N-Methylol imidazolidones: Human health tier II assessment

21 April 2016

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Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
2-Imidazolidinone, 1,3-bis(hydroxymethyl)-	136-84-5
Imidazo[4,5-d]imidazole-2,5(1H,3H)-dione, tetrahydro-1,3,4,6-tetrakis(hydroxymethyl)-	5395-50-6

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

Grouping Rationale

The chemicals in this group, tetramethylol acetylenediurea (TMAD) (CAS No. 5395-50-6) and dimethylol ethyleneurea (DMEU) (CAS No. 136-84-5), are structurally related cyclic urea compounds. They possess a common mode of action in their respective roles in industrial applications that results in the release of low to moderate levels of formaldehyde (CAS No. 50-00-0) upon hydrolysis in aqueous and polar solvents. The cyclic urea compounds that are generated during hydrolysis are not likely to cause serious adverse effects; therefore, the hazardous properties of formaldehyde are expected to dominate the toxicity profile of these chemicals, particularly in consumer products.

Import, Manufacture and Use

Australian

The total volume of TMAD (CAS No. 5395-50-6) introduced into Australia, reported under previous mandatory and/or voluntary calls for information, was less than 100 tonnes. Use information was not specified.

No specific Australian use, import, or manufacturing information has been identified for the chemical DMEU (CAS No. 136-84-5).

International

The following international uses have been identified through:

- the European Commission Cosmetic Ingredients and Substances (CosIng) database;
- Galleria Chemica;
- the Substances and Preparations in Nordic countries (SPIN) database;

- the United States (US) Personal Care Products Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary;
- the US Environmental Protection Agency Aggregated Computer Toxicology Resource (ACToR);
- the US Environmental Protection Agency Chemical and Product Categories (CPCat) database; and
- the US Food and Drug Administration (FDA) - List of Indirect Additives Used in Food Contact Substances.

TMAD

The chemical has reported cosmetic use as a preservative (antimicrobial) in personal care products.

The chemical has reported domestic uses, including in:

- paints, lacquers and varnishes as a preservative (antimicrobial);
- cleaning and washing agents;
- fabric softeners; and
- colouring agents.

The chemical has reported commercial uses, including in:

- reprographic agents;
- durable press agents in textile products; and
- fillers.

The chemical has reported site-limited uses, including in:

- cutting fluids;
- impregnation materials; and
- surface treatments.

The chemical has reported non-industrial use as a pesticide and as a preservative in pharmaceuticals.

DMEU

The chemical has no reported cosmetic or domestic uses.

The chemical has reported commercial uses, including as:

- a durable press agent in textile products; and
- a component of food contact substances such as adhesives, coatings, paper and cardboard components.

Restrictions

Australian

There are no restrictions specific to these chemicals in Australia; however, these chemicals are known formaldehyde donors under aqueous conditions.

Formaldehyde (CAS No. 50-00-0) is listed in Schedule 6 and Schedule 10 of the SUSMP as follows:

- in Schedule 6:

'FORMALDEHYDE (excluding its derivatives) in preparations containing 0.05 per cent or more of free formaldehyde **except**:

(a) for human therapeutic use;

(b) in oral hygiene preparations;

(c) in nail hardener cosmetic preparations containing 5 per cent or more of free formaldehyde;

(d) in nail hardener cosmetic preparations containing 0.2 per cent or less of free formaldehyde when labelled with the statement: PROTECT CUTICLES WITH GREASE OR OIL;

(e) in all other cosmetic preparations; or

(f) in other preparations containing 0.2 per cent or less of free formaldehyde when labelled with the warning statement: CONTAINS FORMALDEHYDE.'

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

- in Schedule 10:

'FORMALDEHYDE (excluding its derivatives):

(a) in oral hygiene preparations containing more than 0.1 per cent of free formaldehyde;

(b) in aerosol sprays for cosmetic use containing 0.005 per cent or more of free formaldehyde;

(c) in nail hardener cosmetic preparations containing 5 per cent or more of free formaldehyde; or

(d) in all other cosmetic preparations containing 0.05 per cent or more of free formaldehyde **except** in preparations containing 0.2 per cent or less of free formaldehyde when labelled with the warning statement: CONTAINS FORMALDEHYDE.'

Schedule 10 chemicals are 'substances, other than those included in Schedule 9, of such danger to health as to warrant prohibition of sale, supply and use'.

