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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

FULL PUBLIC REPORT

Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[ω-hydroxy-

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Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[ω-hydroxy-

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Swift and Company Ltd (ABN 44 000 005 578), of Level 1, 372 Wellington Rd, Mulgrave, Victoria, 3170

and

3M Australia Pty Ltd (ABN 90 000 100 096), of 2-74 Dunheved Circuit, St Marys, 2760

NOTIFICATION CATEGORY
Standard: Polymer with NAMW < 1000 (more than 1 tonne per year).

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication:
Spectral data
Molecular weight
Polymer constituents including impurities
Manufacture/Import Volume

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows:
Particle size
Acute inhalation toxicity
Skin Sensitisation
Bioaccumulation

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
No

NOTIFICATION IN OTHER COUNTRIES
USA (1994): P94-665
Canada (1994): Schedule VI NSN#2481
Canada (2000): Schedule VII NSN#10412

2. IDENTITY OF CHEMICAL

CHEMICAL NAME
Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis(3-methylbutyl)-2-butyne-1,4-diyl]bis[ω-hydroxy-

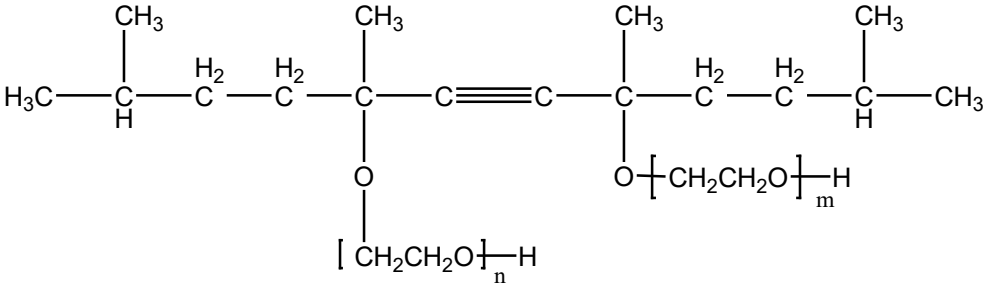
OTHER NAME(S)
2,5,8,11-tetramethyl-6-dodecyne-5,8-diol ethoxylated

MARKETING NAME(S)
Dynol 604

CAS NUMBER
169117-72-0

MOLECULAR FORMULA
$C_{16}H_{30}O_2$ $(C_2H_4O)_n$ $(C_2H_4O)_m$

STRUCTURAL FORMULA



METHODS OF DETECTION AND DETERMINATION

ANALYTICAL METHOD	Matrix assisted laser desorption/ionisation mass spectrometry (MALD/I), gas chromatography mass spectrometry (GC/MS) and chemical ionisation solids probe mass spectrometry (SP/MS) and gas chromatography (GC-FID)
Remarks	Spectra were provided.
TEST FACILITY	Air Products (2000a, 2000b)

3. COMPOSITION

DEGREE OF PURITY
High

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
All hazardous impurities or residual monomers are present at below the relevant cut offs for classification of the notified polymer as a hazardous substance on the basis of monomer impurity content.

DEGRADATION PRODUCTS
Oxides of carbon and incomplete combustion products such as acetylene. The notified polymer is not expected to degrade or decompose under normal conditions of use.

4. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified polymer will be imported from the USA either as a raw material or as a component of a finished product.

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

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

USE
The notified polymer is an ultra low-volatile organic compound (VOC) low foam, non-ionic wetting agent for high performance waterborne applications. It promotes substrate wetting of waterborne systems such as coatings, inks and adhesives.

Initially it is intended to be used as a component of a liquid clear coat for graphic images such as banners, posters and billboards and as a component of fountain solution concentrates in lithographic printing processes.

Other potential uses include:

- A component (0.1- 0.3%) of water based parquet floor lacquers.

- A component (commonly <1%) of water-based inks for both flexographic and gravure applications on plastic film, cellulosic, foil and other substances.
- A component (commonly <1%) of waterborne adhesives such as wood glues, contact cements, caulks etc

5. PROCESS AND RELEASE INFORMATION

5.1. Distribution, Transport and Storage

PORT OF ENTRY
Melbourne and Sydney.

IDENTITY OF RECIPIENTS
3M Australia, St Marys, NSW and Customer site located in Melbourne, VIC.

TRANSPORTATION AND PACKAGING
Use as liquid clear coat component
The notified polymer is imported as a component (2%) of a liquid clear coat and stored at 3M's warehouse before being distributed to the customer. The clear coat will be packaged in a 19 litre Polyvinylchloride (PVC) bucket type container. Transport will be by standard road delivery.

Use as fountain solution component
The notified polymer will be imported into Australia in 200L steel drums and transported to a customer's warehouse. The notified polymer will be transported by road via an approved carrier.

5.2. Operation Description

Use as liquid clear coat component
The liquid clear coat containing the notified polymer is poured into the trough of the laminator. The liquid clear coat laminator circulates the product in the trough and pumps the coating through small applicator bars onto the substrate. The application of the clear coat is fully automated and is not a spray application. When the operation is complete the equipment will be rinsed of the product. Washings are placed in a container and sealed for collection.

Use as fountain solution concentrate component
Formulation
The notified polymer is weighed directly into large mixing tanks ranging in size from 1000 to 8000L. For a batch size of 8000L, 4.8kg of notified polymer is added. The resulting product containing 0.06% notified polymer is then packed into 20L or 200L drums or 1000L IBCs and supplied directly to the printing industry.

End Use
Fountain solutions are used to keep ink from adhering to the non-image areas of a printing plate. The fountain solution concentrate containing the notified polymer is diluted on the printing press to 2 to 4%. At this dilution the notified polymer is present at 0.0012% to 0.0024%. The fountain solution is typically applied to the offset plate by a series of rollers. The product containing the notified polymer is consumed during the process.

Other potential uses: e.g. Use as a floor lacquer
Formulation
Typically, the notified polymer would be transferred via drum pumps to enclosed formulating tanks.

End use
Typically, the lacquer would be applied to parquet flooring by pouring the lacquer onto the floor and then spreading with a wide brush or roller (via machine or manually). The lacquer will typically dry in three hours. It is possible that the floor lacquer could also be applied by spraying.

5.3. Occupational exposure

Exposure Details

Use as liquid clear coat component

Exposure to the product containing the notified polymer at a concentration of 2% could occur upon addition of the clear coat to the laminator trough. Dermal and ocular exposure to drips and spills is the most likely route. Inhalation exposure is not expected due to the low volatility. Exposure during the coating process is expected to be negligible as the process is automated and spray is unlikely to be generated. Workers will wear protective equipment such as goggles and gloves where exposure is possible. Laminating equipment will be well ventilated using a ceiling extraction system.

Use as fountain solution concentrate component

Formulation

Exposure to the notified polymer could occur during addition of the notified polymer to the mixing tank and packing of the final formulated product. The notified polymer is a viscous liquid with a predicted low vapour pressure, therefore, dermal contact is expected to be the main route of exposure. Exposure to the notified polymer in the formulated product is limited due to its low concentration (0.06%). Workers will wear safety goggles at all times and rubber gloves when required.

End Use

Dermal exposure to the notified polymer at a concentration of 0.06% could occur during the addition of the fountain solution to the printing press. Following dilution, exposure to the notified polymer at a concentration up to 0.0024% could occur from intermittent contact with printing rollers. Suitable gloves are expected to be worn by workers.

Other potential uses: e.g. Use as a floor lacquer

Formulation

Exposure to the notified polymer could occur from drips and splashes from the drum pumps. The notified polymer is a viscous liquid with predicted low vapour pressure, therefore, dermal contact is expected to be the main route of exposure.

End Use

Workers could be exposed to the notified polymer at a concentration up to 0.2% during application of the floor lacquer. Dermal and ocular exposure are the most likely routes when using a brush or roller for application. There is also the potential for inhalation exposure with spray applications.

5.4. Release

RELEASE OF CHEMICAL AT SITE

When used as a fountain solution concentrate component (imported in 200 L steel drums) and in other potential applications (floor lacquer), the notified polymer is reformulated. Typical operations involve transferring the notified polymer via drum pumps to formulating tanks. Such process steps are mostly enclosed and result in little environmental exposure.

