File No: NA/273

September 1999

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Component of Sipomer WAM II

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Component of Sipomer WAM II

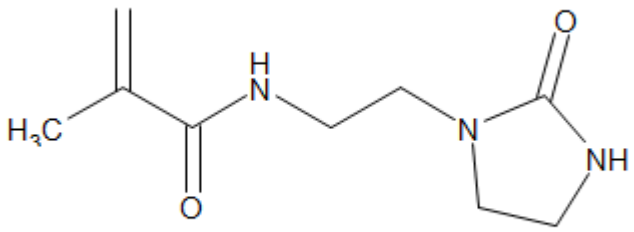
1. APPLICANT

Rhodia Australia Pty Ltd of 7 Citrus St BRAESIDE VIC 3195 has submitted a standard notification statement in support of their application for an assessment certificate for Component of Sipomer WAM II and has not applied for any information to be exempt from publication in the Full Public and Summary Reports.

2. IDENTITY OF THE CHEMICAL

Chemical Name:	1-methacrylamido, 2-imadazolidinone ethane
Chemical Abstracts Service (CAS) Registry No.:	3089-19-8
Other Names:	methacrylamidoethylethylene urea; MAEEU
Molecular Formula:	$C_9H_{15}N_3O_2$

Structural Formula:



Molecular Weight:	197.2
Method of Detection and Determination:	infrared spectroscopy
Spectral Data:	an infrared spectrum was provided

3. PHYSICAL AND CHEMICAL PROPERTIES

The notified chemical is manufactured in a reaction which produces a mixture containing methacrylic acid (CAS No. 79-41-4) and is never isolated. Therefore, the following physico-chemical properties are for the formulated product, Sipomer WAM II. Values calculated for the notified chemical using the ASTER program are given in parentheses.

Appearance at 20°C and 101.3 kPa:	amber liquid
Boiling Point:	100°C (280°C*)
Specific Gravity:	1 077 kg/m^3
Vapour Pressure:	< 0.013 kPa at 25°C (8.8×10^{-5} kPa*)
Water Solubility:	not determined (8 840 g/L*)
Partition Co-efficient (n-octanol/water):	log P_{ow} = -0.47 (-0.7*)
Hydrolysis as a Function of pH:	not determined ($t_{½}$ = 190 days*)
Adsorption/Desorption:	not determined (log K_{oc} = 0.956*)
Dissociation Constant:	not determined
Flash Point:	> 93°C
Flammability Limits:	not determined
Autoignition Temperature:	not determined
Explosive Properties:	not determined
Reactivity/Stability:	hazardous polymerisation may occur at temperatures above 90°C; incompatible with strong oxidising and reducing agents

* calculated ASTER values for the notified chemical

Comments on Physico-Chemical Properties

The notified chemical was never isolated as a defined entity and the test data provided was for Sipomer WAM II, which is a 45% by weight aqueous solution of the product obtained from the following reaction:

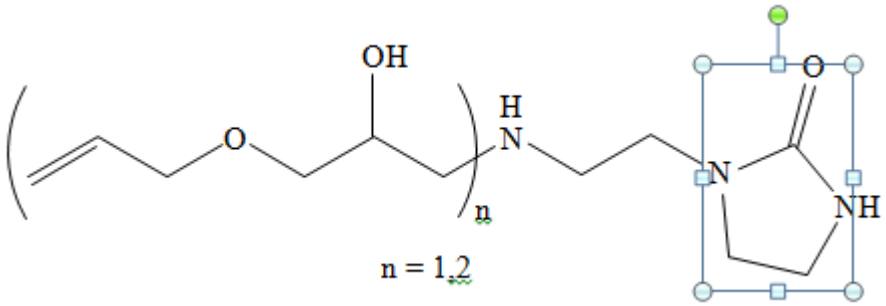
aminoethylethylene urea	+	2-methylacrylic anhydride	→	MAEEU	+	2-methacrylic acid

Water solubility data were not provided for the notified chemical but the notifier states that it is soluble in all proportions. The notifier also mentions a water solubility of 97g/L for the notified chemical in the Carp *Oryzias latipes* ecotoxicity report.

Hydrolysis data were not provided, the notifier states that the notified chemical is a methacrylamide and should be stable in a wide pH range at 25°C.

The boiling point of the notified substance was not available. The boiling point of the commercial product, Sipomer WAM II (45% aqueous solution) is reported to be 100°C.

The partition coefficient, log P_{OW}, of Sipomer WAM II between n-octanol and water was calculated by Quantitative Structure Activity Relationship (QSAR) factors to be less than -0.47 at 20°C. The notifier has also supplied data for an analogue, the predecessor chemical, Sipomer WAM (see figure below). The partition coefficient, log P_{OW}, of Sipomer WAM between n-octanol and water was estimated by the flask shaking method (OECD TG 107) to be < -1.4 at 20°C.



Sipomer WAM

Adsorption and desorption data for the notified chemical was unavailable and the notifier has applied for a variation of schedule requirements based on the argument that all waste will be directed to trade waste treatment processes. Also, given that the notified chemical low partition coefficient (< -0.47) and contains nitrogen atom substituents, it would be expected to bind strongly to silicates in soils, but not to organic matter (Dragun, 1988).

