1,3-Benzenediamine, dihydrochloride: Human health tier II assessment

07 February 2014

CAS Number: 541-69-5

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.

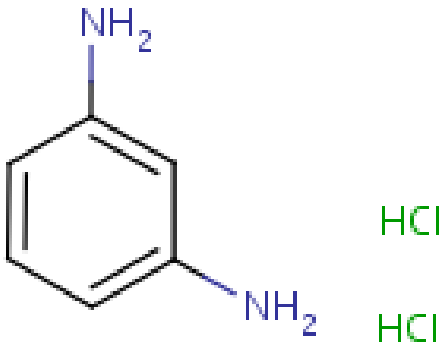
This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

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

Disclaimer

Acronyms & Abbreviations

Chemical Identity

Synonyms	m-phenylenediamine dihydrochloride 1,3-diaminobenzene dihydrochloride m-aminoaniline dihydrochloride m-benzenediamine dihydrochloride 1,3-phenylenediamine dihydrochloride
Structural Formula	
Molecular Formula	C6H8N2.2ClH
Molecular Weight (g/mol)	181.07
Appearance and Odour (where available)	White or slightly red crystalline powder (HSDB).
SMILES	c1(N)cc(N)ccc1

Import, Manufacture and Use

Australian

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

International

The following international uses have been identified through European Union Registration, Evaluation and Authorisation of Chemicals (EU REACH) dossiers; Galleria Chemica; the European Commission Cosmetic Ingredients and Substances (CosIng) database; United States (US) Personal Care Product Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary and the US National Library of Medicine's Hazardous Substances Data Bank (HSDB).

The chemical has reported cosmetic use including:

- in hair dye formulations.

The chemical has reported commercial use including:

- as an analytical reagent.

Restrictions

Australian

The chemical is listed as a group entry in the Poisons Standard (Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)) as below:

Schedule 6:

'PHENYLENEDIAMINES and alkylated phenylenediamines not elsewhere specified in these Schedules:

(a) in preparations packed and labelled for photographic purposes;

(b) in preparations packed and labelled for testing water **except** tablets containing 10 mg or less of diethyl-para-phenylenediamine or dimethyl-para-phenylenediamine in opaque strip packaging provided the directions for use include the statement, “Do not discard testing solutions into the pool";

(c) in hair dye preparations **except** when the immediate container and primary pack are labelled with the following statements:

KEEP OUT OF REACH OF CHILDREN, and

WARNING - This product contains ingredients which may cause skin irritation to certain individuals. A preliminary test according to the accompanying directions should be made before use. This product must not be used for dyeing eyelashes or eyebrows; to do so may be injurious to the eye.

written in letters not less than 1.5 mm in height; or

(d) in eyelash and eyebrow tinting products when the immediate container and primary pack are labelled with the following statement:

WARNING - This product contains ingredients which may cause skin irritation to certain individuals, and when used for eyelash and eyebrow tinting may cause injury to the eye. A preliminary test according to the accompanying directions should be made

before use.

written in letters not less than 1.5 mm in height'.

Schedule 6 chemicals are labelled with 'Poison'. These are substances with a moderate potential for causing harm, the extent of which can be reduced by using distinctive packaging with strong warnings and safety directions on the label.

Appendix C:

'PHENYLENEDIAMINES in preparations for skin colouration and dyeing of eyelashes or eyebrows except when included in Schedule 6'.

Appendix C chemicals are substances of such danger to health as to warrant prohibition of sale, supply and use.

International

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

- EU Cosmetics Regulation 1223/2009 Annex II—List of substances prohibited in cosmetic products: m-phenylenediamine and its salts;
- New Zealand Cosmetic Products Group Standard—Schedule 4: Components cosmetic products must not contain—Table 1: m-phenylenediamine and its salts; and
- Thailand Cosmetic Act—Specially Controlled Substances: m/p-phenylenediamines and salts: 6.0 % in permanent hair dyeing products calculated as phenylenediamines and total quantity not more than 6.0 %.

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):

T; R23/24/25 (acute toxicity)

Xi; R36 (irritation)

Xi; R43 (sensitisation)

Muta. Cat. 3; R68 (genotoxicity)

Exposure Standards

Australian

No specific exposure standards are available.

International

No specific exposure standards are identified.

