Oxiranemethanol: Human health tier II assessment

13 February 2015

CAS Number: 556-52-5

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.

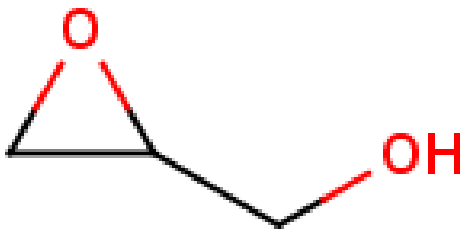
This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

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

Disclaimer

Acronyms & Abbreviations

Chemical Identity

Synonyms	glycidol 2,3-epoxy-1-propanol 1,2-epoxy-3-hydroxypropane 1-hydroxy-2,3-epoxypropane 2-hydroxymethyloxirane
Structural Formula	
Molecular Formula	C3H6O2
Molecular Weight (g/mol)	74.08
Appearance and Odour (where available)	Colourless, slightly viscous liquid with no odour
SMILES	C1(CO)CO1

Import, Manufacture and Use

Australian

No specific Australian industrial use, import, or manufacturing information has been identified.

According to Food Standards Australia New Zealand (FSANZ), the chemical is:

- a potential impurity (present at a maximum residual concetration of 0.5 mg/kg wet weight) in agarose-based ion exchange resins used as a processing aid in beer manufacturing (FSANZ, 2007); and
- a potential breakdown product of 3-chloro-1,2-propanediol, a chloropropanol formed in foods that can be dehalogenated by microbial enzymes (FSANZ, 2003).

International

The following international uses have been identified through Galleria Chemica; the United States Environmental Protection Agency's Aggregated Computer Toxicology Resource (US ACToR); the US National Library of Medicine's Hazardous Substances Data Bank (HSDB); and various

international assessments (US National Toxicology Program (NTP) 13th Report on Carcinogens, 2014; International Agency for Research on Cancer (IARC) Monograph Volume 77, 2000).

The chemical has reported commercial use as an additive (demulsifier) for oil and synthetic hydraulic fluids.

The chemical has reported site-limited uses:

- in manufacturing vinyl polymers (as a stabiliser);
- as an intermediate in manufacturing cosmetics, surfactants and polymers (for detergents and paints);
- as a stabiliser for natural oils;
- as an intermediate in producing epoxides; and
- as an epoxy resin diluent.

The chemical has reported non-industrial uses:

- as a sterilant in pharmaceuticals;
- as an intermediate in preparing glycerol and glycidyl ethers, esters and amines in the pharmaceutical industry; and
- in producing flavouring/sweetening agents and insecticides.

Restrictions

Australian

No known restrictions have been identified.

International

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

- EU Cosmetics Regulation 1223/2009 Annex II—List of substances prohibited in cosmetic products;
- ASEAN (Association of Southeast Asian Nations) Cosmetic Directive Annex II Part 1: List of substances which must not form part of the composition of cosmetic products; and
- New Zealand Cosmetic Products Group Standard—Schedule 4: Components cosmetic products must not contain.

Existing Work Health and Safety Controls

Hazard Classification

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

- T; R23, Xn; R21/22 (acute toxicity)
- Xi; R36/37/38 (irritation)
- Repr. Cat. 2; R60 (reproductive toxicity)
- Muta. Cat. 3; R68 (mutagenicity)
- Carc. Cat. 2; R45 (carcinogenicity).

Exposure Standards

Australian

The chemical has an exposure standard of 76 mg/m^3 (25 ppm) time weighted average (TWA) (Safe Work Australia).

International

The following exposure standards are identified (Galleria Chemica):

- An exposure limit of 1–150 mg/m^3 (0.2–50 ppm) TWA and 1–300 mg/m^3 (0.2–100 ppm) short-term exposure limit (STEL) in different countries such as the USA (California, Hawaii, Minnesota, Tennessee, Vermont, Washington), Canada (Alberta, British Columbia, Quebec, Saskatchewan, Yukon), Denmark, France, Germany, Greece, Iceland, Indonesia, Ireland, Malaysia, Mexico, Norway, Phillipines, Poland, Russia, Singapore, Spain and Taiwan.

