# Dichlorvos

| CAS number: | 62-73-7 |
| --- | --- |
| Synonyms: | O,O-dimethyl-O-2,2-dichlorvinyl dimethyl phosphate; 2,2-dichlorovinyl dimethylphosphate (DDVP) |
| Chemical formula: | C4H7Cl2O4P |

Workplace exposure standard (amended)

| TWA: | **0.01 ppm (0.1 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk., DSEN** |
| IDLH: | **100 mg/m3** |
| Sampling and analysis: |  |

## Recommendation and basis for workplace exposure standard

A TWA of 0.01 ppm (0.1 mg/m3) is recommended to protect for acetyl cholinesterase (AChE) inhibition and associated adverse biological effects in workers exposed at the workplace.

## Discussion and conclusions

Dichlorvos is an organophosphate pesticide compound. Its primary mode of action for mammalian toxicity is *via* the inhibition of AChE activity in tissue including the blood, plasma and brain (APVMA, 2008; ACGIH 2018).

In an experimental study involving adult male volunteers, no observable effects on red blood cell (RBC) AChE, plasma AChE or on physiological function were observed after exposure to 0.01‑0.03 ppm (0.1–0.3 mg/m3) for 39 half-hour periods over 14 days (ACGIH, 2018). In an observational study on pesticides in homes, exposure to 0.15 mg/m3 did not significantly inhibit blood AChE or report changes in electromyograms following an assessment of 100 people (DFG, 1985). A NOEC of 0.15 mg/m3 was reported in human babies exposed for 18 hours per day for five days (APVMA, 2008).

Cholinergic effects have also been studied in animals. A NOEC of 0.05 mg/m3 was reported in rats exposed for 23 hours per day for two years, (US EPA, 1993). A NOAEL of 0.48 mg/m3 was reported in monkeys exposed for two hours per day for four days (ACGIH, 2018).

The recommended TWA is considered adequately sufficient to protect for adverse effects associated with AChE inhibition in exposed workers (ACGIH, 2018).

## Recommendation for notations

Dichlorvos is not classified as a 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.

A skin notation is recommended as evidence indicates absorption through skin resulting in severe systemic effects.

# Appendix

## Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.1 ppm (0.9 mg/m3) | |
|  |
| ACGIH 2014 TLV-TWA 0.01 ppm (0.1 mg/m3) |
| TLV-TWA recommended to protect for cholinergic (AChE inhibition) and other adverse biological effects.  Summary of data:  Organophosphate pesticide that decreases activity of cholinergic enzymes.  Human data:   * Accidental dermal exposure on arms of two workers resulted in death after failure to wash off * Observations in 20 people exposed to an average of 0.213 mg/m3 (24 h) following pesticide application in homes showed a slight decrease (7%) in mean serum AChE activity; however, considerable variation in the direction of AChE activity was noted * Factory workers exposed to 0.7 mg/m3 (averaged over 1 yr) showed slight to moderate plasma and RBC AChE depression * Experimental studies in male volunteers showed: * NOAEL of 0.1 mg/m3 based on effects on RBC plasma AChE and physiological functions after 39 exposures for 30 min over 14 d * Decrease in plasma AChE at 0.4 mg/m3 after 96 exposures of 30 min for 21 d.   Animal data:   * LD50: 75 mg/kg (rats, dermal) * LC50­: 455 mg/m3 (rats, 4 h); 340 mg/m3 (rats, 1 h) * NOAEL: 0.48 mg/m3 (monkeys, 2 h/d for 4 d) * LOAEL: 12.9 mg/m3 (monkeys, 2 h/d for 4 d) * Suggested inhalation exposure is more potent on a body-weight basis than oral exposure based observations in hepatic versus peripheral routes.   Insufficient data available to recommend a STEL.  Not shown to be carcinogen in humans; inconsistent data in animals.  A dermal sensitiser notation assigned based on positive response in guinea pig patch tests, but no observation of sensitisation in humans in the workplace. |
| DFG 1985 MAK: 0.1 ppm (1.0 mg/m3) |
| MAK value recommended to prevent adverse health effects associated with the inhibition of plasma AChE in exposed workers.  Summary of additional data:   * Lethal oral dose ≈50 mg/kg in humans * Subtoxic doses (0.1 ppm) may inhibit the plasma AChE by up to 20% with no adverse effects on health * Exposure to 0.15 mg/m3 did not cause significant inhibition of blood AChE or changes in electromyograms in 100 persons (no further information) * Mutagenic in almost all in vitro test systems * Negative in in vivo mutagenicity tests * Studies in rats and mice did not reveal carcinogenic potential. |
| 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 |
| --- | --- | --- | --- |
| APVMA |  | 2008 | * NOEC humans: 0.15 mg/m3,18 h/d for 5 d (newborn babies); equal to a dose of 0.036 mg/kg/d * ADI of 0.001 mg/kg/d was reaffirmed in the present   review based on the NOEL of 0.014 mg/kg/d (28 d human study for plasma AChE inhibition), and using a safety factor of 10. |
| US EPA |  | 1993 | * LOAEL: 0.48 mg/m3; NOAEL: 0.05 mg/m3 alterations in brain AChE activity (rats 23 h/d, 7 d/wk for up to 2 yr) * A reference concentration of 0.0005 mg/m3 (for general population) was derived by applying a total uncertainty factor of 100 to the NOAEL to protect sensitive human subjects, interspecies extrapolation and lack of reproductive and chronic data. |

### 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 | SK:Sen |
| HCIS | Skin sensitisation – category 1 |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Carcinogenicity – A4; DSEN |
| DFG | H (Skin) |
| SCOEL | — |
| HCOTN | NA |
| IARC | Carcinogenicity- Group 2B |
| US NIOSH | SK:SYS; SK:SEN |

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 | 4.00 |  |  | | 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: | 220.97 |
| --- | --- |
| 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.

Deutsche Forschungsgemeinschaft (DFG) (1985) Dichlorvos – MAK value documentation.

Australian Pesticides and Veterinary Medicines Authority (APVMA) (2008) Dichlorvos Toxicology Assessment

International Agency for Research on Cancer (IARC) (1991) Dichlorvos. IARC Monographs on the evaluation of the carcinogenic risk to humans.

US Environmental Protection Agency (US EPA) (1993) Dichlorvos Integrated Risk Information System (IRIS) Chemical Assessment Summary

US National institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life and health concentrations – Dichlorvos.

US National Institute for Occupational Safety and Health (NIOSH) (2017) NIOSH Skin Notation Profiles: Dichlorvos