Formaldehyde donors are mentioned in the definition of free formaldehyde in Part I of the *Poisons Standard* (Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)) as follows:

- "Free formaldehyde" includes all hydrated and non-hydrated formaldehyde present in aqueous solution, including methylene glycol and formaldehyde released from formaldehyde donors.

International

No international restrictions have been identified for the chemicals.

Existing Worker Health and Safety Controls

Hazard Classification

The chemicals are not listed on the Hazardous Substances Information System (HSIS) (Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available for the chemicals in Australia.

International

None of the chemicals have specific exposure standards.

Health Hazard Information

The chemical TMAD (CAS No. 5395-50-6) has widespread use as an antimicrobial in cosmetics and domestic products. Both TMAD and DMEU (CAS No. 136-84-5) are also employed in the manufacture of textiles. In cosmetic and domestic products, the biocidal mechanism involves formaldehyde release into aqueous solutions. The degree of completeness of formaldehyde release will depend on the concentration of the preservative in the product, the percentage of water in the product, the rate of formaldehyde release from the specific preservative (usually pH dependent), and the length of time since formulation. In the textile industry, the chemicals are used as colouring agents and durable press agents. However, these can degrade following the same hydrolytic mechanism to release traces of formaldehyde into fabric intended for personal clothing or furniture.

There are limited toxicological data available for the chemical DMEU, with most of the available information concerning the diurea TMAD. Where there are data gaps, information from TMAD is considered suitable for read across to DMEU due to their similar modes of action. Formaldehyde and other formaldehyde donors have been previously assessed by NICNAS (NICNASa, NICNASb). Where data are unavailable or limited for both chemicals, data for formaldehyde have been used. For skin sensitisation and systemic toxicity, it is considered that the formaldehyde released from the hydrolysis of these chemicals will be the critical driver of these modes of toxicity. While the toxicity of hydrolysis products other than formaldehyde (acetylenediurea (CAS No. 496-46-8) and ethyleneurea (CAS No. 120-93-4)) are also relevant and have been considered in this assessment, the EU SCCNFP has previously stated that similar formaldehyde-releasing chemicals used in cosmetics should be regulated based on free formaldehyde (SCCNFP, 2002).

Toxicokinetics

Limited toxicokinetic data are available for TMAD and no data are available for DMEU.

Oral absorption of TMAD was found to be low (CTGB, 2013). In an oral absorption study, rats dosed at 200 mg/kg bw and 1000 mg/kg bw of the chemical by oral gavage absorbed 22 % of the dose, with the largest portion of the chemical recovered in faeces (78 %). Only 2–9 % of the chemical was recovered in urine during the week following administration. Tissue distribution studies confirmed that the oral absorption of the chemical was low. Further study details were not described.

A dermal absorption study indicated poor dermal availability of TMAD (CTGB, 2013). Topical treatment of rats with 3 % ^{14}C-labelled TMAD for 6 hours resulted in 87 % of the total dose remaining unabsorbed. Only 1–4 % of the chemical was found in the stratum corneum after 6 hours, and 0.4–3 % of the dose had penetrated the deeper skin at this time point. Of the absorbed material, 0.04 % was excreted in faeces and 0.3 % was excreted in urine. The radioactivity detected in blood, organs and tissues was negligible after 6 and 24 hours, with no radioactivity detected after 48 hours.

Due to release of formaldehyde from both chemicals, formaldehyde is generally present in low concentrations when products containing the chemicals are administered. Formaldehyde is an endogenous metabolic product in many biochemical pathways in humans, and is rapidly metabolised through a number of pathways to formate and excreted in urine, or oxidized to carbon dioxide and exhaled (NICNASa).

Acute Toxicity

Oral

The chemicals have low acute toxicity based on results from animal tests following oral exposure.

Limited data are available for TMAD. The median lethal dose (LD50) in rats was reported as >5000 mg/kg bw, although no further details were included in the report (CTGB, 2013).

The cyclic urea hydrolysis product of TMAD, acetylenediurea (CAS No. 496-46-8) is suspected of harmful effects via the oral route based on a number of notifications to the Classification and Labelling Inventory by industry in the European Union (ECHA C&L); however, this breakdown product is not expected to be hazardous at the concentrations of TMAD used in consumer products.

Dermal

The chemicals have low acute toxicity based on results from animal tests following dermal exposure.

