GALLIUM ARSENIDE

CAS number: 1303-00-0

Synonyms: Gallium monoarsenide

Chemical formula: GaAs

Structural formula: —

Workplace exposure standard (new)

TWA: **0.3 µg/m^3**

STEL: —

Peak limitation: —

Notations: **Carc. 1B**

IDLH: —

Sampling and analysis: The recommended value is likely to be below the current limit of detection for standard sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.3 µg/m^3 is recommended to protect for pulmonary and reproductive effects in exposed workers.

Discussion and conclusions

Gallium arsenide is used as a semiconductor in transistors, solar cells and lasers.

No human data are available. In animals, the critical effects of exposure are pulmonary and reproductive toxicity. A two-year inhalation study in rats and mice reported a LOAEC for pulmonary toxicity at 0.01 mg/m^3 in rats and at 0.1 mg/m^3 in mice. Small but statistically significant increase in alveolar and bronchiolar neoplasms, adenomas and carcinomas were identified in female rats only at 1 mg/m^3; no neoplasms were reported in mice (ACGIH, 2018). From the same study, NICNAS (2013) reported a NOAEC of 0.01 mg/m^3 for carcinogenicity. Inflammation and cytotoxicity may play a role in lung tumours indicating a threshold (IARC, 2015). Carcinogenic effects are found in one sex of one species and are not considered relevant to humans. A NOAEL of 10 mg/m^3 for developmental effects was identified in rats in a gestational inhalation study (ACGIH, 2018). ACGIH (2018) assign a TLV-TWA of 0.3 µg/m^3 using the LOAEC of 0.01 mg/m^3 in rats and applying uncertainty factors to account for absence of a NOAEL in humans and severity of the pulmonary effects in animals.

Given the available animal data, the recommended TWA of 0.3 µg/m^3 is adopted from the ACGIH (2018) and is considered to protect for the identified critical effects.

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 not recommended based on evidence in animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***NA***	***NA***
No report.		
ACGIH	***2005***	***TLV-TWA: 0.3 µg/m³ (0.0003 mg/m³)***
TLV-TWA recommended to protect for pulmonary inflammation and the potential for adverse reproductive effects and lung cancer. Summary of data: • TLV-TWA based on a LOAEC of 0.01 mg/m³ in rats; lack of NOAEC, lack of evidence in humans and severity of the pulmonary effects in animals; no further details for derivation provided • No human data identified. Animal data: • NOAEL 10 mg/m³ for developmental effects in rats in gestational inhalation study • 2-yr inhalation study in rats and mice exposed 6 h/d, 5 d/wk for 105 wk (106 wk for female mice): o rats exposed at 0, 0.01, 0.1 or 1 mg/m³ o LOAEC 0.01 mg/m³: pulmonary toxicity manifested by exposure-related non-neoplastic pathological changes including atypical hyperplasia, alveolar epithelial hyperplasia, chronic active inflammation, proteinosis and alveolar metaplasia o 1 mg/m³ caused small but statistically significant increase in alveolar and bronchiolar neoplasms, adenomas and carcinomas in female rats; significant increase in mononuclear cell leukaemia and an increase in benign pheochromocytoma o at 1 mg/m³ larynx of male rat showed a significant increase in hyperplasia, chronic active inflammation, squamous metaplasia and epiglottal hyperplasia o mice exposed at 0, 0.1, 0.5 or 1 mg/m³ o 0.1 mg/m³ in mice resulted in atypical hyperplasia, alveolar epithelial hyperplasia, chronic active inflammation, proteinosis and alveolar metaplasia o neoplasia not seen in mice • Reported that health effects are likely not due only to its arsenic content. No indication of genotoxic or mutagenic effects.		
DFG	***2014***	***Not assigned***
Summary of additional data: • Grouped with arsenic and its inorganic compounds; no MAK assigned due to carcinogenicity • Carcinogenicity studies with inhalation exposure revealed lung tumours, mononuclear leukaemia and benign phaeochromocytomas in the adrenal glands in female rats; no carcinogenic effects were found in mice		

Source	Year set	Standard
		• Dermal application of rats to doses as high as 10,000 mg showed no evidence of clinical changes indicative of toxicity • From the available studies with workers in the semiconductor industry with possible some cases of exposure to gallium arsenide; the available data show that only very low exposure is to be expected; no increased cancer risk can be derived • Not mutagenic in *Salmonella* mutagenicity tests.
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***NA***	***NA***
No report.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2013	• NOAEC of 0.01 mg/m³ in female rat for carcinogenicity; increased incidence of benign and malignant neoplasms in the lungs at 0.1 and 1.0 mg/m³; 2 yr inhalation study (cited by ACGIH, 2018).
IARC	✓	2015	• Inhalation causes lung and adrenal tumours in rats but not in mice • Inflammation and cytotoxicity may play a role in lung tumours; threshold likely.

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	NA
HCIS	Carcinogenicity – category 1B
NICNAS	Carc. Cat 2
EU Annex	Carcinogenicity – category 1B
ECHA	Carc. 1B
ACGIH	Carcinogenicity – A3

Source	Notations
DFG	Carcinogenicity – 1
SCOEL	NA
HCOTN	NA
IARC	—
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:	no
Dermal LD_{50} ≤1000 mg/kg:	no
Dermal repeat-dose NOAEL ≤200 mg/kg:	
Dermal LD_{50}/Inhalation LD_{50} <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?	No

Additional information

Molecular weight:	144.65
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.

Deutsche Forschungsgemeinschaft (DFG) (2015) Arsenic and its inorganic compounds (with the exception of arsine) – MAK value documentation.

European Chemicals Agency (ECHA) (2019) gallium arsenide – REACH assessment.

International Agency for Research on Cancer (IARC) (2012) Gallium arsenide (see Arsenic and inorganic arsenic compounds). IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Gallium arsenide (GaAs): 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).