

File No: NA/521

October 1997

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

Amine Curative T-4113

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

For the purposes of subsection 78(1) of the Act, copies of this full public report may be inspected by the public at the Library, Worksafe Australia, 92-94 Parramatta Road, Camperdown NSW 2050, between the following hours:

Monday - Wednesday	8.30 am - 5.00 pm
Thursday	8.30 am - 8.00 pm
Friday	8.30 am - 5.00 pm

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

For enquiries please contact the Administration Coordinator at:

Street Address: 92 Parramatta Rd Camperdown, NSW 2050, AUSTRALIA

Postal Address: GPO Box 58, Sydney 2001, AUSTRALIA

Telephone: (61) (02) 9577-9466 **FAX** (61) (02) 9577-9465

Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT**Amine Curative T-4113****1. APPLICANT**

3M Australia Pty Ltd of 950 Pacific Highway PYMBLE NSW 2073 has submitted a standard notification statement in support of their application for an assessment certificate for Amine Curative T-4113.

2. IDENTITY OF THE CHEMICAL

Amine Curative T-4113 is not considered to be hazardous based on the nature of the chemical and the data provided. Therefore the chemical name, CAS number, molecular and structural formulae, spectral data, details of exact import volume, specific use and identity of impurities have been exempted from publication in the Full Public Report and the Summary Report.

**Marketing Name
of Product:**

3M PR500 Moulding Resin (contains
30 - 60% of the notified chemical)

3. PHYSICAL AND CHEMICAL PROPERTIES**Appearance at 20°C
and 101.3 kPa:**

white/cream to tan coloured powder.

Melting Point:

201-202°C

Boiling Point:

decomposes before boiling at > 300°C

Density:

$D^{20}_4 = 1.394$ at 20°C

Vapour Pressure:

3.46×10^{-10} kPa at 25°C

Water Solubility:

< 0.052 mg/L at 20°C

Hydrolysis:

not determined

Partition Co-efficient:

$\log P_{ow} > 4.49$ at 21°C

Dissociation Constant:

not determined

Surface Activity: 71.0 mN/m at 24°C

Fat Solubility: 796.6 mg/100 g fat at 37°C

Comments on Physico-Chemical Properties

The water solubility of the notified chemical was determined to be less than the limit of detection for the column elution method (5.2×10^{-5} g/L), and is described as practically insoluble.

Determination of hydrolysis, adsorption/desorption and dissociation was not attempted due to the low water solubility of the notified chemical. The chemical does not contain any hydrolysable groups. It contains two aromatic amines that are ionisable. However, due to the extremely low water solubility, measurement of the pK_a would be very difficult. Note that under acidic conditions water solubility may increase due to protonation of these amines. It is expected that the notified chemical will strongly absorb to organic matter in soils and sediment due to its high partition co-efficient and practically insoluble nature.

The notified chemical is not expected to be surface active. By definition, a chemical has surface activity when the surface tension is less than 60 mN/m.

4. PURITY OF THE CHEMICAL

Degree of Purity: 97%

Additives/Adjuvants: none

5. USE, VOLUME AND FORMULATION

The notified chemical is to be imported as a component (30 - 60%) of 3M PR500 moulding resin to be used in the manufacture of vehicle parts for the aerospace industry at a rate of up to 10 tonnes per year for the first 5 years.

6. OCCUPATIONAL EXPOSURE

The notified substance will be imported as part of an epoxy product which will be used to produce vehicle parts for the aerospace industry. The product is imported in sturdy 20 litre pails. The pails are warmed in water in a sealed heating vessel to liquify the contents which are then pumped out directly into moulds containing carbon fibres. The moulds are heated to approximately 180°C for curing and release of vapours during curing is stated not to occur.

Worker contact with the product containing the notified substance is expected to be minimal. The most likely route of exposure is via the skin.

7. PUBLIC EXPOSURE

The notified chemical or moulded articles will not be sold to the public. Although public contact with the articles may occur, exposure is expected to be negligible considering the physical nature of the moulded articles. Waste will be cured before being disposed of to landfill. Therefore, negligible public exposure is expected to occur except in the case of accidental spillage. However, spills are expected to be contained with absorbent materials and disposed of in a cured form.

