File No: NA/363

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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

TINUVIN 1577 FF

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, Sport, and Territories and the assessment of public health is conducted by the Department of Human Services and Health.

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

TINUVIN 1577 FF

1. APPLICANT

Ciba-Geigy Australia Ltd of 235 Settlement Road THOMASTOWN VIC 3074 has submitted a standard notification statement in support of their application for an assessment certificate for Tinuvin 1577 FF.

2. IDENTITY OF THE CHEMICAL

Chemical Name:	2-(4,6-diphenyl-1,3,5-triazin-2-yl)-5-[(hexyl)oxy]-phenol
Chemical Abstracts Service (CAS) Registry No.:	147315-50-2
Other Names:	TKA 40046
Trade Name:	Tinuvin 1577 FF
Molecular Formula:	$C_{27}H_{27}N_3O_2$
Structural Formula:	
Molecular Weight:	425.53
Method of Detection and Determination:	methods of detection and determination include nuclear magnetic resonance (NMR) and infrared (IR) spectroscopy and elemental analysis
Spectral data:	**IR:** major characteristic peaks were observed

at: 605, 625, 645, 685, 730, 765, 785, 795, 820, 845, 925, 1000, 1020, 1050, 1065, 1110, 1120, 1170, 1185, 1190, 1230, 1260, 1285, 1350, 1365, 1425, 1455, 1510, 1530, 1585, 1630, 2930, 2960, 2970, 3030 cm^{-1}

NMR: NMR spectrum was provided and was in agreement with the given structure of Tinuvin 1577 FF

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	yellow solid
Melting Point:	149°C
Density:	1191 kg/m^3 at 20°C
Vapour Pressure:	9 x 10^{-10} Pa at 25°C; 9.49 x 10^{-8} Pa at 50°C 1.27 Pa at 200°C
Water Solubility:	< 3 x 10^{-7} g/L at 20°C at pH 6.9 -7.3
Partition Co-efficient (n-octanol/water):	log P_{ow} = 7.18
Hydrolysis as a Function of pH:	not determined
Fat Solubility:	1 g/100 g of fat at 37°C
Adsorption/Desorption:	not determined
Dissociation Constant:	not determined
Flash Point:	not applicable
Flammability Limits:	not flammable
Autoignition Temperature:	no self-ignition
Explosive Properties:	not explosive
Reactivity/Stability:	not an oxidising agent; stable
Particle Size Distribution:	median: 11.7 µm (39.2% < 12 µm) range: 1 - 128 µm

Comments on Physico-Chemical Properties

Hydrolysis as a function of pH was not determined due to the very low solubility of the chemical. Considering the chemical's solubility of 3 x 10^{-7} g/L, to estimate hydrolysis the detection limit of the analytical method must be at least 1/40th of the solubility, ie. 7.5 x 10^{-9} g/L. This is beyond the detection limit of the available analytical methods. There are no functional groups likely to hydrolyse in the environmental pH range of 5 to 9.

A preliminary measurement of octanol/water partition coefficient using the shake flask method (OECD No. 107) yielded a Log P of > 5.26. The shake flask method is valid only for a Log P range of -2 to 4 and the above result indicated that the expected Log P lies outside this range. The Log P_{ow} was therefore estimated using the calculation method (OECD No. 117 Annex) and the computer program CLOGP as 7.18.

Adsorption/desorption data cannot be obtained due to the very low solubility of the chemical in water. The notifier has requested for exemption of this data on the grounds that the chemical is encapsulated in cured polymer films during applications. The high Log P_{ow} indicates that the chemical is likely to sorb strongly to sediment particulates.

Dissociation constant was not measured due to the very low solubility, relatively high molecular weight and the absence of easily dissociable groups.

The substance is not surface active.

4. PURITY OF THE CHEMICAL

Degree of purity: 99.5%

Impurity:

Chemical name:	2-(2,6-dihydroxyphenyl)-4,6-diphenyl-,1,3,5-triazine
Weight percentage:	1% (maximum)

Additives/Adjuvants: none

5. USE, VOLUME AND FORMULATION

The notified chemical is intended to be used as a UV absorber in polymers to counteract breakdown by weather and in particular, UV. The notified chemical is intended to be imported in 25 kg fibreboard boxes at a rate of up to 2 tonnes in the

first year rising to 15 tonnes per year in the fifth year.

