# Antimony and compounds

| CAS number: | 7440-36-0 |
| --- | --- |
| Synonyms: | Stibium |
| Chemical formula: | Sb |
| Structural formula: |  |

Workplace exposure standard (retained)

| TWA: | **0.5 mg/m3 (as Sb) (excluding antimony trioxide)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **—** |
| 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 of 0.5 mg/m3 (as Sb) is recommended for antimony compounds with bioavailable antimony (including inorganic salts and some organic complexes such as antimony alkali metal tartrates; and excluding antimony trioxide) to protect for irritation of the upper respiratory tract, abdominal pain and loss of appetite in exposed workers.

Examination of additional data is recommended for the next scheduled review to discern more detailed divisions based on the composition and critical effects of antimony compounds.

## Discussion and conclusions

Antimony metal is used in batteries, solder, sheet and pipe metal, castings, semiconductors, and pewter. Antimony compounds are widely used in plastics, pigments, paper, paints, ceramics, ammunition and fireworks, and in some pharmaceuticals. The critical effects of exposure in humans are upper respiratory tract irritation, abdominal pain and loss of appetite.

Most available toxicological studies relevant to workplace exposure have been conducted with only the oxides, sulfides and chlorides of antimony. Due to the variety of potential antimony compounds, the recommended TWA is derived from the acute symptoms of antimony pentachloride (SbCl5), which causes the most intense effects of these compounds. Antimony pentachloride may produce up to five molar equivalents of hydrochloric acid (HCl) upon hydrolysis in moisture, which is assumed to be the primary cause of irritation (ACGIH, 2001).

Using the TLV-TWA of 5 ppm (7.5 mg/m3) for HCl, a TLV-TWA of 12.3 mg/m3 for antimony pentachloride is calculated that results in 5 mg/m3 for antimony. A TWA of 0.5 mg/m3 is calculated by applying an uncertainty factor of 10 to account for reported symptoms of SbCl5 exposure being more intense than those of HCl alone (ACGIH, 2001).

A skin notation was considered due to the reported LD50 of 314 mg/kg (rabbits) for SbCl3. However, no evidence of systemic toxicity due to skin absorption is reported in humans. Therefore, no skin notation is recommended.

## Recommendation for notations

Not classified as carcinogenic according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Antimony and compounds are not classified as skin sensitisers or respiratory sensitisers according to the GHS.