8. ENVIRONMENTAL EXPOSURE

Release

The dispensing system used to transfer the notified chemical to the moulds is dedicated, and pumplines are purged with air to get maximum resin into the moulds. As such, residues from pumplines will be minimal, with the notifier indicating around 0.2%. Release of vapours during high temperature polymerisation does not occur.

Any residues remaining in the pails are combined, polymerised and disposed to landfill, prior to the pails being returned to the notifier for reuse.

Fate

Any off specification material and polymerised residues from pails will be disposed of to landfill, where the notified chemical will remain immobile through being incorporated in a solid polymer matrix.

Biodegradation of the chemical was studied using a closed bottle test (OECD TG 301). After 28 days, approximately 2% of the theoretical oxygen demand had been consumed, indicating that the substance is not readily biodegradable. No indication was given to whether there was any inhibition of microbial activity under the test conditions.

A bioaccumulation study on the notified chemical has not been conducted. The molecular weight, lack of biodegradation, low degree of ionisation and high partition coefficient observed in the notified chemical are all features that may give rise to bioaccumulation (1). However, there will be minimal exposure to the aquatic environment from the proposed use.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Summary of the acute toxicity of CAF

Test	Species	Outcome	Reference
acute oral toxicity	rat	LD ₅₀ > 5 000 mg/kg	(2)
acute dermal toxicity	rat	LD ₅₀ > 2 000 mg/kg	(3)
skin irritation	rabbit	non-irritant	(4)
eye irritation	rabbit	slight irritant	(5)
skin sensitisation	guinea pig	non-sensitiser	(6)

9.1.1 Oral Toxicity (2)

<i>Species/strain:</i>	rat/Sprague-Dawley
<i>Number/sex of animals:</i>	5/sex
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	gavage; vehicle: corn oil
<i>Clinical observations:</i>	no significant observations
<i>Mortality:</i>	none
<i>Morphological findings:</i>	none related to treatment
<i>Test method:</i>	according to OECD Guidelines (7)
<i>LD₅₀:</i>	> 5 000 mg/kg
<i>Result:</i>	the notified chemical was of low oral toxicity in rats

9.1.2 Dermal Toxicity (3)

<i>Species/strain:</i>	rat/Sprague-Dawley
<i>Number/sex of animals:</i>	5/sex
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	the test substance was applied under occlusive dressing for 24 hours

<i>Clinical observations:</i>	none
<i>Mortality:</i>	none
<i>Morphological findings:</i>	none
<i>Test method:</i>	according to OECD Guidelines (7)
<i>LD₅₀:</i>	> 2 000 mg/kg
<i>Result:</i>	the notified chemical was of low dermal toxicity in rats

9.1.3 Inhalation Toxicity

Not done.

9.1.4 Skin Irritation (4)

<i>Species/strain:</i>	rabbit/New Zealand White
<i>Number/sex of animals:</i>	2 males/1 female
<i>Observation period:</i>	3 days
<i>Method of administration:</i>	0.5 g of the test substance in 0.9% saline was applied for 4 hours under a semi-occlusive dressing
<i>Test method:</i>	according to OECD Guidelines (7)
<i>Result:</i>	the notified chemical was not a skin irritant in rabbits; no Draize (8) scores greater than zero were recorded

9.1.5 Eye Irritation (5)

<i>Species/strain:</i>	rabbit/New Zealand White
<i>Number/sex of animals:</i>	3/not specified
<i>Observation period:</i>	3 days
<i>Method of administration:</i>	0.1 mL instilled into the conjunctival sac of one eye with the contralateral eye serving as control

Draize scores (8) of unirrigated eyes:

no corneal or iridal effects were observed at any time point

<i>Animal</i>	<i>Time after instillation</i>											
	<i>1 hour</i>			<i>1 day</i>			<i>2 days</i>			<i>3 days</i>		
<i>Conjunctiva</i>	<i>r^a</i>	<i>c^b</i>	<i>d^c</i>	<i>r^a</i>	<i>c^b</i>	<i>d^c</i>	<i>r^a</i>	<i>c^b</i>	<i>d^c</i>	<i>r^a</i>	<i>c^b</i>	<i>d^c</i>
1	2	1	0	1	1	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	0	0

¹ see Attachment 1 for Draize scales
^a redness ^b chemosis ^c discharge

Test method: according to OECD Guidelines (7)

