Lead alkyls: Human health tier II assessment

12 September 2013

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Plumbane, tetramethyl-	75-74-1
Plumbane, tetraethyl-	78-00-2
Plumbane, ethyltrimethyl-	1762-26-1
Plumbane, diethyldimethyl-	1762-27-2
Plumbane, triethylmethyl-	1762-28-3
Plumbane, ethyl methyl derivatives	68610-17-3

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 six organolead chemicals in this group are exclusively used as additives in fuels. These chemicals have been included in this group due to the expectation that the physicochemical properties will not vary greatly and the compounds within this group have related end uses.

Controls to reduce the use of this group of chemicals began in the 1970s when leaded automobile fuel was replaced with unleaded fuel, which is now predominant in most countries. However, piston engine aircraft, some racing automobiles and some recreational marine craft still require leaded petrol to function effectively (EPA, 2011).

Tetramethyl lead (TML, CAS No. 75-74-1) and tetraethyl lead (TEL, CAS No. 78-00-2) are still manufactured and formulated to produce aviation fuel (Avgas). The lead content of Avgas 100 (dyed green) and Avgas 100LL (low lead) (dyed blue) is 0.85 and 0.56 g/L respectively (Shell a, Shell b). While the chemicals (TEL and TML) can be potentially toxic to humans, this is not the only reason for restricting their use in international (Rotterdam convention) and local (Fuel Quality Standards Act 2000) legislation. The use of leaded fuels is controlled because the combustion of fuels containing these chemicals results in the atmospheric release of inorganic lead compounds as fine particulate matter. This inhalable form of lead presents a risk to whole populations if exposed to the chemicals in this group, especially in highly populated centres, and may result in the elevation of blood lead levels, especially in young children (Patocka, 2008).

The toxicity of this group of chemicals varies with the size of the organic groups covalently bonded to lead. For example, TEL is considered to be more easily absorbed dermally and therefore more toxic when compared to TML (NTPa; NTPb; Patocka, 2008). In general, toxicity from lead compounds arises from their affinity for sulfhydryl groups, which are important components of enzymes and proteins in key biological processes (respiration and energy generation), although other mechanisms are also important for the lead alkyls, which show toxicological differences from inorganic lead compounds. Also, lead and calcium share physicochemical properties that allow lead deposition in bones, resulting in cumulative toxicity of lead and its compounds (ATSDR, 2007).

Import, Manufacture and Use

Australian

The following Australian uses were reported under previous mandatory and/or voluntary calls for information:

TML and TEL have reported commercial use as a:

- fuel additive.

TML and TEL have reported site-limited use:

- in the formulation of aviation fuels.

International

The following international uses have been identified through European Union Registration, Evaluation and Authorisation of Chemicals (EU REACH) dossiers and the US National Library of Medicine's Hazardous Substances Data Bank (HSDB).

TML and TEL have reported commercial use as a:

- fuel additive.

TML and TEL have reported site-limited use:

- in the formulation of aviation fuels.

There is no specific information on uses of the other members of this group, but physicochemical similarities and similarity in reactions indicate that the same uses are probable.

Restrictions

Australian

Lead and lead compounds are listed in the Poisons Standard (the Standard for the Uniform Scheduling of Medicines and Poisons—SUSMP) (SUSMP, 2012). The restrictions relevant to this group of chemicals are:

Schedule 6

Lead compounds unless specified in Appendix C or:

(a) when included in Schedule 4 or 5;

(b) in paints, tinters, inks or ink additives;

(c) in preparations for cosmetic use containing 100 mg/kg or less of lead;

(d) in pencil cores, finger colours, showcard colours, pastels, crayons, poster paints/colours or coloured chalks containing 100 mg/kg or less of lead; or

(e) in ceramic glazes when labelled with the warning statement: 'CAUTION—Harmful if swallowed. Do not use on surfaces which contact food or drink', 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.

Introduction (import or manufacture) and export of TML (CAS No. 75-74-1) and TEL (CAS No. 78-00-2) is prohibited (Industrial Chemicals (Notification and Assessment) Amendment Regulations 2005) without the prior written permission of the Director, NICNAS. Tetraethyl lead may be introduced without the prior written permission of the Director (NICNAS) if the importation occurs in aviation gasoline or for the production of aviation gasoline; or in leaded fuel and fuel additives introduced by a person granted an approval under the *Fuel Quality Standards Act 2000* for use specified in the approval.