Health Hazard Information

1,3-benzenediamine (CAS No. 108-45-2) has been assessed as an Inventory Multi-tiered Assessment and Prioritisation (IMAP) Tier II assessment (NICNAS). As 1,3-benzenediamine dihydrochloride is a salt resulting from 1,3-benzenediamine reacted with two molecules of hydrochloric acid, 1,3-benzenediamine is a structurally similar chemical. While there may be differences between the hydrochloride salt and the parent base with respect to local effects, the speciation of the chemical in biological fluids will be dependent on pH but independent of the original chemical form. Where data are unavailable for the chemical (1,3-benzenediamine dihydrochloride) for a specific health endpoint, or where further weight of evidence is desirable, 1,3-benzenediamine data have been used in this assessment.

Toxicokinetics

No data are available for the chemical. However, as for the analogue (1,3-benzenediamine), the chemical is expected to be rapidly absorbed through the dermal route in rats and dogs. In the rat liver, the chemical is expected to be metabolised into three main metabolites (N-acetyl-1,3-diaminobenzene, N,N'-diacetyl-2,4-diaminophenol and N, N'-diacetyl-1,3-diaminobenzene). Urine was reported to be the primary route of excretion (49 %) for 1,3-benzenediamine (HSDB; REACH cited in NICNAS).

Acute Toxicity

Oral

The chemical is classified as hazardous with the risk phrase ‘Toxic if swallowed’ (T; R25) in HSIS (Safe Work Australia). No data are available on the chemical. However, the data available for the analogue (1,3-benzenediamine) supports this classification.

The median lethal dose (LD50) for 1,3-benzenediamine is 280–650 mg/kg bw in rats; 67.7 mg/kg bw in mice; 450 mg/kg bw in guinea pigs; 437 mg/kg bw in rabbits; and 562 mg/kg bw in wild birds (ChemIDPlus; HSDB cited in NICNAS).

Dermal

The chemical is classified as hazardous with the risk phrase ‘Toxic in contact with skin’ (T; R24) in HSIS (Safe Work Australia). No data are available on the chemical. However, the data available for the analogue (1,3-benzenediamine) supports this classification.

The LD50 for 1,3-benzenediamine in mice is 90 mg/kg bw (CIR, 1997 cited in NICNAS).

Inhalation

The chemical is classified as hazardous with the risk phrase ‘Toxic by inhalation’ (T; R23) in HSIS (Safe Work Australia). No data are available on the chemical. However, the data available for the analogue (1,3-benzenediamine) supports this classification.

The median lethal concentration (LC50) for 1,3-benzenediamine is 3.2 mg/L in rats (with 95 % confidence limits of 2.6 and 4.1 mg/L) (CIR, 1997). In the four-hour (nose only exposure) study, red ocular discharge and nasal discharge were observed at concentrations from 0.72 to 3.9 mg/L. Lung noise and tremors were noted at 2 mg/L and laboured breathing was observed above 3.2 mg/L.

Corrosion / Irritation

Skin Irritation

No data are available for the chemical. However, the data available for the analogue (1,3-benzenediamine) indicates that this chemical is a slight skin irritant in New Zealand White rabbits. The irritation scores were below the level for classification (mean scores of 1.5, 1.7 and 0.3 for erythema; and 0, 0.7 and 0 for oedema at 1, 24 and 48 hours, respectively following the patch removal) (REACH cited in NICNAS). Another study in guinea pigs indicates the analogue chemical was an irritant at a 10 % concentration (REACH cited in NICNAS), but the irritation scores are not available making this study unable to be used for classifying the chemical. Local irritant effects for the salt are not expected to be greater than those for the parent base.

Eye Irritation

The chemical is classified as hazardous with the risk phrase 'Irritating to eyes' (Xi; R36) in HSIS (Safe Work Australia). No data are available on the chemical. However, the data available for the analogue (1,3-benzenediamine) support this classification.

In an eye irritation study (OECD test guideline (TG) 405), 0.01 g of 1,3-benzenediamine was instilled in one eye each of two New Zealand White rabbits. Only the eye of one rabbit was washed after 20 seconds. Severe effects occurred in the treated eyes within 72 hours after exposure and persisted for at least 24 hours. These effects included severe conjunctival redness, conjunctival blistering, moderate corneal opacity and iritis, nictitating membrane haemorrhaging and epithelial sloughing of the cornea. Severe chemosis was observed in the unwashed treated eye. The mean scores are not available. However, the maximum scores reported up to seven days are: 3 for cornea, 1 for iris and 4 for conjunctivae. The effects were reversible seven days after the treatment. The chemical, 1,3-benzenediamine, was considered to be an eye irritant (REACH cited in NICNAS).