Result: the notified chemical was a slight eye irritant in rabbits

9.1.6 Skin Sensitisation (6)

Species/strain: guinea pig/Dunkin-Hartley

Number of animals: 10 control/20 test

Induction procedure: 3 pairs of intradermal injections (0.1 mL) in the scapular region consisting of:

- Freund's Complete Adjuvant (FCA) diluted 1:1 with water
- 2.5% of the test substance in Alembicol D
- 2.5% of the test substance in a 1:1 mixture of Alembicol D and FCA

one week following the injection topical induction was performed by applying 0.4 mL of the test substance at a concentration of 70% w/w in Alembicol D under occlusive dressing for 48 hours

Challenge procedure: challenge was performed by applying 0.2 mL of the test substance at a concentration of 50% w/w or 25% w/w in Alembicol D under occlusive dressing for 24 hours

Challenge outcome:

Challenge concentration	Test animals		Control animals	
	24 hours*	48 hours*	24 hours	48 hours
25%	0/20**	0/20	0/10	0/10
50%	0/20	0/20	0/10	0/10

* time after patch removal

** number of animals exhibiting positive response

Test method: according to EC Guidelines (9)

Result: the notified chemical was not a skin sensitiser in guinea pigs at the concentrations tested

9.2 Repeated Dose Toxicity

9.2.1 28-day oral repeat dose study (10)

Species/strain: rat/Crl:CD SD BR VAF/Plus

Number/sex of animals: 5/sex/dose group

Method of administration: gavage in 1% aqueous methylcellulose

Dose/Study duration: dose levels of 0 (control), 10 (low), 100 (mid) and 1 000 (high) mg/kg/day for 28 days

Clinical observations: no signs attributable to treatment

Clinical chemistry/Haematology: *clinical chemistry:* slight lowering of total protein in treated female rats, slight changes in sodium and potassium levels among male rats, sodium, calcium and phosphorus levels among female rats and chloride levels among all treated rats did not exhibit dose-response and appeared unrelated to treatment

haematology: reduced total white blood cell count and level of lymphocytes in female rats of the high dose group were due to the results for a single animal and control values being slightly higher than normal

Organ weights: increased adjusted liver and adrenal weights for female rats in the high dose group

<i>Macroscopic pathology:</i>	enlarged kidneys for one female of the low dose group was thought to be incidental
<i>Histopathology:</i>	minimal centrilobular hepatocyte enlargement in the liver of one female rat of the high dose group considered to be an adaptive response
<i>Test method:</i>	according to OECD Guidelines (7)
<i>Result:</i>	no signs of systemic toxicity could be attributed to the notified chemical at oral doses up to 1 000 mg/kg/day for 28 days

9.2.2 90-day oral repeat dose study (11)

<i>Species/strain:</i>	rat/Sprague-Dawley
<i>Number/sex of animals:</i>	10/sex/dose group
<i>Method of administration:</i>	gavage in 1% aqueous methylcellulose
<i>Dose/Study duration:</i>	dose levels of 0 (control), 10 (low), 100 (mid) and 1 000 (high) mg/kg/day for 90 days
<i>Clinical observations:</i>	no signs attributable to treatment
<i>Clinical chemistry/Haematology:</i>	<p><i>clinical chemistry:</i> no dose-related changes observed</p> <p><i>haematology:</i> no statistically significant differences between treated and control groups</p>
<i>Organ weights:</i>	no dose-related changes; slightly increased liver weight in mid-dose males was attributed to greater variability in this group
<i>Macroscopic pathology:</i>	enlarged kidneys for one female of the low dose group was thought to be incidental
<i>Histopathology:</i>	no distinct or consistent test article-related microscopic changes
<i>Test method:</i>	according to OECD Guidelines (7)
<i>Result:</i>	no signs of systemic toxicity could be attributed to the notified chemical at oral doses up to 1 000 mg/kg/day for 90 days

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* Reverse Mutation Assay (12)

<i>Strains:</i>	TA 1535, TA 1537, TA 1538, TA 98, TA 100
<i>Concentration range:</i>	10 - 5 000 µg/plate
<i>Test method:</i>	Maron and Ames (13)
<i>Result:</i>	the notified chemical did not induce back mutation to prototrophy in any of the strains tested; metabolic activation by rat liver S9 fraction had no effect on observed mutation frequency; precipitation at 5 000 µg/plate may have produced unreliable colony counts so that the upper dose limit should be considered to be 1 000 µg/plate

