File No: STD/1305

September 2008

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

CIM-11

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 the Environment, Water, Heritage and the Arts.

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 334-336 Illawarra Road, Marrickville NSW 2204.

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:	334 - 336 Illawarra Road MARRICKVILLE NSW 2204, 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

CIM-11

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT
Canon Australia Pty Ltd (ABN 66 005 002 951)
1 Thomas Holt Drive
NORTH RYDE NSW 2113

NOTIFICATION CATEGORY
Standard: Chemical other than polymer (more than 1 tonne per year).

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Chemical name, Other names, CAS number, Molecular formula, Structural formula, Molecular weight, Spectral data, Methods of detection and determination, Purity, Import volume.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows:
Adsorption/desorption, Autoignition temperature, Acute dermal toxicity, Acute inhalation toxicity..

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
NCE/171 (May 2007)

NOTIFICATION IN OTHER COUNTRIES
Philippines (2007)

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
CIM-11

MOLECULAR WEIGHT
< 500 Da

ANALYTICAL DATA
Reference NMR, IR and GC spectra were provided.

3. COMPOSITION

DEGREE OF PURITY > 98%

HAZARDOUS IMPURITIES None

NON HAZARDOUS IMPURITIES None

ADDITIVES/ADJUVANTS None

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20°C AND 101.3 kPa: Clear colourless liquid

Property	Value	Data Source/Justification
Melting Point/Freezing Point	< -10°C	Measured
Boiling Point	249°C at 101.3 kPa	Measured
Density	970.8 kg/m^3 at 25°C	Measured
Vapour Pressure	7.2 x 10^{-5} kPa at 25°C	Measured
Water Solubility	Miscible at 25°C	Measured
Hydrolysis as a Function of pH	Stable at pH 4.0, 7.0 and 9.0	Measured
Partition Coefficient (n-octanol/water)	log Pow = 0.03 at 25°C	Measured
Adsorption/Desorption	Not determined	High mobility in soil can be expected from the structure and water solubility.
Dissociation Constant	Not determined	Dissociation is unlikely to occur under normal environmental conditions (pH 4–9) as contains no readily dissociable functionality.
Particle Size	Not determined	Liquid at ambient temperature.
Flash Point	143°C	Measured (method unknown).
Flammability	Not expected to be highly flammable	Estimated from measured flash point.
Autoignition Temperature	Not determined	Not expected to autoignite under normal conditions of use.
Explosive Properties	Not expected to be explosive	The structural formula contains no explosophores.

DISCUSSION OF PROPERTIES
For full details of tests on physical and chemical properties, please refer to Appendix A.

The notified chemical has a low vapour pressure and is miscible with water.
Based on the measured flash point, the notified chemical is not classified as flammable but would be considered to be a C1 combustible liquid [NOHSC:1015(2001)].

Reactivity
The notified chemical is predicted to be stable under normal conditions of use.

5. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified chemical will be imported only as a component of ink, incorporated within cartridges (at < 15% w/w).

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

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	< 1	< 1	< 2	< 2	< 2

PORT OF ENTRY
Sydney

TRANSPORTATION AND PACKAGING
The notified chemical will be imported as a component of ready-to-use (5 ml and 900 ml) plastic inkjet cartridges. The cartridges will be transported by road from the wharf to the warehouse, where they will be expected to be stored in a cool, dry, well-ventilated area.

USE
The notified chemical will be used as a component of imported inkjet printer inks (< 15%).

The inks will be used by office workers and the public for varied printing work. Sealed ink cartridges containing the notified chemical will be used as necessary to replace spent cartridges in inkjet printers.

OPERATION DESCRIPTION
No reformulation or repackaging of the notified chemical will occur in Australia. The cartridges containing the notified chemical will be delivered to the end-user in the same form in which they are imported. The cartridges will be installed or replaced into the inkjet printer by office workers, service technicians or consumers.

6. HUMAN HEALTH IMPLICATIONS

6.1 Exposure assessment

6.1.1 Occupational exposure

NUMBER AND CATEGORY OF WORKERS

Category of Worker	*Number*	*Exposure Duration (hours/day)*	*Exposure Frequency (days/year)*
Importation/Waterside	50	< 8	10-50
Storage and transport	15	< 8	10-50
Office worker	2,000,000	occasional	2
Service Technicians	100	1	170

EXPOSURE DETAILS
Exposure to the notified chemical during the importation, transport and storage of the printer cartridges is not expected, except in the unlikely event of an accident where the cartridge and its packaging may be breached.

Both office workers and service technicians may be exposed (dermal or ocular) to the notified chemical in inks (< 15% concentration) while changing printer cartridges, and service technicians may additionally be exposed during printer maintenance. Dermal exposure to small quantities of the notified chemical may occur if the print heads are touched while replacing the cartridges. In addition, dermal and possibly ocular exposure could occur when handling faulty or ruptured cartridges. Exposure during handling and cleaning of printer components is likely to be limited to the fingertips. Whilst exposure may be more frequent for service technicians than office workers, the exposure of both these workers is expected to be minimal.

Dermal exposure of workers may also occur when handling printed media before the ink is adequately dried, especially when printing on non-absorbent materials. Dermal exposure of office workers to the notified chemical from dried inks on printed paper is expected to be minimal, as the notified chemical will be largely bound to the paper within the matrix of the dried ink.

Inhalation exposure is not expected based on design of the printer and low volatility.

6.1.2. Public exposure
The exposure of the public to the notified chemical in inkjet printer inks is expected to be identical, or of a lesser extent, than that experienced by office workers using the same ink.

