Short chain zinc dialkyldithiocarbamates: Human health tier II assessment

04 July 2014

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Zinc, bis(dibutylcarbamodithioato-S,S')-, (T-4)-	136-23-2
Zinc, bis(dimethylcarbamodithioato-S,S')-, (T-4)-	137-30-4
Zinc, bis(diethylcarbamodithioato-S,S')-, (T-4)-	14324-55-1

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

NICNAS has made every effort to assure the quality of information available in this report. However, before relying on it for a specific purpose, users should obtain advice relevant to their particular circumstances. This report has been prepared by NICNAS using a range of sources, including information from databases maintained by third parties, which include data supplied by industry. NICNAS has not verified and cannot guarantee the correctness of all information obtained from those databases. Reproduction or further distribution of this information may be subject to copyright protection. Use of this information without obtaining the permission from the owner(s) of the respective information might violate the rights of the owner. NICNAS does not take any responsibility whatsoever for any copyright or other infringements that may be caused by using this information.

ACRONYMS & ABBREVIATIONS

Grouping Rationale

This group of three chemical compounds consists of zinc complexes of dialkyldithiocarbamates. The compounds have been included in this group due to the expectation that the physico-chemical properties will not vary greatly, leading to the compounds within this group having related end uses. In addition, information outlined in the Organisation for Economic Co-operation and Development's (OECD) guideline on Grouping of chemicals (OECD, 2007) provided guidance on the grouping of chemicals based on physico-chemical or toxicological criteria. In this report abbreviations will be used when referring to the chemicals listed.

The following abbreviations will apply:

- zinc dibutyldithiocarbamate (CAS No. 136-23-2) - zinc di(Bu)dtc;
- zinc dimethyldithiocarbamate (CAS No. 137-30-4) - zinc di(Me)dtc; and
- zinc diethyldithiocarbamate (CAS No. 14324-55-1) - zinc di(Et)dtc.

Import, Manufacture and Use

Australian

The following non-industrial uses have been identified in Australia:

- Agricultural use; and

- Carbamates as anticholinesterase compounds (with the exception of Ziram) (SUSMP, 2013).

International

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

The chemicals in this group have one or more of the following uses:

Cosmetic use including:

- antimicrobials and antioxidants.

Domestic use including:

- antioxidants in adhesives and coatings.

Commercial use including:

- vulcanisation agents in rubber and latex production;
- matrix inclusion in rubber production;
- chelating agents;
- reprographic agents;
- as solvents;
- process regulators;
- as welding and soldering agents; and
- as heat stabilizers for polyethylene.

Non-industrial use including:

- as fungicides; and
- as indirect food additives for use as components of adhesives.

Restrictions

Australian

Members of this group are listed on one, or some, of the following:

- Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP, 2013) in Schedule 6 (zinc di(Me)dtc);
- Australia New Zealand Food Standards Code (FSANZ, 2013) - Maximum Residue Limits (Australia only) - Schedule 1; and
- Australia New Zealand Food Standards Code (FSANZ, 2013) - Maximum Residue Limits (Australia only) - Schedule 3 - Chemical Groups.

International

Members of this group are listed on one or more of the following (Galleria Chemica):

- EU Cosmetics Regulation 1223/2009 Annex II—List of substances prohibited in cosmetic products;
- EU Cosmetic Directive 76/768/EEC Annex II: List of substances which must not form part of the Composition of Cosmetic Products (English);
- New Zealand Cosmetic Products Group Standard—Schedule 4: Components cosmetic products must not contain;
- Health Canada List of prohibited and restricted cosmetic ingredients (The Cosmetic Ingredient "Hotlist"); and
- China List of banned substances for use in cosmetics.

Existing Worker Health and Safety Controls

Hazard Classification

The chemicals in this group are classified as hazardous. The following risk phrases for human health are listed in the Hazardous Substances Information System (HSIS) (Safe Work Australia) and apply to the members of this group:

Zinc di(Bu)dtc

- Xi; R36/37/38 (Irritating to eyes, respiratory system and skin); and
- Xi; R43 (May cause sensitisation by skin contact).

Zinc di(Me)dtc

- T+; R26 (Very toxic by inhalation);
- Xn; R22 (Harmful if swallowed);
- Xn; 48/22 (Harmful: danger of serious damage to health by prolonged exposure if swallowed);
- Xi; R37-41 (Irritating to respiratory system. Risk of serious eye damage); and
- Xi; R43 (May cause sensitisation by skin contact).

