	5	1	50

EXPOSURE DETAILS

Transport and storage

Transport and storage workers are not expected to be exposed to the notified polymer (< 60%) except in the unlikely event of an accident.

Reformulation

Dermal and ocular exposure to the notified polymer at concentrations up to 60% may occur when manually weighing, connecting and disconnecting pumps, charging the blending vessels, when taking samples from the blending vessel by laboratory technicians, cleaning and maintenance of equipment. The use of personal protective equipment such as coveralls, safety glasses, and gloves by workers will minimise exposure. Inhalation exposure to vapours and aerosols is not likely during reformulation due to the expected low vapour pressure of the notified polymer, also local exhaust ventilation will be employed in areas where weighing and charging of the blending vessels occur to limit inhalation exposure to the notified polymer.

End use

During use of surface coatings dermal and ocular exposure to the notified polymer (< 10%) may occur during the manual application and when cleaning up equipment. When used in industrial printing inks, dermal or ocular exposure to the notified polymer (at < 5%) is possible during connection and disconnection of lines from containers of ink formulation to the printing machine and during printer maintenance. Exposure to the notified polymer will be further minimised by PPE worn by workers such as overalls, impermeable gloves and eye protection.

Inhalation exposure to the notified polymer may also occur during spray application of surface coatings. However, exposure will be limited as the spray paint will be applied in a spray booth with a down draft by

workers using protective equipment including vapour masks and full protective clothing.

Workers will have dermal contact with articles that have surface coatings (< 10%) and inks (< 5%) containing the notified polymer. However, as the notified polymer will be bound to the substrate of the article transfer to the skin and hence exposure is expected to be negligible.

6.1.2. Public exposure

Products containing the notified polymer will only be used for industrial applications and will not be sold to the public. The public will have dermal contact with articles that have surface coatings (< 10%) and inks (< 5%) containing the notified polymer. However, as the notified polymer will be bound to the substrate of the article transfer to the skin and hence exposure is expected to be negligible.

6.2. Human health effects assessment

No toxicity data were submitted, however no toxicity to human health is expected, based on the lack of functional groups of concern, the high molecular weight (> 1,000 Da) and low levels of low molecular weight species.

Health hazard classification

Based on the limited data on the notified polymer it cannot be classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

6.3. Human health risk characterisation

6.3.1. Occupational health and safety

During reformulation workers will handle the notified polymer at concentrations up to 60%, however exposure is expected to be low given the proposed use of PPE and largely enclosed, automated processes. During end use workers will be exposed to products containing the notified polymer at concentrations up to 10%. Exposure to the notified polymer during end use is also expected to be low due to the reduced concentration and the use of engineering controls and appropriate PPE. Exposure of workers to the notified polymer through dried inks and coatings is expected to be negligible. The risk of adverse health effects from exposure to the notified polymer is expected to be reduced by the high molecular weight (> 1,000 Da) of the notified polymer and the lack of any functional groups of concern.

Overall, the risk to occupational health and safety is considered low, considering the expected low exposure and the expected low hazardous nature of the notified polymer.

6.3.2. Public health

Given the negligible public exposure to the notified polymer, the risk to public health is considered to be very low.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Environmental Exposure & Fate Assessment

7.1.1 Environmental Exposure

RELEASE OF CHEMICAL AT SITE

No manufacturing of the notified polymer will take place in Australia. The release of the notified polymer to the environment during importation, storage, and transport is unlikely. The most likely source of a release to the environment during these activities will be a transport accident. However, the capacity and specifications of the import containers are likely to minimise the extent of any such releases. Releases that do occur as a result of accidents are expected to be physically contained, absorbed on inert material, and either reused or sent for disposal to landfill.

During the manufacture of coating formulations and formulation of ink preparations, an estimated 0.5% of the total importation volume of the notified polymer will be lost due to spills. The spills will be readily contained and collected for disposal to landfill. At most, 1% of the total import volume of the notified polymer is anticipated to remain in storage containers as residues. Import drums will be collected by licensed waste

contractors and the residue in storage containers will be cured prior to disposal to landfill. Equipment will be cleaned by rinsing with water and the washings will be treated prior to release to sewer treatment plants, resulting in the collection and disposal of the notified polymer to landfill.

RELEASE OF CHEMICAL FROM USE

Application of coatings

Approximately 90% of the notified polymer will be used in coating preparations applied primarily by roller. However, when coating formulations containing the notified polymer are applied by spray techniques, it is anticipated that up to 10% of the coating product will be accounted for as overspray and be collected as waste material. As the application of coatings will be conducted at industrial sites in designated spray booths, the overspray will be captured in the spray booth and on kraft paper or newspaper. The product will then dry onto the paper and be disposed of to landfill.

