# Phosphorus trichloride

| CAS number: | 7719-12-2 |
| --- | --- |
| Synonyms: | Phosphorus chloride |
| Chemical formula: | PCl3 |

Workplace exposure standard (retained)

| TWA: | **0.2 ppm (1.1 mg/m3)** |
| --- | --- |
| STEL: | **0.5 ppm (2.8 mg/m3)** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **25 ppm** |
| **Sampling and analysis:** There is uncertainty regarding quantification of the recommended value with available sampling and/or analysis techniques. | |

## Recommendation and basis for workplace exposure standard

## A TWA of 0.2 ppm (1.1 mg/m3) is recommended to protect for eye and respiratory irritation in exposed workers.

## A STEL of 0.5 ppm (2.8 mg/m3) is recommended to protect for acute eye and respiratory irritation in exposed workers.

Given the limited data available from the primary sources, it is recommended that a review of additional sources be conducted at the next scheduled review.

## Discussion and conclusions

Phosphorus trichloride is primarily used as a chemical intermediate, chlorinating agent, catalyst and a textile finishing agent.

Critical effects of exposure are eye, mucous membrane and respiratory tract irritation. Exposure of workers at concentrations ranging from 2 to 27 ppm is reported to induce acute irritation of the pharynx, coughing, dyspnoea and severe asthmatic bronchitis. Cats and guinea pigs exposed at 0.7 ppm by inhalation for six hours showed mild signs of intoxication. Exposure at 2 to 4 ppm for one hour produced no severe signs of poisoning and 50 to 90 ppm resulted in severe disturbances in the same study. No specific symptoms are provided. Based on the evidence from this study, separate authors recommended that a maximum allowable concentration for prolonged exposure to phosphorus trichloride should be less than 0.7 ppm. Taking this into account, ACGIH (2018) derives TLV-TWA by analogy to hydrogen chloride (TLV-Ceiling: 2 ppm). DFG (2016) calculate a MAK based on a NOAEC of 3 ppm for local effects on the respiratory tract from a subchronic inhalation study in rats. Both the ACGIH (2018) and DFG (2016) calculated a TWA of 0.17 ppm.

Given the limited available data and remaining uncertainties, the TWA of 0.2 ppm (1.1 mg/m3) derived by ACGIH (2018) and DFG (2016) is recommended to be retained to limit irritation. A STEL of 0.5 ppm (2.8 mg/m3) by ACGIH (2018) is also recommended to be retained to protect acute eye and respiratory irritation in exposed workers.

Noting the uncertainties presented by the primary source material, a review of additional data sources is recommended at the next scheduled review.

## Recommendation for notations

Not classified as a 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 not recommended based on the available evidence.

# Appendix

### Primary sources with reports

| **Source Year set Standard** |
| --- |
| SWA 1991 TWA: 0.2 ppm (1.1 mg/m3); STEL: 0.5 ppm (2.8 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 0.2 ppm (1.1 mg/m3); TLV-STEL: 0.5 ppm (2.8 mg/m3) |
| TLV-TWA and TLV-STEL recommended to minimise the risk of eye, mucous membrane and respiratory tract irritation.  Summary of data:  TLV-TWA and TLV-STEL derived by comparison to effects from exposure to HCl (TLV-Ceiling 2 ppm).  Human data:   * Workers exposed at 1.8–27 ppm (inhalation) exhibited symptoms including burning eyes and throat, mucous membrane irritation and mild bronchitis within 2–6 h * Sub-acute poisoning symptoms include pharynx irritation, coughing, dyspnoea and severe asthmatic bronchitis occurring 1–8 wk after exposure (no concentrations noted) * Exposure at 1 ppm during truck loading operations recorded normal results on a lung function test * In a recorded case, 17 people were exposed to unknown ambient air concentrations resulting from a spill, reported symptoms included burning eyes, lacrimation, nausea, vomiting, dyspnoea and coughing: * diminished capacity observed in follow-up lung function tests.   Animal data:   * Cats and guinea pigs exposed at 0.7 ppm (inhalation) for 6 h showed mild signs of intoxication, 2–4 ppm for 1 h produce no severe signs of poisoning, 50–90 ppm resulted in severe disturbances (specific symptoms were not referenced): * based on these results the inhalation effect of PCl3 considered 5–10 times as intense as resulting from exposure to HCl produced by hydrolysis, using this as a basis a limit of 0.17 ppm is derived * based on this study, separate authors recommended a maximum allowable concentration for prolonged exposure to phosphorus trichloride <0.7 ppm * LC50: 104 ppm (rats, 4 h), 50 ppm (guinea pigs, 4 h).   Insufficient data to recommend a skin, sensitiser or carcinogen notation. |
| DFG 2016 MAK: 0.1 ppm (0.57 mg/m3) |
| Starting from 3 ppm NOAEC and using the procedure of Brüning *et al.* (2014), a concentration of 1 ppm is calculated for the transfer of findings on the respiratory epithelium of the rat to humans. Considering a possible increase in effectiveness in the event of chronic exposure leads to a concentration of 0.17 ppm. This concentration is rounded according to DFG methodology to obtain a MAK of 0.1 ppm.  Summary of additional data:   * Exposure at 0, 0.5, 3 or 10 ppm (rats, 6 h/d, 5 d/wk, 4 wk); no effects in organ weights, urine analysis or clinical, histopathological, haematological, clinical-chemical and ophthalmological examinations: * 10 ppm: squamous metaplasia of the respiratory epithelium and focal purulent inflammation with protein-containing fluid in the anterior nasal cavity * 3 ppm stated as the overall NOAEC for local respiratory effects * since 2014, DFG uses empirical approaches to set MAK values for substances with critical effects on the upper respiratory tract or the eyes. According to this approach, a concentration of 0.17 ppm for workplace air is calculated from this study; rounded according to DFG methodology to establish a MAK of 0.1 ppm (no further details provided). |
| SCOEL NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| **Source** |  | **Year** | **Additional information** |
| --- | --- | --- | --- |
| ECHA |  | 2011 | * LD50: 250–500 mg/kg (rabbits, dermal) * Negative results *in vitro* assays * Negative results *in vivo* chromosome aberration assay. |
| OECD |  | 2004 | * No additional information. |
| US NIOSH |  | 1994 | * LD50: 18 ppm (rats, oral). |

### 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 | — |
| HCIS | — |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | — |
| ACGIH | — |
| DFG | — |
| SCOEL | NA |
| HCOTN | NA |
| IARC | NA |
| US NIOSH | NA |

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 |
| --- |
| |  |  |  |  | | --- | --- | --- | --- | | Adverse effects in human case study: | no |  |  | | Dermal LD50 ≤1000 mg/kg: | yes | 3.00 |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: | no | -3.00 |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  | 0 | **a skin notation is not warranted** | |

### IDLH

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

## Additional information

| Molecular weight: | 137.33 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 5.60 mg/m3; 1 mg/m3 = 0.179 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) (2016) phosphortrichlorid – MAK value documentation.

European Chemicals Agency (ECHA) (2011) Phosphorus trichloride – REACH assessment.

Organisation for Economic Cooperation and Development (OECD) (2004) SIDS initial assessment profile - Phosphorus Trichloride.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – phosphorus trichloride.