Dissociation data for the notified chemical was also unavailable and the notifier has applied for a variation of schedule requirements based on the argument that the chemical is not ionic. The notified chemical has no functional groups that would hydrolyse but at high pH the secondary nitrogen atoms may deprotonate.

4. PURITY OF THE CHEMICAL

The notified chemical is a component of the reaction mixture.

Degree of Purity: 45.5%

The composition of the mixture (hazardous and non hazardous impurities) is given below.

Hazardous Impurities:

Chemical Name	*CAS No.*	*Weight % (range)*	*Weight % (typical)*	*Hazardous Properties*
methacrylic acid	79-41-4	20 – 25%	23%	corrosive (R34) – concentration cut-off 25%; at < 25% to 2%, irritant (R36/38)[a]; exposure standard: 20 ppm TWA[b]
methacrylic anhydride	760-93-0		max. 2%	poison by inhalation[c]
hydroquinone	123-31-9	0.18 – 0.22%	0.2%	harmful; concentration cut-off: 25%[d]; exposure standard: 2 mg/m^3 TWA[b]

[a]NOHSC *List of Designated Hazardous Substances*; at 2% methacrylic acid to be classified with R36: irritating to eyes and R38: irritating to skin;
[b]NOHSC *Exposure Standards for Atmospheric Contaminants*;
[c]Sax NI & Lewis RJ (1996) Dangerous Properties of Industrial Materials. Van Nostrand Reinhold, New York. [d]NOHSC *List of Designated Hazardous Substances*; above 25% hydroquinone to be classified with R20/21/22: harmful by inhalation, in contact with skin or if swallowed;

Non-hazardous Impurities (> 1% by weight):

Chemical Name	*CAS No.*	*Weight % (range)*	*Weight % (typical)*
aminoethylethylene urea;	6281-42-1	1 – 3	1.5
water	7732-18-5		30

Additives/Adjuvants: none

5. USE, VOLUME AND FORMULATION

The notified chemical will not be manufactured in Australia. It will be imported into Australia in 200 L drums in the product Sipomer WAM II as a 45% solution. Import volumes for the notified chemical are as follows:

Year	*1*	*2*	*3*	*4*	*5*
Import volume (tonnes)	5	5	10	10	10

Sipomer WAM II is intended for use as an additive in the surface coating industry, specifically as an adhesion promoter and binding agent for acrylic and vinyl-acrylic latex paints. No reformulation or repackaging of the notified chemical will be carried out in Australia. The acrylic latex paints will be available to the general public for decorative use.

Sipomer WAM II, containing the notified chemical as a reactive monomer, is incorporated at ~ 5% into monomer blends which are then reacted to form acrylic and vinyl-acrylic polymer latex emulsions. These emulsions are in turn used at ~ 50% in the formulation of acrylic and vinyl-acrylic paints. Sipomer WAM II is present in the formulated paints, as a reacted component of the latex polymer chain, at 0.5 to 1.0%, which equates to 0.25 to 0.5% of the notified chemical, MAEEU. This is equivalent to approximately 0.5 – 1% polymerised MAEEU in paint.

6. OCCUPATIONAL EXPOSURE

SIPOMER WAM II will be imported in 200 L steel drums and transported to customer sites to be used to manufacture latex emulsions. No repackaging will occur. Exposure of transport and storage workers should only occur in the event of accidental spillage.

At the customer sites, small samples will be taken for testing. The remainder in the drum will be pumped into a header tank by plant operators then the contents of the tank charged to a reaction vessel. Extractor fans remove vapours as the drums are discharged. The finished latex emulsion is pumped into 200 L drums in a closed system by the plant operators using an automated pumping mechanism. The header tank is rinsed with a water reflux and the washings pumped into the reaction tank. Any residual monomer is reacted to polymer with an added catalyst. The remaining monomer concentration is estimated to be several ppm. The reaction tank is rinsed to an effluent pit.

Plant operators may be dermally exposed to drips and spills of the notified chemical during transfer of Sipomer WAM II to the reaction vessel. The notifier states that plant operators wear goggles, gloves, protective clothing and respirators if necessary.

The notifier has indicated that exposure to the notified chemical may occur during product development, with up to 10 workers potentially exposed. This work would include the preparation of small batches of polymer and the evaluation of different paint formulations. Skin contamination may occur during these operations. The protective equipment to be worn by product development personnel was not specified in the notification, but it would be

expected to be similar to that worn by plant operators.

The notified chemical is at 2.5% in the latex emulsion polymers. As it is now part of a polymer chain further exposure of workers should be minimal.

The customers are identified as major paint manufacturers who will reformulate the latex emulsions into decorative paints. These paints are typically manufactured in closed systems and local exhaust ventilation is used to remove solvent vapours. Paints are typically filled into 1 L – 200 L containers in closed systems and transported to customers.

The notifier has not specifically stated how the paints will be applied but it can be expected that brush, roller and spray methods may be used. During these operations, exposure to workers should be minimal.