During industrial use of the notified polymer, it is estimated that < 0.5% of the notified polymer will be spilt. These spills will be contained and disposed of to landfill. Less than 1% of the notified polymer may remain as residues in the product containers and these are expected to be disposed of to landfill.

Equipment used to apply the coating formulations may be rinsed with water and these washes will undergo a treatment during which time the notified polymer will be removed and disposed to landfill. It is estimated that 1% of notified polymer used in solvent-borne coatings may be released to sewer treatment plants due to application equipment rinsing.

Ink Preparations

Approximately 10% of the notified polymer will be used in ink preparations. During use of the ink products containing the notified polymer, some release is expected to occur during the printing process via cleaning and maintenance operations and small spills (< 0.5%). It is expected these residues will be disposed of to landfill. The inks containing the notified polymer will be applied to a variety of substrates including paper materials using industrial inkjet printers. The applied notified polymer is expected to be trapped in the ink matrix with other components of the ink.

RELEASE OF CHEMICAL FROM DISPOSAL

The majority of the notified polymer will share the fate of articles it has been coated to or applied to and therefore is expected to be disposed of to landfill. It is assumed that all of the notified polymer in ink preparations will be applied to paper and 50% of the paper is expected to be recycled.

7.1.2 Environmental fate

No environmental fate data were submitted. The majority of the notified polymer will be bound in either an inert print matrix on various substrates or immobilised within a polymeric film on coated articles and is therefore not expected to be bioavailable nor mobile. The majority of articles containing the notified polymer are anticipated to be disposed of to landfill, where the notified polymer is expected to degrade by biotic and abiotic processes to form water and oxides of carbon and nitrogen.

An estimated maximum of 6% of the imported notified polymer may be disposed of to the sewer due to washing of coating equipment (1%) and paper recycling (5%). During paper recycling processes, waste paper is repulped using a variety of chemical agents which, amongst other things, enhance detachment of ink from the fibres. Very little of the notified polymer is expected to partition to the supernatant water which is released to sewer. Moreover, the notified polymer would be expected to be efficiently removed from influent in sewage treatment plants through adsorption of this ionic polymer to sludge or by flocculation (Boethling and Nabholz, 1997). The notified polymer is therefore expected to be concentrated in the sludge fraction of on-site or municipal waste water treatment plants. Sludge generated during the washing process will be sent to landfill for disposal or to agricultural land for remediation. The notified polymer will be bound to soil and sludge due to its ionic functions and is not expected to be mobile in the environment (Boethling and Nabholz, 1997).

7.1.3 Predicted Environmental Concentration (PEC)

The PEC was calculated assuming that 6% of the total import volume of polymer would be released to sewer annually, mainly from release during paper recycling and a minor amount from the washing of coating equipment. It was assumed that 90% of the notified polymer partitions to sludge in STPs due to its net positive charge (Boethling and Nabholz, 1997) and the release of the notified polymer will occur over 260 days per annum into the total Australian effluent volume. This corresponds to release only on working days, based on a 5 day work week. The results of the calculation are shown in the table below.

Predicted Environmental Concentration (PEC) for the Aquatic Compartment		
Total Annual Import/Manufactured Volume	15,000	kg/year
Proportion expected to be released to sewer	6%	
Annual quantity of chemical released to sewer	900	kg/year
Days per year where release occurs	260	days/year
Daily chemical release:	3.46	kg/day
Water use	200	L/person/day
Population of Australia (Millions)	21.161	million
Removal within STP	90%	
Daily effluent production:	4,232	ML
Dilution Factor - River	1.0	
Dilution Factor - Ocean	10.0	
PEC - River:	0.082	µg/L
PEC - Ocean:	0.0082	µg/L

Partitioning to biosolids in STPs Australia-wide may result in an average biosolids concentration of 7.361 mg/kg (dry wt). Biosolids are applied to agricultural soils, with an assumed average rate of 10 t/ha/year. Assuming a soil bulk density of 1500 kg/m^3 and a soil-mixing zone of 10 cm, the concentration of the notified polymer may approximate 0.049 mg/kg in applied soil. This assumes that degradation of the notified polymer occurs in the soil within 1 year from application. Assuming accumulation of the notified polymer in soil for 5 and 10 years under repeated biosolids application, the concentration of notified polymer in the applied soil in 5 and 10 years may approximate 0.245 mg/kg and 0.49 mg/kg, respectively.

7.2. Environmental effects assessment

No ecotoxicity data were submitted. Ecotoxicological endpoints for the notified polymer were calculated based on SAR equations assuming a worst case cation charge density for the polymer (Boethling and Nabholz, 1997). The endpoints are summarised in the table below and have been modified by mitigation factors to account for the anticipated binding of the polymer with organic carbon in surface waters.