Health Hazard Information

Toxicokinetics

In a toxicokinetics study, male Fischer 344 (F344) rats received a single dose of the chemical at 37.5 or 75 mg/kg bw by oral gavage or intravenous injection. In the orally treated animals, 87–92 % of the administered dose was absorbed from the gastrointestinal tract. The distribution of the chemical was similar in both dosing groups, with the highest concentrations found in blood cells, followed by the thyroid, liver, kidneys and spleen. The chemical was excreted via the urine (40–48 %), faeces (5–12 %) or exhaled as carbon dioxide (26–32 %). At 72 hours post application, 7–8 % of the chemical remained in the tissues (Nomeir et al., 1995; cited in IARC, 2000 and HSDB).

In male Wistar rats injected intraperitoneally (i.p.) three times with the chemical at 100 mg/kg bw, the major urinary metabolites were *S*-(2,3-dihydroxypropyl)glutathione, *S*-(2,3-dihydroxypropyl)cysteine and β-chlorolactic acid. The formation of β-chlorolactic acid was likely to be secondary to the generation of a-chlorohydrin (also known as epichlorohydrin), which was oxidised by alcohol and aldehyde dehydrogenases (Jones & O'Brien, 1980; cited in IARC, 2000 and REACH).

The chemical is hydrolysed to glycerol (97.2 %) and 3-chloro-1,2-propanediol (2.8 %) in an acidic environment (0.1 M hydrochloric acid). In a neutral environment and at 37 °C, the chemical slowly hydrolyses to glycerol. The chemical reacts with glutathione to form *S*-(2,3-dihydroxypropyl)glutathione at pH 7 or 8 (Jones, 1975; cited in IARC, 2000).

Acute Toxicity

Oral

The chemical is classified as hazardous with the risk phrase ‘Harmful if swallowed’ (Xn; R22) in the Hazardous Substances Information System (HSIS) (Safe Work Australia). The available data support this classification.

The median lethal dose (LD50) in rats was reported to be 420–850 mg/kg bw. Reported signs of toxicity included central nervous system (CNS) depression (characterised by ataxia, incoordination, decreased motor activity); dyspnoea (shortness of breath) and lacrimation (tearing) (REACH).

Dermal

The chemical is classified as hazardous with the risk phrase ‘Harmful in contact with skin’ (Xn; R21) in the HSIS (Safe Work Australia). The available data support this classification.

The dermal LD50 was 1980 mg/kg bw in rabbits (REACH).

Inhalation

The chemical is classified as hazardous with the risk phrase ‘Toxic by inhalation’ (T; R23) in the HSIS (Safe Work Australia). The available data support this classification.

The median lethal concentration (LC50) of the chemical vapour was reported to be 450 and 580 ppm (1.38 and 1.75 mg/L) in male mice and rats, respectively. Reported signs of toxicity included dyspnoea (shortness of breath), lacrimation (tearing), salivation, nasal discharge, aerophagia (swallowing air), and CNS depression or stimulation (Hine et al., 1956).

Corrosion / Irritation

Respiratory Irritation

The chemical is classified as hazardous with the risk phrase 'Irritating to respiratory system' (Xi; R37) in the HSIS (Safe Work Australia). The limited data available support this classification.

Shortness of breath, nasal discharge and irritation and inflammation of the lungs were reported in acute inhalation toxicity studies in rodents (REACH).

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. The chemical was reported to cause necrosis following a few dermal applications in rabbits, but the available information on single applications is not sufficient to consider a higher hazard classification.

In a standard Draize test using a single application on occluded rabbit skin (no details available on the amount or concentration of the chemical used, the length of exposure or the number of animals tested), the chemical was reported to be moderately irritating (Draize score = 4.5/8.0). The chemical was severely irritating when repeated doses were applied over four days, resulting in skin necrosis (Clayton & Clayton [eds.], 1994).