7. PUBLIC EXPOSURE

Public exposure to the notified chemical will occur during do-it-yourself (DIY) painting projects. The extent of the exposure will depend on the size of the project and the number of persons exposed will be determined by the commercial success of the products containing the notified chemical. As Sipomer WAM II is chemically incorporated into the structure of the polymer latex component of the paint prior to sale to the public, exposure to the notified chemical itself is likely to be negligible. Once dry, the notified chemical will be bound into the matrix of the paint and exposure resulting from contact with painted surfaces will again be negligible. Similarly, exposure resulting from the inhalation of paint particles generated during the sanding off of surfaces previously painted with paints containing the notified chemical will be negligible, as the bioavailability of the compound from the cured paint particles is likely to be low to negligible.

In the event of a transport accident involving containers of paint containing the notified chemical, the public is unlikely to come into contact with it as it will be bound into the polymer latex of the paint (see below). Spilt paint may be recovered by adsorption onto suitable material such as sand with subsequent disposal in accordance with local government regulations. If a transport accident were to involve drums of Sipomer WAM II the potential for exposure would be increased. The notified chemical is highly water soluble and would readily enter water ways. Precautions against dispersion of spilt material following a transport accident should be taken. As the material is not volatile, little hazard would be presented to the public in the vicinity of the accident unless direct contact with the material occurred.

The manufacture of paints containing the notified chemical is not anticipated to lead to direct public exposure. The notified chemical has a low vapour pressure and normal industrial hygiene practices would be anticipated to constrain uncontrolled loss of the liquid into the environment surrounding the manufacturing premises.

8. ENVIRONMENTAL EXPOSURE

Release

There is potential for release of the notified chemical during the latex polymer manufacture, paint formulation and paint application. Manufacture and formulation processes will take place at paint manufacturing companies across Australia and any spills that occur are assumed to be contained by plant bunding.

During the manufacture and formulation processes, up to 1% of latex paint would be lost due to spills and washing of equipment according to notifier estimates. This equates to a loss of 100 kg per year of the notified chemical. During painting application the notifier expects that 0.5% latex paint waste (50 kg of MAEEU annually) will be produced from the washing of equipment.

The notifier estimates that transport drums emptied at the formulation site will contain Sipomer WAM II residues at no more than 0.5%, 50 kg of the notified chemical per annum. The drums will be thoroughly rinsed with water and sent to drum reconditioners.

Some residue will also remain in the 'empty' paint containers after use. It is estimated that 200 kg of the notified chemical (2% of the container contents) will remain as residue in the containers annually. However, if significant quantities of the paints are used in the DIY market, a higher figure is expected.

Fate

The waste generated in manufacture, formulation and application of the coating will be disposed to landfill, or by incineration. At the manufacturing and formulation site the notified chemical will be recovered as part of an insoluble solid from wastewater and disposed of to landfill. The containers and their residue will also be disposed of to landfill. Leaching of the notified chemical from landfill is unlikely, given the expected low solubility of the notified chemical once bound inside the polymer matrix of the latex paint.

Once applied to the surfaces of houses as paint, the notified chemical will be incorporated in a hard, durable, inert film where it will be immobilised and would not present a significant hazard. Any fragments, chips and flakes of the paint will be inert and of little concern. Eventually the surfaces that are coated with the latex paint containing the notified chemical will enter the waste disposal stream for either recycling or ultimately for disposal as waste in landfill. Once in the landfill sites, movement of the chemical by leaching is not expected because it will be locked within the polymer matrix of the latex paint.

Any of the latex polymer paint containing the notified chemical released to the sewer, for example, *via* washing of paint application equipment for example, would be insoluble, and expected to become associated with the sewerage plant sludge. The sludge would be either deposited into landfill or incinerated.

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

The inherent biodegradability of the notified chemical was tested by the modified Semi Continuous Activated Sludge test (EPA: 796.3340) over a period of 7 weeks. While this test employs synthetic sewage and is not necessarily an accurate model of a sewage treatment plant, the notifier claims that it is a useful method for assessing inherent biodegradability. Within a 7 week exposure period to micro-organisms, the notified chemical was degraded by 59%.

A 64 day aerobic soil biodegradation study (EPA: 769.3400) was also conducted on the notified chemical at 22°C, with Boone County (USA) silt loam soil (Alfisal). After 64 days the notified chemical was degraded by 95%.

9. EVALUATION OF TOXICOLOGICAL DATA

Toxicological data were available for Sipomer WAM II (45.5% notified chemical, 23% methacrylic acid, up to 2% methacrylic anhydride, 1.5% aminoethylethylene urea and 0.2% hydroquinone) and Sipomer WAM (an analogue of the notified chemical – see Section 3 for structure).

9.1 Acute Toxicity

Summary of the acute toxicity of Sipomer WAM II

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD_{50} > 5 000 mg/kg	(Tox Monitor Laboratories Inc, 1989)
skin irritation	rabbit	slight to moderate irritant	(Tox Monitor Laboratories Inc, 1989)
eye irritation	rabbit	moderate to severe irritant	(Tox Monitor Laboratories Inc, 1989)

Summary of the acute toxicity of Sipomer WAM

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD_{50} > 5 000 mg/kg	(Verlangieri & Shapiro, 1980a; Verlangieri & Shapiro, 1980b)
skin irritation	rabbit	inconclusive	(Verlangieri & Shapiro, 1980c and 1980e)
eye irritation	rabbit	moderate irritant	(Verlangieri & Shapiro, 1980d)
skin irritation	Guinea pig	non sensitiser	(Spear, 1985)

9.1.1 Oral Toxicity

9.1.1.1 Sipomer WAM II (Tox Monitor Laboratories Inc, 1989)

Only a summary of a toxicological study was provided. The study was conducted on albino rats (5/sex) and the LD_{50} was reported to be greater than 5 000 mg/kg. Three females died within 48 hours of dosing. It was stated that animals appeared sickly following dosing. Organs of the thorax and abdomen appeared normal in the survivors.