Zinc di(Et)dtc

- Xn; R22 (Harmful if swallowed);
- Xi; R36/37/38 (Irritating to eyes, respiratory system and skin); and
- Xi; R43 (May cause sensitisation by skin contact).

Exposure Standards

Australian

No specific exposure standards are available.

International

The following exposure standards are identified in (Galleria Chemica) for zinc di(Me)dtc:

An exposure limit (PDK) of 0.3 mg/m³ in Russia and (LLV) of 1 mg/m³ in Sweden.

Health Hazard Information

Toxicokinetics

In general, dithiocarbamate complexes can be absorbed via the skin, mucous membranes, and the respiratory and gastrointestinal tracts. The metabolic decomposition products of dialkyldithiocarbamates include dialkylthiocarbamic acid (as a free acid or as *S*-glucuronide conjugate), carbon disulfide, formaldehyde, sulfate, and dialkyl amines (WHO, 1988).

The chemicals will decrease in hydrophobicity with increasing alkyl chain length, and this will affect absorption and distribution. The toxicity data described below generally show a gradation where the seriousness of effects is in the order methyl > ethyl >> butyl.

Zinc di(Me)dtc is used as read across to determine the toxicokinetics for the members in this group (REACHb). Following ingestion of the chemical, the absorption of this compound appears to be relatively slow, although it was reported to have been detected in all tissues at 2 hours. The greatest concentrations were recorded in organs of metabolism and excretion (liver, lung, kidney), vascularised tissues (spleen, thyroid, adrenals), fat, blood and plasma.

Metabolism occurs via hydrolysis producing CS_2, COS and CO_2 (ca 51%) which is exhaled. Other metabolites, including 2-dimethylamine-thiazolidine carboxylic acid, S-glucuronide and unmetabolised compound were reported as being present in urine and faeces of the test subjects (REACHb, International Labour Office).

Acute Toxicity

Oral

The majority of the chemicals in this group are classified as hazardous with the risk phrase ‘Harmful if swallowed’ (Xn; R22) in HSIS (Safe Work Australia). The available data (median lethal dose—LD50—320-1960(m), 2280(f) mg/kg bw) support this classification for zinc di(Et)dtc and zinc di(Me)dtc (REACHb, REACHc). Reported signs of toxicity include rapid respiration, decrease of motor ataxia and piloerection, irregular respiration, dyspnoea, diarrhoea, incontinence of urine, ataxia in hind limbs or whole body were observed (REACHb, REACHc).

Despite the chemical similarity to the chemicals in this group, zinc di(Bu)dtc had low acute toxicity in animal tests following oral exposure. The median lethal dose (LD50) in rats is greater than 5000 mg/kg bw. Observed sub-lethal effects included diarrhoea, although this effect is likely to be caused by the use of corn oil as the delivery matrix (REACHa). When compared with the oral toxicity results for the other chemicals contained in this group, there is insufficient evidence to support a recommendation to classify.

The acute oral toxicity difference between the chemicals may be related to the toxicokinetic differences.

Dermal

The chemicals in this group are considered to be of low acute toxicity in animal tests following dermal exposure. The median lethal dose (LD50) in rats is greater than 2000 mg/kg bw. Observed sub-lethal effects included local erythema (REACHa, REACHb, REACHc)).

Inhalation

Within this group zinc di(Me)dtc is classified as hazardous with the risk phrase ‘Very toxic by inhalation’ (T+; R26) in HSIS (Safe Work Australia). The available data support this classification (REACHb).

The rat median lethal concentration (LC50) for zinc di(Me)dtc is reported to be 0.13 mg/L for male and female rats. Signs of wet fur, hunched posture, lethargy, piloerection, ataxia, ptosis, laboured respiration, pallor of the extremities, gasping respiration, noisy respiration, increased salivation, hypothermia and red/ brown stains around the snout were observed (REACHb).

The remaining members of the group are not classified on HSIS (Safe Work Australia). The available data, together with the toxicokinetic differences from the acute oral toxicity data, provide insufficient evidence to support a recommendation to classify.

Corrosion / Irritation

Respiratory Irritation

The chemicals are classified as hazardous with the risk phrase 'Irritating to respiratory system' (Xi; R37) in the HSIS. Limited data are available to evaluate this classification.

Skin Irritation

In this group zinc di(Bu)dtc and zinc di(Et)dtc are classified as hazardous with the risk phrase 'Irritating to skin' (Xi; R38) in HSIS (Safe Work Australia).