Limited data are available for TMAD. The median lethal dose (LD50) in rats was reported as >2000 mg/kg bw. No further details were included in the report (CTGB, 2013).

Inhalation

The chemicals have low acute toxicity in animal tests following inhalation exposure.

Limited data are available for TMAD. No mortalities were observed after 7 hours' exposure to saturated vapours of the chemical, although no further details were reported (CTGB, 2013).

Corrosion / Irritation

Skin Irritation

Limited data are available for the chemicals. The available data do not warrant hazard classification.

The chemical TMAD showed slight irritating effects in a skin irritation study with rabbits. The scores for erythema and oedema were reported as 1.5 and 0.165 respectively. However, severe skin irritation was observed after repeated dermal administration to rabbit skin. No other study details were reported (CTGB, 2013).

Formaldehyde is a known skin irritant (NICNASa), although at low reported concentrations of the chemicals anticipated in cosmetic products, skin irritation is not expected to occur.

Eye Irritation

Limited data are available for the chemicals. The available data do not warrant hazard classification.

The chemical TMAD was reported as non-irritating to rabbit eyes; however, no further study details were reported (CTGB, 2013).

Sensory irritation from formaldehyde vapour release is not expected from products containing the chemicals, given that formaldehyde is unlikely to be volatile from aqueous solutions at low concentrations. However, if the chemicals are applied directly to the eye, irritation could occur due to the severe irritancy of formaldehyde (NICNASa).

The cyclic urea hydrolysis product of DMEU, ethyleneurea (CAS No. 120-93-4) is suspected of being irritating to the eyes based on a number of notifications to the Classification and Labelling Inventory by industry in the European Union (ECHA C&L). However, this breakdown product is not expected to be hazardous at the reported low concentrations of TMAD used in consumer products.

Sensitisation

Skin Sensitisation

Based on the limited available animal and human studies, the chemicals are considered to be skin sensitisers. The release of formaldehyde—a known skin sensitiser (NICNASa)—from the chemicals under aqueous conditions is thought to be the causative agent for the observed sensitisation effects.

The chemical TMAD was found to be sensitising in a guinea pig maximisation test; however, no details were reported (CTGB, 2013).

Several instances of sensitisation in humans exposed to low concentrations of TMAD (see **Observation in Humans** section) indicate that the chemical is a sensitiser. The available data support the classification of the chemical as hazardous with the risk phrase 'May cause sensitisation by skin contact' (R43) in the HSIS (Safe Work Australia). The similar modes of action of TMAD and DMEU as formaldehyde releasers support extension of this classification to DMEU.

Observation in humans

There are limited human data available for TMAD. These studies were carried out on patients presenting at dermatology clinics with dermatitis.

In a study carried out on 103 clinic patients suspected of allergic contact dermatitis from contact with clothing, commercially-available allergen tests were applied on unaffected skin of the upper back. After 2 days, the patches were removed, and skin reactions graded according to standard patch test definitions at days 2, 3 and 7 after initial application. Thirty patients were found to be patch-positive. Nine of these patients had previously presented with purpuric allergic contact dermatitis and, out of these, one had a positive patch test result to TMAD. The study concluded that TMAD was one of several formaldehyde-releasing substances capable of inducing purpuric allergic contact dermatitis in humans (Lazarov and Cordoba, 2000).

Two studies were described in a literature review by Hatch and Maibach (1995), in which patients presenting with dermatitis at clinics had been patch-tested against formaldehyde-based textile dyes and resins. In the first study, 11 out of 13 subjects with suspected clothing dermatitis patch-tested positive to one or more formaldehyde-releasing chemicals in the series. One of these patients patch-tested positive to TMAD. In the second study, 16 out of 678 patients with unknown dermatitis were found to be allergic to formaldehyde-based dyes and resins, with 8 of these subjects allergic to TMAD. In both studies, most patients testing positive to TMAD also tested positive to formaldehyde (Hatch and Maibach, 1995).

Repeated Dose Toxicity

Oral

Based on the no observed adverse effect levels (NOAELs) available for TMAD from 28-day and 90-day rat studies (250–1000 mg/kg bw/day), as well as the lack of systemic toxicity of formaldehyde in oral studies (NICNASa), repeated oral exposure to the chemicals is not considered to cause serious damage to health.

In two available 28-day oral studies with rats, no effects attributable to treatment with TMAD were observed, with the NOAEL determined as 1000 mg/kg bw/day (the highest dose level tested). No further study details were reported (CTGB, 2013).