International

The risk of exposure to lead and lead compounds has been recognised internationally, which has resulted in broad restrictions regarding occupational and public exposure.

Tetramethyl lead (TML, CAS No. 75-74-1) and tetraethyl lead (TEL, CAS No. 78-00-2) are PIC (Prior Informed Consent) chemicals, listed in Annex III of the Rotterdam Convention. The chemicals listed in Annex III include pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons.

Existing Worker Health and Safety Controls

Hazard Classification

This group of chemicals is classified as hazardous, with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia):

'lead alkyls' :

T+; R26/27/28 (Very acutely toxic)

Repr. Cat. 1; R61 (Reproductive toxicity—may cause harm to the unborn child)

Repr. Cat. 3; R62 (Reproductive toxicity—possible risk of impaired fertility)

Xn; R33 (Danger of cumulative effects).

Exposure Standards

Australian

Tetramethyl lead (TML, CAS No. 75-74-1) and tetraethyl lead (TEL, CAS No. 78-00-2) have exposure standards of 0.15 and 0.1 mg/m³ time weighted average (TWA) respectively.

International

The following exposure standards are identified (Galleria Chemica):

An exposure limit (TWA) of 0.05–0.2 mg/m³ and a short-term exposure limit (STEL) for TML (0.1–0.5 mg/m³) and TEL (0.1–0.3 mg/m³) in different countries such as USA (Alaska, Hawaii), Canada (Yukon), Norway and Switzerland.

Health Hazard Information

The hazard assessment for this group of chemicals is based on data available for TML (CAS No. 75-74-1) and TEL (CAS No. 78-00-2). The combustion products of TEL, such as lead oxide and other inorganic lead compounds, have been assessed by NICNAS (NICNAS, 2007; NICNASa).

Toxicokinetics

The group of chemicals being assessed (organic lead compounds or tetra-alkyl lead compounds) can be absorbed orally, dermally or by inhalation. The absorption of organic lead compounds depends on several factors such as gender, nutritional status and particle size (if inhaled) (ATSDR, 2007). Tetra-alkyl lead compounds are absorbed dermally to a much greater extent than inorganic lead compounds such as lead acetate, lead oleate, or lead arsenate (ATSDR, 2007). Inhaled vapours are rapidly and almost completely absorbed in human and animal studies (ATSDR, 2007). In four male subjects, 37 % of inhaled vapours of radioactive TEL (1 mg/m³ through a mouthpiece for 1–2 minutes) was deposited in the respiratory tract. After one hour, 50 % of the inhaled compound was detected in the liver and 5 % in the kidneys, with the rest distributed throughout the body (ATSDR, 2007).

This group of chemicals is actively metabolised in the liver by oxidative dealkylation catalysed by the cytochrome P450 enzyme (ATSDR, 2007). TEL is initially converted mainly to triethyl lead and partly to inorganic lead. TML is dealkylated to the more toxic trialkyl form at a slower rate than TEL (ATSDR, 2007). The toxicity of alkyl lead compounds increases with the size of alkyl groups (ATSDR, 2007). Data available from inhalation studies of TEL and TML indicate that the chemicals are excreted via exhaled air (8 %), in urine (76 %) and faeces (16 %). Data from occupational exposure to tetraethyl lead indicate that the chemical is excreted in urine as diethyl lead, ethyl lead and inorganic lead (ATSDR, 2007; DGD, 2005).

Acute Toxicity

Oral

This group of chemicals is classified as hazardous with the risk phrase ‘Very toxic if swallowed’ (T+; R28) in HSIS (Safe Work Australia).

The available data (median lethal dose (LD50) of 14–20 mg/kg bw) support this classification (REACH). An acute toxicity study conducted in Sprague Dawley (SD) rats reported neurological signs of lethargy and irritability. Animals progressed to more severe effects (violent trembling, aggressiveness, convulsions and death) on observation days 5–8 (REACH).

Dermal

This group of chemicals is classified as hazardous with the risk phrase 'Very toxic in contact with skin' (T+; R27) in HSIS (Safe Work Australia). While no specific animal or human studies are available to evaluate this classification, data available from the Hazardous Substances Data Bank indicate that TEL and TML have been reported to penetrate the skin at lethal concentrations, and dermal contact can result in dermatitis and burns (HSDB).

