# Tetramethyl lead (as Pb)

| CAS number: | 75-74-1 |
| --- | --- |
| Synonyms: | Lead tetramethyl, TML |
| Chemical formula: | C4H12Pb |

Workplace exposure standard (retained)

| TWA: | **0.15 mg/m3** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Carc. 2; Sk.** |
| IDLH: | **40 mg/m3** |
| **Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 0.15 mg/m3 is recommended to protect foreffects on the central nervous system (CNS) in exposed workers.

## Discussion and conclusions

Tetramethyl lead (TML) has been used as a fuel additive and in the production of aviation fuel.

Critical effects of exposure are effects on the central nervous system (CNS) and potential developmental effects. The mode of action of TML is analogous to that of tetraethyl lead (TEL) with effects associated with exposure reported as nervous irritability, tinnitus, insomnia, fatigue, muscle pain, disturbed vision, gastrointestinal distress and tremors.

Severe intoxication results in mania, convulsions and brain damage (ACGIH, 2018; DFG, 1995). Workers exposed at workplace air concentrations of 179 µg/m3 have urinary lead concentrations approximating to those in controls. No symptoms of illness are observed. In rats, inhaled TML is approximately one tenth as toxic as inhaled TEL (ACGIH, 2018). DFG (1995) based the MAK recommendation for TML by analogy to TEL. An oral study in rats indicates potential for developmental effects in the progeny of dams dosed during gestation (NICNAS, 2013).

Given the absence of data for effects related to inhalation exposure, the SWA TWA of 0.15 mg/m3 is recommended to be retained. This TWA is cited as being protective of CNS effects.

Consideration should be given to the grouping of TML with TEL and other organic lead compounds at the next scheduled review.

## Recommendation for notations

Classified as a category 2 carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

A skin notation is recommended based on reported systemic effects following dermal absorption.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.15 mg/m3 | |
|  |
| ACGIH 2001 TLV-TWA: 0.15 mg/m3 |
| TLV-TWA recommended to minimise the potential risk of CNS effects, provided skin contact is avoided.  Summary of data:   * Effects associated with exposure reported as nervous irritability, tinnitus, insomnia, fatigue, muscle pain, disturbed vision, gastrointestinal distress and tremors * Severe intoxication resulted in mania, convulsions and brain damage * No specific data or derivation of the TLV is provided: * it is reported that the TLV is based on evidence of workers exposed to TML at workplace air concentrations of 179 µg/m3 having urinary Pb concentrations approximating to not occupationally exposed people * this indicates that the TLV should minimise risks of toxicity if skin contact is avoided; no further information * The saturated vapour concentration of TML exceeds the TLV, thus, a significant fraction of TML can be expected to exist in the vapour phase.   Human data:   * The following are results from a study comparing relative degree of hazard in occupational exposure to airborne TML and TEL: * TML is considerably more volatile than TEL * industrial experience indicates atmospheric exposure is ~3 x greater in TML operations than for TEL manufacture * the concentration of Pb in the urine of workers exposed to TML and those exposed to TEL was not significantly different * neither TEL or TML group had symptoms of illness and urine Pb concentrations averaged slightly above the normal range * no further information * Total pulmonary absorption is estimated as 80% of the inhaled TML * An approximate linear relationship between lead concentrations in workplace air and urinary Pb excretion exists * Workers exposed to TML at workplace air concentrations of 179 µg/m3 having urinary lead concentrations like those in people not occupationally exposed.   Animal data:   * Signs of acute TML intoxication in rats are like those seen after acute poisoning with TEL. No further information (refer to TEL evaluation report) * Inhaled TML is ~0.1 as toxic in rats as inhaled TEL (TLV-TWA 0.1 mg/m3) * Oral intubation of TML at 6 µg/kg/d to adult rhesus monkeys for 6 mo failed to elicit signs of intoxication * TML absorbed through intact skin, at a rate slower than that of TEL; no further information.   Insufficient data are available to recommend a sensitiser or carcinogen notation or TLV-STEL. |
| DFG 1995 MAK: 0.05 mg/m3 |
| MAK value based on analogy to TEL (0.05 mg/m3).  Summary of additional data:   * For the effects of TML in experimental animals and humans, there are much fewer data available than for TEL * Mode of action of TML is analogous to TEL * TEL MAK reduced to 0.05 mg/m3 in 1994; TML reduced to 0.05 mg/m3 in 1995 * Some indication the absorbed TML may be demethylated to yield inorganic Pb and prenatal toxic effects of inorganic Pb might be expected following long-term exposure to TML: * no pregnancy notation due to inadequate database; no further information. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2013 | * Assessed as part of a group of 6 organic Pb chemicals including TEL: * exclusively used as additives in fuels * Classified as hazardous with the risk phrase 'Very toxic in contact with skin'; no specific animal or human studies are available; data available from the Hazardous Substances Data Bank indicate TEL and TML reported to penetrate the skin at lethal concentrations and dermal contact can result in dermatitis and burns * Specific studies for TML indicate that it is not genotoxic when assessed in standard *in vitro* (Ames test) and *in vivo tests* (in vivo chromosome aberration assay); no further information * Rats orally administered TML on GD 9–11 or 12–14 at total doses of 40, 80, 112 and 160 mg/kg body weight: * 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 body weight, tremor and paresis * 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 * The critical health effects include systemic long-term effects, reproductive toxicity and developmental toxicity and systemic acute effects (acute toxicity by oral, dermal and inhalation exposure). |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | No |
| --- | --- |
| **The chemical is not a non-threshold based genotoxic carcinogen.** |  |

## Notations

| Source | Notations |
| --- | --- |
| SWA | Skin |
| HCIS | Carcinogenicity – category 2 |
| NICNAS | Carc. Cat 3, Skin |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Skin |
| DFG | H(skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | NA |
| US NIOSH | SK:SYS |

NA = not applicable (a recommendation has not been made by this Agency); — = the Agency has assessed available data for this chemical but has not recommended any notations

### Skin notation assessment

| Calculation |
| --- |
| Reported to penetrate the skin at lethal concentrations. |

### IDLH

| Is there a suitable IDLH value available? | Yes |
| --- | --- |

## Additional information

|  |  |
| --- | --- |
| Molecular weight: | 267 |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 10.93 mg/m3; 1 mg/m3 = 0.091 ppm |
| This chemical is used as a pesticide: |  |
| This chemical is a biological product: |  |
| This chemical is a by-product of a process: |  |
| A biological exposure index has been recommended by these agencies: | ACGIH  DFG  SCOEL |

## Workplace exposure standard history

| Year | Standard |
| --- | --- |
| Click here to enter year |  |

## References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7th Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the [*TLVs® and BEIs® Guidelines section*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2001) Tetramethyllead – MAK value documentation.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Lead alkyls: Human health tier II assessment – IMAP report.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Tetramethyl lead (as Pb).

US National Institute for Occupational Safety and Health (NIOSH) (2017) NIOSH Skin Notation Profiles: Tetramethyl Lead (TML).