Tinuvin 1577 FF will be added at the rates of 0.1-8% to the powdered or granular polymer material, blended to achieve homogeneity and fed into extruders or moulding machines. It is then used in the manufacture of high quality polycarbonate roofing sheets, engineering plastics and laminating films.

6. OCCUPATIONAL EXPOSURE

The notified chemical is to be imported in a granular form which is stated to be non-dusting. After weighing out, the granules are added to a blender containing the granulated plastic to produce the masterbatch. This is not necessarily a closed system. Exposure to the skin, eye and by inhalation is possible during these operations and is expected to be greatest during blending although the notified chemical is expected to become bound to the plastic granules.

Following blending the plastic masterbatch is added to the hoppers of machinery for melting the plastic and forming it into either polycarbonate sheets or engineering plastic articles such as gears. Exposure should be minimal during these operations. The notified chemical is expected to be bound within the masterbatch and within the moulded articles.

7. PUBLIC EXPOSURE

The polymers containing the notified chemical, will be used in housing applications, eg polycarbonate roof sheeting, in engineering plastics and laminated films. The notifier claims that over 50% effective UV absorption can be expected after 10 years exposure to Australia weather conditions.

The public will not, in general, contact the polymers containing the UV absorber. In the unlikely event of dermal contact with the polymers, the notifier has stated that the chemical is encapsulated, and locked into the polymer structure. Leaching of the notified chemical, as a result of polymer weathering or disposal, is negligible.

Minor public exposure may result from disposal of unused chemical, or accidental spillage of the chemical during transport and storage. However, adequate measures are described by the notifier to minimise the risk of public exposure during disposal, or in the event of accidental spillage.

8. ENVIRONMENTAL EXPOSURE

Release

It is stated that no waste is generated during these formulations but this appears to

overlook that routine cleaning of the process equipment may be needed to maintain operational efficiency. Notifier states that fairly high cost of the chemical would make users to have incentives to conserve all material purchased.

Incineration or disposal to landfill are the recommended methods of disposal for minor wastes (eg trimmings) as well as contaminated packaging material, with incineration being the preferred method.

It is expected to replace some of the other UV stabilisers currently used in Australia due to superior qualities such as very high UV screen activity, low volatility and good compatibility with a variety of polymers, leaving minimum deposits on moulds.

Three possible routes by which the chemical may enter the environment through its use are (a) gradual weathering of sheets and (b) discard of articles to landfill or for incineration and (c) volatilisation during curing. None of these routes are likely to give rise to significant environmental release of the chemical which is expected to remain encapsulated in the plastic by virtue of its minimal water solubility, very low volatility and stability to heat and light.

Fate

Tinuvin 1577 FF is expected to remain encapsulated within the cured polymer material. Due to its very low solubility, leaching of the chemical from waste disposed to landfill or during slow weathering of articles is unlikely. The low solubility and high Log P_{ow} indicate that the chemical will bind strongly to sediment particles in soil. Incineration will break down the chemical producing water vapour and oxides of carbon and nitrogen.

Ready biodegradability investigated in a modified Sturum test (OECD guideline No. 301 B) showed that there was only 2% biodegradation after 28 days in a solution concentration of 10.1 mg/L. Hence the notified chemical is not readily biodegradable.

Although the chemical has a very low water solubility (<3 x 10^{-7} g/L) and a high fat solubility (1000 g/100 g fat) resulting in a high calculated Log P_{ow} of 7.18, the company has not carried out a bioaccumulation test because significant bioaccumulation would be unlikely owing to the very few locations where the chemical will be used and the lack of a delivery mode through water to aquatic organisms. This is acceptable.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Summary of the acute toxicity of Tinuvin 1577 FF

Test	*Species*	*Outcome*	*Reference*
acute oral toxicity	rat	LD_{50} > 2000 mg/kg	(1)
acute dermal toxicity	rat	LD_{50} > 1333 mg/kg	(3)
skin irritation	rabbit	not irritant	(4)
eye irritation	rabbit	slight irritant	(5)
skin sensitisation	guinea pig	non sensitiser	(7)