In a 90-day oral gavage study in rats, a NOAEL of 250 mg/kg bw/day TMAD was reported based on the irritation of the small intestine. This was attributed to the irritating properties of the hydrolysis product of the chemical, formaldehyde. No systemic toxicity was observed (CTGB, 2013).

Dermal

Considering the lowest observed adverse effect level (LOAEL) reported from a 28-day rat study using TMAD (100 mg/kg bw/day), and based on the lack of evidence of systemic toxicity of formaldehyde in relevant dermal studies (NICNASa), the chemicals are not considered to cause serious damage to health from systemic absorption from repeated dermal exposure.

In a 28-day dermal toxicity study in rats administered with TMAD, the primary effect was severe local irritation (ulcerative dermatitis) at all dose levels, although the dose range was not reported (CTGB, 2013). The LOAEL was determined to be 100 mg/kg bw/day. Other effects observed at higher doses included increased haematopoiesis, myeloid hyperplasia in the liver, spleen and bone marrow, as well enlarged reactive axillary lymph nodes. These were considered secondary to local effects.

Inhalation

Based on the results from an inhalation study in rats, as well as the lack of conclusive evidence of systemic toxicity of formaldehyde in inhalation studies (NICNASa), and the low volatility of formaldehyde from dilute aqueous solutions, the chemicals are not expected to be harmful due to repeated inhalation exposure to the formaldehyde released from products containing these chemicals.

In a 28-day inhalation study in rats, a concentration of 20 mg/m^3 of TMAD induced very slight changes in laryngeal epithelial cells, although a NOAEL was not determined (CTGB, 2013).

Genotoxicity

Based on the weight of evidence from the available in vitro and in vivo genotoxicity data for TMAD, the chemicals are not considered to be genotoxic.

TMAD was not mutagenic in an Ames test with 5 strains of *Salmonella typhimurium*, with or without metabolic activation. It was also reported that the chemical is not mutagenic in a mammalian HPRT assay in Chinese hamster V79 cells, but produced statistically significant and dose-related increases in the number of chromosomal aberrations in Chinese hamster V79 cells (with and without metabolic activation). Available in vivo tests (micronucleus bone marrow assay in mice and UDS test in rats) were both negative. No further details of these studies were described (CTGB, 2013).

No data are available for DMEU.

Formaldehyde will generally be present in products containing TMAD and DMEU. While some in vivo studies showed positive results for genotoxicity, formaldehyde was not classified as mutagenic in the Priority Existing Chemical (PEC) assessment report (NICNASa).

Carcinogenicity

No data are available for the chemicals. The chemicals are not likely to be carcinogenic.

While formaldehyde is classified hazardous (Category 2 carcinogenic substance) with the risk phrase 'May cause cancer by inhalation' (T; R49) in HSIS (Safe Work Australia), this applies to inhaled formaldehyde at high concentrations (NICNASa). Formaldehyde is not likely to be volatile from aqueous solutions at the low concentrations present in products containing these chemicals. Therefore, there are no carcinogenicity concerns relating to the role of the chemicals as formaldehyde releasers in such products.

Reproductive and Developmental Toxicity

Limited data are available for the chemicals. TMAD is listed on the Danish Environmental Protection Agency List of Effects 2009 as a reproductive toxin (Danish EPA, 2009). However, studies supporting this classification are not available. Based on the available data for formaldehyde (NICNASa), the chemicals are not expected to cause reproductive or developmental toxicity. In addition, the limited data for TMAD suggest that any reproductive and developmental effects are only observed secondary to maternal toxicity.

In a prenatal oral developmental study, rabbits were treated with TMAD at doses up to 1215 mg/kg bw/day. Maternal toxicity was observed at the two highest doses (405 mg/kg bw/day and 1215 mg/kg bw/day), including reductions in body weight and death (two rabbits per dose group). The specific pattern of gross pathological changes and lesions attributable to the treatment suggested that the lesions were incidental in nature. A significant reduction in mean total foetal weight was observed at the highest dose level, resulting in a NOAEL for foetal toxicity of 405 mg/kg bw/day. The NOAEL for maternal toxicity was determined to be 125 mg/kg bw/day. Further details of the study were not reported (CTGB, 2013).