6.2. Human health effects assessment

The results from toxicological investigations conducted on the notified chemical are summarised in the table below. Details of these studies can be found in Appendix B.

Endpoint	*Result and Assessment Conclusion*
Rat, acute oral toxicity	LD50 = 8000 mg/kg bw; low toxicity
Rabbit, skin irritation	very slightly irritating
Rabbit, eye irritation	slightly irritating
Guinea pig, skin sensitisation – adjuvant test	no evidence of sensitisation
Rat, repeat dose oral toxicity – 49 days (males).	NOAEL 300 mg/kg bw/day
Developmental and reproductive effects	NOAEL > 1000 mg/kg/day
Mutagenicity – bacterial reverse mutation	non mutagenic
Genotoxicity – in vitro mammalian chromosome aberration test (Chinese hamster CHL/IU)	non genotoxic
Genotoxicity – in vitro mammalian chromosome aberration test (human lymphocytes)	non genotoxic
Genotoxicity – in vitro mammalian cell gene mutation test (mouse lymphoma)	non genotoxic

Toxicokinetics, metabolism and distribution
The notified chemical may be absorbed from the gastrointestinal tract or transdermally across the skin, given its low molecular weight, high water solubility, amphiphilic nature and low vapour pressure.

Given its low volatility, inhalation as a vapour is not expected to occur. If it were inhaled as an aerosol, it would be expected to diffuse/dissolve into the mucus lining of the respiratory tract and then have the potential to be absorbed directly across the respiratory tract epithelium (log P>0). It may also be absorbed through aqueous pores (MW < 500) or retained within the mucus and transported out of the respiratory tract and swallowed (EC, 2003).

Acute toxicity
The notified chemical was of low acute oral toxicity in rats (LD50 = 8000 mg/kg bw). Dermal toxicity was not determined and no data was submitted on the inhalation toxicity of the notified chemical. A structurally related chemical is of low toxicity by the dermal route in a study on rabbits (IUCLID).

Irritation and Sensitisation
The notified chemical was found to be slightly irritating to the eye and slightly irritating to the skin, though the observed irritation in either study was not severe enough to warrant classification. In addition, the notified chemical did not display any sensitisation effects when tested in the neat form in the Guinea Pig Maximisation Test.

Repeated dose oral toxicity and toxicity for reproduction
There were some toxicologically significant changes observed in the repeat dose oral toxicity study (49 days males; 45-49 days females), including the disappearance of lipid droplet in hepatic cells and the increase of glycogen and liver weight in female animals that had been treated with 1000 mg/kg/day of the notified chemical. As such, the NOAEL for repeat dose oral toxicity was established as 300 mg/kg/day for this study.

The study also examined effects on reproduction/development, resulting in no significant toxicological observations to offspring. The NOAEL for reproductive and developmental toxicity was established as 1000 mg/kg/day for this study.

Genotoxicity
No structural alerts for mutagenicity. The notified chemical was found to be not mutagenic in bacteria (under the conditions of the Ames test used) and did not induce chromosomal aberrations or mutations in mammalian cells. On the basis of weight of evidence the notified chemical is not expected to be genotoxic.

Health hazard classification
Based on the available data the notified chemical is not classified as hazardous under the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

6.3. Human health risk characterisation

6.3.1. Occupational health and safety

Ink containing the notified chemical at 15% will be contained within a sealed ink cartridge and therefore, exposure via the oral or inhalation routes is not anticipated.

The level of repeat dermal exposure for service technicians and office workers handling sealed cartridges of printing inks containing the notified chemical at 15% is not expected to be significant, compared to the NOAEL of 300 mg/kg bw/day (female rats).

The notified chemical has the potential to be irritating to the eye based on an eye irritation study in rabbits. However, ocular exposure is not expected under normal circumstances, unless the ink residues containing the notified chemical are deposited on the fingers and then rubbed into the eyes. In addition the irritation potential is reduced due to the concentration of the notified chemical (< 15%). Overall, the risk presented by the notified chemical to the health and safety of workers is not expected to be unacceptable.

6.3.2. Public health

The exposure and hazard of the notified chemical to the members of the public during the use of inkjet printers are expected to be identical or similar to that experienced by office workers. Therefore, the risk of the notified chemical to the health of the public is not considered to be unacceptable. Public exposure through accidents during importation, transportation or storage is assessed as negligible.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Environmental Exposure & Fate Assessment

7.1.1 Environmental Exposure

RELEASE OF CHEMICAL AT SITE

The notified chemical will be imported to Australia as a component of printer ink in ready-to-use cartridges. No manufacturing and reformulation of the notified chemical will take place in Australia. Environmental release of the notified chemical is unlikely to occur during importation, storage and transportation.

RELEASE OF CHEMICAL FROM USE

The ink cartridges are designed to prevent leakage and will not be opened during transport, use, installation or replacement. Therefore, release of ink containing the notified chemical to the environment is not expected under normal conditions of use. If leakage or spillage does occur, the ink will be contained with absorbent material and disposed of to landfill in accordance with federal, state and local regulations.

Cartridges are contained within the printer until the contents are consumed and then they are removed and sent for recycling or disposed of to landfill. Around 5% of the ink containing the notified chemical will remain in "empty" cartridges.

Most of the notified chemical (95%) will be bound to printed paper, which will be disposed of to landfill, recycled or possibly incinerated.

