# Phenyl ether (vapouR)

| CAS number: | 101-84-8 |
| --- | --- |
| Synonyms: | 1,1'-Oxybis(benzene), biphenyl oxide, diphenyl oxide, phenyl oxide, phenyl ether, phenoxybenzene |
| Chemical formula: | C12H10O |
| Structural formula: | — |

Workplace exposure standard (retained)

| TWA: | **1 ppm (7 mg/m3)** |
| --- | --- |
| STEL: | **2 ppm (14 mg/m3)** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **100 ppm** |
| **Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 1 ppm (7 mg/m3) is recommended to protect for eye, nasal and upper respiratory tract irritation in exposed workers.

A STEL of 2 ppm (14 mg/m3) is recommended to protect for acute eye, nasal and upper respiratory tract irritation in exposed workers.

## Discussion and conclusions

Phenyl ether is used as a heat transfer agent, in perfumery for its geranium-like odour and as a chemical intermediate in the production of surface-active agents and high temperature lubricants.

Critical effects of exposure are irritation to the eyes, nose and upper respiratory tract.

Very limited human toxicological data for phenyl ether alone is available, with more data pertaining to the eutectic mixture phenyl ether-diphenyl (ACGIH, 2001). Exposure at 7 to 10 ppm (50 to 71 mg/m3) in humans of eutectic mixture caused nausea and irritation to eyes and upper respiratory tract, which is presumed to be due to biphenyl. Short-term exposure (up to one minute) at 5 ppm (35 mg/m3) to perfume-grade phenyl ether (99.9% pure) in humans was ‘well tolerated’ (SCOEL, 2012; HCOTN, 2005). A NOAEC of 5 ppm (35 mg/m3) for eye, nasal and upper respiratory tract irritation was identified in rats and rabbits from an inhalation study over 31 to 33 days (ACGIH, 2001; SCOEL, 2012, HCOTN, 2005).

The TWA of 1 ppm (7 mg/m3) and STEL of 2 ppm (14 mg/m3) are recommended to be retained as assigned by ACGIH (2001), SCOEL (2012) and HCOTN (2005). Based on the available evidence, the recommended TWA is considered protective for irritant effects.