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 in one rabbit, a single drop of the chemical was found to be severely irritating at one, 24 and 48 hours after application. A Draize score of 68/110 was reported as the average of all three observations (details not available). There were no permanent effects to the eye (Clayton & Clayton [eds], 1994).

Observation in humans

The chemical was reported to be irritating to the skin, eyes and respiratory tract following dermal or inhalation exposure (HSDB). Details are not available.

Sensitisation

Skin Sensitisation

The chemical is not considered to be a skin sensitiser.

In a local lymph node assay (LLNA) conducted according to the Organisation for Economic Co-operation and Development Test Guideline (OECD TG) 429, female CBA/CaCrl mice (n = 4/dose) were exposed to 25, 50 or 100 % concentration of the chemical on the auditory pinnae (ear flaps), daily for three days. The auricular lymph nodes were recovered on day six, and the stimulation indices (SI) were calculated to be <3 for all test concentrations (0.5, 1.2 and 1.6 for 25 %, 50 % and 100 % v/v, respectively), indicating the chemical as non sensitising (REACH).

Observation in humans

It was reported that long-term exposure to the chemical might cause skin sensitisation in humans (HSDB). Details are not available.

Repeated Dose Toxicity

Oral

Based on the available data, the chemical is not considered to cause serious damage to health from repeated oral exposure.

In a 90-day study (similar to OECD TG 408), F344/N rats (n = 10/sex/dose) were administered the chemical by oral gavage at doses of 0, 25, 50, 100, 200 or 400 mg/kg bw/day. The no observed adverse effect level (NOAEL) was determined to be 25 mg/kg bw based on the effects (decreased body weight) observed at 50 mg/kg bw/day. Deaths were reported at doses of 200 mg/kg bw/day (3/10 males and 1/10 females) and 400 mg/kg bw/day (all rats, by week two). Death was associated with brain demyelination and necrosis, kidney cell degeneration and necrosis, as well as thymus tissue necrosis (NTP, 1990).

In a 90-day study (similar to OECD TG 408), B6C3F1 mice (n = 10/sex/dose) were administered the chemical by oral gavage at doses of 0, 19, 38, 75, 150 or 300 mg/kg bw/day. The lowest observed adverse effect level (LOAEL) was determined to be 19 mg/kg bw/day based on decreased body weight. Animal deaths were reported at doses of 150 mg/kg bw/day (4/10 males and 3/10 females) and 300 mg/kg bw/day (all mice, by week two). Death was associated with brain demyelination and kidney cell degeneration (NTP, 1990).

Dermal

Only limited data are available. Repeated dermal exposure to the chemical for seven days caused mortalities in rabbits. However, details of systemic effects in these animals were not available in order to draw a conclusion on repeated dose dermal toxicity of the chemical.

Only a short-term study was available. In this non-guideline study (similar to a Draize test), six male Californian rabbits were exposed to 0.2 mL of the undiluted chemical on a shaved intact area (of 1 cm diameter on their back) for one hour, once daily for up to seven days. Three out of six rabbits died following seven applications, and maximum irritation was observed by the fourth application in some animals, with treatment discontinued after five applications due to a maximum eschar score (score not available). All animals showed signs of erythema followed by oedema, and there was increased irritation after each application. There was no weight gain in any of the animals during the treatment period and body weight significantly decreased before death. Localised deep wounds at the site of application were observed at necropsy (Hine et al., 1956).

Although the study indicated systemic toxicity effects in animals 48 hours before death, details were not available. It is also unclear from the information available if the rabbits were exposed to multiple chemicals simultaneously, therefore confounding the interpretation of the outcome. Based on the volume of chemical applied, the dose administered is considered to be equivalent to approximately 114 mg/kg bw/day (based on a density of 1.143 g/mL for 100 % pure chemical, 0.2 mL/day = 0.2286 g/day; minimal body weight = 2 kg; approximate dose = 0.2286 g/2 kg = 0.1143 g/kg = 114.3 mg/kg bw/day).