Inhalation

This group of chemicals is classified as hazardous with the risk phrase ‘Very toxic by inhalation’ (T+; R26) in HSIS (Safe Work Australia). The available data (median lethal concentration (LC50) of 0.85 mg/L) support this classification (REACH).

100 % mortality was observed in animals dosed at 1.59 mg/L or higher. Reported signs of toxicity included hyperexcitability and body tremors in animals dosed at 0.37 mg/L and above (REACH).

Observation in humans

Based on poisoning data, a minimal lethal oral dose of 15 mL of TEL (0.35 g/kg bw) is estimated (NTPa).

A case report describes how four workers were exposed to TEL from cleaning a tank that contained leaded petrol. The four patients presented with a wide array of symptoms such as upper respiratory tract irritation, sneezing, gastrointestinal symptoms (vomiting, abdominal pain and diarrhoea) and neurological symptoms (mild psychosis and anxiety) (Beattie et al, 1972). Further epidemiological studies have identified cases of TEL poisoning from cleaning leaded petrol tanks and identified two mortalities in 25 reported cases (Cassels & Dodds, 1946).

Exposure to TEL through habitual sniffing of leaded fuel, a practice found particularly among children and adolescents to obtain a 'high', results in acute neurological symptoms (HSDB).

Corrosion / Irritation

Skin Irritation

As TEL and TML are classified as very toxic (T+) by ingestion, inhalation and absorption through the skin or eyes, no testing in animals has been conducted to quantify irritation effects (IUCLID, 2000). However, cases of accidental exposure indicate that these chemicals must be considered as potential irritants (IUCLID, 2000; HSDB).

Eye Irritation

As for skin irritation.

Sensitisation

Skin Sensitisation

The IUCLID documents for TEL and TML indicate that, due to the classification of this group of chemicals for ingestion, inhalation and absorption through the skin as being 'very toxic' (T+), no testing has been done to quantify sensitisation. It is expected that sensitisation testing using the existing OECD guidelines would prove lethal to the test animals before any sensitisation could occur (IUCLID, 2000).

Repeated Dose Toxicity

Oral

This group of alkyl lead compounds is currently classified as 'Danger of cumulative effects' in the HSIS. Based on the information below; reclassification to 'Toxic: danger of serious damage to health by prolonged exposure if swallowed' is recommended based on the observation of severe adverse effects at doses of <5 mg/kg/d bw.

The available data from a 13-week oral gavage study in SD rats identified a lowest observed adverse effect level (LOAEL) of 0.2 mg/kg bw/day for TEL. Body weight gain and food consumption was reduced in TEL dosed groups (0.2 and 2 mg/kg bw/day) and signs of neurotoxicity were evident through increased excitability, irritability, tremors and coma. Histopathological findings

included brain and spinal cord lesions and eosinophilic inclusions in the proximal renal tubule (REACH). A further 21-week study conducted in Charles River rats showed similar results at the highest dose used (0.17 mg/kg bw/day) (REACH). Pathological assessment of the animals showed swollen livers, epithelial hyperplasia of the thyroid gland, fatty degeneration of the thymus, and pulmonary oedema (REACH).

Dermal

No data are available.

Inhalation

This group of alkyl lead compounds is classified as 'Danger of cumulative effects' in the HSIS. Based on the information below, re-classification to 'Toxic: danger of serious damage to health by prolonged exposure through inhalation' is recommended based on the observation of severe adverse effects at doses of <25 mg/m³.

Data available from a 35-week study conducted in beagle dogs indicate a lowest observed adverse effect concentration (LOAEC) of 12 mg/m³ for TEL. All animals dosed at this concentration and greater died. The duration of exposure or day of mortality is not reported. In a similar study, Wistar rats were exposed to TEL (12–46 mg/m³) for seven hours for a variable number of days (5–150). The LOAEC identified in this study was 12 mg/m³ (44 days) at which 4/5 males and 5/5 females died (REACH).

Genotoxicity

The genotoxic studies reviewed under the Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profile of lead indicate that lead and its compounds may be genotoxic, particularly with respect to inducing clastogenicity in mammalian cells (ATSDR, 2007). However, the majority of studies reviewed in the ATSDR are for inorganic lead compounds. Specific studies for the current group of chemicals (TEL and TML) indicate that the chemicals are not genotoxic when assessed in standard in vitro (Ames test) and in vivo tests (in vivo chromosome aberration assay) (REACH).