Environmental release of the notified polymer is unlikely during importation, reformulation, storage and transportation. Potential points for release to the environment are during mixing, when small amounts of the notified polymer may be present in washes from mixing vessel cleanup. These washes will be used internally or disposed of accordingly. Spillage during a transport accident is the most likely reason for environmental release.

RELEASE OF CHEMICAL FROM USE

Release of the coating formulation to the environment is not expected under normal use, as it will form an inert matrix once applied to the substrate. The liquid clear coat laminator circulates the product in a contained bath without opportunity for spills or exposure to the operator unless standard operating procedures are ignored. The end product will not be sold to the public; it is used in industrial applications only. The application equipment will be rinsed of the product and placed in a container and sealed for collection. As a worst case scenario, it is estimated that <2% of the product (up to 60 kg/year of the notified polymer) will be lost due to cleaning of the application equipment, spillages and residue in containers, which may potentially be disposed down the drain to the sewers. There may

be a higher environmental exposure when floor lacquers containing 0.1-0.3% of the notified polymer are sprayed rather than applied by brush or roller, with over spray likely to deposit on nearby articles or fall onto the ground.

5.5. Disposal

The majority of the import volume of the notified polymer will ultimately be disposed of to landfill (from applications as a clear coating, fountain solution component and other uses), and is entirely dependent on the fate of the coated articles. A very small amount may enter the sewer system from accidental spills or from cleaning of application equipment such as brushes and rollers.

5.6. Public exposure

Use as liquid clear coat component

The clear coat is to be supplied for industrial use only. Members of the public may be exposed to the notified polymer when handling finished coated products such as banners and posters.

Use as fountain solution concentrate component

The concentrate containing the notified polymer will be supplied solely to industry and is used up during the printing process.

Other potential uses

There is potential that future products which may be formulated using the notified polymer, for example, wood glues, could be supplied to the public. Exposure to the notified polymer up to a concentration of 1% may occur during use of these formulated products.

6. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20ºC and 101.3 kPa Amber liquid with characteristic odour.

Freezing Point < -36ºC

METHOD OECD TG 102 Melting Point/Melting Range.
EC Directive 92/69/EEC A.1 Melting/Freezing Temperature.

Remarks Duplicate tests were performed. In both tests, the viscosity of the test substance increased with decreasing temperature. At a temperature of -35.9ºC in test 1 and at -36ºC in test 2, the stirrer inserted in the test substance could not be moved.

TEST FACILITY NOTOX (2000a)

Boiling Point 185ºC at 101.3 kPa

METHOD ASTM D1120-94, Standard Test Method for Boiling Point of Engine Coolants

Remarks No study provided.

Density 970 kg/m^3 at 21ºC

METHOD ASTM D4052-91, Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter.

Remarks No study provided.

Vapour Pressure 0.00087 kPa at 20ºC

METHOD OECD TG 104 Vapour Pressure.
EC Directive 92/69/EEC A.4 Vapour Pressure.

Remarks Static vapour pressure measurements were made with a capacitance manometer fitted with a 133 Pa capacitive sensor. The reference pressure at the right-hand side of the pressure sensor was kept below 10^{-4} Pa. The temperature of the sample was measured with a platinum resistance thermometer. A total of 48 measurements

were made between 37.52 and 23.81ºC, and the vapour pressure at 20 ºC calculated from the vapour pressure curve.
The notified polymer is moderately volatile according to the classification of Mensink *et al* (1995).

TEST FACILITY NOTOX (2000b)

Water Solubility

0.2-7 g/L at pH 1*
0.2-6 g/L pH7-8*
0.1-6 g/L at pH 10*

* Based on the major part of the test substance (peaks 2-12).

METHOD OECD TG 105 Water Solubility.
EC Directive 92/69/EEC A.6 Water Solubility.

Remarks Due to the nature of the notified polymer (complex mixture of ethoxylated acetylenic diols and alcohols) solubility was determined using an alternative test based on the Flask Method. After an initial test at neutral pH, solubility was determined at pH1 and pH10. Solutions containing 5 different concentrations (range 0.5-306 g/L) were stirred for 5 days at 19ºC. Undissolved material was removed by filtration and centrifugation, and analysis by GC-FID was performed after extraction into n-hexane.

The GC chromatogram showed more than 20 peaks that were ranged into 12 peak groups. The solubility of the highest peak group for all pH values was approximately 20 g/L, this related to an impurity. Based on peak groups 2-12 at pH 1, the solubility of the notified polymer (various levels of ethoxylation) is between 0.2–7 g/L, while at pH 7-8 the solubility is between 0.2-6g/L and at pH 10, the solubility is between 0.1-6 g/L.

If the water solubility of the impurities is discounted in the analysis, then the water solubility of the notified polymer is lower namely 0.2-1g/L (pH1), 0.2-1g/L (neutral pH) and 0.1-0.8g/L (pH10).

TEST FACILITY (NOTOX 2000c), NOTOX (2001a)

Hydrolysis as a Function of pH

$t_{½}$ >1 year at 25 ºC or ≥131 days in aqueous solutions buffered at pH 4 and pH 7, and ≥92 days at pH 9.

METHOD OECD TG 111 Hydrolysis as a Function of pH.
EC Directive 92/69/EEC C.7 Degradation: Abiotic Degradation: Hydrolysis as a Function of pH.

Peak Group	Relative concentrations (%)					
	pH 4		pH 7		pH 9	
	2.4 h	5 day	2.4 h	5 day	2.4 h	5 day
Group 1	98	89	97	86	98	85
Group 2	104	90	100	90	104	92
Group 3	100	92	103	89	103	89
Group 4	115	74	116	70	104	63
Group 5	96	91	95	91	91	81
Group 6	95	82	96	80	95	76
Group 7	92	92	90	89	86	82
Group 8	91	86	86	83	88	82
Group 9	97	89	92	87	91	84
Group 10	99	93	90	89	92	86
Group 11	91	95	85	88	87	86
Group 12	85	113	71	101	71	96

Remarks Buffers were incubated at 50ºC at a concentration of 250 mg/L. The GC

chromatograms of Dynol 604 showed more than 20 peaks that were ranged into 12 peak groups as in the above Table. Quantification of Dynol 604 was based on each of the 12 peak groups.

A relative concentration of >90% was observed after 5 days at pH 4 for peak groups 3, 5, 7, 10, 11 and 12, at pH 7 for peak groups 5 and 12 and at pH 9 for peak groups 2 and 12. For the components from these peak groups, the half-life times at 25ºC are >1 year. These compounds are therefore considered to be hydrolytically stable at these conditions. For the other peak groups (those where <50% but ≥10% decrease in concentration was observed) the half-life times at 25ºC were estimated to be ≥131 days in aqueous solutions buffered at pH 4 and pH 7, and ≥92 days at pH 9.

TEST FACILITY NOTOX (2000d)

Partition Coefficient (n-octanol/water) log Pow 2.2-3.8 at 24ºC (7 components present)

METHOD OECD TG 117 Partition Coefficient (n-octanol/water).
EC Directive 92/69/EEC A.8 Partition Coefficient.

Test substance	Log Pow	Pow
Peak 1	-1.0	$9.1x10^{-2}$
Peak 2	2.2	$1.4x10^{2}$
Peak 3	2.3	$2.1x10^{2}$
Peak 4	3.4	$2.3x10^{3}$
Peak 5	3.5	$3.3x10^{3}$
Peak 6	3.6	$4.0x10^{3}$
Peak 7	3.8	$6.9x10^{3}$

Remarks For a preliminary estimation the partition co-efficient was calculated from the structural formulae of 7 components of the mixture using the Rekker calculation method, using a computer program (ProLogP).

The HPLC Method was chosen for determination of the partition coefficient because the notified polymer was a mixture of compounds. According to test guidelines, the partition coefficient has to be determined at a pH at least one unit above the pKa for a basic group and at least one unit below an acid group. The pKa values were calculated for components 1-7 and subsequently it was decided to use an unbuffered mobile phase. Six chemicals for which the log Pow has been reported) were used to calibrate the elution time in units of log Pow. The mixture components eluted within this range (logPow 1.1 to 6.2) except for peak 1.