Inhalation

Based on the available data, the chemical is not considered to cause serious damage to health from repeated inhalation exposure.

Male Long–Evans rats were exposed (whole body) to 400 ppm of the chemical via inhalation for seven hours/day, five days/week for 50 days. There were signs of minor irritation of the eyes (tearing and encrustation of the eyelids) and minor respiratory distress (no details available) following the first few exposures, but these did not worsen or continue for the duration of the study. A slight decrease in body weight gain, slight reduction in the amount of peritoneal fat and slight increase in haemoglobin content compared with concurrent control animals were reported (ACGIH, 2001; REACH).

Genotoxicity

The chemical is classified as hazardous as a Category 3 mutagenic substance with the risk phrase 'Possible risk of irreversible effects' (R68) in the HSIS (Safe Work Australia). The sex-linked recessive lethal (SLRL) test in *Drosophila melanogaster* was positive for germ cell mutations. Although ambiguous results were reported for the dominant lethal assay in Wistar rats when exposed to the chemical via inhalation, repeated dose oral toxicity studies in rats showed effects on the male reproductive system (see **Reproductive and developmental toxicity** section) indicating that the chemical can reach the testes which causes genotoxic effects, warranting a higher hazard classification.

Several in vitro tests gave mostly positive results for gene mutation and clastogenicity (NTP, 1990; IARC, 2000; ACGIH, 2001; REACH):

- multiple (six) bacterial reverse mutation assays (Ames tests), with or without metabolic activation, in *Salmonella typhimurium* strains TA 97, 98, TA 100, TA 1535, TA 1537, TA 1538 and *Neurospora crassa*;
- two bacterial forward mutation assays without metabolic activation in *Escherichia coli* strain Sd-4 and *Klebsiella pneumoniae*;
- a forward mutation assay with or without metabolic activation in *Schizosaccharomyces pombe*;
- multiple DNA damage and/or repair assays (a single cell gel/comet assay in Chinese hamster ovary (CHO) K1 cells, sister chromatid exchange assays in CHO cells and V79 Chinese hamster lung fibroblasts, a prophage induction and SOS repair assay in *E. coli* PQ 37 strain, an unscheduled DNA synthesis assay in WI-38 cells);
- an in vitro mammalian chromosome aberration test in CHO cells with or without metabolic activation (but an ambiguous outcome in human lymphocytes tested without metabolic activation only); and
- other assays of genetic toxicity (positive in mouse lymphoma assays, but ambiguous in a morphological transformation assay in Syrian hamster embryo cells).

Several in vivo tests gave positive results for genotoxicity (NTP, 1990; IARC, 2000; ACGIH, 2001; NTP, 2007; REACH):

- a sister chromatid exchange assay in male CD-1 mice i.p. exposed to the chemical at 100 mg/kg bw;
- a polychromatic erythrocyte micronucleus assay in the bone marrow of male B6C3F1 mice that received two i.p. injections of the chemical 24 hours apart at doses of 37.5, 75 or 150 mg/kg bw;
- a micronucleus assay in peripheral blood erythrocytes of male and female haplo-insufficient p16Ink4a/p19Arf mice exposed to the chemical by oral gavage doses of 25, 50, 100 or 200 mg/kg bw/day for five days a week for 40 weeks;

- a chromosomal aberration test in bone marrow cells of male and female Wistar rats that received the chemical via i.p. injection (dose not available); and
- an SLRL test and heritable translocation test in *D. melanogaster* resulted in increased SLRL mutations and increased reciprocal translocations in the germ cells of male *D. melanogaster* fed a solution containing 1230 ppm of the chemical for 72 hours.