In a 2-generation oral reproductive toxicity study in rats, the NOAEL for maternal toxicity of TMAD was determined as 100 mg/kg bw/day due to increased liver weights in the higher dose groups (up to 1000 mg/kg bw/day). The NOAEL for reproduction was 1000 mg/kg bw/day for both generations. The development of pups was not affected by treatment up to 1000 mg/kg bw/day. No further study details were reported (CTGB, 2013).

Risk Characterisation

Critical Health Effects

In general, the critical health hazards relate to the release of formaldehyde from products containing the chemicals. In cosmetic and domestic products, these chemicals are used as preservatives; therefore, the critical health hazard is considered to be skin sensitisation.

For workers, health hazards can arise from the presence of formaldehyde gas during formulation of products containing these chemicals (NICNASa).

Public Risk Characterisation

Although use in cosmetic and domestic products in Australia is not known, at least one of the chemicals is reported to be used in cosmetic and domestic products overseas. In these instances, the general public may be exposed to low concentrations of the chemicals via the dermal route. The potential risk of sensitisation relates to release of formaldehyde from products containing the chemicals. The SUSMP specifies limits for the levels of formaldehyde in cosmetic and domestic products (SUSMP, 2016). The current controls are considered adequate to minimise the risk to public health posed by domestic and cosmetic products containing the chemicals; therefore, the chemicals are not considered to pose an unreasonable risk to public health.

While use of the chemicals as durable press agents in Australian textiles is currently unknown, overseas information indicates that the chemicals can be used in clothing, with concomitant release of low levels of formaldehyde observed under certain conditions. In these instances, dermal exposure to residual formaldehyde may occur, increasing the public risk of skin sensitisation. In relation to this, in 2007 the Australian Competition and Consumer Commission (ACCC) investigated the residual formaldehyde content of a broad range of clothing purchased in the Australian market, and "no formaldehyde was detected in any of the garments submitted". In addition to actively monitoring the safety concerns arising from the presence of formaldehyde in consumer products, the ACCC has provided interim, non-regulatory reference limits for levels of formaldehyde in various garment and fabric products (ACCC) that are considered sufficient to mitigate the risk posed by the release of formaldehyde from these chemicals.

Occupational Risk Characterisation

Where these chemicals are handled in a pure or highly concentrated form during formulation, formaldehyde gas could be present and pose unreasonable risks to workers unless adequate control measures to minimise inhalation exposure to formaldehyde released from the chemicals are implemented. The chemicals should be appropriately classified and labelled and the appropriate risk management measures for formaldehyde (NICNASa) should be applied in these cases.

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

NICNAS Recommendation

Assessment of these chemicals 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

Public Health

The chemicals fall within the scope of the listing of 'formaldehyde' in Schedule 6 and Schedule 10 of the SUSMP. Products containing the chemical should be labelled in accordance with state and territory legislation (SUSMP, 2016).

Work Health and Safety

The chemicals are 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]
Sensitisation	May cause sensitisation by skin contact (Xi; R43)	May cause an allergic skin reaction - Cat. 1 (H317)

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

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

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

Advice for consumers

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

Advice for industry

Case-by-case formaldehyde release measurements should be performed by manufacturers to ensure that cosmetic and domestic products, including textiles, comply with the free formaldehyde limits outlined by the SUSMP and the ACCC.

Control measures

Control measures to minimise the risk from dermal and inhalation exposure to the chemicals 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 chemicals are used. Examples of control measures that could minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- using local exhaust ventilation to prevent the chemicals from entering the breathing zone of any worker;

- health monitoring for any worker who is at risk of exposure to the chemicals, 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 chemicals.

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 chemicals 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 these chemicals has not been undertaken as part of this assessment.

References

Australian Competition and Consumer Commission (ACCC). Product Safety Australia. Formaldehyde in consumer products. Accessed March 2016 at **https://www.productsafety.gov.au/content/index.phtml/itemId/973697**

Board for the Authorisation of Plant Protection Products and Biocides (CTGB) (2013). Decision regarding the submission for approval of Acticide FI(N) for use in the Netherlands by Thor GmbH, Admission number 14071 N.

Danish Ministry of the Environment, Environmental Protection Agency (Danish EPA) (2009). List of Effects, 2009. Accessed January 2016 at **http://eng.mst.dk/topics/chemicals/assessment-of-chemicals/lous---list-of-undesirable-substances-2009/**

de Groot AC, Flyvholm M-A, Lensen G, Menne T and Coenraads P-J (2009). Formaldehyde-releasers: relationship to formaldehyde contact allergy. Contact allergy to formaldehyde and inventory of formaldehyde-releasers. Contact Dermatitis 61: 63–85.