TEST FACILITY Notox (2000e)

Adsorption/Desorption log K_{oc} = 2.23-2.41 (soil 115)*
– main test = 1.89-2.18 (soil 164)*
= 1.90-2.23 (soil 230)*

* Tested at 20 ± 2ºC

METHOD OECD TG 106 Adsorption – Desorption
Determined according to test guidelines using a procedure that measures the decrease in concentration when aqueous solutions of a chemical are in contact under laboratory conditions with three different soils common in the agricultural regions in western Europe.

Soil Type	*Organic Carbon Content (%)*	*pH*	*Koc (mL/g)*
Cranfield 115	1.6	8.1	171.8-257.8
Cranfield 164	3.4	7.2	79.0-153.5
Cranfield 230	0.8	5.1	79.9-170.5

Remarks Adsorption and desorption were determined at an initial concentration of 50.8 mg/L using 0.01 M $CaCl_2$ solution with 16 hours shaking for both the adsorption and desorption (2 cycles) phases. The supernatants were analysed by GC. The results in the above table represent ranges for peak groups 5, 7 and 8 above. The notified polymer mixture can be considered slightly mobile to immobile in Cranfield 115 clay loam and slightly mobile in both Cranfield 164 silt loam and Cranfield 230 sandy loam, according to the classification scheme by Mensink (1995).

TEST FACILITY NOTOX (2001b)

Dissociation Constant No dissociation constant values were determined for the notified polymer in water in the pH range 3-11 at 22 ± 0.5ºC. The pKa acid was calculated to be in the range 14.67 –15.28 (average level of ethoxylation) and the pKa basic was calculated to be in the range –4.59 to –2.28 (average level of ethoxylation).

METHOD OECD TG 112 Dissociation Constants in Water.

Remarks For a preliminary estimation of the pKa values of the notified polymer, the calculation method pKalc was used. Furthermore, the titration method (involves the titration of a known amount of substance with standard acid or base, as appropriate) was used to confirm absence of dissociation constant(s) in the pH range 3-11.

TEST FACILITY NOTOX (2000f)

Particle Size Not determined.

Remarks The notified polymer is a liquid under normal conditions of use.

Flash Point 164ºC

METHOD ASTM D93-71, Flash Point by Pensky-Martens Closed Tester

Remarks No Study Provided.

Flammability Limits Not determined.

Remarks The notified polymer is a liquid with a low vapour pressure under normal conditions of use.

Autoignition Temperature 274ºC

METHOD ASTM E659-78 Standard Test Method for Autoignition Temperature of Liquid Chemicals

Remarks Hot Flame Auto Ignition Temperature

TEST FACILITY Phoenix Chemical (2004)

Reactivity

Remarks Stable under normal conditions of use.

Incompatibility with other substances:

- Oxidizing agents
- Reactive metals
- Sodium or calcium hypochlorite
- Dehydrating agents
- Reaction with peroxides may result in violent decomposition of peroxide possibly creating an explosion
- Materials reactive with hydroxyl compounds

7. TOXICOLOGICAL INVESTIGATIONS

A bacterial reverse mutation study was submitted for the notified polymer. Analogue data was provided for the other toxicological end points. The following test substances were used to provide analogue data:

Analogue 1 - Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (higher level of ethoxylation than the notified polymer)

Analogue 2 - Poly(oxy-1,2-ethanediyl), α ,α'-[1,4-dimethyl-1,4-bis(2-methylpropyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (similar level of ethoxylation as the notified polymer)

Analogue 3 - 5-Decyne-4,7-diol, 2,4,7,9-tetramethyl-

Endpoint and Result	*Chemical tested*	*Assessment Conclusion*
Rat, acute oral	Analogue 1	low toxicity, LD50 >2000 mg/kg bw
Rat, acute dermal	Analogue 1	low toxicity, LD50 >2000 mg/kg bw
Rat, acute inhalation		not determined
Rabbit, skin irritation	Analogue 1	non-irritating
Rabbit, eye irritation	Analogue 1	severely irritating
Guinea pig, skin sensitisation – adjuvant test/non-adjuvant test.		Not determined.
Dog, Oral repeat dose toxicity – 91 days.	Analogue 2	NOAEL 600 mg/kg bw/day, NOEL 200 mg/kg bw/day.
Rat, Oral repeat dose toxicity – 91 days	Analogue 2	NOAEL 460 mg/kg bw/day
Rat, Oral repeat dose toxicity – 28 days	Analogue 2	NOAEL 576.8 mg/kg bw/day
Genotoxicity – bacterial reverse mutation	Notified polymer	non mutagenic
Genotoxicity – in vitro chromosome aberration assay in chinese hamster ovary cells	Analogue 3	non genotoxic
Genotoxicity – in vivo.		Not determined
Developmental and reproductive effects	Analogue 2	NOAEL 1000 mg/kg bw/day

7.1. Acute toxicity – oral

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (higher level of ethoxylation than the notified polymer) (analogue)
METHOD	In house
Species/Strain	Rat/Wistar
Vehicle	None
Remarks – Method	No significant deviations from OECD TG 401 Acute Oral Toxicity – Limit Test.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5/male	2000	0
II	5/female	2000	0

LD50	>2000 mg/kg bw
Signs of Toxicity	A red staining of the nose and mouth area was observed in all animals during the 1, 2 and 4 hour observation. A red staining of the eye area and or a wetting of the anogenital area was observed in most animals during the 2 and 4 hour observations. All animals appeared normal from Day 1 through to Day 14.
Effects in Organs	No abnormalities were observed.

Remarks – Results

CONCLUSION	The notified polymer is of low toxicity via the oral route.
TEST FACILITY	MB Research Laboratories (1993a)

7.2. Acute toxicity – dermal

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (higher level of ethoxylation than the notified polymer) (analogue)
METHOD	In House.
Species/Strain	Rabbit/New Zealand Albino
Vehicle	None
Type of dressing	Occlusive
Remarks – Method	No significant deviations from OECD TG 402 Acute Dermal Toxicity – Limit Test.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
I	5/male	2000	0
II	5/female	2000	0

LD50	>2000 mg/kg bw
Signs of Toxicity – Local	Very slight to well defined erythema and/or very slight to slight oedema were observed on Day 1 in all the animals. Very slight erythema in one male and one female animal and moderate oedema in one female animal, were observed on Day 7. There were no signs of dermal reactions on Day 14.
Signs of Toxicity – Systemic	Instances of diarrhoea, few faeces, bloated abdomen, rales, soiling of the anogenital area and wetness of the nose/mouth were noted during the observation period. Four males and 1 female animal were affected. Body weight changes were normal in 9/10 animals. One male lost weight during the first week of the observation period
Effects in Organs	Kidney abnormalities were noted in one female.
Remarks – Results	

CONCLUSION	The notified polymer is of low toxicity via the dermal route.
TEST FACILITY	MB Research Laboratories (1993b)

7.3. Acute toxicity – inhalation

Not provided

7.4. Irritation – skin

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (higher level of ethoxylation than the notified polymer) (analogue)
METHOD	In House
Species/Strain	Rabbit/New Zealand White
Number of Animals	6
Vehicle	None
Observation Period	72 hours

Type of Dressing	Semi-occlusive.
Remarks – Method	No significant deviations from OECD TG 404 Acute Dermal Irritation/Corrosion.

RESULTS

Lesion	*Mean Score**	*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
Erythema/Eschar	0	0	N/A	0
Oedema	0	0	N/A	0

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

Remarks – Results	No erythema, oedema or abnormal physical signs were noted during the observation period.

CONCLUSION The notified polymer is non-irritating to skin.

TEST FACILITY MB Research Laboratories (1993c)

7.5. Irritation – eye

TEST SUBSTANCE Poly(oxy-1,2-ethanediyl), α, α', -[1,4-dimethyl-1,4-bis (3-methylbutyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (higher level of ethoxylation than the notified polymer) (analogue)

METHOD In House

Species/Strain	Rabbit/New Zealand White
Number of Animals	6
Observation Period	21 days
Remarks – Method	After the 24 hour reading the eyes of all animals were examined with sodium fluorescein. No significant deviations from OECD TG 405 Acute Eye Irritation/Corrosion.