9.1.1.2 Sipomer WAM (Verlangieri & Shapiro, 1980a; Verlangieri & Shapiro, 1980b)

Two studies were provided but the brief reporting of the methodology renders their validity uncertain. However, the conclusions were that in Wistar rats, the acute oral (gavage) LD_{50} was 4.6 mL/kg for a 50% aqueous solution of the test substance and greater than 5.0 mL/kg for an 80% solution.

9.1.2 Dermal Toxicity

No data provided.

9.1.3 Inhalation Toxicity

No data provided.

9.1.4 Skin Irritation

9.1.4.1 Sipomer WAM II (Tox Monitor Laboratories Inc, 1989)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 3/unspecified

Observation period: 72 hours

Method of administration: 0.5 mL of the test substance was placed on the skin under occlusive dressing for 24 hours

Draize scores (Draize, 1959):

Time after treatment (days)	***1***	***3***
Erythema		
1	1[a]	0
2	2	0
3	2	0
Oedema		
1	1	0
2	2	0
3	2	0

[a] see Attachment 1 for Draize scales

Test method: similar to OECD guidelines

Result: the notified chemical was a slight to moderate skin irritant in rabbits

9.1.4.2 Sipomer WAM

Skin corrosion test (Verlangieri & Shapiro, 1980c)
Sipomer WAM was scored for skin corrosion (tissue destruction) in six New Zealand White rabbits. One half mL of the test substance was administered under occlusive dressing for 4 hours. After dressing removal, skin corrosion was scored at 4 and 48 hours. No skin corrosion was noted.

Skin irritation test (Verlangieri & Shapiro, 1980e)
A summary of a skin irritation test in rabbits was provided but the data were poorly reported.

9.1.5 Eye Irritation

9.1.5.1 Sipomer WAM II (Tox Monitor Laboratories Inc, 1989)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 3/unspecified

Observation period: 14 days

Method of administration: 0.1 mL of the test substance into one eye

Draize scores (Draize, 1959) of unirrigated eyes:

	Time after instillation									
Animal	***1 day***		***2 days***		***3 days***		***7 days***		***14 days***	
Cornea	***o***	***a***	***o***	***a***	***o***	***a***	***o***	***a***	***o***	***a***
1	1[1]	3	1	3	1	2	2	2	2	2
2	2	4	2	4	2	4	2	4	2	4
3	2	4	2	4	2	4	2	4	2	4
Iris										
1	1		1		0		0		0	
2	1		1		1		2		2	
3	1		1		1		1		1	
Conjunctiva	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***
1	2	2	3	2	2	2	2	2	2	2	1	1	1	0	1
2	2	3	3	2	3	3	2	3	3	2	2	3	2	2	3
3	2	3	3	2	3	3	2	3	3	2	1	2	2	1	1

[1] see Attachment 1 for Draize scales
o = opacity a = area r = redness c = chemosis d = discharge

Test method: similar to OECD guidelines

Result: the notified chemical was a moderate to severe eye irritant in rabbits

9.1.5.2 Sipomer WAM (Verlangieri & Shapiro, 1980d)

Species/strain: rabbit/New Zealand White

Number/sex of animals: 6/unspecified

Observation period: 7 days

Method of administration: 0.1 mL of the test substance into one eye

Draize scores (Draize, 1959) of unirrigated eyes:

Draize scores were zero at beyond 4 days post-instillation. Scores at 24, 48 and 72 hours were as follows:

	Time after instillation								
Animal	***1 day***			***2 days***			***3 days***		
Cornea	***o***	***a***		***o***	***a***		***o***	***a***	
1	1[1]	4		1	4		0	0	
2 - 6	0	0		0	0		0	0	
Iris									
1 - 6		0			0			0	
Conjunctiva	***r***	***c***	***d***	***r***	***c***	***d***	***r***	***c***	***d***
1	2	1	2	0	0	0	0	0	0
2	2	0	0	0	0	0	0	0	0
3	2	0	0	1	0	0	0	0	0
4	2	2	2	2	2	0	0	0	1
5	1	0	3	1	0	2	0	0	0
6	3	3	3	2	2	2	0	0	0

[1] see Attachment 1 for Draize scales
o = opacity a = area r = redness c = chemosis d = discharge

Test method: similar to OECD guidelines

Result: the notified chemical was a moderate eye irritant in rabbits although severe irritation was observed in one rabbit at 24 hours post-instillation

9.1.6 Skin Sensitisation (Spear & Shapiro, 1985)

Data were not provided for Sipomer WAM II. The following data are for Sipomer WAM.

