1,3-Butadiene, 2-methyl-: Human health tier II assessment

04 July 2014

CAS Number: 78-79-5

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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.

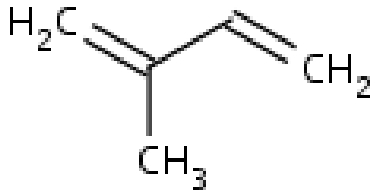
This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

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

Disclaimer

Acronyms & Abbreviations

Chemical Identity

Synonyms	2-methyl-1,3-butadiene isoprene isopentadiene 3-methyl-1,3-butadiene beta-methylbivinyl
Structural Formula	
Molecular Formula	C5H8
Molecular Weight (g/mol)	68.12
Appearance and Odour (where available)	Colourless with an aromatic odour.
SMILES	C(=C)(C)C=C

Import, Manufacture and Use

Australian

No Australian use, import, or manufacture were reported under previous NICNAS mandatory calls for information.

International

The following international uses have been identified through European Union Registration, Evaluation and Authorisation of Chemicals (EU REACH) dossiers; the Organisation for Economic Cooperation and Development Screening information data set International Assessment Report (OECD SIAR); Galleria Chemica; Substances and Preparations in the Nordic countries (SPIN) database; the European Commission Cosmetic Ingredients and Substances (CosIng) database; United States (US) Personal Care Product Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary; and eChemPortal: OECD High Production Volume chemical program—OECD HPV, the US Environmental Protection Agency's Aggregated Computer Toxicology Resource—ACToR, and the US National Library of Medicine's Hazardous Substances Data Bank—HSDB.

The chemical has reported site-limited use including in the manufacturing of:

- polyisoprene, butyl rubber and styrene-isoprene-styrene (SIS) rubber;
- viscosity improvers for motor oil; and
- speciality chemicals, intermediates and derivatives.

The chemical is found in petrol and other hydrocarbon refinery streams. The chemical is naturally emitted to the atmosphere from various plant and tree species and is also formed endogenously in humans (predominant endogenous hydrocarbon exhaled by humans). The chemical is also present in smoke from cigarettes as well as bushfires and woodfires.

Restrictions

Australian

No known restrictions have been identified.

International

The chemical is listed on the following (Galleria Chemica):

- EU Cosmetics Regulation 1223/2009 Annex I—List of substances prohibited in cosmetic products;
- New Zealand Cosmetic Products Group Standard—Schedule 4: Components cosmetic products must not contain isoprene;
- Health Canada List of prohibited and restricted cosmetic ingredients (The Cosmetic Ingredient "Hotlist").

The chemical is also restricted by Annex XVII to REACH Regulation as follows:

Shall not be used in substances and preparations placed on the market for sale to the general public in individual concentration equal to or greater than; either the relevant concentration specified in Annex I to Directive 67/548/EEC, or the relevant concentration specified in Directive 1999/45/EC.

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):

Carc. Cat. 2; R45 May cause cancer.

Muta. Cat. 3; R68 Possible risk of irreversible effects.

Exposure Standards

Australian

No specific exposure standards are available.

International

The following exposure standards are identified (Galleria Chemica):

An exposure limit, time weighted average (TWA) of 8.5–100 mg/m³ (3–36 ppm) and short-term exposure limit (STEL) of 68–300 mg/m³ (24–50 ppm) in different countries such as Bulgaria, Germany, Latvia, Poland, Russia, and Switzerland. A WEEL (Workplace Environmental Exposure Limit) of 2 ppm was established by American Industrial Hygiene Association in 2004. The WEEL was 50 ppm prior to the 2004 revision.

Health Hazard Information

Toxicokinetics

In mammals, the chemical is metabolised by the microsomal cytochrome P450 (CYP450) dependent monooxygenases in the liver. During metabolism, the double bonds of isoprene are oxidised forming two monoepoxides (EPOX-1 and EPOX-2), which can be further hydrolysed, conjugated with glutathione or further oxidised to the diepoxide. The metabolism of the chemical is saturable.

The metabolism and distribution of isoprene vary among species, with metabolism reported to be faster in mice and Syrian hamsters than in rats and rabbits. These differences in metabolism and reactivity may contribute to the marked species differences in toxicological response to the chemical. In vitro studies and a physiological toxicokinetic model suggest that the rate of metabolism in humans is lower than in rodents (Bogaards et al., 2001; Lofroth et al., 1989; Placke et al., 1996; Csanady and Filser 2001; OECD, 2005; REACH).