RESULTS

Lesion	*Mean Score**	*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
Conjunctiva: redness	2.2	3	21 days	1
Conjunctiva: chemosis	2.7	3	21 days	2
Conjunctiva: discharge	1.8	3	14 days	0
Corneal opacity	1.5	3	21 days	2
Iridial inflammation	0.8	1	14 days	0

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

Remarks – Results	Corneal opacity, noted in 5/6 eyes, persisted to day 21 in 3/6 eyes. Iritis, noted in 5/6 eyes, cleared by day 21. Moderate conjunctival irritation, noted in all animals, persisted to day 21 in 3/6 animals.

CONCLUSION The notified polymer is severely irritating to the eye.

TEST FACILITY MB Research Laboratories (1993d)

7.6. Skin sensitisation

Not provided

7.7.1 91-day repeat dose oral toxicity (dog)

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α ,α'-[1,4-dimethyl-1,4-bis(2-methylpropyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (similar level of ethoxylation as the notified polymer) (analogue)
METHOD	In House
Species/Strain	Dog/beagle
Route of Administration	Oral – capsule
Exposure Information	Conditioning period: 56 days Total exposure days: 91 days; Dose regimen: 7 days per week; Post-exposure observation period: None
Vehicle	Gelatin Capsule
Remarks – Method	Deviations from OECD TG 409 Repeated Dose 90-Day Oral Toxicity Study in Non-Rodents. • All animals in the dose groups were dosed daily with the notified polymer during a conditioning period prior to the main study. During, this time doses were gradually increased from 50 mg/kg bw/day to the dose level to be used in the main study. The conditioning period lasted for 56 days. There was a week rest period before the start of the main study. • Clinical observations undertaken were not detailed. • No measure of clotting potential was tested in the haematology study. • The weights of the following organs were not measured: adrenals, epididymides, uterus, thymus and spleen. • The following were not studied as part of the histopathology: gross lesions, uterus, ovaries

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw/day*	*Mortality*
I (control)	4 (male), 4 (female)	0	0
II (low dose)	4 (male), 4 (female)	200	0
III (mid dose)	4 (male), 4 (female)	400	0
IV (high dose)	4 (male), 4 (female)	600	0

Mortality and Time to Death

No mortality was observed during the study.

Clinical Observations

Some of the treated animals exhibited occasional episodes of vomiting. These episodes occurred slightly more frequently in the high dose dogs, both male and female.

There was no statistical significance difference in the feed consumption, feed efficiency and body weight gain between the test groups and the corresponding control groups.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis

Clinical Chemistry

Elevated levels of Serum Glutamic Pyruvic Transaminase (SGPT) were detected in three male mid dose animals. Although elevated levels were detected during the study for the other clinical chemistry parameters, these values had all reverted to normal range by the end

of the study.

Haematology & Urinalysis

There were no significant biological differences in the mean haematological parameters or urinalysis parameters between any of the test groups and the corresponding control groups.

Pathology

Organ Weight

There was a statistically significant increase in the mean liver weight for all mid dose animals and high dose female animals. The liver weight of the high dose male animals was also elevated but not statistically. There was a statistically significant increase in mean kidney weight for mid dose females. However, no dose response relationship was present.

Gross Pathology

No treatment related findings

Histopathology

Rathke's cysts were found in the pituitary gland in four male and 2 female control animals, two male and three female low dose dogs, four male and four female mid dos dogs and three male and four female high dose dog. These were randomly seen and therefore not considered to be treatment related.

Remarks – Results

The increase in the mean liver weight in the mid and high dose animals is due most likely to an adaptive hyperplasia of the endoplasmic reticulum of the hepatic cells as a result of the drug metabolising induction brought about by the test compound. Removal of the test compound from the diet would remove the "enzyme inducer" effect of this compound and thus allow these cells to return back to normal.

CONCLUSION

Based on the absence of adverse health effects, the No Observed Adverse Effect Level (NOAEL) was established as 600 mg/kg bw/day in this study. Based on the increased liver weight observed in the mid and high dose animals, the No Observed Effect Level (NOEL) was established as 200 mg/kg bw/day in this study.

TEST FACILITY	Pharmacopathics Research Laboratories (1979a)

7.7.2. 91-day repeat dose oral toxicity (rat)

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α ,α'-[1,4-dimethyl-1,4-bis(2-methylpropyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (similar level of ethoxylation as the notified polymer) (analogue)
METHOD	Combined Repeated Dose Toxicity Study in Rodents with one generation reproduction study. In House Methodology For details of reproduction study see 7.11
Species/Strain	Rat/Sprague Dawley CD.
Route of Administration	Oral –diet
Exposure Information	Total exposure days: 91 days; Dose regimen: Not stated, however, feed consumption was measured by weighing the feed containers at the beginning and end of the week. Therefore it is presumed that the dose regimen was weekly.
Vehicle	Diet
Remarks – Method	Deviations from OECD 408 90 Day Oral Toxicity Study in Rodents • The rats used were the weanling rats from the reproduction study see 7.11T. The control group consisted of the control weanling rats while each of the test groups consisted of the corresponding test weanling rats.

- Weekly dosing regimen
- Due to the variation in ages of the weanlings, bodyweight varied by up to 50% from the group mean weight for each sex at the start of the study.
- Clinical observations undertaken were not detailed.
- Laboratory determinations were conducted on 5 male and 5 female animals form each group.
    - No measure of clotting potential was tested in the haematology study
    - Clinical chemistry parameters not determined: sodium, potassium, total cholesterol, urea and creatinine.
    - Organ weights determined for 10 animals from each group. The weights of the following organs were not measured: adrenals, epididymides, uterus, thymus and spleen.
- Complete histopathological examinations were performed on 10 male and 10 female animals from each group while only the major organs were examined microscopically in all remaining survivors.

RESULTS

Group	*Number and Sex of Animals*	*Dose/Concentration Mg/kg bw/day*		*Mortality*
		Nominal	*Actual mean**	
I (control)	20 male/20 female	0	0	
II (low dose)	15 male/15 female	500	460	
III (mid dose)	15 male/15 female	1000	920	1 (female)
IV (high dose)	15 male/15 female	2000	1835	1 (male)

*the nominal concentration data were not provided but were calculated using the mean bodyweight and food consumption data and based on the fact that the diets were prepared based on the mean body weight and mean feed consumption during the second previous week. As bodyweights were widely variable with groups, individual doses will differ from this value.

Mortality and Time to Death

One group III female died on day 31 of the study and one group IV male died on day 63 of the study. No clinical signs of toxicity were reported for either of these rats.

Clinical Observations

No abnormal clinical signs were observed in any of the rats, either test or control, during the study. There were sporadic differences in the feed intake between male and female test and control animals, however, these were not considered to be biologically significant, Group IV animals (both sex) had a reduced group mean bodyweight gain throughout the study when compared with control animals. Group II and III animals also showed a reduced group mean bodyweight gain during certain weeks. As animals were weanlings from a reproduction toxicity study initial bodyweights in group III and IV animals were much lower than controls.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis

Clinical Chemistry

Although mean serum glutamic pyruvic transaminase (SGPT) and serum glutamic oxaloacetic transaminase (SGOT) values were significantly lower in the mid and high dose females and high dose male and females respectively, values were within normal range. The mean total protein values were significantly lower in group IV females and the mean alkaline phosphates values were significantly lower in group II and IV females, but again values were within normal range. There were no significant differences between the test animals and control groups with the other clinical chemistry parameters.

Haematology

Haematological parameters were measured on day 45 and at the end of the study. Although statistical differences were seen for red blood cell count, haemoglobin, haemocrit, differential white blood cell count

values, all values were within normal range.

Urinalysis
Parameters were measured on day 45 and at the end of the study. There were no significant findings in any of the parameters in any of the test or control groups, either male or female.

Pathology
Organ weights
The mean hepatic weight of both the low dose and high dose females is significantly higher than the control. The liver to bodyweight ratios revealed a dose related increase, particularly striking in the female test groups. There was a statistical reduction in the mean ovarian weights of the mid and high dose groups and the mean brain weight in both low and high dose test animals.

Macroscopic findings
No pertinent gross pathology findings were observed in any of the rats at terminal sacrifice. In the two rats that died, both kidneys were found to be soft and dilated in the mid dose female and the bladder of the high dose male contained clear red fluid.