European Chemicals Agency, Classification and Labelling Inventory (ECHA C&L). Accessed March 2016 at **http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database**

European Commission Cosmetic Ingredients and Substances (CosIng) Database. Accessed January 2016 at **http://ec.europa.eu/consumers/cosmetics/cosing/**

Galleria Chemica. Accessed January 2016 at **http://jr.chemwatch.net/galleria/**

Hatch KL, Maibach HI (1995). Textile dermatitis: an update. Contact Dermatitis, 32: 319–326.

Lazarov A and Cordoba M (2000). Purpuric contact dermatitis in patients with allergic reaction to textile dyes and resins. Journal of the European Academy of Dermatology and Venereology, 14: 101–105.

National Industrial Chemicals Notification and Assessment Scheme (NICNASa) 2006. Formaldehyde (CAS No. 50-00-0). Priority Existing Chemical Secondary Notification Assessment Report No. 28. Accessed January 2016 at **http://www.nicnas.gov.au/__data/assets/pdf_file/0006/4389/PEC_28_Formaldehyde_Full_Report_PDF.pdf**

National Industrial Chemicals Notification and Assessment Scheme (NICNASb). Human Health Tier II assessment for Formaldehyde Donors. Australian Government Department of Health. Accessed January 2016 at **http://www.nicnas.gov.au/**

Safe Work Australia (SWA). Hazardous Substances Information system (HSIS). Accessed January 2016 at **http://hsis.safeworkaustralia.gov.au/HazardousSubstance**

Substances in Preparations in Nordic Countries (SPIN). Accessed January 2016 at **http://188.183.47.4/dotnetnuke/Home/tabid/58/Default.aspx**

The Poisons Standard (the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)) 2016. Accessed February 2016 at **https://www.comlaw.gov.au/Details/F2016L00036**

The Scientific Committee on Cosmetic Products and Non-Food Products intended for Consumers (SCCNFP), 2002. Opinion concerning a clarification on the formaldehyde and para-formaldehyde entry in Directive 76/768/EEC on cosmetic products. Adopted by the SCCNFP during the 22nd plenary meeting of 17 December 2002. SCCNFP/587/02, final. Accessed March 2016 at **http://ec.europa.eu/health/archive/ph_risk/committees/sccp/documents/out187_en.pdf**

United States (US) Personal Care Products Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary. Accessed January 2016 at **http://gov.personalcarecouncil.org/jsp/gov/GovHomePage.jsp**

US Environmental Protection Agency Aggregated Computational Toxicology Resource (ACToR). Accessed January 2016 at **http://actor.epa.gov/actor/faces/ACToRHome.jsp**

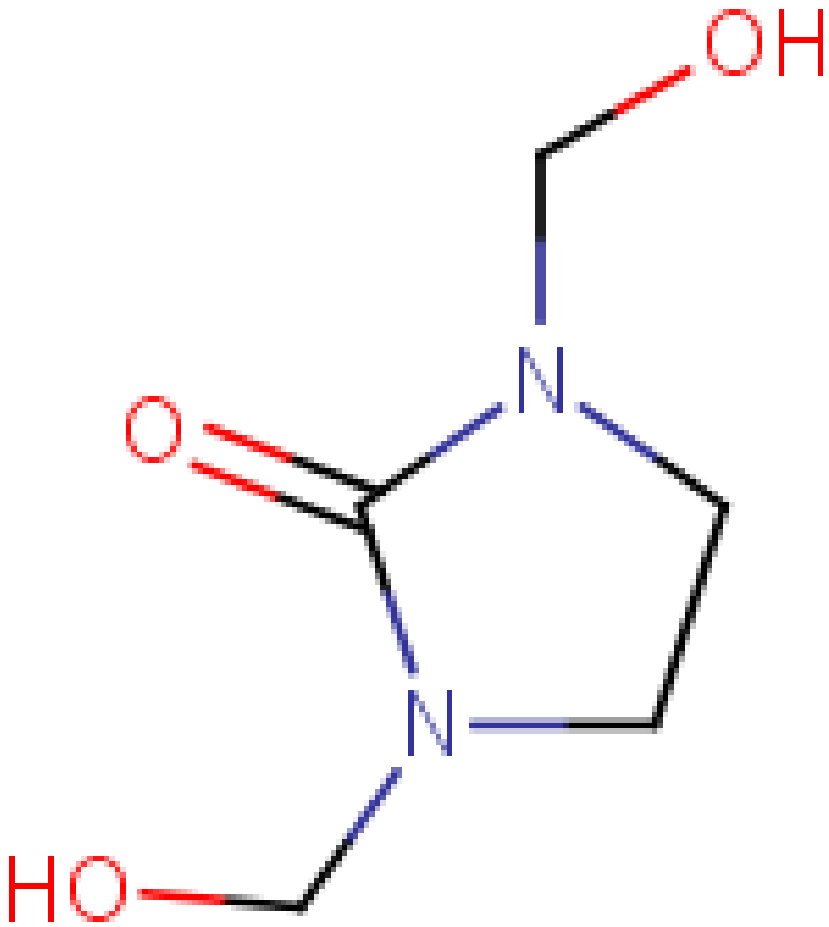
US Environmental Protection Agency Chemical and Product Categories (CPCat). Accessed March 2016 at **http://actor.epa.gov/cpcat/faces/search.xhtml**