9.1.1 Oral Toxicity (1)

Species/strain:	Rat/ Tif: RAI f (SPF)
Number/sex of animals:	5/sex
Observation period:	14 days
Method of administration:	gavage; vehicle, 0.5% (w/v) carboxymethylcellulose in 0.1% (w/v) aqueous polysorbate 80
Clinical observations:	piloerection, hunched posture, dysnea, reduced locomotor activity - recovery within 7 days
Mortality:	none
Morphological findings:	spotted thymus in one female
Test Method:	OECD Guidelines for Testing of Chemicals (2)
LD_{50}:	> 2000 mg/kg
Result:	low oral toxicity in a limit test - single dose of 2000 mg/kg

9.1.2 Dermal Toxicity (3)

Species/strain:	Rat/ Tif: RAI f (SPF)
Number/sex of animals:	5/sex
Observation period:	14 days
Method of administration:	semiocclusive gauze dressing; 24 hour

	treatment; vehicle, 0.5% (w/v) carboxymethylcellulose in 0.1% (w/v) aqueous polysorbate 80
Clinical observations:	piloerection, hunched posture - recovery in 2 days
Mortality:	none
Morphological findings:	spotted thymus in 2 males
Test Method:	OECD Guidelines for Testing of Chemicals (2)
LD_{50}:	> 1333 mg/kg
Result:	low dermal toxicity in a limit test - single dose of 1333 mg/kg administered (dose limited by viscosity of solution)

9.1.3 Inhalation Toxicity: not determined.

9.1.4 Skin Irritation (4)

Species/strain:	Rabbit/ New Zealand White
Number/sex of animals:	3 females
Observation period:	72 hours
Method of administration:	0.5 g of solid under gauze patch and aluminium foil for 4 hours
Test Method:	OECD Guidelines for Testing of Chemicals (2)
Result:	not a skin irritant; no erythema or oedema observed up to 72 hours after decontamination

9.1.5 Eye Irritation (5)

Species/strain:	Rabbit/ New Zealand White
Number/sex of animals:	3/ females
Observation period:	72 hours
Method of administration:	0.1 mL (24 mg) into the conjunctival sac of the left eye

Draize Scores (6) of unirrigated eyes:

	Time after instillation							
Animal	***1 hour***		***1 day***		***2 days***		***3 days***	
Cornea	no score greater than 0							
Iris								
1	0		0		0		0	
2	1		0		0		0	
3	0		0		0		0	
Conjunctiva	***r[c]***	***c[d]***	***r[c]***	***c[d]***	***r[c]***	***c[d]***	***r[c]***	***c[d]***
1	1	1	1	0	0	0	0	0
2	1	1	1	0	0	0	0	0
3	1	0	1	0	0	0	0	0

See Attachment 1 for Draize Scales
[c] Redness [d] Chemosis

Test Method: OECD Guidelines for Testing of Chemicals (2)

Result: slight eye irritant in rabbits

9.1.6 Skin Sensitisation (7)

Species/strain: Guinea pig/ Pirbright White (Tif: DHP)

Number of animals: 20 test, 10 control

Induction procedure: 3 pairs of intradermal injections:
- FCA/saline 1:1
- 5% notified chemical in arachid oil
- 5% notified chemical in FCA/saline 1:1

after one week occluded application of the notified chemical (40% w/w) in vaseline for 48 hours with 10% sodium lauryl sulphate applied 24 h prior to application

Challenge procedure: after 4 weeks occluded administration of 40%

(w/w) notified chemical in vaseline for 24 h

Challenge outcome:

	Test animals		Control animals	
Challenge concentration	***24 hrs****	***48 hrs****	***24 hrs***	***48 hrs***
40%	0/20**	0/20	0/10	0/10

* Time after patch removal
** Number of animals exhibiting positive response

Test Method: OECD Guidelines for Testing of Chemicals (2)

Result: not a skin sensitiser in guinea pigs

9.2 Repeated Dose Toxicity (8)

Species/strain: Rat/ Tif: RAIf (SPF)

