2-Propenoic acid, 2-ethyl-2-[[(1-oxo-2-propenyl)oxy]methyl]-1,3-propanediyl ester: Human health tier II assessment

10 March 2017

CAS Number: 15625-89-5

Preface

This assessment was carried out by staff of the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) using the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework.

The IMAP framework addresses the human health and environmental impacts of previously unassessed industrial chemicals listed on the Australian Inventory of Chemical Substances (the Inventory).

The framework was developed with significant input from stakeholders and provides a more rapid, flexible and transparent approach for the assessment of chemicals listed on the Inventory.

Stage One of the implementation of this framework, which lasted four years from 1 July 2012, examined 3000 chemicals meeting characteristics identified by stakeholders as needing priority assessment. This included chemicals for which NICNAS already held exposure information, chemicals identified as a concern or for which regulatory action had been taken overseas, and chemicals detected in international studies analysing chemicals present in babies' umbilical cord blood.

Stage Two of IMAP began in July 2016. We are continuing to assess chemicals on the Inventory, including chemicals identified as a concern for which action has been taken overseas and chemicals that can be rapidly identified and assessed by using Stage One information. We are also continuing to publish information for chemicals on the Inventory that pose a low risk to human health or the environment or both. This work provides efficiencies and enables us to identify higher risk chemicals requiring assessment.

The IMAP framework is a science and risk-based model designed to align the assessment effort with the human health and environmental impacts of chemicals. It has three tiers of assessment, with the assessment effort increasing with each tier. The Tier I assessment is a high throughput approach using tabulated electronic data. The Tier II assessment is an evaluation of risk on a substance-by-substance or chemical category-by-category basis. Tier III assessments are conducted to address specific concerns that could not be resolved during the Tier II assessment.

These assessments are carried out by staff employed by the Australian Government Department of Health and the Australian Government Department of the Environment and Energy. The human health and environment risk assessments are conducted and published separately, using information available at the time, and may be undertaken at different tiers.

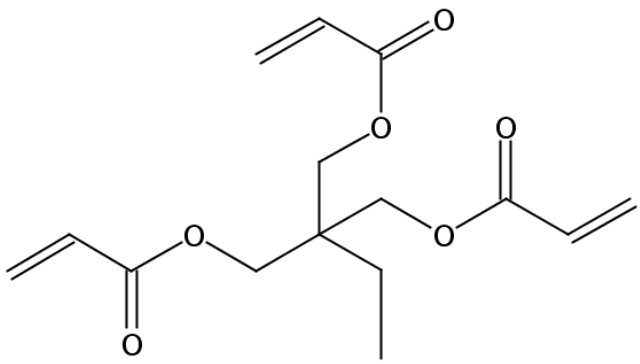
This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

For more detail on this program please visit:www.nicnas.gov.au

Disclaimer

Acronyms & Abbreviations

Chemical Identity

Synonyms	trimethylolpropane triacrylate (TMPTA) 2-ethyl-2-(1-oxoallyl)oxymethyl-1,3-propanediyl diacrylate 1,3-propanediol, 2-ethyl-2-(hydroxymethyl)-, triacrylate acrylic acid, 1,1,1-(trihydroxymethyl)propane triester 2,2-bis(acryloyloxymethyl)butyl acrylate
Structural Formula	
Molecular Formula	C15H20O6
Molecular Weight (g/mol)	296.32
Appearance and Odour (where available)	Viscous, colourless to tan liquid, Acrylic or pungent odour
SMILES	C(=O)(C=C)OCC(CC)(COC(=O)C=C)COC(=O)C=C

Import, Manufacture and Use

Australian

The chemical has reported use in automotive aftermarket products.

International

The following international uses have been identified through:

- the European Union (EU) Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) dossiers;
- Galleria Chemica;
- the United States (US) Personal Care Products Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary;
- the Organisation for Economic Co-operation and Development High Production Volume chemical program (OECD HPV); and
- the US National Library of Medicine's Hazardous Substances Data Bank (HSDB).

The chemical has reported cosmetic use, including in:

- perfumes & fragrances;
- costmetics and personal care products; and

- fingernail applications.

The chemical has reported domestic use, including in:

- paints and coatings;
- adhesives and binding agents;
- colouring agents;
- fillers;
- insulating materials;
- lacquer and varnish; and
- surface treatment.

The chemical has reported commercial use, including in:

- construction material;
- photo chemicals;
- reprographic chemicals;
- solvents; and
- viscosity adjusters.