The available data do not support the classification for zinc di(Bu)dtc (REACHa, U.S. EPA, 2012). When the chemical is applied to intact and abraded rabbit skin zinc di(Bu)dtc was reported as producing a mean value of 0.1 for erythema and oedema and the effects were fully reversible within 72 hours (REACHa, U.S. EPA, 2012).

Data to support zinc di(Et)dtc being classified as hazardous with the risk phrase 'Irritating to skin' (Xi; R38) in HSIS (Safe Work Australia) were limited.

The remaining member of the group was not classified for skin irritation on HSIS. The available data do not support making a recommendation to classify this chemical.

Eye Irritation

The chemicals in this group are classified as hazardous with the risk phrase 'Irritating to eyes' (Xi; R36) for zinc di(Bu)dtc and zinc di(Et)dtc or 'Risk of serious eye damage' (Xi; R41) for zinc di(Me)dtc in HSIS (Safe Work Australia).

The available data support the classification for zinc di(Et)dtc**.** In tests using New Zealand White rabbits the mean scores for corneal opacity, iritis were not greater than 1 and the mean score for conjunctival redness was 3. The effects were not fully reversible within 7 days (REACHc).

The available data support the classification for zinc di(Me)dtc**.** In tests using New Zealand White rabbits, the mean score for corneal opacity was 3 and the mean score for iritis was 2. The effects of corneal opacity, iritis, conjunctival oedema were reported as not reversible. Necrosis and partial destruction of nictitating membrane were reported (REACHb).

The available data do not support this classification for zinc di(Bu)dtc**.** In tests using New Zealand White rabbits, the mean scores for corneal opacity, iritis and conjunctival oedema were not greater than 1, 1 and 2 respectively (REACHa) and it was not found to be an irritant (U.S. EPA, 2012).

Sensitisation

Skin Sensitisation

The chemicals in this group are classified as hazardous with the risk phrase 'May cause sensitisation by skin contact' (Xi; R43) in HSIS (Safe Work Australia).

The available data support the classification for zinc di(Me)dtc**.** It was reported to be a sensitiser as a positive result for skin sensitisation in guinea pigs was seen when it was tested according to OECD TG 406 (REACHb). In a report published by NICNAS, it was determined that sufficient data existed for classification as a hazardous substance with respect to sensitisation by skin contact with a concentration cut of = 1% recommended (NICNAS, 2005).

Repeated Dose Toxicity

Oral

Zinc di(Me)dtc is the only chemical from the group which is classified as hazardous with the risk phrase 'Harmful: danger of serious damage to health by prolonged exposure if swallowed' (R48/22) in HSIS (Safe Work Australia). The available data support this classification.

A 90 day oral feed study in male and female beagle dogs dosed with zinc di(Me)dtc was conducted according to OECD TG 409. Focal necrosis was noted in the liver at 41.07 mg/kg bw/d for females and 12.15 mg/kg bw/d for males (REACHb).

In a 13 week oral gavage study in rats dosed with zinc di(Me)dtc, a lowest-observed-adverse-effect level (LOAEL) of 7.4 mg/kg bw/d was reported with decrease in serum calcium and blood proteins with increase in urea nitrogen as effects (REACHb).

In a 104 week oral gavage study in rats a LOAEL of 36 mg/kg bw/d was reported for zinc di(Et)dtc with hyperplasia of the thyroid gland in all dose groups (REACHc)**.** These data support recommending a classification of 'Harmful: danger of serious damage to health by prolonged exposure if swallowed' (R48/22).

In a 17 week oral gavage study in rats using zinc di(Bu)dtc, LOAELs of 205 and 235 mg/kg bw/d were reported for males and females respectively (U.S. EPA, 2012)**.** The data do not satisfy the cut off value of = 50 mg/kg bw/d to classify the chemical as 'Harmful: danger of serious damage to health by prolonged exposure if swallowed' (R48/22).

Dermal

The lowest observed-adverse-effect level (LOAEL) available from 21 day rabbit studies (100–1000 mg/kg bw/d) for zinc di(Bu)dtc and zinc di(Me)dtc was 300 mg/kg bw/d. Based on the treatment-related effects reported in various repeat dose toxicity studies, the chemicals are not considered to cause serious damage to health from repeated dermal exposure (REACHa, REACHb).

Inhalation

Based on the available information for zinc di(Me)dtc, no hazard classification for repeat dose inhalation toxicity is recommended.