RELEASE OF CHEMICAL FROM DISPOSAL

Around 5% of the ink containing the notified chemical will remain in "empty" cartridges. The notifier will collect the used cartridges by setting up the collection boxes in general merchandising stores and post offices, etc. The collected cartridges will be sent to subcontractors. The subcontractor will disassemble the used cartridges and recycle as raw materials, for example a plastic material to be used to make plastic goods. The remaining ink separated from the used cartridges will be disposed of under Australian regulations. The cartridges that are not collected will be disposed of to landfill.

Printed paper containing the notified chemical will be disposed of to landfill, recycled or possibly incinerated. Recycling of treated paper may result in the release of a proportion of the notified chemical to the aquatic compartment. Waste paper is re-pulped using a variety of chemical treatments, which result in fibre separation and ink detachment from the fibres. The wastes are expected to go to trade waste sewers. Approximately 50% (NOLAN-ITU 2001) of the ink printed on paper will enter paper recycling and a minor proportion of the ink may be recovered during recycling in the sludge. Any quantities of

notified chemical recovered with sludge during the recycling process will be disposed of to landfill.

7.1.2 Environmental fate

The majority of the notified chemical will enter the environment from disposal of paper products on which ink containing the notified chemical will be printed. Approximately 45% of the notified chemical will be disposed of to landfill by binding on the printed waste paper, and eventually degrade *in-situ* by abiotic and biotic processes into water and oxides of carbon. Free notified chemical in landfill may leach due to the expected low K_{OC} and high water solubility.

The other 50% is expected to be released to sewer, after the de-inking of paper during recycling. Assuming a worst-case scenario, the entire amount of notified chemical from paper recycling will be released from sewage treatment plants into aquatic ecosystems. While the notified chemical may be mobile in aquatic ecosystems, it will be largely removed during sewage treatment as it is readily biodegradable. The notified chemical is not expected to bioaccumulate.

For the details of environmental fate studies, please refer to Appendix C.

7.1.3 Predicted Environmental Concentration (PEC)

The Predicted Environmental Concentration arising from the industrial use pattern has been modelled for the worst case in which none of the notified chemical released in aqueous wastes from the recycling of paper is removed by, or degrades in, on-site waste water treatment and sewage treatment plants. As the notified chemical is to be released by industrial processes at paper recycling facilities located throughout Australia, it is anticipated that such releases will occur on 260 days into the Australian effluent volume. The details of the calculation based on these parameters are presented below:

Predicted Environmental Concentration (PEC) for the Aquatic Compartment		
Total Annual Import Volume (upper limit)	2000	kg/year
Proportion expected to be released to sewer	0.5	
Annual quantity of chemical released to sewer	1000	kg/year
Days per year where release occurs	260	days/year
Daily chemical release:	3.84	kg/day
Water use	200.0	L/person/day
Population of Australia (Millions)	21.161	million
Removal within STP	0%	
Daily effluent production:	4,232	ML
Dilution Factor - River	1.0	
Dilution Factor - Ocean	10.0	
PEC - River:	0.9	µg/L
PEC - Ocean:	0.09	µg/L

7.2. Environmental effects assessment

The results from ecotoxicological investigations conducted on the notified chemical are summarised in the table below. Most of these studies were carried out as limit or range finding tests. Details can be found in Appendix C.

Endpoint	*Result*	*Assessment Conclusion*
Fish Toxicity		
Oryzias latipes (96 hours)	LC50 > 100 mg/L	Not harmful
Oryzias latipes (14 days)	LC50 > 100 mg/L	Not harmful
Daphnia Toxicity		
Daphnia magna (48 hours)	EC50 > 1000 mg/L	Not harmful
Daphnia magna (21 days)	EC50 > 100 mg/L	Not harmful
Algal Toxicity		
Selenastrum capricornutum (72 hours)	EC50 > 1000 mg/L	Not harmful

The notified chemical is not harmful to fish, daphnids and green algae, based on these test results.

7.2.1 Predicted No-Effect Concentration

The Predicted No Effect Concentration (PNEC) was calculated using the worst-case value for the acute toxicity to fish (LC50) and using a safety factor of 100 (three trophic levels of aquatic species were supplied).

Predicted No-Effect Concentration (PNEC) for the Aquatic Compartment			
LC50 for fish	> 100		mg/L
Assessment Factor	100		
Mitigation Factor		1.00	
PNEC:	> 1000		µg/L

7.3. Environmental risk assessment

Note that the following risk assessment is conservative, as it assumes that all the notified chemical is released into aquatic ecosystems when paper is recycled, with no removal during sewage treatment.

Risk Assessment	PEC µg/L	PNEC µg/L	Q
Q - River	0.9	> 1000	< 0.0009
Q - Ocean	0.09	> 1000	< 0.00009

The Risk Quotient is less than 0.01 when estimated based on conservative assumptions. Therefore, the notified chemical is not expected to pose an unacceptable risk to the aquatic environment based on the intended use pattern.

8. CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification

Based on the available data the notified chemical is not classified as hazardous under the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)].

Human health risk assessment

Under the conditions of the occupational settings described, the notified chemical is not considered to pose an unacceptable risk to the health of workers.

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

Environmental risk assessment

On the basis of the PEC/PNEC ratio and the reported use pattern, the notified chemical is not considered to pose a risk to the environment.

Recommendations

CONTROL MEASURES
Occupational Health and Safety

- No specific engineering controls, work practices or personal protective equipment are required for the safe use of the notified chemical itself, however, these should be selected on the basis of all ingredients in the formulation.

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

- Service personnel should wear cotton or disposable gloves when removing spent printer cartridges containing the notified chemical and during routine maintenance and repairs.

- 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 *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 chemical should be disposed of by landfill.