The chemical has reported non-industrial use in dental polymers.

It should be noted that while international cosmetic and domestic use has been identified through some sources, the Compilation of Ingredients used in Cosmetics in the United States does not report any occurances of the chemical (CIUCUS, 2011). Furthemore, the chemical is not listed on the US Department of Health & Human Services, Household Products Database or on the Consumer Product Information Database (CPID).

Restrictions

Australian

No known restrictions have been identified.

International

No known restrictions have been identified.

Existing Work Health and Safety Controls

Hazard Classification

The chemical is classified as hazardous, with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia):

- Xi; R36/R38 (irritating to eyes and skin)
- Xi; R43 (skin sensitisation)

Exposure Standards

Australian

No specific exposure standards are available.

International

The following exposure standards are identified (Galleria Chemica):

A US Workplace Environmental Exposure Level (WEEL) exposure limit of 1 mg/m^3 time weighted average (TWA) is set by American Industrial Hygienists Association (AHIA).

Health Hazard Information

Toxicokinetics

Limited information is available on the toxicokinetics of trimethylolpropane triacrylate (TMPTA, Cas no. 15625-89-5).

Dermal absorption of TMPTA is low to moderate. In a toxicokinetic study (Buchhanan et al, 1997), male Fisher 344 (F344/N) rats were exposed dermally to 1.7, 15 or 130 mg/kg bw radiolabelled TMPTA. A separate group to five male rats were administered a single dose of 9.4 mg/kg bw of radiolabelled TMPTA intravenously. Blood samples were collected at 0.08, 0.5, 1, 3, 6, 24, 48 and 72 hours and urine and faeces samples were collected at 8, 24, 48, and 72 hours post-dosing. After 72 hours, the application site was washed and samples were collected for analysis of acetone-extractable radiolabeled TMPTA.

Nearly 19 % of a single dermal dose of 130 mg/kg bw TMPTA was absorbed and an average of 76 % of the administered radiolabelde TMPTA was recovered unabsorbed, 72 hours after dosing. The absorption was inversely related to dose; 33 % of the 15 mg/kg bw and 55 % of the 1.7 mg/kg bw dose were absorbed. An average of less than 5 % of the dose was recovered in the faeces, 72 hours after dermal application at 130 mg/kg bw, compared to averages of 19 % and 45 % at doses of 15 mg/kg bw and 1.7 mg/kg bw, respectively.

Very little radiolabeled TMPTA was found in most of the tissues 72 hours after exposure; however, the kidney had elevated tissue:blood ratios at each dose concentration.

During 72 hours following the intravenous bolus dose of 9.4 mg/kg bw TMPTA, a total of 77 % of the radiolabel was excreted in the urine, faeces, and exhaled carbon dioxide; with urine and exhaled carbon dioxide accounting for the largest percentages. The highest radiolabel concentration was in the blood, and the average total recovery of radiolabel was 90 % during the 72 hours after dosing.

An in vitro dermal absorption study (OECD Guideline 428) used human skin samples to determine the percutaneous absorption of the chemical in humans. The radio-labelled chemical was applied to skin sample and the mean absorption of the chemical during the 24 hour study was determined to be 0.16 % of the applied dose (REACH).

Acute Toxicity

Oral

The chemical has low acute toxicity based on results from animal tests following oral exposure. The median lethal dose (LD50) in rats was >5000 mg/kg bw (REACH).

The chemical (50, 127, 315, 785, 1999 and 5000 mg/kg bw) was administered via gavage to groups of five male Wistar rats per dose. Clinical signs and bodyweight changes were examined frequently during the first four hours after administration and at least daily for 14 days after application. Two of the five animals in the 5000 mg/kg bw group died (REACH).

Dermal

The chemical has low acute dermal toxicity based on results from animal tests following dermal exposure. The dermal LD50 in rabbits is >4.7 mL/kg bw, equivalent to >5170 mg/kg bw, assuming the density of the chemical as 1.1 g/mL (REACH).

The acute dermal toxicity levels of the chemical were determined in rabbits. Albino rabbits received a dosage of 0.32, 0.8, 2.0 or 5.0 mL/kg bw of the chemical using a rubber dam held in place by tape. After 24 hours the chemical was removed. Observations were carried out for 7 days, following which the animals were killed and necropsy was performed. One mortality each occurred at dose levels 2.0 and 5.0 mL/kg bw, while rabbits in all other dose groups survived the treatment (REACH).