Tetraethyl lead (TEL) tested negative for genotoxicity at doses of 0.001–1.0 mg/plate in five *Salmonella typhimurium* strains (TA 1535, TA 1537, TA 97, TA 98, and TA 100) with and without metabolic activation. In a further Ames test, TML was negative at 3–1000 μg/plate in *Salmonella typhimurium* strains (TA 98, TA 100 and TA 1537) with or without metabolic activation (NTPa, NTPb)

Carcinogenicity

Based on the available evidence, chemicals in this group may cause cancer. The available data warrant hazard classification.

Interpretation of an experimental study carried out in Swiss mice (subcutaneous administration of TEL 0.6–2 mg/mouse) is limited due to the high mortality in TEL treated mice (IUCLID, 2000; IARC, 2006). The IARC review of lead and lead compounds concluded that there was inadequate evidence for carcinogenicity in humans and laboratory animal studies for organic lead compounds and tetraethyl lead (IARC, 2006). However, as organic lead compounds are metabolised partly to ionic form in humans and animals, the metabolites are expected to exert the toxicity associated with inorganic lead (IARC, 2006). For inorganic lead, there is limited evidence from human studies and sufficient evidence from laboratory animals for carcinogenicity (IARC, 2006).

A subsequent review by the International Lead Association concluded that there is consistent evidence from studies in rodents that lead compounds are carcinogenic in animals; notably, reproducible renal tumours in male rats following administration of high levels of lead via food or water (LDAI, 2008).

Reproductive and Developmental Toxicity

This group of chemicals is classified as hazardous—Category 1 substance toxic to reproduction—with the risk phrase 'May cause harm to the unborn child' (T; R61) and Category 3 substance toxic to reproduction—with the risk phrase 'Possible risk of impaired fertility' (Xn; R62) in HSIS (Safe Work Australia). The available data support these classifications.

Female rats intragastrically administered TEL (0.01–10 mg/kg bw) on days 6 –16 of gestation showed maternal toxicity at the highest doses (1 and 10 mg/kg bw) with increased resorptions and reduced numbers of viable foetuses. At the highest dose, only 25 % became pregnant, and foetuses showed delayed skeletal development. Also at the highest dose, the uterus became filled with brown fluid, with no foetal tissue discernible. Due to these and other effects (reduced body weight gain, hypoactivity and tremors), high dose treatment was discontinued after three days (NTPa). Similarly, female CD-1 mice intragastrically administered TEL (0.01, 0.1, 1 and 10 mg/kg) on days 5–15 of gestation showed similar maternal and reproductive toxicity (only 25 % became pregnant) compared to the study in rats. Foetuses showed retarded skeletal development, and similar uterine abnormalities (uterus filled with brown fluid, with no foetal tissue discernible) were noted (NTPa).

In a further study, female Sprague Dawley rats were orally administered TML on day 9–11 or 12–14 of gestation at total doses of 40, 80, 112 and 160 mg/kg bw. The low, medium and medium high doses were toxic to the dams and the high dose was lethal. Dams in all dose groups exhibited hyperexcitability, reduced bodyweight, tremor and paresis (NTPb). Progeny showed dose related effects with respect to the degree of malformations (ranging from decreased ossification to an increase in skeletal defects: diminished head-to-hindquarters length and/or malformations of the internal organs or skeleton) (NTPb).

Other Health Effects

Neurotoxicity

Tetramethyl lead administered to rats at weekly intervals during gestation and early postnatal life, raised the total brain lead concentration to approximately 1 μg/g. This resulted in a prenatal body growth being stimulated more than brain growth, resulting in a higher body:brain weight ratio (NTPb).

In a further study, dose related behavioural effects were assessed in rats following injection of TEL (2.6–7.9 mg/kg bw) or TML (8.8–26.2 mg/kg). Both chemicals decreased components of motor activity two days post dosing, and generally increased activity in TEL exposed rats (7–21 days after dosing). Both TEL and TML decreased responsiveness to an acoustic stimulus during the first two weeks of dosing (NTPa, NTPb)

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation include systemic long-term effects (carcinogenicity, reproductive toxicity and developmental toxicity) and systemic acute effects (acute toxicity by oral, dermal and inhalation exposure). The chemical also causes harmful effects following repeated exposure (through oral and inhalation exposure) and skin and eye irritation.

Public Risk Characterisation

Given the uses identified for the chemical, it is unlikely that the public will be exposed since leaded petrol is restricted to specific uses which do not lead to general public exposure. Hence, the public risk from these chemicals is not considered to be unreasonable.