Emergency procedures

- Spills or accidental release of the notified chemical should be handled by 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(2) of the Act; if
  - the function or use of the chemical has changed from a component of imported inkjet printer inks, or is likely to change significantly;
  - the amount of chemical being introduced has increased from 2 tonnes per annum, or is likely to increase, significantly;
  - if the chemical has begun to be manufactured in Australia;
  - additional information has become available to the person as to an adverse effect of the chemical 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.

No additional secondary notification conditions are stipulated.

Material Safety Data Sheet
The MSDS of the notified chemical and products containing the notified chemical provided by the notifier were reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

APPENDIX A: PHYSICAL AND CHEMICAL PROPERTIES

Melting Point/Freezing Point < -10°C

Method JIS K 0065-1966 Test Method for Freezing Point of Chemical Products.
Test Facility CITI (1997a)

Boiling Point 249°C at 101.3 kPa

Method JIS K 2233-1984 Non-Petroleum Base Motor Vehicle Brake Fluids.
Test Facility CITI (1997a)

Density 970.8 kg/m^3 at 25°C

Method JIS K 2249-1987 Crude Petroleum and Petroleum Products – Determination of Density.
Test Facility CITI (1997a)

Vapour Pressure 7.2 x 10^{-5} kPa at 25°C

Method OECD TG 104 Vapour Pressure.
Test Facility CITI (1997a)

Water Solubility Miscible at 25°C

Method OECD TG 105 Water Solubility.
Remarks Flask Method. The test substance (1 g) was visually observed to dissolve in 1 mL water.
Test Facility CITI (1997a)

Hydrolysis as a Function of pH

Method OECD TG 111 Hydrolysis as a Function of pH.
Remarks The notified chemical was found to be hydrolytically stable at 25°C based on the results of a Tier I test conducted for 5 days, at a concentration of 1000 mg/L. The analytical method was not specified.

pH	*T (°C)*	*$t_{½}$ < days>*
4	50	> 365
7	50	> 365
9	50	> 365

Test Facility CITI (1997a)

Partition Coefficient (n-octanol/water) log Pow = 0.03 at 25°C

Method OECD TG 107 Partition Coefficient (n-octanol/water).
Remarks Flask Method. The test substance was analysed by gas chromatography.
Test Facility CITI (1997b)

Flash Point 143°C

Method Unknown
Test Facility SIDS (2000)

APPENDIX B: TOXICOLOGICAL INVESTIGATIONS

B.1. Acute toxicity – oral

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 401 Acute Oral Toxicity..
- Species/Strain: Rat/ CD (Crl: COBS CD (SD) BR)
- Vehicle: None
- Remarks - Method: No significant protocol deviations. A preliminary test revealed conducted at 1000 mg/kg and 4000 mg/kg indicated an LD50 > 4000 mg/kg bw.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	5F / 5M	5000	1F
2	5F / 5M	6400	1M
3	5F / 5M	8000	1M/3F
4	5F / 5M	10000	5M/4F

- LD50: 8000 mg/kg bw (males and females combined)
- Signs of Toxicity: Ptosis was observed up to 5 hours after dosing in all rats dosed at > 5000 mg/kg. There were no other clinical signs of toxicity due to the notified chemical.
- Effects in Organs: Autopsy of the rats that died revealed slight renal pallor in four animals (8000 mg/kg) and slight pallor of the liver in one female (5000 mg/kg). No other macroscopic findings were found.
  Terminal autopsy findings were normal.
- Remarks - Results: LD50 8.3 mg/kg bw (males only)
  LD50 7.8 mg/kg bw (females only)

CONCLUSION: The notified chemical is of low toxicity via the oral route.

TEST FACILITY: HRC (1987a)

OTHER RELATED STUDIES: The notified chemical was determined to have a LD50 > 2000 mg/kg in another study on the same species of rats (SIDS, 2000). No mortalities were observed at the dose levels tested (1000 mg/kg and 2000 mg/kg).

B.2. Irritation – skin

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 404 Acute Dermal Irritation/Corrosion.
- Species/Strain: Rabbit/New Zealand White
- Number of Animals: 3
- Vehicle: None
- Observation Period: 3 days
- Type of Dressing: Semi-occlusive.
- Remarks - Method: No significant protocol deviations.

RESULTS

Lesion	*Mean Score* Animal No.*			*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
	1	2	3			
Erythema/Eschar	0	0	0	1	< 24 hr	0
Oedema	0	0	0	0	0	0

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

Remarks - Results: Very slight erythema was observed in all three animals 30 minutes after removal of the patches. The reactions had resolved at the 24-hour observation period.

CONCLUSION: The notified chemical is very slightly irritating to the skin.

TEST FACILITY: HRC (1987b)

B.3. Irritation – eye

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 405 Acute Eye Irritation/Corrosion.
Species/Strain: Rabbit/New Zealand White
Number of Animals: 3
Observation Period: 7 days
Remarks - Method: No significant protocol deviations. Examination of the eyes was made after 1 hour and 1, 2, 3, 4 and 7 days after instillation.

RESULTS

Lesion	*Mean Score* Animal No.*			*Maximum Value*	*Maximum Duration of Any Effect (day)*	*Maximum Value at End of 7 day Observation Period*
	1	2	3			
Conjunctiva: redness	1.3	0.7	1.3	2	< 7	0
Conjunctiva: chemosis	1.3	0	0.7	2	< 4	0
Corneal opacity	0.7	0.7	1.3	2	< 7	0
Iridial inflammation	0.3	0	0	1	< 2	0

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

Remarks - Results: Slight to moderate corneal opacity was observed in all 3 animals. This was resolved at the 24-hour observation period for one animal and at the 7-day observation period for the other two.