Histopathology
The most frequent histopathological findings observed were focal lymphocytosis (peribronchial and/or perivascular). This is endemic in this type of rat and was seen in both test and control group animals. Hydronephrosis, nephrocalcinosis and nephrolithiasis, again, endemically seen in this strain of rat, were occasionally observed.

Mild centrilobular cloudy swelling and mild zonal cloudy swelling in the liver was observed in three high dose animals (2male, 1 female) and a mid dose male respectively. Hepatic zonal congestion was observed in 2 mid dose male animals. The high dose male that died exhibited hepatitis. There was a mammary adenocarcinoma in a low dose surviving female rat and a mesenteric lipoma in a high dose female rat. These were considered to be incidental.

Remarks – Results
Although the reduction in bodyweight gain may be test substance related, due to the lower starting bodyweight of test group animals it is not possible to draw any conclusions.

The reduction in brain and ovarian weights in mid and high dose animals is not considered to be biologically significant, as they were not supported by histopathological findings. The dose response observed in the liver to bodyweight ratios is considered to be significant, as the increase would persist if one were to correct for the body weight loss of the high dose groups. This is due most likely to an adaptive hyperplasia of the endoplasmic reticulum of the hepatic cells as a result of the drug metabolising induction brought about by the test compound.

CONCLUSION
The No Observed (Adverse) Effect Level (NO(A)EL) was established as 460 mg/kg bw/day in this study, based on the dose increase in the liver to bodyweight ratios and the hepatic cloudy swelling and congestion observed in mid and high dose group animals. However, the dose value should be treated with caution due to uncertainties in the dosing regimen and the large deviation in intergroup bodyweights.

TEST FACILITY	Pharmacopathics Research Laboratories (1979b)

7.7.3. 28-day repeat dose oral toxicity

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α ,α'-[1,4-dimethyl-1,4-bis(2-methylpropyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (similar level of ethoxylation as the notified polymer) (analogue)
METHOD	
Species/Strain	Rat/Long-Evans
Route of Administration	Oral –diet

Exposure Information	Total exposure days: 28 days; Dose regimen: continuously with the diet. Fresh diet was made weekly.
Vehicle	Diet
Remarks – Method	This study was a range finding study, therefore, limited information has been provided. Deviations from OECD TG 407 Repeated Dose 28-day Oral Toxicity Study in Rodents. • No details of pretrial clinical observation. • No details of clinical effects looked for. • No haematological or clinical chemistry determinations are undertaken • No details of which organs are examined during gross pathology determination. • No histopathology determinations are undertaken.

RESULTS

Group	*Number and Sex of Animals*	*Dose/Concentration*		*Mortality*
		Nominal (ppm)	*Actual mean (mg/kg bw/day)*	
I (control)	6 male, 6 female	0	0	0
II (low dose)	6 male, 6 female	750	70.3	0
III (mid dose1)	6 male, 6 female	1500	136.6	0
IV (mid dose2)	6 male, 6 female	3000	283.1	0
V (high dose)	6 male, 6 female	6000	576.8	0

Mortality and Time to Death
No mortalities were observed

Clinical Observations
Physical observations among control and treated groups were unremarkable during course of the study. There was no evidence of a treatment related effect on bodyweight gain. Food consumption values for the treated groups were slightly higher than control values for the first two weeks of the study but were considered comparable to control values during weeks 3 and 4.

Laboratory Findings – Clinical Chemistry, Haematology, Urinalysis
Not determined

Pathology
There was no evidence of treatment related gross changes in tissues or organs.

Remarks – Results

CONCLUSION
The No Observed (Adverse) Effect Level (NO(A)EL) was established as 576.8 mg/kg bw/day in this study, based on the limited data provided. However, as no haematological, clinical chemistry and histopathological observations were conducted this value should be treated with caution.

TEST FACILITY Bio/dynamics (1977)

7.8. Genotoxicity – bacteria

TEST SUBSTANCE Notified Polymer

METHOD	OECD TG 471 Bacterial Reverse Mutation Test. EC Directive 2000/32/EC B.13/14 Mutagenicity – Reverse Mutation Test using Bacteria. Plate incorporation procedure
Species/Strain	*S. typhimurium*: TA1535, TA1537, TA98, TA100 *E. coli*: WP2 uvrA
Metabolic Activation System	5% S9 fraction from Aroclor 1254 induced rat liver (Test 1) 10% S9 fraction from Aroclor 1254 induced rat liver (Test 2)
Concentration Range in Main Test	Test 1 a) With metabolic activation: 0 – 5000µg/plate. b) Without metabolic activation: 0 – 5000 µg/plate. Test 2 TA1535, TA 98 and WP2 uvrA a) With metabolic activation: 0 – 5000µg/plate. b) Without metabolic activation: 0 – 5000 µg/plate. TA1537 and TA100 a) With metabolic activation: 0 – 3330µg/plate. b) Without metabolic activation: 0 – 3330 µg/plate.
Vehicle	Dimethylsulfoxide
Remarks – Method	Deviations from OECD TG471 Positive control (with activation): 2 aminoanthracene only (all strains) Positive control (with activation): Daunomycine (TA98), methylmethanesulfonate (TA100)

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent	3330 (TA100)			
Test 1		3330 (TA1537, TA98, TA100)	5000 (slight)	negative
Test 2		1670 (TA1537, TA100) 3330 (TA98) 5000 (Wp2 uvrA)	5000 (slight)	negative
Present	3300 (TA100)			
Test 1		3330 (TA1537, TA98, TA100)	5000 (slight)	negative
Test 2		3330 (TA1537, TA100) 5000 (TA98)	5000 (slight)	negative

Remarks – Results	No substantial increases in revertant colony numbers of any of the tester strains were observed following treatment with the notified polymer at any dose level, in the presence or absence of S-9 mix, in either mutation test.
CONCLUSION	The notified polymer was not mutagenic to bacteria under the conditions of the test.
TEST FACILITY	NOTOX (2000g)

7.9. Genotoxicity – in vitro

TEST SUBSTANCE	5-Decyne-4,7-diol, 2,4,7,9-tetramethyl- (analogue)
METHOD	OECD TG 473 In vitro Mammalian Chromosomal Aberration Test.
Species/ Cell Type	Chinese Hamster Ovary (CHO) cells

Metabolic Activation System	S9 fraction from Aroclor-1254 induced male rat liver.
Vehicle	Dimethylsulfoxide (DMSO); test substance added as a suspension
Remarks – Method	No significant protocol deviations. In the cytotoxicity assay, doses 19.5, 78.3, 312.5, 1250 and 3500 µg/mL were used, The high dose was selected based on the limit of solubility of the test article in DMSO. Due to unexpected cytotoxicity at 312.5 µg/mL in the initial test 1, only two dose levels were scorable, therefore, test 1 was repeated using a lower range of doses. The results below relate to the second test 1.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Harvest Time*
Absent			
Test 1	19.5, 39.1*, 78.1*, 156.3*, 312.5	3	21
Test 2	9.8, 19.5, 39.1*, 78.1*, 156.3*	21	21
Present			
Test 1	19.5, 39.1*, 78.1*, 156.3*, 312.5	3	21
Test 2	9.8, 19.5, 39.1*, 78.1*, 156.3	3	21

*Cultures selected for metaphase analysis.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent	1250 (3hr exposure), 312.5 (21hr exposure)			
Test 1		312.5	>312.5	negative
Test 2		>156.3	>156.3	
Present	1250			
Test 1		312.5	>312.5	negative
Test 2		>156.3	>156.3	

Remarks – Results	In both tests, no significant increases in chromosome aberrations were observed at any dose level in the presence and absence of metabolic activation. Additionally, no increases in polyploidy were observed in the presence or absence of metabolic activation. The positive controls (methyl methane sulfonate and cyclophosphamide) produced statistically significant increases in the number of cells with structural chromosome aberrations.
CONCLUSION	The test substance was not clastogenic to Chinese Hamster Ovary cells treated in vitro under the conditions of the test.
TEST FACILITY	SRI (1999)

7.10. Genotoxicity – in vivo

Not provided.