Acute Toxicity

Oral

The limited data available indicate that the chemical is of low acute toxicity in animals following oral exposure.

In an acute toxicity study conducted in Wistar rats, 15 animals of both sexes were given single doses (250, 500, 1000, 2000, 2150, 2250 and 2500 mg/kg) of isoprene in oil by a stomach tube. The results showed that isoprene doses of >500 mg/kg induced signs of sedation and breathing difficulties one hour after exposure to the chemical. These clinical signs continued to manifest for seven days. The number of deaths occurring, as early as one day after exposure, was strongly correlated with the increasing isoprene doses. There were four, eight, 11 and 15 mortalities at 2000, 2150, 2250 and 2500 mg/kg of isoprene respectively. However, this study was considered limited due to the lack of sufficient experimental details. Based on this data, the median lethal dose (LD50) for isoprene is >2000 mg/kg bw (REACH; OECD, 2005; Government of Canada, 2008).

Dermal

No reliable data are available.

Inhalation

Several pre-good laboratory practice (GLP) lethality studies in rats and mice are available. The results of these studies indicate that the chemical is of low acute toxicity in animals following inhalation exposure with reported median lethal concentrations (LC50s) in the range of 139–214 mg/L (REACH; OECD, 2005).

Wistar rats were exposed to six concentrations of isoprene (duration not reported) and the changes in the thymus were evaluated. The results indicated that acute inhalation of 8.40 and 21.41 mg/L of isoprene caused pathological changes in the rats. These include abnormalities in cellularity, mitotic index, absolute and relative weights of the thymus and proliferative activity. However, this study lacked sufficient information for proper evaluation (REACH).

Corrosion / Irritation

Respiratory Irritation

Degeneration of the olfactory epithelium was observed in several repeated dose toxicity studies (see **Repeated dose toxicity: inhalation**). Generally, the effects were noted at 1950 mg/m³.

Skin Irritation

The chemical is reported to have a low potential for skin irritation in animals. The effects were not sufficient to warrant a hazard classification (REACH).

In a skin irritation study, the skin of two New Zealand White rabbits was painted with 100 % isoprene twice a day for five consecutive days. The results indicated reversible erythema.

Eye Irritation

The limited data available indicate that the chemical may be irritating to eyes, there is not sufficient information to warrant hazard classification. According to a non-GLP study, the chemical was reported to cause eye irritation in rats, however no further details were provided.

Observation in humans

Isoprene vapours are reported to be slightly irritating to the eyes, lungs and skin of humans (OECD, 2005).

In a pre-GLP study, human volunteers experienced slight irritation of the upper respiratory tract following exposure to isoprene at 160 mg/m³; although, there is uncertainty in the reliability of this study due to limited information.

Irritant effects in the upper respiratory tract, mucous membranes and olfactory tract have been reported in workers from a rubber production company. The level and prevalence of the effects were correlated with increasing length of service (IARC, 1994).

These observations, together with the olfactory degeneration observed in the repeated dose animal studies, are considered sufficient to warrant classification for respiratory irritation (see **Recommendation** section).

Sensitisation

Skin Sensitisation

No data are available. The chemical does not contain a structural alert for skin sensitisation (OECD Toolbox).

Repeated Dose Toxicity

Oral

No data are available.

Dermal

No data are available.

Inhalation

Several studies have demonstrated that repeated isoprene exposure by inhalation results in a number of non-cancerous effects, in addition to the increased incidences of multi-organ tumours (see **Carcinogenicity**). In addition to hyperplasia observed at sites at which tumours occurred (lungs and forestomach), effects were generally observed in the haematological system, nasal cavity, liver and testes. Effects in the thymus, spinal cord and spleen were observed in some studies. The available studies also indicated that mice were more susceptible to the damaging effects of inhaled isoprene than rats (Placke et al., 1996; NTP, 1999; OECD, 2005; REACH). These studies and effects are summarised below, with the exception of effects observed in reproductive organs, which are described in the **Reproductive and developmental toxicity** section.