A diffuse, crimson-red colouration of the conjunctivae, observed in two animals, was accompanied by obvious swelling with partial eversion of the eyelids in one animal.

Slight iridial inflammation was observed in one animal only. This was resolved at the 48-hour observation period.

The reactions were resolved in all animals 4 or 7 days after instillation.

CONCLUSION: The notified chemical is slightly irritating to the eye.

TEST FACILITY: HRC (1987c)

B.4. Skin sensitisation

TEST SUBSTANCE	Notified chemical
METHOD	EC Directive 96/54/EC B.6 Skin Sensitisation Maximisation test (Magnusson and Kligman, 1970)
Species/Strain	Guinea pig/Dunkin-Hartley
PRELIMINARY STUDY	Maximum Non-irritating Concentration: intradermal: 0.25% v/v in water topical: 100%
MAIN STUDY	
Number of Animals	Test Group: 10 Control Group: 5
INDUCTION PHASE	Induction Concentration: intradermal: 5 % v/v in water topical: 100%
Signs of Irritation	intradermal: slight irritation was observed in test animals at sites receiving the notified chemical (5% v/v). No irritation was observed in control animals receiving water for irrigation only. topical: slight erythema was observed in the test and control animals after topical application.
CHALLENGE PHASE	topical: 100% and 50% v/v in distilled water
Remarks - Method	The test sites were pre-treated with sodium lauryl sulfate 24-hours before topical induction.

RESULTS

Remarks - Results	There were no dermal reactions observed in any of the test or control animals following challenge.
CONCLUSION	There was no evidence of reactions indicative of skin sensitisation to the notified chemical under the conditions of the test.
TEST FACILITY	HRC (1995a)

B.5. Repeat dose toxicity

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 422 Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test.
Species/Strain	Rat/Crj: CD (SD)
Route of Administration	Oral – gavage
Exposure Information	Total exposure days: Males 49 days Females, from 14 days before mating to day 3 of lactation (41-45 days). Dose regimen: 7 days per week Post-exposure observation period: 1 day
Vehicle	Distilled water
Remarks - Method	Functional observation and sperm examinations were not performed because the test was conducted by the TG adopted in 1990. Biochemical and haematological analysis and urinalysis for females were not performed.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw/day*	*Mortality*
control	12M, 12F	0	0
low dose	12M, 12F	100	1
mid dose	12M, 12F	300	0
high dose	12M, 12F	1000	0

Mortality and Time to Death
One male animal in the 100 mg/kg dose group died at Day 17. The cause of death was estimated to be an incorrect administration.

Clinical Observations
There was no effect in body weight gain or on food/water consumption.

In the 1000 mg/kg group, salivation, which appeared immediately after dosing and lasted for about 1 hour, was observed in approximately half of the animals, in males from day 29 of dosing and in females from day 10 of gestation.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis
No effect caused by administration of the notified chemical was observed for males at any dose level in the haematological findings.

A significant low value of α 1-globulin fraction was observed in males dosed at 1000 mg/kg and a slight increase of albumin ratio and A/G ratio in protein fraction were observed in this group.

Effects in Organs
Gross pathology: In one male animal of the 1000 mg/kg group, a diffusion of dark reddish spots was observed in the lung. In one female animal of the 1000 mg/kg group, an adhesion of adipose tissue on spleen, liver, stomach and on periphery to these organs was observed. In females dosed at 1000 mg/kg a significant increase in liver weight (absolute and relative) and kidney weight (relative) was observed. In other cases, there were no macroscopic anomalies.

Histopathology: In the histopathological findings of the group of females dosed at 1000 mg/kg, an increase of glycogen and disappearance of lipid droplet of hepatic cell was observed. No significant histopathological findings was observed in males dosed at 1000 mg/kg.

Reproductive Toxicity

Effects on Parental (P) animals:
In the group of 1000 mg/kg dose group, the effect by the administration of the notified chemical was not observed in any of female estrus cycle and estrus frequency, sexual copulation and impregnation rates, female gestation period, delivery and nursing status. Furthermore, no effect was also observed in corpus luteum count, implantation traces and implantation rate, the number of neonatal pups born and delivering rate.

Effects on neonatal pups (F1)
In the 1000 mg/kg group, the effect of the notified chemical was not observed in number of survivals at nursing Day 0, number of stillborn infants and birth rate and sex ratio. There was no neonate with anomaly in body surface. In addition, the effect of the administration of the notified chemical was not seen in survival rate and body weight on the day 4 after birth, and there was no anomaly observed at autopsy.

Remarks – Results
In regard to the general toxic effect by the repeat administration, salivation was the only treatment related effect observed in males at the 1000 mg/kg dose level. In contrast, salivation and disappearance of lipid droplet in hepatic cells and increase of glycogen and liver weight were recognised in females at the 1000 mg/kg dose level. Based on these observations the NOAEL in regard to the repeat toxicity was estimated to be 300 mg/kg bw/day both in males and females.

No reproductive and developmental toxicity was observed at the treatment limit concentration (1000 mg/kg).

CONCLUSION

The general toxic No Observed (Adverse) Effect Level (NO(A)EL) was established as 300 mg/kg bw/day in this study, based on clinical signs in both sexes and histopathological and organ weight findings in female at 1,000 mg/kg.

The reproductive toxic No Observed (Adverse) Effect Level (NO(A)EL) was established as > 1000 mg/kg bw/day in this study, for both parental animals and neonatal pups.