ADDITIONAL INVESTIGATIONS

7.11T. Toxicity to reproduction – one generation study

TEST SUBSTANCE	Poly(oxy-1,2-ethanediyl), α ,α'-[1,4-dimethyl-1,4-bis(2-methylpropyl)-2-butyne-1,4-diyl]bis[w-hydroxy- (similar level of ethoxylation as the notified polymer) (analogue)
METHOD	Single generation reproduction study in the rat combined with a ninety one day feeding study. In house.
	For details of repeat dose toxicity study see 7.7.2
Species/Strain	Rat/Sprague Dawley
Route of Administration	Oral –diet.
Exposure Information	Exposure period – female: From initiation of mating through gestation and up to 21days post partum. Exposure period – male: 20 days mating period)
Vehicle	Diet
Remarks – Method	Deviations from OECD TG415 One-Generation Reproduction Study • Dosing was initiated only at the start of mating. In order to elicit any adverse effects on spermeogenesis/oestrus, dosing should start approximately 70 days prior to mating in males and at least two weeks prior to mating in females. • Copulation plugs were not observed, therefore gestation length could not be calculated. • Litter weight not recorded. • Litter size was reduced to 10 on day 4 post partum. • Pups killed on day 4 were not studied for possible defects.

RESULTS

Group	Number and Sex of Animals	Dose/Concentration mg/kg bw/day		Mortality
		Nominal	Actual	
I	10 male/20 female	0	not determined	0
II	10 male/20 female	50	not determined	0
III	10 male/20 female	1000	not determined	0
IV	10 male/20 female	2000	not determined	1

Mortality and Time to Death

One group IV male died on day 12. No clinical signs of toxicity were recorded.

Effects on Parental (P) animals:

Clinical Observations

No clinical signs of toxicity were observed in either test or control animals. There was considered to be no significant differences in feed consumption or body weight gain. The individual feed consumption in females during weeks 4 and 6 was highly irregular due to different stages of pregnancy and litter age.

Pathology

Pulmonary congestion and a tapered cylindrical opaque body was observed in the high dose male that died. There were no gross abnormalities noted in ay of the other animals. Histopathologically, mild acute prostatitis was observed in the high dose male that dies. The histological examination of the reproductive organs of all Fo parents, test as well as control did not reveal any abnormalities.

Reproductive parameters

There was a decrease in the number of liveborn pups both male and female at the high dose level. There were no significant differences in litter size and gestation index between test and control animals. There was slight reduction in fertility index in the high dose animals.

Effects on 1st Filial Generation (F1)

No gross abnormalities were observed in any of the stillborn pups in either the test or control animals. There were no significant intergroup differences in viability index (day 0 to 4), however, a slight reduction in viability index (day 4 to 21) was observed in high dose animals. A dose dependent reduction in bodyweight of weanling rats was noted, with the high dose considered to be significant.

Remarks – Results

As the pup weight at birth was not recorded, it is not clear whether the low weanling bodyweight is due to a low birth weight or a reduced postnatal growth rate or both.

As dosing only began on day 1 of mating, the fact that no dose dependent differences in fertility were noted should be treated with caution.

Actual dose levels could not be determined, based on the repeat dose toxicity study (7.7.2), the actual dose is likely to be lower than the nominal dose.

CONCLUSION

Based on the decrease in the number of liveborn pups, the reduction in weanling bodyweight and the slight reduction in survival of F1 animals between day 4 and 21 at the high dose, The No Observed (Adverse) Effect Level (NO(A)EL) was established as 1000 mg/kg bw/day in this study.

TEST FACILITY Pharmacopathics Research Laboratories (1979b)

8. ENVIRONMENT

8.1. Environmental fate

8.1.1. Ready biodegradability

No biodegradability tests were conducted on the notified polymer; however, an analogous non-ethoxylated surfactant (5-Decyne-4,7-diol, 2,4,7,9-tetramethyl-) was shown not to be readily biodegradable under the conditions of the OECD TG 301B Carbon Dioxide (CO2) Evolution Test (Modified Sturm Test; Notox, 1999). The same surfactant (5-Decyne-4,7-diol, 2,4,7,9-tetramethyl-) was shown to be inherently biodegradable (just >20%) in an OECD 302A Semi-Continuous Sludge (SCAS) test (Air Products, 1999)). 5-Decyne-4,7-diol, 2,4,7,9-tetramethyl- is non-ethoxylated and contains two carbon atoms less than the notified polymer. Based on the structural similarity to 5-Decyne-4,7-diol, 2,4,7,9-tetramethyl-, the notifier expects the notified polymer would not be expected to readily biodegrade but rather to be inherently biodegradable.

8.1.2. Bioaccumulation

A bioaccumulation study was not conducted. Based on the range of values for the partition coefficient of the major components (2.2-3.8) the notified polymer is not expected to bioaccumulate significantly, particularly considering the low aquatic exposure from the proposed uses.

8.2. Ecotoxicological investigations

8.2.1. Acute toxicity to fish

TEST SUBSTANCE	YAC-93A-973//N565 (analogue of notified polymer containing both ethoxylated and propoxylated side chains, with a similar overall average of groups present)
METHOD	Acute Toxicity Test towards Fish – static (in compliance with U.S EPA TSCA 797.1400)
Species	Rainbow trout (*Oncorhynchus mykiss*) [juvenile]
Exposure Period	96 hours
Auxiliary Solvent	None
Water Hardness	130-160 mg $CaCO_3$/L
Analytical Monitoring	Chemical analysis at 0, 24, 48, 72 and 96 hours.
Remarks – Method	Range-finding and definitive tests were conducted. The nominal exposure concentrations for the range-finding test were 0.0 (control), 0.1, 1.0, 10, 100 and 1000 mg/L total product. After 96 hours, complete mortality was observed at concentrations of 100 and 1000 mg/L. Based on the results the following test concentrations were used for the definitive test (2.5, 5.0, 10, 20 and 40 mg/L). 19 L glass exposure vessels were used and the photoperiod was 16 h light: 8 h dark with transition periods. Analytical testing showed that the test material was stable during the tests (74-100% of nominal) and thus nominal concentrations were used. Temperature: 11.9-13.0°C. pH 8.0-8.3. Dissolved oxygen 9.2-9.4 mg/L. Standards and test solutions were tested by HPLC employing an external standard. All test solutions were clear throughout with no visible precipitate or surface film.

RESULTS

Concentration mg/L		*Number of Fish*	*Mortality*			
Nominal	*Actual*		*24 h*	*48 h*	*72 h*	*96 h*
control	0	10	0	0	0	0
2.5	<2.0	10	0	0	0	1
5.0	3.7	10	0	1	1	4

10	10	10	3	10	17	17
20	18	10	20	20	20	20
40	39	10	20	20	20	20

LC50 11 mg/L (95% CI = 8.8-13.0 mg/L) at 96 hours.
NOEC <2.0 mg/L
Remarks – Results The results of the definitive study showed that complete mortality was observed at the mean measured concentrations of 18 and 39 mg/L within 48 hours. No mortality was observed at the lowest concentration tested. Sub-lethal effects were observed at all test concentrations and included loss of equilibrium and fish floating on the surface of the test solution.

CONCLUSION The ecotoxicity data indicates the notified polymer is harmful to rainbow trout.

TEST FACILITY ABC Laboratories (1999a)

8.2.2. Acute toxicity to aquatic invertebrates

TEST SUBSTANCE YAC-93A-973//N565
(analogue of notified polymer containing both ethoxylated and propoxylated side chains, with a similar overall average of groups present)

METHOD Acute Toxicity Test to the Water Flea, *Daphnia Magna* – static (in compliance with U.S EPA TSCA 797.1300)
Species *Daphnia magna*
Exposure Period 48 hours
Auxiliary Solvent None
Water Hardness 144-148 mg $CaCO_3$/L
Analytical Monitoring Analytical monitoring at 0 and 48 hours showed that the test substance was stable during the tests.
Remarks – Method A range-finding test was performed at concentrations of 0 (control), 0.10, 1.0, 10, 100 and 1000 mg/L. Complete immobilisation was observed after 48 hours at concentrations of 1000 mg/L. No test substance related immobility was observed at concentrations below 1000 mg/L. Based on these results a nominal concentration range of 0.0 (control), 50, 100, 200, 400 and 800 mg/L was selected for the definitive test. Photoperiod: 16 h light: 8 h dark with transition periods. Standards and test solutions were tested by HPLC. Test pH 7.9-8.0. Temperature 20.7-20.9°C. Dissolved oxygen 8.2-8.4 mg/L.