Number/sex of animals: 10 males, 10 females in control and high dose
5 males, 5 females in low and mid dose groups

Method of administration: orally (in the diet)

Dose/Study duration:: control, low, mid and high dose groups (respectively) calculated as: 0, 8.95, 59.1 or 1130 mg/kg/day for males and 0, 8.62, 55.5 or 1090 mg/kg/day for females; feeding of the notified chemical continued for 4 weeks with a 4 week recovery period for groups of 5 males and females in the control and high dose groups

Clinical observations: no clinical signs

Clinical chemistry/Haematology no effect on haematological profile or clinical chemistry parameters

Histopathology: no treatment-related changes

Test Method: OECD Guidelines for Testing of Chemicals (2)

Result: no organ toxicity observed; no signs of toxicity at any dose

9.3 Genotoxicity

9.3.1 Salmonella typhimurium and Escherichia coli Reverse Mutation Assay (9)

Strains:	TA 1535, TA 1537, TA 98 and TA 100; *E. coli* WP2 *uvrA*
Concentration range:	312.5 - 5000 μg/plate
Test Method:	OECD Guidelines for Testing of Chemicals (2)
Result:	not mutagenic in the bacterial strains tested in the presence or absence or metabolic activation provided by rat liver S9 fraction

9.3.2 Gene Mutation Test in Chinese Hamster V 79 cells (10)

Type of mutation:	forward mutation to 6-thioguanine resistance
Doses:	18.5 to 500 μg/mL for 5 hours with metabolic activation provided by rat liver S9 fraction and 21 hours without metabolic activation
Test Method:	OECD Guidelines for Testing of Chemicals (2)
Result:	not mutagenic in mammalian cells *in vitro*

9.3.3 Cytogenetic Test on Chinese Hamster Cells *In Vitro* (11)

Cell line:	Chinese hamster ovary cells
Doses:	125, 250 and 500 μg/mL for 3 hours (followed by 15 or 39 hours recovery) with metabolic activation provided by rat liver S9 fraction and 18 or 42 hours without metabolic activation
Test Method:	OECD Guidelines for Testing of Chemicals (2)
Result:	not clastogenic in mammalian cells *in vitro*

9.4 Overall Assessment of Toxicological Data

The notified chemical exhibited low acute oral (LD_{50} > 2000 mg/kg) and dermal (LD_{50} > 2000 mg/kg) toxicity in rats. It was not a skin irritant but was a slight eye irritant in rabbits and was not a skin sensitiser in guinea pigs. No signs of toxicity or organ toxicity were observed in a 28-day feeding study in rats at doses up to about 1000 mg/kg/day. No mutagenicity was observed in bacteria and no mutagenicity or clastogenicity were observed in Chinese hamster cells *in vitro.*

The notified chemical would not be classified as hazardous according to Worksafe Australia's *Approved Criteria for Classifying Hazardous Substances* (12) in relation to acute lethal effects (skin, eye), irritant effects (skin, eye), sensitising effects (skin) or severe effects after repeated or prolonged exposure (oral route).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The concentration of the chemical recorded in the various aquatic tests listed below were very much higher than its water solubility (3×10^{-7} g/L). These higher concentrations were achieved with the aid of the solubilisation agent alkylphenol-polyglycolether (ARKOPAL).

Zebra fish

A static acute toxicity study (OECD-guidelines No. 203) with Zebra fish (*Brachydanio rerio*) was performed in de-chlorinated tap water maintained at a temperature of 23 ± 1°C and a pH of 8.0. No fish mortalities were observed at any of the concentrations up to 96 h. Daily observations also indicated that there was no effect of the chemical on the swimming behaviour, loss of equilibrium, respiratory function, exophthalmos or the pigmentation of the fish. The test revealed the NOEC to be ≥ 9.2 mg/L and the 96 h LC_{50} to be > 9.2 mg/L.

The concentrations of the notified chemical used in the study are listed in the table below. A significant difference between the nominal dose and the measured dose is evident besides a >50% reduction between the initial measured concentration (0 h) and the final concentration after 96 h. Deposits of the chemical were observed at all test concentrations explaining the differences in the nominal and measured concentrations.

