# 1,2-Dibromo ethane

| CAS number: | 106-93-4 |
| --- | --- |
| Synonyms: | Ethylene dibromide, EDB |
| Chemical formula: | C2H4Br2 |

Workplace exposure standard (new)

| TWA: | **0.1 µg/m3 (0.02 ppb)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Carc 2, Sk.** |
| IDLH: | **—** |
| **Sampling and analysis**: The recommended value is below the current limit of detection for available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 0.1 µg/m3 (0.02 ppb) is recommended to reduce the risk of cancer in exposed workers.

## Discussion and conclusions

1,2- dibromo ethane (EDB) is widely used as a fumigant, in waterproofing, as a solvent for resins, in dyes and pharmaceutical manufacturing.

EDB causes severe irritation of the eyes, skin, mucous membranes and respiratory system. It can cause liver and kidney damage, respiratory distress, central nervous system (CNS) depression, reproductive effects and anaesthesia (ACGIH, 2018; SCOEL, 2011). There is enough evidence of carcinogenicity in experimental animals. However, human carcinogenicity studies are inconclusive (ACGIH, 2018; NICNAS, 2013; SCOEL, 2011). The mode of action for carcinogenicity is considered genotoxic and there is insufficient evidence to establish a threshold exposure concentration at which zero risk of cancer exists (NICNAS, 2013; SCOEL, 2011; US EPA, 2004).

EDB is characterised as a non-threshold based genotoxic carcinogen. The recommended TWA has been derived at a minimal cancer risk level by applying an inhalation unit risk value. This value is based on studies reporting significant increase of tumour incidences in rats (US EPA, 2004).

## Recommendation for notations

Classified as a category 1B 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 skin notation is recommended based on evidence suggesting dermal absorption and adverse systemic effects in animals.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA NA NA | |
|  |
| ACGIH 2001 TWA: NA; STEL: NA |
| TLV not recommended for occupational exposure. Data not available to recommend a TLV-STEL or a SEN notation.  Severe eye, skin, mucous membrane and pulmonary irritant, can cause liver and kidney damage, respiratory distress, central nervous system (CNS) depression and anaesthesia.  Summary of data:  Human data:   * Elevated vapour concentrations highly irritating to the mucous membranes and can cause anaesthesia, followed by death * 50 ppm reported as dangerous to humans in a case of subacute poisoning due to the accidental inhalation of EDB * An epidemiological study reported 3 episodes of exposure at ≈100–200 ppm: * exposed workers experienced GIT discomfort, vomiting and respiratory effects (<1 h) above 100 ppm or by longer exposures at lower concentrations (75 ppm) * the plant with greater EDB exposure (19–31 ppm) reported 5 malignant neoplasms versus 2.2 expected and compared to no neoplasms at the plant with lower EDB exposure (1‑10 ppm) * inadequate evidence for the carcinogenicity of EDB in humans (IARC, 1999).   Animal data:   * LC50: 200 ppm (rats, 8 h) * LD50: 117 mg/kg (rats, oral) * Animals exposed 7 h/d, 5 d/wk for 6 mo tolerated levels ≤25 ppm without adverse effects; intolerable at 50 ppm * A study reported foetal abnormalities in pregnant rats and mice exposed at 31.6 ppm for 23 h/d GD 6-15 * IARC evaluation reviewed multiple studies on carcinogenicity the oral, inhalation and dermal routes, determined that there was sufficient data of carcinogenicity in animals * based on empirical evidence including an increased incidence of alveolar/bronchiolar lung tumours in rats and mice, and an increased incidence of peritoneal mesotheliomas in male rats produced following inhalation of EDB * Mutagenic in *Salmonella* and mouse lymphoma assays; induction of chromosomal aberrations and SCE in cultured Chinese hamster ovary cells * A skin notation is assigned based on reported CNS depression and mortality in rabbits following dermal application. |
| DFG NA NA |
| No report. |
| SCOEL 2011 TWA: NA; STEL: NA |
| Identified as a local and systemic experimental carcinogen (according to animal studies), with a genotoxic mode of action (sufficient genotoxicity data provided).  Current quantitative data not reliable for quantitative cancer risk assessment for humans.  Experimentally, the carcinogenicity reported at 10 ppm; lower concentrations have not been tested. Classified as a genotoxic carcinogen without a threshold.  Summary of additional data:  Human data:   * Reported 2 workers died shortly after inhalation exposure whilst cleaning inside a tank; * concentrations measured ≈ 20 h after the accident were between 15–41 ppm (28 ppm average), with the first worker exposed for ≈5 min and the second for 20–30 min * the first worker died about 12 h and the second about 64 h after entering the tank * No cytogenetic effects on peripheral lymphocytes were reported in two studies * plant workers were exposed at varying levels and exposure durations * one conducted on 14 plant workers exposed to concentrations ranging 8-2,165 ppb and the second on 60 plant workers (at six different plants in the same area) exposed to concentrations ranging 16-175 ppb. * Multiple studies suggested a correlation between long-term exposure (6 wk–5 yr) and reproductive toxicity * the studies (concentrations 8-60 ppb) found potential antifertility influence from exposure specifically reduced semen quality and reproductive impairment in male workers.   Animal data:   * LC50: ≈400 ppm (rats, inhalation, 5 h) * LD50: 0.146 g/kg (male rates, oral) and 0.117 g/kg (female rats, oral) * Multiple inhalation studies on rats and mice at 10–40 ppm for 78–106 wk led to significantly higher incidence of alveolar/bronchiolar carcinomas and adenomas, mammary tumours and respiratory and circulatory impairments * study determined NOAEL of 3 ppm * Dose-dependent increase in liver DNA alkaline-labile sites and single-strand breaks in female rats * A single IP dose reported DNA adducts in livers of several strains of rats * Mutagenic in *Streptomyces coelicolor,* *Aspergillus nidulans,* * *Salmonella typhimurium* TA1535 expressing human GST1-1 showed greatly enhanced mutagenicity * Highly mutagenic in *Salmonella typhimurium* NM5004, |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 1999 TWA: 0.002 mg/m3 |
| Occupational exposure in air corresponding to target risk and prohibitive risk levels were estimated as 0.002 mg/m3 and 0.2 mg/m3, respectively. Estimates based on an animal study, as current epidemiological data did not allow a quantitative risk assessment.  Summary of additional data:   * The committee conducted a risk estimation for the occupational setting using a rat study in which 50 male and female rats were exposed to different concentrations, the total incidences of rats with a mixture of different tumours were 7/100 (0 mg/m3), 87/100 (77 mg/m3) and 93/100 (307 mg/m3) * Assumed no difference exists between experimental animals and humans with respect to toxicokinetics and mechanism of tumour induction. * A lifetime cancer risk estimated under occupational conditions (i.e., 8 h/d, 5 d/wk, 48 wk/yr for 40 yr), amounted to   1.64x10-2 [mg/m3]-1, leading to the following risk levels:   * 4x10-5 for 40 yr of exposure to 0.002 mg/m3 [target risk level] * 4x10-3 for 40 yr of exposure to 0.2 mg/m3 [prohibitive risk level]. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| HSE |  | 2005 | * WEL TWA of 0.5 ppm (3.9 mg/m3); no STEL value available * Carcinogenic and skin notations assigned * No information located on assessment of EDB. |
| IARC |  | 1999 | * Genotoxic in a broad range of *in-vitro* and *in-vivo* assays and binds covalently with DNA in vivo. |
| NICNAS |  | 2013 | * Based on the weight of evidence from the available *in vitro* and *in vivo*genotoxicity studies, the chemical is considered genotoxic. |
| US EPA-IRIS |  | 2004 | * Inhalational RfC of 0.009 mg/m3 derived based on a mouse chronic inhalation study for protection against nasal inflammation * Identified as “likely to be carcinogenic to humans” based on inadequate data in humans and sufficient data in animals -classified as Group B2 –Probable Human Carcinogen * “*The evidence for 1,2-dibromoethane’s potential genotoxicity is strong*”. * IURs calculated as 6x10-4 (µg/m3)-1 and 3x10-4 (µg/m3)-1 corresponding to 95% upper bound and central tendency estimates, respectively. |
| US NIOSH |  | 1994 | * REL of 0.045 ppm TWA and ceiling of 0.13 ppm for 15 min * An IDLH of 100 ppm is estimated, based on acute toxicity data in humans and animals. |