## 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.

There are insufficient data to recommend a skin notation.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 1 ppm (7 mg/m3); STEL: 2 ppm (14 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 1 ppm (7 mg/m3); TLV-STEL: 2 ppm (14 mg/m3) (Vapour fraction) |
| TLV-TWA recommended to minimise the potential for eye and upper respiratory tract irritation and nausea in exposed workers.  Summary of data:  Used as a heat transfer agent, in perfumery for its geranium-like odour and as a chemical intermediate in the production of surface-active agents and high temperature lubricants.  Human data:   * No evidence in industrial setting that the liquid mist or vapour was a human health hazard, under normal manufacturing conditions, handling and use * Limited toxicological data for phenyl ether alone suggested there was no apparent systemic toxicity at concentrations that did not produce a disagreeable odour * One study recommended vapour concentrations be kept below 1 ppm to avoid objectionable odours and nausea.   Animal data:   * LD50: ≈4,000 mg/kg (rats and guinea pigs, oral); surviving animals displayed injury to liver, spleen, kidneys, thyroid and intestinal tract * Exposure at 0, 4.9 and 10 ppm for 7 h/d, 5 d/wk, total of 20 exposures, in rats, rabbits and dogs, plus additional exposure at 20 ppm in rats (same duration): * no signs of toxicity or irritation at 4.9 ppm * mild ocular and upper respiratory tract irritation at 10 ppm in rats and rabbits, (not noted in dogs) and eye and nasal irritation at 20 ppm in rats * Somewhat irritating following local skin and eye application in concentrated form, but not irritating in dilution.   Insufficient data to recommend skin, SEN or carcinogenicity notations. |
| DFG 2014 MAK: 1 ppm (7.1 mg/m3) |
| Summary of additional data:   * Peak limitation designated category I: local irritant effects determine MAK * No further information. |
| SCOEL 2012 TWA: 1 ppm (7 mg/m3); STEL: 2 ppm (14 mg/m3) |
| Summary of additional data:   * Distributed in all organs and tissues 1 h following IP injection in rats, with maximum concentrations in liver, lung, kidneys and spleen * Short-term and prolonged exposure (duration not given) at 5 ppm (35 mg/m3) to perfume-grade phenyl ether (99.9% pure) in humans ‘well tolerated’; no further information * Exposure at 7–10 ppm (50–71 mg/m3) in humans of eutectic mixture (containing biphenyl and phenyl ether) caused nausea and irritation to eyes and upper respiratory tract, presumed to be due to biphenyl * Reported odour thresholds of 0.0012–0.1 ppm * Rats inhaling saturated atmosphere of 28 ppm for 6 h did not have signs of toxicity * LD50: >5,000 mg/kg (rabbits, dermal); >7,490 mg/kg (rats, dermal) * NOAEL: 100 mg/kg/d (male and female rats, dermal, 13 wk); exposure at 0, 10, 100, 300 and 1,000 mg/kg/d, 6 h/d; based on dose-dependent increase desquamation incidence and erythema of the skin and increase in liver weight * Did not produce skin sensitisation in maximisation test on 25 volunteers * Sub-chronic or chronic inhalation studies with phenyl ether alone not available * Sub-acute exposure of rats, rabbits and dogs to vapours (also cited by ACGIH, 2018): * NOAEL of 5 ppm (35 mg/m3) with LOAEL of 10 ppm (71 mg/m3) for irritation of eyes and nose in rats and rabbits * NOAEL of 10 ppm (71 mg/m3) in dogs * Oral administration of 400 mg/kg/d to male rats for 2 mo produced GI tract irritation, degenerative changes in liver and kidneys and increased thyroid function at 13 mo; study insufficiently reported, hence, unreliable * NOAEL: 20 mg/kg/d (male and female rats, 13 wk); based on organ weight changes, attributed to reduced body weight * Genotoxicity not observed in *in vitro* studies and no *in vivo* data available.   NOAEL of 20 mg/kg/d corresponds to inhalation concentration of 140 mg/m3 (assuming 70 kg bw and 10 mg/m3 inhalation volume). This is adjusted to 35 mg/m3 by applying an UF of 4 to account for interspecies differences. This NOAEL for systemic toxicity corresponds to the NOAEL of 5 ppm (35 mg/m3) for irritation. The NOAEL of 5 ppm (35 mg/m3) is used as POD to propose an OEL of 1 ppm (7 mg/m3) taking into account limited data with short durations of exposure (uncertainty factor not specified). |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2005 Not assigned |
| Summary of additional data:   * Duration of short-term exposure at 5 ppm (cited in SCOEL, 2012) ≤1 min * Committee utilises NOAEL of 35 mg/m3 (5 ppm) to derive HBROEL. Following application of AF of 3 for intraspecies variation, a HBROEL of 10 mg/m3 (1.4 ppm) is recommended * Skin notation not considered necessary. |

### Secondary source reports relied upon

NIL.

### 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 | NA |
| DFG | NA |
| 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: |  |  |  |
| Dermal LD50 ≤1000 mg/kg: | no |  |  |
| Dermal repeat-dose NOAEL ≤200 mg/kg: | yes | 3.00 |  |
| Dermal LD50/Inhalation LD50 <10: |  |  |  |
| *In vivo* dermal absorption rate >10%: |  |  |  |
| Estimated dermal exposure at WES >10%: |  |  |  |
|  |  | 3 | **consider assigning a skin notation** |

### IDLH

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

## Additional information

| Molecular weight: | 170.20 |
| --- | --- |
| 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) (2014) Diphenyl ether (vapour) – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2012) Recommendation from the Scientific Committee on Occupational Exposure Limits for Diphenyl ether. SCOEL/SUM/182.

Health Council of the Netherlands (HCOTN) (2005) Diphenyl ether. Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/147.

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