RESULTS

Concentration mg/L		*Number of D. magna*	*Number Immobilised*	
Nominal	*Actual*		*24 h*	*48 h*
control	0	20	0	0
50	47	20	2	5
100	89	20	12	14
200	175	20	13	20
400	335	20	19	20
800	575	20	20	20

EC50 70 mg/L (CI 56-85 mg/L) at 48 hours
NOEC
Remarks – Results The results of the definitive study showed that after 48 hours of exposure, complete immobility (mortality) was observed at concentrations of 175, 335 and 575 mg/L. Sublethal effects were limited to quiescence in the 89 mg/L treatment. The 48-hour EC50 for Daphnia magna exposed to the

test substance was estimated to be 70 mg/L. The no-observed-effect-concentration (NOEC) was not established (less than a mean measured concentration of 47 mg/L).
After 24 hours, the 200, 400 and 800 mg/L test solutions appeared cloudy with a surface film, and at test termination the 100 mg/L test solutions exhibited a surface film. Thus some of the sub-lethal effects could have been physical rather than chemical.

CONCLUSION The ecotoxicity data indicates the notified polymer is harmful to *Daphnia magna*.

TEST FACILITY ABC Laboratories (1999b)

8.2.3. Algal growth inhibition test

TEST SUBSTANCE YAC-93A-973//N565
(analogue of notified polymer containing both ethoxylated and propoxylated side chains, with a similar overall average of groups present)

METHOD Acute Toxicity Test towards the Green Alga–static (in compliance with U.S EPA TSCA 797.1050)

Species	Green Alga *Selenastrum capricornutum*
Exposure Period	96 hours
Concentration Range	
Nominal	0, 2.5, 5.0, 10, 20, 40 and 80 mg/L
Actual (mean)	0, <2.02, 4.7, 8.7, 17, 34 and 77 mg/L
Auxiliary Solvent	None
Water Hardness	Not measured
Analytical Monitoring	Standards and test solutions were tested by HPLC. These were 85-96% of nominal at test initiation and appeared to be stable throughout the 96-hour exposure. Due to analytical method limitations, the lowest test concentration (2.5 mg/L nominal) could not be accurately quantified.
Remarks – Method	A range-finding test was performed at concentrations of 0 (control), 0.1, 1.0, 10, 100 and 1000 mg/L. Based on cell counts at 96 hours, growth inhibition (as compared to the control) was 30% at 10 mg/L and 88% at 100 mg/L. Based on these results a nominal concentration range of 0, 2.5, 5.0, 10, 20, 40 and 80 mg/L was selected for the definitive test. The initial density for the control was 0.96 x 10^4 cells/mL and the density after 96 hours (control) was 2.27 x 10^6 cell/mL. The tests were run under continuous lighting (average light intensity 4305 lux); Standards and test solutions were tested by HPLC. Test pH 7.4-7.5. Temperature 22.1-22.8°C. All test solutions were clear with no visible precipitate or surface film.

RESULTS

Time	*EC50 Value (mg/L)*	*95% Confidence Intervals*
24	9.1	5.7-13
48	6.4	4.1-8.6
72	9.2	7.6-11
96	12	8.5-15

Remarks - Results The 96-hour EC50 based on cell density is estimated to be 12 mg/L with 95% confidence limits of 8.5 and 15 mg/L. The 96-hour NOEC is <4.7 mg/L based on cell density.

CONCLUSION The ecotoxicity data indicates the notified polymer is harmful to the Green Alga *Selenastrum capricornutum*

TEST FACILITY ABC Laboratories (1999c)

8.2.4. Sewage micro-organisms inhibition test

No test results and report are available, though the notifier indicates that the related non-ethoxylated surfactant 5-Decyne-4,7-diol, 2,4,7,9-tetramethyl- had an 3 h EC50 of >680 mg/L when tested according to OECD TG 209, Respiratory Inhibition Test (Air Products, 1999).

9. RISK ASSESSMENT

9.1. Environment

9.1.1. Environment – exposure assessment

Almost no environmental exposure of the notified polymer is expected once the clear coating is dried and trapped in the hard and durable coating matrix. The notifier states that the substance will be used exclusively in industrial facilities. The environmental safety controls and use pattern for the notified polymer would indicate a limited potential for its release into the environment.
The notified polymer is a mixture of components, with impurities which are readily soluble in water; however, aquatic release is considered unlikely and after drying, the notified polymer is likely to be stable within an inert matrix on coated articles.

Emptied containers containing a residue of notified polymer will be disposed of by licensed drum recyclers and will likely be sent to landfill for disposal. While in a landfill the notified polymer is expected to be slightly mobile to immobile, it will be eventually dispersed and it will degrade through biotic and abiotic processes, and consequently, significant exposure to the environment should not occur.

As a worst case scenario, 2% of the total import volume is released to waterways through inappropriately discarded washings, equating to 60 kg/annum of notified polymer. Australia has a population of ~19.5 million people, and an average value for water consumption of 200 L/person/day has been adopted for this national-level assessment (3900 ML/day for total population). Based on this the likely concentration in sewage effluent is a maximum of 0.041 µg/L.

The notified polymer has seven components present, each differing in the number of ethylene oxide units attached, as such, some components bearing a high Pow may have the potential to bioaccumulate, though this will be limited by the low aquatic exposure from the proposed uses.

9.1.2. Environment – effects assessment

The results of the ecotoxicological data indicate the notified polymer is harmful to fish, daphnia and algae. The most sensitive species are fish, where the 96 hour LC50 is 11 mg/L and the NOEC was <2.0 mg/L. Acute results are available for three trophic levels. Applying an assessment factor of 100 to the most sensitive species (fish), the predicted no effect concentration (PNEC) is 110 µg/L. It is however expected, that there will be minimal release to water.

The notified polymer is classified in the EU with the risk phrases:

R52 Harmful to aquatic organisms

R53 May cause long term adverse effects in the aquatic environment

9.1.3. Environment – risk characterisation

The notified polymer will interact with other components to form a stable chemical matrix and, once dry, is expected to be immobile and pose little risk to the environment. It will enter environmental compartments only indirectly by disposal of waste coated articles to landfill. Based on the import volume, method of packaging and low concentration in coating formulations, release of the notified polymer to the aquatic environment is expected to be low.

The PEC/PNEC ratio for the aquatic environment, assuming a worst case, is 0.041/110 = 0.0004. This value is much less than 1, indicating low risk to the aquatic compartment.

The notified polymer is not likely to present a risk to the environment when it is stored, transported, used, recycled and disposed of in the proposed manner.

9.2. Human health

9.2.1. Occupational health and safety – exposure assessment

Use as a clear coat component

Incidental dermal and ocular exposure to the notified polymer during addition of the clear coat to the laminator trough is likely to be low due to its low concentration in the imported product (2%). Inhalation exposure is expected to be negligible due to the low volatility of the notified polymer. Exposure during the coating process is expected to be negligible as the process is automated and spray is unlikely to be generated.

Use as fountain solution concentrate component

Formulation

Incidental dermal and ocular exposure to the notified polymer could occur during weighing and addition of the notified polymer to the mixing tank, particularly if addition is manual. Exposure to the notified polymer in the formulated product during packing is low due to its low concentration (0.06%) in the formulated product.

End Use

Although incidental exposure to the notified polymer could occur during the addition of the fountain solution to the printing press, exposure is likely to be low due to the low concentration of the notified polymer (0.06%). There will be negligible exposure to the notified polymer from intermittent contact with the printing rollers due to very low concentration (0.0024%).

Other potential uses: e.g. use as a floor lacquer

Formulation

Incidental dermal and ocular exposure to the notified polymer could occur during reformulation.

End Use

Exposure to the notified polymer during end application will be limited due to the low concentration of the notified polymer (<1%).

9.2.2. Public health – exposure assessment

Use as liquid clear coat component

The clear coat is to be supplied for industrial use only. Members of the public may be exposed to the notified polymer when handling finished coated products such as banners and posters, however, the notified polymer is unlikely to be bioavailable in this form.