Inhalation

The chemical was of low acute toxicity in animal tests following inhalation exposure. The median lethal concentration (LC50) was >0.55 mg/L air (REACH).

The acute inhalation toxicity of the chemical was determined using five Charles River rats per sex. The animals were exposed to the vapour of the chemical at a single concentration of 0.55 mg/L air (nominal) for 6 hours followed by an observation period of 14 days. No mortalities occurred during the test. There were no reactions noted during exposure or during the 14-day observation period. The average body weight gains were within the normal limits. Necropsy performed on all rats at the end of the observation period did not reveal any gross pathologic alterations (REACH).

Corrosion / Irritation

Skin Irritation

The chemical is classified as hazardous with the risk phrase ‘Irritating to skin' (Xi; R38) in the HSIS (Safe Work Australia). The available data support this classification (REACH).

In a skin irritation study (OECD Guideline 404), three male New Zealand White (NZW) rabbits were exposed to 0.5 ml of pure chemical for 4 hours. The animals were then monitored for 7 days. No mortality was observed; however, there was slight to defined erythema and/or oedema present after 24 hours. Slight ischemia and incrustation were also observed. A mean erythema score of 2.25 (intact skin, 24 and 72 hour readings) and a mean oedema score 1.5 (intact skin, 24 and 72 hour reading) could be calculated.

The test material was considered to be moderately irritating to skin (REACH).

Eye Irritation

The chemical is classified as hazardous with the risk phrase ‘Irritating to eyes’ (Xi; R36) in the HSIS (Safe Work Australia). The available data support this classification.

In an eye irritation study (OECD Guidelines 405) in two NZW albino rabbits, the animals were exposed to 100 µL of the chemical. No washout followed the administration of the chemical and observations were carried out at 1, 24, 48, 72 hours and 7 days. The chemical was found to be an irritant to the eye with, slight corneal damage, slight iritis and moderate to severe lesions of the conjunctivae in the first 24 hours. The degree of corneal damage increased over the course of the seven-day observation period (REACH).

Sensitisation

Skin Sensitisation

The chemical is classified as hazardous with the risk phrase ‘May cause sensitisation by skin contact' (Xn; R43) in the HSIS (Safe Work Australia). The available data support this classification.

In a guinea pig maximisation test (OECD Guideline 406), 24 female albino guinea pigs were intradermally induced with 1 % TMPTA in olive oil. Topical induction used 25 % TMPTA in petrolatum. Two weeks after induction, the animals were challenged with 0.1 % and 0.5 % TMPTA in petrolatum for three hours. Control animals were also patch tested with the test chemicals at the same concentrations. Reactions were recorded 3 hours after the challenge exposure.

Six animals treated at 0.1 % TMPTA and 16 animals at 0.5 % TMPTA showed skin reactions (REACH).

In a second sensitisation study (Nethercott et al., 1983), groups of 10 female albino Hartley/Dalkin guinea pigs were induced and then challenged with TMPTA. Three intradermal injections were administered to each shoulder: 0.1 mL of a 0.5 % or 10 % solution of TMPTA in propylene glycol; 0.05 mL FCA and 0.05 mL of a 0.5 % or 10 % solution of TMPTA in propylene glycol; and 0.1 mL FCA. After one week, 0.5 % or 10 % TMPTA in petrolatum was applied to the animals’ shaved shoulders, which were then wrapped for 48 hours. The animals were challenged 2 weeks after the topical exposure with skin patches of non-irritant concentrations of TMPTA for 24 hours. Four guinea pigs that were administered 0.5 % TMPTA and 10 of 20 guinea pigs administered the 10 % solution became sensitized.

An in vivo mouse ear swelling test was conducted to evaluate the potential for TMPTA to induce contact hypersensitisation in mice (REACH). The maximal non-irritating and minimal irritating doses were determined to be 0.1% and 0.25% TMPTA respectfully, prior to the test.

The mouse ear swelling test was conducted according to the National Toxicology Program (NTP) protocol. Chemical concentrations of TMPTA in acetone at 0 % (control group), 0.01 %, 0.05 %, or 0.1 % (w/v) were applied epicutaneously to the ear of female BALB/c mice (8 per group). The three test groups received a challenge dose of 0.25% TMPTA (25µL). No significant differences in the percentage of ear swelling were observed between theTMPTA-challenged mice and the background controls at 24 or 48 hours after dosing.

