# Antimony trioxide

| CAS number: | 1309-64-4 |
| --- | --- |
| Synonyms: | Antimony sesquioxide, antimonous oxide,  flowers of antimony, antimony(III) oxide |
| Chemical formula: | Sb2O3 |
| Structural formula: |  |

Workplace exposure standard (amended)

| TWA: | — |
| --- | --- |
| STEL: | — |
| Peak limitation: | — |
| Notations: | **Carc. 2** |
| IDLH: | **50 mg/m3 (as Sb)** |
| Sampling and analysis: | The recommended value is readily quantifiable through currently available sampling and analysis techniques. |

## Recommendation and basis for workplace exposure standard

A TWA is not recommended due to a lack of reliable human inhalational carcinogenicity data. Exposure should be minimised as far as possible to protect for myocardial damage and pneumoconiosis from short-term exposure and potentially lung cancer from chronic exposure.

There is insufficient data available to recommend a STEL or peak limitation.

Investigation of additional data sources is recommended at the next scheduled review due to the incomplete dataset for antimony trioxide.

## Discussion and conclusions

Antimony trioxide (Sb2O3) is typically encountered in antimony processing, for which co-exposures to other antimony derivatives (e.g. elemental antimony, antimony trisulfide) exist (DFG, 2007; ACGIH 2001).

Antimony trioxide is classified as a suspected human carcinogen due to an increased prevalence of lung cancer in workers exposed to antimony mixtures. However, the available occupational data is insufficient to distinguish the potential carcinogenic effects of Sb2O3 exposure from these other compounds (US EPA, 1995). The isolated compound demonstrates mutagenicity in mouse and human cell lines *in vitro* (DFG, 2007). The critical short-term effects of exposure are myocardial damage and pneumoconiosis, for which no threshold level is established in the available studies. It is noted that the TWA for other inorganic antimony compounds is based on the irritant effects of antimony pentachloride (ACGIH, 2001), which is not appropriate in this case.

An inhalational NOAEL of 0.51 mg/m3 measured in mice is noted (US EPA, 1995). In the absence of reliable human exposure data, including inhalational carcinogenicity, a TWA that minimises the risk of cancer cannot currently be recommended. Similarly, the available IDLH for antimony may not be suitable for antimony trioxide.

