CYANAMIDE

CAS number: 420-04-2

Synonyms: Amidocyanogen, carbimide, carbodiimide, hydrogen cyanamide, carbamonitrile, cyanoamine, cyanogenamide, cyanogen nitride

Chemical formula: CH_2N_2

Workplace exposure standard (amended)

TWA: **0.2 mg/m^3**

STEL: —

Peak limitation: —

Notations: **Carc. 2, Sk., DSEN**

IDLH: —

Sampling and analysis: There is uncertainty regarding quantification of the recommended value with currently available sampling and/or analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.2 mg/m^3 is recommended to protect for effects on the male reproductive system and subsequently reduce the potential for local irritation effects in exposed workers.

Discussion and conclusions

Cyanamide is used as a chemical intermediate for dicyandiamide in melamine production and, as a fumigant, in metal cleaning, refining of ores and the production of synthetic rubber.

Critical effects include local irritant effects and effects on the male reproductive system in mammals. A 52 week oral study with cyanamide in dogs reported a NOAEL of 0.2 mg/kg based on chronic inflammation of the testes, atrophy of testicular tubules, atrophy and necrosis of germ epithelium cells, hypo- and aspermatogenesis and reduced spermatocyte counts and immature sperm in the epididymides (HCTON, 2004).

The oral NOAEL was converted by HCOTN (2004) to a health based TWA of 0.2 mg/m^3 using standard factors and parameters. The recommended TWA of 0.2 mg/m^3 is considered to protect for the listed effects.

Recommendation for notations

Classified as a category 2 carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser and not classified as a respiratory sensitiser according to the GHS.

A skin notation is recommended based on evidence in animals supported by the absorption rate by the skin.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 2 mg/m^3***
ACGIH	***2001***	***TLV-TWA: 2 mg/m^3***

TLV-TWA recommended to minimise the potential for eye and skin irritation in exposed workers and for the Antabuse effects in those who consume alcohol after work.

Summary of data:

Human data:

- Antabuse effects compared with other compounds:
  - 1/2 as severe as tetraethylthiuram disulfide
  - 1/6 as severe as thiram; TLV-TWA for thiram recommended at 1 mg/m^3
- No further information.

Animal data:

- LD_{50}: 125 mg/kg (rats, oral)
- Very irritating and caustic to the skin
- 100 mg instilled into eye of rabbits was severely irritating.

Insufficient data to recommend notations for skin, sensitisation and carcinogenicity or a STEL.

DFG	***2007***	***MAK: 0.2 ppm (0.35 mg/m^3)***

MAK recommended to protect for systemic and local irritation effects in exposed workers.

Summary of additional data:

- NOAEL of 0.2 mg/kg in dogs
  - 52 wk feeding study
  - immature sperm and decreased corpuscular volumes, increased leukocyte counts and decreased platelet counts
- Using this NOAEL as a starting point the MAK was derived as follows:
  - airborne concentrations = (oral dose x oral absorption in animal % x 70 kg human body weight) / (species-specific correction factor x inhalation absorption in humans % x 10 m^3 air breathed per 8 h shift)
  - where: oral dose = 0.2 mg/kg; oral absorption in dogs = 100%; species-specific factor = 1.4; human inhalation absorption 100%
  - convert daily exposure to 5 d working week (7/5) = 1 mg/m^3 x 1.4 = 1.4 mg/m^3 (0.8 ppm)
  - corresponding air concentration of 1.4 mg/m^3 (0.8 ppm); as the NOAEL was based on the animal data the derived value is halved (0.4 ppm) then round down to the preferred numeral 0.2 ppm (0.35 mg/m^3)
- Dermal LD_{50}: 742 mg/kg female rabbit; 901 mg/kg male rabbit.

Source	Year set	Standard
SCOEL	***2003***	***TWA: 1 mg/m^3***

Summary of additional data:

- TWA based on the same NOAEL of 0.2 mg/kg as reported by DFG (2007) extrapolated to an inhalation concentration of 1.4 mg/m^3:
  - assuming 100% retention and absorption of inhaled material, a breathing volume of 10 m^3 in 8 hr and a bw of 70 kg
  - rounded to 1 mg/m^3
- No evidence of mutagenicity or carcinogenicity.

OARS/AIHA	***NA***	***NA***

No report.

HCOTN	***2004***	***TWA: 0.2 mg/m^3***

TWA recommended to protect for effects on the male reproductive system as evidenced in dogs.

Summary of additional data:

- Effects from 3 repeated cyanamide oral dose studies in male dogs as including chronic inflammation of the testes, atrophy of testicular tubules, atrophy and necrosis of germ epithelium cells, hypo- and aspermatogenesis and reduced spermatocyte counts and immature sperm in the epididymides
- NOAEL of 0.2 mg/kg based on immature sperm in dogs 52 wk feeding study (as DFG and SCOEL)
- TWA is derived via conversion of the 0.2 mg/kg NOAEL using the following factors:
  - 7/5 for work-week conversion
  - 1.4 for allometric scaling from dogs to humans
  - 9 for inter- and intraspecies variation
  - 70 kg human breathing 10 m^3 of air with 100% retention
- Skin notation warranted based on determination that the amount absorbed by the skin is greater than 10% of the amount taken up by inhalation when exposed to the TWA concentration
- Concluded no mutagenic or genotoxic potential.

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	NA
HCIS	Carcinogenicity – category 2, Skin sensitisation – category 1

Source	Notations
NICNAS	NA
EU Annex	Carcinogenicity – category 2, Skin sensitisation – category 1
ECHA	NA
ACGIH	NA
DFG	H (skin), Sh (dermal sensitiser)
SCOEL	Skin
HCOTN	NA
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		
Adverse effects in human case study:		
Dermal LD_{50} ≤1000 mg/kg:	yes	
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%:		
		consider assigning a skin notation

IDLH

Is there a suitable IDLH value available? No

Additional information

Molecular weight:	42.04
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) (2007) Cyanamide – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2003) Recommendation from the Scientific Committee on Occupational Exposure Limits for cyanamide. SCOEL/SUM/100_rev.

Health Council of the Netherlands (HCOTN) (2004) Cyanamide and calcium cyanamide. Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/133.

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).