In a 28 day inhalation study, male and female Sprague Dawley (SD) rats were exposed to doses of 0.1, 0.3, 1.0 or 3.0 µg/L of zinc di(Me)dtc for 5 d/wk according to OECD TG 412. Although dose dependent inflammatory and proliferative lesions were noted in the respiratory tract, complete recovery of the trachea and tracheal bifurcation lesions and partial recovery of the lung and laryngeal lesions were reported. The no observed-effect level (NOEL) was 0.1 mg/m³ based on histopathological findings in the larynx. There were no treatment-related histological changes found in the rats from the low dose group (REACHb).

Genotoxicity

Overall, from a variety of in vitro and in vivo studies (Ames test, mammalian chromosome aberration test, mammalian cell gene mutation assay, unscheduled DNA synthesis and micronucleus study) the data indicate that the chemicals in this group have no mutagenic or genotoxic potential (REACHa, REACHb, REACHc). In one study, clastogenic effects were noted for zinc di(Bu)dtc (U.S. EPA, 2012).

Carcinogenicity

The members in this group are not classified for carcinogenicity in HSIS (Safe Work Australia) as potential carcinogens.

The International Agency for Research on Cancer (IARC) reported that there is limited evidence in experimental animals for carcinogenicity for zinc di(Me)dtc and that there were no data available from studies in humans. IARC determined that it is not classifiable as to its carcinogenicity to humans (Group 3) (IARC, 1997).

A report published by the Environmental Protection Agency (EPA) suggested that there was insufficient evidence to consider zinc di(Bu)dtc as having the potential to be carcinogenic (U.S EPA, 2012).

Carbon disulfide, a major metabolite of zinc dialkyldithiocarbamates, is not classified as a carcinogen (ATSDR, 2012).

Reproductive and Developmental Toxicity

The chemicals in this group are not classified as reproductive or developmental toxicants in HSIS (Safe Work Australia).

In a reproductive toxicity test in SD rats, zinc di(Me)dtc was administered orally (via dietary intake) to 30 animals per sex. Reproductive performance was unaffected by test substance administration at concentrations of 3-46 mg/kg bw (males) and 5-85 mg/kg bw (females). Reduced pup weight in F1 and F2 was noted for the latter concentration and the litter size was reduced for the 10 mg/kg bw/d and 25 mg/kg bw/d dose. The dose of 10 mg/kg bw/d was reported as the no observed adverse effect level (NOAEL) for both parental and developmental (pup weight) toxicity and 25 mg/kg bw/d was reported as the NOAEL for reproductive toxicity (REACHb, ATSDR). Decreased F0 body weight and body weight gain were noted in 27 mg/kg bw/d dose group for males and females. The F0 females has decreased brain weight and the F0 males had increased liver weights at 27 mg/kg bw/d dose. The F1 and F2 pup weights were also noted in a reproductive toxicity study using zinc di(Me)dtc, although developmental toxicity was not reported (U.S. EPA, 2012).

The main metabolite of concern for the zinc dialkyldithiocarbamates, carbon disulfide, is considered toxic to reproduction and development and so it cannot be assumed that the developmental effects in these studies only occur secondary to maternal toxicity (REACHd). While there is no available evidence of reproductive and developmental toxicity for the remaining members of this group, the potential toxicity from the metabolite may also lead to some effects.

Other Health Effects

Neurotoxicity

Based on the available data, zinc di(Me)dtc is considered to be neurotoxic.

In a neurotoxicity study equivalent to OECD TG 418, SD rats were exposed to a single dose via oral feed of zinc di(Me)dtc at 0, 15, 300 or 600 mg/kg bw. At the highest dose (600 mg/kg bw) mortality was reported in 25% of males and 44% of females. In the 300 mg/kg bw dose group, 8% of mortalities were recorded for females with no mortality rate recorded in the male dose group. Treatment-related signs included gait alterations, abnormal respiration and excreta and a distended abdomen during the first days after exposure of the 300 and 600 mg/kg bw doses. Cyanosis, hypothermia, enophthalmos, unkempt appearance, hypoactivity and ptosis were also noted in the mid dose group (REACHb).

The main metabolite of concern for the zinc dialkyldithiocarbamates is carbon disulfide which has been reported to be a neurotoxin (REACHd). Therefore, while there is limited evidence of neurotoxicity for zinc di(Me)dtc and no data for the remaining members of this group, the potential toxicity from the metabolite may lead to some effects.

