METHYL HYDRAZINE

CAS number: 60-34-4

Synonyms: MMH, Monomethylhydrazine

Chemical formula: CH_6N_2

Structural formula: —

Workplace exposure standard (retained)

TWA: **0.01 ppm (0.019 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **Sk.**

IDLH: **20 ppm**

Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.01 ppm (0.019 mg/m^3) is recommended to protect for irritation of the eyes and respiratory tract, liver damage and haematological (blood) effects in exposed workers.

Discussion and conclusions

Methyl hydrazine is used primarily as a component of jet fuels and altitude control fuel in missile propellants and transfilling gas or liquids. It is also used as a chemical intermediate, solvent and in pharmaceuticals.

Critical effects of exposure are upper respiratory tract and eye irritation, liver damage and plasmacytosis.

Limited toxicological data is available in humans. Human susceptibility is considered more like dogs than rats and monkeys (NICNAS, 2014). A ninety-day inhalation study in animals reported haematological effects in rats and dogs and discolouration of the liver in dogs following exposure at 0.1 ppm. In a six-month inhalation study, haemolytic anaemia and Heinz bodies are observed in dogs at 0.2 ppm. In a one-year inhalation studies in rats and mice, caused reduced growth rate, eye and nasal irritation, liver damage and plasmacytosis was reported at 0.02 ppm (ACGIH, 2018). Evidence of carcinogenicity was observed in rodents; however, the relevance to humans is not evident and not considered relevant (ACGIH, 2018).

Given the available data, the current TWA of 0.01 ppm is recommended to be retained consistent with the TLV-TWA by ACGIH (2018).

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 recommended based on evidence suggesting potential dermal absorption and adverse systemic effects in animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1998***	***TWA: 0.01 ppm (0.019 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 0.01 ppm (0.019 mg/m^3)***

TLV-TWA recommended to minimise the upper respiratory tract and ocular irritation, liver damage, plasmacytosis, and tumorigenicity.

Confirmed animal carcinogen with unknown relevance to humans based on pulmonary tumours observed on rodents.

Skin notation assigned due to systemic toxicity observed from absorption through the skin in animals.

TLV-TWA based on evidence in rats and mice demonstrating reduced growth rate, eye and nasal irritation, liver damage and plasmacytosis at 0.02 ppm and on the evidence of carcinogenicity observed in hamsters and mice (no further information on the derivation of TLV-TWA).

Human data:

- Limited human data
- Human poisons relate to ingestion of N-methyl-N-formylhydrazone; of which methyl hydrazine is the principal metabolite; no further information

Animal data:

- LC_{50}: 74 to 78 ppm (4 h) for rats; 56-–65 ppm (4 h) for mice; 162 ppm (1 h) for monkeys, and 96 ppm (1 h) for dogs
- Symptoms of acute toxicity include convulsions, neurological effects, hypoglycaemia, vomiting, anaemia, bilirubinemia, increased methemoglobinemia, and ocular and upper respiratory tract irritation:
  - pathological changes were observed in the lungs, liver, kidneys and brain of exposed animals; no further information
- Dermal LD_{50}: 93 mg/kg (rabbits); 47 mg/kg (guinea pigs); 239 mg/kg (hamsters); 183 mg/kg (rats)
- Summarised study: rats, dogs and monkeys exposed at 0, 0.04, or 0.1 ppm, 24 h/d, 7 d/wk for 90 d:
  - haematological effects in rats and dogs at 0.1 ppm
  - discolouration of the liver at 0.1 ppm in dogs
  - elevated serum phosphorus in rats at 0.04 and 0.1 ppm
- Rats, mice, dogs and monkeys exposed 6 h/d, 5 d/wk for 6 mo at 0, 0.2, 1, 2, or 5 ppm:
  - body weight reductions in rats at 1 to 5 ppm
  - haemolytic anaemia and Heinz bodies in dogs at 0.2 ppm
  - increased methemoglobin formation at 2 and 5 ppm
  - bile suppression in dogs at 0.2 ppm, hepatic and renal tubular haemosiderosis at 2 and 5 ppm
  - increase in biportal or centrilobular cholestasis and bile duct proliferation in mice exposed at 2 and 5 ppm
  - haemolysis and Heinz bodies formation in erythrocytes in monkeys at 5 ppm
  - transient anaemia, reduced haematocrit and haemoglobin in dogs exposed at 0.2 ppm; hepatic damage at 2 ppm

Source	Year set	Standard
• 1 yr inhalation study in rats, mice, hamsters and dogs; 6 h/d, 5 d/week at 0.02 ppm (rats and mice) and 0.2, 2, or 5 ppm (rats and hamsters): ○ decreased rate of growth in rats at 0.02 ppm ○ nasal irritation and plasmacytosis in mice at 0.02 ppm ○ renal cysts at 0.2 ppm in mice ○ hydronephrosis and a significantly higher incidence of lung tumours, nasal adenomas, nasal polyps, nasal osteomas, hemangiomas and liver adenomas and carcinomas in mice exposed at 2 ppm ○ tumours were not dose dependent in rats at any dose ○ rhinitis and an increased incidence of biliary cysts in hamsters exposed at 0.2 ppm; increase nasal polyps, interstitial fibrosis of the kidney and benign adrenal adenoma and reduced body weight at 2 or 5 ppm ○ no pathological changes in dogs • Weak positive responses were reported in a spot test in *E.coli* and *Salmonella* tests.		
DFG	***1973***	***0.1 ppm (0.25 mg/m^3)***
Summary of additional data: • Initial gagging, difficulty breathing, severe nausea and violent vomiting in 2 men ~700 m from a spillage (no further information).		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2002***	***Not assigned***
Evaluation of carcinogenicity and genotoxicity. Summary of additional data: • No data in humans • Sufficient evidence of carcinogenicity in animals • Recommended to be considered carcinogenic to humans based on animal data.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2014	• Vapours reported to irritate the eyes, nose and throat in humans • Human susceptibility more like the dog than rat or monkey • Not considered to be genotoxic based on i*n vivo* evidence.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	Insufficient data
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	Skin
HCIS	Carcinogenicity – category 1B
NICNAS	Carc. Cat. 2
EU Annex	Carcinogenicity – category 1B
ECHA	Carcinogenicity – category 1B
ACGIH	Carcinogenicity – A3
DFG	H (skin), Sh (dermal sensitiser)
SCOEL	NA
HCOTN	Carcinogenicity – category 2
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?	Yes

Additional information

Molecular weight:	46.1
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) (1973) Methylhydrazine – MAK value documentation.

European Chemicals Agency Regulation (ECHA) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Health Council of the Netherlands (HCOTN) (2002) N-Methylhydrazine. Evaluation of the carcinogenicity and genotoxicity. The Hague: Health Council of the Netherlands; publication no. 2002/07OSH.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) Hydrazine, methyl: 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).

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – methyl hydrazine.