There were also some inconclusive or negative in vivo results for various tests (IARC, 2000; REACH):

- negative results in a chromosomal aberration test in bone marrow cells of mice that were exposed to the chemical via oral (five doses of 226 mg/kg bw/day) or intraperitoneal (five doses of 145 mg/kg bw/day) routes;
- negative results in an erythrocyte micronucleus assay in the bone marrow cells of female Chinese hamsters that were exposed to the chemical twice (in a 24-hour interval) intraperitoneally at 0.02, 0.06 or 0.18 mL/kg bw; and
- an ambiguous outcome in a dominant lethal assay in Wistar rats that were exposed to the chemical vapour via inhalation at doses of 0, 40, 130 or 400 ppm for six hours/day for five days.

Carcinogenicity

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

The IARC has classified the chemical as ‘Probably carcinogenic to humans’ (Group 2A), based on inadequate evidence for carcinogenicity in humans, but sufficient evidence for carcinogenicity in animals (IARC, 2000).

In two-year carcinogenicity studies, F344/N rats and B6C3F1 mice were administered the chemical via oral gavage doses of 0, 37.5 or 75 mg/kg bw/day, five days per week for 103 weeks (n = 50/sex/dose). Multiple dose-dependent tumours were induced in both rats and mice exposed to the chemical. In rats, metastasising mesothelioma and mammary gland tumours were the most frequent in males and females, respectively. Other tumours were found in the brain, forestomach and thyroid gland (males and females); as well as the intestine, skin and Zymbal gland in males; and the oral mucosa, clitoral gland and blood cells (leukaemia) in females. In mice, tumours of the Harderian gland were the most frequent in males and females. Male mice also had tumours of the forestomach, liver, lung and skin; whereas female mice had tumours of the mammary gland, subcutaneous tissue, uterus and skin (NTP, 1990).

Genetically modified haploinsufficient p16Ink4a/p19Arf mice, treated with the chemical at doses of 0, 25, 50, 100, or 200 mg/kg bw five days per week for 40 weeks, showed an increased incidence of histiocytic sarcomas and alveolar/bronchiolar adenomas in males and increased alveolar/bronchiolar adenomas in females. Non-neoplastic lesions in male and female mice included hyperplasia of the forestomach and brain neuronopathy (NTP, 2007).

In Syrian golden hamsters that received the chemical by an oral gavage dose of 100 mg/kg bw/day, twice weekly for 60 weeks, a 'marginal increase in the incidence of splenic haemangiosarcomas' was reported (IARC, 2000; NTP, 2007).

A dermal carcinogenicity study conducted in 20 female ICR/Ha Swiss mice showed no tumours when the chemical was applied topically (100 mg), three days per week for 520 days (ACGIH, 2001).

Reproductive and Developmental Toxicity

The chemical is classified as hazardous as a Category 2 substance toxic to reproduction with the risk phrase ‘May impair fertility’ (T; R60) HSIS (Safe Work Australia). There were several studies in rats and mice indicating reproductive toxicity effects, supporting this classification. Although some studies indicated foetal effects, these were considered to be secondary to maternal toxicity.

In repeated dose oral toxicity studies, male F344/N rats that received the chemical at doses equivalent to or greater than 25 mg/kg bw/day for 90 days had reduced sperm count and motility, as well as degenerated and atrophied testicles. Male B6C3F1 mice that were orally exposed to the chemical at doses greater than 19 mg/kg bw/day for 90 days had reduced sperm count and motility (NTP, 1990). In 16-day repeated dose oral toxicity studies, male F344/N rats and male B6C3F1 mice that were exposed to the chemical at 300 mg/kg bw/day showed inflammation and/or swelling and/or degeneration of the epididymus, or atrophied testicles (NTP, 1990).

In pregnant Sprague Dawley (SD) rats, the chemical was administered in one uterine horn at doses of 10, 100 and 1000 mg on gestation day (GD) 13, whilst saline was administered in the contralateral uterine horn. The dams were euthanised on GD 20. A resorption rate of approximately 50 % was reported for all treatment groups compared with controls; 44 % of the surviving foetuses treated with 1000 mg of the chemical had malformations, mostly of the forelimbs, hindlimbs or pinnae (IARC, 2000).