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation vary within the group, but include systemic long-term effects (reproductive toxicity, developmental toxicity), systemic acute effects (acute toxicity by the oral and inhalation route of exposure) and local effects (corrosivity and skin sensitisation). The chemicals may also cause harmful effects following repeated exposure (through inhalation), harmful systemic effects following a single exposure through oral and inhalation exposure, and skin and eye irritation.

Public Risk Characterisation

Provided that normal precautions are taken to avoid prolonged skin and eye contact, the risk to public health posed by cleaning and cosmetic products containing the chemical at concentrations less than 10% is not considered to be unreasonable. At higher concentrations, potential harm is reduced by using strong warnings and safety directions on the label.

Occupational Risk Characterisation

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

NICNAS Recommendation

Assessment of the 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

Products containing the chemicals should be labelled in accordance with state and territory legislation (SUSMP).

Work Health and Safety

Zinc di(Me)dtc is recommended for classification and labelling under the current approved criteria and adopted GHS as below (excepting the classification for skin irritaion). This assessment does not consider classification of physical hazards and environmental hazards.

For the remaining chemicals in this group, the following classification amendments and notes should be made:

- No amendment to the classification and risk phrase for zinc di(Et)dtc 'Irritating to eyes' (Xi; R36).
- An amendment to the classification and risk phrase for di(Bu)dtc as the data do not support the classification of 'Irritating to eyes' (Xi; R36).
- An amendment to the classification of zinc di(Et)dtc to include 'Harmful: danger of serious damage to health by prolonged exposure if swallowed' (R48/22).

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Harmful if swallowed (Xn; R22)* Very toxic by inhalation (T+; R26)*	Harmful if swallowed - Cat. 4 (H302) Fatal if inhaled - Cat. 2 (H330)
Irritation / Corrosivity	Risk of serious eye damage (Xi; R41)* Irritating to skin (Xi; R38)* Irritating to respiratory system (Xi; R37)*	Causes serious eye damage - Cat. 1 (H318) Causes skin irritation - Cat. 2 (H315) May cause respiratory irritation - Specific target organ tox, single exp Cat. 3 (H335)
Sensitisation	May cause sensitisation by skin contact (Xi; R43)*	May cause an allergic skin reaction - Cat. 1 (H317)
Repeat Dose Toxicity	Harmful: Danger of serious damage to health by prolonged exposure if swallowed (Xn; R48/22)	May cause damage to organs through prolonged or repeated exposure - Cat. 2 (H373)

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

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

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

Advice for consumers

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

Advice for industry

Control measures

Control measures to minimise the risk from oral, dermal, ocular, 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 chemical is used. Examples of control measures which may minimise the risk include, but are not limited to:

- using closed systems or isolating operations;[1]
- using local exhaust ventilation to prevent the chemical from entering the breathing zone of any worker;[2]
- 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;[3]
- air monitoring to ensure control measures in place are working effectively and continue to do so;[4]
- minimising manual processes and work tasks through automating processes;[5]
- work procedures that minimise splashes and spills;[5]
- regularly cleaning equipment and work areas;[5] and

- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemical.[5]

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 chemicals has not been undertaken as part of this assessment.

References

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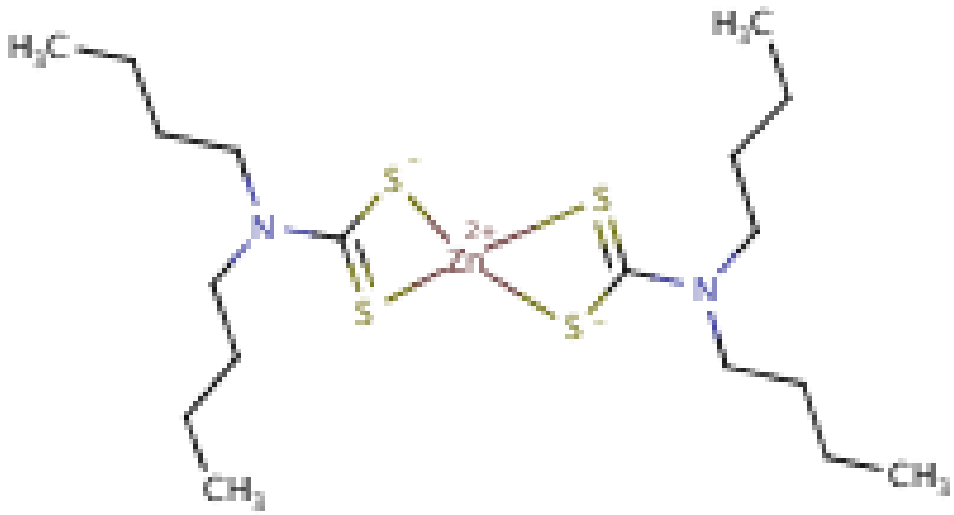
The Poisons Standard (the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)) 2013. Accessed June 2014 at **http://www.comlaw.gov.au/Details/F2013L01607/Download**