Species/strain: guinea pig/Dunkin-Hartley

Number of animals: 10 males in test group; 10 males treated with positive control substance dinitrochlorobenzene (0.3%)

Induction procedure:

test group: day 1 and alternate days excluding weekends for 10 applications	0.5 mL test substance applied to the thoracolumbar region under semi-occlusive dressing for 6 hours

control group:
0.3% DNCB as above — as above

Challenge procedure:

14 days after 10th induction application — application as for induction to the left flank

Test method: — Buehler method, OECD TG 406

Challenge outcome:

	Test animals		***Positive control animals***	
Challenge concentration	***24 hours****	***48 hours****	***24 hours****	***48 hours****
100%	0/10**	0/10	9/9	9/9

* time after patch removal
** number of animals exhibiting positive response

Result: — the notified chemical was not sensitising to the skin of guinea pigs

9.2 Repeated Dose Toxicity (Sipomer WAM II)

For this study, only the results tables were available.

Species/strain: — rat/unspecified

Number/sex of animals: — 6/sex/dose group

Method of administration: — oral, assumed to be by gavage

Dose/Study duration: — 0, 40, 200 or 1 000 mg/kg/day with extra 14-day recovery groups for the control and high dose

Clinical observations: — body weight and food consumption were unaffected by treatment

2 high dose males and 1 high dose female (recovery group) died during the study

the most significant observations were salivation and abnormal respiratory sound in the high dose group and recovery group

Clinical chemistry/Haematology/ Urinalysis — *Haematology*
no treatment-related effects

Clinical Chemistry

	serum glucose was 18% lower in the female high dose recovery group; females of the high dose group exhibited a 2% drop in chloride relative to controls *Urinalysis* the female high dose recovery group exhibited a doubling of the urine volume
Macroscopic findings:	*Organ weights* the female high dose group exhibited a 13% increase in relative kidney weight in comparison with controls *Gross pathological findings* elevation of the mucosa of the forestomach was found in 3 high dose males and 6 high dose females; in the two males found dead, the small intestine and stomach (one animal) and large intestine (the other animal) were filled with gas; the female found dead had a gas-filled stomach
Histopathology:	4 males and 6 females of the high dose group exhibited hyperkeratosis of the forestomach; in one high dose male a whitish region of the left testis correlated with decreased spermatogenesis and sperm granuloma; in this same male increased eosinophilic bodies were observed in the kidney; the two males and female found dead had lung congestion and one of the males had spleen atrophy; in both male and female recovery groups, no abnormalities were detected
Test method:	similar to OECD guidelines
Result:	the notified chemical had local effects on the forestomach with a NOEL of 200 mg/kg/day

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* and *Escherichia coli* Reverse Mutation Assay

9.3.1.1 Sipomer WAM II (Eda, 1993)

Strains:	*S. typhimurium* strains TA 98, TA 100, TA 1535, TA 1537; *E. coli* strain WP2 *uvrA*
Concentration range:	0, 50, 100, 200, 500, 1 000, 2 000 or 5 000 μg/plate (experiment 1); 0, 313, 625, 1 250, 2 500 or 5 000 μg/plate (experiment 2)

Test method:	similar to OECD guidelines
Comment:	negative controls were within acceptable limits and the positive controls demonstrated the sensitivity of the test; there was no mention of cytotoxicity of the test substance
Result:	the test substance did not induce an increased number of mutants above background in either the absence or presence of metabolic activation provided by rat liver S9 mix

9.3.1.2 Sipomer WAM (Wolf & Shapiro, 1985)

Strains:	*S. typhimurium* strains TA 98, TA 100, TA 1535, TA 1537 and TA 1538
Concentration range:	0, 0.5, 1, 5, 10 or 50 μL/plate
Test method:	similar to OECD guidelines
Comment:	negative controls were within acceptable limits and the positive controls demonstrated the sensitivity of the test; cytotoxicity was observed at 100 μL/plate
Result:	the test substance did not induce an increased number of mutants above background in either the absence or presence of metabolic activation provided by rat liver S9 mix

9.3.2 Chromosomal Aberrations in Chinese Hamster Lung (CHL) Cells: Sipomer WAM II (Ajimi, 1993)

Cell line:	CHL
Doses:	0, 300, 450 or 600 μg/mL (absence of metabolic activation provided by rat liver S9 mix); 0, 500, 1 000 or 2 000 μg/mL (absence and presence of S9 mix); treatment times were 24 and 48 hours
Test method:	similar to OECD guidelines
Comment:	a cell fission suppression test established an upper dose limit of 600 μg/mL in the absence of S9 and 2 000 μg/mL in the presence of S9; the percentage of cells containing chromosomal aberrations (CA) (excluding gaps) observed in this study was maximal at the highest doses as follows:

treatment time (hr)	*dose (μg/mL)*	*% cells with CA*
- S9		
24 h	0	0.5 (1.0*)
	600	21.0
	2 000	32.5
48 h	0	0.0
	600	45.5
+S9		
24 h	0	1.0
	2 000	2.5

* control for study ±S9 with a top dose of 2 000 μg/mL

Result: the test substance was clastogenic in CHL cells in the absence of S9 fraction

9.4 Neurotoxicity, Developmental Toxicity and Genetic Toxicity of Acrylamide and Analogues

There are a number of studies in the peer-reviewed literature concerning the neurotoxicity, developmental toxicity and genetic toxicity of acrylamide and structural analogue chemicals. There are also a number of other studies uncovered by literature search but these are not reviewed here as they have not been peer-reviewed and only the abstract was available.