9.3.2 *Saccharomyces cerevisiae* Recombination Assay (12)

<i>Strain:</i>	<i>S. cerevisiae</i> D3
<i>Concentration range:</i>	0.025 - 2.5% w/v
<i>Test method:</i>	not stated
<i>Result:</i>	the notified chemical was not recombinogenic in <i>S. cerevisiae</i> D3 in either the presence or absence of metabolic activation provided by rat liver S9 fraction following a 4 hour treatment at 30°C

9.3.3 Micronucleus Assay in the Bone Marrow Cells of the Mouse (14)

<i>Species/strain:</i>	mouse/CD-1
<i>Number and sex of animals:</i>	10/sex per dose group
<i>Doses:</i>	0, 2 000 mg/kg
<i>Method of administration:</i>	intraperitoneal
<i>Test method:</i>	according to EC Guidelines (15)
<i>Result:</i>	the notified chemical did not induce a statistically significant increase in micronucleated polychromatic erythrocytes at either the 24 hour or 48 hour sampling time

9.3.4 Chromosomal Aberrations in Cultured Human Lymphocytes (16)

<i>Species/strain:</i>	<i>Homo sapiens</i>
<i>Treatment regime:</i>	lymphocyte activation by 2% phytohaemagglutinin for 48 hours followed by 22 hour treatment with the test substance and 2 hours in 0.25 µg/mL colchicine to arrest mitosis; concentrations of test substance were 3.1, 12.5 and 30 µg/mL without metabolic activation (rat liver S9 fraction), 12.5, 50 and 100 µg/mL with S9
<i>Test method:</i>	according to OECD Guidelines (7)
<i>Result:</i>	the notified chemical did not induce a statistically significant increase in chromosomal aberrations in either the presence or absence of metabolic activation provided by rat liver S9 fraction

9.4 Overall Assessment of Toxicological Data

The notified chemical exhibited low acute toxicity by the oral ($LD_{50} > 5\,000$ mg/kg) and dermal ($LD_{50} > 2\,000$ mg/kg) routes. No systemic toxicity was identified in oral repeat dose studies for periods of either 28 or 90 days at doses up to 1 000 mg/kg/day. The notified chemical was not a skin irritant but was a slight eye irritant in rabbits, was not a skin sensitiser in guinea pigs and was not genotoxic as judged by negative results in a *S. typhimurium* mutagenicity study, a recombinogenicity assay in *S. cerevisiae*, a mouse bone marrow micronucleus test and induction of chromosomal aberrations in cultured human lymphocytes.

The notified chemical would not be classified as hazardous in accordance with Worksafe Australia's *Approved Criteria for Classifying Hazardous Substances* (Approved Criteria) (17) in relation to the toxicological studies submitted.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following ecotoxicity studies have been supplied by the notifier. The tests were carried out to OECD Test Methods in compliance with Good Laboratory Practice Standards.

Test	Species	Results
Acute Toxicity* 96 hour Semi-static	Rainbow Trout (<i>Oncorhynchus mykiss</i>)	LC ₅₀ > 6.5 mg/L NOEC ≥ 6.5 mg/L
Acute Immobilisation# 48 hour Static	Water Flea (<i>Daphnia magna</i>)	EC ₅₀ = 1.1 mg/L NOEC = 0.8 mg/L

* Only one test concentration, mean measured 6.5 mg/L (10.0 mg/L nominal)

Mean measured concentrations tested 0.083, 0.13, 0.28, 0.48, 0.80, 1.7, 2.7, 4.2 and 4.5 mg/L.

The values of 6.5 mg/L and 4.5 mg/L (rainbow trout and water flea tests, respectively) were the highest concentrations that could be prepared, having regard to the amount of auxiliary solvent permitted. Near nominal concentrations could not be maintained in the studies due to the very low water solubility of the notified chemical. The notifier claims that the apparent “loss” was due to settlement. This was seen at levels in excess of 10 mg/L (nominal), where most of the test sample was seen to form a precipitate.