TEST FACILITY BOZO (1997)

B.6. Genotoxicity – bacteria

TEST SUBSTANCE Notified chemical

METHOD OECD TG 471 Bacterial Reverse Mutation Test.

Species/Strain	*S. typhimurium*: TA1538, TA1535, TA1537, TA98, TA100 *E. coli*: WP2uvrA
Metabolic Activation System	S9 fraction from Aroclor 1254 induced rat liver.
Concentration Range in Main Test	a) With metabolic activation: 312.5-5000 µg/plate b) Without metabolic activation: 312.5-5000 µg/plate
Vehicle	Water
Remarks - Method	No significant protocol deviations. Plate incorporation method.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent	> 5000			
Test 1		> 5000	> 5000	Negative
Test 2		> 5000	> 5000	Negative
Present	> 5000			
Test 1		> 5000	> 5000	Negative
Test 2		> 5000	> 5000	Negative

Remarks - Results

In the preliminary dose range finding study with dose levels of up to 5000 µg/plate no toxicity was observed.

No substantial increase in revertant colony numbers of any of the tester strains were observed following treatment with the notified chemical at any dose level, with and without metabolic activation, in either mutation test.

The concurrent positive control compounds demonstrated the sensitivity of the assay and the metabolising activity of the liver preparations.

CONCLUSION The notified chemical was not mutagenic to bacteria under the conditions of the test.

TEST FACILITY HRC (1995b)

OTHER RELATED STUDIES The notified chemical also did not induce mutations in *S. typhimurium* and *E. coli* strains with and without metabolic activation using the pre-incubation method (SIDS, 2000)

B.7. Genotoxicity – in vitro

TEST SUBSTANCE Notified chemical

METHOD OECD TG 473 In vitro Mammalian Chromosome Aberration Test.
Species/Strain Chinese hamster
Cell Type/Cell Line CHL/IU cells
Metabolic Activation System S9 fraction from phenobarbital/5,6-benzoflavone-induced rat liver.
Vehicle Distilled water
Remarks - Method No significant protocol deviations.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Harvest Time*
Absent			
Test 1	0, 300, 600, 1200	6 hr	24 hr
Test 2	0, 300, 600, 1200	24 hr	24 hr
Test 3	0, 300, 600, 1200	48 hr	48 hr
Present			
Test 1	0, 300, 600, 1200	6 hr	24 hr

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent	> 1200			
Test 1		> 1200	> 1200	Negative
Test 2		> 1200	> 1200	Negative
Test 3		> 1200	> 1200	Negative
Present	> 1200			
Test 1		> 1200	> 1200	Negative

Remarks - Results The notified chemical was not cytotoxic and did not induce chromosomal aberrations or polypoidal cells with and without metabolic activation at any dose level studied for both short and continuous treatments (including 10 mM (1200 µg/mL), the treatment limit concentration).

The concurrent positive control compounds demonstrated the sensitivity of the assay and the metabolising activity of the liver preparations.

CONCLUSION The notified chemical was not clastogenic to Chinese hamster cells treated in vitro under the conditions of the test.

TEST FACILITY HRI (1997)

B.8. Genotoxicity – in vitro

TEST SUBSTANCE Notified chemical

METHOD OECD TG 473 In vitro Mammalian Chromosome Aberration Test.
Species/Strain Human
Cell Type/Cell Line Lymphocytes
Metabolic Activation System S9 fraction from Aroclor 1254 induced rat liver.
Vehicle DMSO
Remarks - Method No significant protocol deviations.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Harvest Time*
Absent			
Test 1	19, 37, 74, 147, 295, 590*, 885*, 1180*	3 hr	20 hr
Test 2	19, 37, 74, 147, 295, 590*, 885*, 1180*	3 hr	20 hr
Present			
Test 1	19, 37, 74, 147, 295, 590*, 885*, 1180*	3 hr	20 hr
Test 2	147, 295, 590*, 885*, 1180*	3 hr	20 hr

*Cultures selected for metaphase analysis.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*		
	Cytotoxicity in Main Test	*Precipitation*	*Genotoxic Effect*
Absent			
Test 1	> 1180	> 1180	Negative
Test 2	> 1180	> 1180	Negative
Present			
Test 1	> 1180	> 1180	Negative
Test 2	> 1180	> 1180	Negative

Remarks - Results

The notified chemical was not cytotoxic and did not induce chromosomal aberrations or polypoidal cells with and without metabolic activation at any dose level studied for both short and continuous treatments (including 10 mM (1180 µg/mL), the treatment limit concentration).

The concurrent positive control compounds demonstrated the sensitivity of the assay and the metabolising activity of the liver preparations.

CONCLUSION

The notified chemical was not clastogenic to Human lymphocytes treated in vitro under the conditions of the test.

TEST FACILITY

HRC (2003)

B.9. Genotoxicity – in vitro

TEST SUBSTANCE

Notified chemical

METHOD

OECD TG 476 In vitro Mammalian Cell Gene Mutation Test.

Species/Strain: Mouse

Cell Type/Cell Line: Lymphoma L5178Y cells

Metabolic Activation System: S9 fraction from Aroclor 1254 induced rat liver.

