# Phosphorus oxychloride

| CAS number: | 10025-87-3 |
| --- | --- |
| Synonyms: | Phosphoryl chloride, phosphoryl trichloride |
| Chemical formula: | POCl3 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **0.02 ppm (0.13 mg/m3)** |
| --- | --- |
| STEL: | — |
| Peak limitation: | — |
| Notations: | — |
| IDLH: | — |
| **Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 0.02 ppm (0.13 mg/m3) is recommended to protect for irritation of the eyes, mucous membranes and respiratory tract in exposed workers.

## Discussion and conclusions

Phosphorus oxychloride is not a persistent chemical as it completely hydrolyses in water. It is used as an intermediate in the manufacture of numerous products including plastics and elastomers, lubricant oil, surfactants, and sequestrants and organophosphorus pesticides (SCOEL, 2015).

Critical effects of exposure are irritation of the respiratory tract, mucous membranes and eyes (ACGIH, 2018: SCOEL, 2015).

Limited data are available from human and animal studies with a lack of repeat exposure inhalation studies. DFG (2015) derive a MAK based on a read-across to phosphorus trichloride, whereby the reported irritation threshold is at 1 mg/m3 in rats and humans and it is five times lower than phosphorus trichloride (5 mg/m3). A NOAEC is not identified in available studies. A LOAEC of 0.48 mg/m3 (0.08 ppm) is reported based on weight loss, respiratory irritation and increased kidney weights (SCOEL, 2015). The validity of this four-month study in rats and guinea pigs was questioned by DFG (2015) and OECD (2004).

Based on the available evidence, a TWA of 0.02 ppm (0.13 mg/m3) by DFG (2015) is recommended to protect for irritation of the eyes, mucous membranes and respiratory tract in exposed workers.

## 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 warranted based on the available evidence.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.1 ppm (0.63 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 0.1 ppm (0.63 mg/m3) |
| TLV-TWA recommended to minimise eye, skin and mucous membrane irritation, respiratory difficulties and kidney damage in exposed workers. Derivation of TLV-TWA is not provided.  Summary of data:  Human data:   * Chronic and acute cases of occupational poisoning reported, no further information * Symptoms include intense irritation of eyes, skin and mucus membranes, dizziness, headache, weakness anorexia, nausea, vomiting, chest pain, cough, dyspnoea, bronchitis, bronchopneumonia, pulmonary oedema and nephritis.   Animal data:   * 4 h LC50: 48 ppm (rats); 52 ppm (guinea pigs) * Irritant effects reduced when neutralised with ammonia, however toxicity increased * 4 h LC50: 44 ppm (rats); 41 ppm (guinea pigs) * More toxic than phosphorus trichloride based on acute inhalation studies.   Limited toxicological data available but can hydrolyse to phosphoric and hydrochloric acids. Insufficient data to recommend Skin, SEN or carcinogenicity notations or TLV-STEL. |
| DFG 2015 MAK: 0.02 ppm (0.13 mg/m3) |
| Summary of additional data:   * Insufficient data to set MAK due to lack of repeat exposure inhalation studies * 1 min exposure in volunteers caused subjective annoyance at 1 mg/m3; no further information * ‘Irritation threshold’ of 1 mg/m3 in rats; decreased respiratory rate; 5 mg/m3 for phosphorus trichloride * MAK derived based on read-across to phosphorus trichloride (MAK 0.1 ppm); NOAEC of phosphorus trichloride for sensory irritation in rats and volunteers is 5 fold higher, thus MAK lowered to 0.02 ppm * Target organs of 4 h inhalation study cited in ACGIH (2001) were trachea and lungs * Severe caustic effect caused on rabbit skin, occlusive treatment with undiluted chemical for 24 h; 1 min exposure to shaved rabbit skin also caused irreversible caustic effect * Corrosive to eyes of rabbits. |
| SCOEL 2015 TWA: 0.01 ppm (0.064 mg/m3); STEL: 0.02 ppm (0.13 mg/m3) |
| Summary of additional data:   * LD50: 380 mg/kg (rats, oral) * ≈15% hydrolysed in the atmosphere; distribution in the organism is limited by rate of hydrolysis * Severe damage to GIT tissue in humans following oral ingestion; no further information * Inhalation exposure of rats, mice, rabbits, guinea pigs at lethal concentrations caused acute irritation of respiratory tract, dystrophic changes in CNS, liver and kidney * Single 4 h exposure in rodents caused decreased oxygen consumption at 6 mg/m3, and decrease in breathing rate at 1 mg/m3 * Workers exposed at 10–20 mg/m3 in production plant caused symptoms 1–7 wk following inhalation, including ocular and respiratory irritation, cough, acute dyspnoea and asthmatic bronchitis; symptoms after peak exposures at 70 mg/m3 manifest after 1–3 h * Exposure at 0.48 mg/m3 (0.08 ppm) (rats and guinea pigs, 4 h/d, 5 d/wk, 4 mo duration); lowest dose tested; weight loss, respiratory irritation and increased kidney weights; effects mild and reversible, therefore considered by OECD as LOAEC: * Exposure at 1.34 mg/m3 (0.2 ppm) (only other dose tested) caused severe irritation of respiratory tract, chronic rhinitis, tracheitis and hyperplasia of mucous glands * Accidental dermal exposure in humans caused redness, inflammation and corrosion * Chromosomal aberrations in bone marrow of rats following 4 mo inhalation exposure at 1.34 mg/m3; due to lack of experimental information, data cannot be adequately assessed: * authors concluded transfer of compound to bone marrow unlikely * Negative results in Ames test * No carcinogenicity data from animals or humans.   OEL based on LOAEC of 0.48 mg/m3 (0.08 ppm), AF of 3 for LOAEC to NOAEC, 3 for sub-chronic to chronic, rounded to 0.01 ppm. STEL recommended due to local irritancy. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2019 | * No additional information. |
| ECHA |  | 2019 | * LD50: 1,000 mg/kg (rabbits, dermal) * No additional information. |
| OECD |  | 2004 | * Toxicant acting at portal of entry; systemic toxicity not expected by any route * Evaluation of LOAEC (as cited by SCOEL, 2015) study limited; methodology and results lacking detail. |
| US NIOSH |  | 2007 | * REL: TWA 0.1 ppm (0.6 mg/m3); ST 0.5 ppm (3 mg/m3). |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Insufficient data | |
| --- | --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | | Insufficient data |
| **Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.** | | |

## Notations

| Source | Notations |
| --- | --- |
| SWA | — |
| HCIS | — |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | — |
| ACGIH | — |
| DFG | — |
| SCOEL | — |
| 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: |  |  |  | | 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? | No |
| --- | --- |

## Additional information

| Molecular weight: | 153.33 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 6.26 mg/m3; 1 mg/m3 = 0.160 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) Phosphorylchlorid – MAK value documentation.

European Chemicals Agency (ECHA) (2019) Phosphorus oxychloride – REACH assessment.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2015) Recommendation from the Scientific Committee on Occupational Exposure Limits for phosphoryl trichloride. SCOEL/REC/181.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2019) Phosphoryl chloride: Human health tier I assessment – IMAP report.

Organisation for Economic Cooperation and Development (OECD) (2004) SIDS initial assessment profile – Phosphoryl trichloride.

US National Institute for Occupational Safety and Health (NIOSH) (2007) NIOSH Pocket Guide to Chemical Hazards – Phosphorus oxychloride.