In another study similar to OECD TG 405, 0.01 g of 1,3-benzenediamine was instilled in one eye each of two albino rabbits. Only the treated eye of one rabbit was washed after 20 seconds. Ocular effects (such as cloudiness, development of blood vessels, redness, swelling and discharge) occurred within 72 hours after exposure and persisted for at least 24 hours (mean scores not available). The effects were reversible within the 14-day observation period. 1,3-Benzenediamine was therefore considered to be a moderate eye irritant (REACH cited in NICNAS).

While the local irritant effects of the salt are not expected to be greater than those of the parent base, and are likely to be lower, in the absence of specific data for the chemical, this classification is supported.

Sensitisation

Skin Sensitisation

The chemical is classified as hazardous with the risk phrase ‘May cause sensitisation by skin contact’ (R43) in HSIS (Safe Work Australia). No data are available on the chemical. However, the data available for the analogue (1,3-benzenediamine) support this classification.

In a local lymph node assay (LLNA) (equivalent to OECD TG 429), 1,3-benzenediamine was a skin sensitiser in CBA mice; all tested with concentrations of 2, 5 and 10 % dosed topically once a day for three days. The effect concentration for tripling the response (EC3) was calculated as 0.49 % (REACH cited in NICNAS).

Repeated Dose Toxicity

Oral

No data are available for the chemical. The data available for the analogue (1,3-benzenediamine) indicates that although there were treatment-related effects in rats in the 90-day study at doses within the hazard classification range (no observed adverse effect level (NOAEL) of 6 mg/kg bw/d), the incidence and severity of these effects are not sufficient to warrant a hazard classification.

In a 90-day study (non-guideline), groups of 20 rats were administered 1,3-benzenediamine by gavage at 0, 2, 6 or 18 mg/kg bw/d. The following effects were reported at 18 mg/kg bw/d: liver degeneration (significant in one case with nuclear pyknosis,

where the nucleus of the cell shrinks and the chromatin condenses to a solid, structureless mass), dose-dependent significant increase (percentage increase not available) in the absolute and relative liver weights in females and males, and increased kidney weight in females. There were no reported mortalities (IUCLID, 2000; REACH cited in NICNAS).

Dermal

No data are available for this chemical. The data available for the analogue (1,3-benzenediamine) were insufficient to make a conclusion regarding the potential of the chemical to cause serious damage to health from repeated dermal exposure.

Dermal application of 1 mL/kg bw/d of an oxidative dye formulation containing 1.5 % of 1,3-benzenediamine (with 3 % of hydrogen peroxide) to 12 rabbits for 13 weeks did not induce toxicity (CIR, 1997 cited in NICNAS).

In a two-year study, 0.2 or 1 mg of 1,3-benzenediamine was applied to the skin of mice (strains: C57BL/6Bd and C3Hf/Bd; n=20/sex and 40/sex, respectively) three times a week. No treatment-related effects were reported. The mortality rate was comparable with the control groups (between 10–50 % in both strains) except in C57BL/6Bd male mice where there were no mortalities in the control group, compared with 10–35 % in the treated groups. No explanation was available for the high mortality rates observed in most control and treatment groups (IUCLID, 2000 cited in NICNAS).

Inhalation

No data are available.

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 limited data for the chemical and the analogue (1,3-benzenediamine) supports this classification. There are no positive in vivo germ cell data to consider upgrading this existing classification.

In an Ames test with the strains of *Salmonella typhimurium* (TA98 and TA1537), the chemical was mutagenic with metabolic activation at up to 1250 µg/plate but showed negative results without metabolic activation. The chemical was not mutagenic with *S. typhimurium* (TA100, TA1535) and *Escherichia coli* (WP2uvrA/pKM101) at up to 5000 µg/plate with and without metabolic activation (CCRIS).

The analogue (1,3-benzenediamine) showed positive results in many in vitro tests such as Ames assays, sister chromatid exchange assay, microscreen assay, chromosomal aberration tests (in Chinese hamster ovary cells— (CHO), Chinese hamster lung cells— (CHL) and in human lymphocytes) and a forward mutational assay. In addition, 1,3-benzenediamine was positive in an in vivo micronucleus assay (REACH, IUCLID, 2000 and CIR, 1997 cited in NICNAS).

Carcinogenicity

Based on the information available, the chemical is not expected to be carcinogenic.

The International Agency for Research on Cancer (IARC) stated that no evaluation of carcinogenicity of this chemical can be made as it has only been tested as a constituent of a hair-dye formulation in mice using skin painting, and in rats by subcutaneous injection ('was inadequately tested') (IARC, 1978). Therefore, the chemical falls under Group 3 (Not classifiable as to its carcinogenicity to humans) (IARC, 1978—last updated March 1998). However, data (below) from carcinogenicity studies in rats and in mice (in diet) (HSDB) were not available at that time for IARC to conclude the evaluation of the potential carcinogenicity of this chemical.

