# Naphthalene

| CAS number: | 91-20-3 |
| --- | --- |
| Synonyms: | Albocarbon, dezodorator, moth balls, naftalen, naphthalin, naphthene, tar camphor |
| Chemical formula: | C10H8 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **10 ppm (52 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk.** |
| IDLH: | **250 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 10 ppm (52 mg/m3) is recommended to protect for respiratory irritation, haemolytic effects and cataracts in exposed workers.

## Discussion and conclusions

Naphthalene is primarily used in the production of phthalic anhydride. It is also used in carbamate pesticide, naphthalene sulfonates, dyes, synthetic resins, antiseptics, pigments and smokeless powder. In crystalline form, it is commonly used as a deodorant, moth repellent and pesticide.

Critical effects from exposure include upper respiratory tract irritation, haemolytic effects and cataracts.

Haemolytic anaemia and cataracts were the major toxic effects reported from accidental exposure. Cataracts were reported in eight of 21 workers from a dye plant following long-term exposure. No more cataracts were reported following the implementation of procedures to minimise exposure. There are no quantitative exposure related data in humans. Mice exposed at 10 ppm for four hours had swollen and vacuolated Clara cells in their airways. Non-malignant pulmonary, alveolar and bronchiolar adenomas were identified in female mice exposed for two years at 30 ppm (ACGIH, 2018; DFG 2001; SCOEL, 2010).

The current TWA of 10 ppm is recommended to be retained as derived by ACGIH (2018), but the STEL of 15 ppm is recommended to be removed as there is insufficient evidence to recommend a STEL. No other primary source has assigned a value. The recommended TWA is cited to be protective of respiratory irritation, haemolytic effect and cataracts.

## Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). The evidence of carcinogenicity classification in notation sources suggests a review of this classification is required.

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

A skin notation is recommended due to evidence of dermal absorption in humans and contribution to systemic effects.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 10 ppm (52 mg/m3); STEL: 15 ppm (79 mg/m3) | |
|  |
| ACGIH 2014 TLV-TWA: 10 ppm (52 mg/m3) |
| TLV-TWA recommended to protect for upper respiratory tract irritation, haemolytic effect and cataracts.  Summary of data:  Human data:   * Case reports of accidental and intentional poisonings in adults and infants; haemolysis, anaemia, kernicterus methemoglobinemia and, in some cases, death; no exposure data * Cataracts in 8 of 21 workers working with melted naphthalene; no cataracts after procedures reduced exposure; no exposure data * Inadequate evidence to determine if naphthalene is carcinogenic in humans.   Animal data:   * LC50: 96 ppm (rats, 8 h) * Acute study in rats and mice; 4 h exposures: * 2 ppm – slight reductions in proximal airway Clara cell mass in some mice * 10 ppm – Clara cells in the proximal and some distal airways appeared swollen and vacuolated in mice * 75 ppm – maximal reductions in Clara cell numbers in mice * 110 ppm – no changes in the airways of rats * Rat nasal and mouse alveolar epithelial tissues are more susceptible than humans to cytotoxic metabolites of naphthalene; Clara cells in rodents primary site of metabolic activation * Oral dose of 0.5–1.0 g/kg/d for 5 d for 6 wk produced cataracts in laboratory animals * Evidence of respiratory and nasal tumours in rodents; non-malignant pulmonary and alveolar/bronchiolar adenomas at 30 ppm in female mice; adenomas of the nasal respiratory epithelium and non-malignant neuroblastomas of the olfactory epithelium in rats exposed at 30 ppm: * these tumours types unlikely to occur in humans due to metabolic and anatomical differences.   *In vitro* dermal absorption rate of 7–30 µg/cm2/h. Amount absorbed by Coverage of both hands ~4 h ≡TWA of 5 ppm.  Skin notation recommended, powdered naphthalene shown to penetrate excised skin at a rapid rate resulting in moderate internal doses.  No derivation of TLV-TWA provided. Insufficient evidence to recommend sensitiser notation or TLV-STEL. |
| DFG 2015 Not assigned |
| No MAK due to animal carcinogenicity evidence and mechanism of formation of lung tumours may not be species-specific.  Summary of additional data:   * Not mutagenic in bacteria * DNA strand breaks or DNA repair not induced in cultured rat hepatocytes * Produces chromosomal aberration in CHO cells and in mouse embryo cells * Evidence of genotoxicity *in vivo* only in somatic cells. |
| SCOEL 2010 Not assigned |
| No TWA recommended due to carcinogenic evidence in animals and uncertainty involving mechanism.  Summary of additional data:   * Critical effects haemolytic anaemia, respiratory tract damage and respiratory tract carcinogenicity * 2 yr studies on rats and mice, nasal and lung inflammation at 10 ppm, the lowest exposure level investigated * Background cytotoxicity and chronic inflammation likely mechanism of tumours produced in rodents; uncertainties remain; no TWA recommended. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2015 | * 13-wk inhalation study in rats; exposed 6 h/d, 5 d/wk: * 58 ppm induced erosion of the olfactory epithelium, hyperplasia of basal cells in the olfactory epithelium and loss of Bowman's glands * 2 ppm (lowest dose) minimal atrophy, rosette formation in the nasal epithelium, occasional degenerate cells, loss of Bowman's glands and minimal hyperplasia * The data available support an amendment to the hazard classification in the HSIS. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| 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 | Carc. 2 |
| HCIS | — |
| NICNAS | Carc. Cat 3 |
| EU Annex | Carcinogenicity – category 2 |
| ECHA | Carc. 2 |
| ACGIH | Carcinogenicity – A3, Skin |
| DFG | Carcinogenicity – 2, H (skin) |
| SCOEL | — |
| HCOTN | Carcinogenicity – category 3 |
| IARC | Carcinogenicity – Group 2B |
| 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: |  |  |  |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  |  | | Estimated dermal exposure at WES >10%: | yes | 2.00 |  |  | |  |  | 2 | **insufficient data to assign a skin notation** | | |

### IDLH

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

## Additional information

| Molecular weight: | 128.17 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 5.24 mg/m3; 1 mg/m3 = 0.191 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) (2015) Naphthalene – MAK value documentation.

European Chemicals Agency (ECHA) (2019) Naphthalene – REACH assessment.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2010) Recommendation from the Scientific Committee on Occupational Exposure Limits for naphthalene. SCOEL/SUM/90.

Health Council of the Netherlands (HCOTN) (2012) Naphthalene. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2012/30.

International Agency for Research on Cancer (IARC) (2002) Naphthalene. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2015) Naphthalene: 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 National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Naphthalene.