Occupational Risk Characterisation

During product formulation, dermal, ocular and inhalation exposure of workers to the group of chemicals may occur, particularly where manual or open processes are used. These may include transfer and blending activities, quality control analysis, and cleaning and maintenance of equipment. Worker exposure to this group of chemicals at lower concentrations may also occur

while using formulated products containing the chemicals. The level and route of exposure will vary depending on the method of application and work practices employed.

The occupational risk to this group of chemicals from the formulation, storage and cleaning (of storage tanks) is expected to be minimal given the legislative controls introduced to minimise the use of leaded petrol in specific aircraft (piston engine aircraft), some racing automobiles and some recreational marine craft.

Given the critical systemic long-term and systemic acute/local health effects, the chemical may pose an unreasonable risk to workers unless adequate control measures to minimise dermal, ocular and inhalation exposure are implemented. This group of chemicals should be appropriately classified and labelled to ensure that a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) has adequate information to determine appropriate controls.

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

NICNAS Recommendation

Current risk management measures are considered adequate to protect public and workers' health and safety, provided that all requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory. No further assessment is required.

Regulatory Control

Work Health and Safety

The chemical is recommended for classification and labelling under the current approved criteria and adopted GHS as below. This assessment does not consider classification of physical hazards and environmental hazards.

The change in classification proposed below is based on data available for TEL (CAS No 78-00-2). It should be used as a default for all members of the group. If empirical data become available for any member of the group indicating that a lower (or higher) classification is appropriate, for the specific chemical, this may be used to amend the default classification for the chemical.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Very toxic if swallowed (T+; R28)* Very toxic in contact with skin (T+; R27)* Very toxic by inhalation (T+; R26)*	Fatal if swallowed - Cat. 1 (H300) Fatal in contact with skin - Cat. 1 (H310) Fatal if inhaled - Cat. 1 (H330)
Repeat Dose Toxicity	Toxic: danger of serious damage to health by prolonged exposure through inhalation (T; R48/23) Toxic: Danger of serious damage to health by prolonged exposure if swallowed (T; R48/25)	Causes damage to organs through prolonged or repeated exposure - Cat. 1 (H372)
Carcinogenicity	Carc. Cat 3 - Limited evidence of a carcinogenic effect (Xn; R40)	Suspected of causing cancer - Cat. 2 (H351)

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Reproductive and Developmental Toxicity	Repro. Cat 1 - May cause harm to the unborn child (T; R61)* Repro. Cat 3 - Possible risk of impaired fertility (Xn; R62)*	May damage the unborn child. Suspected of damaging fertility - Cat. 1A (H360Df)

[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 this group of 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;
- using local exhaust ventilation to prevent the chemical from entering the breathing zone of any worker;
- health monitoring for any worker who is at risk of exposure to the chemical if valid techniques are available to monitor the effect on the worker's health;
- air monitoring to ensure control measures in place are working effectively and continue to do so;
- minimising manual processes and work tasks through automating processes;
- work procedures that minimise splashes and spills;
- regularly cleaning equipment and work areas; and
- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemical.

Guidance on managing risks from hazardous chemicals are provided in the *Managing risks of hazardous chemicals in the workplace—Code of practice* available on the Safe Work Australia website.

Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

Obligations under workplace health and safety legislation

Information in this report should be taken into account to assist with meeting obligations under workplace health and safety legislation as adopted by the relevant state or territory. This includes, but is not limited to:

- ensuring that hazardous chemicals are correctly classified and labelled;
- ensuring that (material) safety data sheets ((m)SDS) containing accurate information about the hazards (relating to both health hazards and physicochemical (physical) hazards) of the chemical are prepared; and

- managing risks arising from storing, handling and using a hazardous chemical.

Your work health and safety regulator should be contacted for information on the work health and safety laws in your jurisdiction.

Information on how to prepare an (m)SDS and how to label containers of hazardous chemicals are provided in relevant codes of practice such as the *Preparation of safety data sheets for hazardous chemicals— Code of practice* and *Labelling of workplace hazardous chemicals—Code of practice*, respectively. These codes of practice are available from the Safe Work Australia website.

A review of the physical hazards of the chemical has not been undertaken as part of this assessment.