US Food and Drug Administration (FDA). The List of Indirect Additives Used in Food Contact Substances. Accessed January 2016 at **http://www.accessdata.fda.gov/scripts/fcn/fcnNavigation.cfm?rpt=iaListing**

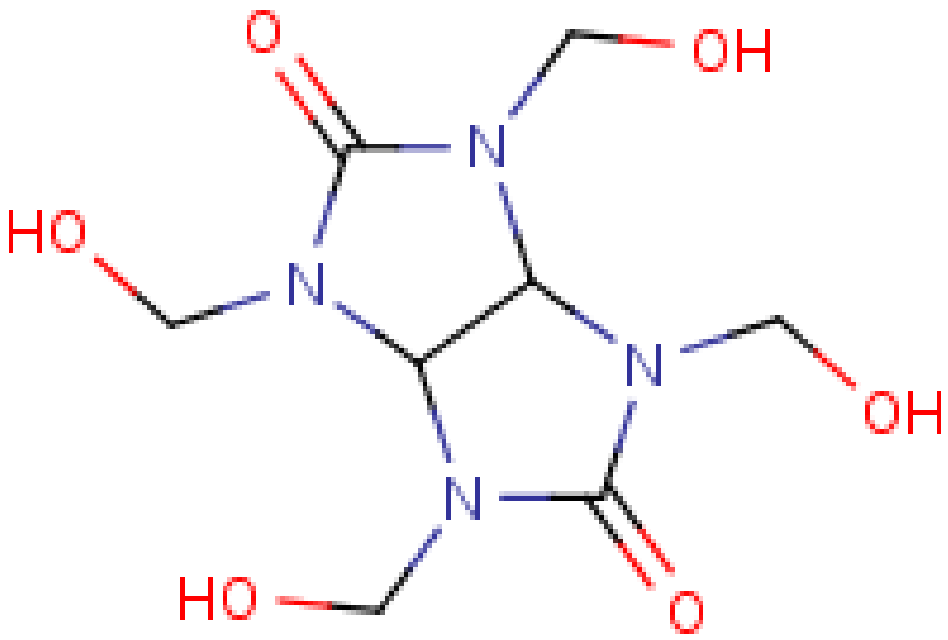
Last Update 21 April 2016

Chemical Identities

Chemical Name in the Inventory and Synonyms	**2-Imidazolidinone, 1,3-bis(hydroxymethyl)-** dimethylolethyleneurea Fixapret AH N,N'-dimethylol-2-imidazolidinone dimethylol ethylene urea DMEU
CAS Number	136-84-5
Structural Formula	

	
Molecular Formula	C5H10N2O3
Molecular Weight	146.1

Chemical Name in the Inventory and Synonyms	**Imidazo[4,5-d]imidazole-2,5(1H,3H)-dione, tetrahydro-1,3,4,6-tetrakis(hydroxymethyl)-** N,N',N'',N'''-tetramethylol imidazoimidazole tetramethylolglycoluril Fixapret 140 TMAD tetramethylol acetylene diurea
CAS Number	5395-50-6
Structural Formula	

	
Molecular Formula	C8H14N4O6
Molecular Weight	262.22

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