In a carcinogenicity study, four groups of Wistar-King rats (n=5/group) were subcutaneously injected with the chemical at 0, 12 or 24 mg/kg bw/d for 5–11 months. No tumours were produced in any of the treated or control groups, except in one rat where fibrosarcoma was found at the highest dose tested (HSDB).

In a carcinogenicity study, groups of male rats (n=25/group, strain not reported) were administered the chemical (in the diet) at 0, 1000 or 2000 ppm for 18 months. Study mortality was 100 % in the high dose treated groups at 15 months. A recovery of lost body weight at week 20 after discontinuation of treatment was observed in some of low-dose treated groups. Both low and high dose groups showed an increased incidence of gastro-intestinal and liver tumours (incidence not reported), but treated rats showed generally fewer tumours than the controls (40 % and 41 % for high and low dose treated rat groups, respectively, and 59 % for controls) (HSDB).

In another carcinogenicity study, groups of mice (n=25/sex/group, strain not reported) were administered the chemical (in the diet) at 0, 2000 or 4000 ppm for 18 months. The study mortality rate was 100% in high and low dose groups in both sexes at 15 months and 19 months, respectively. Mean bodyweights of high-dose mice were reduced at 12 months. No significant increased incidence of tumours was identified in treated groups compared with the control group. Amyloid bodies were noted from 12 months onwards in all treated mice (HSDB).

Reproductive and Developmental Toxicity

No data are available for the chemical. Based on the available data for the analogue (1,3-benzenediamine), the chemical is not expected to have reproductive or developmental toxicity. All reported foetal effects for the analogue are likely to be secondary to maternal toxicity.

In a reproductive and developmental toxicity study (similar to OECD TG 414), three groups of 25 female rats (OFA (SD) SPF) were orally dosed with 1,3-benzenediamine at 10, 30 or 90 mg/kg bw/day on gestation days 5–16. At the highest dose, 6/25 dams died and statistically significant body weight changes were observed. Reduction in the number of litters with live pups, lower average body weight of live pups, increased total resorptions and an increased number of early and late dying embryos were also observed at the highest dose, compared with the control group. There were no major malformations. No statistically significant effects were observed in foetuses of dams of other treatment groups. The no observed adverse effect level (NOAEL) for maternal toxicity and foetal developmental toxicity was 30 mg/kg bw/d (REACH and CIR, 1997 cited in NICNAS).

In a similar study (non guideline), three groups of Sprague Dawley (SD) female rats were orally dosed (gavage) with 1,3-benzenediamine (in propylene glycol) at 0, 45, 90 or 180 mg/kg bw/d on gestation days 6–15. No mortality was observed. At 180 mg/kg bw/d, a significant decrease in mean maternal weight gain and an increased number of foetal resorptions (not statistically significant) were observed. The numbers of foetal implantations and foetal anomalies were not significantly different from the controls (IUCLID, 2000, REACH and CIR, 1997 cited in NICNAS). Details and effects on other treatment groups are lacking.

In a multigeneration reproduction study, 0.5 mL of a hair dye formulation containing 1.5 % of 1,3-benzenediamine, mixed with an equal volume of hydrogen peroxide (6 %), was applied on shaved skin on the back of SD rats (six groups, n=40/sex) twice a week until each rat was 100 days old. Three additional groups were used as controls. The rats were paired and mated for 15 days. The fertility, gestation, survival and live birth indices were comparable with the control groups in all generations. No toxicological signs related to the treatment were noted. Only mild dermatitis was observed intermittently throughout the treatment period in each generation (CIR, 1997 cited in NICNAS).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation include:

- systemic long-term effects (mutagenicity);
- local effects (skin sensitisation and eye irritation); and
- systemic acute effects (acute toxicity from oral, dermal and inhalation exposure).

Public Risk Characterisation

Although use of the chemical in Australia is not known, it is reported to be used in hair dye formulations overseas (HSDB). However, the chemical is not on the 'List of chemicals used as dyes in permanent and semi-permanent hair dyes in Australia' (NICNAS).

In Australia, this chemical is controlled as part of the chemical group phenylenediamines. Phenylenediamines are listed on Schedule 6 and Appendix C of the SUSMP with restrictions and prohibitions on its use in specific cosmetic products (including hair dyes) and other domestic uses. The Schedule 6 entry in the SUSMP allows phenylenediamines to be included in hair dye preparations and in eyelash and eyebrow tinting products with specific requirements.