In another study, male and female mice were allowed to mate for 30 min and then female mice were treated with the chemical at doses of 0 or 250 mg/kg bw at 1, 6, 9 or 25 hours after mating (n = 23–31/dose/time-point). Mice were euthanised on GD 17. Increased resorptions were reported in all treatment groups compared with the control group; foetal anomalies (details not available) were reported in the one-hour and six-hour treatment groups (IARC, 2000).

Wistar rats were exposed (whole body) to the chemical gas at doses of 0, 50, 150 and 300 ppm (highest dose reduced to 250 ppm due to toxicity) for six hours/day from GD 6–16 (n = 19–22/dose). The maternal no observed adverse effect concentration (NOAEC) was reported to be 50 ppm based on decreased weight gain and reduced food intake at 150 ppm. Mortalities (4/22), increased post-implantation loss, decreased foetus weights, and

reduced ovary and uterus weights were reported at 250 ppm. The foetal NOAEC was 150 ppm based on increased number of ribs and dislocated sternum segments at 250 ppm (REACH). The foetal effects could have been secondary to maternal toxicity.

No evidence of teratogenicity was reported when pregnant CD-1 mice were administered the chemical by oral gavage doses of 0, 100, 150 or 200 mg/kg bw/day (n = 30–37/dose) on GD 6–15 and euthanised on GD 18. At 200 mg/kg bw/day, there were maternal deaths (5/30) and one dam produced a litter of 15 stunted foetuses (an effect that was likely secondary to maternal toxicity). Further, over 17 breeding cycles, there were no differences in the number of offspring produced by female (SEC x C57BL6) F1 mice that were administered the chemical at doses of 0 or 300 mg/kg bw by i.p. injection, before mating with (C3H/R1 x C57BL10) F1 male mice (IARC, 2000).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation include systemic long-term effects (carcinogenicity, mutagenicity, reproductive toxicity) and systemic acute effects (acute toxicity from inhalation exposure). The chemical can cause harmful effects following acute oral and dermal exposure. The chemical is also an irritant to the eyes, skin and the respiratory system.

Public Risk Characterisation

Given the uses identified for the chemical, it is unlikely that the public will be exposed. Hence, the public risk from this chemical is not considered to be unreasonable.

Occupational Risk Characterisation

Given the critical health effects, the chemical could pose an unreasonable risk to workers unless adequate control measures to minimise dermal, ocular and inhalation 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.

The data available support an amendment to the hazard classification in the HSIS (Safe Work Australia) (see **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 and environmental hazards.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Harmful if swallowed (Xn; R22)* Harmful in contact with skin (Xn; R21)* Toxic by inhalation (T; R23)*	Harmful if swallowed - Cat. 4 (H302) Harmful in contact with skin - Cat. 4 (H312) Fatal if inhaled - Cat. 2 (H330)
Irritation / Corrosivity	Irritating to eyes (Xi; R36)* Irritating to skin (Xi; R38)* Irritating to respiratory system (Xi; R37)*	Causes serious eye irritation - Cat. 2A (H319) Causes skin irritation - Cat. 2 (H315) May cause respiratory irritation - Specific target organ tox, single exp Cat. 3 (H335)
Genotoxicity	Muta. Cat 2 - May cause heritable genetic damage (T; R46)	May cause genetic defects - Cat. 1B (H340)

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 2 - May impair fertility (T; R60)*	May damage fertility - Cat. 1B (H360F)

[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 industry

Control measures

Control measures to minimise the risk from oral, dermal, ocular and 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 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;
- 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 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.

References

American Conference of Governmental Industrial Hygienists (ACGIH) 2001. Documentation of the Threshold Limit Values and Biological Exposure Indices for Chemical Substances. 7th Edition, Glycidol, 556-52-5.