Use as fountain solution concentrate component

As the notified polymer, is supplied solely to industry in this use and is consumed during the printing process, public exposure to the notified polymer through this use is not expected.

Other potential uses

Exposure to the notified polymer may occur during use of other formulated products, such as wood glues, however, exposure is expected to be low due to the low concentration of polymer in the products (up to 1%).

9.2.3. Human health - effects assessment

Acute toxicity.

An analogue of the notified polymer (slightly higher level of ethoxylation) was of low oral and dermal toxicity in acute rat studies.

Irritation and Sensitisation.

In a skin irritation study with an analogue (slightly higher level of ethoxylation), no erythema, oedema or abnormal physical signs were noted. However, in a dermal toxicity study with the

same analogue, very slight to well defined erythema and/or very slight to moderate oedema were observed with all reactions reversed by day 14. Based on an assumption that the notified polymer behaves similarly to the test substance, the notified polymer is considered to be a slight skin irritant. In the eye irritation study with the same analogue, corneal opacity, iritis and moderate conjunctival irritation was noted. Conjunctival irritation and corneal opacity persisted to day 21. Based on an assumption that the notified polymer behaves similarly to the test substance, the notified polymer is considered to be severely irritating to the eye.

No skin sensitisation study was conducted, however, based on structural considerations the notified chemical is unlikely to be a skin sensitiser.

Repeated Dose Toxicity
In a 91 day oral repeat study in dogs (which also included a 56 day conditioning period prior to the 91 days) with an analogue (2 carbon atoms less in the backbone than the notified polymer, similar level of ethoxylation), an increase in the mean liver weigh was observed in high and mid dose animals. This effect was considered to be reversible on removal of the test substance. The No Observed (Adverse) Effect Level (NOAEL) was established in this study as 600 mg/kg bw/day.

In a 91 day oral repeat study in rats with the same analogue, an increase in the liver to bodyweight ratios and hepatic cloudy swelling a congestion was observed in high dose animals. This effect was considered to be reversible on removal of the test substance. The No Observed (Adverse) Effect Level (NOAEL) was established in this study as 460 mg/kg bw/day. The rats used in this study were weanlings from a reproduction study. In addition, the dose value should be treated with caution due to uncertainties in the dosing regimen and the large deviation in intergroup bodyweights

In a 28 day oral repeat study in rats with the same analogue, there was no evidence of treatment related changes at any dose. As such the No Observed (Adverse) Effect Level (NOAEL) was established in this study as 576.8 mg/kg bw/day. However, as no haematological, clinical chemistry and histopathological observations were conducted this value should be treated with caution.

Mutagenicity.
The notified polymer was negative in an Ames test and an analogue of the notified polymer (non ethoxylated version of the notified polymer and with 2 carbons less in the backbone) was negative in an in vitro chromosomal aberration study in Chinese Hamster Ovary Cells.

Toxicity for reproduction.
In a single generation reproduction study with an analogue (2 carbon atoms less in the backbone than the notified polymer, similar level of ethoxylation), a decrease in the number of liveborn pups, a reduction in weanling bodyweight and a slight reduction in the survival of pups between day 4 and 21 was observed at the high dose. The No Observed (Adverse) Effect Level (NOAEL) was established in this study as 1000 mg/kg bw/day. This value was based on the nominal dose. Actual dose levels could not be determined, based on the related repeat dose toxicity study (7.7.2), the actual dose is likely to be lower than the nominal dose.

Hazard classification for health effects.
Based on the assumption that analogue data are acceptable and indicative of toxicity of the notified polymer, the notified polymer is classified as hazardous under the NOHSC *Approved Criteria for Classifying Hazardous Substances*. The classification and labelling details are:

R41 Risk of Serious Damage to Eyes

9.2.4. Occupational health and safety – risk characterisation

Use as a clear coat component
Incidental dermal and ocular exposure could occur during addition of the clear coat to the laminator trough. Although the notified polymer is a severe eye irritant its concentration in the imported liquid clear coat is below the cut off for classification according to NOHSC *Approved*

Criteria for Classifying Hazardous Substances. Therefore the risk to workers is expected to be low.

Use as fountain solution concentrate component
As the notified polymer is a severe eye irritant and incidental dermal and ocular exposure may occur during weighing and addition of the polymer to the mixing vessel, there is a risk of eye irritation during these processes. The risk is low during blending as the process is enclosed with little potential for exposure. During the filling and packaging processes, the risk of eye irritation arising from exposure to he notified polymer is low due to the low concentration of polymer in the formulated product.

The risk of adverse effects from repeated exposure is low due to the relatively high NOAEL (lowest was 460 mg/kg/day in 91-day rat study) and the overall low potential for exposure.

Other potential uses
There is a risk of eye irritation during reformulation as the notified polymer is a severe eye irritant and there is potential for incidental ocular exposure. The risk to workers handling formulated products containing the notified polymer is expected to be low due to the low concentration.

9.2.5. Public health – risk characterisation

Use as a clear coat component and use as fountain solution concentrate component
The health risk to public health arising from exposure to the notified polymer is expected to be negligible.

Other potential uses
In future the notified polymer could be included in products that may be sold to the public. However, the concentration of the notified polymer in these products is expected to be low (up to 1%). Therefore, the health risk to public health from use of these products is expected to be low.

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

10.1. Hazard classification

Based on the assumption that analogue data are acceptable and indicative of toxicity of the notified polymer, the notified polymer is classified as hazardous under the NOHSC *Approved Criteria for Classifying Hazardous Substances*. The classification and labelling details are:

R41 Risk of Serious Damage to Eyes

and

As a comparison only, the classification of notified polymer using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations, 2003) is presented below. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

	Hazard category	***Hazard statement***
Serious eye damage/eye irritation	1	Causes serious eye damage
Chronic hazards to the aquatic environment	2	Toxic to aquatic life with long lasting effects

10.2. Environmental risk assessment

The chemical is not considered to pose a risk to the environment based on its PEC/PNEC ratio and reported use pattern.

10.3. Human health risk assessment

10.3.1. Occupational health and safety

Use as a clear coat component

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

Use as fountain solution concentrate component and other potential uses

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

10.3.2. Public health

Use as a clear coat component and Use as fountain solution concentrate component

There is Negligible Concern to public health based on its reported use pattern.

Other potential uses

There is No Significant Concern to public health based on its reported use pattern.

11. MATERIAL SAFETY DATA SHEET

11.1. Material Safety Data Sheet

The MSDS of the notified polymer and products containing the polymer provided by the notifiers 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 a matter of public record. The accuracy of the information on the MSDS remains the responsibility of the applicant.

11.2. Label

The label for the notified polymer and products containing the polymer provided by the notifiers were in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace Substances* (NOHSC, 1994b). The accuracy of the information on the label remains the responsibility of the applicant.

12. RECOMMENDATIONS

REGULATORY CONTROLS

Hazard Classification and Labelling

- Use the following risk phrases for products/mixtures containing the notified polymer:
  - $\geq$ 10%: R41
  - 5% $\leq$ concentration $\leq$ 10%: R36

Control Measures

Occupational Health and Safety

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer as introduced.
  - Avoid contact with eyes
  - Avoid splashes and spills

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer as introduced:
  - Splash-proof goggles, chemical resistant industrial clothing and impermeable

gloves;

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.

Environment

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

Disposal

- The notified polymer should be disposed of in a landfill in compliance with federal, state and local authorities. Waste product may also be incinerated in an approved combustion system. Careful measures should be undertaken to avoid release of the notified polymer to the sewer system and watercourses.

Emergency procedures

- Spills/release of the notified polymer should be handled by stopping the leak/spill if possible, reducing vapour spreading with a water spray and constructing a dike to prevent water flow. If recovery is not feasible admix with dry soil, sand or non-reactive adsorbent and place in an appropriate chemical waste container. Transfer to containers by suction, preparatory for later disposal. Flush area with water spray. For large spills, recover spilled material with a vacuum truck.

12.1. Secondary notification

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

(1) Under subsection 64(1) of the Act; if
  - the notified polymer is included in products at a percentage $\geq$5%

or

(2) Under subsection 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.

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