In a two-week repeated dose inhalation study, F344 rats and B6C3F1 mice (20 animals/sex/group/species) were exposed to a series of isoprene concentrations of 0, 1220, 2438, 4876, 9751 or 19503 mg/m³ for six hours a day, five days a week for two weeks. The results showed that in rats, isoprene exposure for two weeks, at any dose, did not cause any pathological changes or incidences of gross or microscopic lesions. This study reported a no observed adverse effect level (NOAEL) of 19503 mg/m³ for rats.

In contrast to the results in rats, the two-week repeated exposure of mice to isoprene caused a reduction in body weight in males from the 19503 mg/m³ group. Dose-related increases in the mean liver weight/body weight ratios; and decreases in relative thymus, and spleen weights were also noted in male mice. Changes in organ weight and haematological profiles were observed in both sexes. Microscopic lesions were present in various organs. These included forestomach lesions in females and epithelial hyperplasia in both sexes (at all doses), thymic atrophy in males dosed at 19503 mg/m³, nasal lesions in animals dosed at 4876 mg/m³ and above (with the severity proportionate to isoprene concentrations) and diffuse liver changes consistent with highly glycogenated hepatocytes in all male dose groups. A NOAEL could not be established for mice in this study.

The findings above were consistent with the data from the subsequent repeated dose inhalation studies.

In a GLP-compliant repeated dose inhalation study, F344 rats and B6C3F1 mice (10/sex/group) were exposed to 0, 195, 613, 1950, 6129, or 19503 mg/m³ of isoprene (whole body inhalation) for six hours a day for five days a week for 13 weeks. The results showed that isoprene exposure did not cause measurable damage in rats. Exposure of male and female mice to 1950 mg/m³ (700 ppm) isoprene or higher induced haematologic abnormalities and forestomach focal epithelial hyperplasia. In male mice, degeneration of the nasal cavity (olfactory epithelium) was noted following exposure to 19503 mg/m³ (7000 ppm) isoprene. Cytoplasmic vacuolisation of hepatocytes due to glycogen accumulation was also observed at the two highest dose levels (OECD, 2005).

In a 26-week inhalation exposure study, B6C3F1 mice and Fischer 344 rats were exposed to 0, 195, 613, 1950, 6129, or 19503 mg/m³ of isoprene vapour by inhalation for six hours a day, five days a week for six months. Animals were evaluated both at 26 weeks and after a further 26-week recovery period. In rats, other than changes to the testes observed at the highest dose (see **Reproductive and developmental toxicity)** there were no observed effects. For mice, in addition to effects observed in the forestomach and nasal cavity (similar to the 13-week study), changes were observed in the lung following the 26-week recovery period. These were manifested as the increased incidence of alveolar epithelial hyperplasia in the 1950 mg/m³ and higher exposure groups. In addition, the incidence of spinal cord degeneration was significantly increased in all exposure groups following the 26-week recovery period and reversible reduction in hindlimb grip strength was observed in the 613 mg/m³ and higher exposure groups. However, these effects on motor function and spinal cord were not observed in chronic carcinogenicity studies in mice and rats.

Non-cancerous effects in the kidney and spleen were observed in a 104-week study in rats (see **Carcinogenicity section**)**.** The incidence of renal tubule hyperplasia was significantly greater in males than in females exposed to 19503 mg/m³ isoprene and the severity of kidney nephropathy was slightly increased in this group. The incidences of splenic fibrosis were also significantly greater in males than in females dosed with isoprene at 1950 mg/m³ and above.

Genotoxicity

The chemical is classified as hazardous—Category 3 mutagenic substance—with the risk phrase ‘Possible risk of irreversible effects’ (Xn; R68) in HSIS (Safe Work Australia). The available data support this classification.

Isoprene was negative in several in vitro assays, including bacterial mutation, sister chromatid exchanges (SCE) and chromosomal aberration tests in exposed Chinese hamster ovary cells. However, the chemical was genotoxic to mouse bone marrow in vivo (SCE and micronuclei induction) following inhalation exposure. The chemical also produced DNA damage in a comet assay with human peripheral blood mononuclear cells and human leukaemia cells in vitro (Fabiani et al., 2007; Government of Canada, 2008; IARC,1999; NTP, 2011; OECD, 2005).

Neither of the metabolites EPOX-1 and EPOX-2 were mutagenic to *Salmonella typhimurium* TA100 or TA98 when tested up to lethal concentrations (30 mM), whereas another possible minor metabolite, 2-methyl-1,2,3,4-diepoxybutane, was mutagenic in TA100 test (IARC, 1999; NTP, 2011). The metabolite EPOX-1 caused DNA damage in the in vitro comet assay described above (Fabiani et al., 2007).