As a continuation of this study, a local lymph node assay (LLNA) was conducted with female BALB/c mice. Six mice were treated with 50 µL dermal applications of 0 % (vehicle controls), 0.05%, 0.1%, or 0.25% (w/v) TMPTA in acetone. The local lymph node assay indicated no significant increase in lymph node cell proliferation in mice administered TMPTA compared to the vehicle controls (REACH).

Based on the results from the two maximisation tests, TMPTA is considered to be a skin sensitiser.

Observation in humans

In a human patch test, six workers were treated with TMPTA 0.1 % in petrolatum for 48 hours. The sites were examined and scored after 30 min according to the scoring system recommended by International Contact Dermatitis Group. The sites were examined further at 72 and 96 hours (REACH).

Results showed a positive reaction in one worker. This worker had oedematous or vesicular reactions after 48 and 96 hours (REACH).

In a second study, a suspected sensitised group of 8 workers was patch tested. The chemical at 1 % in petroleum was applied to a gauze test patch for 48 hours. Examinations were conducted one hour after removal. Out of the 8 workers, 7 had positive reactions to 1 % of the chemical. The results suggest that TMPTA is a strong allergen that is capable of sensitising a high proportion of the workforce exposed to it in a short amount of time (REACH).

Repeated Dose Toxicity

Oral

Long-term oral repeat dose studies are not available for the chemical. In a short-term 14-day dose selection study, male and female Crl:WI(Han) rats (5/sex/dose) were administered 0, 100, 300 or 1000 mg/kg bw/day of TMPTA, in polyethylene glycol, by gavage every day for 14 days (REACH).

No mortality occurred during the study period. Salivation was noted shortly after dosing for all males and females from 100 mg/kg bw/day onwards. Treatment related effects on body weight were noted for males at 1000 mg/kg bw/day only. Slightly higher liver weights (absolute and relative to body weight) were recorded for females after treatment at 1000 mg/kg bw/day. At necropsy, treatment related findings included irregular surface of the forestomach observed in 2, 5 and 5 males and 1, 5 and 5 females of the 100, 300 and 1000 mg/kg bw/day group, respectively. In addition, one female at 300 mg/kg bw/day was noted with irregular surface of the glandular mucosa of the stomach.

Based on the study, dose levels of 30, 100 and 300 mg/kg bw/day were selected for a combined 28-day repeated dose/reproductive toxicity study (REACH).

In the study, the chemical was administered by oral gavage at dose levels of 30, 100 or 300 mg/kg bw/day (5 animals/sex/dose level). Concurrent controls (10/sex/group) received the vehicle, polyethylene glycol 400, alone . The males were exposed for 29 days commencing two weeks prior to mating. The females were exposed to the chemical for two weeks prior to mating, during mating, during gestation, and at least 4 days of lactation, approximately 41-55 days.

Administration of TMPTA at dose levels of 30, 100 and 300 mg/kg bw/day did not result in any significant systemic toxicological effects in either sex. There were adverse local morphologic alterations in the stomach which indicated a local irritant effect of the substance rather than a systemic effect.

There were no treatment related toxicological changes noted in any of the parameters investigated in the study.

Dermal

Based on the data available, no dose related systemic effect could be observed up to and including 12 mg/kg bw/day.

In one 16-day study, groups of five male and female B6C3F1 mice were administered 0, 12.5, 25, 50, 100 or 200 mg/kg bw/day of the chemical 5 days a week for 16 days. All mice survived to the end of the study. Skin irritation was noted at the site of application in all males and females treated at 100 and 200 mg/kg bw/day and one female treated at 50 mg/kg bw/day. The body weight gain of the male mice treated at 200 mg/kg bw/day was less than half of that of the controls, while all 100 and 200 mg/kg females had an increased final mean body weight compared to the controls (REACH).

In a short-term dermal exposure study, groups of 10 male and 10 female F344/N rats were administered 0, 0.75, 1.5, 3, 6, or 12 mg/kg bw in acetone, 5 days per week for 14 weeks. All rats survived to the end of the study, and the mean body weight of the dosed group was similar to the vehicle controls. Skin irritation at the site of application was noted in five males and in all females administered 12 mg/kg bw/day (REACH).

In the same study another group of 10 male and 10 female B6C3F1 mice were administered the same concentrations of the chemical over the same duration. All mice survived to the end of the study, and the mean body weight of the dosed group was similar to the vehicle controls. Skin irritation at the site of application was noted in both male and female mice in the 12 mg/kg bw/day group (REACH).