While there is no identified use of this chemical in Australia based on voluntary surveys, should the chemical be used for hair dying and eyelash and eyebrow tinting, it will cause unreasonable risks to consumers based on the identified hazards of the chemical. NICNAS has recommended changes to the SUSMP entry for the parent base, and these changes should also apply to this salt.

If this chemical is included in cosmetic products containing N-nitrosating agents, carcinogenic N-nitrosamine compounds could be formed (SCCS, 2012).

Occupational Risk Characterisation

Given the critical health effects (systemic long-term effects, local effects and systemic acute effects), the chemical may pose an unreasonable risk to workers unless adequate control measures to minimise exposure to the chemical are implemented. Based on the available data, the hazard classification in HSIS is considered appropriate.

NICNAS Recommendation

Further risk management is required. Sufficient information is available to recommend that risks to public health and safety from the potential use of the chemical in cosmetics be managed through changes to poisons scheduling.

Assessment of the chemical is considered to be sufficient provided that risk management recommendations are implemented and all requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

Regulatory Control

Public Health

At present, the chemical falls within the scope of the listing of ‘phenylenediamines’ in Schedule 6 of the SUSMP for use in hair dye preparations under specified conditions.

Considering the severe health effects possible from exposure to this chemical (i.e. skin sensitisation, potential mutagenicity), it is recommended that this chemical be excluded from the ‘phenylenediamines’ group entry in Schedule 6 of the SUSMP for its use in hair dye preparations and eyelash and eyebrow tinting products.

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]

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Acute Toxicity	Toxic if swallowed (T; R25)* Toxic in contact with skin (T; R24)* Toxic by inhalation (T; R23)*	Toxic if swallowed - Cat. 3 (H301) Toxic in contact with skin - Cat. 3 (H311) Toxic if inhaled - Cat. 3 (H331)
Irritation / Corrosivity	Irritating to eyes (Xi; R36)*	Causes serious eye irritation - Cat. 2A (H319)
Sensitisation	May cause sensitisation by skin contact (Xi; R43)*	May cause an allergic skin reaction - Cat. 1 (H317)
Genotoxicity	Muta. Cat 3 - Possible risk of irreversible effects (Xn; R68)*	Suspected of causing genetic defects - Cat. 2 (H341)

[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 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;
- 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.

References

Approved Criteria for Classifying Hazardous Substances [NOHSC: 1008(2004)] Third edition. Accessed October 2013 at http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/ns2004criteriaforclassifyinghazardous

Chemical Carcinogenesis Research Information System (CCRIS). National Library of Medicine. Accessed December 2013 at http://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+ccris:@term+@rn+541-69-5

ChemIDplus Advanced. Accessed November 2013 at http://chem.sis.nlm.nih.gov/chemidplus/

Cosmetic Ingredient Review (CIR) 1997. Final report on the safety assessment of m-phenylenediamine and m-phenylenediamine sulfate. International Journal of Toxicology 16(suppl.1) pp. 59 - 115.

Cosmetics Directive (CosIng). 1,3-benzenediamine dihydrochloride (541-69-5). Accessed November 2013 at http://ec.europa.eu/consumers/cosmetics/cosing/

Galleria Chemica. Accessed at November 2013 at http://jr.chemwatch.net/galleria/

Hazardous Substances Data Bank (HSDB). National Library of Medicine. Accessed on November 2013 at http://toxnet.nlm.nih.gov

International Agency for Research on Cancer (IARC) 1978. Some Aromatic Amines and Related Nitro Compounds(Hair Dyes, Colouring Agents and Miscellaneous Industrial Chemicals), volume 16. 1,3-benzenediamine dihydrochloride (541-69-5). Accessed November 2013 at http://monographs.iarc.fr/ENG/Monographs/vol16/volume16.pdf

National Industrial Chemicals Notification and Assessment Scheme (NICNAS). Human health assessment for 1,3-benzenediamine (108-45-2). Australian Government Department of Health. Accessed November 2013 at http://www.nicnas.gov.au

Safe Work Australia (SWA). Hazardous Substances Information System (HSIS). Accessed November 2013 at http://hsis.safeworkaustralia.gov.au/HazardousSubstance

Scientific Committee on Consumer Safety (SCCS) Opinion on Nitrosamines and Secondary Amines in Cosmetic Products, 2012. Adopted at its 14th plenary meeting of 27 March 2012. Accessed September 2013at http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_090.pdf

The Poisons Standard (the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)) 2013. Accessed October 2013 at http://www.comlaw.gov.au/Details/F2013L01607/Download

Last update 07 February 2014

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