### 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)) | 6 x 10-4 |
| Calculated TWA value (µg/m3) | 0.13 µg/m3 |

## Notations

| Source | Notations |
| --- | --- |
| SWA | NA |
| HCIS | Carcinogenicity – category 2 |
| NICNAS | — |
| EU Annex | NA |
| ECHA | Carcinogenicity – category 1B |
| ACGIH | Carcinogenicity – A3, Skin |
| DFG | NA |
| SCOEL | Carcinogenicity – A, Skin) |
| HCOTN | Carcinogenicity – category 1B |
| IARC | Carcinogenicity – Group 2A |
| US NIOSH | — |

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. |

### IDLH

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

## Additional information

| Molecular weight: | 187.86 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 7.68 mg/m3; 1 mg/m3 = 0.13 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.

European Chemical Agency (ECHA). (2019). Substance information – 1,2-dibromoethane. <https://echa.europa.eu/substance-information/-/substanceinfo/100.003.132>

Health and Safety Executive (HSE). EH40/2005 Workplace exposure limits (Third edition). Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended). Published 2018. http://www.hse.gov.uk/pUbns/priced/eh40.pdf

Health Council of the Netherlands (HCOTN). (1999). 1,2-Dibromo ethane. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 999/07OSH.

International Agency for Research on Cancer (IARC). (1999). 1,2-Dibromo ethane. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS). 2013. Ethane, 1,2‑diromo-: Human health tier II assessment.

Strategy of the Scientific Committee on Occupational Exposure Limits (SCOEL). (2011). Recommendation from the Scientific Committee on Occupational Exposure Limits for 1,2‑dibromoethane (ethylene dibromide). SCOEL/SUM/166.

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