Carcinogenicity

The chemical is currently classified as hazardous as a Category 2 carcinogen with the risk phrase ‘May cause cancer’ (T; R45) in HSIS (Safe Work Australia). The available data support this classification.

The International Agency for Research on Cancer (IARC) has classified the chemical as Group 2B (possibly carcinogenic to humans) (IARC, 1999) and the European Commission has classified it as Category 2 (regarded as if they are carcinogenic to man; may cause cancer). The U.S. National Toxicology Program (NTP) has classified isoprene as being reasonably anticipated to be a human carcinogen (NTP, 2011). The above classifications were based on the consistent observations of increased incidences of neoplastic effects of isoprene in multiple organs.

In a carcinogenicity study, male B6C3F1 mice were exposed to isoprene by whole body inhalation at doses of 0, 27.9, 195, 390, 780, 1950, or 6129 mg/m³, four or eight hours a day for five days a week for 20, 40 or 80 weeks. This was followed by recovery/holding periods until the study was terminated at 96 or 104 weeks. Female mice in this study were exposed to 0, 27.9, 195 mg/m³ for 80 weeks and held until week 104. Male mice had significantly increased incidences of tumours in the lung, liver, forestomach and Harderian gland in addition to histiocytic sarcomas and non-significantly increased incidences of heart and

spleen haemangiosarcomas. Increased incidences of Harderian gland and pituitary adenomas (significant) were observed in female mice exposed to the highest concentration (195 mg/m³). For male mice, the low observed effect level (LOEL) appeared to be 1950 mg/m³ for lung tumours and haemangiosarcomas, 780 mg/m³ for malignant forestomach tumours and histiocytic sarcomas, 390 mg/m³ for liver tumours, and 195 mg/m³ for Harderian gland tumours. For female mice, the LOEL appeared to be 195 mg/m³ for all total non-liver, non-lung adenomas and possibly for hemangiosarcomas (Placke et al., 1996; OECD, 2005).

Evidence of carcinogenicity was also apparent in a 26-week repeated dose inhalation study (described in **Repeated dose toxicity: inhalation)** with increased incidences of tumours in several tissues observed at doses of 1950 mg/m³ and higher, including alveolar/bronchiolar adenoma or carcinoma, Harderian gland adenoma, hepatocellular adenoma or carcinoma and forestomach squamous-cell papilloma or carcinoma. There was no clear dose response at higher doses, possibly as a result of saturation of metabolism (IARC, 1995; OECD, 2005).

The NTP report from the two-year inhalation study in F344/N rats provided further evidence of the carcinogenic activity of isoprene (NTP, 1999). In this study, 50 male and female rats were exposed to doses of isoprene at 0, 613, 1950, 19503 mg/m³ for six hours a day, five days a week for 105 weeks. The results from the histopathological evaluations indicated that isoprene caused an increase in incidences of mammary gland fibroadenoma and carcinoma, renal tubule adenoma and hyperplasia, splenic fibrosis, testicular interstitial cell adenoma and a low incidence of rare brain neoplasms (NTP, 1999). Generally, effects were observed at doses of 1950 mg/m³ and higher, although mammary gland fibroadenoma was observed in all exposed females.

Although there is a lack of epidemiological data, isoprene which is a structural analogue of 1,3-butadiene (CAS No. 106-99-0), has been associated in lymphohaematopoietic cancer in exposed workers (NICNAS).

Reproductive and Developmental Toxicity

Although limited data are available, the information for this chemical and its structural analogue, 1,3 butadiene (CAS No. 106-99-0) show the potential for specific reproductive or developmental toxicity.

In an inhalation study, Swiss CD-1 mice and Sprague Dawley (SD) rats were exposed to 0, 780, 3900, 19503 mg/m³ isoprene for six hours a day, seven days a week during gestational days 617 for mice and days 6–19 for rats. The results showed a marked species difference, such that the isoprene-induced changes were more prominent in mice than in rats. In mice, exposure to all doses of isoprene caused a reduction in foetal body weight. Moreover, a decrease in maternal weight gain and uterine weight and increased incidence in supernumerary ribs were observed in mice which were treated with the highest dose of isoprene (19503 mg/m³). At the two highest doses, the presence of a cleft palate was observed in two of the foetuses. These skeletal changes are considered likely to be secondary to maternal toxicity, although, the effects on foetal bodyweight were observed at all doses and are not considered secondary. Based on the results, a reported NOAEL of 3901 mg/m³ was determined for maternal toxicity and <780 mg/m³ for developmental toxicity in mice (Anderson, 2001; OECD, 2005; REACH).