Approved criteria for classifying hazardous substances [NOHSC:1008(2004)]. Third edition [NOHSC:1008 (2004)]. Accessed at http://www.safeworkaustralia.gov.au/sites/swa/about/publications/Documents/258/ApprovedCriteria_Classifying_Hazardous_Substances_NOHSC1008-2004_PDF.pdf

Clayton GD and Clayton FE (eds.) 1994. Patty's Industrial Hygiene and Toxicology. Volume II Part A: Toxicology. 4th edition, pp. 422-425. John Wiley& Sons.

Food Standards Australia and New Zealand (FSANZ) December 2007. Final Assessment Report, Application A600 - Agarose Ion Exchange Resin as a Processing Aid for Beer. Accessed at http://www.foodstandards.gov.au/code/applications/Documents/A600_FAR_Agarose_ion_exchange_resins_FINAL.doc

Food Standards Australia and New Zealand (FSANZ) October 2003. Chloropropanols in food - An analysis of public health risk. Accessed at http://www.foodstandards.gov.au/publications/Documents/Technical Report Chloropropanol Report 11 Sep 03.doc

Galleria Chemica. Accessed December 2014 at http://jr.chemwatch.net/galleria/

Globally Harmonised System of Classification and Labelling of Chemicals (GHS) United Nations, 2009. Third edition. Accessed at http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html

Hine CH, Kodama JK, Wellington JS, Dunlap MK& Anderson HH 1956. The toxicology of glycidol and some glycidyl ethers. AMA Archives of Industrial Health 14(3) pp. 250-264.

International Agency for Research on Cancer (IARC) 2000. Some Industrial Chemicals, IARC Monographs Volume 77. Accessed at http://monographs.iarc.fr/ENG/Monographs/vol77/index.php

Jones AR 1975. The metabolism of 3-chloro,- 3-bromo- and 3-iodoprpan-1,2-diol in rats and mice. Xenobiotica 5(3): 155-165. (Cited in IARC, 2000).

Jones AR and O'Brien RW 1980. Metabolism of three active analogues of the male anti-fertility agent alpha-chlorohydrin in the rat. Xenobiotica 10, 365-370. (Cited in IARC, 2000 and REACH).

National Toxicology Program (NTP) 1990. Technical Report Series No. 374 - Toxicology and Carcinogenesis Studies of Glycidol. US Department of Health and Human Services. Available at http://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr374.pdf

National Toxicology Program (NTP) 2007. NTP GMM 13 Report - Toxicology and Carcinogenesis Study of Glycidol. US Department of Health and Human Services Secretary. Available at http://ntp.niehs.nih.gov/ntp/htdocs/gmm_rpts/gmm13.pdf

National Toxicology Program (NTP) 2014. Report on Carcinogens (RoC), Thirteenth Edition. US Department of Health and Human Services. Available at http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html

Nomeir AA, Silveira DM, Ferrala NF, Markham PM, McComish MF, Ghanayem BI& Chadwick M 1995. Comparative disposition of 2,3-epoxy-1-propanol (glycidol) in rats following oral and intravenous administration. J Toxicol Environ Health 44(2):203-17. (Cited in IARC, 2000).

Registration, Evaluation and Authorisation of Chemicals (REACH) Dossier. 556-52-5. Accessed December 2014 at http://echa.europa.eu/web/guest/information-on-chemicals/registered-substances

Safe Work Australia (SWA). Hazardous Substances Information System (HSIS). Accessed December 2014 at http://hsis.safeworkaustralia.gov.au/HazardousSubstance

Substances in Preparations in Nordic Countries (SPIN). Accessed December 2014 at http://188.183.47.4/dotnetnuke/Home/tabid/58/Default.aspx

US Environmental Protection Agency's Aggregated Computational Toxicology Resource (ACToR). 556-52-5. Accessed December 2014 at http://actor.epa.gov/actor/faces/ACToRHome.jsp

US National Library of Medicine's Hazardous Substances Data Bank (HSDB). 556-52-5. Accessed December 2014 at http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB

Last update 13 February 2015

Share this page