Nominal concentration (mg/L)	10	18	32	58	100
Measured concentration(mg/L)	7.2	12.5	25.4	48.7	88.1
Measured conc. 48 h (mg/L)	5.2	9.3	4.2	4.9	9.2

Daphnia

Static acute toxicity testing on *Daphnia magna* (OECD-guidelines No. 202) was carried out with 20 individuals per test concentration. No immobilisation was recorded at 24 or 48 h for any of the test concentrations. The test showed the NOEC to be > 11.2 mg/L and the 48 h EC_{50} to be > 11.2 mg/L.

The nominal and measured concentrations given below again indicate significantly lower measured concentrations particularly at 48 h. This is probably explained by the precipitation of the chemical during the test period as observed in the fish test.

Nominal concentration (mg/L)	10	18	32	58	100
Measured concentration(mg/L)	11.0	15.9	25.1	58.1	113.6
Measured conc. 48 h (mg/L)	1.7	3.8	6.0	6.1	11.2

Algal growth

The test on growth inhibition of the green alga *Scenedesmus subspicatus* (OECD-guidelines No. 201) was carried out in Erlenmeyer flasks stoppered with aluminium caps and maintained on a shaker, under continuous light with a quantum flux of 131 $\mu E/m^2s$. The test showed that the E_bC 50 (0-72 h) was >74.5 mg/L.

The measured concentrations were slightly lower than the nominal concentrations but the measured concentrations at 72 h were not markedly different from those at 0 h (table below). This indicates that there was little increased precipitation of the chemical with time during this test as compared to the Fish and *Daphnia* tests. The company attributes this to a difference in the way the chemical was milled in a marble mill to prepare the stock solution. For the Fish and *Daphnia* tests it was milled for approximately for 24 h whereas for the algal test it was milled for 72 h.

Nominal concentration (mg/L)	1.23	3.7	11	33	100
Measured concentration(mg/L)	0.9	2.8	8.0	25.1	78.3
Measured conc. 48 h (mg/L)	0.8	1.9	6.0	23.5	74.5

Microbial activity

An activated sludge from a sewage treatment plant was used to assess the effect of the notified chemical on the respiration of aerobic waste water bacteria. The testing protocol was according to the document EEC 87/302 except that a settled sludge was used instead of a centrifuged sludge and the test substance was added directly to the medium without preparing a stock solution. No solubiliser was used and it is not known how much of the chemical was in solution. Bacterial oxygen consumption was not affected at any of the added concentrations of the chemical. After 3 h testing the EC_{50}, EC_{20} and EC_{80} were all determined to be >100 mg/L, a result indicating that the notified substance had no inhibitory effect on microbial respiration at the concentrations studied.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The chemical will be used in a small number of plants producing engineering plastics and roofing sheets. It is used at levels of 0.1% - 8% as a proportion of the base polymers. Typical products incorporating the chemical are extruded sheets for use in housing applications, in engineering mouldings and laminating films. Notifier claims that no waste is generated during its incorporation into these plastic products.

The proposed use pattern of the chemical will result in its encapsulation within polymer matrices. This combined with the extremely low solubility of the chemical in water indicate the possibility of leaching of the chemical to be negligible.

The high Log P_{ow} (calculated, 7.18) and the high lipid solubility (1000 g/100 g fat) indicates that the notified chemical has potential to bioaccumulate, particularly in the aquatic compartment. However the very low water solubility of the chemical

(3×10^{-7} g/L) clearly indicates that water does not provide an effective transport vehicle for the mobilisation of the notified chemical. Therefore the potential impact of the notified chemical on aquatic species is limited.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified chemical is unlikely to exhibit toxic effects either acutely or following repeated or prolonged exposure. It is not likely to be a skin irritant and would be, at most, a slight eye irritant. It is not likely to be a skin sensitiser and should not be genotoxic.

Exposure to the notified chemical is expected to be low during transport and storage through the use of standard international fibreboard cartons and should only occur in the unlikely event of an accident.

Exposure during manufacture of plastic articles containing the notified chemical is expected to be low and may be confined to weighing out and blending operations. Although a sizeable proportion of the particles of the chemical are of respirable size, the commercial form is formulated to be non-dusting.