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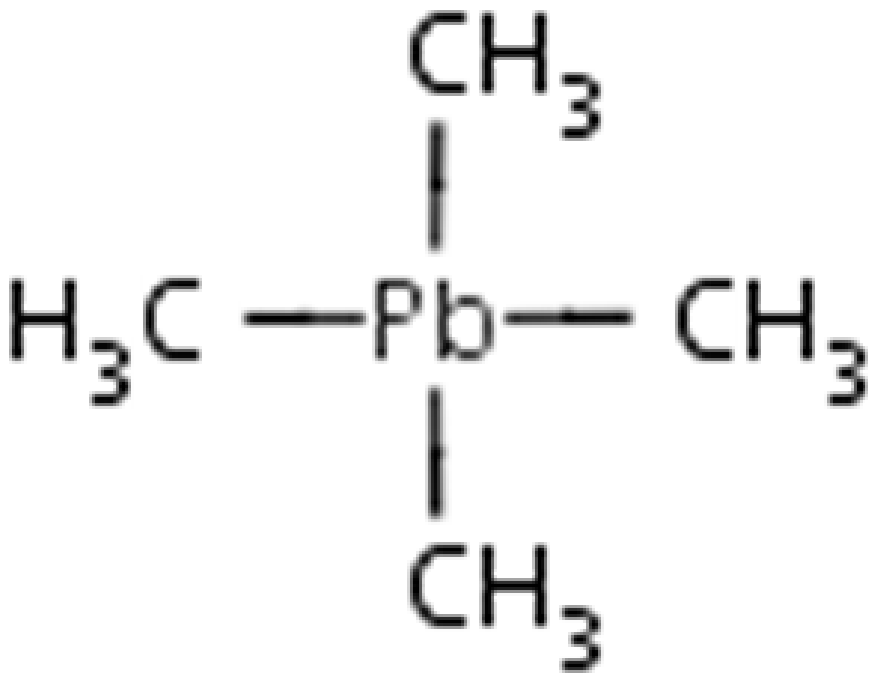
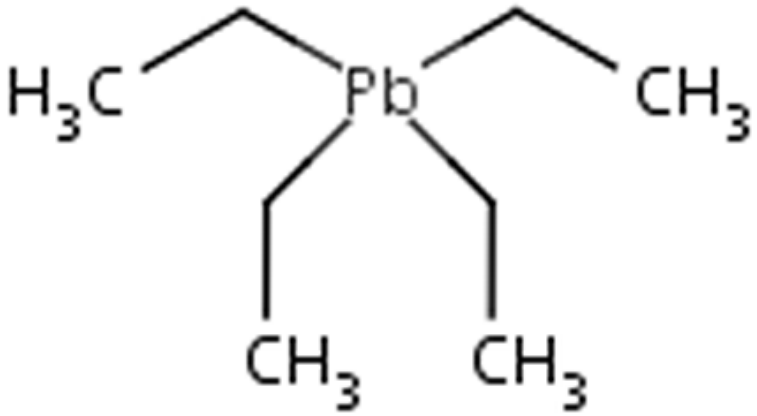
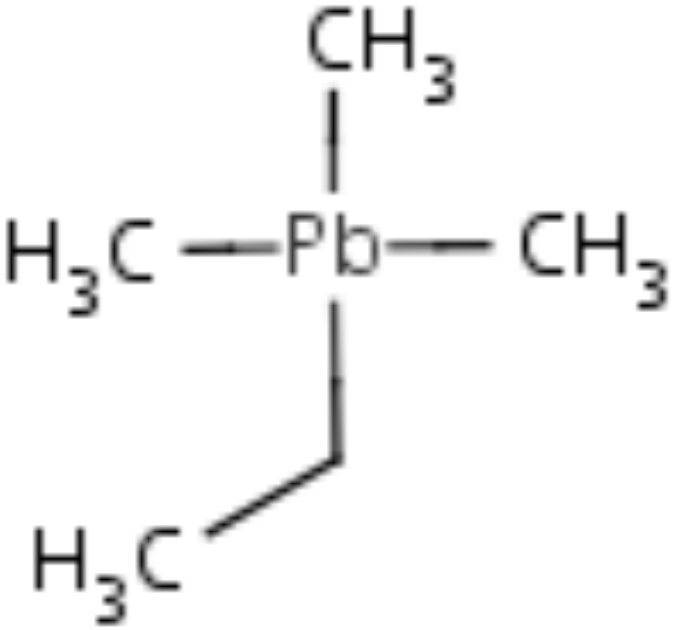
Chemical Identities

