# Lead chromate (as Cr)

| CAS number: | 7758-97-6 |
| --- | --- |
| Synonyms: | Lead(II) chromate, chrome yellow, C.I. pigment yellow |
| Chemical formula: | PbCrO4 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **0.007 µg/m3** |
| --- | --- |
| STEL: | **­**— |
| Peak limitation: | — |
| Notations: | **Carc 1B, DSEN** |
| IDLH: | — |
| **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 0.007 µg/m3 is recommended to reduce the risk of cancer in exposed workers.

## Discussion and conclusions

Lead chromate and related compounds have historically been used as pigments in oils and paints. It is considered a hexavalent chromium (Cr[VI]) compound. Based on evidence in animals and humans, Cr(VI) is considered a non-threshold based genotoxic carcinogen (ACGIH, 2018; DFG, 2016; US EPA, 1998). Its carcinogenicity is likely to act *via* a mutagenic mode of action.

As such, the recommended TWA of 0.007 µg/m³ (in line with Cr[VI]) has been derived at a minimal cancer risk level applying an inhalation slope factor. This factor is based on data from a study reporting an increased risk of lung cancer in exposed workers (USEPA, 1998).

## Recommendation for notations

Classified as a category 1B carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser but not a respiratory sensitiser according to the GHS.

The evidence suggests that a skin notation is not warranted.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.05 mg/m3 | |
|  |
| ACGIH 2018 TLV-TWA: 0.0002 mg/m3 (as Cr(VI)); TLV-STEL: 0.0005 mg/m3 |
| TLV-TWA and TLV-STEL recommended to minimise the potential for respiratory tract cancers, irritant effects, and sensitisation of the skin and respiratory tract.  Summary of data:  Considered a hexavalent chromium (Cr(VI) compound.  TLV-TWA is based on values set for exposures to other Cr(VI) compounds; much lower than the level at which any lead-related health effects are expected to occur.  Human data:   * Case report of lung cancer in 46 yr old male; non-smoking spray painter, no family history of lung cancer; 15 yr potential exposure up to 118 µg/m3 * Study in 3 paint manufacturing factories: * 2 factories where lead chromate and zinc chromate were produced had a statistically significant excess of lung cancer deaths; exposure defined as high or medium * 1 factory where lead chromate produced; small cohort that limited analysis finding * no information on smoking status * Limited evidence for lead chromate causing cancer in humans; however, there is sufficient evidence in humans and animals that all Cr(VI) compounds can cause lung cancer * Case reports of lead poisoning and intoxication from exposure to lead chromate.   Animal data:   * Tumours in multiple organs and tissue of rats (12 intramuscular injections, 9 mo) * Intrapleural injections of rats over 27 mo developed lung tumours.   Genotoxicity   * Mutagenic *in vitro* in bacterial tests * Studies in isolated human lung cells show the chromate component is responsible for marked genotoxic and clastogenic effects.   *In vitro*, animal, and epidemiological studies show that all Cr(VI) compounds are likely human carcinogens. |
| DFG 2012 Not assigned |
| No recommended MAK due to confirmed carcinogenic properties.  Summary of additional data:   * Increased relative risk of mortality from lung cancer in chromate and chrome-plating plants * Confirmed carcinogenic effects in animals * Genotoxic in numerous studies with bacteria and mammalian cells * Chromium–DNA adducts can reduce the accuracy of base pairing in DNA replication and cause gene mutation; increased mutation frequency and genomic instability due to the formation of DNA double strand breaks can be attributed to an incorrect mismatch repair of chromium–DNA adduct. |
| SCOEL 2004 TWA: 100 µg/m3 |
| No further data. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2016 TWA: 10 µg/m3; STEL: 20 µg/m3 (soluble Cr[VI] compounds) TWA: 50 µg/m3 (poorly soluble Cr[VI] compounds) |
| Concludes all hexavalent chromium compounds are carcinogenic substances with no threshold and genotoxic mechanisms. As such, risk-based values are recommended to replace the current TWAs and STEL.  Additional lifetime cancer risk:   * 4 in 100,000 for 40 yr of occupational exposure to 0.01 µg/m3 * 4 in 1,000 for 40 yr of occupational exposure to 1 µg/m3. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| US EPA |  | 1998 | * Rapidly taken up by cells through sulphate transport system where quickly reduced to trivalent forms; trivalent forms do not readily cross cell membranes * Carcinogenesis likely to result from the formation of mutagenic DNA lesions following intracellular reduction to Cr(III) * Inhalation unit risk factor derived from mortality study (1951) and follow up (1975) on a cohort of chromate workers investigating lung cancer association with the work environment * An additional follow up (1997) reported that lung cancer rates clearly increased by gradient level of exposure to total chromium * The relationship between gradient level of exposure and lung cancer rates is less clear for trivalent and hexavalent chromium. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | Yes |
| **The chemical is a non-threshold based genotoxic carcinogen.** |  |
| Is a cancer slope factor or inhalation unit risk value available? | Yes |
| Inhalation unit risk value (1/(µg/m³)) | 1.2 x 10-2 |
| Calculated TWA value (µg/m3) | 0.007 µg/m3 |

## Notations

| Source | Notations |
| --- | --- |
| SWA | Carc. 1B |
| HCIS | Carcinogenicity – category 1B, Skin sensitisation – category 1 |
| NICNAS | Carc. Cat 2, Skin sensitisation |
| EU Annex | Carcinogenicity – category 1B |
| ECHA | Carc. 1B |
| ACGIH | Carcinogenicity – A1, RSEN, DSEN |
| DFG | Carcinogenicity – 1, Sh (dermal sensitiser), H (skin) |
| SCOEL | — |
| HCOTN | — |
| IARC | Carcinogenicity – Group 1 |
| 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 |
| --- |
| Insufficient data to assign a skin notation. Dermal uptake considered low due to low water solubility. |

### IDLH

| Is there a suitable IDLH value available? | No, the chemical is a genotoxic carcinogen |
| --- | --- |

## Additional information

| Molecular weight: | 323.19 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 12.22 mg/m3; 1 mg/m3 = 0.76 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) (2012) Chromium(VI) compounds (inhalable fraction) – MAK value documentation.

European Chemicals Agency (ECHA) (2019) lead chromate – REACH assessment.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2004) Recommendation from the Scientific Committee on Occupational Exposure Limits for Lead Chromate. SCOEL/SUM/117.

Health Council of the Netherlands (HCOTN) (2016) Hexavalent chromium compounds. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2016/13E.

International Agency for Research on Cancer (IARC) (2012) Arsenic, Metals, Fibres and Dust. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2015) Lead chromates: Human health tier II assessment – IMAP report.

Tenth Adaptation to Technical Progress Commission Regulation (EU) No 2017/776 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (the CLP Regulation).

US Environmental Protection Authority (US EPA) (1998) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Hexavalent Chromium.