Following blending the chemical is likely to remain bound to the plastic granules prior to their addition to the hopper of moulding machines so that exposure following blending should be reduced. Incorporation in the plastic articles at rates ranging from 0.1 to 8%, exposure should not be possible.

The risk of adverse occupational health effects during transport, storage and use of the notified chemical is expected to be minimal given its likely low hazard potential.

Products utilising the polymer containing the notified chemical include roof sheeting, engineering plastics and laminated films. In general, the public will not be exposed to the notified chemical, although accidental dermal contact with the polymer containing the notified chemical may occur. No dermal irritation or sensitisation has been reported. The potential for minor public exposure exists during transport, and disposal of the chemical if accidentally spilt.

13. RECOMMENDATIONS

To minimise occupational exposure to Tinuvin 1577 FF the following guidelines and precautions should be observed:

- If engineering controls and work practices are insufficient to reduce exposure to the notified chemical to a safe level, then the following personal protective equipment which conforms to Australian Standards (AS) or Australian/New Zealand Standards (AS/NZS) should be worn;

Safety goggles should be selected and fitted in accordance with AS 1336 (13) to comply with AS/NZS 1337 (14),

Industrial clothing must conform to the specifications detailed in AS 2919 (15) and AS 3765.1 (16),

Impermeable gloves or mittens conforming to AS 2161 (17),

All occupational footwear should conform to AS/NZS 2210 (18);

- Spillage of the notified chemical should be avoided, spillages 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 Material Safety Data Sheet (MSDS) should be easily accessible to employees.

14. MATERIAL SAFETY DATA SHEET

The MSDS for Tinuvin 1577 FF was provided in accordance with the National *Code of Practice for the Preparation of Material Safety Data Sheets* (19).

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

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act, secondary notification of Tinuvin 1577 FF 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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4. Hagemann med. vet Ch.,1992, *Primary skin irritation study with Tinuvin 1577 FF in rabbits*. Study No: 924093, project on file, Ciba-Geigy Ltd (Stein, Switzerland).

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11. Ogorek, B, 1993, Cytogenetic assay on Chinese Hamster Ovary Cells in vitro with Tnuvin 1577 FF. Study No:924173 project on file, Ciba-Geigy Ltd (Stein, Switzerland).

12. National Occupational Health and Safety Commission 1994, *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(1994)], Australian Government Publishing Service, Canberra.

13. Australian Standard 1336-1982, *Recommended Practices for Eye Protection in the Industrial Environment*, Standards Association of Australia Publ., Sydney, 1982.

14. Australian Standard 1337-1984. *Eye Protectors for Industrial Applications*, Standards Association of Australia Publ., Sydney, 1984.

15. Standards Australia, 1987, *Australian Standard 2919 - 1987 Industrial Clothing,* Standards Association of Australia Publ., Sydney, Australia.

16. Standards Australia 1990, *Australian Standard 3765.1-1990, Clothing for Protection against Hazardous Chemicals Part 1 Protection against General or Specific Chemicals,* Standards Association of Australia Publ., Sydney.

17. Australian Standard 2161-1978. *Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves)*, Standards Association of Australia Publ., Sydney, 1978.

18. Standards Australia, Standards New Zealand 1994, *Australian/ New Zealand Standard 2210 - 1994 Occupational Protective Footwear, Part 1: Guide to Selection, Care and Use. Part 2: Specifications,* Standards Association of Australia Publ., Sydney, Australia, Standards Association of New Zealand Publ. Wellington, New Zealand.

19. National Occupational Health and Safety Commission (1994). *National Code of Practice for the Completion of Material Safety Data Sheets*, [NOHSC:2011(1994)], AGPS, 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	1	Any swelling above normal	1	Any amount different from	1

normal	slight	Obvious swelling with partial eversion of lids	slight	normal	slight
More diffuse, deeper crimson red with individual vessels not easily discernible	2 mod.	Swelling with lids half-closed	2 mild	Discharge with moistening of lids and adjacent hairs	2 mod.
Diffuse beefy red	3 severe	Swelling with lids half-closed to completely closed	3 mod. 4 severe	Discharge with moistening of lids and hairs and considerable area around eye	3 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