Vehicle: DMSO

Remarks - Method: No significant protocol deviations.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Expression Time*	*Selection Time*
Absent				
Test 1	142, 283, 578, 826, 1180	24 hr	48 hr	10-14 days
Present				
Test 1	142, 283, 578, 826, 1180	4 hr	48 hr	10-14 days

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*		
	Cytotoxicity in Main Test	*Precipitation*	*Genotoxic Effect*
Absent			
Test 1	> 1180	> 1180	Negative
Test 2	> 1180	> 1180	Negative
Present			
Test 1	> 1180	> 1180	Negative
Test 2	> 1180	> 1180	Negative

Remarks - Results

In both the absence and presence of S9-mix, the notified chemical was not cytotoxic or mutagenic at the dose levels used for the study (including 10 mM (1180 µg/mL), the treatment limit concentration).

CONCLUSION

The notified chemical was not mutagenic to Mouse lymphoma L5178Y cells treated in vitro under the conditions of the test.

TEST FACILITY

TNO (2005)

APPENDIX C: ENVIRONMENTAL FATE AND ECOTOXICOLOGICAL INVESTIGATIONS

C.1. Environmental Fate

C.1.1. Ready biodegradability

TEST SUBSTANCE: Notified chemical.

METHOD
- Inoculum: Return sludge from four Japanese sewage treatment plants, mixed with samples of surface water and sediment from six Japanese receiving waters.
- Exposure Period: 28 days
- Auxiliary Solvent: None
- Analytical Monitoring: BOD, TOC, GC of notified chemical.
- Remarks - Method: The study was validated using the reference compound aniline.

RESULTS

Notified chemical		*Aniline*	
Day	*% Degradation (BOD)*	*Day*	*% Degradation (BOD)*
7	7	7	64
14	30	14	76
21	57	21	76
28	74	28	76

Remarks - Results: The notified chemical did not meet criteria for ready biodegradability based on BOD under standard conditions, but better results (82 and 92%, respectively) were obtained using TOC and GC analysis. Degradation of the notified chemical after 2 weeks in a subsequent open system study reached 92% by TOC and 100% by GC. These results meet criteria for ready biodegradability, and indicate that the notified chemical can be expected to degrade at low concentrations in the environment.

CONCLUSION: The notified chemical is readily biodegradable.

TEST FACILITY: CITI (1996).

C.1.2. Bioaccumulation

The bioaccumulation potential is considered low based on the low log Pow.

C.2. Ecotoxicological Investigations

C.2.1. Acute toxicity to fish

TEST SUBSTANCE: Notified chemical.

METHOD
- Species: Orange killifish (*Oryzias latipes*)
- Exposure Period: 96 hours
- Auxiliary Solvent: None
- Water Hardness: 55.6 mg $CaCO_3$/L
- Analytical Monitoring: GC
- Remarks – Method: Limit test (100 mg/L)

RESULTS: The nominal concentration was confirmed by analysis.

Concentration mg/L	*Number of Fish*	*Mortality*

Nominal	*Actual*		*24 h*	*48 h*	*72 h*	*96 h*
0	0	10	0	0	0	0
100	102	10	0	0	0	0

LC50	> 100 mg/L at 96 hours.
NOEC	100 mg/L at 96 hours.
Remarks – Results	No symptoms of toxicity were observed during the exposure period.

CONCLUSION The notified chemical is not harmful to fish.

TEST FACILITY CITI (1997c)

C.2.2. Prolonged toxicity to fish

TEST SUBSTANCE Notified chemical.

METHOD	OECD TG 204 Fish, Prolonged toxicity test (14 day study) – flow through
Species	Orange killifish (*Oryzias latipes*)
Exposure Period	14 days
Auxiliary Solvent	None
Water Hardness	55.6 mg $CaCO_3$/L
Analytical Monitoring	GC
Remarks – Method	The test concentrations were selected based on the results of the acute study.
RESULTS	The nominal concentrations (6.25, 12.5, 25, 50 and 100 mg/L) were confirmed by analysis.
LC50	> 100 mg/L at 96 hours.
NOEC	100 mg/L at 96 hours.
Remarks – Results	No mortalities occurred, and no symptoms of toxicity were observed during the exposure period.
CONCLUSION	The notified chemical is not harmful to fish under prolonged exposure conditions.
TEST FACILITY	CITI (1997d)

C.2.3. Acute toxicity to aquatic invertebrates

TEST SUBSTANCE Notified chemical

METHOD	OECD TG 202 Daphnia sp. Acute Immobilisation Test and Reproduction Test - static.
Species	*Daphnia magna*
Exposure Period	48 hours
Auxiliary Solvent	None
Water Hardness	55.6 mg $CaCO_3$/L
Analytical Monitoring	GC
Remarks - Method	Limit test (1000 mg/L). The nominal concentration was confirmed by analysis.
RESULTS	No effects were seen in any of the exposed daphnids.

Concentration mg/L		*Number of D. magna*	*Number Immobilised*	
Nominal	*Actual*		*24 h*	*48 h*
0	0	4x5	0	0
1000	1030	4x5	0	0

LC50	> 1000 mg/L at 48 hours
NOEC	1000 mg/L at 48 hours
CONCLUSION	The notified chemical is not harmful to aquatic invertebrates.
TEST FACILITY	CITI (1997e)