Chapin *et al.* (1995) summarised the literature on acrylamide toxicity and that of various analogues as a preamble to a multigeneration study of the effects of acrylamide, N, N'-methylenebisacrylamide, N-(hydroxymethyl)acrylamide and methacrylamide on Swiss mice.

Acrylamide acts at several levels in the reproductive system: alteration of mating and copulatory behaviour, damage of testicular structure and effects on epididymal sperm function. The ability to cause dominant lethality in epididymal sperm, heritable translocations in testicular germ cells and other genetic damage suggests a genetic effect. A study by Hashimoto and co-workers (cited by Chapin *et al.*, 1995) the ability of acrylamide and analogues to produce neurotoxicity and testicular atrophy. The testicular effects and neurotoxicity of acrylamide and related compounds administered at ½ or $^1/_3$ of the LD_{50} demonstrated that the testicular effects and neurotoxicity were not strongly related. In terms of neurotoxicity (a single test of ability to decrease time or a rotorod) the compounds were ranked (from the most potent to the least potent) as isopropyl acrylamide > acrylamide > methacrylamide > N-(hydroxymethyl)-acrylamide > N, N'-methylenebisacrylamide. Based on decreased terminal testis weight, the compounds were ranked (from the most potent to the least potent) as N, N'-methylenebisacrylamide > N-(hydroxymethyl)-acrylamide > isopropyl acrylamide > acrylamide > methacrylamide. However, Chapin *et al.* (1995) suggest that testicular weight is a gross measure of reproductive toxicity. In their study with Swiss mice, doses were kept low to minimise structural testicular damage, thereby allowing a comparison of the relative sensitivity of neurotoxicity and dominant lethality.

Chapin *et al.* (1995) concluded that the primary site of reproductive toxicity of acrylamide was in the male and that it was entirely accounted for by dominant lethal activity. A lack of female reproductive toxicity was consistent with other reports. There was greater detectable reproductive toxicity than neurotoxicity, particularly in the second generation. Reproductive toxicity in the form of dominant lethality was also observed for N, N'-methylenebisacrylamide and N-(hydroxymethyl)-acrylamide with minimal neurotoxicity observed at low doses used in these studies. On a constant dose basis the ranking was N, N'-methylenebisacrylamide > acrylamide > N-(hydroxymethyl-acrylamide. No effects were seen with methacrylamide at the doses used.

An earlier review of the health effects of acrylamide was published by the International Programme on Chemical Safety (Anon, 1985). In humans acrylamide poisoning can be associated with peripheral neuropathy and autonomic nervous system involvement. Although acrylamide was not mutagenic in *Salmonella typhimurium*, it induced chromosomal aberrations in the spermatocytes of male mice and increased the cell transformation frequency in Balb 3T3 cells in the presence of a metabolic activation system. Acrylamide was shown to be an initiator for skin tumours in mice when administered by various routes and increased the incidence of lung tumours in mice screening assays. There is no evidence in either man or animals of any gross teratogenic effects resulting from acrylamide exposure.

A literature review provided by the notifier comprised various abstracts of studies on the biological effects of methacrylamide. A study by the National Toxicology Program (George, 1991), in which CD-1 mice were administered methacrylamide via the oral route on gestation days 6 - 17 at dose levels up to 180 mg/kg, revealed mild maternal effects at the top dose. Clear developmental toxicity was observed namely an increased proportion of non-live implants and decreased mean foetal body weight per litter.

The notifier provided a structure-activity analysis of the notified chemical and other acrylamide analogues. It was argued that the notified chemical contains a bulky substituent on the amide nitrogen and that this would reduce the biological activity, as evidenced by the fact that the LD_{50} of N-substituted acrylamide analogues is inversely proportional to the size of the substituent. It was also argued that 2-methyl substitution at the double bond (such as occurs in the notified chemical) reduces the biological activity. Evidence for this is that the neurotoxicity of methacrylamide is about 10-fold lower than for acrylamide. Although this may be the case, the IPCS review suggests that acrylamide analogues can undergo biotransformation to acrylamide *in vivo* and that this could be a possible cause for their biological activity.

9.5 Overall Assessment of Toxicological Data

There were no toxicological data for the notified chemical itself. However, there were data available for the product to be imported: Sipomer WAM II and for an analogue, Sipomer WAM.

Sipomer WAM II and Sipomer WAM exhibited very low acute oral toxicity in rats (LD_{50} > 5 000 mg/kg). Sipomer WAM II was a slight to moderate skin irritant in rabbits and the Sipomer WAM data were inconclusive. Sipomer WAM II was a moderate to severe eye irritants in rabbits, possibly due to the methacrylic acid component and Sipomer WAM was a moderate eye irritant. It would be classified for health effects as an eye irritant, under the

NOHSC *Approved Criteria for Classifying Hazardous Substances* (National Occupational Health and Safety Commission, 1999a).