## Recommendation for notations

Classified as a category 2 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 not recommended due to a lack of evidence for systemic toxicity from skin absorption.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA Year TWA: 0.5 mg/m3 (as Sb) | |
|  |
| ACGIH 2001 — |
| TLV-TWA is not currently recommended due to conflicting human exposure data including carcinogenic activity.  Suspected human carcinogen notation assigned based on case studies of antimony production plants that associate antimony exposure with an excess risk of lung cancer in workers exposed to a mixture of antimony compounds.  Recommends exposure by all routes be minimised as far as possible.  Critical effects of acute exposure are myocardial damage, which may lead to heart disease, and lung cancer.  Summary of data:  Human studies:   * Assessment based on case studies primarily of antimony ore (Sb2S3) processing plants, which represent mixed exposures to various antimony compounds * A study of workers (n=125) in the abrasive industry reported 8 deaths from heart disease (6 acute and 2 chronic) in workers exposed to an average concentration in air of 3.0‑mg/m3 Sb2S3 (range 0.58–5.5 mg/m3; monitoring type unspecified) for 8 mo to 2 yr * workers examined had ECG changes (37/75), with urinary Sb levelbetween 0.8–9.6 mg/L * Study of workers in a processing plant reported air concentrations ranging 0.5–37 mg/m3 (monitoring type unspecified) and urinary levels in workers of 0.425–0.680 mg/L * there was no evidence of systemic toxicity despite radiographic changes in lungs * 44 cases of exposure-related pneumoconiosis in study of antimony plant (n=262) * Lung cancer deaths in antimony factory workers greater than in local community comparative study (10 *vs*. 8) * No acute or short-term effects from exposures <10 mg/m3 in 24 yr at production plant * high turnover (31%/yr) precluded long-term epidemiological studies * Higher incidence of adverse effects noted in exposure statistics from UK plants compared with USA suggested reasons for discrepancy are co-exposures to caustic soda and zircon plant effluents at UK plants, younger workers in USA plants who worked for fewer years, and longer history of lung cancer in UK region where studies were carried out.   Animal studies:   * LD50: 3,250 mg/kg (rats, ip) * Extensive pneumonitis and fatty degeneration of liver in guinea pigs exposed to 45 mg/m3 Sb2O3 (inhalation, daily, >3 wk, no further information provided) * disorders and degeneration of the heart in rats, rabbits and dogs exposed to 3.07–5.6 mg/m3 industrial-grade Sb2O3 (inhalation, 7 h/d, 6 wk duration) * Lipid pneumonias in rats and rabbits exposed to 100–125 mg/m3 (rats) and 89 mg/m3­ (rabbits) of Sb2O3 (inhalation, 100 h/d, 10 and 14.5 mo respectively) * no evidence of lung cancer in rats nor rabbits * The incidence of lung tumours in female rats exposed to Sb2O3 (45 mg/m3) or antimony ore concentrate (40 mg/m3, 46% Sb mostly as Sb2S3) were 27% and 25%, respectively (7 h/d, 5 d/wk, 1 yr) * no incidences noted in male groups. |
| DFG 2007 — |
| Summary of additional data:  Sb2O3 classified as a category 2 carcinogen due to tumorigenic effects in female rats (same study as ACGIH, 2001). Mechanism of carcinogenicity is not understood. Sb and its inorganic compounds are classified as germ cell mutagens due to evidence from *in vivo* studies. Compounds in which Sb is not freely bioavailable are excluded from the classification. Absorbed pentavalent antimony is primarily converted to trivalent metabolites.  Human studies:   * Increase of ≈2-fold in lung cancer mortality observed among smelter workers 45–64 y.o. (no further information provided) * No clear association between incidences of lung cancer in British cohort study of processing plant workers exposed to combination of Sb ore, metallic Sb, Sb2O3, As, As2O3, Pb and PAHs (concentrations not specified). * significant increase (32 compared to expected 14.7 cases) in the mortality rate due to lung cancer observed in workers who had started work prior to 1961 * lung cancer mortalities occurred in 5 out of 9.2 expected cases in workers who started after 1960 * after a period of >20 yr since initial exposure, 27 lung cancer cases observed compared with 12.6 expected cases * Repeat insult patch test with 52 subjects (45 females and 7 males) found no skin reactions during the induction or the provocation phases (study flagged as viewed with reservations) * induction treatment carried out using 24 h application of antimony trioxide (85.3%) every second day for 18 d * provocation carried out 2 wk after induction and lasted 24 h.   Animal studies:   * LD50:> 2000 mg/kg (rats, dermal, Sb2O3 and Sb2S3) * Mutagenic in bacterial cells and human and mouse lymphocytes. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2011 — |
| Summary of additional data:  Assessment grouped with other Sb compounds. Carcinogenicity classification prioritised for review pending evaluation of NTP inhalational study. Animal data on antimony and other antimony compounds are insufficient to evaluate the carcinogenic potential.  Human data:   * Correlation between incidences of colon cancer and high co-exposure to both lead and antimony (concentrations not specified) in study of occupational cancer incidences in art-glass industry workers (n=888 males) * Pentavalent antimony compounds are not mutagenic *in vitro*; however, the trivalent (physiologically relevant) compounds are. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2015 | * International TWA range 0.1–0.5 mg/m3 and STEL ranges  0.75–2 mg/m3 * Low acute toxicity in animal inhalation tests. * LC50: > 5,200 mg/m3 (rats, 4 h). |
| APVMA |  | 2018 | * Antimony trioxide used as termite insecticide. |
| IARC |  | 1989 | * Sufficient evidence for the carcinogenicity of Sb2O3 in experimental animals. |
| NTP |  | 2018 | * Available human studies frequently do not provide information on the antimony species to which subjects were exposed. |
| US EPA |  | 1987 | * NOAEL of 0.51 mg/m3 measured by rate of lung clearance and interstitial lesions in chamber study (rats, 6 h/d, 5d/wk, 1 yr); human equivalent concentration of 0.051 mg/m3 * Antimony accumulates in the lung but not in other tissues; no difference in antimony levels in liver or kidney in deceased smelter workers compared with non-exposed group. |
| ECHA |  | 2009 | * Antimony related dermatosis may occur in humans exposed to antimony trioxide at high temperatures. |
| US NIOSH |  | 1994 | * IDLH value based on the critical effects of SbCl5, no recommendation given for Sb2O3. |

### 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 | Carcinogenicity – category 2 | |
| NICNAS | Carc. Cat. 2 | |
| EU Annex | Carcinogenicity – category 2 | |
| ECHA | — | |
| ACGIH | Carcinogenicity – A2 | |
| DFG | Carcinogenicity –2 | |
| SCOEL | NA | |
| HCOTN | Carcinogenicity – category 2 | |
| IARC | Carcinogenicity – Group 2 | |
| 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 |
| --- |
| |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | |  | Adverse effects in human case study: | no |  |  |  |  |  | |  | Dermal LD50 ≤1000 mg/kg: | no |  |  |  |  |  | |  | 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 not warranted** | | | | |

### IDLH

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

## Additional information

| Molecular weight: | 291.52 |
| --- | --- |
| 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.

APVMA online resource (2018) - Greenzone Sock Termite Barrier – label documentation

Deutsche Forschungsgemeinschaft (DFG) (2007) Antimony and its inorganic compounds (inhalable fraction) – MAK value documentation.

European Chemicals Agency (ECHA) (2009) Annex XV dossier Proposal for Harmonised Classification and Labelling Diantimony trioxide.

Health Council of the Netherlands (HCOTN) (2011) Antimony and antimony compounds. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2011/33.

International Agency for Research on Cancer (IARC) (1989) Antimony trioxide and antinomy trisulfide. IARC Monographs on the evaluation of the carcinogenic risk to humans volume 47.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2000) Antimony Triacetate: Human health tier II assessment – IMAP report.

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National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2016) Antimony sulfide (Sb2S3): Human health tier II assessment – IMAP report.

National Toxicology Program (NTP) (2018) NTP-RoC Revised Draft: Antimony Trioxide.

NIOSH Immediately Dangerous to Life or Health Concentrations (IDLH) (1994) Antimony compounds (as Sb) – IDLH documentation.

US Environmental Protection Agency (US EPA) (1987) Antimony trioxide – Integrated Risk Information System (IRIS) documentation.