The results show the notified chemical to be non-toxic to fish up to the limit of its solubility. No mortalities or other adverse reactions observed during the fish testing. However, the chemical is described as moderately to highly toxic to aquatic invertebrates, with 85% of the water fleas immobilised at 1.7 mg/L after 48 hours. No algal growth inhibition data were supplied. This data omission is accepted on the basis of the chemical's expected negligible release to the environment, and the aquatic compartment in particular. However, based on the chemical's toxicity to other aquatic organisms, and the fact that a similar monomer previously assessed showed inhibitory effects to algae at extremely low concentrations (0.38 µg/L), it is expected that the notified chemical could show considerable toxicity to algae at very low concentrations, *ie* less than 1 mg/L.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notified chemical will be manufactured into moulded composites at one site only in Australia, located in Melbourne. The moulded articles are typically used in the aerospace industry, and once moulded, the notified chemical is very unlikely to present an environmental hazard.

Prior to manufacture, the chemical is transported by road from Sydney to Melbourne. The imported product (containing the notified chemical at 30 - 60% w/w) is highly viscous, described in the submission as a paste. As such, any accidental spillage should be easily contained, and should not present a hazard. Considering the notified chemical's high toxicity to aquatic invertebrates (*Daphnia magna* NOEC = 0.8 mg/L) and predicted very high toxicity to algae, all precautions should be taken to avoid it entering waterways.

Around 0.2% of the notified chemical is expected to be lost per annum through residues from pumping lines during manufacture of moulded articles. As a worst case, if this were to enter the sewage (assuming manufacture occurs on 260 days of

the year and a daily effluent output from the sewer is 250 ML), the concentration in the sewage treatment plant (STP) will be around 0.35 ppb. The low water solubility and high partition coefficient suggest the majority of this will be lost to sludge within the STP, which will be landfilled or incinerated. Minimal amounts only would be expected to enter receiving waters where it would be diluted even further. Although the amounts reaching aquatic systems based on these figures are likely to provide a sufficient safety margin, the predicted strong ability of the notified chemical to inhibit algal growth makes any release to sewer undesirable. The preferred method of disposal is polymerisation followed by landfill.

While the chemical could bioaccumulate in theory, the hazard is anticipated to be minimal due to the expected very low exposure to the aquatic compartment and its very low water solubility (1).

When used in the proposed manner, the use of the notified chemical is expected to have a low potential for environmental hazard.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The toxicological studies provided suggest that the notified chemical is not a health hazard in terms of acute or chronic toxicity, skin irritancy, skin sensitisation or genotoxicity. There may be a potential for slight eye irritation although the chemical would not be classified as hazardous according to the Approved Criteria.

Exposure of workers involved in transport and storage of the notified chemical is expected to be minimal except in the event of an accident.

Exposure of workers involved in producing the moulded articles is also expected to be minimal in view of the enclosed system in which the imported container is placed prior to liquifying its contents by heating. The liquified contents are pumped out into moulds containing carbon fibres and heated to 180°C for solidification. No contact with the liquid product is likely and vapours are removed by local exhaust ventilation.

The risk of adverse health effects to workers or the public from transport, storage, use or disposal of the notified chemical is expected to be minimal in view of its low hazard and limited opportunity for exposure.

The imported product containing the notified chemical is classified as hazardous according to the Approved Criteria (see Material Safety Data Sheet (MSDS)). One of the epoxy resin components (CAS No. 1675-54-3) is a skin sensitiser and an irritant (18) and is present at a concentration of at least 15% which is above the threshold for classification of the resin as hazardous (1% for sensitising effects). Therefore, there is an occupational health risk of skin sensitisation and skin irritation which needs to be minimised by the wearing of personal protective equipment as described below. The risk to the public of skin sensitisation or irritancy is expected to be minimal given the limited opportunity for public exposure.

13. RECOMMENDATIONS

To minimise exposure to the notified chemical the following guidelines and precautions should be observed:

- Spillage of the notified chemical should be avoided, spillages should be cleaned up promptly which should then be put into containers for disposal or recycling;
- Good personal hygiene should be practised to minimise the potential for ingestion;
- A copy of the relevant MSDS should be easily accessible to employees

When handling the imported resin (see attached MSDS) exposure should be minimised by:

- Wearing gloves which conform to Australian Standard (AS) 2161 (19);
- Wearing industrial clothing which conforms to AS 2919 (20);
- Curing drum residues prior to disposal

To limit environmental exposure, the chemical should not be allowed to enter drains or waterways.