The eye irritation of Sipomer WAM II may have been contributed to by the methacrylic acid, which is corrosive.

Sipomer WAM was not a skin sensitiser in guinea pigs. Both chemicals were not mutagenic in bacteria but Sipomer WAM II was clastogenic in CHL cells.

In a 28-day repeated dose oral study in rats, the main effects of Sipomer WAM II were local effects on the forestomach with a NOEL of 200 mg/kg/day.

The notified chemical is an analogue of acrylamide, which is a known genetic, reproductive and neural toxicant. It is listed in the NOHSC *List of Designated Hazardous Substances* (National Occupational Health and Safety Commission, 1999b) as a category 2 carcinogen and a category 2 mutagen. The risk phrases R45: May cause cancer; R46: May cause heritable genetic damage and R 48/23/24/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed are appropriate for acrylamide.

A closer analogue of the notified chemical is methacrylamide, which also has 2-methyl substitution at the double bond. From analogue data, methacrylamide appears to be less toxic than acrylamide. It is not listed on the NOHSC *Designated List of Hazardous Substances* (National Occupational Health and Safety Commission, 1999b) but exhibits neurotoxicity and developmental toxicity, namely increased resorptions. As methacrylamide does not have the bulky substituent on the amide nitrogen, it is believed to be more reactive than the notified chemical.

Therefore based on test data for Sipomer WAM II and analogue data for Sipomer WAM and the acrylamides, the notified chemical would be expected to have low acute toxicity, slight to moderate skin irritant properties and moderate eye irritant properties. It would not be expected to be a skin sensitiser. On the test data available, the genotoxicity profile is inconclusive.

Based on analogue data, the notified chemical may have reproductive and neurotoxicity properties, however, on the assumption that the chemical would be less reactive than methacrylamide, hazard classification on the basis of these properties cannot be justified. The available data supports a hazardous substance health effects classification of the notified chemical as an eye irritant, with the risk phrase R36.

Sipomer WAM II, containing the notified chemical and methacrylic acid, is a hazardous substance with the risk phrases R36/38, based on test data and the concentration of free methacrylic acid.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier has supplied the following ecotoxicity studies summarised below.

Test	*Species*	*Test concentrations (nominal) mg/L*	*Results (nominal) mg/L*
Acute Toxicity (Semi-Static Test) (OECD TG 203)	Carp *Oryzias latipes*	9, 13, 20, 30, 44, 67 & 100	48 h LC_{50} = 22.6
Acute Toxicity - Immobilisation (Static Test) (OECD TG 202)	Water Flea (*Daphnia magna*)	168, 240, 343, 490, 700 & 1000	24 h EC_{50} > 1000*

*This test and result is for Sipomer WAM

Fish
A 48-hour definitive study, performed in accordance with OECD test guidelines, demonstrated that Sipomer WAM II had no toxic effects on the test fish up to a nominal concentration of 13 mg/L. A 48 h LC_{50} was estimated to be 22.6 mg/L using the method of Doudoroff. The raw data shows 30% mortality at 20 mg/L and 90% mortality at 30 mg/L, so the estimate of the LC_{50} of 22.6 mg/L seems reasonable.

Aquatic Vertebrates
The notifier did not supply information concerning the ecotoxicity of the notified chemical on Water Flea. However, the notifier supplied ecotoxicity data for Sipomer WAM. This study demonstrated that Sipomer WAM had no immobilisation and toxic effects on the test *Daphnia magna* up to a nominal concentration of 1000 mg/L.

Algae
The notifier did not supply information concerning the ecotoxicity of the notified chemical on algae.

Microorganisms
The inherent biodegradability of the notified chemical was tested by the modified Semi Continuous Activated Sludge test (EPA: 796.3340) over a period of 7 weeks. Within a 7 week period the notified chemical was degraded by as much as 59%. The percent degradation, however, rapidly decreased after 5 weeks. Closely corresponding to the rapid decrease after week 6, was an observed shift in the microbial population to one that was predominantly fungal, indicating that some level of toxicity was achieved by the notified chemical that was not quantified by the notifier.

Conclusion
The ecotoxicity data for the notified substance indicates that it is practically non-toxic to aquatic invertebrates and slightly toxic to fish and microorganisms.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The low environmental exposure of the chemical as a result of the proposed use, together with its expected negligible environmental toxicity once polymerised, indicate that the overall environmental hazard should be negligible.

The only other source of environmental contamination is from accidental spills during transport and handling. The information provided in the material safety data sheet (MSDS) is adequate to enable cleanup operators to limit the environmental exposure and, therefore, the environmental effects. Should the notified chemical find its way into the environment from sources such as paint application and equipment washing by DIY users, factors like dilution, since it is highly soluble and inherent biodegradability suggest that the overall environmental hazard should be negligible.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

No toxicological data were provided for the notified chemical. Toxicity is extrapolated from analogue data for the product Sipomer WAM II, a structurally similar chemical Sipomer WAM and the acrylamides. The notified chemical is expected to have a low acute toxicity. It is a slight to moderate skin irritant and a moderate eye irritant, but not a skin sensitiser. It may have neurotoxicity and reproductive toxicity, however, hazard classification on the basis of these properties cannot be justified. Sipomer WAM II and Sipomer WAM were not mutagenic in bacteria, however, the former was clastogenic in mammalian (CHL) cells. This is insufficient to warrant a hazard classification.

