BISMUTH TELLURIDE (INCL. SE-DOPED)

CAS number:	1304-82-1
Synonyms:	Dibismuth tritelluride
Chemical formula:	Bi_2Te_3 $Bi_2Te_3 + Bi_2Se_3$ (Se-doped)

Workplace exposure standard (retained)

TWA:	10 mg/m^3 5 mg/m^3 (Se-doped)
STEL:	—
Peak limitation:	—
Notations:	—
IDLH:	—
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 10 mg/m^3 for bismuth telluride and 5 mg/m^3 for selenium-doped bismuth telluride are recommended to protect for respiratory effects in exposed workers.

Whilst the recommended TWA is considered protective, a review of additional data sources for further information on Se-doped and undoped bismuth telluride toxicity is recommended to further clarify dose-response relationships.

Discussion and conclusions

Bismuth telluride is used as a semiconductor and topological insulator. When alloyed (or doped) with selenium, it is used as a thermoelectric material for refrigeration and power generation. The evidence derived from animal studies suggest that pulmonary lesions are the critical effect of long-term exposure to doped bismuth telluride. There is limited evidence of undoped bismuth telluride causing the same target organ effects.

Data from human studies are limited. Subjects exposed under controlled conditions (vacuum hoods) reported no adverse effects except for “telluride breath”, a garlic odour associated with exposure (ACGIH, 2001).

It is expected that the recommended TWA for undoped bismuth telluride will prevent for irritant effects in exposed workers. A lower TWA is recommended for Se-doped bismuth telluride given mild but reversible effects in animals.

Recommendation for notations

Not classified as a hazardous 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 10 mg/m^3 (5 mg/m^3 (Se-doped))***
ACGIH	***2001***	***TVL-TWA 10 mg/m^3 (Undoped) / 5 mg/m^3 (Doped)***

TLV-TWA recommended to minimise the potential for pulmonary effects and granulomatous lesions observed in chronic studies in animals with the doped mixture.
 	
Summary of data:
Human data:
• Limited human data
• No adverse health effects reported by human subjects exposed in a controlled environment using vacuum hoods, other than 'telluride breath' or breath with a sharp garlic odour (no further information).
 	
Animal data:
• Chronic exposure (6 h/d, 5 d/wk for 12 mo) in dogs, rabbits and rats to bismuth telluride (doped with stannous telluride) at 15 mg/m^3 (mean) resulted in small granulomatous lesions developing in lungs of dogs after 6 mo:
  ○ rabbits and rats showed similar histologic results, with rats showing fewer granulomas and some areas of epithelisation of the alveolar walls
  ○ in dogs exposed for 8 mo and then sacrificed at 12 mo, the lesions were shown to have regressed
• Similar study using undoped bismuth telluride (15 mg/m^3, 11 mo) observed no adverse effects other than those characteristic of inhalation of an inert dust
• Insufficient data available to recommend a skin or sensitiser notation or STEL.		

DFG	***NA***	***NA***
No report.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2003***	***Not Assigned***
Toxicological database information available for bismuth telluride, doped or undoped, too poor to justify recommendations for health based OEL.		

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	—
HCIS	NA
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	Carcinogenicity – A4
DFG	NA
SCOEL	NA
HCOTN	—
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
Insufficient data to assign a skin notation.

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	800.83 (undoped)
Conversion factors at 25°C and 101.3 kPa:	1 ppm = Number mg/m^3; 1 mg/m^3 = 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* on the ACGIH website.

Health Council of the Netherlands (HCOTN) (2003) Dibismuth tritlluride (undoped and Se-doped). Health-based recommended occupational exposure limit. The Hague: Health Council of the Netherlands; publication no. 2003/062.