C.2.4. Chronic toxicity to aquatic invertebrates

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 202 Daphnia sp. Acute Immobilisation Test and Reproduction test – semi static.
Species	*Daphnia magna*
Exposure Period	21 days
Auxiliary Solvent	None
Water Hardness	Total hardness 55.6 mg/L
Analytical Monitoring	GC
Remarks - Method	The nominal concentrations (25, 50 and 100 mg/L) were confirmed by analysis. Forty daphnids were exposed at each concentration.
Remarks - Results	Occasional mortalities (one daphnid on the 18th day of exposure to 100 mg/L, and two on the Day 21 at 25 mg/L) did not appear to be dose related. The 21 day EC50 was > 100 mg/L. Reproductive capacity remained unimpaired by exposure to the notified chemical, with cumulative production of juveniles reaching 86.1 in controls and 102, 109 and 98.7 under exposure to 25, 50 and 100 mg/L. There was no statistically significant difference between control and exposed daphnids. The 21 Day NOE_rL was > 100 mg/L.
CONCLUSION	The notified chemical is not harmful to daphnids and does not impair their reproduction.
TEST FACILITY	CITI (1997f)

C.2.5. Algal growth inhibition test

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 201 Alga, Growth Inhibition Test.
Species	*Selenastrum capricornutum*
Exposure Period	72 hours
Concentration Range	Nominal: 100, 316 and 1000 mg/L Actual: 101, 314 and 1003 mg/L
Auxiliary Solvent	None
Analytical Monitoring	GC
Remarks - Method	Control cell density increased by a factor of 120 during the exposure period.
RESULTS	There was some slight inhibition of algal growth at the two highest test concentrations, as indicated by slight reductions in cell density at 24, 48 and 72 hours.

Biomass		*Growth*	
E_bC50	*NOEC*	*E_rC50*	*NOEC*
mg/L at 72 h	*mg/L*	*mg/L at 72 h*	*mg/L*
> 1000	100	> 1000	1000

CONCLUSION	The notified chemical is not harmful to green algae.
TEST FACILITY	CITI (1997g)

BIBLIOGRAPHY

BOZO (1997) Combined repeat dose and reproductive toxicity of *notified chemical* by oral administration in rat (Test No. B-608). BOZO Research Centre Ltd., Gotenba Laboratory, Japan.

CITI (1997a) Measurements of physico-chemical properties of alkanediol (C=5-12) [tested with *notified chemical* (Test Substance No. K-1261)] (Study No. 81261K). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan.

CITI (1997b) Partition coefficient determination between 1-octanol and water of alkanediol (C=5-12) [tested with *notified chemical* (Test Substance No. K-1261)] (Study No. 81261K). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan.

CITI (1997c) Acute toxicity test of *notified chemical* in orange killifish (*Oryzias latipes*) (Study No. 91744). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan. (Unpublished study provided by notifier).

CITI (1997d) Prolonged toxicity test (14 days) of *notified chemical* in orange killifish (*Oryzias latipes*) (Study No. 91745). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan. (Unpublished study provided by notifier).

CITI (1997e) Acute immobilisation test of *notified chemical* in water fleas (*Daphnia magna*) (Study No. 91742). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan. (Unpublished study provided by notifier).

CITI (1997f) Reproduction inhibition test of *notified chemical* in water fleas (*Daphnia magna*) (Study No. 91743). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan. (Unpublished study provided by notifier).

CITI (1997g) Growth inhibition test of *notified chemical* in algae (*Selenastrum capricornutum*) (Study No. 91741). Chemicals Inspection and Testing Institute, The Chemicals Biotesting Center Kurume Laboratory, Japan. (Unpublished study provided by the notifier).

EC (2003) Technical guidance document in support of commission directive 93/67/EEC on risk assessment for new notified substances and commission regulation (EC) No 1488/94 on risk assessment for existing substances Part 1.

HRI (1997) Chromosomal aberration test of *notified chemical* in cultured Chinese hamster cell. Hatano Research Institute, Food and Drug Safety Center, Japan. (Unpublished study provided by the notifier).

HRC (1987a) Acute oral toxicity in rats of *notified chemical*. Huntingdon Research Centre Ltd., Huntingdon, England. (Unpublished study provided by the notifier).

HRC (1987b) Irritant effects on rabbit skin of *notified chemical*. Huntingdon Research Centre Ltd., Huntingdon, England. (Unpublished study provided by the notifier).

HRC (1987c) Irritant effects on rabbit eye of *notified chemical*. Huntingdon Research Centre Ltd., Huntingdon, England. (Unpublished study provided by the notifier).

HRC (1995a) *Notified chemical* skin sensitisation in the guinea pig. Huntingdon Research Centre Ltd., Huntingdon, England. (Unpublished study provided by the notifier).

HRC (1995b) *Notified chemical* bacterial mutation assay. Huntingdon Research Centre Ltd., Huntingdon, England. (Unpublished study provided by the notifier).

HRC (2003) *Notified chemical* in vitro mammalian chromosome aberration test in human lymphocytes. Huntingdon Research Centre Ltd., Huntingdon, England.

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 (2001) National Standard for the Storage and Handling of Workplace Dangerous Goods [NOHSC:1015(2001)]. 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.

NOLAN-ITU (2001) National Packaging Covenant Council, Independent Assessmentof Kerbside Recycling in Australia Revised Final Report - Volume I, NOLAN-ITU Pty Ltd, January 2001.

SIDS (2000) [Notified chemical]: OECD Screening Information DataSet (SIDS) for High Production Volume Chemicals. UNEP Chemicals. International Programme on Chemical Safety (IPCS), a joint programme of the United Nations Environment Programme, the International Labour Organization, and the World Health Organization.

TNO (2005) Gene mutation test at the TK-locus of L5178Y cells with *notified chemical*. TNO Quality of Life, Business unit of Physiological Sciences, Netherlands. (Unpublished study provided by the notifier).

United Nations (2003) Globally Harmonised System of Classification and Labelling of Chemicals (GHS). United Nations Economic Commission for Europe (UN/ECE), New York and Geneva.