In a long-term 105-week study (OECD Guideline 453), groups of 65 male and 65 female mice and rats (strain unspecified) were treated dermally with the chemical at 0, 0.3, 1.0 or 3.0 mg/kg bw/day in acetone for 5 days a week for 105 to 106 weeks. The survival and mean body weights of the test animals were similar to those of the control group. Local effects at the site of application were observed at 0.3 mg/kg/day and above in rats, while local effects in mice were only seen from 1 mg/kg bw/day. No systemic toxicity was observed in the rats or the mice (REACH).

Genotoxicity

The chemical was tested for mutagenicity in the Ames test (standard plate test, according to OECD 471) both in the presence and in absence of metabolic activation, using *Salmonella typhimurium* strains TA 1535, TA 100, TA 1537 and TA 98. Tests without activation showed no increase in the number of his- revertants. Tests with activation also showed no increase in the number of his- revertants for TA 1537, TA 98 and TA 100, while TA 1535 revealed weakly positive reaction with no dose-dependency over a dose range of 500 µg - 5000 µg/plate (REACH).

The genotoxicity potential of the chemical was tested in several *in vitro* and one *in vivo* genotoxicity tests. Of the four in vitro studies, two (OECD Guidelines 473 and 476) produced positive genotoxic effects; however the results were discarded as cytotoxicity was also observed at the concentrations used. All other tests gave negative results.

Based on the results from these tests, the chemical was considered not to be genotoxic.

Carcinogenicity

Carcinogenicity studies by the oral route are not available. A two-year dermal carcinogenicity study (OECD Guideline 451) did not indicate carcinogenic effects in mice or rats (NTP, 2012).

In the study, 65 male and female mice or rats (F344/N rats and B6C3F1/N mice) per group were dermally exposed to 0, 0.3, 1.0, and 3.0 mg/kg bw/day of the chemical for 2 years. Five animals per sex and group were euthanased after 2, 13, and 52 weeks to evaluate effects on the skin. Male and female rats and mice in the mid and high dose groups and low dose female rats showed increased incidences of epidermal hyperplasia, hyperkeratosis, and signs of chronic inflammation. Both hyperplasia and hyperkeratosis are characteristics of chronic irritant contact dermatitis (Berardesca and Distante, 1994).

There were increased incidences of tumours at sites other than skin in the current studies. Incidences of uterine stromal polyp or stromal sarcoma (combined) occurred in female mice with a positive trend as well as there being a significant increase in the 3.0 mg/kg group. This was not considered to be a significant effect as uterine stromal polyps have been seen in control groups of B6C3F1 mice (Tamano ***et al***., 1988) particularly in older mice.

A marginal increase in the incidence of malignant mesothelioma was also observed in male rats. This is a common spontaneous lesion of the peritoneal cavity in male F344/N rats, often arising from the tunica vaginalis of the testes (Hall, 1990). In this study all incidences were present in the tunics around the testes with dissemination into the peritoneal cavity. There was a positive trend in the incidence of mesothelioma; the incidence in 3.0 mg/kg males was significantly greater than in the concurrent vehicle controls receiving acetone. However, because of the variability of these tumours in the historical controls and the fact that the incidence in the high dose group was only one tumour outside of the historical control range, the marginally increased incidences were considered to be equivocal evidence of carcinogenic activity of the chemical in male rats.

Despite the observed local effects, no increase in skin tumours compared to control animals could be detected. No test-substance related increase in neoplastic lesions was found for male mice and female rats (NTP, 2112).

The chemical is not considered to have carcinogenicity potential.

Reproductive and Developmental Toxicity

Based on the available data, the chemical is not considered to cause reproductive or developmental toxicity following oral exposure to TMPTA at concentrations up to 300 mg/kg bw/day.

In the combined 28-day repeated dose and reproductive/developmental toxicity study (discussed in ***Repeated Dose Oral toxicity*** section), TMPTA was administered by oral gavage to 10 Crl:WI(Han) rats at dose levels of 30, 100 or 300 mg/kg/day (5/sex/dose level). Concurrent controls (5 animals/sex) received the vehicle, polyethylene glycol 400, alone (REACH).

Males were exposed for 2 weeks prior to mating and during mating. The females were exposed for 2 weeks prior to mating, during mating, during gestation, and at least day 4 of lactation.