Insufficient evidence to warrant recommendation of a skin notation. However, a review should be considered based on the limited evidence available from animal experiments.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA Year TWA: 0.5 mg/m3 (as Sb) |
|  |
| ACGIH 2001 TLV-TWA: 0.5 mg/m3 (as Sb) |
| TLV-TWA recommended to minimise potential for irritation of the upper respiratory tract, abdominal pain and loss of appetite.  Summary of data:  Acute or chronic exposure to concentrations significantly above the TLV-TWA is expected to result in pneumonitis and cardiac or haematological disorders. The TLV-TWA is calculated from the theoretical hydrolytic production of 5 molar equivalents of HCl from SbCl5, which results in 5 mg/m3 (as Sb). An UF of 10 is applied because the intensity of critical effects for SbCl5 exposure is greater than that of HCl alone.  TLV does not apply to antimony trioxide which has a withdrawn TLV‑TWA (previously 0.5 mg/m3).  Insufficient data to recommend a STEL or skin, carcinogenicity or sensitising notations.  Human studies:   * URT irritation, delayed abdominal pain and loss of appetite at 73 mg/m3 (as Sb) and 146 mg/m3 (as HCl) following brief accidental exposures (duration unspecified) * Effects more severe than HCl alone, which is the major hydrolysis product of SbCl3 * SbCl5 reported to act similarly, but in a more intense manner (no further information provided) * 8 heart disease deaths (6 acute, 2 chronic) in abrasive industry workers report (n=125; 8 mo–2 yr), average air concentration: 3.0 mg/m3; range: 0.58–5.5 mg/m3 (monitoring type unspecified) * of 75 workers examined, 37 showed ECG changes; 14 with BP > 150/190 * in another study, 7/111 had ulcers, with urinary antimony levels ranging between 0.8–9.6 mg/L * Processing plant worker study reported urinary levels in workers of 0.425–0.680 mg/L at air concentrations ranging from 0.5–37 mg/m3 (monitoring type unspecified). * No evidence of systemic toxicity despite radiographic changes in lungs.   Animal studies:   * Studies pre-dating 1940 deemed unreliable due to lack of substance purity * LD50:100 mg/kg (rats, intraperitoneal) - Sb * LD50:1,000 mg/kg (rats, intraperitoneal) - Sb2S3 * Acute poisoning marked by weight and hair loss, dry scaly skin, congestion of heart, liver, and kidneys and eosinophilia. * low tissue storage capacity of Sb noted * Lipid pneumonias were noted in rats and rabbits exposed to 100–125 mg/m3 (rats) and 89 mg/m3­ (rabbits) of Sb2SO3 (inhalation, 100 h/mo, 10 and 14.5 months, respectively) * no evidence of lung cancer in rats nor rabbits * Incidence of lung tumours of 27% and 25% in female rats exposed to Sb2O3 (45 mg/m3) or Sb ore concentrate (40 mg/m3, 46% Sb mostly as Sb2S3), respectively (7 h/d, 5 d/wk, 1 yr); no incidences noted in male groups. |
| DFG 2007 — |
| Summary of additional data:  Sb2S3 classified as a category 2 carcinogen due to tumorigenic effects in female rats (same study as ACGIH, 2001). Mechanism of carcinogenicity not understood. Sb and its inorganic compounds are classified germ cell mutagens based on evidence from *in vivo* studies.  Compounds in which Sb is not freely bioavailable are excluded from the classification.  Absorbed pentavalent Sb 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. * A worker exposed to 99.86% purity metallic Sb developed reversible dermatosis (exposure: 8 hr average, 0.39 mg/m3; 250 min average, 0.67 mg/m3 in the afternoon).   Animal studies:   * LD50 >2000 mg/kg (rats, dermal, Sb2O3 and Sb2S3) * LD50: <314 mg/kg (guinea pigs, dermal, SbCl3) * most available dermal toxicity studies are poorly documented * Irreversible and progressive decrease in myocardial contraction strength in dogs and isolated canine hearts at 10–15 mg/kg (single administration, Sb sodium tartrate) * Pentavalent Sb compounds are not mutagenic *in vitro*; trivalent (physiologically relevant) compounds are. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2011 — |
| Summary of additional data:  Carcinogenicity classification prioritised for review pending evaluation of NTP inhalational study. Animal data on Sb and other Sb compounds insufficient to evaluate carcinogenic potential.  Human data:   * Correlation between incidences of colon cancer and high co-exposure to both Pb and Sb (concentrations not specified) in study of occupational cancer incidences in art-glass industry workers (n=888 males). |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2000, 2015, 2016 | Antimony triacetate (2000):   * OEL for antimony trioxide (handling and use: 0.5 mg/m3 TWA) should be employed in workplaces using antimony triacetate   Antimony trisulfide (2016):   * LC50: >5,040 mg/m3 (rats, 4 h). Black foci in the lungs of rats were observed; however, no deaths or other treatment-related symptoms of toxicity over 15 d post-treatment. |
| IARC |  | 1989 | * Limited evidence for carcinogenicity of Sb2S3 in experimental animals. |
| NTP |  | 2018 | * Available human studies frequently do not provide information on the Sb species to which subjects were exposed. |
| US EPA |  | 1987 | * Acute illness at estimated dose of 0.5 mg/kg in 70 people after drinking lemonade containing 0.013% antimony. * 56 people presented burning stomach pains, colic, nausea, and vomiting; most recovered within 3 h. |
| ECHA |  | 2009 | * Dermatosis from antimony exposure in smelter workers characterised by vesicular or pustular lesions * symptoms presented in 63% exposed workers, during summer and when working near hot furnaces. |
| US NIOSH |  | 1994 | * IDLH based on slightly delayed abdominal pain and persistent anorexia at air concentrations up to 73 mg/m3 in workers briefly exposed to Sb. |

### 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 | — |
| HCIS | — |
| NICNAS | — |
| EU Annex | — |
| ECHA | — |
| ACGIH | — |
| DFG | Carcinogenicity – 2 |
| SCOEL | NA |
| HCOTN | — |
| IARC | — |
| 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 |
| --- |
| |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Conclusion:** |  |  |  |  |  |  |  |  |  | |  |  | Adverse effects in human case study: | no |  |  |  |  |  |  | |  |  | Dermal LD50 ≤1000 mg/kg: | yes | 3.00 |  |  |  |  |  | |  |  | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  |  |  |  |  | |  |  | 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: | 121.8 (elemental) |
| --- | --- |
| 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

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