Endpoint	*Result*	*Assessment Conclusion*
Fish Toxicity	LC50 (96 h) = 34.7 mg/L	Harmful
Daphnia Toxicity	EC50 (48 h) = 16.3 mg/L	Harmful
Algal Toxicity	EC50 (96 h) = 3.48 mg/L	Toxic

The notified polymer is potentially harmful or toxic to aquatic organisms in environmental waters with typical levels of total organic carbon. The SAR estimation procedure used here is a standard approach and is considered reliable to provide general indications of the likely environmental effects of the polymer. However, this method is not considered sufficient to formally classify the acute and long term hazard of the notified polymer to aquatic life under the Globally Harmonised System for the Classification and Labelling of Chemicals (United Nations, 2009).

7.2.1 Predicted No-Effect Concentration

The estimated hazard data for the notified polymer indicates that, after allowing for the mitigating effects of organic carbon in surface waters, the most sensitive ecotoxicological endpoint is for algae. The endpoint for algae was therefore selected for the calculation of the PNEC below. A conservative assessment factor of 1000 was applied since ecotoxicity endpoints were calculated using SAR equations based on groupings of broadly related polymers

Predicted No-Effect Concentration (PNEC) for the Aquatic Compartment		
Algae (EC50, 96 h)	3.48	mg/L

Assessment Factor	1000	
PNEC:	3.48	µg/L

7.3. Environmental risk assessment

Risk Assessment	PEC µg/L	PNEC µg/L	Q
Q - River	0.082	3.48	**0.023**
Q - Ocean	0.0082	3.48	**0.002**

The risk quotient (Q = PEC/PNEC) for aquatic exposure is calculated to be < 1 based on the above calculated PEC and PNEC. The Q value of < 1 indicates the notified polymer is not expected to pose an unacceptable risk to the aquatic environment from its proposed use pattern at the proposed maximum import volume.

8. CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification
Based on the limited data on the notified polymer it cannot be classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)].

Human health risk assessment
Under the conditions of the occupational settings described, the notified polymer is not considered to pose an unreasonable risk to the health of workers.

When used in the proposed manner, the notified polymer is not considered to pose an unreasonable risk to public health.

Environmental risk assessment
On the basis of the PEC/PNEC ratio and the reported use pattern, the notified polymer is not considered to pose an unreasonable risk to the environment.

Recommendations

CONTROL MEASURES
Occupational Health and Safety

- Spray applications should be carried out in accordance with the Safe Work Australia *National Guidance Material for Spray Painting* [NOHSC (1999)] or relevant State and Territory Codes of Practice.
- 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 *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)] workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Disposal

- The notified polymer should be disposed of to landfill.

Emergency procedures

- Spills or accidental release of the notified polymer should be handled by physical containment, collection and subsequent safe disposal.

Regulatory Obligations

Secondary Notification
This risk assessment is based on the information available at the time of notification. The Director may call for the reassessment of the chemical under secondary notification provisions based on changes in certain circumstances. Under Section 64 of the *Industrial Chemicals (Notification and Assessment) Act (1989)* the notifier, as well as any other importer or manufacturer of the notified chemical, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified chemical is listed on the Australian Inventory of Chemical Substances (AICS).

Therefore, the Director of NICNAS 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 polymer has a number-average molecular weight of less than 1000;

or

(2) Under Section 64(2) of the Act; if
- the function or use of the polymer has changed from a component in industrial coatings and industrial printing inks, or is likely to change significantly;
- the amount of polymer being introduced has increased from 15 tonnes, or is likely to increase, significantly;
- the polymer has begun to be manufactured in Australia;
- additional information has become available to the person as to an adverse effect of the polymer on occupational health and safety, public health, or the environment.

The Director will then decide whether a reassessment (i.e. a secondary notification and assessment) is required.

Material Safety Data Sheet
The MSDS of the notified polymer provided by the notifier was reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

BIBLIOGRAPHY

Boethling, RS & Nabholz VJ (1997) Environmental Assessment of polymers under the U.S. Toxic Substances Control Act. In: Hamilton, JD Sutcliffe R ed. Ecological Assessment of Polymers Strategies for Product Stewardship and Regulatory Programs, 1st ed. New York, Van Nostrand Reinhold, pp 187-234.

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

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

NOHSC (2004) Approved Criteria for Classifying Hazardous Substances, 3rd edition [NOHSC:1008(2004)]. National Occupational Health and Safety Commission, Canberra, AusInfo.

NTC (National Transport Commission) 2007 Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG code), 7th Edition, Commonwealth of Australia

United Nations (2009) Globally Harmonised System of Classification and Labelling of Chemicals (GHS), 3rd revised edition. United Nations Economic Commission for Europe (UN/ECE), <http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html >.

US EPA (United States Environmental Protection Agency) (2007), Interpretive Assistance for the Assessment of Polymers. Updated 22 January 2007: http://www.epa.gov/oppt/sf/pubs/InterpretiveAssistancePolymers0107.pdf Accessed (30 August 2010)