No treatment-related effects in relation to reproduction (mating, fertility and conception indices, precoital time, number of corpora lutea and implantation sites) and developmental toxicity (gestation index and duration, parturition, maternal care and early postnatal pup development (mortality, clinical signs, body weight and macroscopy)) were seen. No morphological findings in the reproductive organs of either sex which could be attributed to the chemical were found. Spermatogenic staging profiles were normal for all males examined. Based on these results, a NOAEL of 300 mg/kg bw/day for reproductive toxicity and for developmental toxicity was derived from this screening study (REACH).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation include skin and eye irritation and skin sensitisation.

Public Risk Characterisation

Considering the use of this chemical in hair conditioners, hair fixers and other potential domestic products (based on overseas information), the main routes of public exposure are expected to be through the skin, and inhalation from products applied as aerosols. However, although use in cosmetic and domestic products in Australia is not known, widespread consumer use is not expected as American data sources do not indicate current use of the chemical (see **Import, Manufacture and Use** section).

The chemical may also be present in consumer articles manufactured from plastics, but the chemical is not expected to be released from these items.

Occupational Risk Characterisation

During product formulation, oral, dermal and inhalation exposure may occur, particularly where manual or open processes are used. These could include transfer and blending activities, quality control analysis, and cleaning and maintaining equipment. Worker exposure to the chemical at lower concentrations could also occur while using formulated products containing the chemical. The level and route of exposure will vary depending on the method of application and work practices employed.

Given the critical health effects, the chemical could pose an unreasonable risk to workers unless adequate control measures to minimise exposure are implemented. The chemical should be appropriately classified and labelled to ensure that a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) has adequate information to determine the appropriate controls.

NICNAS Recommendation

Current risk management measures are considered adequate to protect public and workers' health and safety, provided that all requirements are met under workplace health and safety, and poisons legislation as adopted by the relevant state or territory. No further assessment is required.

Regulatory Control

Work Health and Safety

During product formulation, dermal and occular exposure may occur, particularly where manual or open processes are used. These could include transfer and blending activities, quality control analysis, and cleaning and maintaining equipment. Worker exposure to the chemical at lower concentrations could also occur while using formulated products containing the chemical. The level and route of exposure will vary depending on the method of application and work practices employed.

The chemical is recommended for classification and labelling under the current approved criteria and adopted GHS as below. This assessment does not consider classification of physical and environmental hazards.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Irritation / Corrosivity	Irritating to eyes (Xi; R36)* Irritating to skin (Xi; R38)*	Causes serious eye irritation - Cat. 2A (H319) Causes skin irritation - Cat. 2 (H315)
Sensitisation	May cause sensitisation by skin contact (Xi; R43)*	May cause an allergic skin reaction - Cat. 1 (H317)

[a] Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)].

[b] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) United Nations, 2009. Third Edition.

[*] Existing Hazard Classification. No change recommended to this classification

Advice for consumers

Products containing the chemical should be used according to the instructions on the label.

Advice for industry

Control measures

Control measures to minimise the risk from dermal and ocular exposure to the chemical should be implemented in accordance with the hierarchy of controls. Approaches to minimise risk include substitution, isolation and engineering controls. Measures required to eliminate, or minimise risk arising

from storing, handling and using a hazardous chemical depend on the physical form and the manner in which the chemical is used. Examples of control measures that could minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- using local exhaust ventilation to prevent the chemical from entering the breathing zone of any worker;
- minimising manual processes and work tasks through automating processes;
- work procedures that minimise splashes and spills;
- regularly cleaning equipment and work areas; and
- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemical.

Guidance on managing risks from hazardous chemicals are provided in the *Managing risks of hazardous chemicals in the workplace—Code of practice* available on the Safe Work Australia website.

Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

Obligations under workplace health and safety legislation

Information in this report should be taken into account to help meet obligations under workplace health and safety legislation as adopted by the relevant state or territory. This includes, but is not limited to:

- ensuring that hazardous chemicals are correctly classified and labelled;
- ensuring that (material) safety data sheets ((M)SDS) containing accurate information about the hazards (relating to both health hazards and physicochemical (physical) hazards) of the chemical are prepared; and
- managing risks arising from storing, handling and using a hazardous chemical.

Your work health and safety regulator should be contacted for information on the work health and safety laws in your jurisdiction.

Information on how to prepare an (M)SDS and how to label containers of hazardous chemicals are provided in relevant codes of practice such as the *Preparation of safety data sheets for hazardous chemicals—Code of practice* and *Labelling of workplace hazardous chemicals—Code of practice*, respectively. These codes of practice are available from the Safe Work Australia website.

A review of the physical hazards of the chemical has not been undertaken as part of this assessment.

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