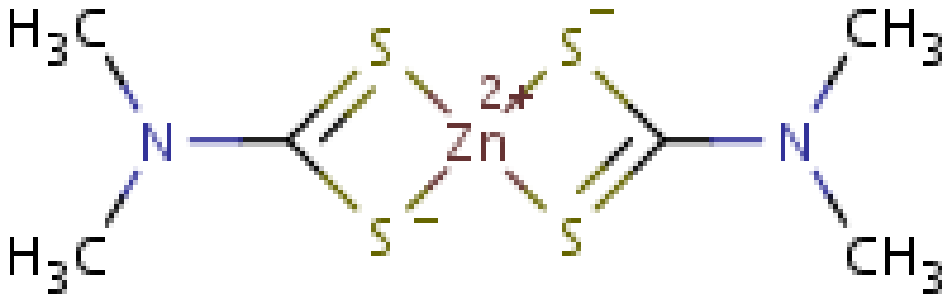
World Health Organisation (WHO) 1988. International Programme on Chemical Safety (IPCS) Environmental Health Criteria 78 - Dithiocarbamate Pesticides, Ethylenethiourea and Propylenethiourea: A General Introduction. Accesses June 2014 at **http://www.inchem.org/documents/ehc/ehc/ehc78.htm**.

Last Update 04 July 2014

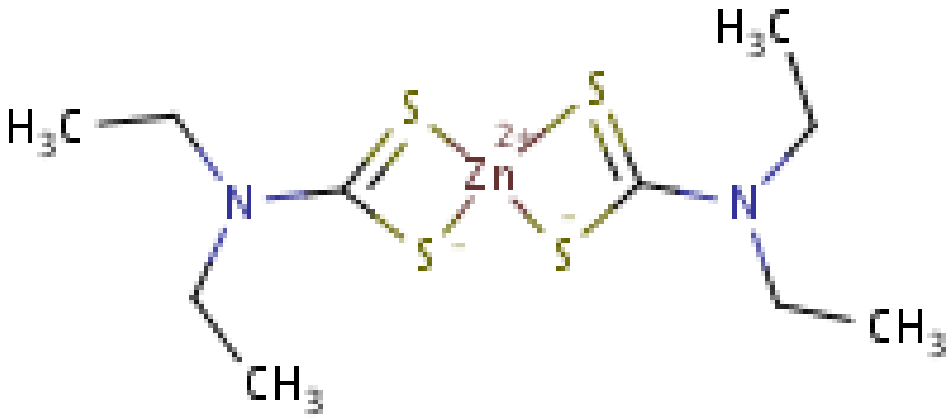
Chemical Identities

Chemical Name in the Inventory and Synonyms	**Zinc, bis(dibutylcarbamodithioato-S,S')-, (T-4)-** Butyl zimate Zinc dibutyldithiocarbamate Zinc, bis(dibutyldithiocarbamato)- Butyl ziram (Dibutyldithiocarbamato)zinc(II)
CAS Number	136-23-2
Structural Formula	

Molecular Formula	C18H36N2S4Zn
Molecular Weight	478.18

Chemical Name in the Inventory and Synonyms	**Zinc, bis(dimethylcarbamodithioato-S,S')-, (T-4)-** Zinc dimethyldithiocarbamate Ziram Bis(dimethylcarbamodithioato-S,S')zinc Antene Carbazinc
CAS Number	137-30-4
Structural Formula	
Molecular Formula	C6H12N2S4Zn
Molecular Weight	309.86

Chemical Name in the Inventory and Synonyms	**Zinc, bis(diethylcarbamodithioato-S,S')-, (T-4)-** Zinc diethyldithiocarbamate Ethyl zimate Diethyldithiocarbamic acid zinc salt

	Ethyl ziram Zinc diethylcarbamodithioate
CAS Number	14324-55-1
Structural Formula	
Molecular Formula	C10H20N2S4Zn
Molecular Weight	365.96

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