Considering all the toxicity data, the notified chemical is a hazardous substance with the risk phrase R36: Irritating to eyes.

Sipomer WAM II, containing the notified chemical and methacrylic acid, is a hazardous substance with the risk phrases R36/38, based on test data and the concentration of free methacrylic acid.

Occupational Health and Safety
Exposure of transport and storage workers handling drums of Sipomer WAM II is not expected to occur except in the event of accidental spillage.

Sipomer WAM II will be imported in 200 L steel drums. It will be sampled for quality control (QC) testing and formulated. QC operators should wear goggles, gloves and overalls to protect against the possibility of skin and eye irritancy. During formulation, Sipomer WAM II is pumped to a header tank off the reactor vessel. At this point that the greatest likelihood of exposure exists from drips, spills and splashes and personal protective equipment namely gloves, goggles and overalls, must be used to reduce the risks of skin and eye irritation. Product development personnel may also be similarly exposed when conducting tests on small batches. Inhalation exposure should be minimised by the use of extractor fans, but a respirator will be necessary if exposure to fumes is possible. Once the Sipomer WAM II is within the enclosed reactor vessel further exposure is unlikely. The risk of adverse health effects arising from exposure to the notified chemical is low due to the

enclosed nature and automatic control of the latex manufacturing process.

Following reaction of monomers to form the emulsion polymer, exposure to the notified chemical is expected to be minimal as residual monomer levels are low. The notified chemical is included in monomer blends at approximately 5% and in final paint products the notified chemical is present at 0.5 to 1%. Therefore, exposure to the notified chemical is not expected during formulation of the polymer into paint and during paint application.

Public Health
As the notified chemical is present in the final paint products at 0.5 to 1%, and will be bound into the polymer latex, contact with uncured paint containing it will result in negligible exposure to the notified chemical. Once the paint has cured the potential for exposure to the notified chemical will be further reduced. At the levels of exposure likely from the proposed use pattern for products containing Sipomer WAM II, and based on the toxicological profile of the notified chemical, the notified chemical is not considered to present a significant risk to public health.

13. MATERIAL SAFETY DATA SHEET

The MSDS for Sipomer WAM II was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (National Occupational Health and Safety Commission, 1994).

This MSDS was provided by the applicant as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the applicant.

14. RECOMMENDATIONS

To minimise occupational exposure to the notified chemical during QC sampling, product development and transferring Sipomer WAM II to reaction vessels, the following guidelines and precautions should be observed:

- Goggles, gloves and overalls conforming to Australian or Australian/New Zealand Standards should be worn during sampling and transfer of the notified chemical. Goggles should conform to AS 1336 and AS/NZS 1337, gloves to AS 2161.2 and overalls to AS 2919. If a respirator or mask is required, it should conform to AS/NZS 1715 and 1716;
- Spillage of the notified chemical should be avoided. Spillage should be cleaned up promptly with absorbents which should then be put into containers for disposal;
- Good personal hygiene should be practised to minimise the potential for ingestion;
- A copy of the MSDS should be easily accessible to employees.

If the conditions of use are varied, greater exposure of the public to the notified chemical will occur. Under such circumstances, further information will be required in order to assess the risks to public health.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of the notified chemical shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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Attachment 1

The Draize Scale for evaluation of skin reactions is as follows:

Erythema Formation	*Rating*	*Oedema Formation*	*Rating*
No erythema	0	No oedema	0
Very slight erythema (barely perceptible)	1	Very slight oedema (barely perceptible)	1
Well-defined erythema	2	Slight oedema (edges of area well-defined by definite raising	2
Moderate to severe erythema	3	Moderate oedema (raised approx. 1 mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1 mm and extending beyond area of exposure)	4

The Draize scale for evaluation of eye reactions is as follows:

CORNEA

Opacity	*Rating*	*Area of Cornea involved*	*Rating*
No opacity	0 none	25% or less (not zero)	1
Diffuse area, details of iris clearly visible	1 slight	25% to 50%	2
Easily visible translucent areas, details of iris slightly obscure	2 mild	50% to 75%	3
Opalescent areas, no details of iris visible, size of pupil barely discernible	3 moderate	Greater than 75%	4
Opaque, iris invisible	4 severe		

CONJUNCTIVAE

Redness	*Rating*	*Chemosis*	*Rating*	*Discharge*	*Rating*
Vessels normal	0 none	No swelling	0 none	No discharge	0 none
Vessels definitely injected above normal	1 slight	Any swelling above normal	1 slight	Any amount different from normal	1 slight
More diffuse, deeper crimson red with individual vessels not easily discernible	2 mod.	Obvious swelling with partial eversion of lids	2 mild	Discharge with moistening of lids and adjacent hairs	2 mod.
Diffuse beefy red	3 severe	Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
		Swelling with lids half-closed to completely closed	4 severe		

IRIS

Values	*Rating*
Normal	0 none
Folds above normal, congestion, swelling, circumcorneal injection, iris reacts to light	1 slight
No reaction to light, haemorrhage, gross destruction	2 severe