No specific studies investigating reproductive toxicity were available, although, in a 13-week repeated dose toxicity study (see **Repeated dose toxicity: inhalation**) male mice exposed to isoprene at 19503 mg/m³ exhibited reduced testicular weight, while females showed a significantly longer oestrus cycle. Exposure to isoprene at 1950 and 19503 mg/m³ resulted in atrophy of the seminiferous tubules; and reduced epididymal weights, sperm headcounts and motility (Anderson, 2001; Melnick et al., 1994). Reversible decrease in testis weight and testicular atrophy were also observed in mice following 26 weeks of exposure (see **Repeated dose toxicity: inhalation** for details of the study).

Intraperitoneal injection of 7.34 mmol/kg/bw in 21-day-old B6C3F1 mice led to changes in the ovarian follicles, including reduction of primordial and growing primary to pre-antral follicle counts (IARC, 1994).

Effects observed were reduced foetal bodyweight, testicular atrophy, effects on sperm and damage to ovarian follicles were noted for the structural analogue 1,3-butadiene. There are a number of studies in rats and mice available for this analogue that found reproductive and developmental effects following inhalation exposures to the chemical (NICNAS).

Overall, available data for the chemical, together with effects observed for the analogue 1,3-butadiene, provide sufficient evidence to show that isoprene may have potential reproductive and developmental toxic effects. These are considered sufficient to warrant classification for both reproductive and developmental effects (see **Recommendation** section).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation include systemic long-term effects, such as carcinogenicity, mutagenicity, reproductive toxicity and developmental toxicity. A mode of induction for tumours involving direct interaction with genetic material cannot be precluded.

Prolonged exposure to the chemical may also cause respiratory irritation. Although, given the controls required for critical health effects, exposure to irritant concentrations is expected to be unlikely.

Public Risk Characterisation

A previous mandatory call for information indicated that the chemical was not being introduced into Australia.

Although the chemical may be present in consumer articles introduced into Australia, as a residual monomer, the chemical is expected to be present only in trace amounts (OECD, 2005). Consequently, potential for consumer exposure will be negligible; hence, the public risk from this chemical is not considered to be unreasonable.

Occupational Risk Characterisation

Although the mandatory call for information indicated that the chemical was not being introduced into Australia, it is expected to be a constituent of a number of UVCB chemicals within the petroleum industry. Therefore, the exposure to isoprene should be controlled. The risks from exposure to isoprene as a constituent of UVCB chemicals will be further considered as part of any IMAP assessment of these chemicals.

The data available support an amendment to the hazard classification in HSIS (refer to **Recommendation** section).

NICNAS Recommendation

Assessment of the chemical is considered to be sufficient, provided that the recommended amendment to the classification is adopted, and labelling and all other requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

Regulatory Control

Work Health and Safety

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 hazards and environmental hazards.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Irritation / Corrosivity	Irritating to respiratory system (Xi; R37)	May cause respiratory irritation - Specific target organ tox, single exp Cat. 3 (H335)
Genotoxicity	Muta. Cat 3 - Possible risk of irreversible effects (Xn; R68)*	Suspected of causing genetic defects - Cat. 2 (H341)

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Carcinogenicity	Carc. Cat 2 - May cause cancer (T; R45)*	May cause cancer - Cat. 1B (H350)
Reproductive and Developmental Toxicity	Repro. Cat 3 - Possible risk of impaired fertility (Xn; R62) Repro. Cat 3 - Possible risk of harm to the unborn child (Xn; R63)	Suspected of damaging fertility - Cat. 2 (H361f) Suspected of damaging the unborn child - Cat. 2 (H361d)

[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 label instructions.

Advice for industry

Control measures

Control measures to minimise the risk from inhalation 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 which may 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;
- health monitoring for any worker who is at risk of exposure to the chemical if valid techniques are available to monitor the effect on the worker's health;
- air monitoring to ensure control measures in place are working effectively and continue to do so;
- 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 assist with meeting 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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