14. MATERIAL SAFETY DATA SHEET

The MSDS for a formulation containing the notified substance was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (21).

The MSDS was provided by the applicant as part of the notification statement. The accuracy of this information remains the responsibility of the applicant.

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

1. Connell, D.W. 1989, 'General characteristics of organic compounds which exhibit bioaccumulation', in *Bioaccumulation of Xenobiotic Compounds*, CRC Press, Boca Raton.
2. Glaza, S.M. 1988, *Acute Oral Toxicity Study in Rats*, Project no., 71105005, Hazelton Laboratories America Inc, WI, USA.
3. Baldrick, P. 1991, *Acute Dermal Toxicity to the Rat of T-4113*, Project no., 915D/Min 39/AC, Huntingdon Research Centre Ltd, Cambridgeshire, England.
4. Glaza, S.M. 1988, *Primary Dermal Irritation/Corrosion Study in Rabbits*, Project no., 71105006, Hazelton Laboratories America Inc, WI, USA.
5. Glaza, S.M. 1988, *Primary Eye Irritation/Corrosion Study in Rabbits*, Project no., 71105007, Hazelton Laboratories America Inc, WI, USA.
6. Parcell, I. & Healing, G. 1991, *Skin Sensitisation in the Guinea-Pig of T-4113*, Project no., 91387D/Min 49/SS, Huntingdon Research Centre Ltd, Cambridgeshire, England.
7. Organisation for Economic Co-operation and Development 1995-1996, *OECD Guidelines for the Testing of Chemicals on CD-Rom*, OECD, Paris.
8. Draize, J.H. 1959, 'Appraisal of the Safety of Chemicals in Foods, Drugs and Cosmetics', *Association of Food and Drug Officials of the US*, vol. 49, pp. 2-56.
9. European Economic Community 1984, *EEC Directive 84/449/EEC on the Approximation of the Laws, Regulations and Administrative Provisions Relating to the Classification, Packaging and Labelling of Dangerous Preparations*, OJ No. L251.
10. Edwards, J.A.e.a. 1991, *Twenty-Eight Day Oral Toxicity Study in Rats with T-4113*, Project no., 91387D/Min 49/SS, Huntingdon Research Centre Ltd, Cambridgeshire, England.
11. Botta Jr., J.A. 1993, *Ninety Day Oral Toxicity Evaluation in Rats with T-4113*, Project no., 464A-101-034-92, T.P.S. Inc, IN, USA.
12. Noke, M.A. 1988, *In vitro Microbiological Mutagenicity Assays of 3M Company's Compound T-4113*, Project no., LSC-1537, SRI International, CA, USA.
13. Maron, D.M. & Ames, B.N. 1983, 'Revised Methods for *Salmonella* Mutagenicity Test', *Mutation Research*, vol. 113, pp. 173-215.

14. Proudlock, R.J. 1994, *T-4113 Mouse Micronucleus Test*, Project no., MIN 149/941507, Huntingdon Research Centre Ltd, Cambridgeshire, England.
15. European Economic Community 1992, *EEC Directive 92/69/EEC on the Approximation of the Laws, Regulations and Administrative Provisions Relating to the Classification, Packaging and Labelling of Dangerous Preparations*, OJ No. L383.
16. Adams, K., King, J.D., Gray, V.M. & Howell, A. 1991, *T-4113 Metaphase Chromosome Analysis of Human Lymphocytes Cultured in vitro*, Project no., MIN 36/91246, Huntingdon Research Centre Ltd, Cambridgeshire, England.
17. National Occupational Health and Safety Commission 1994, *Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1994)]*, Australian Government Publishing Service, Canberra.
18. National Occupational Health and Safety Commission 1994, *List of Designated Hazardous Substances [NOHSC:10005(1994)]*, Australian Government Publishing Service, Canberra.
19. Standards Australia 1978, *Australian Standard 2161-1978, Industrial Safety Gloves and Mittens (excluding electrical and medical gloves)*, Standards Association of Australia, Sydney.
20. Standards Australia 1987, *Australian Standard 2919-1987, Industrial Clothing*, Standards Association of Australia, Sydney.
21. National Occupational Health and Safety Commission 1994, *National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]*, Australian Government Publishing Service, Canberra.

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