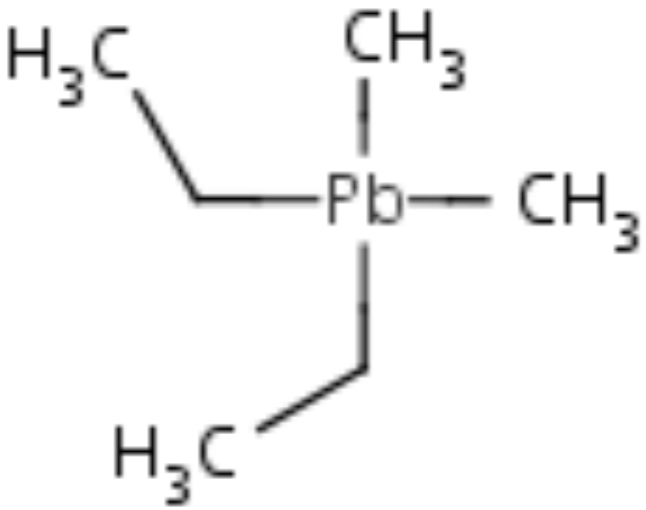
Chemical Name in the Inventory and Synonyms	**Plumbane, tetramethyl-** Lead, tetramethyl- Tetramethyl lead Tetramethyl plumbane
CAS Number	75-74-1
Structural Formula	
Molecular Formula	C4H12Pb
Molecular Weight	267.3

Chemical Name in the Inventory and Synonyms	**Plumbane, tetraethyl-** Lead, tetraethyl- Tetraethyl lead Tetraethyl plumbane
CAS Number	78-00-2
Structural Formula	
Molecular Formula	C8H20Pb
Molecular Weight	323.44

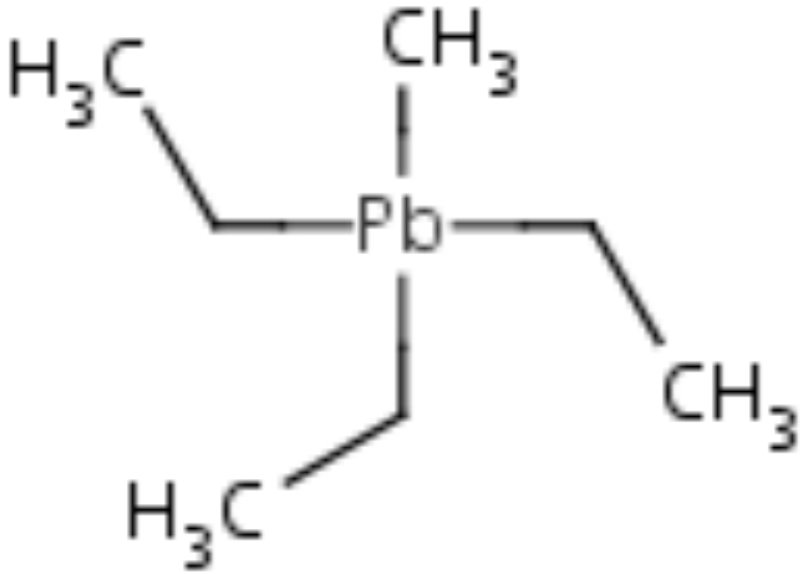
Chemical Name in the Inventory and Synonyms	**Plumbane, ethyltrimethyl-** Lead, ethyltrimethyl- Ethyltrimethyl lead Ethyltrimethyl plumbane
CAS Number	1762-26-1
Structural Formula	

	
Molecular Formula	C5H14Pb
Molecular Weight	281.4

Chemical Name in the Inventory and Synonyms	**Plumbane, diethyldimethyl-** Lead, diethyldimethyl- Diethyldimethyl lead Diethyldimethyl plumbane
CAS Number	1762-27-2
Structural Formula	

	
Molecular Formula	C6H16Pb
Molecular Weight	295.4

Chemical Name in the Inventory and Synonyms	**Plumbane, triethylmethyl-** Lead, triethylmethyl- Triethylmethyl lead Triethylmethyl plumbane
CAS Number	1762-28-3
Structural Formula	

	
Molecular Formula	C7H18Pb
Molecular Weight	309.4

Chemical Name in the Inventory and Synonyms	**Plumbane, ethyl methyl derivatives** Tetraethyllead, tetramethyllead redistribution mixture
CAS Number	68610-17-3
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	

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