# o-Chlorobenzylidene malononitrile

| CAS number: | 2698-41-1 |
| --- | --- |
| Synonyms: | o-chlorobenzalmalonitrile, CS, OCBM,  (o- chlorobenzal)malononitrile,  2-chlorobenzylidene malononitrile,  ß,ß-dicyano-o-chlorostyrene |
| Chemical formula: | C10H5ClN2 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **0.02 mg/m3** |
| --- | --- |
| STEL: | — |
| Peak limitation: | — |
| Notations: | **Sk.** |
| IDLH: | **2 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 0.02 mg/m3 is recommended to protect for respiratory tract irritation in exposed workers.

The recommended TWA is considered sufficiently low to protect for the effects of acute short-term exposure. Therefore, a peak limitation is not recommended.

## Discussion and conclusions

o-Chlorobenzylidene malononitrile is a ‘tear gas’ and is used primarily by military and law enforcement personnel as an incapacitating agent for crowd control.

When used, effects include intense eye and skin irritation, coughing, difficulty in breathing, chest tightness, running nose, dizziness, nausea and vomiting. It is reported to be incapacitating after 20 seconds at 12 to 20 mg/m3. Exposure at 1.5 mg/m3 for 90 min resulted in headaches in three of four volunteers. A two-year inhalational study in rats reports a NOAEL of 0.075 mg/m3 for non-neoplastic toxic changes in the respiratory epithelium of the nasal passages (ACGIH, 2018).

The recommended TWA is derived by applying an uncertainty factor of four to the NOAEL of 0.075 mg/m3 reported in rats and appropriately rounded upwards to 0.002 mg/mg/m3. The evidence suggests that the recommended TWA is sufficiently low to protect for short-term exposures.

## 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 review of the GHS classification is recommended for dermal sensitisation due to evidence in animals and case reports of dermal sensitiser effects.

A skin notation is recommended based on evidence of systemic effects following dermal contact in workers.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 Peak limitation: 0.05 ppm (0.39 mg/m3) | |
|  |
| ACGIH 2001 TLV-Ceiling: 0.05 ppm (0.39 mg/m3) |
| TLV-Ceiling recommended to minimise the potential for eye and nose irritation, headache and potential dermal sensitisation.  Summary of data:  Human data:   * Effects experienced include intense eye and skin irritation, coughing, difficulty in breathing, chest tightness, running nose, dizziness, nausea and vomiting * Incapacitating at 12–20 mg/m3 >20 sec * Exposure at 1.5 mg/m3 for 90 min resulted in headaches in 3/4 volunteers; headaches continued for 24 h in 2 volunteers; 1 volunteer developed slight eye and nose irritation; * 4–5 mg/m3 decreased ability to complete mathematical problems; no tolerance after repeated exposure * No clinical abnormalities in 7 volunteers exposed at 1–13 mg/m3 for 15 d; no tolerance noted * Handling in industrial settings has significant potential for skin sensitisation; incidents of dermatitis on arms and neck.   Animal data:   * 30 mg/m3 for 1 h, male rats and mice, no harmful effects noted * 13 wk inhalation study: * 1/10 male rats died before 13 wk at 6 mg/m3 (highest dose) * reduced thymus weight in male and female rats at 6 mg/m3 * focal erosion with regenerative hyperplasia and squamous metaplasia of the respiratory epithelium and suppurative inflammation in rats * all mice exposed at 6 mg/m3 and 1/10 female mice at 3 mg/m3 died before end of study * mice experienced compound-related lesions of the nasal passage including squamous metaplasia of the nasal epithelium and inflammation * Non-neoplastic toxic changes in the respiratory epithelium of rodent nasal passages reported from long-term repeat exposure study (6 h/d, 5 d/wk, 2 yr) * NOAEL of 0.075 mg/m3 for hyperplasia, squamous metaplasia of the respiratory epithelium and degeneration of the olfactory epithelium with ciliated columnar and/or squamous metaplasia * highest dose 0.75 mg/m3 rats and 1.5 mg/m3 mice   Insufficient evidence to assign a SEN notation. |
| DFG NA NA |
| No report. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2004 TWA: 0.02 mg/m3 |
| TWA recommended to minimise the potential for respiratory tract effects.  Summary of additional data:   * Previous guideline was 0.4 mg/m3 as a ceiling value * Biotransformed to cyanide * NOAEL of 0.075 mg/m3 for metaplasia of the olfactory and respiratory epithelium in rats (same study reported in ACGIH) * Skin sensitising tests in guinea pigs produced positive response in most of the animals * TWA is derived by applying a factor of 4 to the observed NOAEL in rats for intra- and interspecies variation and the type of effect and rounded up to preferred value. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NTP |  | 2019 | * No further information. |

### 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 | NA |
| HCIS | NA |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Carcinogenicity – A4, Skin |
| DFG | NA |
| SCOEL | NA |
| HCOTN | Skin |
| 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: | yes |  |  | | Dermal LD50 ≤1000 mg/kg: |  |  |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  |  | **a skin notation is warranted** | |

### IDLH

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

## Additional information

| Molecular weight: | 188.62 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = Number mg/m3; 1 mg/m3 = Number 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.

Health Council of the Netherlands (HCOTN) (2004) (2-Chlorobenzylidene)malononitrile. Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/098.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – o-chlorobenzylidene malononitrile.